THE ARABESQUE OF LOCAL KNOWLEDGE

Potatoes, farmers and technicians in highland Tiraque, Cochabamba, Bolivia

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Potatoes, farmers and technicians in highland Tiraque, Cochabamba, Bolivia

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To all despite all

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INTRODUCTION

The work presented here is about potatoes, an Andean product now common throughout the world that consumers, used to having it on their tables, have reduced to a simple tuber, an ordinary product, and not really an interesting part of their meals. Perhaps because of that the reader will be surprised by the, at times, lengthy theoretical discussion throughout, especially in the first two chapters. However, it is worth clarifying –appealing to the reader's patience– that these chapters are not motivated by a pedantic or pretentious attitude but, to the contrary, by a sincere and committed concern about knowledge, about what it is or what we understand to be, its processes of construction and destruction, its manners of revealing itself and the ways in which it is utilized; in short by a concern about how it is conceived and put into practice by different cultures and actors. Evidently the study object of this work has to do with knowledge and, particularly, with the encounter between different traditions of knowledge, which –in the case of and through potato cropping– take place between farmers and experts. In this way potatoes become not the vulgar tuber from which one must scrub the dirt and cook in order to eat it, but the privileged means for the mentioned encounter, the vegetal bridge or rather the ground, the field of battle (as paraphrased by Norman Long in relation to "battlefields of knowledge") across which farmers' and technicians' scrutinize each other for, later on, to encounter each other, becoming entangled, intermingled, mixed; losing and gaining 'room for manoeuvre', strategic elements and properties; going forward and drawing back.

In this way the present research makes problematic the fact that knowledge is something that is socially constructed or de-constructed through encounters or intersections between different forms of knowledge and practice, and more specifically through processes of institutional intervention in development. The initial questions that guided this research made reference to the dynamics and results of a long intervention process of technological innovation in the cultivation of potatoes, both at mezzo and micro levels. At the mezzo level the analysis has focused on the entities and the networks fostering innovation or technological transfer at a regional level (Cochabamba), networks which are also considered to be regional systems of knowledge, or frameworks of agricultural knowledge. At the micro level, the analysis has focused on the two communities of potato growers chosen for fieldwork (Qoari and Boquerón). On the other hand, the research questions also take up the modes of persistence of local knowledge of potato cultivation and to the reconfigurations of this local knowledge in its encounters with techno-scientific knowledge. Consequently this research has attempted to attain the following goals:

- To establish the role of knowledge, in terms of its diversity, dynamics and intersections, in the implementation of international development programs in Cochabamba.
- To analyse and conceptualise how knowledge is configured and managed within an institutional and cultural context focused on technological innovation, and
- To determine the implications of this innovation, both in the knowledge and practice of local agricultural producers.

The theoretical perspective upon which this research widely draws is the actor oriented approach introduced years ago by Norman Long at the University of Wageningen. Within this framework the contributions of Alberto Arce and Eleanor Fisher have been fundamental, especially in regard to the importance of metaphor.

In the first chapter the relationship between knowledge and rural development is explored. It is argued here that such a relationship is not simply a bipolar one between knowledge and development but multi-polar or multiplex; between development and other forms which are linked to knowledge (its other entities or ghosts, disguised under the patterns of the baroque spirit, following Arce's assertions) namely, 'memory', ''forgetfulness' and 'ignorance'. When development intervention meets the lack of knowledge problem, it actually encounters ignorance. When it focuses on the past flourish of ancient cultures it meets a knowledge deleted (forgetfulness). And when it discovers –or encourages– ancient conservation, production or transformation practices, it meets stored or filed away knowledge i.e. memory. It was an almost fortuitous reading of Mercia Eliade that made me reflect on the importance of these forms related to knowledge, and particularly the way in which they were presented together or assembled in ancient times. These spooky forms become the basis for the later interpretation deployed in the last chapters which display the fieldwork findings.

However, talking of development and intervention is also to talk of techno-science or scientific knowledge. Before dealing with these notions from a social science perspective (a task carried out in chapter two) I assumed that it could be telling or interesting to contrast traditional forms of knowledge with those of a scientific spirit and rationale, at least regarding its central aspects, for instance, with the problem of methodological doubt, which steers us to the problem of truth -a problem I have tried to avoid but which has remained as a shadow, above all in the footnotes. Leaving apart the problem of truth, I have continued, almost as a digression, with other approaches to knowledge which have led me to the issue of local knowledge in a very inspired manner. Here the contributions of Huzinga concerning games and knowledge and Geertz on common sense or the studies on perception of so the called 'new biologists' have all been of great importance for grasping local knowledge, theoretically as much as practically when, later on, I observed and analysed farmers practices and techniques. Closing the circle in this way around local knowledge I outline its historical background and subsequently I summarise the contributions of an actor oriented approach to this topic.

The second chapter, which is also a bit bizarre and fragmentary, deals –as pointed out above– with science and technology because I realised that if the research work was about the intersections of local knowledge with that of science and technology, then the latter deserved also an adequate treatment. Nevertheless the number of studies and schools of interpretation surpassed my own initial efforts of inventory and synthesis and, in the end, the chapter resulted somehow in a set of summaries of and contentions of the different schools and themes they deal with. Was all this necessary? Maybe not. Notwithstanding some insights on the non-technical facets of technology, the notion of machine much appropriated for the bureaucratic apparatus of development, or the sophisticated discussions of the actor-network theory and finally the radical criticism made by the actor oriented approach of the flaws of the transportational or linkage extension paradigm were highly relevant for the next chapters within which the empirical findings called for a vigorous reflection.

Thus, to have a better grasp of the problem of technology I have drawn on work done in the fields of social anthropology (Long, Arce, Fisher, Villarreal, Olivier de Sardan, Geertz, Latour, Callon and others), philosophy (Heidegger, Marcuse, Negri and Rella) and sociology (Habermas, Bourdieu and Giddens).

The third chapter is a first empirical descent into the regional/institutional level. Prior to focusing on potato growers' knowledge and its intersections with that of technicians and extension workers, I provide an historical analysis about the arrival and development of government and non government development organisations devoted to technical change. This chapter corresponds entirely to the second objective of the study, which seeks to analyse how knowledge is configured and managed within the set of organisations working in technological innovation in Cochabamba. Here I have tried to respond to such questions as who are those who take on the mission of bringing about technological innovations for potato production in the region; where do they come from; endowed with what kind of discourses, rationale, justifications, proposals and methods; and, ultimately, in what way do they structure institutional frameworks at the mezzo level for organising the unfolding of their intervention strategies. As the reader will see, the history of planned interventions, particularly in the Province of Tiraque for improving potato cropping, displays a lot of unexpected events, contradictory facets and even revealing anecdotes.

Before developing the chapters on the two communities of Qoari and Boquerón, and as a sort of transition between this first part and the last, one chapter has been introduced, i.e. the fourth, which depicts in a contextual way the main features of the communities under study (and of the province to which they belong), their agricultural production and the general characteristics of local knowledge on potato cultivation. Finally, I analyse the long process of technical transfer that has taken place in this zone since the apparition of the first development organisations. Thus, general information on the Province of Tiraque and the two communities is presented, highlighting their geographical, historical, economic and social aspects. In this chapter the reasons for choosing such communities become explicit. Considering the kind of research undertaken in this study, there is some necessity for information on general indicators concerning the living conditions of the population in the zone and other socio-cultural and organizational aspects, although such traditional indicators do not render a sound image of the reality they seek to portray.

On the one hand, this chapter is meant to demonstrate that the long experience of technology introduction in both communities make them highly pertinent for research. On the other, the chapter is meant to provide a sound general description of the extent and variants of the innovation process that took place in these communities, since each follows a different path as far as technical innovation is concerned, and at the same time displays a different history concerning relationships with the organisations that promote technical change. The characterisation of this change is made on the basis of a statistical method of multiple correlation, which allows for the elaboration of farmer typologies and variable correspondences. Beyond the technicalities of the method, what is interesting is that it has led me toward an extensive interpretation of the innovation process, establishing the main differences between producer groups as well as between communities. This interpretation or assessment of the extent of the technical change constitutes the basis for the subsequent in-depth analysis of local knowledge on potatoes and its reconfigurations in both communities.

Indeed, the last two chapters are focussed on detailed anthropological fieldwork in the communities and are surely the most interesting part of the research study. In chapter five a detailed examination of the lay knowledge of women and men in relation to potato varieties is carried out, starting with a discussion on the theme of metaphor. In this chapter the distinction between technique and practice is also discussed in order to further the analysis of the importance and meaning of metaphors in the christening of potato varieties for normative cultural repertoires and community social life. Next I present also the metaphorical knowledge on soils and sowing practices. In this way we are able to connect cultural interpretations to notions, representations and meanings that farmers have about the tuber. The chapter ends with seed selection and classification criteria, the technical itinerary, and the other uses of local knowledge for potatoes.

The sixth and last chapter deals directly with the intersections or interfaces between farmers and technicians, and therefore with the reconfigurations that take place in farmers' knowledge as much as in their agricultural practices (regarding soils, diseases, pest control and so on). The issue of loss or gain of biodiversity is also dealt with as well as the alimentary and market flaws of the introduced potato varieties. After summarising the changes in other domains of local knowledge I argue that the encounters between farmers and experts also imply an effect on the latter (of discontinuity and 'rebounding'). An analysis is also outlined of what I call the "other reconfiguration" –i.e. the development, partial and fragmentary, of farmers' local knowledge equivalent, namely the technicians' "local knowledge". The chapter ends with some final reflections on the limits of reconfiguration.

The thesis closes with reflections on the main conclusions of the research.

ONE: Knowledge and tradition: a discussion of cultural aspects of knowledge

1.1 The multiple utterances of knowledge

When some state agency or NGO carries out a project on technological innovation to better agricultural practice, to improve its productivity and eventually raise farmers' living standards, more often than not the project implementation faces a variety of problems. Technicians and developers realise, for instance, that farmers are unable to operate or manipulate new technologies, equipment or high yielding seeds brought about by the project. This is simply the problem that farmers are unaware of the new technology's nature, its ways of working, its properties and its advantages or possibilities. Another problem has to do with the fact that farmers in the past may have developed sound soil conservation techniques and properly marshalled farm resources (we think, specifically, going backwards in time, of the achievements of great ancient civilisations like the Inca Empire) but, unfortunately, at present, most of their rich former technologies and practices are lost or forgotten. Farmers used to know, and very well, how and what to crop and how to preserve and improve their productive resources, but present-day farmers have either unintentionally lost these skills, or have more consciously ignored past ways and knowledge. There appears a lack of urgency or vision to communicate or learn about techniques at some point between the past and present and across geographical areas. Thus a third major obstacle to production, conservation or management, is related to the recollection, recognition, and recovery of what may be remembered. If we abstract this ignorance, forgetfulness, and memory from their context we will notice that all of them are closely related to a central concept: knowledge. Ignorance, forgetfulness and memory refer – each one in a different way – to knowledge.

Knowledge on the other hand is largely concerned–especially in the scientific tradition–with truth[1]. In our case of technological change for developing agriculture, the assumptions, rationale, effectiveness, correctness and outcomes of modern technology are intimately linked to the notion of truth, and become truth, in the practical, empirical achievements of this technology while intervening in or transforming reality[2] and thus achieving what was called *veracitas* in classical times. Moreover the problem of truth – whether a person or society is closer to or farther from it – implies another problem: the problem of authority. Insofar as modern technology is based upon the assumption of truth, it can then validate or invalidate other knowledge or technologies, keeping for itself such authority and privilege. However, the idea of truth – nested at science's very hearth – has, since the birth of modernity, been married to a not so conspicuous companion: disbelief, to an obsessive penchant for doubting. Along with truth and doubt, science has also been particularly concerned with ignorance as a negation of knowledge and truth, seeing in it an inimical force that prevents us from knowing (knowing the truth precisely).

In the following sections I will refer to the way in which science has dealt with the problem of truth, ignorance and doubt and, subsequently, to the ways in which ancient –or traditional– cultures have thought about the problem of knowledge (and its corollaries of ignorance, forgetfulness and memory or recognition). The latter ways of conceiving of knowledge have been peculiar to ancient agrarian societies and differ from those developed by science in modern societies. Taking a look at them will help us to get a better understanding of how local (farmers') knowledge is structured and to assess to what extent knowledge and its diverse corollaries – ignorance, oblivion and memory – are related to each other and can, at the end of the day, share

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[1] According to K. Popper, scientific results are relative since they are "… the results of a certain stage of scientific development and liable to be superseded in the course of scientific progress". But, truth cannot be relative at all: "If an assertion is true, it is true for ever" (Popper 1970: 657). The Spanish writer Enrique Jardiel Poncela (1983) states that "the truth very much resembles a lack of imagination".

[2] As for the critical realism perspective (initially a philosophical movement), "…the relation between the theories is one of conflict rather than merely difference, this presupposes that they are alternative accounts of the *same* world, and if one theory can explain more significant phenomena in terms of its descriptions than the other can in terms of *its*, then there is a rational criterion for theory choice, and *a fortiori* a positive sense to the idea of scientific development over time" (Bhaskar 1998: xi). This seems to suggest that one of the theories is closer to the truth than the other; or, at least, that one theory is more interesting than the other. Almost in the same vein as the Italian philosopher, G. Vattimo (qua narratives and interpretations, see below, this chapter), the poet León Felipe (1987), Spaniards like Jardiel Poncela, wrote: "… but they have put me to sleep with all the stories…/and I know all the stories".

the same meaning (!), contrary to the scientific tradition in which knowledge can only lie at the opposite corner from ignorance[3].

1.1.1 Science, truth and doubts

Furthering the paradoxes between knowledge and ignorance, K. Popper compares what he calls *conspirator ignorance theory* with the 'theory of manifest truth' (Popper 1994: 23), establishing that the same principle governs both theories. In the case of the former, ignorance is not merely a lack of knowledge but the work of some evil power that pollutes and infects our minds[4] (hence, goodness and truth would be intimately related). In the case of the theory of manifest truth, knowledge and truth are God's or Nature's gifts to mankind, so that truth is evident to anyone willing to see it. Such an 'optimistic epistemology' is present in the *veracitas dei* principle of Descartes, which states that God's veracity becomes manifest truth, and also in the *veracitas naturae* principle of Bacon, to which nature is an open book ready to reveal its truth to us (and, in general, man – as Plato commented - is an anxious being wishful to learn, investigate and discover). Thus, ignorance (the lack of knowledge) and truth (and the absolute knowledge of it) have the same origin and lineage, one beyond man. Knowledge and ignorance come from the same source, meaning that they share the same nature and they are, in some way, the same.

Contrary to the hopeful idea of man anxious to acquire knowledge, we find another one, asserted by Plato himself, Parmenides, the Sufi sages and the like: man is too foolish, clumsy, unskilled, to be able to obtain true knowledge: the *episteme*. Jenofanes said that human knowledge is nothing but conjecture[5], at best similar to truth. Socrates confessed that he did not know,

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[3] J. L. Borges (1985: 25) wondered about the paradox of knowledge in these terms: "...[T]o know is to acknowledge, but as long as you have known previously you are able to acknowledge what you knew, but to know is to acknowledge... how to asses such a dialectic?" (My translation. *Nota Bene*.- Translations into English of all the quotations, which are not originally written in English, are mine –see References to find the sources in their original language). Actually, what he was trying to stress was knowledge as an impossibility, either because we know already (then we do not need to know) or because we are not able to know at all (since to know supposes acknowledging what was –and still is- unknown).

[4] He identifies Marxism as a modern version of this theory. To Marxists the capitalist press distorts truth and fills up labourers' minds with false ideologies.

[5] Alcmeon had a similar judgement: "Gods possess certitude but to us as men it has only been conceded to conjecture" (Alcmeon as quoted by Glaserfeld 1998: 20). In the tradition of the East searching the truth was considered nonsense: "It is not necessary to seek the truth, it is sufficient to stop with our visions" (Lamparelli 1996: 22). To Zen, as far as the truth remains

that all he did was to pose questions, without giving answers. To pose questions and reject giving answers means to be committed in a search to which all responses and findings are relative and provisional. Inquiring, accordingly, is deeply related to doubting, to hesitation before any human answer to the questions about truth. Here we can find an interesting liaison between ignorance and doubt, the latter being the very reason why, sometimes, we betray truths and, many times, we are steered to disbelieve. Nevertheless it is important to differentiate the distinct types of doubt. Socrates doubted human knowledge and rejected any pretension of knowledge or wisdom. Descartes, for his part, doubted everything but with the aim of attaining a totally certain knowledge inspired by God; what he was actually seeking was a *truth criterion*, a way to obtain doubtless knowledge and wisdom. On the contrary, to Socrates wisdom was a realisation of our limitations, our scarce knowledge[6]. In agreement with this acknowledgement[7], Nicolas de Cusa, Erasmus, Montaigne, Locke and Voltaire (followed later by Stuart Mill and Russell) founded the 'tolerance doctrine' (Popper 1994: 39)[8].

To Bacon and Descartes, as long as truth is manifest, and rejecting the idea of conspirator ignorance, the very source of ignorance becomes ourselves: we the negligent, the obstinate, poisoned of prejudices. But, if we are the very source of ignorance, what then is the source of our knowledge?[9] At this point Popper criticises science since it has always sought for some authority to validate its assertions: God, reason, our senses[10]. However what Popper

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as concept it is not really the truth ("the finger that points out the moon is not the moon") (1996: 22).

6 A. Arnold (1992: 17), through a quotation of Bacon, shows us how the same rationale (concerning the function of doubt to attain truth) is present in Bacon's philosophy: "If a man begins with certainties he shall end with doubts; but if he will be content to begin with doubts he shall end in certainties".

7 Making a paraphrase of the latter –and in referring to the paradox highlighted by Borges– we could state that the *acknowledgement* of our *ignorance* is the true *knowledge* (linking "dialectically" these contradictory terms).

8 "We all are fallible and inclined to error. Forgive each other for our absurdities" (Voltaire as quoted by Popper 1994: 39). The problem with the "tolerance doctrine" as much as with pluralism is that they only recognise and accept the differences that constitute *the other* but do not necessarily do anything to alleviate or lighten the burden the other might bear. Pluralism does not imply solidarity.

9 For ancient Egyptians and also for Chinese the source of our knowledge was our heart: "It is thanks to the heart that all knowledge exists, the tongue formulates what the heart has conceived of" (Jacq 1998: 63).

10 When Bacon assumes human senses as the source of knowledge, he is assuming that the individual is such a source. Notwithstanding if we remember that his scientific method was borrowed from religious (Christian) trials against witchcraft, then we find that the actual

forgets or is unable to notice is that science has not only been largely related to power (military, economic and political) but that science itself, due to its nature, is authoritative. It has always appealed to some source of authority – inner or external, it does not matter - since it has always aspired not only to be the true knowledge but the true authority, the competent one. If some truth is kept silently in our mind, such a truth is not related to authority; once we instruct, train, judge or demonstrate we are exerting some authority; even when we advise someone, or make suggestions, indirectly we are acting as authorities[11].

From Popper's point of view, the problem does not lie in the answer we might have for the above question, asking what the best source of knowledge is, but in the question itself. As with other authoritative questions, the question regarding the sources of knowledge is a genetic one: inquiring about knowledge's origin supposes the belief that its genealogy can legitimate it. Accordingly, what Popper proposes is not to respond to the question, but rather to change the question itself; the appropriate question ought to be: how can we detect and dissipate error? It is not worthwhile to ask about the sources of our knowledge since it will always be more conjecture, opinion, *doxa* than *episteme*. This new question would express a so-called 'critical rationalism' linked, to some extent, to Kant's *autonomy principle* according to which we cannot accept the orders or opinion of any authority as a basis for ethics. Ultimately, the only knowledge we are able to hold is the knowledge of our ignorance which guides us towards a 'cult ignorance', and in our infinite ignorance we are all equal[12].

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source remains religious. What has occurred –and science has "forgotten"— is that the method has been dissociated from History to keep scientific method pure from any irrational (inquisitorial) trace (Alberto Arce, personal communication).

[11] To Lao Tzu, the Taoist philosopher, the true knowledge, wisdom, has to come from within of each of us. To teach, to tell someone what to do or what to believe in is useless. We can only suggest, ask, listen. (Lao Tzu 1994)

[12] Many centuries before, Farid Ud-Din Attar referred to the futility of boasting with the pretension of knowing something:

> Oh you that appraise truth, do not search analogies, the existence of this Being without comparison does not permit them. If neither prophets nor celestial messengers have understood the most insignificant particle and have put their foreheads on the dust in saying: 'We have not known you as you truly are', Who am I then to conceit saying I know him?"

The sameness of knowledge and ignorance is depicted in the following terms:

> Oh, my heart, if you want to get to the source of knowledge, be careful. To each atom there is a different door, and from each atom a different way leads to the mysterious Being I am talking about. To know yourself you have to live one hundred lives.

1.1.2 Knowledge and the like in ancient cultures

The idea of knowledge as acknowledgement comes from Platonic doctrine. According to Plato, before being cast into this world we held a complete, total knowledge. Once we are in the world we forget all, absolutely, and need to recall or recollect, i.e. to *re-cognise*[13]. Plotinus argues that memory is for those who have forgotten (like the peasants who have forgotten ancient ecologically-sound cropping techniques) (Eliade 1975: 119). Nevertheless memory (*mnemne*) is different from recalling or recollecting (*anamnesis*). To remember is a virtue for those who have forgotten, but the perfect one –that one that never loses the vision of truth (the scientist, for instance)- does not need to recall. Further, forgetting symbolises the return to life: hence it could be argued that farmers are alive since they have forgotten ancient agricultural knowledge, and now are ready to be taught by modern extension workers.

The Greek personification of memory is the Goddess Mnemosyne, sister of Kronos and Okeanos and mother of the Muses. She knows "all that has been, all that is, all that will be" (*ibid*: 120). When the Muses possessed some poet, he directly drew on Mnemosyne's knowledge of origins and genealogies (the genesis of the gods and the birth of humanity). Re-calling was, in this case, 'evoking' the source of everything, the primordial reality, and the knowledge of that mythical time was memory. The privilege of entering the other world, conferred by the Goddess on the bard, makes of the past a dimension of the beyond. Another way of getting the forgotten knowledge was *metempsychosis*, the ability to remember former lives, an art that Pythagoras and Empedocles claimed to master ("...in former times I was already a boy and a girl, a bush

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> Nonetheless God is known by himself and not by you; it is He who opens the way that steers to himself and not human wisdom. The knowledge of God it is not gathered visiting rhetoricians. *Knowledge and ignorance are in this case the same thing*, because they cannot explain nor describe (1994: 16) (Emphasis added).

[13] "For Plato, learning is, in the last analysis, recollecting (cf. Especially *Meno* 81, c, d). Between two existences on earth the soul contemplates the Ideas: it shares in pure and perfect knowledge. But when the soul is reincarnated it drinks of the spring Lethe and forgets the knowledge it obtained from direct contemplation of the Ideas" (Eliade 1975: 124).

This Platonic idea (that followed what Pindaro already had stated) upon knowledge was opposed to a former one held by Parmenide ("Knowledge and life, instead of a stable dwelling, are a lane", in Rella 1994: 72). It was also, to some an extent, different from the one discussed by Schilos in his Agamemnon ("The ways of wisdom, He (Zeus) open out to mortals applying the law of knowledge through pain –*to pathei mathos*—(...) Wisdom despite their disappointment in they penetrates", in Rella 1994: 73). To F. Rella (1989: 24) Plato opposes his immutable and coercive *episteme* to the pilgrim knowledge conception as a way, being tragedians and sages, sort of inimical opponents that were to be annihilated. Opponents like Heraclitus who had affirmed the identity between logos and disagreement; between reason, language and divergence (*kata logon/kata erin*).

and a bird, a mute fish in the sea" Empedocles affirms). To Greeks, accordingly, there were two kinds of memory: the first drew from myth (cosmogony, theogony, genealogy), and the second referred back to personal former lives. Overcoming forgetfulness, then, was overcoming death. Thus, memory and forgetfulness or oblivion appear to be intimately related. To help overcome oblivion and to keep memory alive Egyptians raised obelisks and Romans columns and arches full of their historical accounts, epic tales, cultural narratives.

In another (more) ancient tradition, that of India, Gods suddenly fell from Heaven (and precipitated to Earth) when their memory failed or they got confused and forgot their divine nature. Forgetting was, consequently, equivalent to sleep or to loss of the self (blindness and disorientation)[14]. In one episode of amnesia in the epic Indian literature, Matsyendranath falls in love with the queen of Ceylon and, succumbing to temptation, completely forgets his divine identity (which is not strange in such a case). Contrary to gods who have a perfect consciousness of their identity, human beings are ignorant by nature. Such a judgement will be assumed later on, as we will see in chapter 2, by modern science.

We can perceive that myth was to be learnt as 'the sum of useful knowledge' (*ibid*: 125). A significant life was one inspired by this stock of knowledge (a set of acts already performed and thoughts already formulated). *A contrario*, ignorance was equivalent to the twin brothers Sleep and Death (*Hypnos* and *Thanatos*), to oblivion, to intoxication and even to drunkenness. In ancient Egypt priests similarly insisted on being guided by *rectitude* (proper behaviour dictated by gods) and considered ignorance a sort of sin that required them to be purified by celestial wisdom (Jacq 1998). Nevertheless it is worthy of note that in oriental mysticism, Buddhism and Taoism for instance, forgetting is also a condition to liberate our soul from forlornness and anguish -caused by human trouble- and to enter the realm of stillness (a problem is a problem in as far as you think it is, then you should *forget it*, ignore it).

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[14] "Indian literature uses images of binding, chaining, and captivity interchangeably with those of forgetting, unknowing, and sleep to signify the human condition; contrariwise, images of being freed from bonds and the tearing of a veil (or the removal of a bandage from the eyes), of memory, remembering, being awakened, the waking state, express abolishing (or transcending) the human condition, freedom, deliverance (*moksa*, *mukti*, *nirvana*, etc.) (Eliade 1975: 116). It is actually astonishing how exactly scientific discourse and modern educational institutions repeat moral and religious discourses of ancient "pre-scientific" societies when they allude to the problem of ignorance or unknowing.

In this manner we have seen how knowledge can be linked to recognition (remembrance), ignorance or oblivion and to the art of doubting. In the following we will focus on knowledge as a game: discourse games, language games or *speech games*[15].

1.1.3 The game-like dimension of knowledge

J. Huizinga points out that ancient cosmogonic speculation has a fundamentally playful (*ludic*) character. Indeed, its explanations elaborated through ritual enigmas, riddles, puzzles, misleading questions and amazing responses prove that sacred tradition, more often than not, involved play games: "The enigma, we can conclude is, at first, a sacred game which, somewhere between the game, is serious and of the highest importance, without losing its *ludic* character" (Huizinga 1996: 135).

During those "sacred games" some sage was interrogated by another wise man or by a number of them, putting all his wisdom and knowledge at stake, taking a chance. Thus Zarathustra responds to King Vitaspa's seventy sages and Solomon answers to the questions posed by the Queen of Saba (amongst the Greeks, enigmas were central to their cultural life and they were used to aporias[16]). Much later, as Umberto Eco (1995 *passim*) has recreated, theological debates in the middle ages constituted passionate tournaments; during Reform times in Europe, similar religious discussions took place between Luther and Zwinglio or T. de Beza and the Catholic priests; and science inherits these sacred game practices when its discussions take the shape of fierce competition.

Here it is useful to stress that playing games is not related only to competition –in a sort of Olympic élan- as Huizinga remarks. Amongst children, as much as amongst sages, farmers, scientists, and so on, playing games also allows for a time to share, to enjoy being together, to have fun and not necessarily to gain anything: gifts, prestige or whatever.

Games of asking and responding in ancient ages were played as equals; in Nagasena's words, participants held a conversation as sages and not as kings[17]. There was no authority, no hierarchical relations since all the

[15] To Wittgenstein a language game "(Is) meant to bring into prominence that the speaking of a language is part of an activity, or a form of life" (as quoted by Jeyaraja 1990: 88).

[16] Questions such as the following were common in their speech games:
"If space is something where would it be?" (Zenon from Elea as quoted by Huizinga 1996: 140)

[17] To commence *the conversation*, the king Menandro asks sage Nagasena:

participants were subject to the same game rules; a horizontal relation was maintained from the outset of such 'conversations'. As we will see later, conditions of equality, tolerance and game-like practices can be found in local knowledge as well.

On the other hand, however, knowledge systems often claim some kind of authority. Geertz (1983: 84) points out that even common sense enacts its authoritative story: "Like *Lear*, the New Testament, or quantum mechanics, common sense consists in an account of things which claims to strike at their heart". Before entering the realms of *local knowledge* - and as an introductory passage to it - I will refer to some main features of so-called common sense.

1.1.4 The authority of *common sense*

When common sense or science oppose other rival sophisticated stories (say, the 'phantasmagoric narratives of dream and myth') each of them takes a position of 'competent authority', pulling things down to earth, making of them something 'really real'. In that *sense* common sense could be understood in the following manner:

> As a frame for thought, and a species of it, common sense is as totalizing as any other: no religion is more dogmatic, no science more ambitious, no philosophy more general. Its tonalities are different, and so are the arguments to which it appeals, but like them –and like art and like ideology- it pretends to reach past illusion to truth, to, as we say, things as they are (Geertz 1983: 84)[18].

> "-Venerable Nagasena would you like to hold a conversation with me?
> -If his Majesty wants to talk with me like sages talk among them, I do, but if his Majesty wants to talk with me like kings talk among them, then I don't.
> -How do sages converse among them, Venerable Nagasena?
> -Sages do not get angry when they are forced into a corner but kings, they do."
> (As quoted by Huizinga 1996: 137)

[18] To deliver a fuller idea of common sense, Geertz adds:

> When we say someone shows common sense we mean to suggest more than that he is just using his eyes and ears, but is, as we say, keeping them open, using them judiciously, intelligently, perceptively, reflectively, or trying to, and that he is *capable of coping with everyday problems in an everyday way with some effectiveness* (...) If common sense is as much an interpretation of the immediacies of experience, a gloss on them, as are myth, painting, epistemology, or whatever, then it is, like them, historically constructed and, like them, subjected to historically defined standards of judgement (Emphasis added) (1983: 76).

In spite of cultural differences common sense has, according to Geertz, five general attributes: *naturalness*, *practicalness*, *thinness*, *immethodicalness*, and *accessibleness*. *Naturalness* means that things are seen "as being what they are in the simple nature of the case" (having selected previously, however, the things meant to be considered in nature). Such a naturalness is not necessarily related to some philosophical naturalism to which there is nothing in the universe undreamt of or not imagined by the human mind. *Practicalness* refers to sagacity, sensibility; nonetheless to be practical does not mean to be pragmatic, to commit to the utilitarian. A large share of native or 'savage' practical knowledge does not seem to be actually practical since it entails intellectual requirements, curiosity, the need to know. It is worthwhile to stress that practicalness is "a quality it bestows upon things, not one that things bestow upon it" (1983: 88). This point has been worked out by Lévi-Strauss, who studied 'primitive knowledge'.

Thinness could be compared to 'simpleness' or 'literalness'. There is in common sense a certain tendency to give the impression that it is actually what it appears to be (everything is what it truly is). "The world is what the wide-awake, uncomplicated person takes it to be" (1983:89). Sobriety instead of subtlety, realism in the place of imagination is commanded by this sort of daily wisdom. Things, such as truth to Bacon, are quietly lying before us. They are not cunningly hidden in the world's depths, they are like our hands, the ground we are standing on and the clouds progressing above our heads, just there and "invisible only to the clever"[19]. *Immethodologicalness* means that common sense lacks consistency, it may contradict itself (and pleasingly). It does not have a proper style or form to its discourse though we can say that the sententious saying is the paradigmatic form to express its judgements[20]. *Accesibleness*, the last attribute of common sense, can be distinguished by its assumption that any common person (that is, 'with faculties reasonably intact') can comprehend the conclusions unfolded by common sense, in the end, embrace them. In this manner common sense becomes the broad and common asset of any 'solid citizen'. Its language is rather anti-expert, it does not require esoteric knowledge, the mastery of any techniques or special training. It comes only from our day-to-day experience (maturity) and the only thing it asks of us is to remain 'sound of mind and practical of conscience'. Thus, common sense could be depicted as an ant-heap wisdom,

[19] Expressed in another way, "patentness, too, is in the eye of the beholder" (1983: 90). You have to learn to see as the common individual does –in a specific time and place- without seeing more than the necessary ("you can't see Tuesday, can you?").

[20] "Common-sense wisdom is shamelessly and unapologetically ad hoc. It comes in epigrams, proverbs, *obiter dicta*, jokes, anecdotes, *contes morals* –a clatter of gnomic utterances- not in formal doctrines, axiomized theories, or architectonic dogmas" (1983: 90).

however, one should not forget that this humble heap is also, in its entirety, a cultural system.

1.1.5 Knowledge as perception: recursive descriptions

To close this overview on knowledge I will resort to some biological insights. The works of Varela, Maturana, Lovelock, von Foerster and other 'new biologists' conclude that our relationship (perception, description, interpretation) with nature, with reality, with the world in sum is not as simple as natural knowledge defenders (empiricists, positivists, objectivists) have assumed. Varela, for example (1998: 261), teaches us that even though reality may lie out there before us (*res extensa* as opposed to the *res cogitans*), we are not able to enter this external world. We are imprisoned in the world of our body and its neural system; there is no world except that one we experience through the inner processes of our corporeality[21]. If we consider the problem of perception, we are told that we always perceive perfectly, neatly, and when we do not perceive of something that is present before us, we do not notice any trace, shadow or vestige of its presence that might lead us to the suspicion of its existence, there is simply nothing. Therefore there is a lack of perception *of the lack of perception*. Then the problem of perception is closely attached to our capacity for realising the flaws in it (as it happens in matters of knowledge, wherein ancient wise men lead us to acknowledge the poverty of it). Due to the shortcoming in perceiving of, the act of perception becomes a true act, aimed to searching, noticing, asking, describing and interpreting: "To perceive of is *to act* and if I cannot perceive that I am blind, I am blind; but if I see that I am blind, I am able to see" (Foerster von 1998: 40).

Furthermore, experiments with mammals have shown that one cannot perceive of any sound until it is interpreted: only once it is understood -or one realises what it relates to- is it endowed with meaning, "the whole conductor system is activated" and one is able to hear what was already blaring. Again, to perceive of is to act since pure or natural perception, as passive reception, does not exist. To perceive of is to interpret and to interpret is to act (we are no longer innocent and uninterested observers)[22].

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[21] Even the world out there is not –qualitatively- as we experience it:

> ... "[O]ut there" effectively there is no light or colour, there is only electromagnetic waves; neither there is "out there", sound nor music, there is only air pressure periodical fluctuations; "out there" there is no heat or cold, there is only molecules moving with greater or lesser mean kinetic energy, and so on. Finally, "out there" there is, doubtless, no pain (Foerster von 1998: 42).

[22] Perception, or cognition, as action or *enactment* can be better grasped as follows:

Considering the above, knowledge could be taken as an act of 'computing descriptions of a reality', which, cancelling out 'descriptions' and 'reality', becomes the act of computing prior computations[23]. Referring to 'a reality' is different from saying 'the' reality. The latter is to set out a *confirmation* and is linked to empiricism: my tactile perception confirms my visual sensation that there is a table. The former –computing descriptions of a reality – establishes a *correlation*: the correlation between my tactile perception and my visual impression "produces a kind of experience that could be *described* by saying 'there is a table'" (1998: 43). 'Description' is to be emphasised since cognitive processes do not actually compute things but only descriptions of them. If this is so, reality can never be grasped and it should be taken only as the operation of *recursive descriptions*. Furthermore, if 'to compute' means nothing more than computing descriptions, so we have an allusion to knowledge as an endless recollection of descriptions, which sounds like the ancients' recollection of memories.

The process of knowledge supposes *autonomy*. The neural system is one that organises itself throughout the repetitive process of computing; in a more precise way the system regulates its own regulation (or rules its own ruling). In doing so it is able to compute an enduring stable reality[24]. If we regulate how we rule, then we may say that we are the only ones who decide how to act; we are, in the end, the only ones responsible for our actions (in Serres, 1992 there is a deeper discussion on this issue). In this manner we are led somehow – discarding any form of heteronomy or solipsism - to certain aesthetical and ethical consequences (having discovered in the meantime the *other*, which implies an identity/difference relationship). These consequences would be: to know is to act (the aesthetical consequence), and each time we act we should do it in such a way that the number of choices be enlarged (the

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> In short: the world is not something that is given to us but something we engage in by moving, touching, breathing and eating. This is what I call *cognition as enaction* since enaction connotes this bringing forth by concrete handling (…) This central concern of the enactive position stands in contradistinction to the well-received view that perception is fundamentally the truthful reconstruction of a portion of the physical world through a registering of existing environmental information. In the enactive approach reality is not a given: it is perceiver-dependent, not because the perceiver "constructs" it as he or she pleases, but because what *counts* as a relevant world is inseparable from the structure of the perceiver (Varela 1999: 8, 13).

[23] To avoid objections in relation to the term *computing* von Foerester reminds us of its general meaning: to reflect, to contemplate (*putáre*)things with (*com*), leaving aside any reference to numerical magnitude.

[24] "In fact, the key to autonomy is that a living system finds its way into the next moment by acting appropriately out of its own resources. And it is the splitting, the crossings that articulate microworlds, that are the source of the autonomous and creative side of living cognition." (Varela 1999: 11).

ethical consequence). Autonomy –the fact that some unit, as a result of some operation, detaches itself from its background- is closely related to *reflexivity*. Reflexivity, a notion which is given a central place in Beck, Lash and Giddens' (1994) writings, can be regarded as the distinctively human capacity of *autoreference* (Varela 1998: 252). Further reflexivity entails paradox insofar as it merges two planes of meaning which independently are truthful but when joined become contradictory, inconsistent[25].

In brief, in knowledge processes we are time and again drawn back to perceptions of perceptions of perceptions... As yet the world is somehow plastic: neither subjective nor objective; reality is not our inner construction nor is objectively lying out there[26]. In fact our experiences lack solid foundations, they display only certain regularities and interpretations: "we live in a never-ending metamorphosis of interpretations"[27] (Varela 1998: 263, according to this author similar tenets can be found in the Indian Madthyamic medieval school of philosophy). The old and beloved ideal of objectivity is actually a chimera; we are living in a world wherein nobody can pretend to know better than the other (and all of us should put – all together with Ud Din Attar - our foreheads in the dust, *acknowledging* it):

> *What is salient is that the empirical world of living beings and the auto-reference logic, as well as the experience of the whole reflexivity of natural history, teaches us that ethics, tolerance and pluralism free us from our own values and perceptions, in order to respect others' perceptions and values. Without a doubt, in this way, and no other, knowledge is constituted (*Varela 1998: 263*).*

After this short and certainly incomplete overhaul on knowledge from a cultural point of view, which we has ended with some insights from the 'new biologists' (whose revolutionary theories establish an unexpected encounter with non-Western cultures and philosophies), I will concentrate on the main concept that has guided the present investigation and which has been referred to in so many different ways up to now: the concept of *local knowledge*.

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[25] Overcoming the contradiction between two planes of meaning means to access a superior cognitive plane like that achieved through Zen exercises (Varela 1998: 255). To reflect is then to be able to take the self away from the contradictory, paradoxical situation and to consider it with a new regard.

[26] Our brain is not limited to represent the external reality, it –to an important extent— constructs reality: "It is evident in this light that the functioning of the brain is embedded in the constant enactment of different worlds, which is predicated in the history of viable descent: an organ that constructs worlds rather than reflects on them" (Varela 1996: 111).

[27] The Italian philosopher, G. Vattimo indicates that there are only interpretations (1997).

1.2 Local knowledge

Interest in issues of local knowledge by social scientists can be traced to the question cast by nineteenth century European scholars regarding 'how natives think' (a quest undertaken by Durkheim, Mauss, Lévy-Bruhl, Malinowski, Tylor and so forth, and in current times by M. Sahlins, who was obliged to respond to bombastic accusations from an indignant Sri Lankan scholar).

It was Lévy-Bruhl who remarked that 'primitive mentality' was not to be considered a prior stage (a rudimentary or pathological form) of modern mentality as Durkheim, for instance, did. Lévy-Bruhl's primitive mentality should be regarded as quite different from modern thought and scientific rationality. His contention was that "primitives do not probe causal connections" in a scientific fashion and that was so, not due to alluded shortcomings in their mental structures, but "because such examination is precluded or excluded by their social doctrines, and by the parameters of their systems of knowledge" (Jeyaraja 1990: 88). Thus, there were diverse mentalities or rather 'multiple orientations to reality', distinct 'orderings of reality'[28].

Acknowledging these differences in how experience is construed – ways of 'world-making' - Jerajaya argues that alongside the logical scientific mode, one pole of a continuum, we are endowed with the other pole, a "sensory, polyvalent, presentational and participatory" mode (participatory in the sense that it is shared within a certain community)[29]. M. Sahlins, in addition, points out that *pensées sauvages* do not withdraw from Western empiricism "by an inattention to the world but by the ontological premise that divinity, and more generally subjectivity, can be immanent in it"; moreover,

> *Such pensées sauvages, as nearly every anthropologist knows, require a disciplined empirical disposition. They entail sustained, intensive, and imaginative reflection on experience, on the properties and relations of things. But for all that they do not everywhere constitute experience in the same way, according to the dictates of a universal practical rationality (*Sahlins 1995: 7).

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[28] From the psychoanalytical perspective Freud suggested the existence of a non-rational thinking present in dreaming.

[29] Speaking of *common sense* Varela (1996: 91) says that the questions posed by it in daily life are not pre-defined but *enacted* or, following the phenomenological tradition, they are pushed to emerge (*hervorbringen*).

What Sahlins refers to as 'cultural knowledge' deals with the relation between empirical intuitions and local propositions (and not with objects deprived of meaning).

Historically, native knowledge, later christened *indigenous knowledge*, when 'discovered', was put up against what was known as *civilisation*[30]. 'Culture' was a term coined in the late 18th Century by Germans in opposition to 'civilisation', an utterance of the colonialist spirit of the French and Anglos who discovered 'savages' overseas but, by no means, *cultures* (1995: 11). The contrast between these words was clear: 'civilisation' was used in the singular and enclosed *degrees* of it (at the forefront were, of course, the colonial powers). On the contrary, culture was used in the plural and referred to different *kinds;* it was the legacy of tradition, adapted to specific life conditions where people acquired not only knowledge but *values*[31]. The fact stressed by Herder that culture means a "family or kinship mode of thought" is valid also to local knowledges within which "reason is invested with feeling and bound to imagination" (Herder as quoted by Sahlins 1995: 12). As shown earlier (see *supra*) this was already assumed by pre-modern cultures, but the authority of empirical realists, in a rather early application of Popper's ideas, quickly found *error* where *culture* was also flourishing remorselessly[32].

In tracing some other characteristics of *local knowledge* one might contend that this knowledge demonstrates – to a certain extent – a female version of knowledge. Indeed, gender studies (Gilligan as quoted by Jeyaraja 1990: 97-101) has shown that women adhere to a "morality of responsibility" in which connectedness and relationships are most important. Women's orientations generally address an ethic of care and their stance concerning relationships is "reluctant to generalize and categorize but (possesses) a sophisticated understanding of the nature of choice" (1990: 101). These features have been stressed with respect to local knowledge too.

According Schutz, as long as reality can be ordered it can also be construed in some way: to grasp reality presupposes a process in which subject and object

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[30] The term "civilisation" appeared in France during the 18th Century:

> The meaning was not the same as the sense of "culture" as a way of life that is now proper to anthropology. Among other differences, "civilization" was not pluralizable: it did not refer to the distinctive modes of existence of different societies but to the ideal order of human society in general (Stocking 1968 as quoted by Sahlins, 1995: 10).

[31] "It is by means of this tradition, endowed also with the morality of the community and the emotions of the family, that experience is organized, since people do not simply discover the world, they are taught it. They come to it not simply as cognitions but values" (1995: 12).

[32] Albeit, at present, according to Sahlins, culture would be along with anthropology in its twilight.

are involved. Different needs and levels of consciousness deliver different interpretations in everyday life[33]. Similarly, as Goodman points out, the world can be described according to "multiple frames of reference". He stresses two ways of world-making that are defined by two referential forms: *denotation* for science, since it resorts to literal, linguistic or mathematical description (representation), and *exemplification* for the arts and other types of expression that do not denote but show a lot and involve feelings (presentation[34]). Each enjoys its own truth: the former reflecting the empirical, factual 'scientific truth' and the latter so-called 'aesthetic truth' based on "syntactic and semantic density and pattern recognition, and processes of world-making such as composition, ordering, weighting, and so on" (Jeyaraja 1990: 104)[35]. The ordering of worlds departing from cultural patterning could be described in the following terms (it is stunning how precisely this depiction can be applied to Andean culture as well):

> *(Melanesian life is) ...a dynamic totalistic weaving of nature, society, myth and technology, and (...) the Melanesian village (is) the centre of a surrounding mythic landscape, where mountains, rocks, trees and animals (are) seen as familiar, and as endowed with the power of its ancestor-god...* (ibid: 106*).*

All of us are able to manage idioms, cultural repertoires and concepts circulating within our culture and, eventually, craft different knowledge systems, skills, and practices setting out, in the end, values, narratives, institutions, and prospects of the future, in short: *tradition*. From distinct and relevant realities structured or imagined by social action, cultures, local people, farmers and so forth unfold knowledge activities (Salih 1996: 43).

Simply mentioning tradition does not necessarily mean placing it in opposition to *modernity*. As has been stated frequently, there is not an open, definite, antithetical contradiction between them. Such a contradiction would, to some extent, be a "false problematic". If we are going to say that modernity has the capability to renew and change continuously, arguably we can say the same of any 'authentic tradition' (Galjart 1976: 69). Embracing the alleged tradition/modernity dichotomy leads to a concealment or masking of the

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[33] Schutz describes daily life as follows: "an intersubjective world, common to all of us, in which we have not a theoretical interest but an eminently practical interest" (as quoted by Jeyaraja 1990: 102).

[34] In Richards' terms (1990) to present is to perform, to interpret something vividly. To represent is if any to depict and symbolise, to translate into another idiom, to replicate something in a simplified way.

[35] This is valid also for religious beliefs where a holistic and configurational grasping of totalities can be found. Such a grasping encompasses "aesthetic enjoyment" and "mystic awareness".

ample diversity amongst, for instance, farmers (in the domain of *rural development*) "who may innovate within certain domains but refuse to do it within others" (1976: 69).

The epithet 'modern' (or modernised) has commonly been given to farmers who favour technical innovations and make other evident changes (achieving a more intensive use of mass media, better equipped homesteads, increases in shopping etc.). It has been assumed that one could demonstrate the commitment to modernity through a more dynamic lifestyle, that a manifested disposition to change was the crucial trait of the 'new farmer'. It is common-place to state that modernisation is the direct effect of economic growth and that we assess the former through evidence of the latter. Nevertheless, this practice of assessment seems to be insufficient or rather inadequate for understanding agriculture in non-Western countries. In discussing why farmers do not embrace some innovations one should bear in mind at least all three reasons pointed out by Galjart (1976: 70): 1), ignorance (as was argued at the outset of the chapter): farmers possess no other know-how than their own, 2) incapacity: they know very well what they should do but do not do it due to various constraints, 3) reticence: they know what they are supposed to do (but, who determines what 'they are supposed to do'?) and have the means to do so but, because of 'certain values' or reasons, they remain reluctant. In other words, we must situate farmers within their actual social, political and cultural contexts, abandoning the "antiseptic image of the new farmer" (Fairhead 1993: 195). Therefore, the opposition between modern and traditional is, at the most, an opposition between 'ideal types' which is very often used to benefit either those who want to envision farmers as rational, efficient, benefit-seeking entrepreneurs, or those who prefer to think of farmers as anti-modernisation or anti-globalization militants who strive to defend the 'very tradition' from their external enemies, making a plea for 'anti-development'[36]. In order to delve deeper into such a schematic opposition some scholars have promoted the study of the 'underlying logic' (social, economic) which guides farmers' behaviour[37].

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[36] Tradition defenders have an archaic image of peasants but their procedures do not differ from the ones utilised by "modernisers". Both consist of representations, clichés, stereotypes that mislead the analysis (Dozon and Pontie 1985: 72).

[37] One could argue that farmers, in terms of logic (*logos*), are frequently not logical but rather contradictory and even irrational. To talk about logic implies somehow a mastery (virtuosity) over something, but there are so many things that are beyond our control (if anything it can be said that we "try" to be logical). Moreover, to state that there is logic reveals our desperate attempt to make sense of things and our behaviour, to find out that there is something rational, coherent, predictable and explainable in them. But what we perceive of as reality or ourselves is ambiguous, unpredictable and we, above all, master so little.

Returning to the issue of local knowledge, we must realise that representations and definitions of local knowledge have shifted over time. At first local knowledge was seen as 'primitive', 'irrational' or 'wrong' (as discussed above). Later on it was understood as a 'valuable and under-utilised' resource that should be incorporated into formal research and extension activities, thanks to a new 'goodwill morality' cultivated by technicians of the new era (Arce 1993: 4-7)[38]. At present it is represented as a set of "contrasting, multiple epistemologies produced within particular agro-ecological, socio-cultural and political economic settings" (Scoones and Thompson 1994: 17-18).

Taking into consideration all the preceding insights about local knowledge, I now wish to summarise its main features and traits as a way of knowing and as a set or body of ideas and techniques deployed for practical purposes.

If we scrutinise farmers' knowledge in some locality we will probably be disappointed not find any impressive or elaborated local knowledge, but rather a pattern of "partial, diffuse and contradictory knowledge" (Jansen 1998). So whence could we argue that local knowledge is something special? Local knowledge is presented as partial, diffuse and contradictory (that is, poor); and each time we should not expect it to be complete, sophisticated, finished, and institutionalised.

Creativity is the term Fairhead (1993) employs when referring to local knowledge, but creativity does not mean certainty, accuracy or correctness. Due to this, farmers quite often do not feel very confident about what they 'know'[39]. Like Popper and the ancient Greeks they venture only *conjectures*, humble propositions ('hypotheses' as Fairhead puts it). Normally they do not dare to state that they know. Maybe because they 'know' very well that what they know is all the time too close to error and misunderstanding, and too misleading (and that – as many cultures have recognised - true knowledge could not be expressed in any other way):

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[38] Arce raises the problem of reducing the development issue to a matter of goodwill, morals and values held by experts:

> Chambers' phenomenological position leads him to identify a change in experts' values as the basic requirement for rural development reconstruction. However the question is how Chambers can induce rural experts and professionals to adopt his goodwill morality. Apparently, he believes that practitioners can change, if only they get access to better scientific insights. This means that in his view science is portrayed as somehow neutral and devoid of issues of power. (Arce 1993: 4).

[39] "As farmers' practical knowledge is empirical, hypothetical and continually reviewed, people are not confident enough to express it easily, and would not want to be held responsible for the mistakes of those they advise." (Fairhead 1993: 194)

> *Local knowledge is better envisaged as empirical and hypothetical. Nobody locally is in a position to say what is 'right' or what is 'wrong' and to turn a farmer's hypothesis into truth (...) local knowledge lies as much in its methods, in its lack of overbearing authority, and in its fluidity as in 'what is known'. It is living and dynamic, so in describing it one ought to be very careful not to see it as – or worse, turn it into - stone.* (Fairhead 1993: 193)

My quoting, in the first part of this chapter, some Sufi mind was that it appears that local knowledge shares many characteristics with what is known, in the Islamic world, an *arabesque*. The arabesque is related to the labyrinth, which can be seen as something evil (infernal) or good[40]. In Islamic architecture[41] decoration does not seek to emulate a Creator, and that is why stable and eternal forms are avoided while "precarious, unfinished, fragile" elements are evoked. The arabesque reflects a sort of "vague negation of closed geometric forms" and expresses human fantasy in its own chaotic way[42]. It seems to encompass what has been, what is, and what will be (including attempts that did not succeed but which remain as possibilities) (Rella 1994: 9-21). The arabesque, like modernity, was *a-topos*[43]; and local knowledge, calling upon another paradox concerning knowledge, could be seen as a highly localised arabesque and, simultaneously, as a-topos (see below the discussion of this notion based on Arce and Fisher).

In fact, local knowledge can be compared with many artistic or cultural forms: arabesques, labyrinths or mazes, religious tattoos, baroque architecture (the burdensome Bolivian or Brazilian churches of the 17th and 18th Centuries, for instance). Arce and Fisher (1999: 53) illustrate how the Baroque represented a "game of knowledge" wherein people and things were repositioned, and ostentation and detail were the "aesthetic protocol" for their transformation (in an appearance of virtue):

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[40] "Place of horrors to be dominated through the stratagem of Ariadne's thread and the violence of Theseus' sword (...) happy place, which shelters from law and the violent *nomos*" (Rella 1994: 10).

[41] It is not strange to refer to knowledge as *architecture*. K. Zimmerer (1996), describing the huge taxonomy developed by Quechua potato cultivators in Peru, speaks of rising *cathedrals*.

[42] It is also assumed to be an original form since –like *bricolage* to C. Levi Strauss– it encompasses each possible form: "And hence *the self form of possibility which, while not enacted yet, is nil. This nil however is not nothing: rather it is 'infinite plenitude'*" (Rella 1994: 21). To Baudelaire the arabesque was "the most spiritual" and "most ideal" design (as quoted by Rella 1989: 32).

[43] In other words, not situated or, more precisely, lacking place. Not able to be situated in a specific place because it is not demarcated by borders or margins (Rella, 1989: 33).

> *This transformation was like a carnival of externalities that circulated as manifestations of the way people experienced relationships to one another and to objects in the exterior world. For us today, the masked ball and wig are key symbols of the Baroque era. People became different things through the use of masks and associated customs. In short, the personhood of baroque actors was unveiled through the act of being 'the self' in the game of 'the other'. This was a game of knowledge in which people became things through illusion, diversity and mystery, but within a constant public exhibition (*Arce and Fisher 1999: 53*).*

Apart from such aesthetical and ontological features, local knowledge retains other more pragmatic and operative characteristics relative to its fields of application. Although local knowledge constitutes an – at times diffuse – mixture of configurations and representations (encapsulating images and meanings) we should not ignore or overlook its practical aspects. It is possible to identify some of its general 'properties' even though in reality one would hardly be able to neatly define their boundaries.

Local knowledge, *lato sensu*, can encompass numerous fields, domains and cognition frameworks which are not always – at least not directly – related to the development *problematique* (e.g. treatments of spiritual possession, divination, warfare and so on). Some authors (Olivier de Sardan 1995) have proposed identifying so called "people's technical knowledge" in terms of the techno-scientific fields of knowledge, in order to make operational the link between local knowledge and development issues[44]. Therefore "technical local knowledge" can be seen as a bundle of practical or operational knowledge including all fields of social practice (management, soil science, climatology, health and so on). It can also be taken as a frame of meaning through which social actors are able to interpret relevant practices and to make them relevant to their lives[45]. Other configurations of knowledge – the scientific, for instance, brought about by development projects – are interpreted and evaluated by means of the lenses and resources of the local configuration (thus local knowledge is then *normative* and *evaluative* as well). Local knowledge, then, is both practical and empirical:

> *Local knowledge is multiple, variable, heterogeneous, and unevenly distributed (according to differences in gender, age, wealth and personal trajectories[46]). It is not, as has been argued so many times, a 'traditional' knowledge in the sense it does not change*

[44] Normally, three large fields have been identified by development practitioners as relevant to development: knowledge of agriculture, livestock and environment; knowledge of human and animal health; and knowledge of farm management.

[45] This is to say that local knowledge does not lack theoretical or elaborated manifestations.

[46] "A standard local knowledge shared by everyone would be a fiction. There is common knowledge amply shared and specialised knowledge, sometimes monopolised by someone" (Olivier de Sardan: 145).

> *or 'evolve'. It is always incorporating new insights, practices from its social and institutional environment (…) Nonetheless local technical knowledges do not become necessarily a 'system', and they are far from being upheld by any integrative indigenous theory. Widely founded in personal experience they are flexible and agglutinative, without explicative pretensions for the long or medium run. Perhaps in some way they (people, farmers) reject trying to know more (*Olivier de Sardan, 1995: 145-146*).*

1.3 The *Actor-Oriented Approach* and the problem of knowledge

The approach upon which the following empirical research is based is *actor-oriented.* According to this perspective, the 'problem' of knowledge is no longer a matter of philosophical or epistemological discussion enclosed within 'Western' assumptions about science and reality[47]. Instead an actor-oriented approach seeks to achieve a demystification of prevalent ideas on science and to unveil – by means of detailed ethnographic work – how the 'production' of knowledge arises from everyday practices, contingent encounters and the unfolding of particular strategies that consequently shape, define and use that knowledge.

Adopting this point of view, I argue that the study of the creation and transformation of knowledge can be effectively understood through giving close attention to how different life-worlds intersect with each other, and thus generate bridges and *interfaces* between 'knowledgeable' and 'capable' actors (scientists, bureaucrats, technicians and farmers) involved in the process.[48]

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[47] When discussing the "nature of knowledge", Arce and Long (1992) emphasise its social and provisional features, in the sense that it is recurrently and continuously constructed and destroyed.

> Knowledge is constituted by the ways in which people categorise, code, process and impute meaning to their experiences. This is as much true of 'scientific' as of 'non-scientific', everyday forms of knowledge. We should not therefore equate knowledge with some professional, specialised or esoteric set of data or ideas. It is something that everybody processes, even though the grounds for belief and the procedures for validation of knowledge-claims will vary. Nor should the concept of knowledge carry with the implication of 'discovering the real facts', as if they lay 'out there' ready for uncovering. Such a view is based upon an 'objectivism' which assumes 'the world is composed of facts and that the goal of knowledge is to provide a literal account of what the world is like' (...) Moreover knowledge is constructive in the sense that it is the result of a great number of decisions and selective incorporations of previous ideas, beliefs and images, but at the same time destructive of other possible frames of conceptualisation and understanding (Arce and Long 1992: 211).

[48] "The production and transformation of knowledge resides not in category systems or classificatory schemata per se but in the processes by which social actors interact, negotiate

In order to do this one must analyse the actors' everyday practices, performances, their manoeuvres, discourses, 'speech games' (their 'social imagery'), and the struggles and contestation within the networks in which they take part. In this way the process of how knowledge is embodied and reassembled will come to light[49].

However, one should not assume that knowledge emerges from 'self-contained' cultural or institutional systems that guide or dictate (in terms of power or authority) individual or group behaviour, nor that it supposes the reinforcement of commitments. In an actor-oriented approach, there are no hierarchies or distinctions among different kinds of knowledge[50]. Moreover, if there are 'many different intersecting knowledge frames', implying contradictions, struggles and negotiations, then there are no longer any commonalities in the concepts of knowledge[51]. This means that all kinds of knowledge intersect or collide in the construction of meanings, social arrangements and practices.

When this perspective assumes that there are such intersections it not only refers to conflictive encounters (when development may be described as a 'battlefield of knowledge') or discontinuities that perpetuate the reproduction of ignorance (instead of knowledge), but also refers to positive encounters wherein processes of exchange, assimilation or fusion can take place. Such non-conflictive encounters are described as *accommodation* between different repertoires[52]. Subsequently, *negotiation* is not only assumed to consist of

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and accommodate to each other's life-worlds, leading to the reinforcement or transformation of existing types of knowledge or to the emergence of new forms" (Arce and Long 1992: 214).

[49] Stressing how knowledge is concretely embodied and lived, F. Varela points out "…that the proper units of knowledge are primarily *concrete*, embodied, incorporated, lived; that knowledge is about contingency; and that the uniqueness of knowledge, its historicity and context, is not a "noise" concealing an abstract configuration in its true essence. The concrete is not a step toward something else: it is both where we are and how we get to where we will be." (Varela1999: 11).

[50] "An actor-oriented perspective refuses to draw sharp distinctions between different kinds of knowledge on the basis of their origin, pedigree and so-called authority" (Arce and Long 1994: 77).

[51] One might take this affirmation to its extreme manifestation stating as hermeneutics sustains that "there are no facts, but only interpretations" (Vattimo 1997: 2). Consequently if there are many and different forms of knowledge and also many forms of conceptualising it; does this not lead to a nihilistic and relativistic point of view (characteristic of the "nihilistic vocation of hermeneutics") which implies a risk of falling into vagueness, vacuity and obviousness?

[52] "Indeed the field of rural development involves not so much a confrontation of epistemologies but rather an accommodation between distinct knowledge repertoires based upon different conceptions of 'society' and 'nature', and the implications these different

smooth or regulated participation but as '...the outcome of the struggles, claim-making and interactions between different actors which give new meaning to resources and lead to changing social relations...' (Arce and Fisher 2000: 1). Here it is worthwhile to point out that negotiation is an issue of paramount importance within certain 'fields' of knowledge (socio-economic, political, and cultural) but within actual agricultural fields (plots, orchards, pastures) this issue does not appear to be so central. That is to say, 'negotiations' with a crop, apparently, differ from negotiations among men, the latter involving struggle and opposition, while the former could be more properly portrayed as performance, as Richards has proposed.

Consequently knowledge is not an encapsulated asset – the stone image of Fairhead (see above). It does not only constitutes a set of insights/skills/devices, nor is it only a way of depicting something or endowing it with meaning, but it is also, and principally, "a capacity for action" (Arce and Fisher 2000: 1), for reshaping societal and natural realms through practice. Conversely, knowledge comes into being through actors' practices[53].

The game (continuing with this playful image) of *positioning* and *repositioning* is central to local knowledge. At first local people are positioned within a more extensive and complex field of interaction involving science and technology, the state and the market. And then, inversely, local people reposition such external knowledge in the practical context of their own lives. The capacity of repositioning expert knowledge is what Arce and Fisher call *pseudopodia*:

> *This constitutes the extensive 'pseudopodic' nature of knowledge. To explain, this refers to the temporary protrusion of the social fibre of a given place (or location) that envelops and embeds expert knowledge. Hand in hand with the local capacity to encompass expert knowledge is a critical attitude towards what is perceived to be something 'external'. This generates a motion or set of changes that entail fusion, blending and counter-movements vis-à-vis expert knowledge (*Arce and Fisher 2000: *9).*

Knowledge processes of this nature steer towards "...[T]he reassembling of the recursive properties of entities and the redrawing of boundaries in such a

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cosmologies might have for negotiating and defining development practices such as 'participation', 'accountability' and 'organisational efficiency'' (Arce and Long 1994: 80).

[53] Here we meet again the contradiction actualised by Borges: we should distinguish between knowledge and its *uses*, but using knowledge means constructing, creating it (like a song: as long as it is interpreted it exists and each new interpretation is another version of it, another construct), but you can only use already existing things...(how can *spending* equate with *accumulating*?).

way that new social forms emerge out of existing ones" (Arce and Long 2000: 17). Eventually, the process of nesting or embedding expert knowledge brings about, like a reflux, transformation of prior (local people's) knowledge: in other words, its *mutation*:

> *...[T]hey [in this case, new knowledges] can lose (deletion), gain (translocation) and exchange (transduction) specific characteristics or properties. The forms that result are never fully controllable and may be propelled, in certain circumstances, by outside interventions, although internal rearrangements take precedence over externalities, because it is these that give the form its identity, qualities, organisational shape, capacities and meanings (*Arce and Long 2000: 17*).*

There is a "social frictional nature of knowledge (...) Boundaries divide and frame the relationships between knowledge groups"[54] (Arce and Fisher (2000). Accordingly, margins between 'epistemic communities' – like uncontrollable and disputed frontiers — are crucial. At the margins knowledge becomes 'blurred'. From them resistance spreads out as a result of the friction between norms, values, and aims.

In knowledge interfaces a "re-bounding effect" (Parkin, 1995) takes place. By rebounding is meant "the motion from one place to the other and back again; a trace without beginning or end that undermines categorisation of expert and indigenous knowledge" (Arce and Fisher 2000). The presence and operations of expert knowledge unleash local contrasts and confrontations. Resorting to its concepts and discourse, local people use and reconstruct scientific knowledge in situated encounters with development experts. In this manner, lay people craft a way of life, reorganising alien knowledge in accordance with their own values, skills and institutions. The outcome of such knowledge processes is the emergence of 'partial totalities', unfinished and open works: knowledge thus is like the *arabesque*.

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[54] In that sense Heraclitus held forth that there was an identity relation between logos and disagreement; between reason, language and divergence (*vid. Supra*): i.e. to know, to articulate some discourse means to spawn divergence, competence and opposition. Since knowledge is by and large attached to action and power, frictions with other understandings and goals will be an unavoidable outcome. Chuang-tzu also posited a similar tenet: "The Path (the Tao) comprises the wholeness in unity: when there is division, there is definition" (Lamparelli 1996: 23). Thus, the mental activity can be seen as one that, fundamentally, leads to division and contraposition.

Further, Seng-ts'an, somewhat similarly to the 'new biologists', said: "If you know your mind with the mind, you will not be able to avoid a big confusion." To the *Brhadaranyaka-Upanishad* the moment we become knowledgeable objects we are no more knowledge subjects. ("By means of what will be known the knower?") (1996: 20).

In the end, local knowledge is not exclusively local or global, indigenous or expert. The newly assembled, conflated knowledge cannot be seen as being local or global: "...[T]he merging and relocation of origins of beliefs and behaviour (takes place) as people engage in 'counterwork' that involves the interplay of 'hegemonic' and 'non-hegemonic' discourses irrespective of their global or local origin". Likewise the "...[P]atterns of connections across diverse forms of knowledge are not reducible to a comprehensive space in terms of scale and scope" (Arce and Fisher 2000). The resulting knowledge depends on "intricate interweaving of situated people, their experiences, sense of history, values and their image of the future"[55] (2000). Thus, the consequent (concomitant) knowledge would constitute an 'a-topic' (*a-topos*) expression of the encounter, the interface between expert and local people's knowledge[56].

The theoretical journey undertaken in this first chapter concerning knowledge, particularly local knowledge, is – together with the discussion on science and technology dealt with in the second chapter – fundamental for understanding farmers' livelihoods, their strategies, practices and technology, especially within a socio-cultural context such as the Andes. I consider that, in the present thesis, it has not been possible to ignore what has been said and written about so called 'lay knowledge' and its similarities and differences with 'expert knowledge'. Although in a summarised way – and it goes without saying an incomplete way – I have attempted to attain a valid and useful approach to the notion of local knowledge, not only for establishing what we are talking about when we refer to such knowledge, but also for building a necessary theoretical basis for analysing the variety and significance of forms of local knowledge for potato cultivators in the research area in Bolivia (see especially Chapters 5 and 6).

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[55] The problem relative to the symmetry of knowledge relations between experts and natives seems to remain solely as one mortifying the former. The latter, taking –as the tradition of the former dictates— those relations as *data*, seem to be much more interested in how to readdress alien knowledge according to their rationale.

[56] Following F. Rella we realise that "The lack of place is therefore what paradoxically permits us to clasp space in its whole enfolding extension, to seize concrete 'reality'. It is necessary therefore to subtract to the 'place' what renders it as such: what makes of it 'site', protecting us in its interior, within the secure perimeter of its boundaries" (Rella 1994: 9; in an other passage, 1989: 33, the author stresses that the outer limits become inner margins i.e. *thresholds*, which are not exclusive but inclusive, including even what can question itself. Thus, the truth –Florenskij— in the same way is a-topic inasmuch as it encompasses what can invalidate it). Weil also argued (as quoted by Rella, 1994: 9) that only being rooted in the lack of place is it possible to embrace, like all the saints, what is length, width, height and depth. Socrates, to conclude, was considered an a-topic sage by his disciples.

That is, if we want to decipher and understand the ways in which local knowledge emerges, is organised and expressed in some specific locality, as well as its ongoing processes of reconfiguration and the scope and modalities of technical changes that are incarnate and manifest in such processes, we cannot disregard the necessity of delimiting theoretically the precise object of study and making explicit its constitutive elements. An 'operational definition of terms' is not enough. Instead it requires an in-depth reflection and deconstruct of the meanings and practices associated with the various knowledge components involved, and the development of a convincing methodology for exploring the complexities encountered.

TWO: Knowledge and modernity: a discussion about science and technology

2.1 On some questions about science and technology

In 1953, Martin Heidegger declared, provocatively for the times, that "the essence of technology was not anything technical at all"[57]. In the wake of prevailing ideas of 'modernity', that is how it was seen: merely as a tool. Emile Durkheim, one of the founding fathers of sociology, and Hegel before him, also thought in such a way. For Hegel, the determining feature of the machine and thus scientific technology in general was its independence or autonomy as an instrument. But this was not the case for Heidegger who affirmed that seeing technology as something neutral means surrendering to it in a rather unreflective manner. Assuming that it is designated as a way of achieving some ends as a result of human activity, its instrumental determination, although correct, would not suffice to define it. Conceiving of and making instruments and machines and attempting to respond to the necessities to which they are aimed constitute arrangements that become technology in another form.

Durkheim, being immersed in the enunciation of the rules of his sociological method (1982: 50-51), points out what he sees as the difference between science and technology. A main difference would lie in the fact that science, through knowledge, can explain the world while technology (which he brackets with the *arts*) responds only to so-called vital necessities, aimed at the domain of practice: technology empirically addresses practical problems without minding the explanations that scientific knowledge might draw upon[58].

According to Heidegger, the starting point for this modern idea of technology is the *ratio principle* as defined by Leibniz, which states that everything can be

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[57] 'La Pregunta por la Tecnica', 1997.

[58] One century later, P. Bourdieu still expresses a similar view

computed[59], a principle to which economists, above all, have adhered with enthusiasm, affirming their total commitment to modernity. Such a principle is a form of rational representation that ensures the possibility of calculation and, at the same time, that the calculus be sure, or more precisely, perfect or exact[60].

Another German philosopher, Nietzsche, sees technology as *the will of power*. This implies a consummated metaphysics for world domination that constitutes not only the problem of authoritative states but of modernity itself. According to Jünger, the culmination of this process is realised in the occupations of soldier and worker nested at the core of industrial society during the first half of the 20th Century. This was a time of ferocious competition and exacerbated animus. For Nietzsche, the issues of work categories and social mobility are of central importance since the passage from peasant to industrial worker does not only imply the proletarianization process. It is a real promotion, a radical social ascent. Philosophers and other scholars harboured scorn towards peasants and saw the modernisation process as a sort of liberation for them.

Starting with the 'Zarathrustra project', in which the power realm belongs to the worker, Junger aims to establish that *technology is the mode and manner in which the worker image mobilises the world* (emphasis added) (Ayestarán 1996a: 101). This connects up with the work of Karl Marx who is principally concerned with workers conditions, the commodity relation and the problem of power.

2.2 Technology and machine

In Marx we see again the contradiction already perceived by Hegel between tool and machine, a contradiction related to the improvement or innovation of labour instruments. Seemingly, Marx did not realise the problems that technology was going to bring. In *Das Kapital* (Vol. 1) he limits himself to celebrating, in awe, the machine's 'skill' and potentiality, referring only to its productive capacities[61]. Finally he stresses, as Hegel did, the difference

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[59] *Nihil est sine ratione*

[60] The modern world, in this manner, "reduces itself to a measure tape". What is known by us as a **place** is rather a **space** "which makes room for things" (Andoni *et al.* 1996: 97). In other work Appadurai proposes that we think of the local in a different way from that of the traditional one of modernity: namely scales. Scales are certainly just another type of measurement that say little about things, beings and their relationships. Thus, Appadurai recommends that we think of locales in terms of contextuality.

[61] Nevertheless he was worried about the significance of machines for workingmen. He noticed that there was a direct antagonism between labourer and machine since "[T]he object

between the tool as a human extension and the machine as autonomous mechanism. To him, technological innovation was strongly linked to relative 'surplus value', a comparative advantage for some capitalists in relation to others who did not take advantage of such innovations (Cabo 1996: 156). All of this corresponds to a narrow economistic perspective

In contrast to Marx's views on technology, Mumford (in Andoni 1996b) states that crafting tools is not only an attribute of humans (apes make tools). His contention is that man is more than a toolmaker. Due to his complexity, energy and capacity to create himself, he is, above all, a symbol maker (cf. Andoni 1996: 82). To him the shift from an 'organic' to a 'mechanical' view encompasses a commitment to an ideal that the machine itself appears to be endowed with: where everything can be standardised, regulated, measured, as Leibniz stated[62]. Based upon this, Mumford arrives at the concept of the *megamachine*, a notion that encapsulates the model of a large bureaucratic scheme predicated perhaps on a religious hierarchical structure, a division of labour and the conversion of men as part of such a machine. An example of this megamachine could be the Egypt of the pharaohs, a machine able to build the pyramids, work groups coordinated by experts with the Pharaoh at the apex of the machine. The megamachine of current times (driven by the State or transnational corporations) also displays its particular traits.

> *The current megamachine achieves its servers' submission, their alienation by means of diverse eschatological messages: during the big war by the necessity of fighting the absolute evil that represented fascist dictatorships, later on through the obligation of fighting communism and finally by the promise of material progress and welfare. The idea that technical development will steer us to economic growth and the betterment of life of every single individual is the bribe this megamachine offers to us (*in Andoni 1996b: 48*).*

The notion of a megamachine is quite similar to another one, that of the *ecological machine* proposed by A. Negri (1988). To Negri the machine is a set of pre-conditions; that means accumulated labour, and a condensed labour force, which requires a new labour force to activate itself in order to unfold its wealth. In other words the machine is a system whose mechanical conditions constitute an ordered universe, an ideal scheme that can be filled with new

of improved machinery is to diminish manual labour" (Marx 1994: 79), to the point of making it superfluous. Machinery is a power inimical to the labourer since "[I]t is the most powerful weapon for repressing strikes, those periodical revolts of the working-class against the autocracy of capital" (1994: 79).

[62] We should remember however that Pascal himself, father of modern rationalistic philosophy, stated that "the last step of reason is to acknowledge that there are infinite things which surpass it (the rationalistic philosophy)" (as quoted by Lamparelli 1996: 85).

activity (1988: 78). Negri discusses the magic of machines when referring to their power, "as much mysterious as sophisticated".

Hence idea of the 'ecological machine' can be understood as follows:

> *[I]t is an ecological arrangement, a complex dimension in the sense that a number of determinations coincide there to shape it. The social machine is a natural machine exalted by human tasks – also through dirty tricks, and through the elements of destruction that human activity has introduced in nature. However, here again, the abstract and compact features of this machine, the rigidity of this set of determinations are already destroyed – the elements' indifference opposes the antagonism of the choice for life, against death, on behalf of the collective and co-operation, against profit* (Negri 1988: 83)[63].

There is a clear difference of thinking between Negri's *ecological machine* and Mumford's *megamachine*. Negri's machine is fairly naïve with respect to productive forces: the machine – involving accumulated and creative labour - is on its own an innocent potency[64] or, at least, a neutral one which can be either a tool for destruction or for life and co-operation within society. Whereas Mumford's machine, also a complex instrument, systemic and ecological, is by itself an instrument of domination and exploitation: a means of fraud and deceit (being at one and the same time useful for human welfare and effective for the destruction of the enemy).

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[63] Comparing the state and its institutions to machines has been a traditional recourse in social sciences. P. Bourdieu, for instance, in an article titled *Men and machines* (1981) refers to institutions as infernal machines, stressing the need to elucidate "the true principles of their functioning":

> *The apparatchit, who owes everything to the apparatus … can be trusted with the highest responsibilities because he can do nothing to advance his own interests that does not ipso facto help to defend the interests of the apparatus. He is predisposed to defend the institution, with total conviction, against the heretical deviations of those whose externally acquired capital allows and inclines them to take liberties with internal beliefs and hierarchies. In short, in those cases most favourable to a mechanistic description of practices, analysis reveals a sort of unconscious adjustment of positions and dispositions, the true principle of the functioning of the institution, precisely in the aspect which gives it the appearance of an infernal machine (*1981: 314*).*

[64] The idea that technology or machines are innocent is common to other authors, such as Blöch who believes that capitalism is, doubtless, what dispossesses technology (as a productive force) of its innocence. From the Francfort School, T. Adorno as well points out that we cannot blame technology as being the cause of all our problems: "technology is not a sort of fatality, it is the way in which it is involved in our social relations that creates a fatality" (Ayestarán 1996b: 194).

Actually, both Negri's and Mumford's proposals seem correct. What is terrible is not that oppression proceeds endlessly (nor that the hoped kingdom of Liberty and Good is never installed), but that every new form of liberation – principally material -, every facilitation, comes along with, inseparably, new and more sophisticated forms of oppression, with new restrictions, new unintended consequences, and limitations that condition those facilities and utilities. In the end the negative outcomes would seem to annul the positive ones. When one sums up both outcomes the result is zero. We are liberated yet more enslaved than ever, despite the machines and technology (and also thanks to them). What is scary is, precisely, that we are doomed to a certain amount of distress and unfairness that annihilates a corresponding portion of liberation and ease. The final outcome is neutral, invariable over time. And this neutrality is tragic: in the end, things remain the same but in a more complex way.

Such a "zero sum"[65] is also present in the actual mechanical machine itself, which takes the shape of something neutral; however, not in the naïve sense of the instrument's 'innocence' but in the sense of the machine constituting the active reservoir of our forms of oppression and our means of liberation. Looking to the ancient cultures again, it is valid, perhaps, to state that the machine as invention and ruse is as such an *artifice*[66]. A mix of art and deceit, the machine encompasses the art and *techne* and becomes amazing or 'magic' as Negri ventures; but, at the same time, it conceals both the fraud and political machinations of the contemporary world.

Hence, the liberating force of technology (the instrumentalisation of things) becomes the fetters of liberation itself (through the instrumentalisation of man). Almost in a religious-like fashion - where the very truth is unveiled by a concurrent veiling - the mathematisation of nature, as illusion, seems to unveil an absolute truth whereas it veils at the same time the world of social and political practice. Thus, the science of mathematics is actually a veil of symbols that simultaneously represents and disguises practice. In other words, pure objectivity reveals itself as the object for a subjectivity that sets up

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[65] The zero sum argument is rather an old one, which does not proceed from modern mathematical "game theory". It is possible to find it previously in Hölderlin who believed that happiness only could be spelled tragically: "In him (in Hölderlin) there is the temptation of reading Tragedy as the expression of a totality wherein the subject annuls himself (to make oneself equal to zero. That would be the essence of Tragedy)" (as quoted by Rella 1989: 12).

[66] There is in Spanish a better word to designate it: *artilugio*. This term means, "clever artefact not really important". This "not really important" appears to stress a depreciatory judgement concerning the fancies and toys of technology. In English there are a lot of similar designations: *dodge*, *contrivance*, etc.

the ends (telos). The constitution of technological rationality is a political process: "technology has become the very vehicle of reification".

In this context, the loss of freedom for man is justified for the sake of a more comfortable life and higher productivity. Such an instrumentalist vision of reason leads man toward a more totalitarian society based upon reason. This, in the end, became the *project* of modernity.

2.3 Socio-technical regimes

Before turning to review how the actor-oriented approach might deal with technical change, I wish to comment briefly work dealing with so-called *socio-technical regimes*. First of all, we need to elucidate what a “regime” is meant to be exactly. A regime is envisaged as a complex set of behavioural regulations, to which actors are subjected –willingly or unwillingly. For technological matters, a regime acts as intermediary or mediator between specific technical innovations and thus affects how they are conceived, developed and disseminated, encompassing all phases from invention to diffusion. Thus a regime holds “the whole picture” and it can be described as a socio-technological “landscape” (Rip and Kemp 1998). On the other hand, technology can be described as subsuming all artefacts and structural sets of artefacts, and in this sense it represents a “material culture[67]”, that is, “something around us that we can travel through” (Mango 2002: 17). Hence it becomes, in the literal sense, a real landscape. Moreover, if the actors involved think of themselves as being immersed in such a landscape in the sense that they depend on the particular sets of artefacts for subsistence or livelihood, then the meaning of the landscape becomes metaphorical.

The notion of socio-technical regime, then, views technology development as essentially embedded in society. That is, it considers both the technical and the social as integral processes: in other words, it captures the ways in which technology development occurs and how it is adopted or appropriated by society. We must remember, however, that regimes do not arise or reproduce themselves automatically. They are activated and sustained by network interactions and inter-organisational within certain fields of practice and with particular social worlds, since any regime needs to be regulated in order to ensure its survival. Consequently, the notion of a technical regime is a wider and more encompassing concept than that of “technological paradigm”. Since

[67] Technology is always cultural. Even the most modern and scientific artefact has a cultural origin and also, beyond its practical utility, cultural purposes, for example, in respect to issues of prestige, identity, and ‘progress’.

it includes social and cultural constraints, it structures and places limits on the activities of scientists, researchers, engineers and users.

2.4 Actor-Network theory: a "radical constructivist perspective" on science and technology

In many respects, the issue of socio-technical regimes is closely related to the contributions of Bruno Latour, Michel Callon and John Law who adopt a more radical constructivist position on science and technology. It seems that their theoretical work and research begun in the 1970s when, for instance, Callon and Vignolle wrote about power and economic determinations in a French research centre. Based on the notion of "logics of action", they were able to analyse the interactions between organisational unities, the relationships of domination existing there, the alliances amongst professionals, and conflicts arising between coalitions and so forth (Callon and Vignolle 1976: 235-238).

Later on Latour elaborated –in a Durkheimian style–- seven methodological rules to guide radical constructivist studies. He identified two Janus-liked visions of science opposed to each other: one face full of life, the other austere; one uncertain, the other sure of itself; one representing science as completely made or realised, and the other depicting science in the process of making itself. The first rule states that *social constructivism* takes science "in action", with no interest in science already *made*. That means that constructivists focus their studies on how facts or machines are transformed into 'black boxes' or they follow the controversies that re-open them (Latour 1995: 31, 627).

The second rule establishes that the objectivity or subjectivity of a specific postulate, and the efficacy or inefficacy of some procedure are not determined by any intrinsic quality but by the successive transformations they deliver into others' hands. These two first rules allow the researcher to know at which stage of the production of facts a statement –taken as the study object– is, and eventually to discover who is trying to convert it into *fact* and who, *a contrario*, is trying to reduce it to *arte-fact*. The third rule affirms that any stable representations of Nature that exist are the outcome of the regulation of (scientific and technical) controversies, not of Nature being what it is. Consequently we can never utilise the consequence (the particular state of Nature) to explain how and why a controversy has been closed or rounded off. That is, we cannot resort to the "final response" to a problem in order to clarify how it has been solved.

The fourth rule posits that society is not separate from science or technology. They are not independent domains. Hence, for instance, to say that technology is socially made is redundant)[68]. Accordingly, like nature, society is also a consequence and not a cause. This rule, then, applies the same principle to society as that applied to nature. The state of nature and society are two symmetric consequences of researchers' action "that seeks the recruitment of humans and non humans" (Latour 1995: 628). The fifth rule reveals that behind researchers, engineers –be they prestigious and powerful or not - there are numerous workers, "partenaires", technicians, who are normally forgotten, barely not visible and omitted from any list of scientific personnel. Thus, to determine the composition of *techno-science'*, as extensive a "list" as possible should be made of all of those working there.

The sixth rule, regarding problems of "irrationality" or "distortion", puts forward that, for constructivism, it does not make sense to inquire about what rule of logic has been broken or what social structure could explain any distortion. What is relevant to study is "...the angle and direction of the observer's displacement and the network length, which is construed in such a way" (Latour 1995: 628). In other words this rule suggests that regarding the techno-sciences it is simply a matter of scale, in terms of how narrow and fragile networks are, and what is relevant is an examination of their enlargement. The seventh and last rule proposes: "Before attributing some particular quality to the scientific spirit or method, at first we will examine the manifold ways by which inscriptions (forms, models, tables, printed papers) are regrouped, combined, tied amongst them and thrown back again". Only if something remains unexplained –once so called "long networks" have been studied– will it be possible to speak of "cognitive factors".

Latour also presents six fundamentals that, as a whole, say more or less the following: Facts and machines are transformed by a large number of actors; and their traits are consequences of collective action and not its cause. Researchers and engineers speak in the name of their allies (supported and recruited by them), and of course these allies sway the results according to their interests. We are never confronted directly with science but with a gamut of, more or less strong or weak, associations of humans and non-humans. The more esoteric the contents of science and technology the more

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[68] Callon, Law and Rip (1986) state: "science is politics by other means"). Scientific people mobilise the "scientific" as well as the "political" in their struggles: "The idea that there is a special scientific method, a realm where truth prospers in the absence of power, is a myth. Indeed, it is particularly important to follow actors closely when they enter strategic loci, for it is often in the interests of the forces at work to conceal the way in which they act" (1986: 4). Previously, the Frankfurt School had already unveiled the political dimensions of science and its transformation into ideology.

they are outwardly extended. Thus what is designated as science and technology is just a subset of the techno-sciences. Irrationality is, at all times, an accusation brought about by those who are constructing their own network against anyone who thwarts their plans. Therefore, there is often no large division between purports but only networks larger or shorter than others. Hard facts are not the rule but the exception since they are only necessary in some cases for removing someone or persons. The history of techno-sciences' is, to a large extent, the history of getting together resources throughout a network in order to accelerate the inscription, mobility, reliability, combination and cohesion of traces that make remote action possible.

It is appropriate to explain at this point, what *techno-sciences* amount to. Following Latour's thinking, they can be seen as the alignment of diverse actors' interests, which are related in some way to a certain "project". A pre-condition for such alignment is to reckon with sufficiently ambiguous goals (thus each actor can adjust his/their own objectives to them). Briefly, techno-science is a community of interests that makes possible large laboratories, huge institutes and enormous research centres. Paradoxically, although –apparently– these entities appear to be completely independent (working for the sake of science), they are more dependent than ever in relation to that all-encompassing community of interests. When they are really independent they lack resources, the means, support, and so on[69]. Central to the existence of techno-sciences are the complex and continuous processes of negotiation through external networks to get resources and to justify the work of the inner network of researchers (at the laboratory, for instance). However both dimensions, external/internal, are part of the same story and there are connections, associations, *translations* between them and their narratives. There are not two stories: stories of people (institutional, political), on the one side; stories of things (scientific, technical), on the other:

> *This unique story does not tell us if the amino-acids are "influenced" by the minister's, boss' or colleagues' opinions. It neither tells us that minister's and colleagues' trajectories have been "determined" by the discovery of pandorine's amino-acids. It only tells us that some bonds have been established and that the pandorine's essence falls unintelligible without the reconstituted existence of such translation liaisons.* (Latour 1995: 391).

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[69] Here we could insert a sort of rural parallel comparing the farmer's independence with the researcher's dependency: the former, with only a piece of land and scarce resources, is independent; the latter, with all the facilities at his/her disposal in the research station, is –on the contrary– totally dependent.

Translation is another central concept for constructivism. In relation to this and other concepts, Callon *et al.* (1986) have elaborated a brief glossary (with cross references). Here, we will consider, along with *translation*, the concepts of *actor-network* and *enrolment*, which help to further clarify the constructivist perspective. Translation can be understood as:

> *The methods by which an actor enrols others. These methods involve: (a) the definition of roles, their distribution, and the delineation of a scenario; (b) the strategies in which an actor-world (q.v.) renders itself indispensable to others by creating a geography of obligatory passage points; and (c) the displacement imposed upon others as they are forced to follow the itinerary that has been imposed. The elementary form of translation is that of interessement (q.v.)*[70] *(*Callon et al. 1986: xvii*).*

One could argue that translation is a form of agency (above all if we consider some of its attributes as "the delineation of a scenario" or the strategies that are unfolded by an actor). The mediation that translation and *interessement* carry out is, certainly, "interested" or strategically aimed at some objective. Enrolment is depicted in the following manner:

*The definition and distribution of roles by an actor-world (q.v.). It should be noted that roles are not fixed and pre-established, and neither are they necessarily successfully imposed upon others (*Callon *et al.*1986: xvi).

An actor-network is conceived of as an actor-world[71] "in action"; i.e. the actor-network uses the structure of the latter, with its set of actions and their outcomes, in order to translate or enrol a number of entities. The actor-network definition goes as follows:

> *The structure and operation of an actor world (q.v.): an interrelated set of entities that have been successfully translated (see translation) or enrolled (see enrolment) by an actor that is thereby able to borrow their force and speak or act on their behalf or with their support. The entities may be seen as forming a network of simplified points (…) whose simplicity is maintained by virtue of the fact that they are juxtaposed with others. The actor who speaks or acts with the support of these others also forms a part of the network. Hence the term actor-network, for the actor is both the network and a point therein* (Callon et al. 1986: xvi).

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[70] *Interessement* consists of: "The action of interesting, enrolling or translating which involves one entity attracting a second by coming between that entity and a third. Interessement is thus a transaction between three entities" (Callon *et al*. 1986: xvii).

[71] An actor-world is defined as: "The world of entities generated by an actor-network (…) It emphasises that, for any given actor, there is nothing beyond the network which it has created, which constitutes it, and of which it forms a part" (Callon *et al.* 1986: xvi).

Latour also refers to machines. However he does not discuss their philosophical status or the problems they create for modern society, in the manner that Marcuse or Habermas have done. This author is interested, anthropologically, in following their processes of conception, construction, diffusion, and transformation. To him, the object (the machine), is subject to multiple modifications when it passes from one hand to another. It is not only transmitted from one actor to another, by hand; it is actually "composed" collectively by all actors implicated there, in a global process. There is no transmission without transformation, no diffusion without creation (Latour 1995: 251). Moreover, in alluding to Diesel's case, Latour argues that there is no clear division between what is called *invention*, *development* (from whence the expression *Research and Development* has originated) and *innovation* (that is considering the process wherein prototypes are constructed, which will be reproduced by thousands and eventually sold all over the world).

Diesel not only thought that his engine was ready to work –to be commercialised and used– when he "invented" and patented it in 1887, he even wrote a book where he conceived of a society founded on solidarity, which would be suited to the technical novelties he proposed. Hence there is no sharp distinction between invention and innovation. Nonetheless there is an immense difference between the ideas and experiments of some inventor and the resultant machines made by an army of engineers, technicians and workers with huge investments of time and money. There is a "spectacular change of scale". Besides this change of scale there is something else: the final product might be completely different from its ancestor spawned by the inventor's mind. To deal with this problem the diverse actor-networks will deploy a gamut of translation endeavours, negotiating with humans as much as with non humans.

The "force of science" is not only founded in machines and their power. It is also based on something more fragile and light, although more political and influential: texts (inscriptions), which tell stories of laboratories, for instance:

> *The force of this political ploy by the scientist-entrepreneur resides in the way a world is built within the text that presents a story of, say, experimental rats and their reactions to the injections of drugs. The success of a given text lies in the extent to which its authors manage to enrol others such the latter accept the picture proposed to them, offer the authors recognition and credit, cite the paper in their own publications, and make grants available to them in the future* (Callon et al. 1986: 11).

As regards the problem of studying science "in action", "the construction of fictions about fiction construction" (Latour and Woolgar 1986: 282), the constructivist perspective enhances the issue of fallibility, drawing on

Popper's contentions. A very reflexive appreciation of laboratory studies cannot ignore this problem that concerns truth (again): "…*all* forms of description, report, observation and so on can always be undermined (…) *all* texts are stories" (1986: 283-4). Nonetheless, we need to come to terms with this problem (insoluble and unavoidable) of fallibility –rather than keep it as only a resource for criticism, as an instrument irony. If we recast the above constructivist argument against their works, we would also see – as did the ancient Greeks concerning the problem of truth – only conjectures in those works. However, we cannot reduce everything to *aporia*. What they actually argue is, stressing Latour's second rule (see above), that the validity of any text or attempt is a *social matter*: what others are doing with it and for how long, whether they believe in it, are manipulating and transforming it, before surpassing it and subsequently forgetting it (a forgotten fact is, so to speak, non-existent).

> *It is a reminder that the value and status of any text (construction, fact, claim, story, this account) depend on more than its supposedly "inherent" qualities. As we suggested earlier, the degree of accuracy (or fiction) of an account depends on what is subsequently made of the story, not on the story itself (…) Each text, laboratory, author and discipline strives to establish a world in which its own interpretation is made more likely by virtue of the increasing number of people from whom it extracts compliance. In other words, interpretations do not so much inform as perform (*Callon et al. 1986: 284-5).

Nor can technical innovation, in this vein, be grasped solely as a technical consequence (natural and logical) but rather as some *innovator*'s capacity to utilise resources drawn from already established networks to build a new one, able to maintain "two way exchanges" with the former (Callon and Law 1989: 72). Such networks have been designated "socio-technical networks" since they are mobilised by a number of heterogeneous agents (with knowledge, theory, know-how and so forth) and include all sorts of investments (material or non-material), concerning information and production. In the workings of these networks ("the twists and turns of translators") the boundaries between disciplines start to disappear along with the differences between scientific content and social context. In other words, translators do not distinguish between the nature of their actions.

The relation between *innovation* and *tradition* is conceived of in a particular way. Normally they have been taken as opposites; to Merton, from his functionalist point of view, innovation was a kind of *deviance* (Merton 1957, as quoted by Callon and Law 1989: 78). However, to Schumpeter there was a somewhat dialectical relationship between innovation and tradition since the firm, "an essentially conservative object", to reproduce itself "must sponsor technological innovation". For the *sociology of translation* when constructivists focus on social action they discover degrees of innovation, namely "new socio-technical innovations being assembled and imposed ... on others" (1989:78)[72]. On the other hand, tradition is assumed to be a local construction: "All translators (…) select and constitute traditions which will frame their innovations in the most favourable manner, reinforce them, and generally afford them a satisfactory environment" (1989: 79). Tradition, consequently, does not determine things; it is chosen and borrowed from in accordance with translators' interests and strategies. One could argue that "the creative use of rules" is in the end the tacit acceptance of them –in order to remain a player in the game.

Something interesting in the constructivist's perspective is that they make a call for not separating science and knowledge from material production: "Instead of separating science and knowledge from production and material goods, we should rather recognise their indissoluble character" (Callon and Law 1989: 78). Local knowledge is meant to work in a similar way: theoretical assumptions and explanations (culture and knowledge) are not separated from either labour or from its productive outcomes.

2.5 Criticism of the Actor Network Theory

Golinski (1998) has raised a criticism of actor-network theory. At first he stresses the displacement of the sociology of scientific knowledge from a macro-social level of analysis to case studies centred on small groups working in micro realities such as laboratories. Pioneers in applying ethnographical methods to the study of such specific places were Latour, Woolgar, Knorr-Cetina and Lynch. Golinski argues that even though interactions among small groups of researchers within a laboratory are no less "social" than the social forces beyond them (say, social classes or political movements) this shift in the level of analysis means a restriction or even a methodological simplification "of the social context relevant to understanding scientific practice than had previously been claimed" (Golinski 1998: 11). The very problem does not lie in the "restricted specification" as such, but in the disregard it encompasses as to causal explanations:

> *Some of the laboratory studies had been influenced by the outlook of ethnomethodology, which, as an approach to the sociological study of everyday activities, had specifically disavowed causal explanations of social action (*Lynch 1993: 90-102, 113-116 as quoted by Golinski 1998: 11).

[72] As in symbolic interaction, ethnomethodology and other interpretive sociologies *social action*, here, is invested with a "creative" character.

An excess perpetrated by Latour – according to Golinsky - is the move from semiotics to an "ontology of a radical new kind". The account advanced by Latour and Callon seems to endow *actants* (human and nonhuman actors) with functions similar to those played by signifiers in a discursive field. Both classes of entities can exchange signifying roles; in the inscriptions of engineers or scientists effects can originate from humans and nonhumans. But in real practice, in the actual world it is hard to accept this new ontology "in which nonhuman entities are ascribed an equal degree of agency with humans" (1998: 41). Many authors have discovered as "implausible" the conflation of semiotics and ontology in the works of the actor-network scholars, which would express a failure in distinguishing a detached (neutral) social analysis from the re-inscription of scientists' accounts.

Another point of debate against the actor network theory is the question of "historical narrative". Besides the problem of "hylozoism" (the ascription of living agency to nonliving things) there is a breaking of the postulate of symmetry. This postulate demands of the analyst a symmetrical neutrality in relation to the sides involved in some debate (in this case a scientific one). When Callon ascribes an active role to the scallops in the resolution of the controversy regarding the collectors in northern France, he is actually making a judgment in favour of the debate winners. In his monograph on Pasteur, Latour also submits an "unbalanced historical narrative" by giving things a decisive role. This sort of distortion means abandoning the symmetry postulate[73] since the analyst does not remain neutral.

> *So long as the humans are engaged in a debate over what the properties of the nonhuman actors are, Schaffer insists, the postulate of symmetry requires that the analyst remain neutral. An account of the debate should not ascribe to nonhumans the ability to decide the issue, because the author can only do so by identifying himself with the winner side. After all, the microbes did not tell their side of the story; it was Pasteur who was nominated their "spokes-person" (…) Latour and Callon have located nonhumans in the networks they describe according to the subsequent outcomes of disputes that were still raging while the networks were being built. Their retrospective narratives of the enrolment of nonhumans obliterate the openness and uncertainty that always surrounds science in the making, by reaching forward to the situation after the debates have been resolved (*Golinski 1998: 43*).*

Following Lynch's discussion (1991, as quoted by Golinski 1998), Golinski asserts that science does not have privileged pre-given places; on the contrary, science constitutes its own action spaces: so-called "topical contextures" (inside or beyond the laboratory). Although Latour claims that the distinction between the inside and the outside must be dissolved, a more discriminating

[73] The "non-partisan analysis", which was practiced by Machiavelli.

analysis would have to concentrate on both: "the reconfiguration of spatial relations that investigative practices accomplish" and "the ways they are laid out across space defined in other terms (architectural, geographical, ecological, and so on)". Investigators should scrutinise closely the boundaries that are dissolved and those that remain (looking at the juxtapositions made and the distances preserved).

Anthropologizing the analysis of scientific knowledge by studying small groups of practitioners seems to reduce science to a subculture. It is necessary to acknowledge the size of the context wherein it takes place (widening the optic). It would be more productive to map the large-scale networks in which scientists are involved, which might be broader than those of other human subcultures:

> *It is only if they cease to be blind to these factors that cultural studies of science will truly contribute to the critical understanding of scientific knowledge in its globally pervasive role (*Golinski 1998: 172*).*

Moreover there are variations in the constitution of networks due to different organisation patterns and distribution criteria of materials, artefacts, human resources and discourses. There is at least the possibility of multiple and competing centres of power in which the relation between techno-science and "political structures" becomes crucial: "Different polities or regimes of construction, in other words, might well be uncovered by a more sensitive historical approach" (178). Nevertheless when there is competition between networks "compromise may be required" as well. Indeed, in the determination of standards for units of measurement, common standards are not only the result of steadily broadening networks from some powerful centre towards the neutral surrounding area (as Latour infers). Such an agreement on common standards of manufactured products or measurement units "can enable a mutually profitable exchange to take the place of destructive rivalry" (180). Despite the importance of Latour's "agonistic" model of the enlargement of scientific networks, one should be aware that "metrology" can be the result of agreements or exchanges[74] rather than only the outcome of some "Machiavellian individuals" trying to raise their empires.

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[74] Long and Arce, going further in their analysis than Golinsky, stress (see Chapter 1) how different types of knowledge can **accommodate** each other rather than simply clash. The compromise, agreement, and exchange that Golinsky refers to can also be read as accommodation processes.

2.6 Innovation, transfer and dissemination of technology

Here I summarise conceptualisations worked out in sociology, communication studies, agronomy, institutional economics and peasant economics.

The topic of technical change among peasant agriculturalists has long been an object of study in which distinct perspectives are addressed. In the present research I take this change *lato sensu*, as reflecting a partial or slight alteration (variation, modification, mutation) of the farmer's technical itinerary[75] –his means and practices– as much as the profound transformation that might occur in the whole "production system". Technological change may be generated internally or induced from the outside. In the former case it may be a result of changes in natural resource conditions, or in the social aspects of processes of labour and production. In the latter, changes may occur as a result of migration flows, market penetration or planned intervention (government or non-government. With intervention comes what often is known as "technological transfer", which is just a particular mode, among others, of technological change. Regarding the notion of technological change Durbin has worked out the following general definition:

> *Movement of the technology based on science that goes from countries leading the economy (most of them in the North) toward regions of the world (especially in the South) where traditional technical tools are the customary norm* (Durbin 1996: 297).

In a more particular way it can be grasped as the technical set (of diffusion and adoption) that comprises "…the procedures which enables us to canalise 'innovation' from its origin to the target population: firstly making it known and later on ensuring its proper implementation" (Miranda 1994). Recently more "participatory" proposals have been put forth in relation to the transfer of technology. PROINPA[76] Foundation, for instance, assumes that:

> *Transfer of technology is the process of delivering a technology to its potential users. It is important to acknowledge that they do not only adopt a new technology, they also adapt it. This transfer encompasses two stages: participatory validation and diffusion (*IBTA-PROINPA 1996: 9).

In peasant economics, technical change is taken as "… the adoption of new methods of production by farm households" (Ellis 1993: 223). This

[75] A technical itinerary can be understood as: "…a logical and ordered combination of the techniques that allow for controlling the environment and getting from that some production" (Sebillote 1978).
[76] PROINPA: Promoción e Investigación de Productos Andinos.

understanding of technical change is rather narrow, since adoption, as discussed above, is just one side of the shift in technology (generating, adapting, combining may also be involved). What is interesting is the distinction provided by Ellis between technology and technique, and between technological change and technical change. Technology, following economists, encompasses all methods of production developed within the "existing state of scientific knowledge". Technological change then would be restricted only to new production methods derived from scientific advances. On the other hand technique is thought to be "any single production method, i.e. a precise combination of inputs used to produce a given output" (1996: 224). Techniques can be represented by points on an isoquant or iso-product curve. According to neoclassical economics a change in technique, such a change in input proportions, is "factor substitution" (some change in the combination of inputs to produce the same output level); while a change involving "an inward shift in the entire isoquant", let's say producing a qualitative or significant shift, would be technological change (i.e. reducing resources while producing the same output or, alternatively, increasing output using the same resources). Further technical change is "disembodied" when "the reasons for the increased productivity cannot be identified" (1993: 227); on the contrary, it is "embodied" when those reasons are known (for instance, in higher yields resulting from improved seeds technical change is "embodied" in those seeds). Whatever the technical change, its relative success –as Ellis remarks- depends on an array of factors, natural and socio-economic (among which markets are of great importance).

From the point of view of the new institutional economics (NIE), the neoclassical approach made a major advance in explaining the rate of technological change and bias by price signals (the theory of induced technological innovations):

> *The objective of the pure neoclassical theory of induced technological innovations is to explain the rate and bias of technological change as an economic response to market forces by profit-maximizing entrepreneurs and by the state. This theory was cast in its modern form by introduction of the concept of a 'metaproduction function' [Hayami and Ruttan 1985] and of its isoquants, the 'innovation possibility curves' (IPC's) [Ahmad 1966]. The IPC is the envelope of all the isoquants (technologies) that an entrepreneur or the state can develop with a given research budget for a given state of scientific knowledge. (…) The role of technology is thus to allow an increase in factor substitution away from the factors that have become relatively more expensive and towards those that have become relatively cheaper (*de Janvry et al. 1989: 357*).*

Nevertheless, in institutional economics, such an advance is not enough since "price signals are indeed a necessary but far from sufficient explanation"

(1989: 356). Resorting to a transaction cost approach, de Janvry and his colleagues find that in a context of incomplete or segmented markets the "structure of asset ownership" is determinant for the rate and bias of technological change. If technology constitutes a public good generated in public research centres, "collective action" is often used for addressing or re-addressing resource allocation toward alternative innovations, and "[T]he structure of political power can thus further distort the rate and bias of technological change"[77] (de Janvry *et al*. 1989: 356).

Taking into consideration that land and labour are agriculture's primary production factors, technological change in agriculture is meant to substitute them through land- or labour-saving capital. The former is identified with biological/chemical and water investments characteristic of the Green Revolution (improved seeds, fertilizers, insecticides, irrigation). Since this kind of capital increases yields it is land-saving. Labour-saving capital is identified with machinery and equipment, mostly tractors. This kind of capital increases the land area per worker and the productivity of labour (de Janvry *et al*. 1989: 358).

2.7 A critical view of social sciences' traditional perspective on technological diffusion

Historians, sociologists and economists –and later anthropologists- (in that chronological order) have undertaken studies on the issue of technological innovation. Since anthropological contributions to this field are not old-fashioned or traditional at all (at least considering the headway made by actor-network theory depicted above, and those of Long's innovative Wageningen School, briefly presented below, we will concentrate on the contentions advanced by scholars coming from the other disciplines.

[77] According to de Janvry, Latin America is the best example of how collective action and autonomous state initiatives influence the allocation of public research budgets, and consequently technological biases in public sector research. In Colombia large-scale sugar plantations and in Ecuador *hacendado* milk producers were able to influence the allocation of public research funds in their favour. Their successful collective action was based upon some structural conditions: they were a small group of producers, powerful, homogeneous and regionally concentrated. On the other hand, when a commodity was nationally important either as a wage good or as a source of foreign exchange, and even where the technological change beneficiaries were numerous and disorganised, the state proved able to act on their behalf. Thus successful research programmes were developed in Colombia (rice) and Argentina (corn). In the Bolivian case, it is said that big commercial producers have largely benefited, cost–free, from public research in agriculture.

Economists, traditionally, have underestimated the importance of technology in their analyses. After having distributed facts and data amongst their concepts (production, capital, labour) there is a residual they call "technology". The static vision of a general equilibrium has distanced neoclassical economists, at the macro level, from important fields such as that of economic development. Thus as Robbins states, in the post-war period, "technological problems and economic ones are fundamentally different" (in Flichy 1995: 16). Even when the topic of technology arose unexpectedly in the 1950s, they insisted on keeping to their traditional production functions (the production of a period of time as a function of used capital plus labour and some constants).

In the domain of microeconomics, technology is always seen as an externality. For Blaug what is relevant to this field is innovation, not "invention" (i.e. technology). Such a separation between invention and innovation is also present in Schumpeter to whom innovation means setting up a new production function in the old tradition of Walras, who saw technical progress as simple changes in the coefficients of manufacturing. Against this long tradition in neoclassical economics, Bruton argued as early as 1956: "The pathetic condition of our understanding regarding the origin and process of technical change [constitutes] the most important deficit [in economics]" (Bruton in Blaug 1963).

If we assume that technical change consists of three main stages: invention, innovation and diffusion of innovations, we will see that, concerning the latter, economists based their analyses on the idea of imitation and the epidemiological model of propagation. Their description of the progress of innovation as a function of time is represented graphically as a curve whose shape is similar to an "S": with a slow start, later a vigorous increase, and finally stagnation (sigmoidal shape)[78].

A number of critiques can be raised against the traditional economic approach to technical diffusion. First, it ignores the problem of launching, and accordingly that of the conception of the technical object: it has no "thickness", it has been totally developed before its diffusion and will not be modified any more. Latour, in his study on Diesel's engine, proved that things are not so simple at all). Such a finiteness of a technical object allows for a definition *a priori* of its diffusion space, taking the technical object as

[78] Probability is an important element in economists' analyses of diffusion. Thus Mansfield argues that "[T]he probability that one firm will introduce a new technology is an increasing function of the proportion of firms that are already using it, of innovation profitability; and a decreasing function of the investment amount" (1961: 762 as quoted by Flichy 1995: 22).

something external: an object that leads to imitation but not to transformation or adaptation. This dichotomy between technique and diffusion misled economists –used to modelling everything– who therefore did not notice the evolution of the technical object.

American sociologists, fifteen years before the economists, had already considered the issue of technological dissemination. For Ryan and Gross, who conducted a survey on hybrid maize diffusion, diffusion of technology works according to a cumulative process and within an "influence network": individual behaviour in a population in which each interacts with the others, affects the others' behaviour: the success showed by hybrid maize offered a contingency of change to those not acquainted with experimentation and, likewise, adoption by some agriculturalists stimulated their mates to follow them). Rogers (1983) has been the main exponent of the 'influence network theory'. To him there are five determinant features for the adoption of a new technology:

- Its relative advantage for being measured economically but also with respect to social prestige or satisfaction
- Compatibility with the social group's values
- Complexity of innovation
- Possibility of testing it (viewing the results achieved by cropping new hybrid maize)
- Visibility of innovation

There are also five stages in the decision-making process: knowledge (in the sense of being told or informed), persuasion, decision-making, materialisation (putting into practice the new technique) and confirmation. Rogers also categorized new technology users into five types: innovators, first users, first majority, second majority and latecomers. In chapter four I also present a producer typology in relation to technical change but based upon different criteria, which refer not to the adoption velocity (or delay) but to its degree (full/partial adoption), including adaptation, rejection or abandonment of innovation. Roger's typology enables us to follow the evolution of adoption rate, which, graphically, takes the shape –as in the economists' case- of an "S" curve.

Studying hybrid maize introduction in Iowa, sociologists realised that more than information, it was interpersonal relationships that persuaded farmers to innovate: a small number of innovators "talking" to friends about the innovation and the latter in their turn, to other friends, and so on was the main mode of technical change, which resulted in the S-shaped curve. "Reciprocal influence" brought forth an exponential increase that corresponded to the first two parts of the curve (which displayed a rapid massive adoption before decline). In this manner the epidemiological model was given sociological foundations. Observing this phenomenon Katz (1971), another sociologist, pointed out that though the media brought about information, it was personal contacts that legitimized it.

Hence, the importance of opinion leaders was noted concerning technical dissemination. Amongst their peers they played a training role, later becoming social change agents. Indeed Rogers perceived farmers who adopted change first, when open to the external world, as becoming the future opinion leaders. However, this assertion regarding the propensity of opinion leaders to innovate was criticised by economists who were somewhat astonished by the partiality of sociological analysis, which did not take into consideration either the utility of the product adopted or its quality.[79] When differences between products are evident at first sight it is, certainly, easy to make a decision, but when they are only slightly different, even after applying statistical models, it is difficult to be sure of a choice. Moreover, yields achieved by technicians in farmer's plots, at least in the Andean region, are often not replicable, due to several constraints.

According to Flichy (1995: 30) the 'diffusionist' sociological model responds to a colonial situation: "centralised operation of modernisation", which is not suitable for much less linear diffusion contexts. But the main shortcoming of this diffusion model is its abstraction of technology since it does not consider the transformations of the technical object, thus only applicable to the final stage of technical development. Nevertheless, this school has carried out empirical studies rich in descriptions of technical change circulation in social networks. And finally Rogers has acknowledged the importance of "transformation" (a central issue for Long as we will see below) integrating it in his latest studies on diffusion and calling it "re-invention":

> *Rogers introduces the concept of "re-invention", the way whereby users modify the apparatus (artefact) they adopt. If, for a long time, such a behaviour has been considered by diffusion sociologists as a "noise" in the process of diffusion, or as an obstacle to rational and affective utilisation of a new technique, today "re-invention" appears to be the sign of a true integration of novelty into adopters' culture* (Flichy 1995: 31).

Historians have been the first from the social sciences' point of view, to study technology under the umbrella of the "history of inventions". This history has been assessed as mythological and hagiographic. It is seen as mythological because it makes poorly defined autonomous forces intervene in the invention

[79] Sociologists reacted by asserting that farmers are not 100% *homo economicus*.

process, and it is hagiographic because the inventor appears as an individual endowed with supernatural faculties, those that only saints possess in relation to their divinity. Rosenberg has labelled historical accounts of this type as the "heroic theory of invention" (1982: 55). As he points out, patents, as much as history books and language, associate particular dates and names to each invention.

Some of these historical descriptions neglect or miss the social, political or economic context that surrounds technical invention. They emphasize an "inner perspective" trying to unveil the very logic of technological evolution, which, allegedly, would be totally different from that of socio-economic historical evolution. Fevre opposes this perspective stating that each age has its own technology shaped by history and at the same time shaping history.

> *Each age has its own technology, and this technology has its age's style. Such a style which displays to what extent things are entangled in human affaires (…) technology, as it were, bears the influence of what can be called general history, and, at the same time, acts over this history (*Fevre 1935: 533 as quoted by Flichy 1995: 33).

Other historians have focussed their work on so-called 'technical systems' analysing dominant technologies over the long run. These systems are coherent sets of compatible and articulated artefacts, equipment and techniques. An example of such systems would be the articulation between the domains of iron and coal in the nineteenth century.

To conclude this outline of traditional approaches to technical change, we can underline that for economists and most historians, technology is something external to the economy, each separated and having their own rationale. With respect to sociologists, even though they provide plausible sociological explanations for existing diffusion models, they do not give enough attention to the economic relevance of innovation, missing a key point in farmers' strategies. As regards the technical object, all of them (namely historians, sociologists and economists) take it as something completely finished before its dissemination (*prêt a porter*) but, in the end, sociologists acknowledge the importance of transformation by technicians and users and propose the creative notion of *re-invention*.

2.8 Technological change and knowledge interfaces

Long and Villarreal (1993, 1994) have elaborated on critical problems in the way knowledge is dealt with through diffusion studies of technological change or transfer. Indeed, extension science has developed a "linkage approach" or "transportational paradigm" associated with the adoption and dissemination of technological innovation, dealing in this manner with "the processes of knowledge acquisition, utilisation and transformation" (Long and Villarreal 1993: 142). A fundamental flaw of the linkage or transportational model is its presupposition that:

> *… [T]he process of knowledge dissemination/utilisation involves the transfer of a body of knowledge from one individual or social unit to another, rather than adopting a more dynamic view that acknowledges* the joint creation of knowledge *by both disseminators and users (*Long and Villarreal 1994: 42, emphasis added).

A much more dynamic view entails looking at knowledge as the result of or arising from an encounter of horizons:

> *… [S]ince the processing and absorption of new items of information and new discursive or cognitive frames can only take place on the basis of already existing networks of knowledge and evaluative modes, which are themselves reshaped through communication. Moreover, although creation/dissemination is in essence an interpretative and cognitive process entailing the bridging of the gap between a familiar world and a less familiar (or even alien) set of meanings, knowledge is built upon the accumulated social experience, commitments and culturally-acquired dispositions of the actors involved (…) Processes of knowledge dissemination/creation simultaneously imply several interconnected elements: actor strategies and capacities for drawing on existing knowledge repertoires and absorbing new information, validation processes whereby newly introduced information and its sources are judged acceptable and useful or contested, and various transactions involving the exchange of specific material and symbolic benefits. Implicit in all this is the fact that the generation and utilization of knowledge is not merely a matter of instrumentalities, technical efficiencies, or hermeneutics (i.e. the mediation of the understandings of others through the theoretical interpretation of our own), but involves aspects of control, authority and power that are embedded in social relationships. (*Long and Villarreal 1994: 42).

In contrast to the linkage paradigm, a key issue for understanding diffusion or dissemination of knowledge and consequently technological innovation is that of *discontinuity*. And regarding the problem of meaning this is not simply a matter of transfer but rather of transformation or reshaping. Intersection of actors' lifeworlds, and interactions between them, constitute the ways in which knowledge arises. Knowledge is "multilayered", and thus it implies multiple frames of meaning. Contrary to the blue-print vision of the transportationalists, who take knowledge as a "unitary and systematised" product, it is seen as a process, that is "fragmentary and diffuse":

> *Furthermore, in coming to grips with knowledge processes, we must aim to understand questions of dissonance as well as consonance of ideas and beliefs, explore discontinuity rather than just the linkage of lifeworlds or social domains, and not so much the transfer of meaning as the transformation (*Long 2001: 176*).*

The linkage model appears to suppose the existence of only one community of knowledge constituted by farmers, fieldworkers, technicians and researchers; but, in fact there are several distinct *epistemic communities*, each "… share[ing] roughly the same sources and modes of knowledge" (Long and Villarreal 1993: 147). "Roughly" because, as we will see in chapter five, such communities are neither homogeneous nor do their members have the same goals.[80] In chapter one I discussed the levels and modes of generalisation and specialization of local knowledge.

There is a paradox highlighted by Long and Villarreal in relation to the emergence of a knowledge system created or engineered by science (extension or communication sciences): "… if indeed one did succeed, this would be at the expense of innovativeness and adaptability to change…" (Long and Villarreal 1994: 43). Paradoxically, to create a knowledge system would signify somehow to deprive knowledge of life and concentrate on the dissection of its corpse, since –innovativeness and adaptability- "… depend on the diversity and fluidity of knowledge, rather than on integration and systematisation" (Long and Villarreal 1994: 43).

Drawing on some insights from Hawkins, Long argues that new technologies promote particular technological rationales since they are not only inputs or products but an information flow associated with determined assumptions, objectives and ways of intervention in reality: "Technology development and dissemination is managed and shaped by specific public and private interests and influenced by prevailing policy discourse and by market possibilities" (Long 2001: 178).

Non-technical aspects of technical change or advice are normally neglected: advice and dissemination are not an uninterested undertaking they assume and wait for farmer loyalty - a loyalty to their services, inputs, products, brands. And farmers know very well that accepting a gift means to owe

[80] In this chapter it is possible to observe how some farmers take the whole technical package, whereas others only some components (seeds, chemicals and so on) organising their own "menu" for technical change. Still others pull out of innovation attempts, frustrated with their irrelevant achievements.

someone something (what Temple, 1986, calls *gift dialectics*). Since technological change involves not only products but advice then it has a "technico-administrative character" as well, as Benvenuti spells out (Benvenutti 1975). Nonetheless this advising is not an unproblematic flux of technical information that mechanically reaches a farmer's heart and mind; it is "filtered" by his technology set up and life-world ("internalising this externality", as Long puts it, 2001). Technology itself is modified to suit him, networks are reshaped and action (practices) addressed according to his aims. All this, which has been labelled as *adaptation*, seems to have been overlooked by agricultural economists such as Ellis and others who, in relation to technical change, only recognise the *adoption* figure.

Attribution of meaning is thus another non-technical aspect, which constitutes a "field of struggle" for social contestation in relation to ideas, events and actions. On the one hand, there are development intervention models that "become strategic weapons in the hands of those charged with promoting them" (Long 2001: 182). On the other, there are farmers with a differential use of knowledge who transform it on their way:

> *… [T]hat is, farm knowledge varies and is accorded different social meanings depending upon how it is applied in the running of farms. This is readily seen in the use of different technologies (e.g. tractor, plough, hoe or axe) but is also evident in the specific meanings that a particular instrument or factor of production acquires as it is coordinated with other production and reproduction factors (…) Hence adopted technology is forever being reworked to fit with the production strategies, resource imperatives and social desires of the farmer or farm family* (Long and Villarreal 1993: 154-55).

Besides the process of appropriation, transformation or rejection of new technologies, there are other processes that combine or link different social domains (for example, those based on the family, community, market, and development agency). Each of these domains implies particular normative repertoires and ways of behaving, and so in organizing production the farmer has to select and coordinate "the most appropriate normative and social commitments". However, this is never a totally free selection since prior value preferences and "available stocks of knowledge, resources and relationships" (Long and Villarreal 1993: 155) guide and shape a farmer's decisions.

If we agree that the notion of 'knowledge system' is an ideal elaboration, a methodological instrument for analysis, then we can accept that, in reality – and above all in the distant and "scabrous" peasant landscapes - there are only segmented, poorly articulated knowledge networks interconnecting researchers, extensionists and farmers (Box 1989: 167). Such systems or rather 'networks' have fragile, changeable communication channels and sometimes none at all. Thus the assumption of permanent and coherent linkages is nothing more than fiction.

Moreover, as Box has cogently argued, there exist are not only official, institutional, technical, or rational modes of innovation but many other kinds. Drawing upon data from the Dominican Republic, he identifies, for example, the important role played by small-scale traders and their extensive market connections in the dissemination of new seed varieties. A similar point emerges later in the present thesis with respect to extension information and the adoption of new potato varieties. In Chapter 6, I highlight two forms of technical innovation: namely, that institutionalised through the ways in which extension officers and NGO staff induct farmers into their formal roles of apprentices and 'pupils' of innovation; and that associated with more informal "non-technical" modes facilitated by traders, "compadres", relatives and friends in which farmers operate as simply amateurs -animated dilettantes free from the rigorous methods and rules of formal knowledge systems.

A last contention to deal with here –and one which will end this chapter– is that labelled the question of *multiple realities*, in which exist "… potentially conflicting social and normative interests, and diverse and fragmented bodies of knowledge" (Long and Villarreal 1993: 158). Such multiple realities imply 'found-out' truths (based upon the *veracitas* reached by technical findings and achievements) which, as is the case of landraces and biodiversity, signify another kind of diversity: a *truth-diversity*[81]. Here the problem becomes that of discovering "whose interpretations or models (e.g. those of the agricultural scientists, politicians, farmers or extensionists) prevail over those of other actors and under what conditions" (Long and Villarreal 1993: 158). That means that:

> *Knowledge processes are embedded in social processes that imply aspects of power, authority and legitimation; and they are just as likely to reflect and contribute to the conflict between social groups as they are to lead to the establishment of common perception and interests. And, if this is the normal state of affairs, then it becomes unreal to imagine that one can gently 'nudge' knowledge systems towards better modes of integration and coordination (*Long and Villarreal 1993: 158).

Looking at knowledge acquisition/dissemination in this manner –as I attempted to do in Chapter 1 – is to acknowledge it as fundamentally a social experience which reaches beyond the formalism of institutional approaches,

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[81] Popper –more than scandalised, terrified– would say that such a proposition is in itself *true* sacrilege.

the idealism of typical conceptions and the technicalities of linkage models. We should not *forget* or *ignore* but rather *recall* all the time that such processes involve real social actors attached and committed to specific networks of interest that are themselves emergent and stretch out to embrace even the remotest of regions. Returning to Latour and actor-network theory, we should also underline that such networks consist not only of social elements but also of material and "extra-somatic" resources that, in turn, acquire huge social significance.

However, acknowledging and recalling, as we will see in the final chapters, imply something else that must be taken into account. Their importance for the theme of knowledge acquisition/dissemination and subsequent technological change in agriculture can be characterised as being of "recursive significance" (Arce, personal communication referring to Benson's work). Acknowledging or, more precisely, *recognising,* can be assumed –stressing the aspects of memory and practice that this term encompasses– as recognising which practice leads to: the "recognition of practice" (see Chapter 6). That is, to recognise is to revisit: a house, a city, some place, some plot; and practice is then to recursively visit places and events. And revisiting, as we will see, steers us toward a new knowledge, that is, a new place which remains the same but is somehow already other and, in this manner, we are able to overcome the *aporia* that "to know is to acknowledge".

Recalling is also to revisit, however not in terms of space but in terms of time: to revisit remembrances, recollections, or people and places but in the past. Nevertheless one hardly goes back to the identical or unvarying since lots of things do not remain changeless. With respect to agricultural production, varieties or soil conditions, farmers themselves when they want to obtain produce considered of high value, or to maintain the same productive conditions which their experience and memory appreciate, more often than not are compelled to recreate them or rather to 'reinvent' them (in a similar way to that pointed out by Rogers in relation to the technical artefact in the process of innovation). Thus recalling, means to reinvent what one produces, what one consumes, and finally what one is. And memory allows us to recognise ourselves in all this (see Chapters 5 and 6).

In this chapter I have also discussed 'machines'. Mumford refers to a "mega-machine", that large bureaucratic scheme of religious hierarchical structure. For Negri, the machine is an ordered universe, a system of condensed labour force. In the case of Bourdieu, the state and institutions in general, as we have seen, are identified with "infernal machines". For our purposes, "the machine" is a metaphor of what Olivier de Sardan nominates as the "developmental configuration"[82], which is also another metaphor for development and its institutions, its fundamentals and its persuasive and irresistible force, what Arce calls the "policy community". Indeed, in the following chapter and, to some extent, in the sixth, we see how such a metaphor (the machine) –perhaps somewhat exaggerated– illustrates in a suggestive manner the action of development projects and programmes, government and non government organisations, which act (they are actors) as true war machines, defending and invading territories, conquering the "native population", organising painstakingly their strategies and alliances, postulating their vision of technical innovation under particular "confessions" and "cults", which differentiate them from the others who compete with them. We also will see that induced and organised technical change –at the regional and mezzo level, i.e. the department of Cochabamba)– is conducted from an arrangement or setting within which diverse development machines oppose each other or join together in accordance with their interests and targets.

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[82] "...there are actors and institutions which take development as object or objective, dedicating to it time, money and professional competence. It is the presence of a 'developmental configuration' what defines the existence itself of development (…) I shall nominate 'developmental configuration' that, largely cosmopolitan, universe of experts, bureaucrats, NGO responsible, researchers, technicians, projects chiefs, field agents, who live on, in some way, the others' development, and who mobilise or manage with this purpose considerable material and symbolic resources" (Olivier de Sardan 1995: 7).

THREE: The institutional setting of technological change in agriculture in Cochabamba

This chapter starts with a short discussion on the issue of policy design and the role of human agency in such design or elaboration. My intention is to show that policies – as much as the programmes and projects issued from them – are not merely technical and regulatory principles or sets of actions of implementation and monitoring, but the outcomes of struggles and negotiation between different actors with different orientations.

This is followed by a description of the organisations committed to technological change in the region (Department) of Cochabamba, displaying their policies and rationales, their methods and fields of action. Here special attention is given to the dynamic experienced by the organisations specifically devoted to technical change in potato cultivation, during the long intervention process deployed in the province of Tiraque, which was the main regional scenario for that process.

3.1 Policy approaches and the issue of agency

Beyond technical definitions we may grasp planning in the way Mannheim did: as "contemporary social techniques" to reconstruct or reshape society (in Arce 2002a: 1). Yet to Mannheim planning was an administrative and regulating force constituting the modern state, differing from foregoing government liberal conceptions (parliamentary democracy). Currently globalisation has affected all life's domains and consequently the known policy processes[83]. Today there is greater concern about people's capacity to cope with reforms at the macro level.

[83] For Arce (2002a: 9): "Understanding policy implementation within contexts where face-to-face interactions take place between low-level bureaucrats and beneficiaries is extremely important. However we also have to trace the way in which contemporary policy initiatives take place across tracts of space broader than those present at the local level or within national boundaries" (see Arce 2001). This view should not be confused with one that

During the sixties and seventies the "administrative man" model was sharply criticised regarding his role of rational decision-maker. In discussing the contributions of Simon, Arce points out the limitations of this model *vis-à-vis* the policy process:

> *He (Simon) did this (criticism on the administrative man image) by suggesting that absolute rationality is an impossible human achievement, in so doing, he problematised the model of the administrative man in his interactions with the policy process. Simon argued that two constraints contribute to a tension between the technical performance of the administrator and his own value orientations: namely, the administrative man's rational capacity is limited by his incomplete knowledge of the consequences of a particular course of action, and his capacity is conditioned by the organisational environment (*Arce 2002a: 2).

Certainly policy processes impact on people's living conditions but people are endowed with agency to cope with such processes. Although agency has been recognised as an important component of the policy process, it is in its implementation that agency had been ignored[84]. Nevertheless new studies in the 1970s focused on actors' interactions at policy implementation locales and portrayed organisations as flexible structures. Later on, in the 1980s and 1990s, research showed the importance of micro-sociological analysis for the issue of human agency (studying the polity of policy implementation):

> *The study of agency in an organisational context (focusing on the role of policy implementers on the ground) provided an understanding of policy-makers as initiators of purposeful and intentionally oriented action. From this perspective, policy-makers were able to use social resources to manage and control policy situations. Arguably, this approach presented policy as a more complex process, than portrayed by earlier studies. It also extended analysis beyond the decision-making of actors in higher positions within an organisational hierarchy (*Arce 2002a: 4).

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suggests the nation state has lost relevance in the contemporary period, rather that we also have to look beyond its borders to understand the impact of the international policy community at the national and local levels.

"We need to trace the broader field of contemporary policy, in order to bring into the analysis influences with an absent presence, such as international agencies, which need to be characterised and explained through social analysis. This is of relevance to recent studies of the trans-nationalisation of macro-policies and reform agendas (stabilisation, adjustment and reforms, see Ellis, 2000: 160-179) that have tried to reorganise services and the production and consumption process, as well as regulations determined by nation states" (Arce 2002a: 9).

[84] This goes against the idea of "symbolic homogeneity", which "…denies people of their political position for communicating contrasting visions about democratically shared values: values that should be incorporated into the scientific and expert projects meant to bring modernity into society. These values concern the respect for individual experience, everywhere and under every condition, in understanding and judging the meaning and relevance of the ongoing transformation of the existing human condition" (Arce 2002a: 3).

This shift in policy research meant focusing on the interface between front-line officials and the public, i.e. the study of what Lipsky (1980 in Arce 2002a) designated as "street-level bureaucrats", who have particular interests and are not neutral in their orientations and actions. The implementers' agency was evinced by the fact that they did not just deliver policy but actually made it: they enjoyed a sort of discretion and autonomy from organisational authorities. What Lipsky's analysis lacks, according to Marinetto (1999 in Arce 2002a), is the structuring processes that affect the situational interpretation of policy officials in their face-to-face encounters, which in their turn sway the policy process. Nor does Lipsky's account take into consideration the asymmetrical distribution of power and economic resources, which affect terrain officials' actions.

However, studies at the "street-level" did allow for the conceptualisation of policy as the outcome of actor's interactions, scrutinising "live-situations" beyond the politico-administrative system. But, as Arce has pointed out, "… we still do not have a clear understanding of the influence of power relations within the politico-administrative context of policy delivery" (2002b: 5). Another perspective, that of Grindle, stresses that policy is just a function of an established social order, "in which incremental changes are produced for low status clients" (Arce 2002b: 6), restating in that manner institutional authority. Nonetheless we must not forget that policy actions have the capacity to deal in unpredictable ways with contradictions arising from life-situations.

Studies of intervention from an actor-oriented perspective have emphasised that development experts cannot control the local dynamics of social change. The importance given to local actors' knowledge and experience (agency) allows us to recognise how they "manufacture" diversity and heterogeneity in agrarian change scenarios, reshaping the outcomes of policy deliveries (i.e. "localised modernities"[85]). Long, precisely, has studied how relationships between intervening agencies and local groups evolve according to differences within a farmer population and contrasting agrarian situations, highlighting the differential social responses to changing circumstances as actual manifestations of individualisation processes in social change[86]. Long has creatively documented the intrusion of development planning in people's actions, shaping (broadening and constraining) their options. Thus we must

[85] "It is in the life experience and the projects of peasantry and bureaucracy where we can find the content of the modern world" (Arce 2002b: 13)

[86] Arce goes on to argue that it is in the life experience and the projects of peasantry and bureaucracy wherein we may find out "the content of the modern world", with the actor-oriented approach contributing to "… a theory of everyday experience rather than to a theory of consciousness" (Arce 2001: 13).

acknowledge the relevance of development policy intervention for current analysis of social change, working within a perspective that misses neither the macro nor the micro mode of sociological explanation. Policy processes are complex as much as contested (by diverse social actors) and encompass what may be called "policy interfaces"[87]. Further, Mannheim had already argued that planning was the only way to organise and undertake –as a technique of governance- increasingly complex socio-economic programmes regulating people and resources. He saw in this technique the only mode of governance and coordination that, at the technological level required, was able to secure social reproduction and political survival. Arce, paraphrasing Giddens, points out that, although Mannheim falls short of formulating the importance of an expert system, both authors coincide in perceiving of planning as a social technique which institutionally responds to "the fear of insecurity affecting individuals and groups in a modern society" (2001: 10). In relation to insecurity in "non industrialised countries", Arce goes on to argue that,

> *"… we need to remember that people living in non industrialised countries have been generally unprotected from the effects of colonial rule and policies. This sense of insecurity has not diminished with the struggle for national independence in Africa, Asia and parts of Latin America. Problems with national bureaucracies, internal political contradictions, and the national boundaries left behind by the colonial legacy have generated social and institutional dynamics where risk and lack of trust is an every day reality. In this context, people and their institutions are constantly re-assembling and re-organising those elements, which they consider to be part of modern social life in industrialised Western countries (*Arce 2001: 11).

In this context of modern structures and state power, actors' identities and modes of individuality have an unequivocal reference to social practice, as they engage in position-taking and claim-making. As contended above, actors are able, within their life-worlds, to operate and endow with new meanings, so-called instrumental rationality, experiencing the modern world from their particular ontologies with their own sense of history.

On the other hand we must be aware that, in a broader context, international development priorities are the result of interactions between different and multiple organisations:

> *"… bilateral donors, donor agencies (such as Band Aid), national governments, and knowledge centres. However, we should not forget that social movements exist, which act as counterpoints to international development agendas and policy priorities. One just needs to remember the important role played by environmental groups in carving*

[87] In such interfaces "rationality" becomes a contested process as well. This has been emphasised by Mannheim and Long.

> *space within international policy agendas for sustainable development during the 1980s. More recently the anti-globalisation movement has challenged the World Trade Organisation in pushing for a re-conceptualisation of the notion of trade along the lines of ethical and fair trade. In this a combination of practices –from street protests, NGOs advocacy and local grass root organisations –make themselves politically felt and have increasingly been taken into account by the policy community (*Arce 2000b: 2).

In this manner we can question the generalised idea of a homogeneous and hegemonic discourse deployed by the 'development machine'. Development discourses are, on the contrary, "unstable and situational". This does not mean that each development organisation does not have its own "policy orientation"[88]. We can also speak of a "policy community"[89]:

> *A policy community is a symbolic area in which encounters among members allow them to share some ideas, practices and assumptions about the development process. They may have other ideas that they do not share, or that they accept as being part of the inertia within the institution (i.e. those unchallenged assumptions, such as, that the market is the absolute institution to allocate resources and services in development processes) of a development community. Members' interactions tend to constitute and reconstitute development issues within an agenda that forges new connections to international and national processes of change that may produce social and economic heterogeneity. In other words, a development agenda becomes a symbol of a bundle of issues such as health, economy, good governance, democracy, accountability, gender equality, participation, citizenship and sustainable development; each can become attached to a single priority that the policy community accepts as part of their agenda (*Arce 2002b: 12).

We should not, however, assume that there is no conflict or disagreement in such communities. Evidently there are conflicts of interests but they are focused on the particular traits that development ought to retain (i.e. assumptions, criteria, purposes). Thus we can specify that a policy community involves the notion of "collective action around the value of pursuing development" (2002b: 13). Despite the conflicts that divide actors of the community, there is a common language amongst them which permits them to communicate with each other reinforcing their identity, and enabling them to engage with problematised realities as a body (with an *esprit de corps*) that shares a common policy discourse. In fact actors, through their knowledge and power, create a framework for policy action which includes at least three levels: the levels of policy makers, applicants, and –finally– policy receivers. Concerning the last level, there arise not only "functional conflicts"

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[88] "… the set of ideas, assumptions, and methodologies that orients policy-makers and practitioners when addressing specific development problems" (Arce 2002b: 1).

[89] Here we understand *community* in terms of what Crewe and Harrison call (quoted in Arce 2002a: 13): conceptual entities of social relations.

in reference to the suitability of the methods or ways of development but actual attitudes and movements of contestation:

> *Since local understandings and knowledge have a filtering effect on externally generated policies, they are contested because they impinge on the re-organisation of everyday life. In this respect, (policies) represent a state of animation, in which, as external approaches of intervention are necessarily institutionalised and de-institutionalised, because they enter the existing life-world of the individuals and social groups affected by development programmes. These interventions are mediated and transformed by a configuration of actors and social and cultural properties, these emergent actions create simultaneous and contradictory tendencies towards market-led development, good governance, and decentralisation (*Arce 2002b: 12-13).

Policy community members, through their narratives, endow cultural and political development objectives with a particular language and terms like food security, poverty alleviation and so on. Nonetheless these terms do not have a unique meaning for the community members. Their acceptance supposes a prior process of value negotiation amongst the members. This negotiation implies a constant tension in the attempt to accommodate macro-level policies and local interpretations in their effects on livelihoods and strategies. Concerned with this process the policy community can however restore its existence by means of negotiation. But the result is multiple and diverse: different approaches operate within the community as a whole, be it in line with one another or separated and even opposed to each other.

> *In brief, the development policy community encompasses contradictory and conflictual social relations rather than just economic and technical relations. Without taking these contradictory and conflictual social relations seriously it is difficult to assess where challenges to development policy initiatives are likely to emerge in the policy community or in society as counter-tendencies, [and] the nature of such challenges and their likelihood of failure or success (*Arce 2002a: 18).

Institutions, individuals and social groups have the "potential capacity" for obtaining conducive results adequately manoeuvring resources, relations and political skills. Although, being affected by the policy community's actions, they may not be able to remove or change the development agenda, some members of the community –some NGOs for instance- will become sensitive and receptive to their interests and claims[90]. According to Arce it would be worthwhile to study the policy community's "social life" throughout its different levels of interaction:

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[90] "The coexistence of different interpretations of development problems and issues that emerge within the policy community (for instance between NGOs and government with respect to development issues) may lead to active competition for political influence, through a process of claim-making" (2002a: 23).

> *The aim should be to identify modes of policy transformation and conflicts between different domains, affecting power relations within the development policy community. An understanding of policy as action could lead us to analyse the constant modifications that take place within existing features of the dominant development agenda. Eventually this could contribute to studies of how incremental transformations of the dominant social order, values and beliefs may transform some of the normative aspects of the development process* (Arce 2002b: 19).

The transformation of normative development aspects departs from the existing power relations, beliefs and strategies of the social actors interacting in the community. Such manifestations of human agency and local knowledge transcend the community domains thus setting up new ideas and practices, which redirect everyday life, trade, labour relations and poor households' access to resources.

Returning to a macro-level analysis we should consider the necessity of conceptualising the policy action scheme and its new "forms of centrality" vis-à-vis the field of development policy. The push of neo-liberal programmes has minimised the role and significance of the nation-state qua development agent (i.e. as a guiding and implementing force), establishing a "multi-domain policy reality". Currently international multilateral organisations (IMF, World Bank, WTO) have a huge influence and their language leads development policies to specific assumptions, priorities and values. They have been influential in creating a "discursive reasoning"[91] of development that is displayed as objective knowledge, ranking and ordering priorities, and providing a rationale behind key assumptions about the causes of development problems. But, by no means is such reasoning homogeneous; there are challenges, disagreements or, at least, differences in the emphasis given to some issues amongst the distinct multilateral organisations. Working with different development approaches, there arise strains inside this policy domain. Nevertheless differences are negotiated and common factors strengthened in order to maintain the coherence of such discursive reasoning.

[91] Arce points out that "Discursive reasoning refers to the ways development institutions use their discourse to justify their understanding of the cause of a problem, provides a direction for the activities of the organization" (2002b: 20).

3.2 An overview of organisations related to technical change in Cochabamba[92]

In the region (department) of Cochabamba there is a variety of organisations devoted to technological issues concerning agriculture. Fields of work are also diverse, stretching from nature-based resources (soil and water) and crops themselves, to machinery supply, equipment and agricultural implements. In the table presented below I provide a summary of the different organisations –not all but probably the most well known– that are related to technical matters, classified according to their field of work. All organisations seem to uphold good faith and will, that is, we have to acknowledge that, in general, their experiences are, to a degree, successful in spite of the problems they have had to face and overcome. They have learnt to bear and maintain the difficult and complicated relations with farmers.

TABLE 1
Organisations working with technological innovation in Cochabamba

ORGANISATION	FIELD OF APPLICATION
PROLADE	Soil
PROMIC	Basin management
PRONAR	Irrigation
DESEC-ARADO	Potato cropping
SEPA	Potato cropping
PROINPA	Andean tubers
CIFP-CSP	Maize and other crops
CIF-SEFO	Fodder
CIFEMA	Equipment and implements

Source: Seminar, "Technological Change in Farmer Agriculture", 1999

In the following I outline a brief description of each of the above organisations, starting with those working with basic resources, then continuing with the organisations devoted to maize, fodder and mechanisation, and ending with those concerned with technological change in potato cultivation (which will be more closely analysed).

[92] All the discussion and information presented here originated from the seminar: "Technological change in farmer agriculture" organised at San Simón University by the author in October 1999. Information also comes from interviews held with staff of the different organisations and documentation to which access was possible.

PROLADE

The "*Laderas*" (hillside) project started in 1996 on the basis of an agreement between the British research centre SRI and the Agronomy Faculty of San Simón University. Its major aim has been to control erosion and to improve soil fertility, starting with low-cost and easily-applicable vegetative practices. The project method is to investigate, *in situ* farmer's plots, stressing practical and cheap methods of soil and water conservation (with an emphasis on vegetative species, live-barriers and cover crops). PROLADE deployed its activities in the provinces of Esteban Arce, Tiraque and Cercado (all of them situated in the department of Cochabamba).

As regards to technology the project approach is based on an encounter between farmer's knowledge and scientific knowledge. This approach is rather critical about research stations'[93] and traditional agricultural extension[94] roles. To make possible the encounter between the project and farmers they have based their work on participative methods (Participative Rural Appraisal and so on). The basic spatial unit for project activities is the micro basin, in which production systems are concentrated. The technology supplied, or rather the one they want to develop jointly with farmers is defined as low-cost, easy-application and appropriate for agriculture on hillsides (where this technology is not fully existent yet). The choice of or preference for participatory methods (an institutional option) has meant disagreement and friction with the Agronomy Faculty at San Simón University, since to some members of the staff, these methods are totally lacking in scientific rigor. Such disagreements arose on occasion with some thesis presentations for receiving the *Ingeniero Agrónomo* (Agronomist Engineer) degree:

> *(In relation to thesis works) We have witnessed in the Faculty hard opposition from some lecturers. They said: 'this has no scientific rigor at all'. However, what we are most*

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[93] "... experimental stations have managed to produce varieties that increment production 3, 4 up to 5 times farmers' production; but farmers do not adopt (these improvements), because of other types, let's say, of research methods that have started to emerge. This is due to the fact that in experimental stations, the scientist was the one who determined what to investigate and under what conditions (very controlled conditions), and when to bring new seeds to the farmer's lands where resources are scarce. The result was really poor (perhaps even poorer than the poor resources the farmer has, one might add)" (E. Céspedes, Seminar proceeding).

[94] Engineer Cespedes refers to the "Agricultural extension from the U.S., for instance, adopted by the IBTA (Bolivian Institute of Agricultural technology), which was suited for large, medium and small-scale agricultural entrepreneurs because they had a reasonably high educational level and in addition to the necessary economic resources. But that extension method has not worked with peasants" (Cespedes ibid).

> *interested in is what the farmer wants and looks for (*Céspedes, Seminar proceedings*).*

Here we can see the contradictions if not the struggle between a traditional agronomy school and a new one based upon participative methods. Senior engineers refuse to accept alternative methods in the name of scientific method –which may be acceptable if one thinks of the "hidden" flaws of such methods. Nevertheless, underlying methodological objections an anachronistic reasoning remains, according to which engineers teach and demonstrate and farmers listen, learn and apply.

So as to justify, to some extent, project activities, PROLADE staff refer to land degradation in Bolivia. In accordance with data (presented at the above mentioned seminar), 31 to 45% of land in Bolivia faces erosion problems. Desertification (degradation of arid, semi-arid and sub-humid zones) affects 41% of national territory (though according to other sources[95], desertification amounts to 60%). These differences in estimation mean in fact relative divergences as to land degradation in Bolivia, which suggests that one should consider prudently any of these types of assessment). Erosion rates are high (316 to 394 tons per hectare) with a loss of 1800 tons in the arable layer. However, at the same time, the project stresses peasants have a sound knowledge of soil conservation and erosion control; a knowledge dealing with practices largely developed by peasants: furrows, *melgas* (regular pieces of land), ditches (*zanjas de coronación*: *lark'as*), borders, *pircas*, etc.

From all this arises another contradictory situation: on the one hand, there are fit practices of prevention and control long since applied by farmers; but on the other erosion continues to advance –frighteningly, it seems. It could be argued that ancient practices are being abandoned or *forgotten* (technicians lament that the generation of new farmers' knowledge and techniques is very slow with respect to the erosion process accelerated by demographic pressure on land). Another explanation asserts that statistical aggregations and generalisations tend to magnify things or that the critical situation of some zones make general averages rise unnecessarily. Nor is mentioned, the sudden or violent disappearance of land due to avalanches, floods and volcanic eruptions, very frequent in young mountains like the Andes, and which can be more disastrous in comparison to erosion caused by human practices. On the other hand, the high emigration rate of farmers provokes alarm, although at the same time it should reduce pressure on land.

The project contention is that farmers need new techniques because "traditional" would not suffice: "… we cannot be limited to peasant knowledge, it is not sufficient" (Céspedes, Seminar proceedings). Thus the

[95] Galopo (2002: 45).

farmer image construed by the project is one that presents the farmer as knowledgeable but, simultaneously, lacking certain knowledge and skills. Moreover, though farmers are not homogeneous, their communitarian 'logic' and local organisation slow down the process of differentiation. According to the project, the poor farmer does not easily risk accepting a conservation technology, since he commands scarce resources. In contrast it is the 'rich' farmer who participates more, and takes more risks. Farmer in general tend to adopt technologies that incur less risk, but they manifest a short term perspective and show little interest in conservation measures that are effective over the long run. The farmer assumes a qualitative criterion at the time of adopting some technology: quantitative details are not of interest to him since he does not like to scrupulously measure things.

Nevertheless what remains unclear concerning the PROLADE project is its discourse or "ideology" of development: namely, what kind of rural development do they support for peasants in the zones in which they work? Nor has PROLADE addressed the issue of replicability or sustainability in relation to their work and innovations: how can they assess whether farmers will continue with the practices introduced or recovered by the project?

PROMIC

The Basins Integral Management Programme (PROMIC) started in 1991 as part of an agreement between the governments of Bolivia and Switzerland. A mission in 1990 had already initiated research-action activities on basin management. The programme work area encompasses the Central and Low valleys, and the Valley of Sacaba (all situated in the department of Cochabamba). Although this covers an area of approximately 500 square kilometres, the mountain range with 38 basins and an influence area of 300 square kilometres in the valley, the effective work carried out up to now has mainly been limited to one basin, the *Taquiña* basin (situated close to the city of Cochabamba). The programme has identified three strategic elements for its work: 1) the reversal of degradation processes in basins, which are linked to soil loss, 2) the decrease of natural risks (floods), and 3) the preservation of hydraulic resources. Beneficiaries of the programme's activities are the populations settled throughout the basins (peasants) as much as those in the influence areas (mainly the urban population).

PROMIC seeks the participation and co-ordination of local people, and also of public and private institutions. One of principal basins' management goals is to raise productivity and accordingly farmers' incomes. The basis for PROMIC work is the peasant community and its unit, the farm.

The vision of PROMIC regarding local knowledge is similar to that of the former project –and many others– accentuating the farmer's misjudgements and the mistaken practices he/she follows (i.e. inappropriate crop rotation, downhill furrows, degenerated seeds, misuse of pesticides, long fallows without cover, excessive grazing, lack of sanitary controls, etc.). In general, the farmer image "adopted"[96] by the programme reveals a calamitous situation: "A few years ago this family seemed to have only this fate, a precarious life, an eroded land, with poor harvests …" (Seminar proceedings, 7/10/99). A sort of contradictory *manicheism* peculiar to development projects leads to the same contradiction evinced already by PROLADE, when they state at the same time that "Long since farmers have known very well their mountain and are expert in the use of this land with marked slopes and simultaneously affected by frosts and hailstorms" (7/10/99). What breaks the continuum of conservation and stability is the population pressure on land. In the end the contention remains: peasants knew –and still they know– a lot but, like some gods from India, they have 'forgotten' and become ignorant and have fallen from Heaven (or at least from the steep mountains toward the cities as a result of out-migration). Projects help farmers to remember and improve their knowledge (they give them back their memory, so as to be able to go back to Heaven and thus regain their welfare and their true identity). The doctrinal principle continues to be the same, and still works quite well.

The programme acknowledges that during its work "the farmer's vision complements and guides the specialists' technical vision" (7/10/99). Programme technicians acknowledge as well –with surprise- that, contrary to what is assumed, the ones who want to know more are not the ignorant but those who knows the most. This is certainly contradictory in relation to the property of local knowledge pointed out by Fairhead, according to which farmers reject knowing too much. One could argue that farmers' willingness to learn depends on many factors and situations (their interests, necessities, the circumstances and so forth).

As in other cases, here we find an idealization of past ages in contrast to a negative judgement of the current state of affairs. Certainly present farmers' life conditions are difficult and they face many problems regarding natural

[96] Forms of *adoption*, *adaptation* and *rejection*, as we can see, are not limited to aspects of technological innovation. At the discursive level, the ideological elaboration of farmer development projects, and above all those addressed to the change or transfer of technology, are almost so imaginative, audacious and contradictory –adopting and adapting things– as farmers are in relation to technical proposals. Development languages and ideas also have their own processes of "technical innovation" with respect to depictions, perceptions, meaning endowment and interpretations.

resources[97]. A positive thing in PROMIC's work is the sustainability of its actions. They follow a continuous monitoring of their activities, evaluating and measuring their impact. Two main variables are constantly evaluated: the environmental variable (i.e. evolution of vegetal coating, avalanches, hydraulic resources, slopes, beds and agriculture), and the socio-economic (i.e. farm income, floods, and participation in local municipalities). Besides the mechanical and agronomic tasks of soil conservation the programme has introduced sprinkler irrigation which, nonetheless, does not seem affordable for everyone. PROMIC is assured that the commercial volume of agricultural production has increased by 40% and that emigration flow has diminished. An important beneficiary of basin management is a brewery located at the foot of the mountain.

The work methodology of PROMIC is participatory inducing an active farmer's participation in planning. As regards monitoring and sustainability studies different scales are considered (environmental and socio-economic ones). Spatial planning is adopted as a strategic tool for sustainable development (small-scale territorial ordering). The programme is starting to replicate its work in other areas. Its development perspective (discursively that of sustainable development) emphasises income generation based upon traditional economic approaches to poverty. The technological tenet manifested by the programme is that of appropriate technology, which allegedly revaluates local techniques.

PRONAR

The National Irrigation Programme (PRONAR) derives from former experiences with irrigation projects such as the Irrigation Project "Altiplano Valleys" (PRAV) and the "Intervalleys Irrigation Project" (PRIV). It is financed by the Inter-American Development Bank (BID), the technical German co-operation (GTZ) and, as national partners, the Bolivian Government and local beneficiaries. Its aims are the adequate and sustainable use of hydraulic resources in irrigation, and the contribution to the betterment of peasants' living conditions. In consequence its investments are oriented to irrigation projects for farmer households. Its technical assistance consists of advice for distinct entities (NGOs, municipalities, departmental governments, farmer organisations), training programmes, studies and research (PRONAR 1999).

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[97] What makes a difference is '*scandal*'. Modernity scandalises and goes into panic for what farmers accept silently, with resignation.

PRONAR's core perspective on "technical assistance" can be summarised in the quotation heading one of its documents: "Customs as it were show the modes of being and seeing of persons and peoples, and point out much better than any other information the way to follow for those who want to *accompany* them" (PRONAR 1999: 7, emphasis added). This assertion recalls the discussion presented in the first chapter concerning *tradition* and makes a criticism of the "traditional" manner in which projects broach the problem of development, ignoring farmers' knowledge and techniques. It becomes an argument against the technocratic and economicist vision of development projects: "(In them) Farmer participation is valued only by the quantity of days/man contributed" (1999: 9). It asserts that there has been a permanent misunderstanding between development programmes and peasant communities and that development action should be effected through negotiation and concerted effort.

To "accompany" becomes relevant when PRONAR emphasises that the point is not to make projects *for* farmers but to participate in *their* projects. This means that the local community should be the "institutional engine" for irrigation management and project formulation. In their turn, external institutions appear to be just service deliverers, facilitators which only chaperon the process[98].

This is a perspective quite different from those maintained by the rest of the organisations devoted to technological issues in agriculture, and implies some inevitable tensions between the people working in the programme and the institutional framework to which it belongs (a large and complex hierarchical structure of ministries, vice-ministries, departments and funds). Its proposals are not only those of decentralisation and participation but an actual alignment with the "communal Andean tradition". So far, it implies conflicts and contradictions with conventional development discourses, official

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[98] This contention is somewhat similar to that which the "successive limited comparisons model" supposes: "This model portrayed policy-makers as acting cautiously, and learning from errors in an incremental way, without a grand design and limiting achievements rather than obtaining the final policy goal. Incrementalism is presented as the action process of policy initiatives in democracies; it leads to only marginal change. In effect, the agency of policy makers is presented as one of muddling through in organisational contexts.

"The notion of incrementalism evolved into an analysis of 'disjointed incrementalism'; namely, an understanding of policy action as subject to comparisons between alternative policy options to change conditions gradually, rather than to solve problems. According to this model, in order to exercise their agency policy agents act through a series of approximations, which come to form a style of management. This understanding inspired an analysis of policy as a process of partisan mutual adjustment in which co-ordination is achieved through everyday decision-making. Constant bargaining and negotiation are part of reaching decisions, and final collective resolutions are always a compromise" (Arce 2002a: 3).

planning and nation-state control over nature-based resources[99]. But it also means a better approach to farmer problems, a more horizontal relation with communities and joint action based upon local knowledge.

A peculiar trait concerning the people working in the programme is their professional background. They are civil and agricultural engineers or agronomists: technicians who face the challenge of "shifting the vision"[100] and who fully recognize and value peasant knowledge (not only "validating" it). These people educated in the rational and technical tradition (the severe natural knowledge) come to find in science a kind of fundamentalism –an accusation that was formerly cast like a stigma against those who had lost the "spirit of objectivity"– while embracing Andean culture or other similar causes: they are engineers who surrender to a love of culture, ancient values, tradition.

Notwithstanding, the programme has still many things to solve. The proposed water law in which the programme is involved has already passed through more than 30 versions, due to being currently an explosive issue. Here we can see the limits of a communal and localist vision: namely, the impossibility of satisfying each particular, local or partial interest and high expectations in relation to a scarce resource like water; and the unavoidable state imposition that is not only incapable of balancing interests and differences but openly committed to support powerful economic interests and national and local elites[101]. On the other hand, the programme does not take, from its perspective, a clear position as regards the milieu (i.e. it considers criteria to enlarge capacities for collecting water but not the effects of dams, or

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[99] Such contradictions and tensions are not strange to the domain –a "local situational field"- wherein macro-policies are transformed or contested by different discourses, cultures and management techniques: "This is the domain where the reality of a macro-policy is circumscribed by the existence of different bureaucratic interests, cultures and management styles. This can generate continuities and discontinuities between different members of the policy community as social expressions of the locally situated interactions (Arce 2002a: 21). On the other hand: "This may show that there is not an exclusive international cultural institutional dominance and we need to give due recognition to national bureaucracies and their institutional culture enveloping and re-directing international policies and programmes in terms of their institutional and personal interests (22).

[100] "Cambiar la mirada": We might remark that it is anthropologists, sociologists and the like that are commonly accused of being bewitched by the enchantment of "exotic cultures".

[101] The lastest laws on natural resources show to what extent they are arranged according to political and economic power: an environmental law that is minimally effective in its application; a forest law, deformed in the senate and labelled as colonial law (promoting only extractive activities) which gives advantages to timber firms and presents structural limitations to monitoring its compliance; a land law in which the government itself denies and betrays the consensus reached with indigenous movements, peasant communities and small landholders.

conduction/distribution infrastructures regarding bio-diversity and the environment). Neither do they seem to be acquainted with aspects of peasant economics (economic obligations, benefits, income, labour, markets and so on).

It is not necessary to elaborate on the images of the peasant and technology this organisation holds. But it is worth pointing out that its development conception is very much linked to what is known as *de-colonisation*, *de-westernisation* or, as they put it: to *de-learn* what has been imposed and does not correspond to "their own" and to breed instead their own heritage.

CIFP-CSP

The Pairumani Genetic Research Centre (CIFP) working in conjunction with the Pairumani Seed Centre (CSP) has a philosophy and work conception quite different from and even opposite to the PRONAR programme. Here we deal with a private entity (a non profit entity, albeit according to current times one that has gained some entrepreneurial traits and is now trying to convert the centre into a self-sustaining entity), which is principally financed by the Simón I. Patiño Foundation. This institution co-ordinates its activities, at national level, with the ministries of Agriculture and Sustainable Development, with what used to be the Bolivian Institute of Agricultural Technology IBTA, today SIBTA), and with the National Seed Programme as well as with other private organisations. At an international level the CIFP-CSP is linked to the International Centre for the Improvement in Maize and Wheat, the International Institute of Genetic Resources, the International Centre for Tropical Agriculture, the University of Wisconsin, the Perlotremare Agronomic Institute of Florence, and the University of Cambridge (7/10/99).

The activities of the CIFP-CSP centre comprise a genetic improvement programme for maize whose aim is to obtain suitable varieties for small-scale agriculturalists, taking into account their main uses, preferences and necessities (comprising a diversity of textures that include soft, semi-hard and hard grains). It has worked with, above all, disease-tolerant varieties, which have been among the most readily adopted due to the importance for farmers of having resistant and tolerant varieties. The centre produces basic seed as well as commercial varieties and hybrids. Other programmes that have been developed are those for beans, broad beans and vetches.

The centre's orientation regarding the issue of genetic diversity conservation (Bolivia being one of the most important sites) is to conduct conservation *ex situ* (i.e. conservation must be carried out by specialised centres and not by peasants). The centre contends that this reasoning has a moral nature (!): if peasants were meant to preserve the genetic patrimony, we would be condemning them to preserve the diversity solely for scientific reasons, preventing them from cultivating high-yielding varieties:

> *I find it very disloyal to the farmer and lacking in morals to tell him: look, I have a maize variety that yields eight tons per hectare whereas you have one that produces one ton per hectare; but as you are supposed to maintain the diversity (...) [then you must] continue to produce it and I will not give you this variety of eight tons* (7/10/99).

A beautiful narrative. Firstly it assumes that the farmer is interested in high yielding varieties as if they were stones (a new version of the "stone image" of local knowledge as depicted by Fairhead). In the stereotypical entrepreneurial vision it does not matter if the business deals with tons of maize or stones, but to peasant it is still very important if one is talking about maize or stones. Value to them does not reduce to a greater or lesser number of tons for the market: patterns of consumption and other cultural criteria are also important to farmers. Secondly, here we find the "cargo" image of intervention working nicely: farmers are longingly awaiting for "miraculous varieties" in order to become rich as soon as possible and, concerning genetic diversity, it is assumed that this is a matter to be left to the accountable and competent authorities: technicians and scientists (and today to the powerful bio-technology bodies). Thirdly, there is a sort of veiled paternalism: namely, deciding for the other and undervaluing the participation of farmers, as spelled out previously by the PRONAR representative. Finally, it is assumed that farmers should cultivate certain varieties (the commercial varieties coincidentally developed by techno-scientific programmes) and not others (unproductive local varieties important only for scientific concerns). In the end, despite the role established by the authority of science in relation to peasants or the mission of Andean indigenism (to preserve tradition) assigned to them, they will follow their own ways under the existent constraints and opportunities.

The technical dissemination undertaken by the centre encompasses four aspects: the regional proofs of varieties requested by NGOs or farmer groups; the demonstration plots that consist of in situ proofs, through which farmer's produce is compared with that produced by the centre (following a criterion based upon economic calculation); the educational plots in which is sown what farmers request -an interesting experiment in which farmers acknowledge, in the Platonic sense and with the help of technicians, characteristics and traits of crops they could not perceive of by themselves, and in turn technicians become aware of farmers' criteria for variety selection (an intersection of knowledges102); and lastly, the training courses for trainers: the NGO technicians and, in the future, the municipal staff.

The vision the centre has of the farmer is somehow contradictory: on the one hand he is seen as innovator, displaying a commercial inclination but, on the other hand, he is perceived of as a pitiful being living in "infrahuman conditions". Thus they make the mistake of reification by supposing that everyone sees things like they do and that this is quite natural. Hence they assume the place of others, not as if they were them, but as they are in fact, and this makes a substantial difference. They are long since accustomed to their own demerits and miseries but become easily scandalised by the situation of others.

Farmers' acceptance and appreciation of the varieties produced by the centre can be illustrated in the province of Mizque. Before the centre had formally distributed one its varieties, the technicians were surprised to find that it had already been obtained by and was being cultivated by farmers of the region. This experience shows not only the farmer's openness but his manifest agency concerning his agricultural interests. Something similar occurred in Colombia when some farmers stole a new bean variety from the experimental station where it had been developed. (See also the work of Box on the Dominican Republic).

Among the weaknesses confronted by the centre are the agreements established with NGOs, since the lifetime of the latter is quite unpredictable. This can seriously affect the continuity of the work undertaken, as we will see later in the case of an important NGO, PROSEMPA, which was part of institutional arrangements for potato improvement. Another decisive obstacle in working with such organisations concerns their "philosophy" or institutional principles. Such differences make it difficult for the centres to co-ordinate with NGOs engaged in ecological agriculture or in the revalorisation of local knowledge. From the centre's perspective such organisations "paralyse (peasant) development". We have already seen how technicians do not manage to acquire a coherent image of farmers and how the latter may vary in their own perspectives. And likewise we cannot ask technicians, nor philosophers either, for consistency[103]. Here we encounter again the negative

[102] "... there can be other types of criteria that are not always the ones we the technicians consider, sometimes we help farmers in realising some characteristics they are not able to grasp" (7/10/99).

[103] It is neither strange nor fortuitous to find these contradictions –upon which we have insisted maybe too much- in technicians' perceptions, in their imagery regarding farmers. Some authors had already identified and highlighted these types of ambiguities or contradictions (cf. Fairhead 1993: 200-202).

idea that farmers are aggressive, innovate, and know very well what they want; but, like children, are unaware, immature, the easy prey of cultural wizards and other romantic charlatans in love with folklore. We should remember that under the apparent "paralysis" there is an autonomous torrent of life, which follows its own ways in spite of our pretentious freezing or changing of powers.

Part of this vision of the farmer is the evaluation of his knowledge. To the centre representative, and following popular predicaments or requirements of education, for those (peasants) that are not "qualified", say those with an educational level defined as poor104, "… the only job they can do is that of beasts of burden, or to beg". This vision is totally opposite to that upheld by PRONAR, a programme fascinated with Andean peasant wisdom. Finally, it is important to add a remark on the issue of gender. Due to out-migration and multiple occupational activities, officials are more likely to meet women than men. Because of this, the different centres should give more priority to incorporating in their technical bodies female officials to interact with female farmers, since such interactions are difficult for male personnel.

CIF-SEFO

Another successful organisation focusing on technology transfer is that jointly formed by the Fodder Research Centre (CIF) and the Fodder Seeds Centre (SEFO). The CIF-SEFO is devoted to research, transfer, production and trade of fodder seeds. It is autonomous and has a multidisciplinary character. Its staff belongs to San Simón University. One of its positive features is the generation of sales of technology and seeds. Initially the centre was financed by the Swiss Technical Co-operation (COTESU), and at present a large part of its shares is invested in small-scale farmers (49%). The organisation also

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[104] We can make a wordplay with "*poor* educational level" and "educational level of the *poor*". In the first case we can situate the phrase in the context of a western teenager with secondary school studies, access to Internet, cable television, libraries, art museums, etc. but with *poor* spoken language skills as well as very *poor* writing skills –appropriate to the "telegramatic" Internet language–, who commonly does not read, who consumes very *poor* food in terms of nutrition, is regrettably tied up to the youth products market, and has very *poor* religious or moral values (and is inclined to violence and vandalism). In the second educational level we can place a *poor* rural youth, who is knowledgeable about his natural environment, utilises intelligently the scarce resources he has access to, masters the techniques for building a dwelling, cropping, crafting work instruments and preparing meals. He cultivates relationships of reciprocity and has high religious and moral values. And ultimately, when he comes to our cities, he humbly accepts lugging the heavy sacks that "enrich" us, since that is also culture and not just being 'poor'.

cooperates with ORSTOM, a French research body and a Dutch rhizobiology project.

The approach of CIF-SEFO to the issue of technology transfer is to gradually direct the research and work carried out by agronomists at the station towards farmers' plots, leaving more activities, inputs and power to the farmer. Here one can speak of a transition from the recommended package ("perfect and invented by us", as spelled out by one of the CIF-SEFO speakers, 8/10/99) to an open set of options for the farmer, from which he can choose one more relevant to him. The core of this proposal lies in who, in the end, makes the decisions. CIF-SEFO admits that, still to a large extent, central decisions are made by them[105]. As to the issue of training there is, like in the Pairumani centre (CIFP-CSP), a preference for training trainers and not directly farmers (8/10/99).

SEFO, started thirty years ago and became a production company in 1977. It produces fodder seed in different zones of Cochabamba, Santa Cruz and Tarija. It assumes that local knowledge is useful and practical and can combine well with local technicians' initiatives leading to the generation of shared innovations, as illustrated by the case of a peanut harvester made of wood which turned out to be much cheaper than the type CIAT (the Tropical Agriculture Research Centre) wanted to buy. In general, the centre shows a respect for local technologies that are effective: "If the farmer, for example, has a harvest technique that is good I take advantage of that and only make small improvements" (8/10/99). For the harvesting and cleaning of seed it has been observed that the work peasant family members do by hand is actually much better than the work of the more refined machine.

SEFO has exported fodder seeds to other countries in Central and South America as well as to countries further afield such as Pakistan. Exports are not really huge since they are carried out by small-scale producers working with intensive-labour technologies, however the produce is of high quality. One

[105] The proposition of positively evaluating farmer's knowledge and choices can be found, as we saw in chapter one, in new approaches from extension sciences and communication studies. Such propositions have been criticised (Arce, 1993) since they incarnate a wilful and populist approach wherein the "noble savage" meets its ideal companion in the figure of the "good technician". It would be worthwhile to point out also that there are some subtle differences between "making a decision" as such and "(apparently or partially) making a decision". Indeed it appears to be really difficult to do something when the farmer has not already made the same decision: such as in affairs of seduction where the suitor discovers that his decision is a tardy echo of his victim's earlier decision (in chapter seven we will elaborate on these metaphorical comparisons between knowledge or decisions and love games).

much discussed issue is how fair the distribution of profits is for small-scale producer or shareholder in relation to the total revenue received? A final point is that technicians attribute a pragmatic vision to farmers just as they do to their own experiments.

> *The harvest is divided into two, for the centre and the farmer. The farmer considers experiments as... I mean, for the farmer all this is something very commercial. The farmer accepts that the engineer, a bit crazy, grows something odd on his plots but, basically, to the farmer this is purely trade* (8/10/99*).*

This hints that the farmer, far from being a staunch defender of his cultural values[106], is vexed with mercantile matters, has very concrete economic interests and is interested in and even eager for any unexpected opportunity or advantage, that is, he is as 'weak' as any mortal to temptations too close to him: opportunist like a good gambler.

CIFEMA

The Centre for Research, Training and Extension in Agricultural Mechanization (CIFEMA) is another programme of San Simón University (UMSS) with already twenty years of activities. As the PROMIC programme, it comes from a bilateral agreement between the Bolivian and Swiss governments. The centre's focus has to do with agricultural mechanisation and its activities can be outlined in three main areas: technology, human resources training and infrastructure for supporting agriculture. These activities are framed in two programmes: research/training and production/commercialisation (7/10/99).

Since 1982, the production of CIFEMA has been centred on manual tools (rakes, pitchforks threshers), agricultural implements (animal-traction ploughs and harrows), and equipment for agriculture (threshing machines and balers). The sole limitation in the volume of production is low demand for tools. At the outset there were many difficulties in the transfer of such products to farmers. CIFEMA's first artefact, "a rather, in this case, non-

[106] It is quite difficult to perceive in a peasant reflexive ethics or aesthetics and, further, that they originate genuinely within their own a strategy of cultural defence (unless we consider as such the paradoxical outward 'Andean' evangelisation that is overall an invention of good –excessive– *faith*, which sees more miracles than the saint himself who has done them. Nonetheless, assuming that thinking is asking oneself, as Heidegger puts it, it is almost unavoidable that, in the Andean scene, during some *acullicu* (communitarian coca chewing) or on the embers of some feast, some elder asks himself about his culture's future ("What will become of all this?").

functional plough –definitely much too heavy" (7/10/99), did not get a positive response from the farmer. So the centre deployed an aggressive marketing strategy (involving visits to the field, promotional prices) with four sales channels: direct sales at the centre headquarters (which amounted to 30% of the total[107]); sales by promoters who were renowned farmers who obtained credit for offering the tool to other farmers (some 70 promoters in the whole country); sales by agents (about 10 in the country); and finally, sales to development organisations.

In CIFEMA they think prices are of paramount importance to farmer's decision making, as shown above in other examples and as we will see more precisely in one of the case studies concerning certain *rejas* (grids) from CIFEMA (see chapter 5). Hence, it is not the inflexible authority of tradition[108] that prevents farmers from succumbing to the pleasures of new technology, and giving way to its favours[109]:

> *A plough, a piece of equipment, a manual instrument (…) as a new proposal does not represent for small-scale producers (…) a priority. Priorities to them can be nourishment, buying seed, fertilisers…* (7/10/99*).*

CIFEMA's technological objective is to lighten agricultural work, to save time (by bettering conditions on the plots or facilitating extra time to work more land) and, perhaps, to lessen production costs. Considering the cost objective, it is hard to imagine that improved tools or equipment would be cheaper than the simpler ones utilised by the farmers. On the subject of saving time this becomes relative if we take into account not the efficient use of it but its local availability: if, in the countryside, what we have more of is time, it sounds like nonsense to try to save it (but, we should acknowledge, this is not always the case). In reference to the lightening of the heavy field tasks, farmers themselves show their agreement on this.

According to the centre technicians, the offered technology does not demand a shift in the production system, and therefore it is easily adopted by the

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[107] The centre's traumatic initial experience with a "too much well conceived of plough" motivated an actual celebration when later on the first farmer (from North Potosi) appeared at the centre to buy an improved version: "... we almost held a feast when a farmer came to CIFEMA and said, 'I have seen some ploughs, they say you sell them' (...) we followed him up to the bridge (there is one at the entrance of CIFEMA) (...) taking pictures of him and filming his leaving..." (7/10/99).

[108] Galjart's contention stressed the false dichotomy between the modern and the traditional, mentioning other causes for the failure to adopt new technology (cf. chapter one).

[109] In the amply dispersed *Farmer First*, M. Fernández and H. Salvatierra (1990: 146-150) tell us how evident it may be that the offered alternatives require capital, labour, and ecological conditions "… (to) which subsistence farmer does not have access".

farmer and, in many cases, adapted or even improved according to the particular production conditions. The farmer is also open to innovations that imply a greater female presence in the operations with instruments such as the plough.

As with SEFO, this centre tends toward economic autonomy having become a combined organisation (Combined Anonymous Society, SAM), and has the obligation of passing to small private partners, in coming years, a large part of its shares (40%). To date the centre is linked to some entities in England and Northern Ireland for its staff training.

Perhaps, the most meaningful experience for CIFEMA has been its encounter with farmers' local knowledge as was experienced with the release of its first plough. This first artefact came from a competition organised by the institution wherein twenty farmers presented their own "inventions". The original idea was to take and reproduce the winning artefact and sell it to farmers, but technicians decided to improve the awarded tool still a bit more, "based upon some hypothesis and calculations"[110], and they delivered a "better" plough with a greater work capacity. As described above, the outcome was much too heavy a tool for the existing production system.

3.3 The course of the institutional endeavours to improve potato cultivation in Tiraque

In the following section I present a brief description of the organisations dedicated to technical innovation and dissemination in potato cropping in the Tiraque province. At the same time, I sketch out the particular features for each phase of their long intervention.

3.3.1 Early incursions: pioneers and the first *knowledge system*[111]

The revolutionary process that took place in Bolivia in 1952 resulted in the land reform of 1953, which was only a formal recognition of the prior *de facto* land occupation by peasants who –often violently– removed landlords

[110] "Improvers" always will want to improve something. The technician's *raison d'etre* is to make an improvement, even if the result is not fit for us, we inveterate bunglers.

[111] We can define *knowledge* (and information) system as: "the articulated set of actors, networks and/or organizations expected or managed to work synergically to support knowledge processes which improve the correspondence between knowledge and environment, and/or the control provided through technology use in a given domain of human activity" (Röling, 1992b in Engel 1995: 37).

(*hacendados*) from the land. Since then these pre-capitalist landlords have disappeared as a social class.

Until the sixties there were some government attempts[112] to increase agricultural production and ameliorate the living standards of peasantry. By the early sixties the highlands of Tiraque and Carrasco, two provinces situated in the eastern part of Cochabamba, were still under the same agricultural patterns developed during the *Hacienda* regime. Peasants continued to cultivate grains such as wheat, maize, barley and some potatoes, but mainly for local consumption.

In 1964 the first development project was implemented by DESEC[113] in the area. The technological package introduced succeeded in overcoming the main and insuperable natural *constraint* to intensive/extensive potato cultivation: namely two plagues[114] related to climatic variations in temperature and humidity. This constituted a turning point for local agricultural systems since the intervention rapidly induced changes in the *farming style*: in cropping patterns, the crops themselves (new potato varieties displacing other rather diverse crops –including native potato varieties); all of which, ultimately, led to an intensified production of improved potatoes in an ever larger area.

One might ask why the *constraint* image appears at *that* moment and in *that* place? It seems that until then farmers did not realise that they confronted a serious natural-productive restriction, which condemned them to the dark *marginality* (we return to this term later) domains. Perhaps some landlords, governmental officials and technicians had already noticed there was some kind of constraint affecting agriculture but farmers, in referring to that period, do not talk of "constraints" (during this period grains were the main staple and potatoes were a secondary crop). This of course does not mean that farmers were not familiar with the two mentioned plagues –but did they *perceive of* them as *constraints*? or of *enacted* entities –as Varela puts it (see chapter one). It is argued by scholars who have studied Andean peasant cosmological visions (e.g. Grillo, Rengifo, Valladolid, van Kessel and others) that plagues and other pests that attack crops are taken as part of nature and life. The presence of insects or fungus is like the arrival of rains or cold

[112] Such as the creation of rural co-operatives and the policy of promoting peasant migration toward the tropical region of Santa Cruz.
[113]*Centro de Desarrollo Social y Económico*. Maybe the first NGO that appeared in Bolivia: "The organization where I work was founded in 1963, videlicet it has had a fairly long life" (J. Demeure 7/10/99).
[114] Their Quechua names are *t'octu* and *qhasu* (*Phytophthora Infestans* and *Alternaria Solani Sp*).

weather: they arrive because it is their time to do so. Farmers, like Marcus Aurelius, would be in harmony with their own fate.

Constraint, certainly, is an important term for development matters, but 'constraints' are our invention. They are born and emerge from the objectives we ourselves define and impose. A rock is just a rock until we decide to build a road over it, then it becomes a constraint. Like the appearances of sacred beings which occur for some reason (to give commandments, for instance), restrictions or problems are specifically restrictions or problems for something or someone[115], they are not gratuitous, they do not seek only the pleasure of displaying themselves. If someone talks about restrictions it is quite natural to ask, in relation to what?, and for whom? The invention of restrictions is not a first step but a logical consequence of some purpose: for instance, the purpose of converting an ample social and geographic space in a potato production specialised zone.

A hypothetical farmer's awareness of the above restriction would signify his identification with development values and an early market orientation. The production of speciality in the Tiraque highlands shows us, qua farmer's strategies and practices, that the discovery of constraints was also one of *opportunity* for both farmers and development organisations. As a result the Tiraque farmers were involved in new and multiple relations with NGOs, the state and the market.

The intervention spread out and enclosed a large number of communities wherein producers were organised into small groups called ARADO (*Acción Rural de Apoyo al Desarrollo Organizado*) which received technological support from DESEC (via its technical branch ASAR: *Agencia de Servicios Agricolas Rurales*). As a consequence of such rapid changes in production as much as in organisation, the region became a **strategic place**[116] for the installation of: a research station (Toralapa); the most important potato market in Bolivia ("*El Puente*"); an important storage infrastructure, built up by the centre (in Lope Mendoza); and a training centre for potato producers, also belonging to the centre (Zapata Rancho). All of them visible and tangible testimonies of the specialisation process carried out throughout the mountains of Tiraque and Carrasco.

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[115] Such as steering some believers along the pathways of progress, for instance.

[116] In the sense of *locale* described by Giddens (1990: 18) but since the very beginning articulated as a social space, a specific one which was, at the same time, the *locus* for the intervention. Their boundaries do not correspond to or exactly match those "imagined" by planners, geographers or governmental agencies since their deductive, administrative criteria do not correspond –very often– to the actions, networks, product flows unfolded by local actors.

The, today-famous, market place "El Puente" was not actually "created" by the intervention. Before the historical insurrection of 1952 there was already some trade there: peasants used to sell firewood at that point along the road[117], and also some peasant women sold food and produce.

After the land reform peasants were not willing anymore to go to the weekly town fair, since the town (Totora) where the fair took place was also the symbol *par excellence* of the *hacendados'* power in the region. Peasants wanted to have their own *feria* (fair) because of the abuses and excesses committed against them in town, but also because now –as independent producers– they felt free and able to manage their own market and confirm in this way their recently gained political power[118].

As peasants did not agree upon the (most appropriate) place for the new market (the more powerful communities sought to become such a place), in the end a rather strange location, somewhat unusual, was chosen for the placement of the market. However, this location was adequate to peasants' criteria of choosing a more or less **neutral** place.

Paradoxically this market place - placed far away from any urban centre, lacking infrastructure and services, located at an almost random point on the road, whose main characteristic was the bridge across the Lope Mendoza river - became strategically fit for the actors meant to meet over there, and consequently for the kinds of transactions and relationships that were to take place between them. For such actors (e.g. peasants partially specialised in potatoes, big truckers and buyers linked directly to the largest national markets, and other brokers related to regional and local markets) that point in the road, linking the more important cities of the country (La Paz, Cochabamba, Oruro, Santa Cruz and Sucre), actually became a crucial point for the intersection of their interests and livelihoods. An intersection that, perhaps, would not have been possible if technological innovation had not been brought about through intervention.

In referring to DESEC, the development organisation that started this important and long process of intervention, what can we say about their development approach? Don Juan (Jean Demeure), founder and father of this

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[117] The name "El Puente" originates in the location of the market beside the bridge that crosses the Lope Mendoza River.

[118] In fact, in many locations of the countryside several campesino fairs were being created by peasants to make possible social and economic transactions, which were non-existent until then.

institution, stated: "It was an initiative of a group of people 30 years old or younger, an answer to a social uneasiness; and a fundamental diagnosis, in the 1960s, of marginality… There was –and there is- a huge lack of services and support …". The problem of marginality was (and is) manifold, according to Don Juan:

> *There was marginality not only in production but also in organisational aspects. All peasant organisation was a sort of continuance of the post-agrarian reform political struggle, an organisation of (agrarian) trade-unions, peasant militias with very little interest in agricultural production* (J. Demeure*).*

Consequently the general objective of DESEC has been: "… to overcome marginality, in more specific terms, the promotion of farmer organisations with a socio-economic nature, independent from political struggle, and the allowance of services to those organisations…" (J. Demeure). After summarising the tenets of marginality we will return to the issue of organisation.

The promoted farmer organisations (groups of associated producers –of potatoes in this case–, which embodied a sort of corporative leadership) were structured in light of a theory of *marginality*. Fundamental assumptions of this theory consist in seeing farmers, indigenous groups and other social categories as people who are marginalized in terms of economics (they are poor), politics (they are excluded by the state), and ecology (they inhabit a provincial/rural hinterland). That is, they are depicted sub-proletarians. Opposite them is a "hegemonic, excluding and privileged society". Analytically, then, marginality is understood as exclusion, contrary to development which implies incorporation or integration (Vekemans 1969: 6-7)[119]. Theoretical sources for marginality include the perspectives on *underdevelopment* (CEPAL: Economic Commission for Latin America) and *dependency* theory. Sometimes development actions based on a marginality approach have been labelled as "*paternalistas*" (paternalist) and "*asistencialistas*" (assistencialist).

Organisational requirements were crucial to the centre's development projects: "It was essential to us –before delivering any type of service or establishing customer relations- , to get someone organised with whom one might then dialogue. Based on this, our first effort has been one of an

[119] Within this paradigm, already present in those years, though used somewhat differently from contemporary discussions, they talked about marginality's "globalidad" (globality), and about global and overarching ("englobante") global society, about globalisation and its resulting marginalisation of certain social sectors.

organisational nature" (J. Demeure). But what for them signified being organised and forming an organised group?

> *… an organised stable group, can be identified (with institutional values, of course), and manifests itself through periodical meetings, internal elections, common activities, payment systems that ensure group stability… within the concept of freedom of association.* (J. Demeure*).*

This implies that first we need someone organised to talk to, and second that we are going to organise you. One could might be content with existing local organisations (the farmer's trade union or the community organisation, for instance), but they should be organised in the way established and accepted by us, that is as pupils, apprentices or, rather, clients, in order that they could be sold the 'seeds of development'. Otherwise we would have to deal with 'disorganised' or 'misorganised' people.

During this period of peasant militias and active political movements the organisational programme of the centre certainly faced the suspicion of local organisations: "Sometimes the *centrales sindicales* (central trade-union organisations) became suspicious, and viewed this other organization with some distrust…" (J. Demeure). The control exerted by armed peasants encompassed all those rural areas considered now theirs since the disappearance of the *hacendados*. Such control implied a military or police presence.

> *There was a bit of suspicion. You must not forget that agrarian trade unions, peasant militias, up to the early sixties, were present everywhere and controlled every single "tranca" (road control post). The tranca in the Valle Alto, for instance, was still in the possession of armed peasant leaders, so one had to explain where one was going to, for what and by what means* (J. Demeure).

Even the state showed its uneasiness regarding the new organisations:

> *On the other hand the state as such considered it was a bit rare, even suspicious that we went to the countryside for lending services. There was a lot of suspicion, they thought we went to organise a political disturbance or to meddle in something that was not our business: agricultural extension and things like that.*

Regarding the technical work of DESEC, Don Juan depicts it this way:

> *We had proposed from the start technical advice, better sanitary controls, inputs availability (...) and later, a bit later, in 1967-68, we started to tackle-down the potato seeds theme. I guess multiplying healthy seed has been a fundamental point, and delivering the necessary inputs. We always talk of a "chain": advice, accompanied by*

> *inputs, and through the "técnico" (technician) since advice without inputs is just commiserated advice without real effect.*

In summary the services allowed by DESEC can be split into three types: technical, financial, and training services. The main outcome of this lengthy intervention was certainly a rise in potato yields, whose significance is evinced by the huge enlargement of the El Puente market place and this (the yields increase) is a matter of pride to the centre: "In Tiraque and Carrasco (…) for years they have maintained (a yield of) 16 tons per hectare on average, for all those farmers associated with that organisation (ARADO). In zones in which, formerly, the average was between 6 to 8 (tons)" (J. Demeure). Income generation has been the principal goal for DESEC, due to the fact that its technological conception is intimately linked to its profitability and consequently to market requirements (limiting the idea of sustainability to economic concerns):

> *…it is not possible to isolate technology from (production) systems and it is not possible to isolate profitability systems from those of sustainability. If (something) is not profitable today (…) then it is not sustainable and someday dies; and if it is not sustainable in the short term, the very base of production is destroyed* (J. Demeure).

Things die someday but to state that Andean farmers –after surviving for many centuries– will die tomorrow because they do not fit with today's market exigencies is too rash. With respect to the work methods applied to farmer organised groups (ARADO), the centre has followed production relations traditionally held by farmers in the Andean region, namely so called "*trabajo en compañía*" (sharecropping), which Don Juan labels 'joint ventures':

> *We have accepted the proposal of many peasant organisations to work with ancient/traditional systems of compañía. We have adapted them. They put forth their work, their knowledge, their tradition, their instruments; we contribute technology, improved seed, sanitary control, fertilisation and both the farmer and we, share the harvest.*

The financial support for the work of DESEC, beginning in the 1960s, came exclusively from a Catholic organisation: MISEREOR. This organisation have financed a lot of projects[120] (and has been the most important financial source, funding a half of all the finance received by the centre). From the 1970s

[120] According to Don Juan's account DESEC was the first lay organisation that received Catholic support for "social action": "In that time all social actions were done by the church, the *oblato* priests in Oruro and Potosí, the *Agustinians* in the *Yungas*, the *Franciscans* in a number of regions. It was the religious congregations or bishoprics that undertook projects, but there was no lay action in development (…) I guess we started with the idea of farmer organisations with a social nature.

onwards other organisations from The Netherlands and Belgium also supported DESEC. Something interesting and almost curious is that DESEC staff members ("a lot of people"), during the sixties, were awarded scholarships in Chile as much as to get them acquainted with the marginality approach as to receive the church's social doctrine (courses in sociology and communication): "We are an organisation with Christian inspiration (…) in that time there was a lot of social awareness. All the marginality theory, people promotion, all that was developed in Chile. Others went to Colombia".

Regarding co-ordination with other governmental or non-governmental organisations, Demeure said:

> *At the onset, in the sixties, there was very little (co-ordination) since there was almost nothing (in terms of development institutions) except Toralapa (the experimental station) with whom we already had relations. And we have to say as well that at that time public entities, in general, saw us as intruders. At that time the concept of NGO did not exist; and they wondered why we meddled in the countryside. They had misgivings about our intentions and were not convinced we were not politicians. There was too much mistrust and also a sort of monopoly spirit. They felt they did everything, which was not the truth at all since although they had this spirit of monopoly they did not have the means to reach all the places and, because of that, they tolerated us: becoming realistic (!)*

However, DESEC started and maintained relationships with state offices: the Ministry of Agriculture and "farmer issues" and its departmental offices. To a certain extent with the Ministry of Planning, the Institute of Colonisation, the Agricultural Bank, the Bank of the Bolivian State: "but we have not achieved too much with these institutions". At present –and formerly– the centre has relationships and agreements with different institutions:

> *At the national level we have relations with universities, not always active relations but we have them. For instance, to date, with the Agronomy Faculty, we have supervised theses. We have fellowship holders from Spain, and Belgium. With regard to national research centres we have had many relations with experimental stations not always very active ones because they have had difficult breakdowns during their history. But Patacamaya, Toralapa, San Benito, we have had contact with them. With PROINPA since its birth, with the Pairumani centre (CIFP-CSP), the Veterinary Faculty in Santa Cruz... We co-ordinate with municipalities, development committees -at the provincial level–, and with numerous institutions like SEFO, SEPA, PROLADE…*

Before closing this part of the chapter relating to the first technical intervention phase in the Tiraque mountains I would like to point out that DESEC was the first and maybe the only real *knowledge and information system* in the region of Cochabamba, dealing with potato technical innovation and dissemination. It has had a system core constituted by three main components: DESEC (created in 1963: the wet-nurse institution), ARADO (1963: the organised farmers), and ASAR (1964: the technical branch). The extended system is constituted by this core and the following organisations (related above all to DESEC): VIPO (*Vivienda Popular* –People's Housing–, 1965: entrusted with farmer housing), SEPSA (*Servicio Popular de Salud* –People's Health Service–, 1966: designated to offer basic health services), and ICE (*Instituto Campesino de Educación* –Peasant Institute of Education–, 1967: dedicated to non formal educational and training activities). Figure 1 depicts the whole system.

The success of DESEC –since it deployed a really successful programme spreading potato and potato seed production in a large area (mainly close to the road to the city of Santa Cruz[121])– allowed it to structure the complex system that represents its culminating moment, after which it started to fade. At first the complementary system disappeared: VIPO, SEPSA and ICE did not prove to be sustainable since it was difficult for an NGO to maintain services that were a heavy burden even for the central government. But the knowledge system lasted until the eighties when finally ASAR, the technical branch, left the region[122], dismantling the system which had endured so long. The only system component that stayed was ARADO: the organised farmers groups, which were the pre-condition, the bedrock, according to DESEC philosophy, of the institutional work for development and which, paradoxically, as we will see, was the main cause of the system's collapse. Indeed, it was not a problem of co-ordination or information flows that led to the breakdown, even though like any system DESEC had had troubles in these areas:

> *We have preferred a de-centralised system to allow each institution to have a greater autonomy of action, but this implies also, a little bit, some co-ordination and information difficulties, communication problems between the distinct units*...(J. Demeure).

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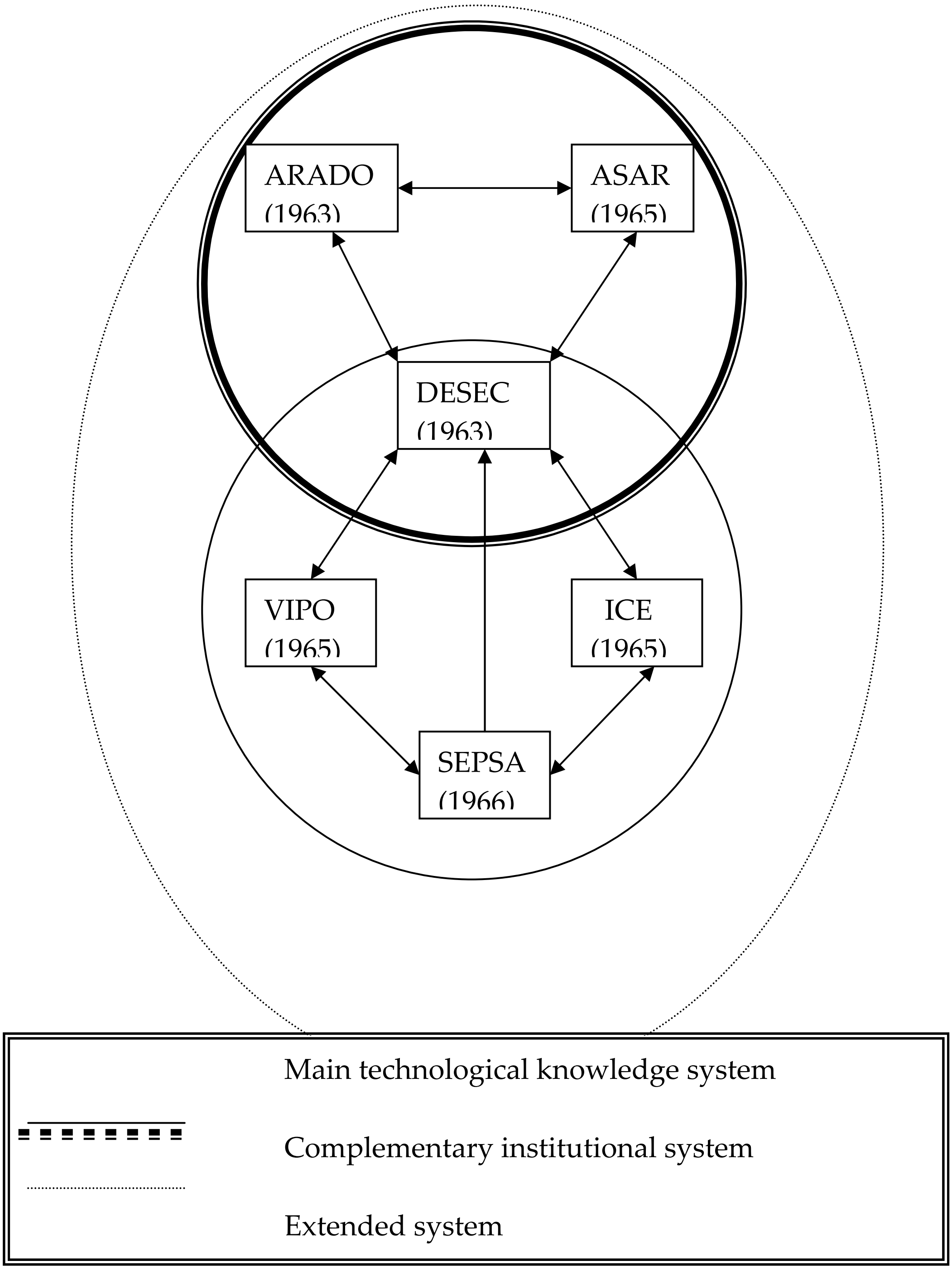
[121] Engineer Jonás Colque, the technician responsible for ARADO specifies this organisation's domain boundaries: "From Km. 73 in Qoari up to Comarapa we stretch out –on the old road to Santa Cruz– more or less to Km. 300, 280, I am not sure". In another interview he was more accurate: "Our action zone is the old road to Santa Cruz, from Km. 75 up to 230, on the road, and then entering more or less 80 to 100 Km., on the road, from Epizana up to Sucre (Epizana is the dividing point to continue to the city of Sucre). Arado has to date 500 associates".

[122] Don Juan told us: "For many years ASAR had extended technical services to ARADO, as stated before: advice, inputs, credit, seed multiplication, etc. Up to the 1980s when ASAR proposed to ARADO the transfer of all services…"

FIGURE 1
THE DESEC KNOWLEDGE INFORMATION SYSTEM



The first and principal part of the chain construed by the centre, namely, the most important link to the organised farmers, failed. Not because of technical assimilation (the relative specialisation process had been successful) but because of economic accountability: farmers started to neglect their payment agreements and debts started to accrue like a snowball. Engineer Colque referred to this problem with disappointment and bewilderment:

> *With respect to credits there is a problem. For instance, people come to get credit; even, sometimes, they are begging us for credit and they assure us they are going to comply with payments. But, for x or y reason, when the moment for paying has arrived (they do not pay), and we acquire the problem… I have to say that this is an old problem, not a contemporary problem. There are a lot of farmers that think that when we give credits they are "a fondo perdido"; that is the idea. Then when you are going to cash in they no longer want to pay, there is no idea of accountability in their notion about the fact that when you receive a credit you have to return, as a debtor. So the biggest problem is in the bad recovery of delivered credits.*

Alongside the problem of bad loans, the centre has recently faced some funding problems:

> *From 1993 to 1996 we have gone up, we have increased the number of associates, the sown area. In 1997-98, with the drought, we have had problems (...) Financial support lasts 10 or 12 years and then ends, so we have to look for another source and this means delays (...), and this last years' sponsors are more demanding, so this causes delays, you see...*

The debt problem has led some people like Engineer Colque to realise that they had become paternalistic: "we have been creating a lot of paternalism, financing almost all the activities...". However beyond the style, methods and flaws of any development organisation one must give attention to the development proposals and strategies themselves: sometimes they may become old and fall into abeyance.

3.3.2 The era of the warring states: competing systems and discourses[123]

The solitary performance of DESEC was disturbed when new NGOs loomed on their horizon (especially CEDEAGRO[124], INEDER[125], and CIPCA[126]). Two facts steered new efforts in the mountains of Tiraque and Carrasco: the success achieved by DESEC that made evident the feasibility of development work in that region, and the arrival of the era of NGOs: by the end of the 1960s these newly created development organisations started to flourish among the humble countryside flowers. One of them (CEDEAGRO) was able to give birth to the Potato Producers' Association (APP: *Asociación de Productores de Papa*) which encompassed potato producers of other provinces. INEDER, founded by Maoist militants, whose scholarships in Holland had coincided with the Maoist fashion in Europe, chose the province of Carrasco as its development realm, setting up its own institutional complex there. CIPCA, a Catholic NGO, settled in Tiraque along with other government and non-governmental organisations, such as IBTA, CORDECO, PDAI, SEPA, CASDEC and so on. Here we will concentrate on those organisations related to the "potato issue", stressing how contested visions, conflicting objectives and opposed strategies made development an object of discrepancy and in fact an actual battlefield.

From the outset, the "house" of DESEC did not look with satisfaction on the arrival of new development organisations invading *its territory*, although Don Juan tried to deny the idea that they had one:

> *No, no, no. We do not have any territory, what happens is: when you have worked for many years to consolidate an action and then other organisations come, they are not going to work the same as you but they take what is already achieved and this is not pleasant at all. A lot of farmers have reacted to this: "we are already organised, they should go to organise other people that are not organised yet. Here we already have technical services, go work with others who do not have them yet…"*

According to the concept of co-ordinated work, synergic relationships or flows of knowledge and information (key elements of a knowledge system)

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[123] Here we adopt Long's practical definition of discourse: "A set of meanings, metaphors, representations, images, narratives, and statements that advance a particular version of 'the truth' about specific objects, persons and events. Discourses produce 'texts' written and spoken, or even non-verbal like the meanings embodied in architectural styles (e.g. buildings may 'speak' of civic pride, such as town halls and factories of the industrial revolution) or dress fashions (e.g. associated with a person's class status, gender, age or ethnic affiliation)" (Long 2001).

[124] *Centro de Desarrollo Agropecuario*

[125] *Intsituto de Educación para el Desarrollo Rural*

[126] *Centro de Investigación y Promoción del Campesinado*

are likely to be lacking in this second phase of technical innovation and diffusion. In responding to the question of whether there were some common experiences or types of exchange, Don Juan responded:

> *Hmm... I do not see, hmmm...I do not see. Many organisations appeared but regrettably without co-ordination. I refer to organisations such as CEDEAGRO, CIPCA – CEDEAGRO above all- but without trying to co-ordinate anything.*

Although there was no a formal co-ordination, frontline technicians met each other ing the field and "sometimes developed some relationships…" Moreover, at the institutional level, problems of competition and distrust arose immediately between the different development "houses" in Tiraque, as Don Juan readily acknowledges: "There was a problem of competition between institutions, but I would not say that these institutions were rivals", or: "I would say that at times there has been more competition than else".

Facing this conflictive development landscape one is obliged to enquire about the factors or reasons that separated and created opposition among organisations committed to the progress and welfare of poor Tiraque peasants. According to the DESEC point of view there were important differences with respect to institutional philosophies, purposes and methods. In reference to the nature, philosophy and aims of the newcomers, it was said that:

> *They were indubitably linked to political proposals, were they not? (Proposals) of some political parties of that time: the MIR, the FRI (…) We have never identified ourselves with any political party, nor have we not wanted to instrumentalise our actions with political purposes, to conquer votes and so forth (…) In the seventies, you know, many NGOs resolved to fight against dictatorships; this mere formulation was already a fairly political one* (J. Demeure).

Regarding the methods employed by the new institutions:

> *Other organisations preferred to work with farmer sindicatos (unions) with the criterion that the union would encompass the whole community whereas a group (of farmers) would not necessarily. We have defended the association's freedom at all times because the work with the unions sometimes becomes an elite game wherein the leaders make decisions and farmers have to follow them (…) whereas we do not care whether some central campesina is with us* (J. Demeure*).*

CEDEAGRO, the main opponent of DESEC in Tiraque was constituted in July of 1981 at a strategic moment and as a consequence of certain socio-political processes. The founders, Martha García and Orlando Soriano, were working formerly in another NGO, the Catholic organisation that had a national presence: CIPCA[127],

> *The central team were Licenciada Martha García and Engineer Orlando Soriano who came from CIPCA where they had been working since 1975. At the start of 1980 Lic. Martha García was designated director of CIPCA-Cochabamba and the first coup d'Etat of the 1980s came when she held that position and she had to dismantle the office because the central office in La Paz had been stormed…* (Germán Lazarte).

During the dictatorial government of 1980-81 many NGOs were closed because they were considered subversive and contrary to the "national interests". In such circumstances, and in order to give continuity to the work carried out by CIPCA, the board decided to support Martha Garcia's "institutional resistance work" providing her with funds from the Farmer Training Social Project (PROSACA) that allowed her organisation to resume support for resistance and to defend the CIPCA social base. With the success of their resistance actions taken against dictator García Meza, the core or central team (Martha, Orlando and Germán) perceived of the opportunity of creating a new organisation christened CEDEAGRO. And soon the military government was overthrown.

CEDAGRO produced the following discourse: "We met a de-structured (*campesino*) movement, without expectations, without development vision, without a political proposal, and the peasant was searching desperately for some support to better his living standards, his productivity…"[128] (German Lazarte). Consequently the purposes of CEDEAGRO were to back up and strengthen farmer organisation, and secondly, to support the livelihoods and agricultural production in order to achieve better yields and income. But, in contrast to DESEC, CEDEAGRO did care about politics: "We considered the political aspect encouraged political reflection to see where the peasant wants to go, what his perspective is (…) The three important points are thus: the organisational one, the economic-productive one, and the political one" (Germán Lazarte).

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[127] Orlando Soriano and German Lazarte, agronomists, had worked formerly in IBTA and the Agriculture Ministry as agricultural extensionists dealing with the issue of technology transfer. After working in the city of Sucre, they went to Cochabamba and Orlando Soriano worked as an extension official for the Ministry in Tiraque, where they were awakened to the "potato problem" and possibly they also saw (perception is a selective action) the successful work of DESEC, which had already developed its institutional circuit.

[128] Germán Lazarte also mentions the credit problem: "(Farmers) did not have access to credit although the Agricultural Bank existed at that moment, but with very limited actions and few resources which did not satisfy the demand, especially for potato production..." We will see below how this problem was dealt with and its consequences.

As happened with other NGOs (for instance, with the rival "house" of the Maoist militants: INEDER) the drought of 1982-83 –which had dramatically affected agricultural production- propelled CEDEAGRO towards success, supplying it with more funds and a greater influence in Tiraque province (due to the water scarcity CEDEAGRO and other development organisations, had to "reformulate" their actions). Consequently, and unlike DESEC, this centre carried out various irrigations projects (dams in Qhochimita, Thuturuyu, Chulchunqhani). But its greatest achievement was the so-called *Asociación de Productores de Papa-APP* (Potato Producers Association) even though this organisation was not in fact CEDEAGRO's creation:

> *The potato producers association was initially advised by the agriculture ministry, [but] later on due to the lack of economic resources this advice was not possible any more. Then, it was IBTA that, a little bit, took on that advisory role. Once this institution disappeared we took over all that social base to work with, and ever since we have been in Tiraque (*G. Lazarte).

Thus the "new" APP was born in Tiraque propelled by Orlando Soriano's initiative and the contribution of Germán Lazarte in Cliza:

> *He (Orlando) starts to organise farmers on the highlands of Sank'allani, Qochimita, Chaqho, Huacawasi, and so on. And then they organise a small workshop on the potato problematique… so in 1975 the first potato producers association is organised in Tiraque, at a local level. But the intention was to spread out and so we started to work with some other technicians of Ayopaya province, Morochata, etc; and small producer groups start to be organised. There were no unions (they were forbidden by the dictatorial government), due to the fact that it was not possible for them to be social base. Later on it is the farmer's union that takes on and appropriates this movement. So at that moment the departmental (regional) potato producers association starts to consolidate through an encounter in Tiraque in 1976, in October or November. Thereafter the association became massive, increasing to up to 20.000 associates at some point. The fourteen provinces of Cochabamba started to participate and analyse and debate the potato problem. That was the most important moment. At the time that the APP substituted for the peasant movement, there were no unions or federations. It became the national peasant organisation. There were not only potato producers but producers of all types. It was the peasant's political instrument, its discourse, its contest movement against Banzer (the military dictator), and this is not all. After García Meza's coup d'etat a meeting was organised in 1980, because they (farmers) needed fertilisers. There were no loans, and they urgently needed those inputs, and so they held the meeting in Tiraque. Since then the APP has gained in reputation value and it has obliged the state to seek ways to provide technical assistance and inputs to the APP. Nonetheless the APP (later) did not wait for a government solution to its problems and with its own means started to import large amounts of agrochemicals in 1978-79* (Germán Lazarte).

The objectives of APP were to improve farmers' social and economic conditions via potato production, not only in order to increase potato yields but also, within the organisation, to stimulate reflection on economic-productive elements as well organisational and political aspects so that the organisation could become a solid reference and instance for farmers' demands. Depicted in a more institutionalised way, its objectives were:

> *To improve potato production with good quality seeds and to solve sanitary problems, as well as input and credit supply.*
> *To face emergent commercialisation problems related to prices, measures of weight and trading systems.*
> *To build productive infrastructure (irrigation schemes, silos, etc.).*

The "house" of CEDEAGRO, by means of a specific agreement, became the APP "technical arm", its adviser and loans facilitator. Thus, the APP reached its pinnacle during this period of dictatorship; and, paradoxically, the return of democracy brought its decline. The role of debt was highlighted as an important factor in its decay since the APP was not able to control the commercialisation process or the middlemen:

> *With the return of democracy, farmer unions take on their role again, they start to restructure themselves, and many APP leaders become their community representatives. So the APP ceases to be the peasants' political instrument and shrinks to a small instrument only for production concerns. They start to see the APP as merely an institution for inputs provision: seeds, chemicals and, to some extent, technical assistance. Another aspect, which I believe is very important to the total break-down of the APP, was its assumed commitment to loans. It is the APP that takes this role of transfering them (credits) to its associates... I believe the recovery of debt was very deficient, and it was not possible to get back all that money... And I believe this was an important cause for the APP break-down, I mean not recovering those resources. They have even sold domains and other things to cover the APP debt with the banks... and in this manner the APP collapsed down.*

Thus the mighty APP that had resisted General Banzer's dictatorship and had contributed to General García Meza's overthrow was defeated by debt, just as happened to the DESEC system. Their organised cohorts of farmers were not able to retrieve outstanding loans and so the strong and well structured organisations did not attain their development goals. To the question of whether the APP still exists, Engineer Lazarte responded: "It still exists in the heads of some people".

Yet how was the APP experience perceived by DESEC? Demeure exclaimed,

> *Uf!! That was a typical case. The APP was an affiliation game at the level of the leaders: 'this Central is with the APP, and that one and that other one…' Bah! The APP could state it had thousands of affiliates. It was an elite game. I go to the province of Ayopaya and conquer the provincial central organisation of farmer unions, then I can say the Central is with us, they number thousands of peasants (…) We are not interested in mobilising people, for what? Mobilising seeks to get support … having to do with problems in order to generate conflicts.*

In their turn how did the people from CEDEAGRO consider the DESEC group?: "We have not been competitors, nor have we attempted to co-ordinate activities, simply we have avoided having some discussions of a technical nature with them" (G. Lazarte) (like opposed doctrinal groups that do not have any council). How to explain these distant and scarce relations when they were working in the same region? Don German refers to the issue of territory, each "house" of development held its realms and the frontiers were rather hermetical:

> *Each institution at that moment had an action area (…) somehow we (CEDEAGRO) had a territory, an almost defined space, as long as ARADO had another action area, its organisations well defined. I believe, because of that, we have worked a little bit separately from each other. We both have been in the same sector but working with different organisations…*

Regarding the work of DESEC, Don Germán acknowledges the importance of its contribution but emphasises the lack of sustainability:

> *Taking into account the work carried out by them I think this was pretty important, especially the work of ARADO and ASAR… But I have to say that when they left, nothing remained, I do not know if they neglected human resources training to make their projects sustainable. We perceived this after they left the zone: there was no continuity to their work, there were no pay-offs from their actions. Maybe they were a well organised group, with very clear objectives, but they lacked a vision of human resource training that could have sustained the ARADO-ASAR project: then, once they leave, their work disappears automatically.*

Jonás Colque, the previously mentioned ARADO technical manager, acknowledges that lack of co-ordination and co-operation has meant duplication of efforts, confusion for the farmer, and even more debts for him when other NGOs come and give him more loans:

> *Sometimes we duplicate efforts, for instance, in training: (the day after our work) another (organisation) comes and the farmer does not know where to go, to our programme or to the other one. We should meet all institutions and try to co-ordinate in order not to repeat efforts or resources… We have not had problems (with other development organisations)… Perhaps a certain rivalry as to credits. That is, we give*

> *loans and there are farmer partners that become debtors, then the other institution gives another loan to this debtor and so he falls more into debt. So we say we should co-ordinate…*

In the end there were some relationships between CEDEAGRO and DESEC, after all the mutual mistrust was not so exaggerated as to prevent any kind of exchange between them:

> *Later on, only in 1987-88, we started to have some relations (with the DESEC group) for exchanging seed, for example. In those days ARADO was fundamentally devoted to seed production. They had worked appropriately in this field and we were able to recover some seeds and utilise them in our sowing tasks. So it was a weak relationship, almost a casual one (*G. Lazarte*).*

With respect to the other opponent, the "house" of INEDER, Don German is rather critical:

> *In the province of Carrasco an institution called INEDER had huge funding from NOVIB, a Dutch institution. Instead of undertaking productive actions they spent their time involved in political actions. They succeeded in strengthening the Central Campesina in Carrasco called the Central of Moyapampa. But the leaders were paid by INEDER. They were its employees. This (experience) was not sustainable either. Then the farmers started to rebel against INEDER. They (INEDER) sought to generate a process of confrontation between farmers and thus achieve hegemony (…) They even tried to extend their activities to the Tiraque province, but this was not possible. INEDER people were members of the FRI (Frente Revolucionario de Izquierda), a Maoist political party. Because of this we called them "the Chinese".*

CEDEAGRO was not a solitary organisation fighting against, on the one hand, the empire of DESEC and, on the other, the house of the "Chinese". It belonged to an important national NGO network (that of the "*miristas*", grouped under the MIR –*Movimiento de Izquierda Revolucionaria*–, a political force linked to European Social Democracy). Besides, CEDEAGRO, like DESEC, developed international and national relationships with universities, research centres and experimental stations:

> *We have a national network which is AIPE (Association of Institutions for Education). We also obtained the support, in relation to potato research, from the Gembloux University (Belgium). We have maintained a close relationship with the Toralapa Station for around ten years, working on research with them. Later on with the Pairumani centre in maize production, and with the San Benito station in fruit production; thereafter with the Tropical Agriculture Centre of Santa Cruz, and fundamentally with the IBTA. We have also had relationships with the Cusco University regarding amaranto production, and with La Molina University, for bean cropping (*G. Lazarte*).*

Funding for CEDEAGRO has come from Belgium (SOSFAIM), OXFAM (Canada, England, U.S.), and AGCB (Germany). But one has to take into account that the funding, as much as the co-operation with other centres or organizations, does not refer only to the "Tiraque experience" but also to the new domain conquered by this NGO in the province of Mizque after they left the highlands of Tiraque. Yet is why did CEDEAGRO leave the region of Tiraque?

> *At first because other institutions started to arrive. This was the case of CIPCA. At that time they carried out the same work as us and later started to bring their proposals to the same farmer groups that we were working with. On the other hand we had to give more attention to the other province (Mizque) that needed CEDEAGRO support. Besides, we had already been already ten years in the zone and we started to thinking that it was opportune to move… (*G. Lazarte).

The relationship between CEDEAGRO and CIPCA has been rather strange. CEDEAGRO originated from CIPCA (see above). One of its founders was designated director of CIPCA in Cochabamba and was linked to the Catholic Church. But it seems that CEDEAGRO did not see in CIPCA a fellow organisation. According to Don German, CIPCA eagerly wanted to work with the APP but it was not part of its structure (CIPCA was a sort of parvenue). On the contrary, CEDEAGRO was the APP's technical instrument and there was even an agreement between them. Thus, CIPCA appeared to CEDEAGRO as another unpleasant competitor that they have to tolerate since they were related by origin and by their confessional beliefs. But then DESEC was also related to the Catholic Church. So why then all these contradictions between them?. Beyond the problem of institutional survival as "sustainable" development programmes –in the sense of making sustainable the development organisation itself– there was a problem of political orientation. Any large institution like the Catholic Church has a left and right wing. DESEC, the pioneer development organisation in Bolivia, was likewise on the right, though at times it seemed apolitical and naïve. Nevertheless it contributed to the de-politisation of development, following the prominence of US interests in the sixties and those of the dictatorships. CIPCA and CEDEAGRO, on the contrary, (and naturally the house of INEDER) naturally) were on the left wing struggling against capitalist imperialism and its local epigones and servants, their military dictators. For them, development was a fundamentally political issue or rather the way to enrol people into the political struggle. On the other hand, DESEC was closer to what can be identified as "agricultural development", whereas CEDEAGRO was located more or less in the middle between development matters and political activism, and INEDER for its part was closer to the latter, at least discursively[129].

A final last organisation created during this period was SEPA (*Semilla de Papa* –Potato Seed), also called UPS (*Unidad de Producción de Semilla de Papa*). SEPA "…was born as a development project prompted by IBTA, ASAR and COTESU" (according to SEPA). SEPA represented the first important attempt to co-ordinate and combine institutional efforts for organising a common programme for seed production in the Tiraque highlands:

> *...SEPA is the potato seed production unit. By 1983 the opportunity arose for agreement with Swiss Technical Co-operation (COTESU) to conduct a joint programme in potato seed. ASAR agreed to become a SEPA partner, a shares partner. Jointly with COTESU and IBTA we formed an association. ASAR transferred or contributed shares to SEPA for Zapata Rancho installations, vehicles, personnel... (*J. Demeure*).*

As Augusto Urquieta (SEPA Manager) points out, the development organisations in Tiraque were aware that it was necessary to address the seed problem: "In 1984 different institutions identified the necessity of creating a development project that engaged in potato seed production under optimal genetic and sanitary conditions…". There were previous co-ordination experiences shared by DESEC, COTESU and IBTA but these were not really important and lacked continuity,

> *The first co-ordination experience was with COTESU but not on potatoes, instead fodder. We had conducted some experiments with them by the end of the 1960s in Pilapata, Huayapacha and also something with IBTA since this institution managed the experimental station at Toralapa. We had exchanged some techniques, lets say (...) Toralapa had its limitations but once or twice they provided us with basic seed. We have had good relations but not always very productive ones* (J. Demeure).

SEPA's main objectives were the improvement of potato cropping in order to develop a systematic seed production of appropriate varieties for the different national agro-ecological zones; and to achieve a genetic and sanitary high quality seed production, adapted to the technological and economic level of the country. SEPA have also given technical assistance to potato producers. We have to take into account that SEPA is not a network but "an entity that has its founder partners" (A. Urquieta). SEPA has links with the International Potato Centres in Lima (Peru) and The Netherlands, and the Latin American Potato Association. Its financing comes from COSUDE (Swiss Co-operation for Development, formerly COTESU). SEPA's staff members have followed

[129] Those days, political parties like the FRI, were said to be "to the left of the left".

training courses in different countries: Mexico, The Netherlands, Belgium, Sweden, Switzerland and Argentina.

SEPA it is not actually a development project nor an NGO. It is a combined firm (with government and private shares). In their view, farmers are "entrepreneurs":

> *We see the farmer as a small-scale entrepreneur. He should have freedom of choice like any urban entrepreneur. Based on this, we have a contractual relation with the farmer wherein he gives his land and labour, and we offer seed and technical advice. There is then a contractual relation between the farmer as entrepreneur and SEPA (*A. Urquieta).

The problem here is not related to the kind of established relationship or institutional vision of the farmer. The farmer can be seen as an enterprising agent (currently all people are assumed to have some "entrepreneurial" potential). The problem is SEPA seed prices:

> *If we talk about SEPA seed costs (prices), they are very high. The smallholder does not have access to them; so they (the seeds) are not meant for small farmers. SEPA objectives are addressed to big and medium-size potato producers. That is due to its entrepreneurial structure (*G. Lazarte*).*

Hence, the success of the technical innovation of SEPA is linked to those cultivators able to pay more (twice) for seed than they did before: "They (farmers) can find seed, Bs. 50 for100 kg. in the marketplaces; but here they pay Bs. 100 for 50 kg. For the farmer, going from 100 kg. of extremely bad quality to 50 kg. of high quality is a big step" (Urquieta). Moreover, according to Don Augusto, at present they sell more to farmers than to institutions, and this, he adds, is leading SEPA to become self-financing as a profitable business.

SEPA is a rather closed or hermetical organisation. At least for CEDEAGRO, it has been difficult to work with SEPA:

> *I believe their policy (of SEPA) has been dedicated exclusively to the production of seed and not to sharing this kind of work with other institutions. There was no access to pre-basic seed for multiplication processes. Well then, as for buying potato seed, they offer it to all the country. We have had some experiences with PROINPA concerning the exchange of genetic material regarding seed production, and it has provided us with some species or varieties (other than those produced by SEPA). But then again, those produced by SEPA always have been restricted in their use. For instance, we do not have access to the holandesas (dutch varieties). So I believe they act in a monopolizing way.*

> *Tthere is not any kind of opening to other institutions for potato seed production (*G. Lazarte*).*

The work of SEPA consists of two stages: at the laboratory, *in vitro*, the multiplication of some potato plants freed from virus takes place; subsequently the production of pre-basic seed. In the field, under contract, they engage in commercial seed multiplication with farmers. However, this sort of technological monopoly –according to Don German, their closed nature– was meant to end with the appearance of yet another institution already mentioned by don German: PROINPA[130]. Ironically SEPA itself was one of its promoters and as Urquieta says:

> *Together with other institutions they recognised the need to create institutions strictly devoted to research and able to offer high quality seeds. Consequently we have always kept good relations with these kind of institutions (*A. Urquieta*).*

Don Juan also referred to the support given to this new organisation and its fellow PROSEMPA[131]: "PROINPA and PROSEMPA emerged, we could say, supported by DESEC and SEPA since it was necessary to have research centres on potatoes" (J. Demeure).

In the next section we will see how these amicable relationships evolved and what impact the arrival of new organisations such as PROINPA and PROSEMPA had on the regional framework of institutions focusing on potato technology and research.

3.3.3 Rise and decay of an agricultural knowledge framework[132]

To complete this account on the institutional dynamics surrounding potato technological innovation in Cochabamba, I now describe its last phase, which can be characterised as an *agricultural knowledge framework*. This last stage starts with the arrival –as mentioned above– of two powerful organizations.

Besides the support from DESEC and SEPA, PROINPA was promoted by the Peruvian Potato International Centre and some engineers in Cochabamba:

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130 We have seen in chapter two that PROINPA is responsible for: *Promoción e Investigación de Productos Andinos*

131 PROSEMPA promotes the *Programa de Mejoramiento de Semilla de Papa*

132 "(The) *Agricultural knowledge framework* is a field that articulates a set of factors, institutions and their networks who are expecting to manage the relationship between science and technology to come together, in order to achieve increase in productivity or to improve the use of natural resources within the domain of agriculture" (Arce 1997: 1).

> *PROINPA was created in 1989 as an effort of the Potato International Centre (CIP) located in Lima-Peru, and it dedicated all its regional studies to Andean tubers, especially potatoes (…) The idea was to create here in Bolivia a Pilot Project. Dr. Gandarillas established contact with CIP members to jointly organise the project. (*Rolando Oros*).*

From its birth, PROINPA has been intensively linked to other institutions. Its relationship with the state (through important support from IBTA) has been privileged. Besides, the organisation has received help from the Swiss Co-operation (COSUDE) and the Inter-American Bank. As pointed out above, it is linked to CIP and also to CYMMIT, and the International Plant Genetic Resources Institute (IPGRI). As to research and postgraduate studies (for its staff) they have held important linkages with national universities (public and private) as well as international ones (e.g. Louvain and Gembloux in Belgium, Leeds in England, Wisconsin and Madison in the U.S., and Wageningen in the Netherlands). These multiple relationships show that PROINPA has always cared for training personnel. In contrast with the staff from the other organisations related to potato technology, researchers and technicians from PROINPA normally write and publish papers and articles documenting their experiences and findings (often in co-operation with prestigious scholars and foreign universities). On the other hand, PROINPA continuously organises, national and international seminars and workshops. They have also worked with some private companies such as HAAS, a business dedicated to milk and sausage production.

PROSEMPA was also founded in 1989, with the purpose of achieving a general objective: that is, to strengthen the formal/non formal potato seed system of production, multiplication and distribution. From this general objective many specific objectives can be extrapolated:

To strengthen organisations and human resources involved in the seed production, multiplication, distribution and use processes, in terms of technical and managerial transfer; another objective was to set up an appropriated technological offer for potato seed production, following producers' characteristics (…) Another objective was to contribute to the structuration and consolidation of the Potato National Programme led by the National Seed Council, making possible inter-institutional co-ordination through the Potato Inter-Institutional Committees (Cerbando Lazarte).

These specific objectives were related to gender issues (José Pardo), and farmers' training (Victor Hugo Román). The funding for PROSEMPA has come from Dutch technical co-operation (with a small contribution from the national treasury), and PROSEMPA, like PROINPA, has been committed to training its staff through workshops at a regional/national level (in Cochabamba, Potosí or Chuquisaca); and a number of its professionals have followed short term, postgraduate and MSc. courses in Argentina, Peru, Colombia, Ecuador, Paraguay and the Netherlands[133]. PROSEMPA has also supported theses (for bachelor degrees) at San Simón University and other public universities in other departments of Bolivia. Regarding its relationships with the state, PROSEMPA had formal links with the National Council of Seed and its regional offices. Later we will see how relationships with the state become crucial to the future of this organisation.

PROINPA's objectives were:

> *To identify potato cropping problems; to establish laboratories and to have the equipment to generate and develop "integrated pest control". In order to be free from nematodes we cannot think of a pure chemical solution, we would be falling again into "green revolution" and pesticides abuse. [PROINPA methods include] the use of chemicals but also a cultural component and biological control (*Rolando Oros*).*

PROINPA started with a national survey of potato diseases and the outcomes of diagnosis were clearly relevant to its investigative efforts:

> *The first phase has implied a very strong work in identifying the main diseases in Bolivia that affect potato crops. So the fundamental problem has been always the "tizón tardío" (phitophtora infestans), a disease that drastically affects potato crops. Ranking these diseases by their effect we get the following order: first tizón, secondly insects (moth, curculio) and third nematodes (*Rolando Oros*).*

The principal PROINPA technological offer was then integrated pest control and complementary soil conservation methods.

PROSEMPA, like PROINPA, achieved a national scope working in 24 zones in the departments of Cochabamba, Chuquisaca and Potosí. In Cochabamba they worked in communities from Morochata, Cocapata, Independencia, Pojo and Tiraque. PROSEMPA activities consisted of extension: It was a technology transfer programme:

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[133] It appears that the PROSEMPA support for training lasted just some years. After that, perhaps due to the internal conflicts, its director: "… did not want to hear about any course, if we say we want to go he responded: 'who wants to go will find the doors open'" (Edwin Quintana).

> *… more or less a sort of validation, we had validation plots and demonstration plots on fertilisation levels. (A task) co-ordinated with FERTISUELOS (an NGO) and PROINPA for the dissemination of potato varieties (…) We transferred to farmers both institutions' technologies (*José Pardo*).*

The methodology of PROSEMPA was interesting and had a notorious impact as we will see. They worked with groups of motivated farmers (30 on average), who formed a producers association. PROSEMPA took care of training and the management of loans. Its officials elaborated a project that was presented to credit institutions and they negotiated the interest rates. Farmers themselves took on the loans, PROSEMPA's role being that of mediation:

> *Because of that we organised courses on commercialisation, market assessment, price formation, and production costs. We taught these topics to the organised groups in order that, later on, they could look for their own markets, formulate projects, manage their credits and production. We helped them a little bit concerning trade channels, and also about production flows, and we co-operated with them in the search for markets for their product… (*José Pardo*).*

In comparing this work with that of ARADO, PROSEMPA technicians see important differences (some of them worked formerly in ASAR or ARADO):

> *ARADO, ASAR was different (…) ARADO handles certain capital that is distributed as credit (and then) necessarily has to ask for some interest in relation to this service, be it in seed or in inputs. It is another system, a more entrepreneurial system. PROSEMPA was more of a transfer, chaperone system (…) Because of this APROSEPA (Potato Seed Producers Association, a community-based producers' organisation generated by PROSEMPA) can now manage alone: they canalise their credits, organise commercialisation, seek their markets, define when to sow, on what area… In ARADO, instead, farmers only wait each year for inputs, in order to produce and sell the harvest to ARADO (…) Can you imagine if we had worked with the ARADO system? There would not have been any organised group, or association. If we have worked in a dynamic way the outcomes are there to see: APROSEPA Norte Ayopaya, APROSEPA Villazón, APROSEPA Tarija, Las Juanas in Potosí, and other groups in Morochata (engineer Pardo refers, with a visible pride, to those farmer organisations, which have emerged from their founding organisation: PROSEMPA, and endured longer than it)* (José Pardo*).*

Hence, PROSEMPA's main success was the autonomous management of potato seed producer organisations. Initially support for PROSEMPA was strong, through training and multiple institutional coordination. They even gave seed to farmers for free and, afterwards, seed producers started to work more independently:

At that point we stopped giving free seed since it was seen as a gift (…) Later on the farmers started to organise small seed producer enterprises and they started to buy the seed. The new phase of PROSEMPA starts here, only supporting the farmers in very specific matters (in production and trade) (…) The seed came from UPS, CORACA[134] Potosí, CORACA Cochabamba, ARADO. CORACA produced good seed that we disseminated, and in addition the farmers were already producing their own seed (…) When we had the seed producers we motivated them to use high quality seed; so far we have only recommended where they can buy such seed: from SEPA, ARADO, CORACA, PROINPA. Thus, there were already 30 small enterprises of seed producers… (Victor Hugo Román).

Giving attention to the last part of the quotation we see that PROSEMPA was a fundamental part of the regional potato cultivation system or rather *agricultural knowledge framework*, linking the other institutions to its extension and dissemination work. In this way we can speak of the emergence of a new system or network with objectives and tasks more or less defined:

> *…if you want, it was like a system where SEPA provided the seed, PROINPA investigated the problems and PROSEMPA disseminated PROINPA findings and SEPA seed (…) PROINPA, PROSEMPA and SEPA, in some way, were conceived of as fellow projects. (*Rolando Oros*).*

In this section, I have preferred to speak of an 'agricultural knowledge framework', which entails a "network" idea since here we have a number of institutions and their own networks generating a new –broader, but still localised– network at the regional level (see Figure 2). It would be plausible of course to speak of particular systems that come together to form a broader system within which they become sub-systems and so on. But the idea of networking seems to entail other notions more related to actors' attributes such as human agency, organising processes, knowledge processes, or power configurations, which do not belong –at least not necessarily– to the systemic repertoires[135]. The system perspective sounds a little more impersonal (networks are –almost in reverse– *inter*personal), systems does not imply necessarily actors who are knowledgeable and clumsy, capable and bunglers, smart and goofy at the same time. Further, the concept of *agricultural knowledge framework* addresses specifically the issue of managing the relationship of science and technology aimed at agricultural development (increase of productivity and improvement of natural resources use).

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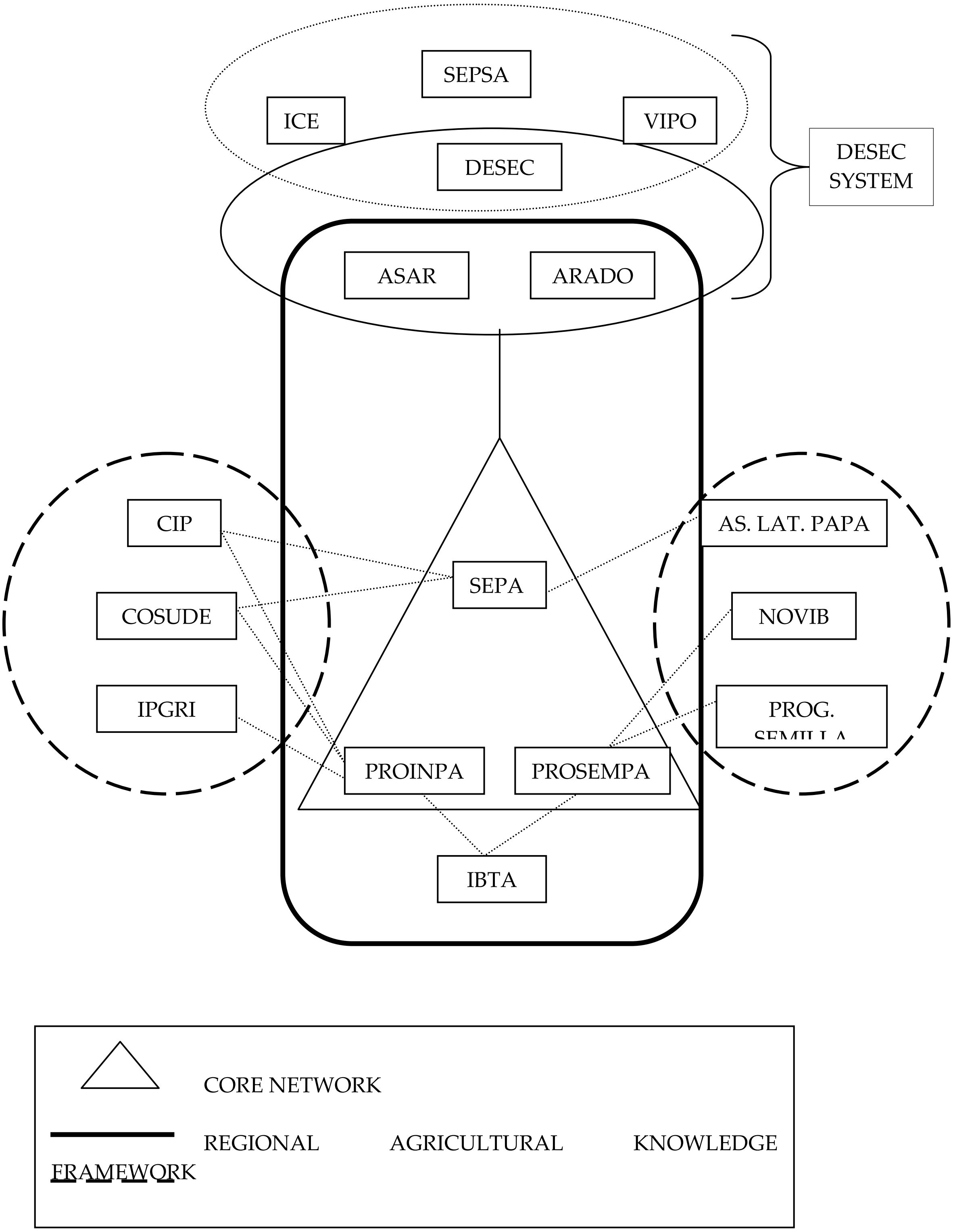
134 Corporación Agropecuaria Campesina (Farmer Agricultural Corporation, a farmer-based development organisation).

135 According to Long, networks "… are made up of sets of direct and indirect relationships and exchanges (interpersonal, inter-organisational and socio-technical). They usually transcend institutional domains and link together a variety or arenas. Networks are characterised by flows, content, span, density and multiplicity" (Long, 2001)

FIGURE 2

THE REGIONAL AGRICULTURAL KNOWLEDGE FRAMEWORK



The figure displays at its centre the core of the framework, a triangle composed of PROINPA, PROSEMPA and SEPA. This triangle can be seen as the field articulating the principal institutions (and components) of the network, which are meant "to manage the relationship between science and technology" –namely the relation between the scientific research of PROINPA, the technical application of SEPA, and the dissemination/transfer task of PROSEMPA, which, in the end, was supposed "to achieve an increase in productivity (and) improve the use of natural resources". The thick line encompasses the so-called Agricultural Knowledge Framework, including (below) the government IBTA and (above) ASAR-ARADO of the DESEC system. To the left and to the right, in broken lines, the "outer" networks are displayed –those developed by the core institutions.

Theoretically this network was well conceived and at the start it worked quite well but some incoherence and signs of entropy soon appeared in terms of system; and signals of competition and rivalry between actors, in terms of networks:

> *In some cases there was an effort at duplication when, for instance, PROINPA offered four varieties and we (PROSEMPA) took the four varieties and started to validate them in the zones we were working in. But, PROINPA simultaneously carried out its own testing adjacent to us or nearby. Perhaps the role played by PROINPA was not well defined or there was a misunderstanding regarding it. PROINPA's role was technology generation and PROSEMPA's was to transfer that technology. Nonetheless I believe PROINPA started, in some way, to distort the role it was meant to play, so we (over that matter) collided with them somewhat.* (José Pardo*).*

However, to PROINPA staff it was entirely natural to leave their laboratories and to amble a little through the farmers' fields. It was even necessary to its survival as an organisation:

> *PROINPA carried out the integrated controls. This was the technology. SEPA was devoted to produce seed of certified quality. PROSEMPA was (the organisation) that worked more with farmers and with small enterprises of seed producers who multiplied SEPA seed (…) PROSEMPA was a kind of branch in the communities. PROINPA was conducting laboratory research, and SEPA was in its laboratory and in the field producing seed. But this has changed since we cannot wait in our laboratories for someone to talk to the farmers in order later to give us feedback. (*Rolando Oros*).*

Thus, PROINPA did not want to remain confined in its laboratories; its executives sought a broader role for it. They thought PROINPA needed to widen its activities in order to ensure its future. They were afraid, in some way, of the destiny of the knowledge network (they could not trust simply in the network), and they were right as we will see. Also they were already working with "participatory extension methods" introduced by the Colombian CIAT (Tropical Agriculture Research Centre) and they needed, consequently, someone to participate with: they needed farmers and their plots. But from the knowledge network viewpoint, PROINPA was invading its fellows' technical territory and was putting its individual interests before those of the network as a whole:

> *PROINPA, was a research institution that but wanted to get into extension, it collided with PROSEMPA (…) I knew PROINPA was getting some funding to do extension, a thing it should not have been doing since it was strictly a research organisation (*Edwin Quintana*).*

Likewise SEPA, disappointed, saw how PROINPA was producing new potato seeds and introducing them in farmers' fields, thus creating a sort of rivalry between the two organisations. Nonetheless, and this we have to take into account, PROINPA's integrated control methods were not limited to chemical or biological measures but included the production of varieties resistant to plagues and diseases. In this case PROINPA was following a set of methods to beat the desease *tizón tardío*: "Well, specifically as result of the integrated pest control, PROINPA obtained six new varieties resistant to *tizón* (resistant but not always accepted by the market, see chapter six)" (Rolando Oros). Furthermore, according Engineer Oros, PROINPA's mission had always encompassed seed production. He explained:

> *PROINPA has always had a wing devoted to seed production but has always sought co-ordination with SEPA. SEPA was in charge of multiplying and selling commercial varieties; we have undertaken studies of the native varieties. We used laboratory and seed production to evaluate biodiversity (…) There was a special project dedicated solely to the recovery of native seed. This project was not shared with SEPA (…) We produce hybrids, basic seed, actually all seeds, because, as you know, PROINPA is responsible for the germ plasma bank of Bolivia (*Rolando Oros*).*

On the other hand, PROINPA, disenchanted and almost offended, saw how the house of SEPA was not applying its integrated pest control methods but, on the contrary, insisted on using its more expensive chemical methods:

> *SEPA technicians also had a disease control strategy. They did not always accept PROINPA developments as valid proposals. There was resistance on the part of SEPA technicians (…) each organisation testing their own technologies instead of coordinating to make something efficient together (*Rolando Oros*).*

This situation provoked jealousy between the organisations: "… if there are two persons doing the same there is always jealousy. SEPA had its own integrated control and we had another". In terms of salubrious scientific competition, PROINPA tried to demonstrate to SEPA the suitability (or superiority) of its methods:

> *PROINPA's proposal for tizón, consists in alternatively using a systemic product and another "of contact". Instead, SEPA's strategy consists of applying the systemic product in a preventive manner until the disease shows. There are conceptual differences (…) We believe that our method may be very useful to SEPA in order to optimise its costs, and we have both carried out comparative tests … but they have never accepted the results as valid and they persist with their strategy (*Rolando Oros*).*

In the end, what happened was that while PROINPA started to undertake extension, competing in some way with PROSEMPA, it also started to produce seed, affecting SEPA's interests. SEPA, reciprocally, did not apply the methods developed by PROINPA. PROSEMPA (the branch in the field), on the other hand, that was meant to disseminate the technology of PROINPA and feed it back "every day", did not do so[136]. Thus the co-ordination inside the network became poor: "The co-ordination level was very low" (Jaime Rocabado).

Even though there was an inter-institutional board meant to promote co-ordination, to exchange information, and to allow joint decision-making, in a word to create synergy, the board as such was weak, amorphous, encompassing heterogeneous and centrifugal interests:

> *There was a board with two representatives from PROINPA, one national and the other international; two from PROSEMPA, likewise, one national and one international; two from SEPA likewise; one from COSUDE; one from the Dutch co-operation; and one from the government seed office. To me, more than a board, this was a council since there was no director or board. Everybody made suggestions and voted for the proposals launched during the meetings at which projects were evaluated. This board was organised by PRODEPA, the national potato programme (*Rolando Oros*).*

Actors' interests and disagreements and individual institutional strategies showed the flaws of such a board, and it is not surprising that it was a fleeting experience.

> *Actually institutional jealousy was not the reason for the lack of co-ordination but the existence of disagreements. For instance, there were always difficulties when they had to vote for the person for some project board, since there was no person on the board who had the last word. As I tell you, it was more of an advisory council (*Rolando Oros*).*

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[136] "They were working closely with farmers, supposedly we had to keep in touch every day; however it was not the case..." (Rolando Oros).

However all these signals of dissolution did not suffice to put an end to the network although they pointed to its break up. An unexpected episode would lead to the abrupt collapse of this complex knowledge/technical network.

3.3.4 The Fall of the House of PROSEMPA

> *While I gazed, this entire orb of the satellite burst at once upon my sight –my brain reeled as I saw the mighty walls rushing asunder- there was a long tumultuous shouting sound like the voice of a thousand waters –and the deep and dank tarn at my feet closed sullenly and silently over the fragments of the 'House of Usher.' (*E. Allan Poe: The Fall of the House of Usher*)*

PROSEMPA was a powerful development 'house', successful among its peers, prestigious in the farmers' eyes, commanding huge funding, and present in several departments of Bolivia (Cochabamba, Potosí, Tarija, Chuquisaca, Oruro, La Paz and Santa Cruz). But, like the House of Usher, one day it disappeared.

There are many versions of the fall of the house of PROSEMPA. To engineer Germán Lazarte (from CEDEAGRO) it was a matter of the domino effect. Once IBTA disappeared, it pulled PROSEMPA down with it: "I think it was due to IBTA's disappearance that PROSEMPA was not able to continue…"

To engineer Oros of PROINPA, the cause was the aloof attitudes of the Dutch:

> *"Look, as regards PROSEMPA, there has never been a complete analysis of what happened to them. But in the end I believe the Dutch management totally cut themselves off, they were not very self-critical. That's all I can tell you about PROSEMPA … although from my personal point of view its organisational structure was very vertical. There was the chief, the project managers, the technicians… There was an abysmal distance between them. The opinion of the technicians who worked very well in the field co-ordinating with those from PROINPA and SEPA, was not taken into consideration over there at the top".*

Perhaps it is more important to hear PROSEMPA staff's own opinion since they lived through the dissolution process. To some of them, like engineer Oros, the Dutch were the ones to blame: "The Dutch government attacked in this way; they ordered them (PROSEMPA technicians) to either you carry out their objectives or there was no more financing. They forced them, in those years, to achieve their objectives" (Edwin Quintana). The only comment I would make here is that if you have to be forced to achieve your own goals there is something wrong.

To others, the guilty party was the national government:

> *Well, government policies were the cause since at that time PROSEMPA appropriately implemented the project, which originally had three phases. But it stopped at phase two, due to lack of government funding. As a consequence, the Dutch government said: "If the Bolivian government does not co-operate with the agricultural extension process we will terminate our financing"* (Jaime Rocabado*).*

To grasp how national policies (which, at the outset of the chapter, we saw are not so national but imposed by multilateral agencies) led to PROSEMPA's downfall, we can refer to engineer Pardo's version:

> *I worked in PROSEMPA almost up to the end and from what I understand is there was a change in (Bolivian) government policies. That is, with PROSEMPA there was a vision geared to rural development, production and so on. But the government shifted course after the elections and the (new) government put the 'inter-oceanic corridor' in capital letters (here Mr. Pardo means that the priority for the new government was exports). Well then, when I was working in this institution, I knew that the Netherlands Embassy had outlined the fundamental conditions for its support, be it as international agreement or "a fondo perdido".*
>
> *Thus, when you as a country change your policy and state 'my priority is roads', while the Dutch government priorities are not roads but agricultural extension, and rural development, then what the Dutch government does is to put its hands up and to say: I do not have money for roads, only for rural development. And the Bolivian government says: I do not need money for rural development, I need money for roads. Then, at that point, the Dutch–Bolivia relation breaks down and PROSEMPA disappears for lack of finance* (José Pardo*).*

Another version reads as simply a case of funds being cut off: "The reasons for PROSEMPA's disappearance were that the Dutch government cut off finance and the national government was not able to take it on and support PROSEMPA's fabric" (Cerbando Lazarte). It is difficult to imagine a "natural death" for PROSEMPA, moreover, especially if we take into account that it left without starting its final last phase. The closure speeded up and reinforced the idea of disagreements between the Bolivian and Dutch governments. Victor Hugo Román tells us:

> *We had a last evaluation, later PROSEMPA abandoned its last stage, which was that of consolidation. In that evaluation they recommended three more years for us with the aim of consolidating all activities. At that moment a research and extension project was being outlined by World Bank officials. It was a huge project at national level that required IMF and European Community participation. There were already funds for such a project. The World Bank paid for the consultants' work and the product was a project that was presented to President Banzer and Minister Conde. That great effort,*

unfolded by the involved institutions to create an organisation of research and technology transfer –which was millionaire and big– was not understood in its true dimensions by the government. People in government told the financing agencies that agriculture was not a priority. Their priorities were roads, irrigation schemes, hospitals, etc… So much effort and money simply to end up with the World Bank saying: "if you do not want it we withdraw our support". And thus the project was moved to Peru. Today they are implementing in Peru this research and extension-transfer project. The money assured by the Netherlands and the European Community went there, and PROSEMPA had no choice but to stop working since the national government did not accepted the promised funding

We have pointed to some of the internal problems in PROSEMPA's structure; engineer Oros asserted that it was somewhat authoritarian, and lacking in communication channels between the board and field-level technicians. Engineer Quintana recalls vividly such problems, blaming PROSEMPA itself for its final demise.

We blame absolutely PROSEMPA's incapacity. We were unable to understand why there was so much incomprehension (…) the bosses were there, earning their wages, thanks to us working in our zones, and if there had not been farmers over there, we would not have had a job either. It was like a chain, but a chain blocked at the upper end. There were a lot of problems. Our co-ordinators, for instance, our regional supervisors, had a lot of arguments with the national directors to the point that our Peruvian co-ordinator, Ricardo, gave up and resigned. He said: no, we cannot work because you are completely recalcitrant. You do not permit work based on our knowledge, you want to impose things on us that are not sound, that are not feasible in the countryside. There were personnel at PROSEMPA headquarters who, without holding a degree, worked as it they were graduates, because they were godfathers, godchildren –who knows what– since they got drunk at home (with the bosses) at weekends.

*They would come with some idea and tell us 'we will do it this way', without testing the idea in the field or, at least, going to the field to prove if such an idea was practical or not. At least they could have asked us and say: look this is the idea, is it sound or do we have to improve it? They launched an idea directly, imposing it on us: 'you execute it, otherwise go away'. So the people became tired and started to resign. At that time seven of us resigned, and at the national level ten or eleven resigned, I guess. We wanted to denounce all this to the Netherlands but we left it like that. I do not understand why there was such a division between central and regional PROSEMPA, although they said we were a team, Central PROSEMPA here, in the city, and regional PROSEMPA at kilometre 5.5 (outside the city). To us this was enough: we were the hated and over there (in the city) they were the beloved. They had coffee and cake in the afternoon and to us they gave nothing, not even water (*Edwin Quintana).

Edwin Quintana's harsh complaints incline me to think that there were serious conflicts and disagreements within the house of PROSEMPA, and even discrimination and venal behaviour[137]. But, as usual in the break up of development organisations, it is a combination of internal and external factors that lead to disaster or fiasco as in the case of PROSEMPA. On the one hand, we have the inflexibility of the Dutch combined with a policy shift (an old fickleness) of the Bolivian neo-liberal government. On the other, the internal struggle and rigid hierarchy became intolerable for the technicians and field-workers.

One might wonder what the role of farmers was in this process of institutional destruction. Well, farmers were on the land, and the battlefield and "arena of contention" was in PROSEMPA headquarters, and the lobbies of the national government, international agencies and the Dutch Embassy. Maybe farmers knew something about the institutional struggles, maybe not; the people interviewed said nothing about their own possible participation. It seems they remained distant to or even ignorant of the conflict, which was not "their battle". On the other hand, for the other development organisations of this knowledge framework, such as PROINPA, the eventual disappearance of PROSEMPA posed problems, but it also meant new opportunities, for becoming, for example, a "foundation":

> *Well, PROSEMPA had disappeared in 1997-98, and afterwards that branch, if you like, was gone. SEPA acted more as a separate firm. So, although in theory the thing was well composed and we were supposed to run together as a squad (the knowledge framework), there were problems of articulation. At the time, in 1998, IBTA disappeared too (…) and PROINPA as a reaction to this did not want to disappear with it. It had accumulated enough merit to remain and not disappear like PROSEMPA, and it became foundation…*
>
> *(Today) there is openness towards the farmers, and towards the market and this is the foundation's new approach, one of a chain. When I speak of a chain I am talking of one from producer to consumer, including the market and produce transformers. We take into account all actors of the chain (*Rolando Oros*).*

PROINPA did not wish to disappear like IBTA or PROSEMPA. But, we could argue, that it was constantly looking beyond the framework, and that its "new approach" meant an early undertaking of extension activities (the source of PROSEMPA's complaints) and the production of new varieties (which provoked SEPA's distrust). In the end PROINPA appeared to know that the regional knowledge network was ephemeral, or it simply preferred to ensure its own future as an organisation without taking much care of the framework's future.

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[137] For some people there were many complaints about the bad administration of the funding ("by the superior chiefs").

What is striking and even paradoxical is that PROSEMPA, despite the conflicts and disputes that tore it apart internally, performed a remarkable service that still endures. Its institutional weakness was largely compensated by its lasting and relevant work with farmers. Edwin Quintana, one of the more acid critics of the institutional apparatus, is one of the first to acknowledge the importance of PROSEMPA's legacy (and not at the level of national or international lobbies but at the field level, where farmers strive to maintain and develop what was pertinent to them, above all technologically and economically, from PROSEMPA's "lessons"):

> *Whenever the results are good, that technology that has been introduced, is replicated for years and years. I went to my zone last year and what I had done with farmers still exists; I mean, they were able to value the technology they were provided with (…) A contribution was made and that I can testify, since I have already been working privately for two years and I am still dealing with potatoes. That is, I go to the zones where PROSEMPA has worked and I observe that farmers' groups still exist dedicated to potato seed production. There are other groups which have banded together and organised associations. A clear example is APROSEPA from Quillacollo. I bought seed from them in January - 86 quintales (approx. 3.956 kg.) and the same in the zone of Vacas, where there is a very productive variety. So there, groups remain that produce seed, and they do not sell it for consumption but specifically as seed. In Tiraque good producers also remain (*Edwin Quintana*).*

Concluding remarks

In this third chapter, a panoramic view was presented of the organisations dedicated to technological innovation in agriculture, followed by a more in depth analysis of the institutional framework addressed to potato cropping improvement at a regional level in Cochabamba. The organisations working in the field of technical change can be viewed as true "development machines" (in the sense mentioned in Chapter 2). Such machines or "developmental configurations", which take the shape of a mixed set of government and/or non-government organisations, evolve in a triangular pattern based upon three axes: their technological discourse, their political orientation (notably their specific models of development and notions of the "ideal" farmer), and their institutional structure linked to finance, research and educational centres (besides those grass-roots organisations with which they work). These three principal axes either become more closely integrated or they tend repel or oppose each other through the way in which the different technology organisations geared to innovation and diffusion interlock.

Regarding the second development presented in this chapter, namely the history and dynamics of the set of (potato) institutions examined -omitting the particularities of the process of their constitution and evolution -we find the first real knowledge and information system on potato set up in the province of Tiraque (on the basis of the DESEC compound). This finding suggests that at a micro-regional level it is possible to identify such types of systems, within a fairly homogeneous and restricted institutional frame, even though often ephemeral. Thus the segmented and unfinished networks documented by Box (1989) in his studies on cassava in the Dominican Republic are not the only way of articulating or linking farmers, extension officials and researchers.

We have seen how fast this system disappeared and how –almost parallel with its breaking up– a new "age" of competition, rivalry and institutional struggle emerged between the pioneer development organisation (the first development machine in Tiraque, the creator of the first knowledge system) and the new epigone organisations, which arose from disputes over territory and which eroded its political and developmental discourse. In this period, which I have called of the "warring states", I preferred to use the metaphorical denomination of development 'houses' in place of 'machines' to highlight the territorial dimensions of the conflicts that took place in the region, and which were similar in some way to those that occurred in ancient China or feudal Japan for territorial domination and political power.

Concerning the second regional experience of grouping and co-ordinating organisations around potato cropping, I preferred to abandon the concept of "knowledge system", switching to the notion of "agricultural knowledge framework", which I think implies more social and political content than the idea of system (which seems more neutral and presupposes some kind of logical process). The idea of 'framework' seems more useful in relation to the configuration processes of power, organisation and knowledge. Although this might be disputed, the experience described is relevant, since it portrays a major attempt at organising (framing) the articulation, co-ordination and exchange or co-operation between institutions devoted to technical matters in potato production. The practical attempt failed almost from the outset. In fact, in this case, we are no longer dealing with a homogeneous system with a single power centre but with a broader structure consisting of several centres of power, with different sources of finance, different objectives and different technological approaches.

I have employed the term 'house' in reference to the distinctive types of development organisations and their interests. A comparison with the dynastic struggles between Chinese and Japanese war lords reflects very well, in my opinion, the political, territorial, economic and social dimensions of the fierce confrontation that took place in the highlands of Tiraque Province between distinct 'houses' of development, which sought not only to facilitate technological change or steer farmers along specific development paths, but also to establish their supremacy and control in the region, a region that, as I have shown, became important for agricultural production and for shifts in polity at regional and national levels.

As we have observed, political and ideological confrontations arise in part due to different development visions, and to orientations incompatible in terms of technology use (what technology, what kind of agriculture), but also due to the different political positions (of left, centre or right) assumed explicitly by those organisations (ranging from those declaring themselves a-political but with strong ties to the Catholic church, to those openly embracing Marxist ideology). The confrontation is also economic, since although groups may not compete for the same funding sources, the greater or lesser geographical extension of their projects will influence their economic scale of action (and their material and non material revenues). All this leads directly to the territorial dimension. Each organisation, driven by its politico-institutional (and ideological) objectives, will ensure some territory for its dominion, more often than not with important infrastructure at the core of its power and management. And each is going to attempt, from there, to enlarge the frontiers of its realm.

This power game it is not only an affair of the 'lords' who attempt the conquest of territories. The training of farmer para-technicians, the creation of new local leaders (whose careers will be, in some cases, catapulted to the level of Parliament); and the resource facilitation (inputs and so on) for particular households, farmer groups or communities (in addition to the establishment of symbolic familial bonds between the 'lords' and some farmer families) mean the emergence –perhaps ephemeral– of new political leaders and local elites. Many of these will later be co-opted by right-wing parties without having had to make the effort – already made by progressive organisations - to train them). Very often left-wing parties are a sort of school for future political sharks.

Over and above these relationships and the procurement for farmers of some advantages and inputs, the proximity of farmers and technicians at plot level, generates important knowledge, reshaping modalities and the acquisition of new knowledge and skills, not in terms of political or vertical relationships but as knowledge through as dialogue (see Chapter six).

FOUR: A portrait of the peasant communities of Qoari and Boquerón: The dynamics of technological innovation

This chapter opens with an account of the main geographical, historic and socio-economic features of Tiraque province and the two communities selected for detailed study. This is followed by a statistical analysis of the process of technical innovation based on survey data collected in these communities.

The first part seeks to provide general insight on the area of study, drawing on secondary data drawn from the last two national censuses and from various 'poverty maps' and other forms of documentation prepared by NGOs working in the region. These sources of information enable us to build a panoramic vision of the socio-economic characteristics of the province and of the chosen communities within it. Further detailed data of a physiographic, demographic and economic kind are available in annexes 1b and 1c.

Though undoubtedly a case could be made for choosing other locations in Tirague province for conducting ethnographic fieldwork, the communities of Qoari and Boquerón were selected because they presented a number of interesting traits, which are described in detail in the second half of this chapter. As documented in Chapter 3, the province of Tiraque has long been a target for numerous government and non-government organizations concerned with technological innovation. One location significantly affected by this enduring pattern of intervention has been the community of Qoari, which has become a privileged place for planned intervention. Over the years it has become one of the most important territories for "colonisation" by various "development machines" aimed at introducing new technological discourse and practice into newly 'discovered' and conquered rural spaces. In contrast, the other community of Boquerón, situated nearby Qoari, has shown a history of persistent reluctance to development intervention by outside organizations. It has remained closed for most of the time to the introduction of projects in its domain, showing an attitude of resistance or rejection. Exaggerating a little, one might argue that the "development machines" did not succeed in breaking through the hermetic walls of Boquerón, which thus remains unharmed by the "project-iles" utilised against them. Nevertheless, one cannot deny the fact that Boquerón has undergone technical innovation, though pursuing a strikingly different path from that of Qoari. The proximity of both communities to the enormous potato market of "El Puente" – though no longer the most important market-place for either community – and their direct connexion to the main inter-departmental highway have been crucial for their early entry into the process of innovation. These contrasts and similarities make them highly suitable for the present research.

In the second part of the chapter I provide an analysis of survey data collected in the two communities using the method of multivariate correlation, or what is known as "a factorial analysis of correspondences (or associations)". With this method I aim to identify changes brought by intervention in respect to potato varieties and related agricultural practices. In so doing, I draw upon a statistical classification of production units (households), working with the assumption that change is never homogenous for any set of individuals, households, or economic units. The analysis concludes by outlining, on the basis of this classification, a typology of technical change for the research communities.

Finally, in the last section of the chapter, I offer a general picture of the innovations that have taken place in the area - a description that permits, and at the same complements, the more in-depth socio-cultural analysis of the next two substantive chapters.

4.1 Some geographical aspects

Tiraque province of the department of Cochabamba lies 60 km to the south of the departmental capital, at altitudes which vary from 600 to 2.400 metres above sea level. Geographically, it is part of the region of influence of Punata and Arani in the Upper Valley of Cochabamba.

The frontiers of Tiraque, to the north and west, are Chapare province, Arani province to the south, and Carrasco province to the east (see map 1 in Annex 1a). Ecologically, the area varies greatly, since it includes extensive tropical zones, highland plains and narrow valleys. The total area of the province is 167.000 Ha or 1.675 square kilometres.

It is divided into two clearly differentiated regions, a tropical zone which covers about 75% of the province, and another of Andean valleys which covers the remaining 25%. This last zone includes the majority of the peasant communities that form part of the Tiraque micro-region. The Andean valley part of Tiraque province is located in the subtropics, between parallels 17,20 and 17,33 south latitude and 65,24 and 65,42 west longitude. Its topography consists mainly of steep hillsides and four alluvial plains, of which the largest is that of Tiraque, followed by the smaller ones of Sacambilla, Tuturuyu and Toralapa. The Andean zone of Tiraque includes valley headlands and high plateau, which are located in the south of the province, with a total area of 68.814 Ha (688 km2) (CIPCA 1995:7).

Tiraque province has different types of relief, ranging from the alluvial valley or fan to cultivable mountainsides. Their ecological characteristics are varied, according to the altitude, which fluctuates from 2.900 to 4.200 metres above sea level, an altitude range within which 69 communities have established themselves. Within this range, there exists a division into four levels or zones, each with its own particular characteristics of relief, climate, vegetation and cultivars (see Map 2 in Annex 1b). It is worth making clear that it is common for peasant households to possess land in one or more of these zones within the same community and to farm at different ecological levels. Land tenure is held on a family basis with an average landholding per household of 3,2 Ha, of which only 2,3 Ha are cultivable. These zones are made up of the following:

ZONE	ALTITUDE
1. Valley	2.900-3.100 masl
2. Valley head	3.100-3.350 masl
3. Transition	3.350-3.650 masl
4. Puna	3.650-4.200 masl

The communities studied are located in the Andean valley region. Their topography is composed of rather steep mountainsides, alluvial plains with valley heads, and a high plateau. In 1995, the population of the region was 21.908 inhabitants.

The community of Qoari, which is also the Subcentre Qoari,[138] lies 18 km to the south of the provincial capital, the town of Tiraque. Geographically, it lies between the coordinates 17,26 south latitude and 65,40 west longitude from the Greenwich meridian, at an altitude which varies between 3.450m (in the lower parts of the basin) to 4,200m (the peak of Machu Koari). The community of Qoari has an area provided with irrigation from various sources (the Yanakhocha lake and springs) which irrigate about 400 Ha in

[138] 'Subcentre' (*subcentral*) is the second level of Bolivian peasant organisation. Beneath it are the 'basic syndicates' (*sindicatos de base*), i.e. the peasant union of a single local community. See Chart 6 in this chapter for details on the various levels of this organisation.

three zones. To the north, Qoari borders with Sankayani and Yanakhocha Alto-Bajo, to the east with Yanakhocha Alto-Bajo and Chullco Mayo, to the south with Cruz Pampa and Khasa, and to the east with Khasa and Khañacota (see Map 3 in Annex 1b).

The climate is rather cold, with an annual average of 7 C; and annual rainfall is 700mm. It presents an irregular topography with slopes from 5 to more than 45%. 42% of its soils have been classified as Class II and III (according to their use capacity) with the identification of a good content of organic material (CIDETI 1991, CIPCA 1995). This community is divided into three parts: Qoari Alto, Medio and Bajo. It has easy access to nearby old highroad to Santa Cruz, which allows community members to travel directly to the markets or to the city of Cochabamba. Qoari also possesses electric light and drinking water services and local access roads, as well as a primary school and a health post staffed by a paramedic.

The community of Boquerón, also known as Subcentre Boquerón K'asa, neighbouring Qoari, is 15 km from the town of Tiarque. It lies between 3.300 and 3.600 metres above sea level. To the east it borders on the community of Qoari, to the west with that of Kañacota, while to the north and south it does not possess well defined boundaries (see Map 3 in Annex 1b). The community of Boquerón is divided into three: Boquerón Qoari (the central region), Boquerón Alto (to the north) and Boquerón Q'asa (to the south). It has an average annual temperature of 11.C and annual rainfall of 512mm. Its topography is undulating with gentle slopes, and the soils are moderately deep with a low content of organic material, and 70% of the cultivable land belongs to Class III (classification of soils according to their use capacity) (CIDETI 1991, CIPCA1995).

4.2 History of Tiraque

The first native inhabitants of Tiraque were the Chuis, who we can assume to have occupied the area before the Aymara-speaking peoples descended into the valleys which now form the department of Cochabamba and which were later annexed by the Inca empire (Aguiló 1992).

The town of Tiraque, founded in the sixteenth century by Don Antonio Diaz Villamil, was built on the slopes of the mountains of Juno, Guadalupe and San Miguel, between the Millu Mayo and Qochamit'a rivers. On the 4th of January 1872, Tiraque was established as the Third Section of Punata province, covering the cantons of Tiraque, Vacas and Vandiola. These lands were inhabited by free Indians and people of mixed ancestry (*mestizos*) who owned haciendas and coca plantations in the Yungas (hot valleys) of Vandiola.

The Municipality of Tiraque began to function in 1900, with a jurisdiction including Vacas and its surrounding communities – Rodeo V, Cañada Grande, Cañada Chica, Yanatama, Paredones and others – and the actual territory of Tiraque province.

At this time, the haciendas (landed estates) of Tiraque mainly cultivated potatoes, and on a smaller scale, barley, peas, broad beans, papa lisa, coca, maize and so forth. Although Tiraque was not yet known as an important coca producing zone, the townspeople and landlords were strongly linked, in a greater or lesser degree, to the production and marketing of coca. At that time there were about 7.500 inhabitants, including those living in the town and the labour tenants (*colonos*) of the haciendas. There were also 24 piquerías[139] that emerged when some haciendas were broken up, allowing many labour tenants to buy smallholdings. The land register of 1910 shows many properties in the north and western parts of Tiraque, while in the southeast the great estate owners continue to exist. The piquerías were pockets of smallholders who lived near the haciendas, although many piqueros (smallholders in a piquería) led a completely independent life. The piquerias spread all over the northeast part of Tiraque, and of the 69 communities which now exist in the Andean part of the province, 8 were piquerias and 20 were formed by the merger of former pegujaleros (former hacienda workers) and former piqueros.

On the 24th of February 1914, Arani province was created, with Tiraque as its second section, maintaining the same cantons as when it belonged to Punata. According to the townspeople of Tiraque, from the end of the nineteenth century up until the Agrarian Reform of 1953, the most common occupations among the townspeople were associated with the production and marketing of coca, the most profitable commodity at that time, which coincided with the second silver boom.

Each hacienda was a small, dynamic system that varied somewhat in production, depending on its ecological location. Apart from the landlord (*patrón*), there was an administrator, responsible for production and allocation of work tasks, and a *curaca* or foreman, who was a labour tenant chosen by

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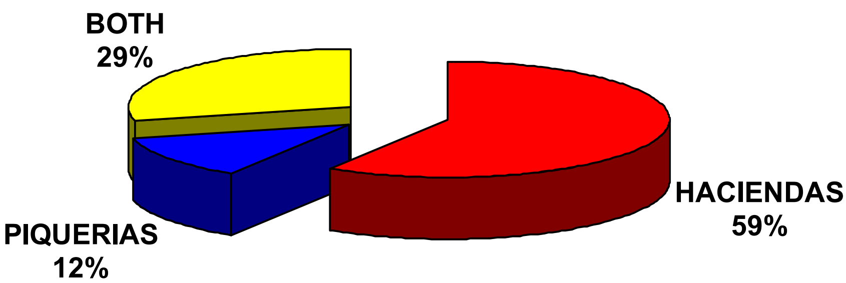
[139] The piquerías were family smallholdings occupied by free peasants. The name comes from 'pico': the picos were the pieces or fractions of land that were left over after the sale of land, in fact a legal confiscation of community lands by the 'unchaining' of 1874 dictated by the republican state. These picos were acquired by peasant smallholders.

the administrator whose job it was to organise the tenants and control their farm work and quotas for giving service at the the hacienda house. The obligations of the labour tenant or hacienda worker were to work without payment and using their own tools on the landlord's fields, for an agreed number of days per month or season, and, in return, to receive a small plot to cultivate to meet their subsistence necessities. In 1900, there were about 85 haciendas in Tiraque and a total of 303 people who owned land. After the Agrarian Reform, 41 communities were established and now they have increased to 69. The diagram below shows their origin (the designation 'both' refers to communities that are composed of ex-hacienda tenants and ex-piqueria members).

FIGURE 3
Origin of Tiraque communities



Source: Collective Sociology Workshop

For Tiraque to crystallise as a province, there was a long way to go from the first attempt in 1950. With the help of the MP Dr Juan José Carrasco, they first presented a bill to create the Province Ismael Vásquez in the territory of Tiraque A (referring to Tiraque of Arani, since Tiraque C, in Carrasco, also exists). The second attempt was in 1972, when Hugo Balderrama was Mayor, when it was proposed to create the province of Hugo Banzer Suárez (then de facto president in his second year of government). Finally, on the 15th of October 1986, Tiraque province was created with one single section and two cantons: Palqa in the highlands and Germán Busch in the tropical lowlands. Not all of the jurisdiction of the municipality passed into the hands of the new province, due to conflicts between the Corregidor of Vacas and the Subprefect of Arani versus the Mayor of Tiraque, which began in 1973 (concidentally the year when 'the massacre of the Upper Valley' was carried out by the forces of the governing regime).

At present, the town of Tiraque is the administrative and commercial centre of the zone. The entry road to the town, directly linked to the old highroad from Cochabamba to Santa Cruz, ends at the square, where the Town Hall, the church and the parish house stand. A few metres on from the square are the courthouse and the police station.

4.2.1 Some historical references to the communities studied

Before the Agrarian Reform, Qoari was a hacienda. After the Reform, three Subcentres were formed: one in Tiraque which belonged to Arani, another in Iluri and the third in Qoari. Over time, several local peasant unions belonging to the Qoari Subcentre split off and formed their own Subcentres, because the original Subcentre paid little attention to these unions and took a long time resolving the problems of affiliated unions, apart from the long distances that separated them. In this way, in 1988, the Payrumani Subcentre was created, and in 1990, the Iskay Wasi Subcentre was created. To a degree, all these divisions reduced the influence of Qoari. However, they were aimed at improving the functioning of the organisation, better access to various services and a better standing more generally. Around 1990, there were unoccupied lands in Qoari, which gave rise to extensive conflict over the determination of the borders between Qoari Alto, Medio and Bajo and Chullco Mayo, since all four unions wanted to work these lands. The conflict led to the formation of three other unions, Duraznillo, Qoari Alto Yana Qhocha and Qoari Medio Yana Qhocha, although the first disappeared after a year and its members joined the other unions (CIDETI 1991). The community of Boquerón, like that of Qoari, before the Agrarian Reform, was part of a large landed estate. Once the Reform had been implemented, the former hacienda became a community composed of several peasant unions, though not without having to face a series of divisions between community members who sought to defend their personal interests. The Boquerón K’asa Subcentre was formed in 1982. Boquerón K’asa is a community with four unions: Boquerón K’asa or Chapi Rancho, Boquerón Grande, Chaupi Suyo and Suraj Mayu or Dami Rancho. These unions tried to split up even further. For example, Boquerón K’asa was divided, but the leaders of the provincial Centre for the 1989-1990 administrative year rejected the split, and so, in the end, they had to join together again. This is the origin of the two existing names of the union: Boquerón K’asa and Chaupi Rancho.

4.3 Social organisation

From the middle of the 1930s onwards, peasants in Tiraque mobilised to obtain land. This eventually led to the Agrarian Reform, which, once completed, converted the landed estates (haciendas) into communities of peasants who had previously lived and worked there. And some of the largest haciendas were converted into more than one community. The same process took place among the smallholding communities (piquerias). Later, problems arose within the peasant unions (sindicatos) themselves, leading to internal divisions, and this is why today some communities comprise more than one union. In the end, the peasant organisations were gradually structured into a hierarchy of local unions, subcentres and centres:

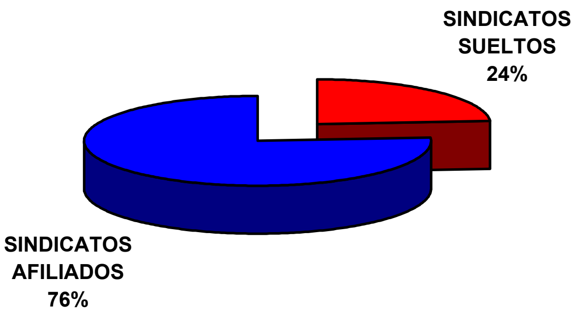
> *At present, peasant organisation in Tiraque is made up of 104 unions in 69 communities; 14 subcentres which group 79 unions (the other 25 are independent unions which do not belong to any subcentre); two regional centres, Iluri Grande and Qoari, which gather together 8 subcentres and 6 unions out of the 25 independents; a Provincial Centre, the Sole Union Centre of Peasant Workers of Tiraque (Central Sindical Unica de Trabajadores Campesinos de Tiraque, CSUTCT) to which are affiliated the two regional centres, the other 6 subcentres and the remaining 19 of the independent unions (*CIDETI 1991:44*).*

4.3.1 The peasant unions

The peasant unions were formed around the struggle for land, in opposition to the state (the first liberals of their day) and the landowners, who had benefited from the legal dispossession of the indigenous population. In the micro-region of Tiraque, some 24% of the unions are independents not belonging to subcentres. Of these, 18% are unions situated on the alluvial fan and in the highlands less distant from the main town and link directly with the Provincial Centre. The remaining 6% are in the Qoari zone and link directly with the Qoari Centre. In the case of the 19 independent unions directly linked to the Tiraque Centre, their affiliation with the Centre is due to several factors. One is the nearness of these independent unions to the town itself, though various political and personal factors also intervene, generating conflicts between specific union membership and their leaders, etc. These independent unions are: Sindicato Pueblo, Capilla Alta, Virvini, Ch'aqo Capilla, Plano Bajo, Pista, K'aspi Kancha Alta, Qolqe Qhoya, Qayarani Bajo, Base Central, Capilla Baja, Quince de Octubre, Plano Alto, Urmachea, Millu Mayu, Puja Wasi, K'aspi Kancha Baja and Sank'ayani Bajo. The diagram below depicts the division of the unions according to their affiliations.

As regards their coverage, the unions include the whole community, with the exception of the elderly who are no longer able to go to the meetings, pay their union dues or take part in communal labour. On the other hand, young couples who have just set up home together may affiliate, as long as they have some land of their own. As we mentioned earlier, in almost all unions there are members who belong to more than one union. The reason for this double affiliation is that often individuals have land in more than one community.

FIGURE 4
Tiraque: percentage of unions according to their affiliation[140]



Source: Collective Sociology Workshop

The most usual posts in the majority of the unions in Tiraque are the following: General Secretary, Secretary of Relations, Clerk (Secretario de Actas), Treasurer, Secretary for Conflicts or Justice, Secretary of Organisation, Secretary of Education, Militia Secretary, Transport Secretary (Secretario de Viabilidad), Secretary for Women's Affairs (Vinculación Femenina), Agriculture Secretary, Sports Secretary, Press and Propaganda Secretary, and Spokesmen.

4.3.2 The subcentres

The level immediately above to the local unions is the subcentre, which forms the intermediate level of union organisation. A few years after the Agrarian Reform, in what was then Canton Tiraque A, there were three subcentres: Iluri, Tiraque and Qoari. In the 1980s the creation of subcentres speeded up, but no longer as a simple parallel to the formation of regional centres, but rather as a response to specific interests and needs. At present, within the microregion there are the following 14 subcentres: Boquerón K'asa, Qotani Bajo, Ch'apisirca, Rodeo, Iluri, Sánchez Rancho, Iskay Wasi, T'oco Rancho,

[140] *Sindicatos sueltos* or "free syndicates" are those which do not belong to any centre or subcentre. To the contrary, *sindicatos afiliados* or "member syndicates" are those which join some centre or subcentre.

Payrumani, Toralapa, Qaña Qota, Walylla P'ujru, Qotani Alto and Dos de Agosto.

4.3.3 The centres

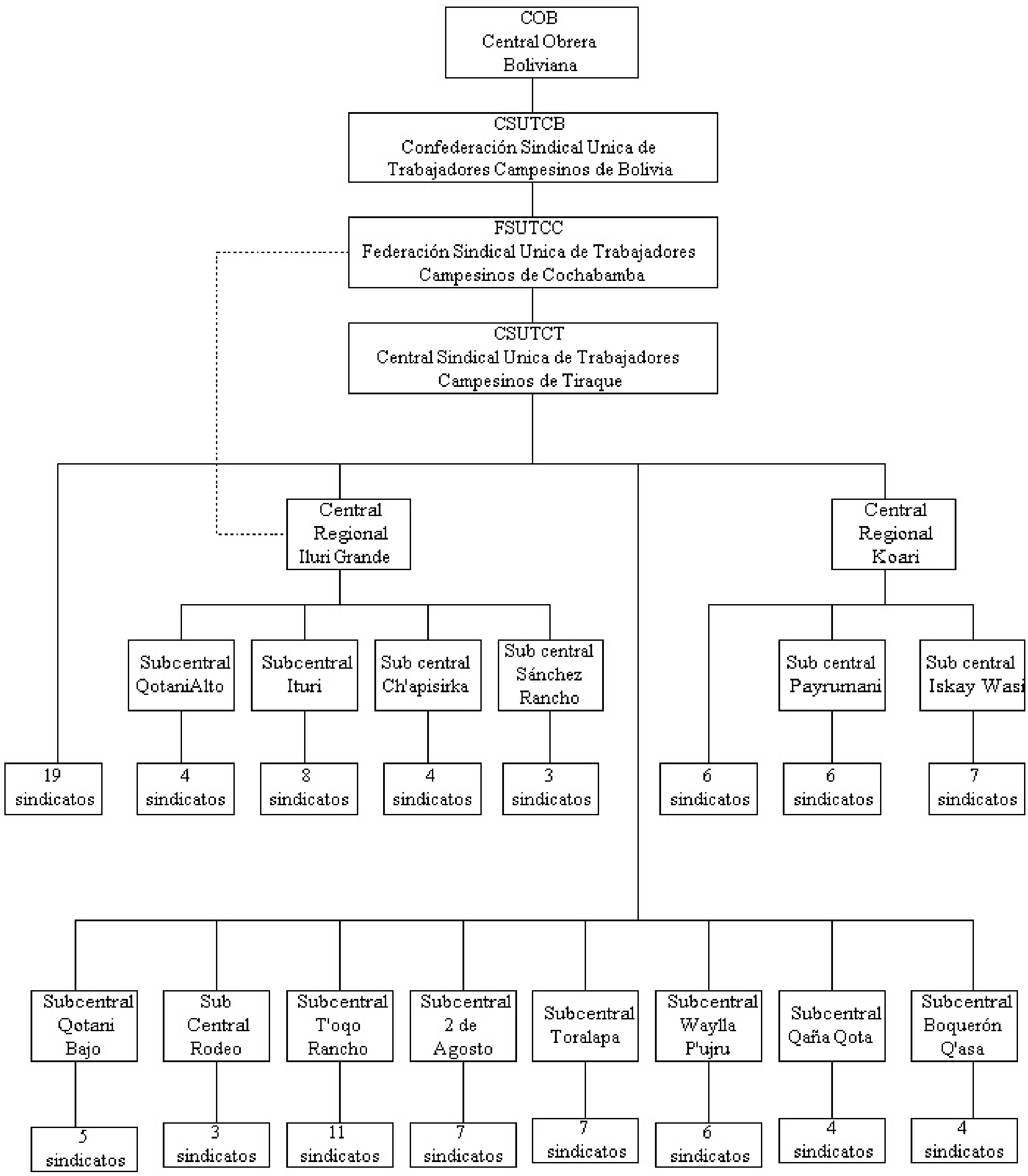
The regional centres

The two regional centres of Iluri Grande and Qoari are situated in the two extreme parts of the province. They were established in the 1980s and given recognition by the Federated Union of Peasant Workers of Cochabamba (Federación Sindical de Trabajadores Campesinos de Cochabamba, FSTCC). According to the statutes of the Provincial Centre, regional centres can only be formed into cantons (a canton is the lowest administrative unit within a province), with a minimum of 5 local unions affiliated to them, but neither of the two actual complies with these requirements. In practice, the regional centre of Qoari is purely nominal and functions as a subcentre; in contrast, the regional centre of Iluri Grande has played an important role ever since its foundation. The centres resolve problems on the part of the subcentres, especially problems over land and boundaries, and conflicts between local unions, etc. The posts in the management committee are similar to those of the local unions.

The Provincial Centre (CSUTCT)

When the new province of Tiraque was created in October 1986, the then Special Centre of Tiraque, which was dependent on the peasant organisation of Arani province, became the Provincial Centre, acquiring autonomy and the position of the most senior peasant organisation in the Andean sector of the new province. Since its foundation, the peasant centre has functioned regularly, resolving problems on the part of lower levels of organisation and visiting the communities to preside over the reconstitution of their management committees, in order to solve problems over land and any other conflicts which require its attention. Its committee members or delegates represent their memberships at general meetings (ampliados) and congresses called by the Departmental or National Confederation. The similar kinds of posts exist in the centre as do in the local unions, except that the centre also has a Secretary for Human Rights. The following diagram shows the union structure in the province in relation to the departmental and national structure.

FIGURE 5
Structure of peasant union organisation



Source: Herbas 1993.

4.3.4 The unions of Qoari and Boquerón

At the time of fieldwork, the unions of Qoari and Boquerón had the following number of affiliated households:

- Qoari community:

1.Qoari Alto	140
2. Qoari Medio	64
3. Qoari Bajo	45
Total:	249

- Boquerón community:

1. Boquerón Alto	88
2. Boquerón K'asa	67
Total:	155

Here it is necessary to clarify that these data correspond to the unions included in the present investigation and not all those unions that form part of the two communities, whether as independent unions or as an integral part of a subcentre. This social organisation constitutes the backbone of peasant action and the types of local response to technological innovation and institutions such as the market, whose outcome generates differences between the two communities under study. In the next section, I explain (with the help of typologies) the differences and similarities that pertain between farmers and their communities.

4.4 The dynamics of technological innovation in Qoari and Boquerón

This section elaborates on data deriving from the survey "*Agricultura y cambio tecnológico en Qoari y Boquerón, provincia Tiraque*" conducted during the second half of 1999 by the Sociology Department[141] of San Simón University. It deals with the nature and scope of technological innovations carried out by institutional intervention in both communities, and their impact on nature-based resources and biodiversity as well as on farmers' practices. The main

[141] Joint research was directed by the author as lecturer in which the following students took part: Carla Rivera, Vilma Saavedra, Hernán Vásquez, Edward Menchaca, Rodrigo Quintana, Marco Escalera y Ricardo Eid. The investigation also had the technical advice of Ing. Delfín Reque Zurita (agronomist).

focus, then, concerns the impact of technical innovations on agricultural practice, resources and productive strategies in the two communities.

It is necessary to warn the reader that the survey conducted in order to obtain the data analysed here was not actually a "socio-economic" diagnostic. It consisted in the application of a questionnaire on the topic of agricultural practices and technology. As long as the aims of this research did not ask specifically for an information "baseline" like (income, yields, economic status, well-being, etc) I considered that its inclusion was not really necessary (we should remember that the research instruments and techniques are established and organised based on the research objectives)[142].

Nevertheless from a general perspective –and completing the depiction carried out along the first part of this chapter– we can say that the economic status of the communities agree with that presented by the last national census (2001) for the province of Tiraque (see Annex 1c). According to this census the provincial population considered "poor" (to which, certainly, belong our communities) reachs a figure of 84%. Even though the communities of Qoari and Boquerón can be taken as "poor" they are not actually "indigent" (see table 18 in Annex 1c), which represent a 25% of the whole Tiraque population (there is no "marginal" population in the province).

The population of our communities could be assessed as "moderately poor" (59% of the province). According to the census criteria for the satisfaction levels of basic needs (see table 19 in the same annex), the communities of Qoari and Boquerón hold "inadequate" levels for some needs: in housing, inadequate materials and insufficient space; in services, inadequate water supply and sanitation. But for other needs as energy, education and health care they have more or less adequate services (electricity, school, health infrastructure).

With respect to the issue of self-sufficiency, it is dealt with but in agro-ecological terms, i.e. as the capacity of maintaining over the long run the fertility and productive potential of the farm through the management of nature (water, soil, biodiversity, air and light). In this way the production system sustains its strength in agronomic, ecological and sanitary terms, and thus is less vulnerable to market fluctuations. A central component of this self-sufficiency is biodiversity since an economical, autonomous and pollution-free agriculture can be achieved only with some biodiversity.

[142] Well then the household economic data were not one of our priorities and consequently we preferred to concentrate on the information assumed as highly relevant for our purposes.

The milieu is better valued under a combination of annual and perennial crops (pastures, trees, shrubs) and livestock, since this allows for a possible synergy between them. Some sub-products become inputs for other production activities, therefore lessening farm vulnerability, with reduced ecological costs and a techno-economic viability (Vilain 1999).

It seems wise at this point to argue why I have chosen to mix ethnography with quantitative statistical methods. My justification or rather the plea for doing so arises from the following considerations.

The first fundamental question that one needs to address concerns the extent to which the statistical analysis and subsequent classification presented below contribute to the objectives of the research.[143] Here my argument is that the principal objective of including a statistical analysis at this point in the thesis is to provide a broader foundation for understanding patterns of socio-technical change and continuity. Although it is primarily households and farmers who directly face and respond to the dilemmas of technical change and development intervention, the scope or extent of these transformations cannot be assessed only at this level.

There is another level of analysis and observation at which the rationale of intervention and innovation also works: namely, that of the community or what is sometimes termed the 'meso-level'. Thus in order to decipher the complex process of knowledge interfaces and reconfigurations – dimensions I highlight in the next two chapters - we have to pay attention to this more aggregated level of analysis. This will enable us to assess the wider impact of planned intervention and define the scope of the innovations.

Communities often function as intervention and transfer units and therefore it is at this level that we can acquire additional insights into the social scope of change: does the intervention/innovation influence a large group of farmers within the communities or, does it reach only a minority or insignificant number of them? Moreover, are we able to say something about a particular technological change as a whole, that is, in terms of its extent, directions and tendencies?

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[143] After two long theoretical chapters, to which I have now added a third dealing with the institutional struggles 'in the name of development', the reader is probably eager for some vivid accounts of the astounding experiences of farmers and engineers in regard to the dynamics of knowledge encounters – on the assumption that there is nothing so alluring as a good ethnographic work. While accepting this, I contend that the study of social change also requires giving attention to more aggregate levels of social phenomena.

Also, what distinctions can be identified among the farmers as regards the levels of innovation achieved? Clearly these and similar questions imply the application of analytical categories or classificatory devices. It is simply not enough to construct individual actors' narratives using case study or open-ended interviewing methods.

The statistical work that follows seeks to contribute to the analysis by establishing the scope and significance or 'weight' of technological innovations in the research communities as a whole and to identify and explain any variations that might arise by reference to the varying conditions and orientations of the farmers/households in the sample. Underlying this is the conviction that farming practice is fundamentally heterogeneous and that a multi-factorial analysis can help us to understand better the underlying social processes and thus the ethnographic detail presented in later chapters.

4.4.1 Some methodological remarks

The methodological strategy adopted for this part of the study consists in selecting a long intervention period which, for comparative purposes, I have divided into two moments in time: the first when development projects first appeared in the zone at the beginning of the sixties (see Chapter 3), and the second, corresponding to the year of the survey (1999). Despite the difficulties of using survey methods for longitudinal studies (in this case *a posteriori*), I have sought the most adequate questions for structuring the questionnaire and for comparing the variables[144].

We were particularly interested in knowing what changes had occurred in potato cultivation during the intervening period; that is, since development projects had started to work in the region. It is important to stress that during this time not only did a wave of projects focusing on technological innovation establish themselves in the area but at the same time several closed down.

We must keep in mind of course that technical change does not only result from the deliberate actions of development organisations –though, commonly, they are the first to bring it about-, since such change can also be promoted by market conditions and develop through the advice and contacts of friends, neighbours and relatives.

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[144] It is possible to argue that asking peasants in relation to periods so far back in time as the sixties or seventies is unlikely to yield accurate information. Nevertheless we should not forget that memory is a central resource for local knowledge in all societies, including Quechua people, who sometimes lack the skill of writing.

Furthermore, our choice of communities for the study was based upon the obvious difference between the relatively "open" community of Qoari, which appeared to be intensively visited by projects and technical staff, and the other "reluctant" or more "closed" community of Boquerón, which was much less targeted by projects and outside specialists.

This contrast suggested that we might find sharp differences between the communities in terms of technical innovation. In order to explore any such differences as well as similarities, I present a statistical analysis that focuses on multiple correspondences, classification and typology.

To this purpose and in order to obtain intelligible data, it is necessary to construct some "indicators of change" for key variables. The latter have been grouped into active and illustrative variables. As active variables - participating directly in the analysis - I have chosen those related to technology, crops and natural resources.

These assist in unveiling the kinds of changes that have taken place during the thirty- odd years. As illustrative variables, I have selected those referring to the socio-demographic aspects of peasant families. A characterisation of the latter helps us to interpret differences in agricultural practice. The data were collected using random sampling and applying a questionnaire[145].

A *simple random sample* method appeared to be the more appropriate design, especially considering that neither the population nor the number of communities was large. To obtain a workable sample size, the formula recommended by Bernard (1991) for small populations was utilised. It contains a "proportions formula" based on the Chi-square distribution for one degree of freedom. The chosen confidence level and the margin of error (a confidence level of 95% and an error of 5%) correspond to those normally accepted for socio-economic research.

On the basis of this, we can assume that the sample was representative of the population and that its size was also sufficiently large (145 households) for the method used. Since we did not have at a hand a complete and informative list of households to obtain a totally random sample, each community was split in more or less similar areas according to the cardinal points, and the questionnaires were administered in as random a way as possible in each of

[145] All the information was stored in a SPSS data base and later transferred to a SPAD-N base for the factorial correspondence analysis and for the classification process and setting up of typologies. The classification was completed using a bivariate analysis, but this time not at the household level but at the community in order to compare communities.

neighbourhoods identified. The main characteristics of the statistical methods applied in the analysis will be dealt with later in the course of elucidating the procedures used and reporting the results.

4.4.2 Agricultural production and intervention in Qoari and Boquerón

To a large extent, both communities are devoted to tuber production (principally potato followed by *oca* and *papalisa*), grains (barley, oats and wheat), "leguminosas" (broad beans, *tarwi*, vetch) and *quinua* (a native highland product). To these crops, vegetables and fodder can be added. The two communities have access to different sources of irrigation: rivers, springs and reservoirs; some of the latter have been rehabilitated and enlarged recently, which has raised the number of irrigation beneficiaries and the perimeter of the irrigation area. The following table presents the main crops and the percentage of farmers cultivating them.

TABLE 2
Crops and percentage of households cultivating them in Qoari and Boquerón

Crop	Producers (%)
Potato	84.4
Broad beans	54.1
Barley	42.2
Oca	27
Wheat	25
Oats	17.4
Papalisa	12
Tarwi	5.5
Vetch	3
Quinua	1.8

Source: Qoari-Boquerón survey, 1999
Sociology Collective Workshop[146]

The crops are ordered according to their importance (more precisely their greater or lesser frequency among the cultivators). Hence the three main crops for these communities are: potatoes, broad beans and barley.

Earlier I drew attention to the difference between the two communities in terms of their level of project intervention experience. This difference is

[146] All the tables and figures presented in this chapter correspond to this source.

depicted in the table below. From this one concludes that Qoari has been much more visited by a diverse range of organizations than Boquerón. A reason for this might lie in the fact that Qoari is on the road connecting the cities of Cochabamba and Santa Cruz; and there is an old *hacienda* house alongside the road which is handy for holding meetings, organizing courses and providing accommodation for the participants. It also has plenty of storage room.

Thus many local organizations and development projects have used this hacienda as centre for their activities. But, perhaps the more important reason, has been that farmers from Qoari appear more open and friendly than their peers from Boquerón.

TABLE 3
Institutional presence by community

Type of institution	Community	
	Qoari	Boquerón
NGO* (technology for potatoes)	4	1
NGO (other works)	2	1
GO**	2	2
Catholic church	3	
International organisation	1	1
Peasant organisation	1	1
Total	13	6

*Non-Government Organisation
**Government Organisation

Table 3 brings out the difference between the two communities: in Qoari, some thirteen organisations have worked there – and some of them are still there– while in Boquerón there are less than half this number. Of these organisations listed, four had to do with technological packages for potato production, three in Qoari and just one in Boquerón. The first NGO (DESEC) project started to work in the area between 1960 and 1964. Table 4 documents differences in the number of potato varieties cultivated in early 1960s as against 1999.

TABLE 4
Potato varieties 1960 and 1999

Varieties in 1960	Varieties in 1999
1. Runa	1. Runa
2. Imilla	2. Imilla
3. Pukahuayk'u	3. Pukahuayku
4. Waycha*	4. Waycha*
5. Canchiri (khuchi aca)	5. Negra
6. Icari	6. Luki
7. Yanahuayk'u	7. Qoyllu
8. Tinequeri	8. Sani Imilla*
9. Luki	9. Holandesa**
10. Chola Imilla	10. Blanca
11. Qoyllu	11. Pestañera
12. Sani Imilla*	12. Pukañahui
13. Holandesa**	13. Gendarme**
14. Qosiña (Puka T'ika)	14. Qosiña
15. Gendarme**	15. Puka Toralapa**
16. Blanca	16. Desiree**
17. Condor Imilla	17. Colombiana**
18. Apacheña	
19. Yurajt'ika	
20. Pestañera	
21. Wicopara	
22. Qetu	
23. Lunca	
24. Lluturuntu	
25. Pukañahui	
26. Ch'aska imilla	
27. Altamachi	

*Introduced native varieties
**Introduced improved (hybrid) varieties
<u>Nota Bene</u>.- Varieties with no asterisk are native ones traditionally cultivated in the zone.

The table brings out graphically the number of native varieties that have lessened over time (more than a half have disappeared), though many are still important for the farmers of both communities. Furthermore, there are some new native tubers that have been introduced into the communities, either by means of traditional exchange or the market or through institutional dissemination. Development projects do not work only with high yielding hybrids but also with native varieties. Through purification processes, *in vitro* cultivation and subsequent multiplication, they offer farmers "clean and healthy" native varieties. Improved varieties (hybrids) arrive on farmers' plots almost exclusively through projects.

The information displayed in Table 4 shows that, in general, the "sum of diversity" diminishes by 37% (from 27 to 17 varieties). It is only the native varieties that lose more diversity (from 23 to 10, that is, more than a half). On the other hand, though the number is small, it is the hybrids that show an increase (from 2 to 5); while introduced native varieties do not present any change (they remain at two over the time period). In Chapter 6 I provide a more detailed discussion on the issue of diversity and the problem of gaining or losing bio-diversity.

4.4.3 Farmer dynamics and technological innovation

Having provided an overview of the particularities the communities under study present regarding production, crop diversity and intervention experience, I now concentrate on farmers and their production/consumption units (i.e. households). It is principally at this level that we can record changes as they happen. On the basis of these data, then, that we can construct typologies and apply a correspondence analysis. The next section is divided into two parts: the first deals with the factorial analysis of correspondences, and the second, with the process of classification and the construction of typologies.

Multiple correspondence analysis

Before entering into the analysis, let me first describe what it amounts to. As its name indicates, it deals with a multiple correlation method. When two variables are associated it is possible to establish if they are highly correlated, poorly correlated or without any correlation at all (i.e. "independent" of each other). In our case, for instance, we could inquire about the existent correlation between the variables "introduced potato varieties" and "access to irrigation", and one could argue –with some probability[147]– that access to irrigation is associated with a larger production of introduced varieties (hybrids). Nevertheless, an association between only two variables is too simple or too poor to show what actually happens in some "real" setting such as a peasant community, which of course is very complex[148]. To overcome this

[147] Such a probability is obtained using statistical tests which determine how probable a particular correlation or association is likely to be between variables and how probable that the correlation is coincidental.

[148] An improvement occurs when we consider two variables, each this time with some "categories" or "modalities". Thus, in our example, the variable "introduced potato varieties" could encompass the modalities "none", "few" and "many". The other variable, "access to irrigation", could have its own modalities as well. In this manner, the relationship is no longer only between the two values ("*a*" and "*b*") but between the values of their modalities

limitation and profiting from the progress made in informatics and statistical software, "multivariate methods" have been developed[149]: comprising analytical and descriptive methods (those of multiple correlation and classification), and inferential and predictive ones (those of multiple regression).

These methods take into account several variables at the same time, registering the manifold relationships that take place between them, which is almost certainly going to be closer to the "reality" than a simple bivariate relationship between two variables. Pursuing this through the case in point, we could argue, for example, that the increase in production of introduced varieties is related not only to a greater access to irrigation but additionally to the possibility of obtaining more seed, the possession of sufficient land and to the respective training received for growing new varieties. Or, inversely, one could contend that the introduction of new varieties leads to the search for new irrigation sources, more land and more training.

Even though the results of such multivariate methods may be, many times, a little bit obvious (the positive side of being obvious is that one can hardly be wrong!), they are interesting enough to provide a useful resource for social research. Since they work with a lot of variables, this implies that they deal with many dimensions at the same time (each variable being one dimension). When we cross two variables (and their values) we are in fact crossing two axes or factors (*x* and *y*, say "size of the land" and "production") for the values of each variable. When we cross ten variables we are crossing ten dimensions or axes, which generates multiple planes that very difficult to observe at the same time. Methods such as the analysis of multiple correspondences work with multiple planes at once (each plane has two axes or factors under *ortogonality* criteria). By means of the application of linear algebra and some other procedures (e.g. centring and normalising variables and so on), this method renders a number of axes and consequently planes which require interpretation. This means that the multiple association method accommodates the different variables (and the "individual units" that correspond to the values of the variables, say, farmers, households, and other social groups) around a number of axes, which are constructed on the basis of the variables, or more precisely based on their correlation with specific axes. Up to this point, the statistician has had much to say, but henceforth it is the researcher who has to interpret the figures delivered by the method. It is he or

(between *a*, *b* and *c* on the one hand, which correspond to the first variable's modalities; and *x*, *y* and *z*, which correspond to the second variable's modalities, on the other hand).

[149] A lot of the methods applied were already developed in the 1920s and 1930s. As for classification methods, the novelties in our days are limited to combinatory procedures.

she who must give some meaning to the "constructed" axes. That is, the correlation between the variables must be read as a whole. In addition, the method (by means of calculating the "inertia" for each axis) offers relevant information on the number of axes to be considered; in other words, it "tells" us which axes explain better and to a greater extent the correlations or associations between the variables.

In concluding this short description of the method, let me return to our particular case example. Let us suppose that we are taking into account ten variables (that is ten dimensions of analysis), which include the variables: "potato introduced varieties" and "potato native varieties" and so on. Yet, in applying this method of multiple correspondences, we find that (simplifying things) the first two axes or factors "explain" a large share of the correlation between our ten variables (say, 70% of the total correlation). Then we need only to look at the first plane (which is made up of the two first axes) to obtain a good illustration of how things are from the point of view of correlation, and to thus to begin with the task of interpretation. Keeping in mind that the variables that most identify with the axes are those more distant to the origin, on the one hand; and more attached to one of the axes, on the other, we can elucidate what each axis is displaying in reference to the variables. Thus if, for instance, the variable "potato introduced varieties" is situated on the positive end of the first axis (x) and just a little beyond it; and on the other end, the negative one, we find the variable "potato native varieties", we can assert that what the x axis shows in fact are changes in potato production in respect to types of varieties grown. We could conclude, therefore, that the x factor is a variation index of the potato varieties (indicating which varieties are cultivated the most and which the least). The second axis also will be interpreted in this manner. So the factorial analysis brings out the existent oppositions between the main variables (i.e. those chosen for the analysis, called "active variables" and which take part in the calculation process), and also between the "illustrative" ones (i.e. the secondary or complementary variables which, in fact, form no part in the calculations).

After this brief technical digression, let us now return to the "real" data before us. First, it is important to make clear that for undertaking the analysis I have considered 9 active variables[150] encompassing 39 modalities as a whole (which means that each variable had, on average, 4 modalities). Since the aim was to establish the changes presented by those variables over time, such modalities express "indicators of change" of the variables. That means, for instance, in

[150] As mentioned above, in factorial analysis so-called *nominal active variables* are considered to be those that are the objects of multidimensional analysis, and which are transformed through a table of condensed codes (Crivisqui 1993, Lebart *et al.* 1995).

the case of native or introduced varieties, whether or not the varieties increase or decrease throughout the period considered[151]. Along with the active variables another 5 illustrative[152] variables have been included (each with their modalities as well). The sum of variables –active and illustrative– is as follows[153]:

Active variables (Shift in)	Illustrative variables
1. Native potatoes (Nº. of varieties)	1. Community
2. Eroded area	2. Nº. of household members
3. Eroded lands (degree)	3. Household head's sex
4. Control and treatments (kinds)	4. Household head's age
5. Access to irrigation	5. Household head's education
6. Fertilisation (kinds)	
7. Sown area	
8. Seed (amount)	
9. Introduced potatoes (Nº. varieties)	

To clarify a bit more the type of variables considered for the analysis, we can see that some of the active variables are actually "ordinal" (native and introduced potatoes, eroded area, eroded lands, access to irrigation, sown area and seed), that is they measure the change in terms of gradation: small, moderate or huge change (increase or decrease). The other variables (control and treatments, and fertilisation) are indeed "nominal" ones, showing only the direction of change (for instance, from organic fertilisation to a mineral one). The illustrative variables are ordinal and nominal, and indicate scale, but they do not encompass indicators of change since each of the latter refer to the present situation; that is, if we take, for instance, age and education level

[151] To show what kinds of modalities each variable had and how they were meant to display the mentioned changes, let us take the case of the "native potato". This variable had 7 modalities (like the "introduced potato" variety), of which three referred to a negative change or decrease: Huge decrease (PN_GD, *Papa Nativa Gran Disminución*), moderate decrease (PN_MD), and small decrease (PN_PD); one modality referred to a situation without change: without change (PN_SC); and the last three referred to positive change or increase: small increase (PN_PA), moderate increase (PN_MA), and huge increase (PN_GA). Reducing the number of native varieties that each farmer had at the start of the considered period from those remaining at its end, it was possible to place each farmer in one of the modalities, establishing in this manner the degree of change and its direction (positive or negative i.e. increase or decrease in the number of varieties cropped).

[152] *Illustrative variables* comprise those variables not projected on the axes defined by active variables; nor do they participate in the calculation of such axes (Escofier and Pages 1990: 16, 40).

[153] In Annex 2, simple frequencies and a histogram of relative weights are presented for each of the active variables, as well as a description of the modalities for both active and illustrative nominal variables.

of the household head then we are considering his or her current age and educational level.

As we have seen with our example, it is first necessary, for the factorial correspondence analysis, to set up the number of axes to be taken into account[154]. We have also seen that the method provides some information that facilitates the task of making a decision on this. Such information consists in the histogram of so called "*Eigen* values", which are presented in the table below (the *Eigen* values as *valeurs propres*, in the table).

TABLE 5
Histogram of the first 30 *Eigen* values

VALEURS PROPRES
APERCU DE LA PRECISION DES CALCULS : TRACE AVANT DIAGONALISATION .. 3.3333
SOMME DES VALEURS PROPRES 3.3333
HISTOGRAMME DES 30 PREMIERES VALEURS PROPRES

NUMERO	VALEUR PROPRE	POURCENT.	POURCENT. CUMULE	
1	0.3855	11.57	11.57	**
2	0.2691	8.07	19.64	**
3	0.2132	6.40	26.04	***
4	0.2005	6.02	32.05	**
5	0.1857	5.57	37.62	***************************************
6	0.1778	5.34	42.96	*************************************
7	0.1668	5.00	47.96	***********************************
8	0.1456	4.37	52.33	*******************************
9	0.1428	4.28	56.61	******************************
10	0.1305	3.91	60.53	****************************
11	0.1224	3.67	64.20	**************************
12	0.1176	3.53	67.73	*************************
13	0.1126	3.38	71.11	************************
14	0.1007	3.02	74.13	********************* (Mean own value)
15	0.0934	2.80	76.93	********************
16	0.0853	2.56	79.49	******************
17	0.0819	2.46	81.95	*****************
18	0.0758	2.27	84.22	****************
19	0.0714	2.14	86.36	***************
20	0.0692	2.08	88.44	***************
21	0.0637	1.91	90.35	**************
22	0.0548	1.64	92.00	************
23	0.0505	1.52	93.51	***********
24	0.0461	1.38	94.89	**********
25	0.0437	1.31	96.20	**********
26	0.0380	1.14	97.34	********
27	0.0328	0.98	98.33	*******
28	0.0230	0.69	99.02	*****
29	0.0184	0.55	99.57	****
30	0.0143	0.43	100.00	***

If we take a look of the table, we realise that the total inertia of the matrix of variables decomposes into 30 factors or axes[155]. This means there are 30 dimensions which comprise all the correlations between the considered variables. General criteria for establishing the number of axes to be considered in the analysis recommend that one has to limit them to the largest *Eigen* values since they encompass a large part of the projected inertia (i.e. they explain a large part of the correlation). Similarly, a sudden and important decrease along the histogram (this is called "elbow rule" because it means a cut in the histogram) shows us how many factors or axes should be taken into account. It is also worthwhile observing the index of the contribution of the

[154] On the technicalities of the method, see Escofier and Pages (1990), Lebart and Morineau (1995), and Crivisqui (1993).

[155] The calculation of the total or global inertia is obtained through: $I_G = \frac{K}{p} - 1 = \frac{39}{9} - 1 =$ 3.3333.

profile-dots to the inertia or, finally, to consider the number of *Eigen* values that exceed the average *Eigen* value (this latter being 0.11111, see the table to the right).

Considering such criteria, we can establish that the first 13 Eigen values (*valeurs propres* in the table) are greater than the average value (implying that we should work with 13 axes, which in practical terms would be too many). The index of contribution to the inertia (the percentage –*pourcent* in the table) of the first two values are relatively greater than those of the rest (11, 57 and 8,07, being greater than their *Eigen* values as well), meaning that these two axes or factors would be enough for the analysis, a criterion which will be the most important for our final decision. Applying "elbow rule" it is possible to appreciate two clear cuts in the histogram: the first between the second and the third values (with a cumulated percentage of 19,64%), and the second one between the seventh and the eighth ones (here, once again, the number of axis would be excessive).

For our decision on how many axes to take into account, we have chosen the criteria of the index of contribution (as index of the correlation between the variables and their respective axis) and the so called "elbow rule", preserving for the analysis the first two axes, which counts for 19,64% of the inertia[156]. Indeed the former shows clearly that the first two axes present the higher "index of contribution", although they explain only 20% of the correlation, and the latter evinces a clear "cut" in the histogram between the second and third values (I also reviewed the information extended by axes three and four since they are a sort of repetition of that given by the first two axes, thus reinforcing what they present).

In our introductory example we mentioned that along each axis or factor we might find some opposition between the variables and their modalities: towards one end of the axis the greatest values and, towards the other, the smallest ones. Identifying the main oppositions between the active modalities along the axes allows us to characterise those modalities and organise the grouping of modalities, which is a sound guide for classification and the construction of typologies (we have to remember that each axis is determined by the modalities that contribute the most to it).

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[156] The contribution of each variable to the total inertia can be obtained by subtracting 1 from its number of modalities and dividing the result by the range (the number of modalities less the number of variables): $\frac{(P_i - 1)}{r}$

The identification of the main oppositions and the determination of what the axes "tell us" (i.e. making explicit what they represent) will be achieved by describing the factorial axes.

TABLE 6
Description of the first factorial axis

DESCRIPTION DES AXES FACTORIELS
DESCRIPTION DU FACTEUR 1
PAR LES MODALITES ACTIVES

ID.	COORD.	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
CS03	-0.76	SUP_PD	SUPERFICIE	14.00	1
CS03	-0.75	SE_SC	SEMILLA	21.00	2
CC02	-0.73	ccon_c>q	Cambio control y tratamientos	22.00	3
CS02	-0.66	SUP_MD	SUPERFICIE	7.00	4
CP02	-0.65	PN_MD	PAPA NATIVA	18.00	5
			Z O N E C E N T R A L E		
CS07	1.07	SUP_SI	SUPERFICIE	36.00	35
CS06	1.14	SE_SI	SEMILLA	35.00	36
CP05	1.31	PN_PA	PAPA NATIVA	17.00	37
CT03	1.31	cte_a	Cambio terrenos erosionados	28.00	38
CP06	2.21	PN_MA	PAPA NATIVA	4.00	39

Looking for possible oppositions in the table above, we find that there is one between the modalities of native potato, specifically between the modality "moderate decrease in native potato varieties (PNMD)" (the number of these varieties), which is situated in the negative axis' part (see the sign of its coordinate: -0.65); and the modalities "slight increase of native potato" (PNPA) and "moderate increase" (PNMA), which are situated in the positive part (with positive coordinates: 1.31 and 2.21). In respect to other modalities, although some display greater coordinates, it is not possible to set up a clear opposition[157].

[157] The shift indicator, rendered here as "slight", "moderate" or "large" increase/decrease (and when there was no change, "without change") in cropped potato varieties – over the thirty year period– has been built up from intervals developed in a SPSS database. For the **native varieties**, for instance, a "large decrease" (in the number of varieties sown) was defined as a reduction of between 5-9 varieties; a "moderate decrease" as a reduction of between 3-4 varieties; "without change" as the absence of change; "slight increase", as a rise from 1 to 2 varieties; "moderate increase", as a rise from 2 to 3 varieties; and so on. A similar procedure was utilised in the case of the **introduced varieties**.

The depicted opposition enables us to identify the first factor or axis as the **index of variation in the number of native potato varieties**. The interpretation that can be drawn from such a variation is that there exists a group of households (represented by the active modalities on the factor's right side, with the coordinates 1.31 and 2.21), which have oriented their strategies towards slight or moderate increase in the number of native varieties that are sown. That is, they tend to increase the "sum of diversity" of native tubers in their land. Opposed to this trend, there is a second group situated on the axis' left side, which displays a slight decrease in the number of native varieties[158] (whose coordinate is -0.65). In summary, we can conclude that the first axis or factor as "index" of the variation in the number of native varieties shows, over the thirty-year period, that there are some farmers who have increased the cultivation –in terms of number– of such varieties, while other farmers have diminished their number.

The only illustrative modality that is related to this variation is the "household head's age" (see the table below) which, in this case, corresponds to the older category and which, paradoxically, is associated with the group of households that reduces the number of native varieties that are cultivated. A plausible explanation, or rather, justification, for such apparent incongruence would argue that, in reality, farm management practices are in the hands of the sons/daughters, and thus paternal authority is simply a formal trait)[159].

TABLE 7

Illustrative modalities in the first axis

DESCRIPTION DU FACTEUR 1
PAR LES MODALITES ILLUSTRATIVES

ID.	V.TEST	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
ED03	-2.15	age_vi	Edad del jefe del hogar	34.00	1
			Z O N E C E N T R A L E		

[158] To back up this assertion we can point to the factor composition (see Annex 2) and verify that the contribution of inertia to these modalities is appreciable.

[159] There is a difference, regarding testing matters, between illustrative and active modalities: the oppositions –between the positive and negative values on both sides of the axis– for the former are based on so-called "test values", which are values attached to hypothesis tests concerning the quality of representation of the modalities along the axis –more specifically it is their typicality in relation to the active elements that is assessed. Values greater than 1.98 or less than –1.98 are not considered because of their scarce probability of their being typical or well represented in the axis. With respect to the active modalities, instead of such test values, their coordinates or square cosines are considered because they constitute a good reference for their quality of representation.

What the second axis seems to show (perpendicular to the first one, completing in this way the first factorial plane whose figure we will see later) is decrease in or loss of both types of varieties: native and introduced. On the negative side of the axis, we find the introduced varieties showing a "slight decrease" modality (PIPD, with the highest coordinate: -1.08, see next table). On the opposite side, with a pretty high coordinate of 2.13, we find a modality of "huge decrease" for native varieties (PNGD). All this adds up to the second axis or factor being an **index or scale of the decreasing levels for both kinds of varieties** (native and introduced).[160] In brief, the second axis seems to indicate that the native varieties disappear more than do the introduced ones.

TABLE 8

Description of the second factorial axis

DESCRIPTION DU FACTEUR 2
PAR LES MODALITES ACTIVES

ID.	COORD.	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
CP01	-1.08	PI_PD	Cambio variedades introducidas	9.00	1
CF01	-1.00	cfe_a>o	Cambio en fertilización	3.00	2
CC01	-0.76	ccon_sc	Cambio control y tratamientos	20.00	3
CS03	-0.57	SE_SC	SEMILLA	21.00	4
CS06	-0.45	SE_SI	SEMILLA	35.00	5
			Z O N E C E N T R A L E		
CS03	1.75	SUER_MA	SUP. EROSIONADA	3.00	35
CS02	1.85	SUER_PA	SUP. EROSIONADA	8.00	36
CS01	1.90	SE_MD	SEMILLA	4.00	37
CP01	2.13	PN_GD	PAPA NATIVA	3.00	38
CS05	2.50	SUP_PA	SUPERFICIE	5.00	39

The illustrative modalities presented here highlight important differences between types of household. Households where the number of native varieties has decreased considerably are female-headed and small in size (ranging from 1-4 members); whereas those where the number of introduced varieties has diminished only slightly are male-headed and large (ranging from 8 to 13 members). Table 9 brings out these differences.

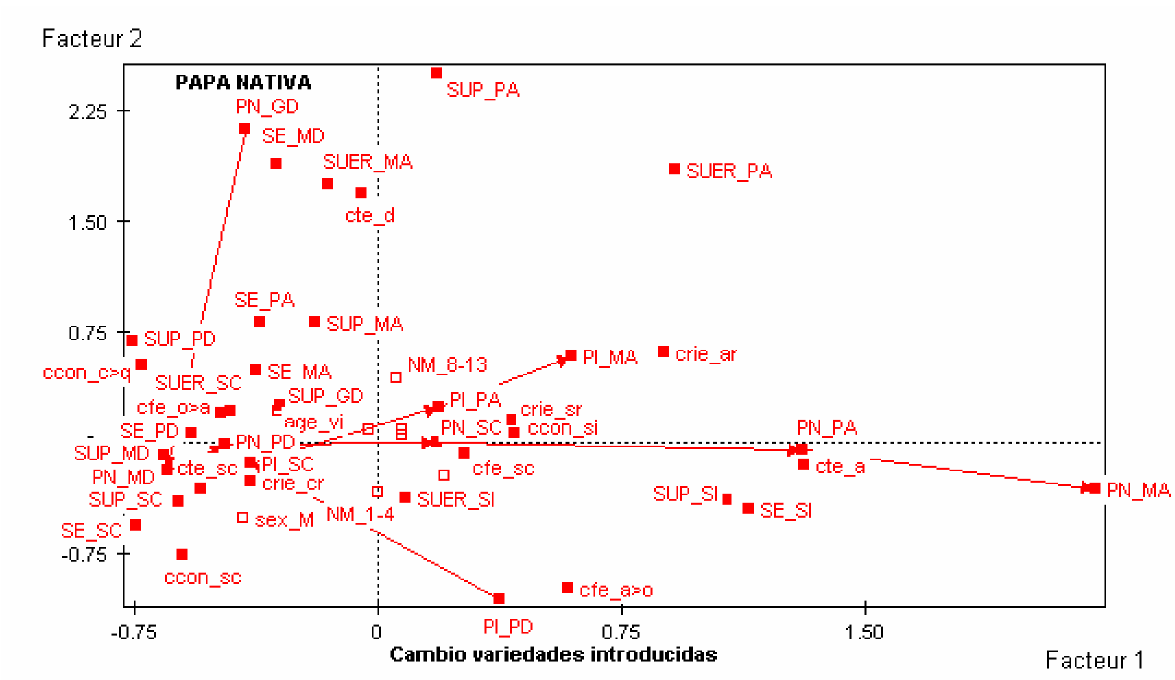
[160] This issue of lost varieties and consequently of genetic diversity is readdressed in the discussion in the final chapter, where an interesting coincidence occurs between that unveiled by statistical analysis and the findings made explicit through ethnographic methods.

DESCRIPTION DU FACTEUR 2
PAR LES MODALITES ILLUSTRATIVES

ID.	V.TEST	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
MI01	-2.87	NM_1-4	MIEMBROS	43.00	1
SE02	-2.26	sex_M	Sexo del jefe del hogar	16.00	2
Z O N E C E N T R A L E					
SE01	2.26	sex_H	Sexo del jefe del hogar	93.00	14
MI03	2.50	NM_8-13	MIEMBROS	25.00	15

Before continuing with this classification process, let us consider the next figure which offers a presentation of active and illustrative modalities over the first two axes of the first factorial plane (which is more important). The figure clearly maps out the "trajectories" of the native and introduced varieties.

FIGURE 6
Modalities over the first and second factors



Active modalities
Illustrative modalities

What it shows is the relative dispersion of the active modalities according to the first plane. The oppositions of each axis are displayed in a graphical form.

Thus along the first axis, defined as the index of variation for the native varieties, we can see the different modalities making a "trajectory" from the left side of the plot to the right one. On the left side –the negative one–, almost in sequential order, there are the modalities which pinpoint the different degrees of decrease: "huge", "moderate" and "slight"(PN_GD, PN_MD, PN_PD). On the right side –the positive one– there is the modality of no change (PN_SC) and the modalities of increase: at first "slight" (PN_PA) and at the end of axis, "moderate" (PN_MA)[161]. In the table describing the first axis there were also other modalities on both sides of the "central zone". We also find them in the figure. On the left side of the graph, there are the modalities SUP_PD ("slight reduction" of the cultivated area), SE_SC (the amount of seed without change) and again a modality on area, SUP_MD, which this time presents a moderate decrease.

This represents a consistent pattern since the reduction in the number of native varieties is also related to the reduction of the cultivated area. There is also the modality "ccon_c>q", which signifies a shift in pest control and treatment in the direction of chemical methods. This would appear to suggest that the decrease in native tubers entails a greater use of chemical inputs.

On the right side of the plane, we also find the modalities associated with the first axis: SUP_SI, SE_SI[162] and"cte_a". The modality "cte_a" means an increase in the level of erosion in already eroded plots, which is possibly related to an increase in the number of native varieties cultivated.

Turning to the second axis, the vertical one, we have to remember that this axis provided a sort of scale for levels of decrease or loss in respect to both native and introduced varieties. On the lower end of the axis (at the bottom of the plot), we find the modality PI_PD, which signifies a slight reduction in the number of introduced varieties. And almost at the top, on the positive side of the axis, is the modality PN_GD (huge reduction in the number of native varieties). The latter, the positive side, is associated –according to the table for the second axis– with other modalities such as SUER_MA (moderate increase in the eroded area), SUER_PA (slight increase in the eroded area), SE_MD (moderate reduction in the amount of seed) and SUP_PA (slight increase in the cropped area).

[161] The statistical importance of the modality "huge increase" is not big enough to take this modality into account, either for the characterisation of the axis, or for its graphical representation.
[162] Unfortunately SUP_SI and SE_SI mean that there is no information either for the change in cropped area or for the amount of seed.

The relation or association between a huge reduction in native varieties and the reduction of seed quantity is coherent, but the relation of the former to increase in eroded and cultivated areas remains incomprehensible. To terminate the account, we should note that the negative side is also described by the modalities "cfe_a>o" (change in fertilisation toward organic one), "ccon_sc" (change in pest control and treatment: without change) and SE_SC (seed amount without change, but also there is SE_SI: seed amount without information).

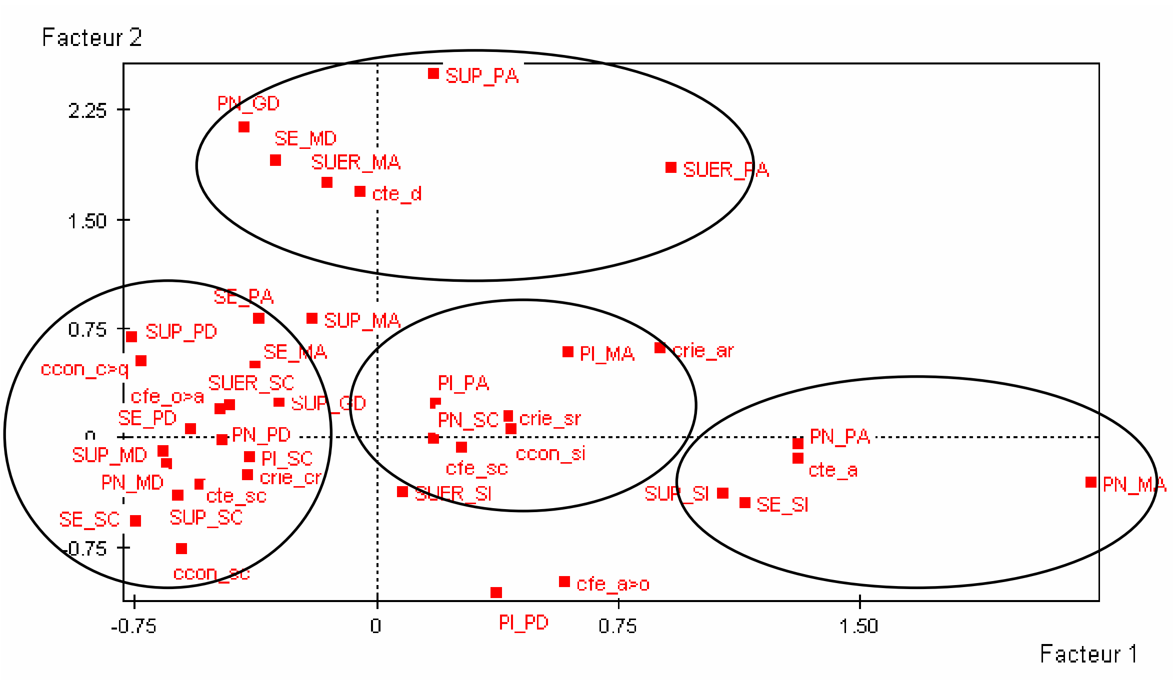
Thus, the decrease in introduced varieties is related to a change in the movement towards organic fertilisation (which is logical since these varieties are highly demanding in respect to mineral fertilisation). Such a decrease also relates to a type of pest control that combines natural and chemical measures. And finally it correlates with maintaining the same amount of seed, which appears somewhat contradictory, but it might mean that, even though the number of varieties decreases, the amount of potato cultivated increases.

At this point, let me clarify the "arrows" that pass through the graph. These describe the trajectories realised by the native and introduced tubers over the long term period. Tracking the native varieties, we encounter large distances between their modalities, which signify that there are greater oppositions between them than between those corresponding to the introduced potato varieties. The illustrative modalities, although close to the origin (this means they come close to mean values).

Classification and construction of typologies

A good hint for dividing the active modalities into categories or strata is obtained by clustering them initially in groups drawn up on the basis of their proximity to each other. Doing this we get the following clustering for the first factorial plane.

Figure 7
Clustering of active modalities over the first and second factors



The classification is obtained by means of a statistical procedure called "ascending hierarchical classification". This classification, displayed below, is achieved on the basis of the first factorial plane and through the decision to "cut up" the classification tree into four categories. Making such a decision means obtaining the best observed "inter/intra inertia" combination along the different cuttings and taking into account the possible number of axes, besides the respective quotient value.

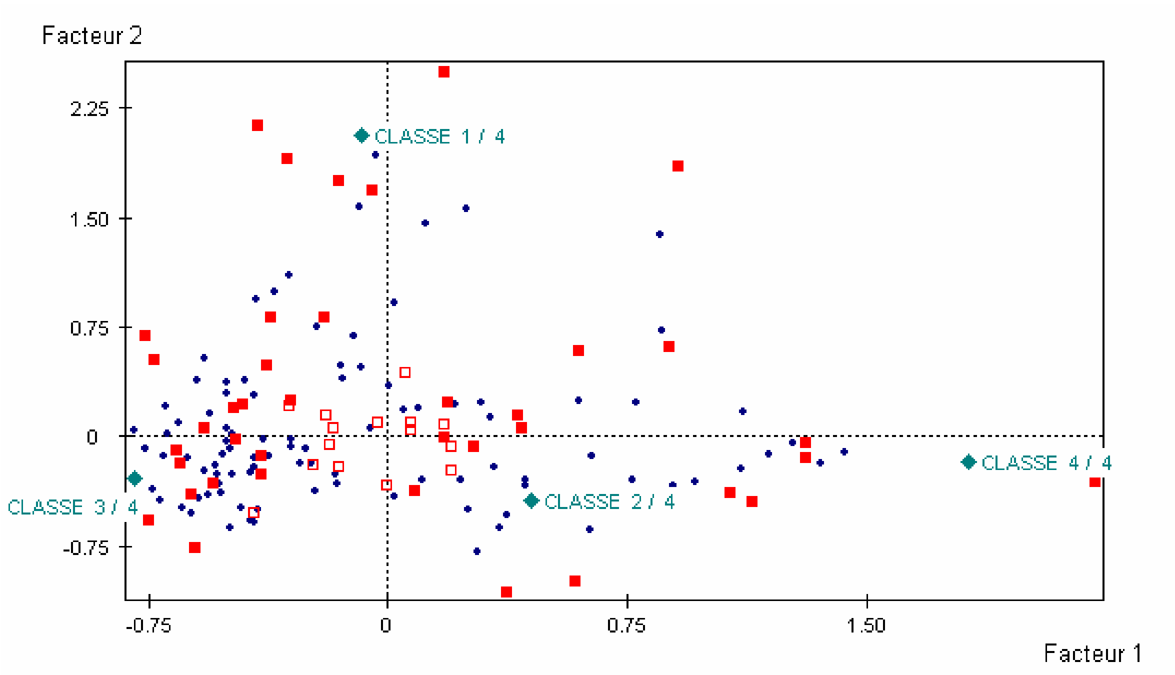
What this means that the created groups or categories are those that maintain the greatest degree of internal homogeneity (between the members of each category) and the greatest difference between the groups, with a total inter/intra inertia quotient that absorbs around 80% of the total inertia (0.79)[163]. In this manner, we can claim that each group is internally fairly homogeneous and the differences between the groups are quite large and heterogeneous. Hence the main objective of any classification technique of this sort is to identify homogenous groups that differ sharply from each other.

In the figure that follows, we can see that all four categories are separated. Then it is possible to observe some oppositions between them. In relation to the second axis, the first and second categories are opposed to each other and,

[163] The obtained inter-category inertia is 0.5177, notably greater than the intra-category inertia, where the highest value encountered was category 3: 0.0515 (see Annex 2).

in relation to the first axis, the third and fourth ones show a similar opposition. Such oppositions can be interpreted following the criteria we established for identifying each axis. To recall, the second axis was depicted as showing the ratio or level of reduction in the potato varieties as a whole. In the description of the categories that follows after figure 8, we find that the second category is characterised by a slight reduction in the number of introduced varieties; while, even though the first category is not explicitly identified with a large loss in native varieties, its location corresponds to this modality (see former figure). The opposition between category three and four is even more sharp: the former shows a decrease in native varieties and the latter, on the contrary, an increase in those same varieties, as it was evinced in the analysis of axis one.

FIGURE 8
Classification of active variables and households



- Individuals (households)
- Active modalities
- Illustrative modalities
- ◊ Categories

In summary what the above figure presents is purely our previous "reading" of the first and second axes, this time displayed conjointly as a plane (the so called "first factorial plane"). Looking at the rhombuses, which precede each category's name ("classe 1/2" and so forth), we can notice that each category is located on the positive side or on the negative one of the axes. This means that they are "opposed" in pairs: category one against category two (in relation to the second axis or *facteur* 2); and category three against category four (in relation to the first axis). Such oppositions can be understood in terms of reduction for all varieties (remember that axis two meant weak or strong reduction of all varieties); or in those of general variation in the number of native varieties (axis one shows the increase or decrease for these varieties). Thus category one is related to a huge decrease in native varieties and category two to a small decrease in introduced ones (according to axis two); on the other hand, category three displays a moderate decrease in native varieties and category four a moderate increase in these varieties (according to axis one). After this brief interpretation of the fundamental characteristics of all four categories –obtained according to the active modalities– I move to describe them in greater detail. (see Annex 2 for a full presentation).

- Category 1

This first category or group of producers displays a reduction in the overall degree of erosion of their land, even though the extent of their eroded area has increased. Alongside this there is a small increase in the area destined for potato cultivation and, therefore, in the quantity of seed used. They have also acquired new extended irrigation extended systems and their households are large (8 to 13 members).

Of all categories, this category is made up of the smallest number of households – only 14. Close observation of the members of this category reveals that their most representative households are from Qoari but those from Boquerón are slightly more numerous. The fact that this category is drawn from households coming from both communities is confirmed by cross-tabulating the variables "category" and "community" (see table 10), which establishes that 57% of the households in this category belongs to Qoari as against 43% to Boquerón.

- Category 2

The second category is characterised by a small decrease in the number of introduced varieties. It is also characterised by the change from chemical/organic fertilisation to organic inputs only. Household heads in this group have finished primary school but –due to some gaps in the data– there is no information about the area affected by erosion and the quantity of seed used. As to the number of members, this category consists of 24 households. The majority households of this category (67%) are from Qoari community.(see next Table).

- Category 3

The third category is the largest with 53 households. Its distribution by community is similar to that of the first category (58% in Qoari and 42% in Boquerón). The households in this category do not show variation in the degree of erosion of their land nor in the quantity of the seed utilised; likewise, the cropping area for potato has not changed significantly. In relation to fertiliser type, these households have moved away from traditional organic manure to combined chemical/organic inputs –currently widespread in peasant agriculture. Control and treatment of pests remain the same (by means of chemicals). Regarding potato production, this group continues the production of the same number of introduced potato varieties and displays a marked drop in the use of native ones. Households in this category have long since had irrigation.

- Category 4

The last category, the fourth, is smaller than the second and third (with 18 households mostly from Boquerón) 78% of the category comes from this community. As far as potato cropping is concerned households here show an increase in native varieties as well as in introduced ones. Their agricultural plots now receive irrigation with the recent enlargement of the irrigation schemes. With respect to soils, they show an increase in the degree of the erosion.

A full picture of the distribution of categories per community is shown in the table below.

TABLE 10
Distribution of categories per community

Community	**Categories**									
	Category 1		Category 2		Category 3		Category 4		Total	
	Q*	%	Q	%	Q	%	Q	%	Q	%
Qoari	8	57	16	67	31	58	4	22	59	54.1
Boquerón	6	43	8	33	22	42	14	78	50	45.9
Total	14	100	24	100	53	100	18	100	109	100

*Number

Having depicted the categories obtained through this method of "ascending hierarchical classification" and summarised their distribution across the two communities, I now aim to generate a producer typology in relation to technical change.

A typological proposal for technical change in Qoari and Boquerón[164]

In order to construct such a typology, we need first to establish which variable or variables (and their modalities in the case of them being "categorical") typify best the distinct groups or categories. Consequently, the choice of relevant variables is of paramount importance, in this case, in respect to technological change. In this manner the delimitation of each cluster will be more precise.

If we agree to think in terms of technological "packages" in the classic sense associated with agricultural intervention programmes, or even as applied to local farmer solutions or to what van der Ploeg (1989) has termed 'styles of farming', then it is imperative that, while recognising them as 'holistic' ideal conceptions, we also acknowledge their diverse nature in their practical application. That is, we will always find in practice that they are continually being reshaped to meet particular circumstances and hence they retain a differentiated relevance and pertinence for each established farmer group and even for individual households.

It is important for us to take account of these critical dimensions when attempting to construct a typology of farmer categories. Table 11 provides a first approximation to defining the four categories.

The characteristics used in this typology are based upon variables that make up a conventional technological package: seeds, fertilisers and chemicals. Other variables, indirectly linked to technological change, have not been taken into account, such as access to irrigation, works of soil conservation and so forth since, although they are important for conducting any technical change, they are not *stricto sensu* part of the package. Furthermore, irrigation management, soil conservation and organisation of labour commonly take place regardless of innovations or transfer of technology.

[164] An important reference for this part of the argument is the work of Gordillo, Blanco and Richmond (1995).

TABLE 11
Typological characterisation of farmer categories

Category	Characteristic Modalities
Category 1	Not characterised by any of the technological change components
Category 2	-Slight decrease in introduced varieties -Change in fertilisation (from "chemical/organic" to "organic")
Category 3	-Change in fertilisation (from "organic" to "chemical/organic") -Moderate decrease in native varieties -Introduced varieties without change -Control and treatments without change ("chemical") -Slight decrease in native varieties
Category 4	-Slight increase in native varieties -Moderate increase in native varieties -Slight increase in introduced varieties

Summarising the table, we can observe that for category 1 technological change is not relevant at all since none of its components appear to be appropriate (nor appropriated by farmers as part of their production systems). Category 2 exhibits a relative distancing from external innovations and a decrease in the number of introduced varieties and an orientation towards organic fertilisation. Category 3 seems to retain a major number of technological change components: in fertilisation, in seeds and in control/treatment inputs, along with a concomitant abandonment of native varieties. Category 4 is the only one identified with an increase in introduced and native varieties but farmers in this category do not seem to be very attached to any other of the components of technological innovation[165].

[165] If we think of our four categories with regard to economic status we realise that we do not have direct information on this but taking into account the variables we have chosen for analysing the technical change, we would dare to signal the third category as that with the best economic conditions. Moreover it is possible that within this huge category there is a small group comprising the very "rich" of the communities. Below this category we could situate the second one, with a long experience of innovation (that means revenue) but retracting from it with damaged soils. At the bottom the first and fourth categories have recent access to irrigation (that means they did not formerly have this economic advantage) and consequently are enlarging the potato production by the number of varieties (category 4) or by the volume of production (category one).

4.4.4 An attempt of interpretation of the dynamics of technological change in Qoari and Boquerón

In the final part of the chapter, the scope of technological change is discussed. farmer typology is critically summarised (pointing out categories' relevant features); alleged differences between communities are evaluated; and I make some reflections concerning technological change.

The scope and dynamics of technological change in the communities of Qoari and Boquerón display particular traits, which are worthwhile emphasizing. Both are located within a common geographical and economic region where the intensive cultivation of potatoes (for seed production and urban consumption) takes place. The area boasts a long history of organisational, institutional and commercial development, yet it is not possible to regard these communities as "specialized" in potato production. The reasons for this are primarily related to the prevailing natural conditions (altitude, above all) which limit the cropping of a wide range of improved varieties and hybrids. In addition, existing socio-economic and cultural conditions tend to prevent, or at least decelerate, a tendency for farmers to specialise in commercial varieties.

Furthermore, despite the three decades of "bombing" farmers' plots with introduced varieties in different "raids" [166] aimed at constantly renewing the varieties released, native varieties have not disappeared nor lessened dramatically throughout the region[167]. Although one can observe a certain reduction, over the long run, in the native "sum of diversity", it is also possible to assert that local knowledge contributes, periodically, to such diversity with new varieties such as *sani imilla*, which had its moment, or the *huaych'a*, a more recent acquisition: varieties which are even profitable –in the good sense of the word– for NGOs and research stations that improve and disseminate them for their widespread production. Nevertheless one could

[166] Here I allude to the "cargo image" of projects that "fall from heaven" depicted by van der Ploeg and Long (1989), see also Long (2001).

[167] In next chapter, I suggest the metaphor of "productive verges" to illustrate how native varieties keep alive thanks to a sort of protective exile in the *purumas*. Put in another way, we can say that native varieties drift apart from sick and exhausted soils towards verges where there are good and healthy soils. This idea of a protective exile is similar to Rella's notion of a 'gentle labyrinth'(see Chapter 1): "a happy place, which shelters [one]from law and the violent *nomos*" [and from 'projects', we might add] (Rella 1994: 10). Moreover, we can assume that being in exile is to lack a'true place' somewhere (that is, lacking a "site"), as Rella asserts, and being cast out to live on the borders might imply gaining a new space that belongs to oneself: a new room for manoeuvre and autonomy. Hence external proscription, or putting oneself on the fringes, may mean internal freedom as against external constraints and limitations.

also argue that local knowledge responses are not sufficient, either in terms of the number of varieties delivered –as absolute value– or their rate of generating new varieties –in relation to time– that is, thinking in commercial terms.

What the households of Boquerón and Qoari prove is that technological innovation is far from homogeneous for them, despite the "uniformity" (Dufumier 1993; 211) of the package (information, techniques, inputs or factors) offered by projects. In fact, as we saw above, the sample of households embraces several different categories or types of producers, each exhibiting particular traits vis-à-vis technological innovation. Some of them, for instance those in Category 3, have decreased, markedly or moderately, their diversity in native varieties. Other groups, such as Category 4, evince a "counter tendency" by displaying an important increase in the production of native varieties. This fact indicates that such varieties continue to remain central to the production and consumption strategies of some peasant families, and are more generally important for the management of a diversity of resources in the communities.

It is also interesting that there is no "invasion" of improved seeds with respect to introduced varieties. There is some increase in the number of them for Category 4, but in Category 3 they are maintained without significant changes, and they even decrease their quantity in Category 2. The interpretation we may draw from this is that, by and large, the diffusion of alien varieties (hybrids, improved, or clean) and their "appropriation" by farmers is not homogeneous. This can be explained by reference to natural constraints, market preferences, farmers' preferred strategies, or the shortcomings of dissemination methods.

If, besides the number of varieties, we take into account other variables, such as the area sown and the amount of seed used, we observe that there are no important changes, only slight trends of increase or decrease. All 4 categories suggest therefore that –unless the communities face some widespread critical natural or socially-generated situation, or an aggressive process of market penetration – the differences between households will remain relatively small in economic and status terms. Both Qoari and Boquerón retain a large intermediate stratum (located between the "richer" and the "poorer" households). This pattern remains fairly stable and is characteristic of communities with relatively limited social differentiation. The existence of such a numerous middle grouping contributes to the maintenance of social stability, since it is unlikely that major divisions or confrontations between opposing social strata will arise and threaten the community. A further outcome of this is that, in general, both communities manage to conserve their natural resources. In fact, according to farmers' perceptions, the degree of erosion has not changed strikingly, though as we will see in the next chapter, there are other problems affecting soils as a consequence of the intensification of potato production.

With respect to the potato crop, the decision by farmers to maintain the same production level for introduced varieties and to lower the level for native ones manifests a more commercial bias in potato production but not such as to lead to the abandonment of a subsistence chemical/organic strategy based upon native potatoes. There is, it seems, a relatively greater presence of households in Qoari who follow this mixed strategy, which is, no doubt, explained by the more persistent efforts deployed by development projects in Qoari. As mentioned before, the shift in fertilisation towards the combination of chemical and organic inputs and the recent increased access to irrigation characterises both communities.

The evolution of potato cropping in category 4 deserves somewhat more discussion. What happens here is interesting. This group of farmers has increased its use of introduced and (even more so) native varieties. Although Qoari has been the favoured *locus* for technical innovation for potato production (*vid supra* the table on institutional presence), Category 4 farmers are predominately located in Boquerón. This category comprises families, which have recently obtained irrigation and face a rise in levels of soil erosion. As is well known, irrigation constitutes a fundamental input or factor in the intensification of agricultural production, which, in the present case, means a greater production of a larger number of varieties (both introduced and native ones). It also entails – because of unskilled application of irrigation methods and a lack of knowledge of soil conservation techniques in relation to intensified forms of production - greater land degradation. Since Boquerón has not been the focus of development project activity on a par with Qoari, training and information on new production and conservation matters have been generally in short supply in the community. This has compounded the issues.

A further key point is that the increased production of native instead of introduced varieties is linked to several other interconnected components: greater crop and livelihood diversification, greater physical access to various food items, and the requirement of native varieties for traditional interpersonal and inter-group food exchange and for use in making ritual offerings at certain times of year, especially during fiestas. On the other hand, the increase in the number of introduced varieties is stimulated by commercial considerations. The enlarged area of irrigation – made possible by investments from outside and in that sense a response to the wider economy –

has of course resulted in much increased production for external markets and a greater demand for introduced varieties. In Boqueron, then, a critical change factor as been the impact of segmented external markets where a variety of local products as well as potatoes are now sold. In contrast, Qoari's patterns of change have been principally shaped by intensive and long-term planned intervention programmes.

Category 2, the second in size, shows opposite trends. This group of farmers has reduced their production of introduced varieties. At first sight this might suggest that they are disappointed with them and have decided to quit growing them. However, if we take into consideration certain other features, we encounter something strange, namely, that this group has shifted from chemical/organic to organic fertilisation. Although we are unable to state definitively that they have switched to agro-ecological production, this case seems to indicate at least a certain drawing back from the market. The illustrative modality attached to the group is education: the household heads in this cluster possess a fairly good educational level for rural areas – they have completed primary school. This cluster is also largely resident in Qoari and therefore well acquainted with the work and discourse of the latest 'sustainability' and 'organic' approaches to agriculture. The example may also be used to suggest that technological change can create not only its devotees but also its deserters who unwilling to keep faith with innovation's many promises.

The smallest group, Category 1, shows a small increase in both the area sown and in the quantity of seed utilised. This cluster is also characterized by a decrease in the degree of soil erosion. As we saw earlier, households of this group –like those of Category 4– have gained access to irrigation rather recently. The rise in potato production, consequent upon more irrigation, generally implies a greater articulation with the market –an opposite tendency to that of Category 2. If we examine the data, we discover that households of this category show a slight increase in introduced varieties and a slight reduction in native ones. This appears to confirm their greater articulation with the market.

While all four categories retain an important level of self-sufficiency, the most self-sufficient seems to be the third category - having controlled the degree and area of erosion, maintained the same cultivated area and quantity of seed and possessed irrigation for years. Although farmers in this category have also passed from organic to chemical/organic fertilisation, and trust more in chemical treatments and work with a reduced number of native varieties (biodiversity), we could still consider them pretty self-sufficient. The fourth category also shows a significant level of self-sufficiency: they manifest a rise in genetic diversity (with more native and introduced varieties) and recently have gained access to irrigation, which implies a more complete management of nature, although they nevertheless show an increase in the degree of erosion. Category 2 appears to be in the process of seeking to regain self-sufficiency, as they move from chemical/organic to solely organic fertilisation, and having reduced the number of introduced potato varieties. The first category exhibits the most contradictory tendencies: they have reduced the degree of erosion, recently obtained irrigation but, at the same time, have increased the eroded area, enlarged the potato cropping area and quantity of seed, yet lessened the number of native varieties. The latter would seem to imply a loss in biodiversity with a consequent reduction in self-sufficiency (with a greater but also more uniform production).

If we now compare the two communities on the basis of their relation to technological change, we find little evidence of major difference. Our initial supposition that Qoari, being the primary target for NGOs, was the privileged scenario for technological innovation, while Boquerón, due to its reclusiveness and distancing from development organisations, would remain indifferent or resistant, turns out to be far too sweeping. Both, in fact, have benefited from technical packages in a similar way and attaining the same level of innovation. Qoari community, with its background of constant institutional presence, delivers a contradictory image of change: on the one hand, a persistent story of technical change (with all its components), and on the other, evidence of a reversal or reduction of such change. Such an outcome steers us to ponder the limits and critical aspects of technical innovation.

The case of Boquerón is equally revealing since, with or without development organisations, technical change found ways to reach the community. The critical elements here were market forces and increased access to water resources. Social networks, now sometimes labelled "social capital", were also significant. As I document in the final chapter of the thesis, they played an important role as "influence networks"(see Chapter 2 of this thesis) or "knowledge networks" (Box 1989), whereby relatives, friends and neighbours became central diffusion agents. In this case, technical change at community level should perhaps be labelled "empirical", 'non-professional' or 'lay'. The non-technical traits of technical change in Boquerón are highlighted by the members of Category 4. This category provides evidence of an "appropriation", above all, of seeds, not other components of technical change (such as fertilisers and chemicals) commonly included in packages provided by projects in the form of credit. A greater degree of erosion here seems also to be related to institutional absence since development projects tend to emphasise techniques and measures for soil conservation. Finally, we must return to stress that deciding to withdraw from projects or dropping introduced technical practices in favour of local solutions is not only a feature of farmers in Qoari but of some individual households in Boquerón. Hence pulling out of technical change is not only a feature of disenchanted farmers previously recruited by projects, but also of those empirical amateurs not satisfied with their achievements.

Let me end this chapter, with some general reflections on technological change. The scope of change and its major features show us that neither the 'adoption' perspective (i.e. the manner in which approaches known as 'peasant economics' studies technical change), nor the 'transfer and dissemination' paradigm (originating from the communication and extension sciences), suffice for understanding such complex processes of change.

The scope of technological change, in the manner posited by agronomic and economic studies, is inhibited or restricted by the internal conditions and strategies of farmer households: the resources and means they possess and the interests they have. All of this is conducive to strange and bizarre ways of adaptation and to the adoption of only some components of the proposed technologies. Such moderation or rather parsimony in technological change is also justified and explained by social and cultural aspects. Consumption patterns, the representations of food and products, diversification strategies and the persistence or strengthening of an autonomy principle (Ploeg van der 1997) are important elements for such an analysis. The farmer is not oriented only pragmatically to means and techniques, to practices and outcomes: he retains particular relations with his natural and social environment (for an in-depth discussion of these issues, see chapters five and six).

Nor can the importance of the market – its signals that, for neoclassical scholars, take on the status of a mandate– be ignored in order to understand the particularities and scope of technical change. One should also not disregard the importance of informal mechanisms of change which, with their empiricism, alteration and adulteration in relation to technical packages, propel change along unforeseen pathways. We should allude as well to the problems, gaps, and obscure facets, which form part of or are created by technological change. These include: the inescapable loss of biodiversity, the degradation of resources (e.g. erosion, new pests, salinity), and health problems caused by careless manipulation of chemicals and equipment.

Next chapters will also, to a large extent, focus on these issues, but from a more ethnographic point of view. It is important to underline that the farmers chosen for the qualitative fieldwork on local potato knowledge and the interfaces with technicians are drawn from the sample survey, discussed in this chapter. Consequently the different perceptions, representations, practices and productive techniques that, as we will see, arise from those farmers' daily experience, are also related to the category they come from.

The farmers listed in the table below have been chosen from category 1. As we have seen, this category is characterised by a greater potato production, which is however more homogeneous as well (lessening the number of native varieties). This category gained access to irrigation not long ago, has some problems of erosion, tends to lose
in self-sufficiency and as to its general economic status, is together with the fourth category, is located at the bottom of the socio-economic pyramid.

Table 12
Category 1: farmers chosen for ethnographic fieldwork

Name	Gender	Age Young Elderly	Economic status High Medium Low	Farming type	Community
1. José Castellón	Male	Young	Low	Category 1	Qoari
2. Remigio Soto	Male	Young	Low	Category 1	Qoari
3. Gregoria…	Female	Elderly	Low	Category 1	Qoari
4. Margarita Hinojosa	Female	Young	Medium	Category 1	Boquerón
5. Quintín Montenegro	Male	Elderly	Low	Category 1	Boquerón
6. Luisa J.	Female	Elderly	Medium	Category 1	Boquerón
7. Simón Vásquez	Male	Elderly	Low	Category 1	Boquerón

Category 2 farmers, who was depicted as decreasing in the number of alien varieties, changing fertilisation towards organic forms, and struggling trying to regain self-sufficiency, and which corresponds to an economic stratum somewhere between the better off of category 3 and the poorer categories 1 and 4. From these farmers I have chosen the following:

Table 13
Category 2: farmers chosen for ethnographic fieldwork

Name	Gender	Age Young Elderly	Economic status High Medium Low	Farming type	Community
1. Pedro Montenegro	Male	Elderly	Low	Category 2	Qoari
2. Benedicta Mejía	Female	Young	Medium	Category 2	Qoari
3. Cristina Salazar	Female	Elderly	Medium	Category 2	Qoari
4. Daniel Paz	Male	Elderly	Low	Category 2	Qoari
5. Luisa Córdova	Female	Elderly	Low	Category 2	Boquerón
6. Constantino Herrera	Male	Young	Medium	Category 2	Boquerón
7. Leonor Córdova	Female	Young	Medium	Category 2	Boquerón

Concerning the more self-sufficient, stable and "richer" category 3 farmers, who were also described as managing appropriately their natural resources (although preferring a combined fertilisation and chemical pest control), keeping a steady potato production but with a decrease in native varieties, I selected the following farmers:

Table 14
Category 3: farmers chosen for ethnographic fieldwork

Name	Gender	Age Young Elderly	Economic status High Medium Low	Farming type	Community
1. Pastora García	Female	Young	High	Category 3	Qoari
2. Bernardino García	Male	Young	High	Category 3	Qoari
3. José Villarroel	Male	Elderly	Medium	Category 3	Qoari
4. Sabina Salazar	Female	Young	Medium	Category 3	Qoari
5. Carlos Alvarado	Male	Elderly	High	Category 3	Qoari
6. Albina Salazar	Female	Young	Medium	Category 3	Qoari
7. Salomé…	Female	Elderly	High	Category 3	Qoari
8. Guillermina Rocha	Female	Elderly	Medium	Category 3	Boquerón
9. Moisés Rivera	Male	Elderly	High	Category 3	Boquerón
10. Tomasa García	Female	Young	High	Category 3	Boquerón
11. Cristina Almanza	Female	Young	Medium	Category 3	Boquerón

From the last category, the fourth one, characterised by an increase in both native and introduced varieties but also a rise in the degree of erosion, recent access to irrigation, assessed as one of the poorer groups (jointly with the category 1), and displaying an improved self-sufficiency, I have chosen the following farmers for qualitative interviewing. The outcomes are discussed in the next chapters.

Table 15
Category 4: farmers chosen for ethnographic fieldwork

Name	Gender	Age Young Elderly	Economic status High Medium Low	Farming type Category 1 Category 2 Category 3 Category 4	Community
1. Severino García	Male	Young	Low	Category 4	Qoari
2. Pascuala Mejía	Female	Elderly	Low	Category 4	Qoari
3. Manuela alvarado	Female	Young	Medium	Category 4	Qoari
4. Cirilo Alvarado	Male	Young	Medium	Category 4	Qoari
5. Constantino Dávalos	Male	Young	Medium	Category 4	Boquerón
6. Concepción Dávalos	Female	Young	Medium	Category 4	Boquerón
7. Andrés Ricaldez	Male	Young	Medium	Category 4	Boquerón
8. Teodocio Mamani	Male	Elderly	Low	Category 4	Boquerón
9. Hilarión Parra	Male	Elderly	Low	Category 4	Boquerón

FIVE: The (local) knowledge of potato cultivators: a caring fondness in the heights

5.1 On metaphors and their relation with knowledge

Metaphor, as shown in other works[15], is central to Andean farmers' knowledge. Before referring to its role in this knowledge and how it works in the mountains of Tiraque, I discuss the relation between metaphor and knowledge in history. In its original sense The ancient Greeks treated metaphor as a conceptual displacement, to the extent that in some cases it was considered language's extravagance *par excellence*[16]. To Aristotle a metaphor was the transfer of the name of something to some other thing[17]; this led to reflections on language and how meaning can become transposed to its opposite. Aristotle also attributed to metaphor a didactic and illuminating function. In *Rhetoric* he states that common words can be given unusual glosses –organised by metaphors- that we do not always know and it is through them that our knowledge is enlarged and enriched. In *Poetics* he acknowledges that the metaphor of 'good and lovely' allows us to contemplate resemblances. Picking up this idea, Borges recalls that, following Aristotle, "…[A]ll metaphor springs from the intuition of an analogy between dissimilar things" (1985: 72). He points out that Aristotle's metaphors reside amid things and not in language. We could similarly argue that this occurs among farmers, who, normally, are not used to writing books but imagine links and relations, as we see later, among the objects of their world. According to Borges it is literary men and their play on words (*tropos*) who make metaphor become mental exercises or puns (*juegos de palabras*). Nonetheless, the point is that Aristotle's notion of metaphor was actually a

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[15] Among them van der Ploeg (1989) and Zimmerer (1996).

[16] M. Le Guern argued that every man's language aims to be reasonable and "metaphor certainly is not" (Parente 2000). The debates between the different named philosophers is derived mainly from this source.

[17] In their Language Sciences Dictionary, Todorov and Ducrot (1972) define metaphor as "[T]he employment of a word in a similar sense although different from the habitual one".

way of knowing, since it shows us new resemblances or analogies unknown until that moment: accordingly the metaphor is something instructive and favourable to our soul. In terms of perception, it is a new description of reality that conveys information (as does the classic scientific method of description that entails observing and measuring things).

In contrast, to Plato, who declared war on poetry, metaphor was an inconvenience rather than a philosophical problem (Parente 2000). He saw in it an obstacle to reason and the figurative language was to him the dangerous idiom of the poet; therefore he ostracised both metaphor and poetry from the disdainful domains of philosophy. Later, the Platonists no longer saw any relation between metaphor and knowledge, they argued, since figures (metaphors) are replaceable by literal utterances without losing anything as to meaning, then they are not indispensable.

However, using metaphors supposes a 'figurative' discourse. To Quintilian all discourse has a determined conformation, some particular presentation (its figure or shape). Todorov argues that, like our body that adopts some attitudes and leans in some particular way, discourses have their own way of being. Then it is not so strange that Aristotelians talked of figures when referring to metaphors; indeed words as *skema*, *conformatio* are related to a body's form. Vico, in his *Scienza Nuova*, went on to argue that men's experience was broadened through assimilating new objects to the data existing inside their own body and soul. In that manner elders talked of a *river's mouth* or of *earth's bowels*[18].

One might wonder why Platonists and rhetoricians were so uneasy with metaphor. It was because both Platonists and rhetoricians held moral tenets. To Plato the language of the immoral poet could pollute the mind and soul, and in relation to rhetoricians, Barthes contends that rhetoric is more than a technique and is instead principally a morality: "A recipe manual, encouraged by practical aims, and a code, a moral prescriptions body whose role is the surveillance (limiting and allowing) over the passionate language deviations" (as quoted by Parente 2000).

In its first instrumental stage (from Aristotle to Cicero) rhetoric was concerned only with the persuasive function of 'speaking well'; from its

[18] For Cassirer (1973) the metaphor is present at the same moment language sounds are articulated: "[I]n fact even the most primitive verbal expression requires a mutation from some cognitive or emotive experience to sound; that is to say to some means that is strange for that experience". Or as Rivano puts it: "to be in language is to be in metaphor" (in Parente 2000).

second 'ornamental' period (from Quintilian) onwards, 'speaking well' has its own value, its worth as such. This aesthetic turn entails, however, a major and important change: for instrumental rhetorical metaphors were thought of in the relation **means-ends**; for ornamental rhetoric the new established relation was between **form** and **content**. In this manner, the first metaphor image, namely **the figure** as a body is replaced by a later image: the figure as garment (Du Marsais). The latter means that there is an original and fundamental discourse which is dressed with colourful although not indispensable raiment.

Hence, according to rhetoricians there was an initial and specific discourse that could be literal or conveyed by means of metaphors, the latter being just elegant clothing that dressed the original idea: an imaginative, unusual or bizarre manner of saying what was already present, nude, in the original idea. For some philosophers of language such as Davidson (1995), metaphors hint or insinuate something but do not signify; therefore they demand from us somehow certain interpretative skills to be able to understand their 'metaphorical meaning'. Following him, the metaphor belongs to the field of practice and not to the realms of meaning. Resorting to some special use of literal meaning, the metaphor succeeds in hinting something as an image does, or a joke. Going farther, Greace (1991) states that metaphors constitute a special kind of equivocation, a transgression of conversational rules (taking as example the statement: "this barkeeper is an insect", which does not mean at all that the poor barkeeper is really an insect). In fact, the frontiers between literal and figurative language are blurred, and it is difficult to establish previously to what extent a statement is literal or metaphorical (the utterance "the coming Friday" does not mean that Friday is actually *coming*).

Since language, as Biese argued, embodies the spiritual and spiritualises the corporal, metaphors in the end become catacretic. That means, due to the absence of names or terms for certain 'spiritual realities', men assimilated to them 'sensible realities' referring to the former by names or figures of the latter (making metaphors).

Arguing against the rhetorical tradition that saw metaphor only from an aesthetic viewpoint (its ornamental function) the German philosopher Nietzsche returned to the Aristotelian doctrine. To him knowledge, in its philosophical sense, was no more than successive displacements from an initial nerve impulse to a certain image and, finally, to some articulated sound. Such displacements or translations were to him indeed, as to the Aristotelians, metaphors. Concepts accordingly were nothing more than the residue of some metaphor. In this vein the 'Truth' to Nietzsche was an outworn army of metaphors of which we have forgotten the original status and we deal with them as though they were things (i.e. reification). Knowledge then is just a collection of dead, fossilized, literalised metaphors. Nietzsche refers to truths as illusions whose metaphorical nature has been forgotten: metaphors without value and sheen like coins that have lost their imprint and are seen no longer as coins but only as pieces of metal (Parente 2000). The paradox in Nietzsche is that concepts and truths insofar as they are 'illusions' are not actually the origin –as philosophers thought- but only such an origin's metaphors. Hence from this point of view we will be faced all the time with metaphors of metaphors (*recursive descriptions* as posited by some scholars). Consequently and since a truth is only a worn out metaphor, the opposition between concepts and metaphors is not an opposition between the true and the false[19] but between the old (petrified) and the new (unknown and strange displacements). In this manner, to Nietzsche all knowledge is based upon metaphors and what we consider currently literal, not contaminated yet by metaphors, was once a metaphor.

More recently some philosophical schools have dealt with metaphor and its implications in direct relation to knowledge. For substitutionalist theory (Black 1966) metaphors do not hold any information and may be substituted by literal utterance[20] (they have no relation to knowledge). For the comparativist school metaphor is similar to comparison and likewise is not related to knowledge (i.e. it has no cognitive function). For interactionist theory, metaphor alters sensibly the meaning of the terms it is connecting, in order to obtain a figurative outcome. Consequently, the metaphor *is* a cognitive phenomenon.

For the interactionist school, metaphorical utterance does not substitute any comparison, rather, as Aristotle put forward it, it creates a new resemblance between the terms it associates. The analogy or resemblance does not exist before a metaphor is created (as a relation already known), on the contrary it is a result of it, of its displacement. Consequently, a prior similarity between metaphor's components (between focus and frame to Black[21] (1966), or vehicle and tenor to Richards (1969) is not a pre-condition for generating metaphors. When a metaphor is made there is an 'interaction' between the concepts it associates. Even our understanding of the metaphor's components is modified by the 'metaphorical projection', their meaning does not remain the same (Parente 2000). Accordingly the metaphor has a cognitive function, namely,

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[19] "Life is not constituted by binary elements but ambiguity, by clearings and shadows" (Arce, personal communication).

[20] However, the transfer from figurative expressions to literal ones (paraphrase) entails always a loss, be it in terms of sense, efficacy or even emotion, as Borges argued.

[21] Later on he opted for "principal subject" and "subsidiary subject".

the appearance of new concepts or, at least, new insights. It constitutes a 'cognitive instrument' which works to elaborate new analogies from dissimilar materials (belonging to different domains).

To grasp in a more comprehensive manner the cognitive importance of metaphor we must give attention to the relation between language and thought. Von Humbolt argued that language was closely related to thought "[T]he world we inhabit is that one we have been given by language" (in Parente 2000). In their turn, Sapir and his disciple, Lee Worf, worked on how language figures shaped a specific culture's world; they were concerned with the conceptual structures relationship of language, the culture that produce them and the sensorial experiences triggered by them. To them, metaphors are not generated in a vacuum, they correspond to cultural values and conceptions, to the way people experience the world.

Other authors devoted to the study of metaphor, Lakoff and Johnson[22] (1981), in alluding to the so called 'conceptual metaphor', asserted that "Our ordinary conceptual system, in terms of which we think of and act, is fundamentally of a metaphorical nature"[23]. To them the metaphorical concepts we utilise structure our perception, behaviour and relationships. According to their insights the metaphor enables us to understand the domain of an experience in terms of other, thus a metaphor can be grasped as a mapping of the encounter of two distinct conceptual domains, departing from human experience. To Johnson the metaphor was unequivocally related to knowledge[24], and he identifies two main features of it: first, it broadens conceptual categories; second, metaphorical cognition is supported by the corporal experience. Both authors take metaphor as a matter of thought and action and only subsequently as a matter of language. Furthermore, it is possible to state that metaphors not only conceptualise pre-existing realities but they actually create new realities and offer guidance for practice. In some cases they function as prophecies that come true by themselves (Watzlawick[25], 1998).

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[22] For Lakoff metaphors are not propositions, they are groupings of conceptual correspondences.

[23] Nonetheless, to be able to understand or decode a conceptual metaphor requires a cultural background which makes possible to interpret it and share its novelty.

[24] "[I]t (metaphor) is a process of human understanding by which we achieve meaningful experience that we can make sense of" as quoted by Parente 2000).

[25] Lakoff and Johnson offer a classical example: when the U.S. president stated that the energy crisis was the moral equivalent of war, this metaphorical contention immediately changed national economic and political behaviour. It worked as an intentional prophecy that in itself sought to become reality.

All metaphor highlights some concept's particular traits while it conceals others. This fact means that the use of metaphors is not neutral, above all if we think of political affairs, a realm where certainly no metaphor is innocent. If this is so we could discuss the veracity or falsehood of metaphors; however what is really important is their efficacy[26]: the perceptions, images and inferences they favour are what really matter. In this sense metaphor is an instrument of persuasion and if we insist in establishing its truthfulness we will be persuaded not to follow this path since metaphors are not to unveil truths but to connect them and thus deliver new ones, which is no more than a re-description of ancient descriptions of some –never spelled out– original truth[27].

5.1.2 Farmer's metaphors for representing potatoes[28]

The importance that metaphor has in Andean culture for representing and giving meaning to nature was mentioned at the outset of this chapter. I also mentioned that, for peasants, in an Aristotelian way, metaphors are the intimate and symbolic relation between things and not only between words (even though they certainly enjoy "*juegos de palabras*"). In representing potatoes the analogies used by farmers are numerous and of diverse natures. Such analogies have to do with plants, animals, places, colours, anatomical references, social practices and so forth. As with other Andean farmers, giving names to their potato varieties (baptising them) is not limited to native tubers, considered their own; they also christen those varieties introduced by other farmers, the market or even the hybrids brought by development projects (see Chapter 6). That means they **adopt** the new varieties (not in the technical sense but in the sense that they establish symbolic kinship links as when they become godfathers, for instance) making them part of the family and the community[29].

The various metaphors created by potato cultivators can be organised and we have attempted to set up a typology for guidance within this other diversity (of metaphors) that has been invented for making familiar the diversity in the field. The table below describes the different metaphor types used by farmers.

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[26] That tension, according to Beardsley, is something special, surprising and hard to describe and analyse and awakens us to discovering its meaning.

[27] Metaphors, as language to Wittgenstein, are something incomplete, relative and contingent; drawn and undrawn in the course of conversations.

[28] In Annex 2, Part Two, the reader can find relevant information concerning the qualitative data gathered for this and next chapter.

[29] Examples of these adoptions are foreign varieties named as "Colombiana" or *Azul ñahui* (blue eyes, a Dutch variety).

TABLE 16
Metaphor typology according to morphological characteristics and other attributes

TYPE OF METAPHOR	METAPHOR	CHARACTERISTICS
Sociocultural meaning	*Nojch'a papa* (daughter-in-law's potato)	Potato with a lot of protuberances
	Machu Huanchi (Granddad killer)	Potato that is hard to swallow because of its dryness
	Gendarme	It has a helmet shape
Animal analogy	*Mono maqui* (monkey hand)	*Qoyllu* potato, purple with a fist shape
	Katari papa (snake potato)	Shaped like a coiled snake
	Pili papa (duck potato)	Its colour is yellow like the duck's whelp
	Lluthu runtu (partridge's egg)	With the shape and colour of a partridge's egg
	Khuchi aca (pig's faeces)	Similar to pig's faeces in shape
	Jamp'atu papa (toad potato)	Similar to a toad in shape
Human analogy	*Wawa papa* (baby potato)	It seems to have a baby's head, eyes, buttock, and so on
	Sonso runa (fool man)	Big potato that, as a fool, only knows how to grow up
	Llokhalla papita (boy potato)	Elongated potato
	Chola imilla (native girl)	Round potato
	Ch'asca imilla (star eyes girl)	*Imilla* potato with wide eyes
Vegetal analogy	*Ñojch'a papa* (daughter-in-law's potato)	It looks like *Puya Raymondi*'s flower (cactus)
	Rosita papa (Little rose potato)	Potato with protusions that resembles the appearance of a rose
	Puka t'ika (Red flower)	Refers to the colour of the variety's flower
	Yuraj t'ika (White flower)	Ibid
Cromatic analogy	*Puka huayk'u* (Red *huayk'u*)	Red skin
	Yana huayk'u (Black *huayk'u*)	Black skin
	Puka Toralapa (Red *Toralapa*)	Red skin (improved variety)
	Icari negra (Black *Icari*)	Black skin
	Yuraj kanchiri (White *kanchiri*)	White pulp
	Yana kanchiri (Black *kanchiri*)	Black skin
	Yuraj imilla (white girl)	White skin
	Yana imilla (black girl)	Black skin
	Puka waych'a (Red *waych'a*)	Red skin
	Pinta boca (Purple *qoyllu*)	Purple pulp. Eating it dyes the mouth purple
	Q'ory songho (Golden heart)	Its core is yellow

[30] In the region of Morochata, Ayopaya province, there is a potato variety called *t'anta wawa* (bread babies) potato: "those papitas are oval ih?, like the *t'anta wawas* they make for praying

Anatomic analogy[30]	*Puka ñawi* (Red eyes)	Its "eyes" are red
	Pestañera (with eyelashes)	Its eyes are like stars
	Azul ñawi (blue eyes)	Its eyes are blue (introduced Dutch variety)
Food analogy	*Rosquete papa* (Biscuit potato)	With a *rosquete* (circular biscuit with a hole in the centre) appearance[31]
Artisanal analogy	*Canastillo papa* (basket potato)	With a shape of a basket[32]
Geographic analogy	*Colombiana*	With reference to its origin (introduced hybrid)

SOURCE: Sociology Collective workshop 1999, Sociology Thesis workshop 2000, this research 2001.

Apart from the peculiar characteristics that differentiate potatoes from each other there are some interesting narratives concerning their names, which enclose particular stories and explanations for those names' origins. Thus, for instance, the daughter-in-law's potato was the potato given to future wives (daughters-in-law) so that they could demonstrate their skills in the kitchen. For applying this test the most important product, in alimentary terms, was chosen: the potato, which as we will see later on, is also viewed as mother, sister, and friend. The multiple protuberances this variety presents (see a picture of it in Annex 3) demanded excellent peeling skills, and represented a painful challenge for the potential daughter-in-law's fingers: going very carefully around each bulge, avoiding on impatient *k'alluda* (cut) and removing only thin peel. Thus, Doña Pastora from Qoari tells that:

> *It is really difficult for peeling, you know; for peeling. When I was going to marry don Bernardino I was asked to peel a basketful; my fingers hurt. I spent almost the whole afternoon peeling in front of my future mother-in-law.*

The "granddad killer" potato story tells us that some time ago an elder peasant went to eat this potato and, because its dryness and stiffness, he almost died choked,

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in Todosantos (Catholic All Saints' Day: 1 November); oval like them, white and speckled with red, flat (*p'altitos*). Due to that they call those potatoes *t'antawawa* (Justo López, Piusilla).

[31] Another name for this potato is k'ausillo: "[T]hat is like biscuits, like little rings are those papitas" (Juan Ruiz, Piusilla). All the information concerning *Morochata* (more specifically *Piusilla* and *Compañía Pampa* communities) comes from a thesis workshop directed by the author in the Sociology Career of San Simón University. Field interviews were brilliantly done by Carmen Ordoñez.

[32] In Piusilla that variety has the same name. Trying to explain the reason of so naming that potato, Casimiro Ruiz points out: "[I] wonder why did they put that name on it. It is perhaps this potato has a lot of eyes, like a basket (plenty of holes)".

> *My mother told me that this potato, the machu huanchi, (a peasant) already old had eaten this potato. As this potato is really hard to swallow, he almost died since he choked. Because of that, from that day on this potato has that name (*Bernardino García*)*

In their turn, *wawa papas* (baby potatoes), are motive of gaiety for farmers. When they find them during the harvest they become frankly content and say, "I have found babies!" With great satisfaction they explain the likeness between the potato and a baby: "this is his face, here you have his cheek..". In the case of *sonso runa* (fool man potato) they relate its size and volume with clumsiness and foolishness: "like a fool who just grows big but can't do anything despite his size" (Severino García). The *mono maqui* (monkey hand), with purple, almost black peel, is a potato that belongs to the *qoyllyu* variety, this potato has almost disappeared; it has this name due to its resemblance to closing fist of a monkey's hand.

The *katari* potato (snake potato), from the *luki* variety, has an amazing resemblance to a coiled snake. It has a long pale body, its upper end presents a flat triangular head shape, typical of snakes. Because of its texture and bitter taste it has an analogical relationship with the snakes' poison.

There are other ingenious metaphors created by peasants from other communities as Piusilla and Compañía Pampa in the province of Ayopaya. They used to have a variety called *pig snout*, "It was like the pig's snout, however we made it disappear" (Casimiro Ruiz). They had also the *alma papa* (soul potato): "That one was oval, big. There is also a red variety. I do not know why it is called that; it does not dye your hand" (ibid). There was as well the big "black mama" (*yana mama*), "It grows big and black, with wide eyes and yellow heart" (ibid). Then there is the *phureja* papa that grows up and boils quickly (bursting like flowers when boiling[33]); the *moceña* (young woman) that is a little yellow tuber; the *ajawiri*, another oval potato; the *sutamari*, red, flat and with a soft peel. One of the *lukis* is called *luki qeto* "because it is like the donkey's small shoe"; and, in general, "potatoes looks like people's heads, ih..!" (Casimiro López).

As we have seen, peasants often know the story or the anecdote behind their varieties' names. However, there are a number of varieties whose name's origin is unknown (I ask myself, why did they give it this name?), nor do all peasants, as we will see later, have the same knowledge of potato varieties. The same happens when denominations comes from technicians or research centres. When farmers are told some introduced variety's name they normally do not know the reason for that name:

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[33] T'ika, t'ika revienta (Casimiro Ruiz, Piusilla).

> *The Robusta (robust) has been here for two years, the Perla (pearl) likewise only two years, and the India as well. All three have appeared at once. I do not know why (they have those names). They told us directly 'they are called this' (*Tomas Villarroel*).*

The manifold analogies, the stories and anecdotes referring to human behaviour, cultural tests, technical skills, institutional challenges and social relations show us that it is in language that all the normative of names and actors' agency lie upon. In the specific case of the daughter-in-law's potato there is a metaphor of age, skills and conditions for marriage. Here we find, on the one hand, the girl's agency (able or not to pass the ritual test or doing something else with respect to it), on the other the institutional marriage norms that set up the rules and conditions. Nevertheless, one may argue whether, as Wittgenstein contends, all reduces to language. *Al contrario* language constructs (their nominal elements) can be seen as a result or reflection of actors' conceptions and practices. Practice as agency, and norms as institutional prescription or technical requirement acquire meaning in language and through this, translation or displacement, construct identity, local and cultural identity. Metaphors then are more than "*juegos de palabras*", a linguistic issue, they are above all the figurative and inspired expression of human agency.

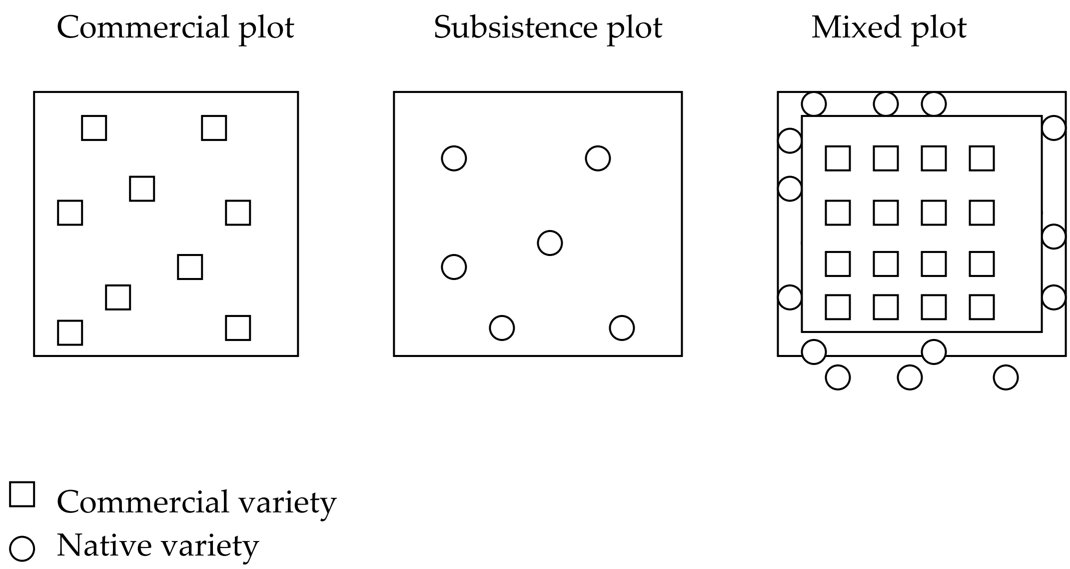
5.1.3 The "dual metaphors"[34] on soils

The soil is the area or plain on which cultivated varieties are ordered. Sowing practices conform to peasant goals, which means setting up certain criteria for locating the different varieties in a particular plot. When the plot is destined for the market, it is normal for it to comprise only one commercial variety. For the native tubers destined for household consumption it is quite common fore many varieties to be sown in the same field. Under other criteria, when commercial and native varieties are distributed in the same plot, the former cover almost the total plot while the latter will occupy only the edges. Quite clearly we are dealing here with a 'commercial plot' whose 'periphery' is used for the inclusion of native varieties. The number of varieties actually depends on the plot size –and, as we will see, on the economic revenue. On average, a plot is approximately a hectare of extension for commercial varieties, (areas for native ones are considerably less) in which up to three varieties are sown. One might say, for instance, that because of its economic importance the

[34] As already mentioned, the dual differentiation idea is worked out by J. D. van der Ploeg throughout his studies on potatoes in Peru (1989, 1990), and more specifically in relation to soil classification. What this author wants to emphasise is the fact that these metaphors are organised in dichotomised or opposite pairs in relation to something, in this case, soil. They could be seen as binary metaphors as well (since they denote contrasting, opposite attributes).

waych'a variety can cover half a plot, a Dutch variety the other half and, over the stony edges invaded by herbs, some native variety. Native varieties, as we will see, are not limited to 'peripheral' production but are, on the contrary, a central part of agricultural production. Such varieties hold their own privileged production spots, which can be seen as 'productive verges'. The average for land tenure in Qoari and Boquerón is more or less three hectares of which two are cultivable[35]. The ordering modalities of the plots depicted above are illustrated in Figure 9.

FIGURE 9
Distribution of varieties one plot



It is significant to highlight that the criteria for mixed cropping different potato varieties are not at all homogeneous. Although most peasants perceive sowing various varieties in the same field as common practice, some have a different opinion. Analysing at first the opinions in favour of cropping a number of varieties together, we find the following reasoning. It is possible to crop in this manner since potato varieties get along with each other. The outcome, commonly, is good even though sometimes one variety grows faster than the others. Luisa Córdova from Boquerón did not know why this should be the case but suggested "maybe one sprouts earlier than the other". This practice is appropriated for commercial plots where only the edges are used for native varieties. However, some farmers sow native varieties in the middle of the commercial ones as Guillermina Rocha –also from Boquerón– does: "Q*oyllus* (native variety) we sow mainly on the corners, sometimes at the centre surrounded by the *waych'a*, mixed up. When we have one variety just this one we sow, if there is another *papita* ("little potato", referred to with

[35] This information was obtained from the focus groups organised in each community.

affection) we sow that one as well". To some farmers it is important to separate each variety from the others if they are to be sown in one plot:

> *In the wata tarpuy (year's sowing), I mean now, we are cropping puquina, india. In the same plot but apart from each other; lets say: below, toralapa; in the middle, robusta; up above, india. They sprout fairly. The robusta and india resist prettily well, they are beating the toralapa (…) the toralapa is getting tired, it does not produce well (*Jorge Villarroel*).*

Accordingly, though there is tolerance and good relations among potatoes there is also a sort of competition between them and stronger potatoes impose themselves on the weaker ones:

> *Potatoes get on with each other, however there are some that do not have strength, some grow a little bit, and others grow high. However they get along with each other reasonably, their growing depends on the seed, there are some watankitos (strong seed) that grow a bit higher* (Juan Ruiz*).*

Their different susceptibility to disease is another reason to keep them in separate spots inside a common plot:

> *(A good way to sow) would be: waych'a and toralapa together, separate from qoyllus, because they get ill quite easily. The waych'a remains healthy when the qoyllu gets ill, burned by the t'octu (Phytophthora infestans) (*Celestino Vegamonte*).*
>
> *Another reason to separate varieties is that harvesting is easier: "You have to sow them a little bit separated. Thus digging up is easier, you get pure qoyllitu on the one hand and pure waych'ita on the other". But in the end, what actually seems to define the number of varieties in a commercial field is the revenue the farmer will obtain from them in the market:*
>
> *It depends ih! Down here, to get a little advantage (benefit),we cultivate just one variety, in the llojchi sowing. At this time we sell more and prices are higher for the waych'a than for the toralapa; that is not convenient for us. The one which has a higher price, we go for that one* (Jorge Villarroel*).*
>
> *Against cropping different varieties together was the view that mixing varieties is like disordering the field or the production space. Other farmers expressed the view that the kind of land each needs differs, native varieties require better land than exogenous varieties: "We sow qoyllus mixing them; the waych'a in other spot. W sow qoyllus where land is good (thañusito), over there and not in large plots, but only in 100 or 50 square meters plots, we sow qoyllu only in that area".*
>
> *Farmers who reject cultivating different potato varieties together also do not like to associate potatoes with other crops. They think that they will fight with each other: "If*

*we mix broad beans and potatoes they can suck up, absorb (ch'onkar) each other. Beans can absorb potatoes and then potatoes will not have a good yield ah!" (Constantino Dávalos). They also argue that for harvesting potatoes it is not good to have other crops in the field: when potatoes are ready for harvesting broad beans and vetches are still blossoming ("and cows come and eat them"). They say "Ch'ajchu (mixing) is not good, sequential cropping is better". Nonetheless even those who do not share the idea of associated or mixed cropping are used to practicing it: "No mixing, but over there on the very edge we cast barley seed (cebadita), so the animalitos (animals) can eat, the horses and their foals that need to gain weight" (Tomás Villarroel); "the edges we put for maize, for choclito (fresh maize) in season" (Jorge Villarroel, Qoari); "We are not used to mixtures, all around the plot we sow cebadita like an enclosure for the animals" (*Gregoria*).*

After this digression on potato cropping patterns, I now concentrate on soil metaphors. Considering local or folk soil taxonomy, we find that a first major division –a dual differentiation as argued by van der Ploeg– is made between 'healthy' and 'sick' soils (*sumaj jallp'as* and *onqoy jallp'as*). The latter mainly consist of the fairly flat lands surrounding the households or located nearby, beside the road[36]. An obvious question is why the sick soils are those around the farmers' huts or close to the road, which, taking into account the advantages as to their proximity and flatness, are the fittest for agriculture? The answer is, precisely because of that. Since plots close to the house or road are suitable for intensive, commercial production, facilitate transport and the visits of development project technicians (engineers often do not like walking too far or do not have enough time to visit terrain), they become "ill", contaminated with dieseases, nematodes[37], and chemicals. Carlos Alvarado, from Qoari, a specialised potato producer and surely a person who knows the most on potatoes in the region, states that native seeds become 'burned' by the chemicals present in the soil when someone ventures to sow them in such land. The problem of these lands close to the road is also highlighted by the director of SEPA, engineer Augusto Urquieta, converging in this manner with farmers' perceptions:

(There is) an intense potato traffic. Without considering fito-sanitary aspects, enormous damage has been inflicted on the zone by infestation of soil parasites. All this is because of mono-cultivation, excessive, intensive soil use without rotations. The easy access zones have their advantages but these access facilities are also prone to destroy and that is what has happened. For example, if you see from Toralapa up to Kilometre 100, there

[36] These lands are also and very often *ch'uas*, that is, washed by excessive irrigation

[37] Nematodes are microscopic organisms that live in the soil and feed from plants' roots, preferably from those plant species desired by them. Potato crops are an excellent lodging for some nematodes that number up to 68 species. Three varieties constitute a real problem for the formal seed production system because their presence entails declassification, loosing the "certification" for producing potato seed according to certification norms in Bolivia.

> *are almost no potato crops (!) there are broad beans or tarwi because they have used the soils excessively. The Nacobus, and the Rosario have disseminated in a very high degree. So, irrigation, easy access as facilities mean also disadvantages if you do not know how to manage them.*

Nevertheless, this is not an obstacle to continued production of some varieties in these soils insofar as they are bound to the market. As long as farmers have their own 'favourite' native varieties for their meals they do not care so much about the kind of produce they sell to the urban people[38]. For sowing their highly appreciated varieties they seek particular places: "I search, then, for good *tierritas* (land) for the seed (…) one has to search for land in the heights" (Carlos Alvarado). These highlands, that we have called "*confín productivo*" (productive verge), mean a strategic exile for the native potatoes; a banishment that renders them invisible to NGOs, state agencies or the market, and expresses the farmer's autonomy from all of them. Peasants call such exile lands *purumas* (virgin land) and they are characteristically stony and steep. They are considered 'virgin' according to farmers, since they have never been sown[39]. Don José Castellón, from Qoari Lagunillas, says:

> *Puruma is for huayk'u (…) puruma is when the land has plenty of grass and is only then ploughed; over there, all the time, we leave some room for huayk'u. Every year we leave at least a bit for huayk'u* (José Castellón, Qoari Lagunillas*).*

As it will be shown *purumas* do not mean only a particular location but lands that keep or accumulate richness, from which the native potatoes will profit. If sown elsewhere these varieties would not give a good yield, as a farmer from Piusilla argues. According to him these varieties only accept *puruma* lands if they are to yield, if they are sown in flatter, warn out lower land, the outcome will certainly be poor:

> *I do not sow qoyllus (native variety) since what they want more is puruma land, up above. Here, on the low lands they only produce very small tubers. I do not sow them either in wata t'arpuy, or in the temporal season (production cycles in a year) (*Casimiro Lopez)[40].

Because of their scarce production or the difficulties faced for getting a good yield from them, they call them *qoyllus "sajra papa"* (selfish potatoes). In fact –

[38] Justo López (Compañía Pampa) says: "For selling we do not care about potato's eyes but we consider the size (of the tuber) and it must be llusk'itu (with a smooth surface), that is all".
[39] In other communities such as of Piusilla and Compañía Pampa *puruma* has a broader sense signifying sound or rested land
[40] With some additional explanations, Victoria Claure, from Compañía Pampa tells us: "Up above they yield well. Here, in the low lands, they do not want to produce, they disappear because of the heat, it dries them up".

as they argue– *huayk'u* varieties are oversensitive and become offended or annoyed quite easily. Accordingly farmers do not usually produce *chuño* with them, but use them as "boiling potatoes" (potatoes that are cooked with their peel) not just because of their culinary properties but because if you peel them, then the next time they will not yield: "*mana pelanchu qoylluta porque mana poqhonchu*". In addition potato cultivators are unwilling to commercialise such potatoes due to this oversensitivity (someone might tread upon them during their transportation by truck, or they might be crushed at the marketplace). The unavoidable result of the qoyllus' resentment is –as alleged above– a poor yield in the next harvest (Severino García).

Purumas, with their properties of virgin fields (although due to their location, slope, and stony conditions they would be hardly considered as appropriate for agriculture by technical criteria as we will see) are reserved for the fragile and beloved local varieties. Sick fields that demand more chemical treatments and mineral fertilizers to continue producing are destined for commercial varieties, which are far more resistant to such conditions. Native varieties are not only more susceptible to chemically saturated soils but they require more attention (demanding heavy work for preparing the field before sowing, and permanent surveillance until the harvest). For farmers these varieties are much too demanding and even capricious in their preferences for a particular soil type:

> *Huayk'u, for instance, needs black earth. I believe that the soil must also have its taste mustn't it, and it can be enjoyed. Luki wants earth with a lot of leñita (firewood) and water; over there it yields well… Yes, potatoes have their preferences too, their likings (*Severino García*).*

One can see that *huayk'us* are among the more demanding potatoes. The introduced commercial varieties, the *waych'a* and *holandesa* seem to adapt well to the zone's natural conditions; and their demands as to soil are few. According to Moisés Rivera, from Boquerón:

> *For waych'a and holandesa you do not need puruma, they produce simply anywhere, you only have to put there chemical fertiliser and manure. On any kind of land: yellow or black, waych'a yields without any problem.*

From the technical point of view things are not so romantic for *purumas.* According to this assessment they include any kind of soils (rich or poor) no matter what the slope, or location (often too high) or the lack of irrigation. To opening a *puruma*, a bit of land anywhere suffices. "*Puruma* is opening new plots in high locations, without considering the slope, irrigation, soil class, distance with respect to the house. To open a plot just a piece of land is necessary. At least one plot per year is opened (in Qoari)" (Chino 2002)[41]". Nonetheless from the technical viewpoint there are some counter opinions counter as, for instance, that of Carmen Camacho, also an agronomist, interviewed during her postgraduate research fieldwork. She, adherent to the "*crianza de la chacra*" (bringing up or nurturing the field) tenets coming from some Peruvian scholars, told us:

> *Don Carlos (Carlos Alvarado, the Qoari farmer "expert" in potato seeds) knows exactly, by the soil colour, what type of potato he has to sow, in what spot and, in that sense, he is "bringing up" soil each year. Hillside soils, he knows by the land colour, and Doña Salomé (his wife) says: "It is quite clear how the land colour is asking you to sow there a particular sort of potato[42]". Potato cropping is useful for soil recovery on hillsides. "On sloping lands (you have to sow potatoes there) at least for three or four years. You go to some place like that, full of stones, and you say this is not going to yield anything, but you carry on, you sow potatoes, and carry on and on and after some four years (those fields) are totally fertile lands".*

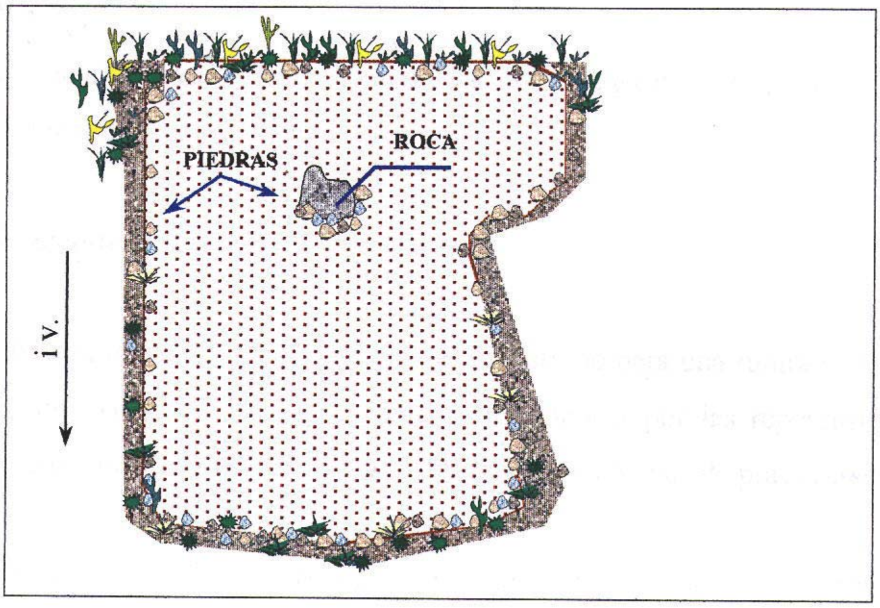
What is interesting and illustrative is the detailed description the technical view provides when observing the tasks for opening a *puruma*:

> *To open up purumas two sizes of pickaxes are utilised (a big and a small one) and a crowbar. With them work starts from the foot of the plot, removing stones and revolving the land with the help of the big pickaxe (until a depth of 20 to 25 cm.), crumbling clods full of grass[43]. Subsequently the removed stones are accommodated; small stones are put in the neighbouring edges; the bigger ones are carried down to the lower edge with the help of the crowbar for constructing a sort of wall. If, inside the future plot, there is a big rock it is left there and other small, medium sized and large stones are heaped around it. In this manner, indirectly, terraces of gradual formation (terrazas de formación lenta) are constructed (*Chino 2002*).*

Figure 10 displays some features of *purumas*.

[41] The work of Chino, engineer agronomist, corresponds to a thesis workshop directed by the author at PEIRAV (a programme of research and education on Andean irrigation), in the Agronomy Faculty of San Simón University.
[42] We will see later a 'combinatory' relationship set up by Morochata farmers between potato and earth colours.
[43] The small pickaxe, called a "cock's beak", is used for crumbling, the crowbar for removing stones and a hammer for breaking stones.

FIGURE 10
Opening of a new *puruma* plot



Habilitación de una nueva parcela "puruma"

Source: Chino 2002

In spite of the first contention from the technical viewpoint I would like to stress *purumas'* strategic importance. *Purumas* are productive verges in the heights that remain safe from degradation and chemical pollution, keeping alive local biodiversity through a protective exile that, as already mentioned, make them invisible as a diversity source.

A second major division among soils has to do with, precisely, their colour. Differences established by the soil's colour are associated with temperature (in the same way physicists use colours for differentiating sounds). On the one side are the hot soils and, on the other, the cold. The former are those presenting red and black colours, and the latter are yellow soils. Black soils are allotted preference for native varieties such as *huayk'us*; red earths are for *waych'a*; yellow soils (cold) are for *waych'a*, *holandesa* and bitter native varieties such as *runas* and *lukis*.

Hence, the taxonomic criterion applied by the farmer implies, in this case, a correlation between colour and temperature. Such a taxonomic pattern, based upon colours (leaving aside temperature concerns) is not actually so different from the technical criterion according to which soils in this zone (for the communities of Qoari and Boquerón) present colours that go from dark brown and grey, through lead, to light brown. Likewise, following that criterion, soils here have a franco-clayey texture, a fine crumbly structure and an arable layer between 0 and 19 cm (CIDETI 1991, see also the soil description presented in Chapter 4). Apart from these technicalities what attracts attention is the existing differences between farmer and technical perceptions on soil colours.

Farmers see red, black, and yellow soils[44]; technicians see grey, lead, and brown ones. Arguments that might explain these differences should not posit that one of them (the technician or the farmer) sees erroneously or defectively. Such differences conform to the conceptual elaboration existing behind each one's perceptive activity: the farmer's metaphorical approach identifies stronger, vivid (primary) colours; the techno-scientific perspective, although more precise as to tonalities and degrees of colour, identifies more grey and dull colours. Why that is so is difficult to know.

A third difference in soils, as hinted above, is related to their altitude. These located higher up are taken as healthy soils; those situated lower down[45], close to the road, are seen as sick or contaminated, which, given their depleted fertility, need more help from man (i.e. more chemicals) to continue producing:

> *Down there is a lot of disease and that land is already bad. It has already lived its life, it has already given its production so many times; it is tired, it needs more chemicals. I mean, it needs help, five times a month we have to fumigate those lands. It is a pity… (*Bernardino Garcia, Qoari*)*

It is acknowledged that there is *man made land*, so one could argue that there is also *man destroyed land* (as engineer Urquieta seems to imply above). Referring to the 'low lands' of Qoari and Boquerón, it is easy to blame development projects for the current situation. However they are not the only guilty parties: the market, urban growth, the new road and improved means of transportation, and finally the peasants' economic objectives are important factors that have contributed to soil degradation.

Looking at the local techniques for opening *purumas* in the highlands, and to the 'counterwork' of unmaking or damaging land downhill at the other extreme, in the area destined for commercial production, which really constitutes the opposite pole as to 'farming style' we must give attention to

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[44] In Chino's account farmers 'see' also *oqe* (brown or more exactly dirty) earths.

[45] They are not strictly 'low lands' since they are situated on between 2.800 and 3.200 m.a.s.l. approximately. Highland *purumas* are situated at up to 4.000 m.

the dichotomised issues of immanency and social construction, in this case of soils. There is immanency present in *purumas* and flat lands: the presence of black (fertile) soils and steepness for *purumas*; and flatness and less fertile soils for commercial fields.

Only over these immanent conditions are men able to construct (or destruct) something socially, they cannot construct whatever they want. On the basis of the immanent characteristics of the *purumas* a new plot is opened up by means of 'social' work and the techniques described above. In an opposed process the immanence of the flat lands is destructured, degraded or ruined also through certain social practices –although this outcome is the result of a much more complex processes. The former might be termed social construction and the latter social destruction. The following table summarises the soil's features so far commented upon and includes some other relevant aspects.

TABLE 17
Peasant taxonomy of soils

Type (Local nomination)	Description	Altitude (masl)	Classification	Community	Sowing date	Sown Varieties
Purumas	Virgin soils, stony, steep and high	Approx. 3450	Very good	Qoari Alto	September, May	All natives
Yana jallp'as	Black soils, very hot and low	Approx. 3200	Very good	Qoari, Boquerón K'asa	September, May, June	*Huayk'us*
Puka jallp'as	Red soils, hot, they tend to get dry, require a lot of irrigation. Low lands	Approx. 3200	Good	Boquerón K'asa, Qoari Bajo	October, May	*Imillas, Waych'as*
Q'ellu jallp'as	Yellow soils, cold and a bit swampy. High lands	Approx. 3350	Regular/bad	Qoari Lagunillas, Boquerón K'asa	September, May	*Lukis, holandesas blanca, runas*
Mixed soils	Of diverse colours. Low lands	Approx. 3200	Regular/bad	Qoari Bajo	October, March	*Waych'a, holandesas*

Source: Rivera 2003[46]

[46] I have to mention and acknowledge the important fieldwork conducted by Carla Rivera during the collective research workshop and also in thesis workshop, under my responsibility. Her interviews were highly valuable for my research. I have to mention and to thank as well Edward Menchaca, another student of the thesis workshop at that time, who carried out an impressive thesis work on the topic of intervention in Tiraque, a research also very useful for my study.

As is evident, the second column of the table summarises the soils' main characteristics. The third presents soil classification which takes as altitude as their basis. The adjectives high/low utilised in the second column correspond *grosso modo* to the altitudinal level specified in the third column.

Following this third classification, highland soils are generally considered by farmers as better than lowland soils. Paradoxically, soils labelled as very good (*yana jallp'as*) or good (*puka jallp'as*) are lower; and soils such as the yellow ones (*k'ellu jallp'as*), that are seen as bad and only suitable for hard potatoes such as the *luki*, *runas* or *holandesas,* are higher. Scholars dedicated to Andean anthropology have extensively studied this ambiguity, or contradiction existent in Andean culture. They have discovered that 'high' and 'low' (*hanansaya/urinsaya* in *Quechua*, and *alasaya/majasaya* in *Aymara*), in terms of quality but also in terms of salience and hierarchy, may be reversed according to geographic criteria. This sort of "logic" comes to light again in the Bolivian study but revealing in this case that these oppositions are reshaped or reworked by the new social and economic circumstances. This means that local knowledge is not traditional in the sense of simply iterating ancient classifications or formulae based on past hierarchies, but is re-ordered by taking into account current local conditions and peasants' experiences.

Thus –in Qoari and Boquerón– the traditional division between high and low lands is, to an extent, modified by the changes introduced through social practice in one of its dimensions: namely the lowlands. Historically inconvenient and detrimental practices have critically affected the condition of these lands. How can we read this fact or consequence? By saying that the lowlands, which were already said to be bad, have been worsened by such behaviour, thus reinforcing the existing division between low and high lands? Or, alternatively stating that the lowlands, which were highlands in regard to quality, were harmfully degraded and converted into 'true' lowlands? In accordance with the second reading, the highlands (*purumas*) remain as such by double argumentation: they are the 'better' and are on the 'top' (this last in its figurative as well as literal sense). If we take into consideration the other variables (colour and temperature) in a sort of taxonomic triangulisation, then we notice that dark (black or red) and hot –that means good– soils can be either above or below and the same goes for pale (yellow), cold –bad– soils. Consequently we find that the best soils are those in the highlands, but not necessarily nor all the time. That is, there are lowlands that are highlands; good (dark and hot ones); and there are highlands, the yellow and cold ones; that are low: bad. Here we come to realise how ambiguous, diffuse and contradictory local knowledge can be.

The fourth classification of soils has to do with temperature. There are hot soils, which are good; and there are cold soils, which are bad. As already been pointed out both colour and temperature are closely correlated, though as van der Ploeg argued, hot or cold soils are not always described as such. Under certain conditions and in relation to certain crops hot soils can become cold and, vice versa, cold soils can change into hot ones.

Reviewing other aspects present in the previous table, we can see that on the top are the best soils descending gradually to the worst ones. As stressed before, better soils (*purumas*, *yanas*, *pukas*) are allotted to native varieties, and poor soils to hard and resistant ones, native (for *chuño*) as much as commercial. Sowing periods for all soils stretch out over a wide time range. For commercial varieties this means a number of production cycles (assuming there is irrigation); and because they yield quickly farmers call such commercial varieties *qinsa quilleras* (meaning they yield in three months.

5.2 Peasants and their concern for theory

For some authors (like Bourdieu and Koningsveld according to van der Ploeg) farmers cannot develop and deal with theories. Instead, they develop a knowledge that goes "from practice to practice", i.e. empirical and instrumental (Ploeg van der 1989: 147). This may be true if we think of theory as a rational discourse, a conceptual construction or critical tenet, as M. Horkheimer has sought to do in his *critical theory*. In the ancient philosophical tradition, however –as in German idealism as well–, theory was a cosmological contemplation "once the divide between being and time has been consummated" (Habermas 1986: 159). Such a division meant the foundation of Ontology, by Parmenide –and developed later by Plato (in his *Timeo*). Theory, in this way, was seen neither speculation nor criticism: it was an anchorage for *logos* tying it to a space freed from instability and uncertainty, and leaving for *doxa* "the kingdom of the transitory" (1986: 160). Likewise Schelling thought of theory as a form of contemplation in which "the herald alienates himself (from the real world) entering the sacral befall"[47] (1986: 159). This type of theory assimilates the philosopher to the cosmos by means of *mimesis*, when he gives personal expression to the cosmos' harmonious succession: "Theory induces the soul to assimilation to the orderly movement of cosmos, through the praxis of life: theory mints in life its form, it reflects its image in one's attitude and one follows its discipline in the *ethos*" (1986: 160).

[47] In its origins the word "theory" was related to *theoros*, the representative that Greek cities sent to the festivals.

Thus, if theory is taken in this manner, as special relation with life and cosmos (nature, men, gods), and not as a set of abstract ideas nor specialised knowledge, we can accept that farmers are able to elaborate theories for their local practices. Moreover, if we take some of Aristotle's insights we will see that peasants effectively do theorise. To this Greek philosopher human activity is split into two types: *praxis* (intransitive activity), the pure individual activity; and *poiesis* (transitive activity), an activity that delivers some product in the end (Savater 1995: 17). Virtues and courtesy formulae are, in the terms of Aristotle, practical things (we might wonder if vices and pleasures are also practical)[48]. Arts and techniques, as Heidegger comprehensively reminds us belong to *poiesis*. In this way we could say that potato cultivation is an *art de la localité* (agriculture as craft[49]) and its transformation into *chuño*, a particular technique that will be analysed later, both activities also belong to the domains of *poiesis*[50].

Before referring to farmers' knowledge concerning potato cultivation we have to remember that the notions, theories, metaphors, and orderings unfolded by farmers in the course of their cognitive activity are based upon their own ways of perception. As advanced in chapter two we must also remember (the "new biologists'" narrative) that perceptions cannot be seen simply as a representation of the external world. They are more complex than that, structuring our relation with nature in a creative way (we enact things and nature, as Varela would say). However, as we are not able to perceive of, or register everything, that is, the whole picture; then perceiving is also *not to see*, and here the problem resides not in not seeing but rather in not seeing that we do not see. If perception is to act, then we have to know (learn) we are blind (in relation to many things, objects, situations), and acknowledge this. We can interpret only what we understand; as long as we cannot understand something it is like not being able to see it, as if it were non existent: blind to our own blindness.

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[48] Nonetheless we should not forget that as Arce (2000) argues, one thing is practice as a matter of reflection for philosophy and another is practice as social product: practices are not independent or isolated affairs, they are closely linked to values, institutions, normative repertoires and cultural patterns.

[49] Van der Ploeg (1997).

[50] In talking of similar topics, Marglin (2000) emphasises the divide between *episteme* and *techne*. Whilst *episteme* is logical and deductive, *techne* springs from intuition and inspiration, and is based over authority, trust and experience. The latter entails a personal network, a process of continuous commentary between actors, constant reinterpretation and hierarchical but fluid relations. The former 'knowledge system' is characterised by impersonal transmission (school), supposes rules of deduction (there are rules as well for changing the principles), and is of the type zero/one, equalling the outside and the inside.

In a similar direction and more sociologically, Bourdieu (2001) argues that our representations of the world not only contribute to a vision of it but, fundamentally, to
its construction. They perform a symbolic work (of representation) through which social groups are produced and 'social agents' impose their world vision "or the vision of their own position within this world and of their social identity" (2001: 61). Thus social space is not the object of a neutral perception but an object of struggle between different agents to impose their world construction and representations (their own categories of perception), and eventually to act in consequence.

Notwithstanding, social agents "…are unevenly armed for imposing their world vision and particularly for acting at the level of denominations and institutions…" (2001: 62). This can be seen quite clearly throughout the encounters between so-called *techno-science* (Latour and Woolgar 1986) and local taxonomies originated from lay knowledge. In such encounters the 'weapons' of modern technology come out (ideologically) as legitimate versus the 'poverty', 'inefficiency' and 'incompetence' of farmer technologies.

5.2.1 Potato images, notions and meanings

Although it might appear difficult to ask farmers (who are supposedly immersed, totally, in practice) about something seemingly so abstract as the meaning of the potato for them, the representations and perceptions present in their responses during field work are frankly astonishing, clearly emphasising that perceptions are social and cultural constructs.

If the potato is female for peasants, how are they seen, firstly, by peasant women who live with her and give thanks to her? Margarita Hinojosa, from Boquerón, says: "the potato is like my companion, certainly. I go up, I go down, she is always with me; for she is like my mom". Pastora, from Qoari Lagunillas, confesses to us:

> *How is my feeling with respect to* la papa*? It is nourishment for us, you see. She is like my mother. She feeds me, makes me live; if not how could I go on living?*

This kind of image belongs to an ontological or symbolic level that expresses a vision peculiar of the Andean world where everybody, including things, is a relative. Such a kinship means that one protects and is protected, raises and is raised. Thus, it is not so strange that the potato is seen as mother, sister, bedfellow, a faithful friend that gives us life, keeps us alive, follows us, and goes along with us wherever we go. Although, as we will see later, there are much more 'objective' perceptions, of an economic nature, or more biological ('visceral') ones that refer to food security.

In terms of symbolic kinship the potato can be 'behind us', as a support as mother or protector, but likewise, 'before us', as a child that needs a 'fondness of care':

> *…[Y]ou can see it (potato) as a person, as a child, whom we have to take care of, protecting them from disease and from the rain; and when there is no rain we feel sorry for them (*Constantino Herrera*)*[51].

For men potatoes can be seen also as a wife:

> *I look after them as I do my wife, just like that. Otherwise they would not produce. Early in the morning I see if they need something; to do that I get up early. I care for them even more than for my wife or my children. They come first, when we have to irrigate we have to interrupt even our meals. That's how we live (*Tomás Villarroel).

As a living being, similar to us (recent human genetic findings state that we are not much more than a earthworm or a mouse), the potato is able to listen to us and we can talk to her (potato is female); thus, Andrés Ricaldez from Boquerón tells us: "From the *chacra* (plot)'s edge I speak with my potato crop, I see if it needs to be weeded and hilled up[52]". Aesthetic appreciation is not rare in the farmer's perception of the crops, neither the particular feelings that it inspires:

> *Potato to me is wealth; I do my tasks p'ijchando coca (chewing coca leaves). Potato is gladness and love. When it flourishes we do not want to move from its side, my family also feels such merriment and we ask someone to take a picture of us beside the blossoming field (*Teodocio Mamani*).*

The motive of sincere jollity and contemplative love, the potato flower's beauty is able to keep them beside the colourful plot and not want to move from there. As before an artwork, a landscape or sunset the farmer takes pictures of the family with the crop in full flower, aware of its beauty and

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[51] In a similar way, Casimiro López from Piusilla, tells us that potatoes are like children: "We take care of them as if they were our children, looking at them when they are good. Like our children, we love them. Right now, in the fields up above they are beautiful, they look like lettuce".

[52] The latter leads us, almost necessarily, to reciprocity relationships set up between crops and cultivators: "...(potato) has a life, I think it can be like a family can't it? It helps us, you see. To survive on our land, indeed (Severino and Bernardino García)

delighting in it intimately[53]. Potato as wealth means all this but it is also something more practical and tangible. The same farmer said earlier: "Potatoes are suitable for foodstuff, for maintaining the family, providing for children's study, for selling it in the marketplace, and for dressing oneself and offering to our guests".

We arrive in this manner at the economic dimension of notions regarding potatoes. The economic significance of potato is fundamental for all peasant communities around the region. Thus in women and men's representations this commercial valuation appears. 'To live on' potatoes does not mean only eating them every day, whether sophisticatedly enjoyed or with a certain tedium (to which we will come back later); it also means that the tuber is a very important commodity, which allows household needs to be satisfied ("Thanks to it I can buy clothing for me and my children", Tomasa García) and pay the labourers hired for a commercial crop:

> *We subsist on potatoes, this year the price of potatos has fallen so we have sold just a little (…) and day labourers, when they work, need coca (leaves), cigarette and chicha, and we cannot afford that; besides we do not have other income* (Pascuala Mejía).

Such an appreciation can lead toward a conjunction between mercantile and technical criteria, which indicates how the institutional discourse spread by projects leaves its imprint on good pupils. Note the following statement: "the potato to me is a benefit, it produces with irrigation and I give it treatment against diseases" (Quintín Montenegro). Another farmer's *"valen, ah!"* (it is valuable) expresses the commercial significance of the crop.

As a basis for local food security the potato leads to other kinds of perceptions, such as, "…Potatoes are necessary for food also for living, without potatoes we are not able to exist…" (José Castellón). There is a clear consciousness that the potato is nourishment's core and column, as Sabina Salazar (Qoari Alto) puts it: "I think that the potato feeds us day and night".

Due to that, despite the negative aspects one might find throughout this long and particular relationship with the tuber, in general it is seen as something good: "The potato will always be good for us, we not only eat it, we live on it, and it is what we produce" (Benedicta Mejía, Qoari Medio). The negative aspects have to do with a fate so inextricably linked to the tuber that it can be seen, to some extent, as a sort of doom.

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[53] Annex 3 presents pictures and drawings of potato plants and varieties (tubers), done by peasant women from Compañía Pampa and Piusilla (Morochata).

The monotony, boredom and weariness associated with eating potatoes all the time become visible above all for those families that cannot diversify their consumption via the market or diversified agricultural production. Geographical constraints do not always permit the cropping of other products. Consequently we meet with opinions which express a certain resignation: "The potato to me is… well, here we do not have vegetables, there are only potatoes, for it is the sole thing that we produce, and we live only on that" (Cristina Salazar).

> *We eat potatoes all the time, there is nothing else to eat here. Some times, once a year, we butcher a sheep; we also utilise potatoes as garniture. There are only potatoes to eat (*Benedicta Mejía*).*

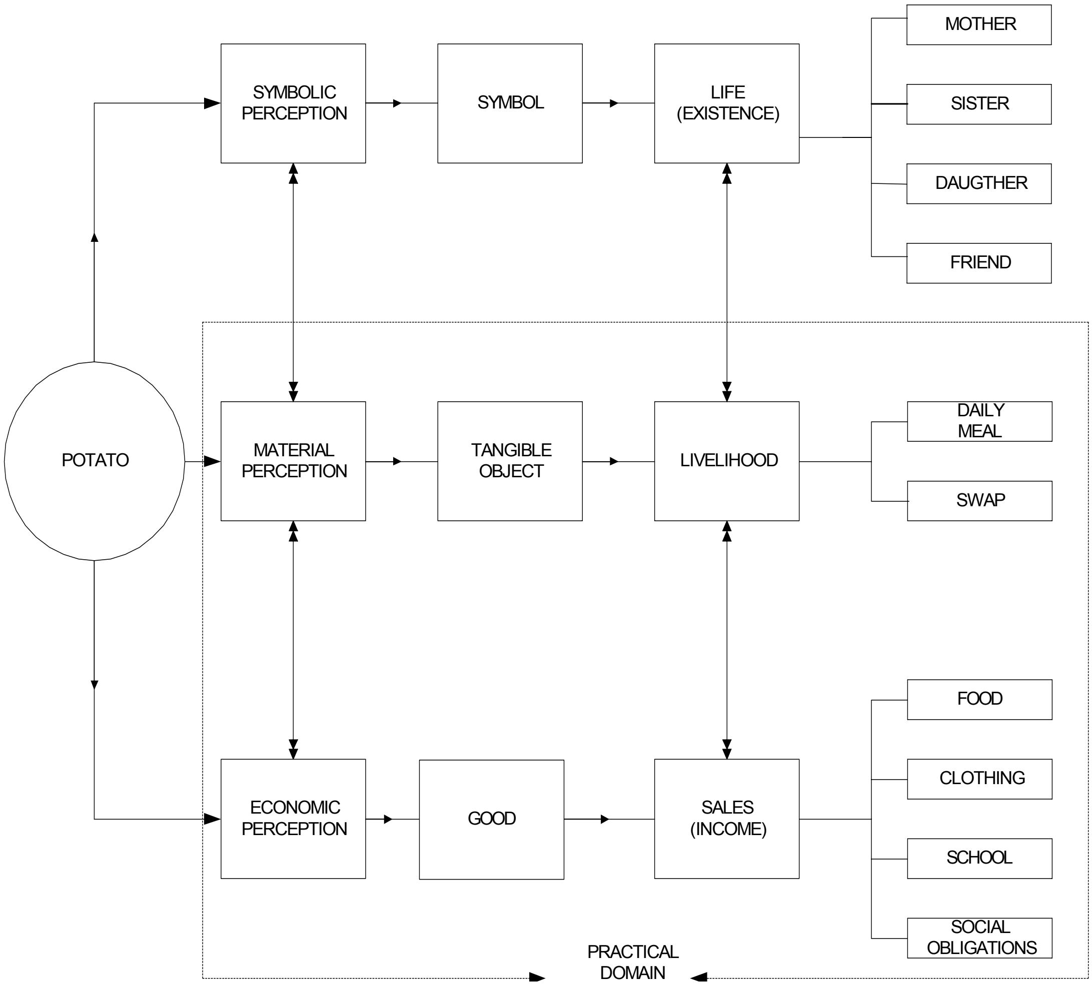
What is evident from the meaning attributed to potatoes by farmers (women and men) in the communities studied is that they feel their life and destiny closely linked to this product. They are born and grow up with it, linked to its cultivation (in both senses, its production and its culture).

Moreover potatoes are not alone, they come with other products such as maize. If there are potatoes then there can be other products because –due to their privileged situation in the Andean culture– they can be exchanged for everything, allowing the peasant household to get other products that fit in with its patterns of consumption: "We always live with potatoes, with them comes maize, we can swap them for what we need, due to the fact that potatoes are valuable" (Manuela Alvarado).

In spite of the tedium and monotony that potatoes may represent at times for farmers, they are highly valued and heartily appreciated: "potatoes to me are magnificent to eat, that's all we produce and they have kept me alive since I was born" (Tomasa García); "Potatoes are all things to me, potatoes give me everything, chuño and broad beans as well" (Albina Salazar).

As Sabina Salazar (Qoari Alto) asserts, potatoes are like a devotion and as any devotion this one encompasses on the one side comradely and esthetical esteem (affection and art: *techne*), and on the other, submission to its conditions and rules, to its restrictions and imposed 'dooms'. The figure below attempts to summarise the distinct perceptions farmers have developed about potatoes.

FIGURE 11
Farmers' perceptions about potatoes



We have seen that the potato is designated female. *Chuño,* for its part, is male but its technology and transformation also embodies *poiesis*. Like the potato it also becomes a close relative, adopting the metaphorical position of a father beside the potato-mother, 'he' being married to 'her'. What is interesting about *chuño* is the fact that, originally as a potato, it is female; once the technological transformation has 'operated' it becomes male. Thus local knowledge and technology are able to transform the identity and gender of the potato, generating masculinity to transform the potato, as mother, in its opposite and complementary figure: father.

> *Chuño to me is like my dad, we eat it jointly with potato. It is as it were married to the potato, you see. Eating without chuño is not pleasant… we always prepare them together (*Tomasa García*).*

Chuño, which is evidently more of an acquired taste, is as highly valued as potatoes. However, its transformation through a technical process has certain advantages over potatoes. For instance, it can be stored for much longer periods, which contributes to extending local food security over time. In that sense, Margarita Hinojosa (Boquerón) says:

> *Chuño is like potatoes for me, besides it keeps for longer than potatoes. After six months potatoes are no longer fit to eat, because they get old. So a bit of chuño lasts you for longer than potatoes.*

In terms of use and flavour, chuño is an extra dimension, an amplification, a variation added to the culinary possibilities of potatoes. Versus the eventual alimentary monologue, it offers an ideal complement, since it is precisely the husband of the potato, as Pastora García (Qoari Lagunillas) states: "Chuño is important, like potatoes, since food is not delicious without chuño". Some varieties seem to be specially 'designed' to be converted into chuños: 'I plant *luki* potatoes for chuño, because they're made just for that, they're *p'alta* (flattened) potatoes, they're *yaku yaku* (full of water), that's why they're just right for chuño' (Concepción Dávalos).

5.2.2 Methods of selecting tubers for seed and criteria for their classification

A certain confusion may arise when one refers to methods, techniques, criteria and practices: we will briefly sketch some differences and peculiarities which aid a better understanding of peasant local knowledge about potato cultivation. What seems to be the most general term, 'criterion', is taken as a norm or a set of norms for 'judging, estimating or recognising the truth' (García-Pelayo 1985:481). Thus, for example, the formal representatives of technical-scientific knowledge establish certain criteria for validating peasant and indigenous knowledge that is for recognising the *truth* of their methods and applications.[54]

This judgement or perception implies, on a more operational plane, a series of decisions, and patterns of identification and organisation (in this case, taxonomies which will be expressed by differentiating and ordering on the

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[54] Escobar sees validation as more than a simple process, technical or quasi-religious, of the revelations of truth. He understands it as a strategy of economics and power: the conceptual and discursive rise of 'biodiversity' presupposes the semiotic conquest of nature (species are no longer resources but rather reserves of value which research, knowledge and biotechnology can liberate on behalf of capital). Indigenous and peasant communities, seduced by this project, become guardians of nature-as-capital, in so far as *local kowledge is recodified in a utilitarian form by science* (Escobar 1998, my emphasis).

basis of seed properties). As is well known, methods are the set of steps, of proceedings, which must be followed to arrive at a certain target. To do so, certain techniques and instruments are required which permit the factual or empirical application of the same. To understand what a technique is, we will return to what Wittgenstein understood as such, a set of rules which need to be mastered (Ayestarán 1996b:113). For this author, a technique, as a regularity, is submerged by practice and becomes a custom, a habit or an institution. But, in this way, a technique ends up confused with practice (as we shall see) which is not very convincing. However, what is most important is the philosopher's identification of its four principal aspects: *regularity, action against theory, criteria of correctness* and *objectivity*. A technique is regular, that is to say, structural: although it may well originate from a theory or a position in the world, it is orientated towards action: the demands for correctness in its execution are usually objective and strict, and as Habermas argues, imply sanctions linked to its effectiveness. As regularity, a technique demands a pattern or model, which implies regular, uniform actions (skill and exercise).

Practice, from an ethnological perspective, may be understood as a set of actions which belong to a particular domain (Blanc-Pamard et al. 1992:348). Thus, agricultural, therapeutic or sexual practices will exist, each of them within their own domain. In general, practice is the application and execution of rules, carrying something out (the practice of a sport, for example, which brings us back to the ethnological definition). But it is also a habit, a use or a custom: e.g. burial practices (García-Pelayo 1985: 1547).

The central difference between practice and technique and which Wittgenstein did not manage to distinguish, confusing the two, is that the first is a social and individual action, and the second is an institutional model, that is to say, it is normative, likewise social but not as action or something which is actually being carried out, but rather a crystallised paradigm, something finished, structural.

Practice is technique in action but cannot be reduced to a simple execution or the invariable repetition. Practice brings with it re-creation, renovation, the perfection of the technique itself or even its abandonment. Arce, referring, strictly speaking, to social practices argues that actions, decisions and practices lead to the negotiation of values (what is correct and what isn't). This evaluation process is due to the fact that people attribute values to their practices and justify them on the basis of norms, 'establishing 'new' meanings and forms of interaction with their resources via the organisation of processes which may include mediation, adaptation, administration and transformation' (Arce 2000: 6).

In this way, the structuring and re-structuring of norms, values, institutions, social actions, and finally, techniques, comes about. The process indicated allows actors to develop their local knowledge, which gives them the capacity to intervene reality through their practices giving a new form and content to social configurations and their physical setting. On the other hand and going in the opposite direction, self-discipline and imitative iteration perfect practice as a reflection of technique, as a replica of the model such as occurs in acts and sports, where action seeks to become confused with and identified with the original pattern, as Wittgenstein understood, often seeking approval and recompense for the correctness achieved, for the performance of the execution,

With reference to agriculture, the term *technical itinerary* is often used, understood as '…a logical and ordered combination of techniques which permit one to control the medium and obtain a certain production from it' (Sebillote 1978). We can find a hybrid of the two tendencies indicated above in this itinerary. On the one hand, dominating the practice in *its domain*(field or sphere, agricultural in this case) brings this closer to its technical pattern (which is how one can understand the 'logical and ordered combination' implied by domination of the technique, carrying out in competent and perfected fashion and which is evaluated in terms of correctness and effectiveness). On the other hand, in Arce's sense, there is a strategic use of the normative system and the technical rules, since peasants are not interested, or at least not very interested, in social rewards – if they exist – for a faithful and perfected replication of agricultural techniques, but they do care about their productive effectiveness.

This strategic use implies directing their knowledge and techniques towards the targets which are fixed (or which they are encouraged to adopt), which may imply changes in techniques, modifying them, or abandoning certain practices. When necessary, for these changes, respective social recognition or legitimation is sought for. Thus, for example, the abandonment of Andean ritual practices in agriculture on the part of peasant converts to 'Christian' (evangelical protestant) churches obeys the new goals and conducts established by the farmers, which are backed up by religious and moral justifications and which also include an institutional reward. In the light of these considerations, I refer to the practices and techniques used in the selection of potato seed and the criteria used for classifying it.

5.2.3 Selection of seed tubers

In the Andean agricultural calendar, the farming year ends when winter begins, the time for cleaning the house, washing the crocks, purifying the body; but also the time of evil and sickness, of the *kharisiri* who wanders the roads in search of victims. When the harvest comes to an end, the period of seed selection begins, lasting from June to August. This activity of selection is carried out above all by the male farmer who resides permanently in the community, with the woman's participation occupying a relatively secondary position. This is mainly due to the knowledge of pests which the first group possesses and the techniques which are applied in the selection process.

However, it is important to distinguish between native and commercial varieties; in the first case, the woman's preferences are important and are taken into account, since these are the varieties which are consumed at home. Hence, feminine criteria have a direct influence on their selection and may even give rise, as happens in some families, to quarrels over which varieties ought to be selected. According to Dionisia, women chose varieties like *quyllu* which will be used for cooking local dishes; men oppose this (*qharis mana munankuchu*) and don't want to sow them, because this uses land which otherwise could be used for commercial varieties which 'give more'. Thus there is a primary difference in criteria in the selection process of commercial local consumption varieties. Market criteria are, in general, poor, and have to do above all with size, while the established cultural criteria for native varieties are complex and have to do with a diversity of flavours and uses.

Selection is not carried out immediately after the harvest. The harvested potatoes are stored in what are called *kayrus* (clamps), holes in the ground where the potatoes are deposited and covered with straw and earth to protect them from the cold; this also avoids their being reached by the sun which turns them green and ruins them. When the moment of selection arrives, the tubers destined for seed are spread out in the sun so that, according to local knowledge, they will resist the diseases which may exist in the land and turn sufficiently 'green'.[55] The size of seed tubers is important, above all for cash crop production, but apart from this and in general, one may consider that there is a critical size limit and tubers smaller than this run the risk of not producing enough, because plots of land that have accumulated too many

[55] "…I leave the seed on the same plot and I let it turn a bit green in the sun so that nothing will happen to it with the diseases" (Hilarion Parra).

agrochemicals can 'burn' such seed.[56] For this reason, when sowing more than one tuber may be placed in each hole.[57] Elsewhere, such as in Ayopaya province, the practice of putting two or more tubers in each hole is also followed,[58] although there are contrary criteria with respect to this.[59] Peasants are well aware that seeds should be totally healthy, which in turn will keep the soil healthy, give a good yield and good seed for the next sowing.[60]. Thus peasants chose large tubors, unaffected by diseases or pests and with lots of eyes:[61] "good potatoes with big eyes (*llik'i ñawis*, open eyes), *plancha ñawis* (flat eyes), that's for seed" (Julia López).[62] The external appearance is also important: "the potatoes should be large, with a pretty face, *llusk'itu* (smooth)" (Cristina Almanza); "if it's ugly and *khirkilla* (warty) it's not good" (SimónVásquez). As we have said, there is one seed for domestic

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[56] "…here down below I don't sow any more because the land is already addicted to the medicines [agrochemicals], so it just burns the seeds when you sow them…" (Carlos Alvarado).

[57] Apart from size, new seed may be differentiated from old seed, as the peasants in the Morochata region do: new seed has big eyes and is like a fecund woman (*musuj muju phichu muju*). Old seed, in contrast, is like a man, small, with tiny eyes and doesn't grow much (*machu muju sak'u*) (Ordóñez 2002).

[58] "One, one, you sow one, it sprouts from that. When [the tuber] is small you sow two, we say 'they keep company. This is very small, it will produce a thin [row of plants], I say. Two will produce a thick [row of plants] is what they say" (Guillermina Rocha). "You take about four potatoes in each hand and you sow one by one, if they're small we sow two because otherwise it would produce *ralita* [small, fragile]. If it's the right size it produces big, leafy [plants], ah!" (TomásVillaroel).

[59] "…you just put one, if you put more in one [hole] they would fight (*ch'amparía*) and would produce just little ones, not big ones. That's why we just put one, but that one must be well sown, good seed with open eyes, if it's to come up well" (Celestino Vegamonte).

[60] However, according to technicians from institutions dedicated to producing improved seed (as the director of SEPA said), the region in general suffers from problems of infested soils. In peasant agriculture, apart from differences between techniques and practices, there are also differences between theory and practice.

[61] The eye criterion seems to be common to the whole Andean region. Zimmerer found that Cusco peasants had a similar idea: floury varieties should have "good eyes like flowers" (1996).

[62] Felicidad Escobar (Piusilla) emphasises the importance of the eyes, "since they [the potatoes] always sprout from the eyes, the eye is the most important thing if the seed is to sprout". In the same way, Alicia Katari gives an ample explanation of the function of the eyes in seed potatoes: "this is its eyes, that's it's backside (*sik'i*) as we say, right? It just opens its eyes, right? …and its heart, but the eyes are more important. Maybe it'll sprout well, or not; others are blind, others rot, they're no good. The blind ones don't have eyes, they rot, they deflate (*ch'usurapun*). Looking at their eyes we sow, if they don't have eyes they don't produce well, nothing comes up, we sow in vain". Apart from the eyes another important aspect is taken into account: "[The potatoes] have eyes, they also have eyelashes, just like eyes. They have *sapicito* , that's where the stalk joins the potato, that's important for seed…if it's to sprout well it has to be llik'I ñawi, not bola sik'i (round backside), for seed…" (Gregoria).

consumption and another for the market. For this last, four categories are established (from the largest to the smallest) which can be described as follows:

- *Qolqe* (first class potatoes)
- *Chapara* (second class potatoes)
- *Murmu* (third and fourth class potatoes)

The first two classes of potatoes are destined for sale and exchange with other peasants, while the last two, combined under the name *murmu*, are kept for domestic consumption. Native varieties destined for family consumption are not governed by size but rather according to their importance as varieties for the patterns of local use, which includes those commercial varieties which have been discarded for sale (the commercial varieties most often sown in Qoari and Boquerón are *waych'a*, *alpha* and *Desirée*).

To conclude this section on selection techniques, I consider how peasants appreciate and perceive the 'technical' criteria with which the projects work. For them, these criteria contain an excessively simplified technique, since they are limited to selection on the basis of the volume which can be held in one hand.[63] Peasants establish hierarchies and differences between varieties based on market considerations and as mentioned above on culturally established consumption patterns. They also note the presence of diseases and other deficiencies in the seed to be selected. It is possible that the project technicians take for granted that the soils for production are totally free of diseases or pests.

According to their selection criteria one takes into account the plant itself (height, size, thickness, number of stalks, number of tubers, its strength and vigour). This means that when tubers are to be separated for seed, they consider in first place their size. Peasant farmers also consider the plant and its characteristics: like the technicians, they recognise the quality of a plant by its foliage and the quantity of stalks (*kay sumaj ch'amparimun, sumaj puni ah!*).[64]

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[63] The peasants, however, do not completely ignore size, since according to them the appropriate size would be that of a hen's egg. A seed of this size will give a good plant. Larger seeds would have to be cut in half for sowing.

[64] "If its stalks are thin, it should grow tall. If it's small, its food just goes there and not to the seed [tuber] and the potato doesn't grow. Its leaves should be bright green and flat" (Leonor Córdova). "Its stalk should be thin, its leaves curly, the useful ones have lots of flowers. The potatoes which are no use only have one flower, with a thin branch, their leaves aren't curly, they come out of just one branch. Good potatoes should have thick stalks and lots of branches" (Alicia Katari). "Free thick, it should come up thick, it should come up lovely, its leaves should come out lovely, *foliorisaspa* [lots of foliage], its stalks should be thick, when it

For Guillermina, a woman potato producer, a plant as high as a person and with large leaves will give good tubers (large and numerous). A field with such plants can even be dangerous. The careless person who enters such a field will inevitably get lost and be killed by these exceptional plants.

5.2.4 Criteria and forms of classification

Figure 12 summarises some of the principal aspects of the criteria for classifying tubers followed by peasants of Qoari and Boquerón.[65] The diagram illustrates that these criteria follow a very specific logic.

It is worth mentioning that among the introduced varieties not only hybrids, basic or improved seeds are included, but also native varieties which are not from the region, such as the *huaych'a* from La Paz.

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flowers it should be bushy (*ch'amparisca*). It flowers a lot" (Guillermina Rocha). "Its leaves, lovely, bright green, shiny, they should be clean and healthy. Its flowers should be all the same, the sick ones are *k'allkitalla* [split, broken], like this [gesture indicating something very small], their flowers just bloom like that. [The flowers] of healthy ones are as big as this, they have to have lots of branches. [Showing a *waych'a* potato and counting its eyes] If all [the eyes] of this potato sprouted (*p'utun*), if they all sprouted, *tatay* (oh Lord!) then that's all right. After that it has branches, two flowers on each branch, that should come out, that's a good potato. If just one or two flowers, that's not good, it should have flowers all over the plant, they should be healthy, they should be big blooms. That's a good potato" (Concepción Dávalos). "Its leaves should be the best, ah! They should be flat. Its flowers should be in bunches and its aylinkus [biological seed] come out big" (Tomás Villaroel).

[65] Given that this is a qualitative analysis, we have followed here the technique known as the production of *native taxonomies*. This consists in the 'description of how people divide cultural domains, and how the pieces of a domain are found to be connected. By 'domain' I want to mean simply a list of words of a language which, in someway, form a set' (Bernard 1991:335).

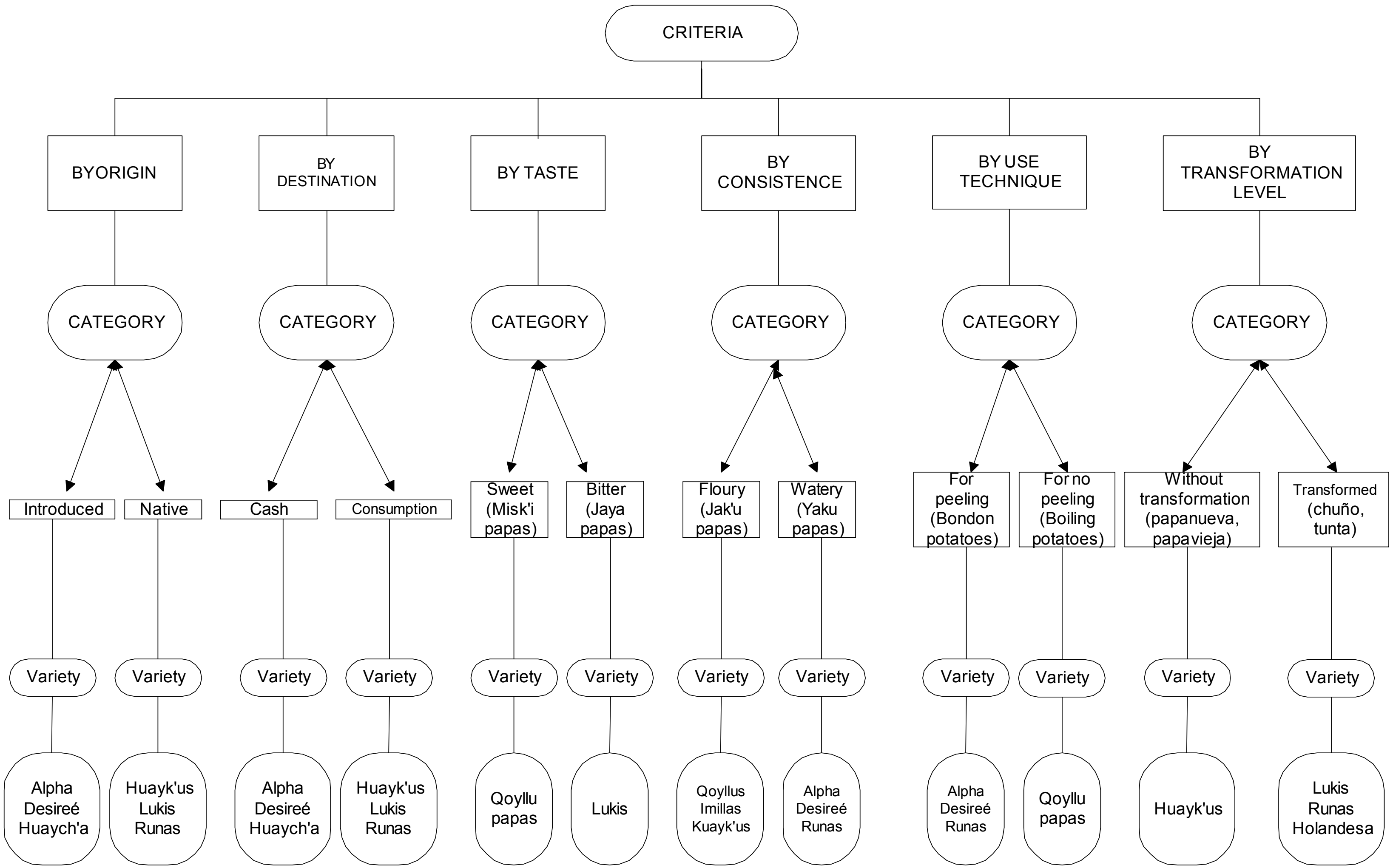

FIGURE 12
Local potato taxonomy

TABLE 18
Tubers according to soil type

Category	Variety	Characteristics	Soil	Use (mode of consumption)	Destiny
Bondon papa (peeled before cooking)	*Kanchiri (yuraj, yana)*	Semi-watery and peeled potatoes	*Q'ellu jallp'a* (yellow earth)	Soups and fried potatoes	Family consumption
Require transformation	Lukis, qetus	Sour taste, need peeling, hard to cook	*Q'ellu jallp'a* (yellow earth)	Making *chuño* and *tunta*	Family consumption
Huayk'us (cooked with their skins on)	*Yana huayk'u* *Nojch'a papa* *Machu-Huanchi* *Pili papa* *Boca pintada* *Llokhalla* *Khuchi aca* *Canastillo*	Floury, easy to cook, "sweet" (pleasant tasting)	*Yana jallp'a* (black earth), *Purumas* (soil which has not been cultivated, or which has been fallow for a long time)	Packed lunches to be eaten en in the fields, salads, *serqe*, *watiya* (baked in earth oven, at the start of the cultivating season)	Exclusively for local and family consumption
Floury	*Imillas (cóndor, yuraj, yana)*	Peeled before cooking	*Puka and yana jallp'a* (red and black earth)	Packed lunches	Family consumption, a small part goes to market
Watery	*Runas (sonso runa, waka lajra)*	Peeled before cooking	*Q'ellu jallp'a* (yellow earth)	Soups, fried potatoes	Family consumption, sometimes for the market
Introduced	*Runa toralapa, rosita papa,puka ñahui, doble H*	Watery, peeled before cooking	*Q'ellu jallp'a* (yellow earth)	Soups, fried potatoes	Market
Introduced	*Alpha, Desirée* (*holandesas*)	Watery (harvest in three months)	Any type of soil	Soups, fried potatoes	Market (Santa Cruz)
Introduced	*Huaych'a paceña, puka waych'a*	Floury, easy to cook and peel	Any type of soil	Any kind of dish	Market (Santa Cruz, Punata), family consumption

Something that stands out in the table is that, although the criteria and their categories are clearly differentiated (or opposed almost as dichotomies like the categories), this does not apply to the varieties, which can appear in several categories at once. This suggests that farmers' normative discernment crosscuts various factors and levels in evaluating a particular variety.

On the other hand, the varieties shown in the table only include a limited number, since, the known varieties which are used, are disappearing or have been rescued from oblivion and are many more than are shown here. During the research, some interesting facets in terms of local knowledge of potatoes could be found: in the random sample questionnaire we obtained 30 identified varieties. In in-depth interviews with a non random sample, the number of known varieties rose a little more; finally, following up case studies of the greatly knowledgeable, one farmer knew and planted more than 80 varieties.

To observe the relation between soil type, destiny of the tubers, and their use, see table 18. Looking at this table, one cannot say that the best soils are assigned to native varieties and the worst, to the commercial ones. In reality, native and commercial varieties overlap like two fans in terms of soil use, in the occupation of spaces or production plans.

The first group occupy from black (*yana jallp'a*) to yellow (*q'ellu jallp'a*) soils, passing through the red earths (*puka jallp'a*); the second group go from red soils to those which are classified as 'any type' (a name which includes those considered even worse than the yellow soils).[66] Referring to the destiny of the produce according to soil type, the best soils (*yanas* and *pukas*) mainly contain tubers for family
consumption; the potatoes which proceed from yellow soils are destined as much for the market as for family use; in soils which can include yellow and red earth as well as those not defined, potatoes are cultivated for the market. As regards the category 'introduced' a possible confusion should be avoided: there are introduced hybrids which do not have a national origin (they are from Holland or Colombia) and others of national origin (those offered by PROINPA, SEPA, etc.) but just the same there are non hybrid introduced varieties which are native (the *waych'a paceña* or, previously, the *sani imilla*). If we look at the uses we see that practically all the varieties are used in local cuisine.

[66] Peasants like those from Piusilla (Morochata) identify particular links between varieties and soil types on the basis of chromatic affinities: red-skinned potatoes are for black (yana) earth, which gives a combination of red and black; white potatoes (for example imilla) are for white (yuraj) earth, which determines a combination of white and white (Cristina López), suggesting a principal of combination based on colour.

5.2.5 Forms of soil conservation

Facing what peasants perceive as an "institutional contamination" of their soils, some have chosen to use only their own seeds, ceasing to acquire what is offered by NGOs:[67]

> *We don't buy seed from the institutions any more. We always use our own seeds to keep our soil clean and free from diseases. Mainly we sow oats, we apply manure from our animals [mainly sheep dung]; when we don't have enough we mix it with chicken manure. We plant legumes as well: broad beans. My mother sows them every year… (*Severino García Coca*).*[68]

Thus they not only avoid introducing seed which in their eyes is potentially damaging (their perception as *enacting*, as Varela conceives it, dictates or proclaims as dangerous the "institutional" seed whose origins and the processes by which it was obtained remain unknown), but they take complementary measures for care of the soil such as sowing oats during the fallow period, which of course is beneficial for soil recovery. The use of animal fertilisers (sheep and chicken dung[69]) is emphasised in protecting the earth and improving its fertility.[70]

For Rengifo (1987) soil management in Andean culture can be divided in two systems: the 'mechanical-structural' and the 'bio-cultural'. The first consists in the organised human modification of the sloping topography via great movements of earth whose results are the terraces, *khochas* or flooded fields, *camellones* or raised fields, etc. The second has to do with indigenous agricultural production practices: ploughing, circular furrows, crop rotation, fallow periods, hilling up, etc. The biological and soil transformations produced by these systems are not only directed to obtaining surpluses in the short term but in themselves constitute a long term investment for the conservation of soil resources. Since the main goal of agricultural

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[67] Apart from this contamination problem the soils of both communities do not have visible erosion problems, despite presenting slopes with inclines between 10% and 50% (Chino 2002).

[68] Care taken with soil includes other measures such as those described by Casimiro Ruiz from Piusilla: "I improve my soil, I take care of it so that it will produce, I dig little furrows so the water won't damage it, we leave it fallow for a year or two, the grass doesn't let the water take [the organic matter] away".

[69] "We irrigate the potatoes, on their little backsides (*sik'isitus*), we put animal dung with earth when they're small" (Severino García Coca).

[70] Agronomists' studies see in peasant soil conservation practices more than simple erosion control measures: these practices include soil preparation, planting systems, crop rotation, vegetation cover, irrigation, etc. which permit a rational use of the soil (Sorrensen and Montoya 1989).

production is basic food security for the family and not obtaining benefits in business terms, the possible damage caused by farming and herding activities are overcome via processes of biological resilience and the 'social administration of resources'. The working of the soil avoids maladjustment provoked by other mechanical methods. Intercropping, spread among tiny plots distributed in different ecological levels, disperses the risks and cancels the dangers of planting just one crop. However, the increase in population and the division of common lands and fluctuations produced by the market have affected these conservation systems, modifying them and reducing their generalised use among peasant families.

Apart from the productive veto on alien varieties brought by projects, a better crop rotation, the use of animal manure for fertility and organic-chemical combination for pest limitation, there is the resource of tuber production on the basis of the fruit of the plant (*mak'unku*) via nurseries. This production permits them to obtain good quality seed. However, the complete process is not short; according to peasants, it takes about three years. The main condition for producing nurseries is to count on fertile and healthy soils.

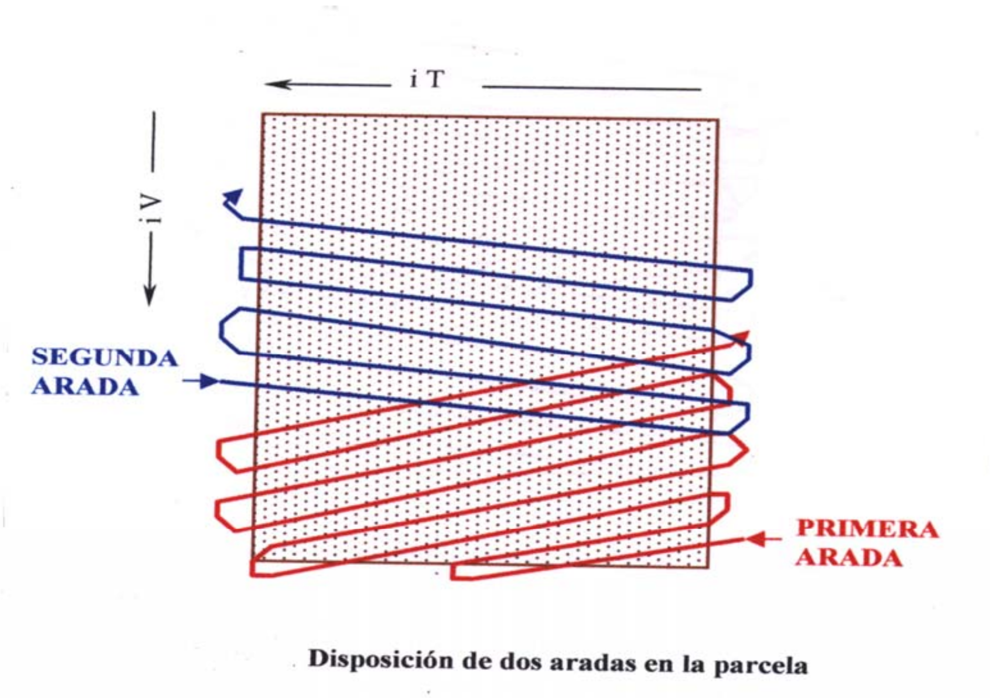
5.2.6 Organisation of labour in the technical itinerary

Although one might think that the division of labour and the relations which are established in the course of production are not the result of local knowledge but rather represent structural relations which "go beyond the will of the producers", they do not cease to be, up to a point, creations of their agency, displays of their knowledge and capacity for organisation. Taking this last into account, this chapter includes aspects related to the organisation of labour in the different phases of potato production.

To start sowing, the cultivator (usually the man of the house) chooses the plot to be worked; he himself, with help from his family, takes charge of the *barbecho* (preparing the earth). After clearing the weeds, the plot is irrigated. If the soil is hard (in fields close to the highway – above all in Qoari – there may be a lot of trampling by animals and people) it is ploughed over several times. Successive crossings with the plough, as part of bio-cultural activity in soil management, are very important for weeding and the future growth of plants.

In the communities of Qoari and Boquerón people plough a plot up to three times so as to achieve a good rotivation of the soil, which allows the seed to germinate easily. As a rule, heavy soils are rotivated more than light ones. If two ploughings or 'crossings' are done, the first will be carried out along the contours of the slope, going from right to left (see figure below), maintaining a certain inclination of the furrows. The second ploughing is carried out in the opposite direction (from left to right), 'crossing' the first furrows which were made and maintaining their inclination.

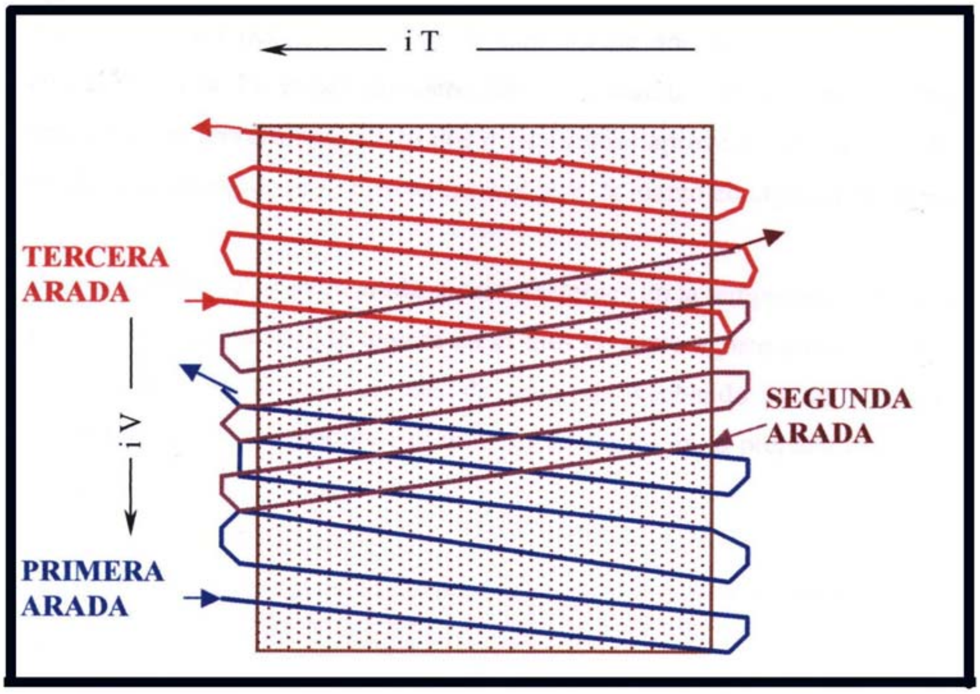
FIGURE 13
Ploughing: first and second "crossings"



Source: Chino, 2002

If it has been decided that it is convenient to plough three times, the first ploughing is from left to right, the second from right to left (crossing the first) and the third has the same orientation as the first but the plough moves in the opposite direction (see next figure). The inclination of the furrows may vary in this last ploughing up to making them straight, depending on how loose the soil is. The inclination of the furrows is fundamental, because it permits cutting the vertical flow of rain and irrigation water, facilitating a surface drainage in the direction of the slope (Chino 2002:67-68).

FIGURE 14
Ploughing: the third "crossing"



Source: Chino, 2002

The number of months between the *barbecho* and sowing varies according to the peasants' own criteria: "we do the *barbecho* about three months before [sowing]" (Tomás Villaroel); "we do the *barbecho* four or five months before…" (Justo López). The need for the *barbecho* and some of its particular points are explained by Justo López:

> *…so that the weeds rot with the sun, the wind, the cold. The land is worked more for sowing, that's why we work, we do the barbecho on the land a good while in advance; it's always been like that since our grandfathers. If we just plant straight off… more weeds come up, it's not well worked. That's why everyone does it early. If we sow, we compare, if they did the barbecho recently and sow a week or two later, kutipachalla they say, that's why it doesn't produce well, just weeds come up. That's why they say that if they do the barbecho in good time the weeds come up and we can kill them before sowing. That's why you have to prepare in time. The barbecho is done by the farming man, the woman helps a little in the barbecho, sometimes she helps to kholachar (pull up) the grass, she burns the dry weeds (kanar).*

It is important to apply manure in the *barbecho* because it has a decisive effect on the land, according to Jorge Villaroel: "First we do the *barbecho* applying animal manure, we put it on in time. After we've finished applying manure only then do we start to work, we say 'it's warmed up' and after that the weeds rot". Since the earth has to be soft to work it, they wait for it to rain or they irrigate the plot first:

> *Yes, they do the barbecho when it rains, that's when they work, when it doesn't rain they irrigate first. Then they straighten it out (ch'erkanku), then they overturn the clods, and then they close [the furrows]. That's how they do it. Don Celestino always does it, we [women] pull up the weeds (*Alicia Katari*).*

> *Well, we work, we irrigate the dry clean earth, if it doesn't rain Ah! The men always do it. Some women do the edges (thaminku), others when the barbecho's well advanced we pull up the weeds, taking out the grass and we throw it on the fire (*Felicidad Escobar*).*

From the preceding quotations, including the first concerning the barbecho, it can be seen that women's work in this first phase is marginal, limited to weeding, burning the dry weeds or simply working the edges of the fields.

After this the sowing[71] arrives in which, due to its complexity and the demand for labour, the whole family takes part and, often other participants as well who may or may not be kinsfolk. Labour thus is acquired through kinship relations (in the modalities of *ayni*,[72] *mink'a*,[73] and others). Recently, however, the widespread and sustained diffusion of Christian churches other than the Catholic Church that have arrived recently in the region, has led to the intensified development of traditional cooperative practices among the 'new brothers'. The relations of collaboration continue to be based on kinship relations, although in this case – as in the case of *compadrazgo*, the relationships are ritual, not blood kinship. However, forms of hiring day labourers are also practised (with a daily wage in cash) since the communities of this region have for a long time been used to market relations, and more than ever due to the influence of the development projects that have been active there.

Sowing is an activity which needs strict planning: on the night before, as in a military operation, the sowing attack is planned:

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[71] In the communities of Qoari and Boquerón they sow three times a year, thus having three productive cycles: mishka, chaupimishka and jatun t'arpuy (the first two with irrigation and the third, the big sowing, on the basis of the rains). Due to climatic peculiarities, altitude and the availability of water the dates of sowing vary.

[72] Mutual aid regulated by kinship relations. A cooperative relationship where work is reciprocated though this does not necessarily presuppose strict symmetry.

[73] Help received is repaid with money or in kind. This relationship is also regulated by kinship symbols.

> *We work with the family, if we have to sow the following day, we talk in the night. The father gives the orders. We say: you're going to take the yoke of oxen tomorrow, you're going to take the horses, we'll take the seed. To the wife we say: tomorrow we're going to sow, you'll cook the packed lunch (sama). That's how we organise ourselves to sow. After that on the following day we go and everyone does what they have to do … in the field we organise ourselves again: you're going to cut up the seed, you'll put the seed in the furrow, you'll put the fertiliser, you're going to chujchukear (to level off), you're going to steer the plough. The father drives the plough or the eldest son, the kids take care of the fertiliser, passing the seed'* (Juan Ruiz*).*

If ever the women's presence is fundamental (and even indispensable), it is in the sowing. The women cut large potatoes into two or three pieces to use them as individual seeds; they make a final selection of the tubers, discarding those which were spoiled during storage (which turned too green or finished up with warts). Potatoes which have been attacked by worms (*khurus*) are no use for seed or for anything, but, since 'peasant logic' is that nothing can ever be wasted and everything always can be used for something, they are buried in the earth – they return them to the Pachamama (Mother Earth) – so that they would turn into fertiliser.

The women of Qoari and Boquerón (as in other communities) have ample skills, the result of practice but also of precise knowledge of how to place the seed in the furrow.[74] They sow each seed about a foot from the next, although the sowing density depends on the size of the seed (each variety varies in seed size) and the slope of the field: the distance between furrows is from 50 to 65 cm. The seeds are one by place placed by hand. This activity presupposes skill, precision and sufficient speed to keep up with the ox-drawn plough. This feminine speciality is so indispensable that, due to new migratory flows which have determined prolonged absences of the women of these communities, in recent years there have been considerable delays in the agricultural calendar in the region; concretely, in the agricultural year 1999, the sowing period did not begin in August-September, as it ought to, but in October, and finished late at the end of November. The vacuum left by these Sabine women captured by migration was covered in part and not without urgency and haste by women from other communities on the basis – once again – of kinship relations: the daughters-in-law, aunts, girl cousins and so on had to come to help out.[75] One might ask why the men of the community did not take on this job or why they did not hire labourers to do it. In reality

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[74] This is common to women in Andean culture. In the communities of Morochata the same happens: "The girls also place [the seed], those who we [hire or contract as] mink'a, but always women" (Alicia Katari). "Well, we women plant the seed" (Guillermina Ruiz). "The wife, or if they have a daughter she sows it too, that's how it's done" (Justo López).

[75] In return for their help they received seeds of varieties which are hard to obtain.

they tried to do both things, but apparently their clumsiness, lack of timing and slowness soon discouraged the producers (who suffered delays as a result which threatened the timing of their agricultural calendar. This 'lack of schooling' shows a vacuum in the respective skills of male farmers, a schooling which requires constant practice from childhood and for which a few months or weeks are not enough.

I describe here the harmony, synchronisation and rhythm which the sowing demands from its participants. In the previously prepared plot the yoked bulls go first, opening the furrow with the plough, usually steered by the father of the family (often there is more than one plough); the wife follows behind the plough depositing the seeds in the furrow, a good way behind another woman (often the daughter) spreads organic manure. Behind them all, scattering little portions of chemical fertiliser and covering the furrows goes another man. This sequence suggests a determined order (man, woman, woman, man) which could be related to Andean dualism and quadric-partition, but, beyond this it seems revelatory of the relationship –also specific – which is given between organic fertiliser-woman and chemical fertiliser-man. This relationship can show, in the different senses of the word, the different orientations of local knowledge: the woman, close to the herds because she breeds and pastures them, is related in knowledge and practice to the input (in reality, the residue) which this 'subsystem' contributes to the 'agricultural subsystem' (dung, known as *huano*); the man, for his part, more related to modernity and its technology, (supposedly) knowing more of the units, measures and combinations of these products, is in charge of applying convenient doses in the field[76] (but we will say more about these differences in knowledge and their origin in the final chapter).

The sowing activities begin with the selection, preparation and storage of the seed. Potatoes are often stored under beds until sowing time. Some farmers mix animal dung with urea in a mixture of five parts of dung to one of urea. The doses for mineral fertilisers are variable. Those most used are, due to the specific nature of the region, the 18-46-0 (diammonium phosphate) and urea (46-0-0). 'Triple fifteen' (15-15-15) is less used. The approximate application of 18-46-0 is about 100 pounds for three or four loads of potato seed [100 to 112 Kg.] In some cases the sheep *huano* is mixed with chicken dung purchased from chicken farms. Attending to the people who help with sowing is considered of great importance. They should be served food, coca leaves,

[76] This does not mean that the women would not be capable of handling the logic and language of units, measures and calculation. The kitchen is a particular setting very demanding for the application of this logic where a good eye and intuition play a very important role.

alcohol and cigarettes. The farmer's wife prepares the food from the early hours of the morning. If labourers have been hired they are given lunch when sowing begins early, if this is not the case they are given coca leaves, *lejia* (an alkaline paste of ashes which when chewed with the leaves releases their active alkaloids) and cigarettes.

The oxen are fed early in the morning. They are watered and then tied to the yoke with a plaited rope (*huasca*) and the ring which connects the yoke to the plough. The plough is carefully prepared, checking its angle by means of a chock in the crux; this calibration determines how deeply it will plough. The width of the furrows is indicated by weeds or branches, according to the angle between the ploughshare and the handles. The same yoke of oxen is often used to close the furrows. In general, the participants in the process are the *yuntero* (who guides the plough), the *semilleras* (who sow the seed), the *guaneras* (who bag up and then spread the manure) and the *puntaleros* or *cantoneros* (who open the furrows on the field edges where the plough does not reach). The sowing team can be made up of five to seven people:

> *In the sowing lots of us sow: some cut up the seed, two plant the seed, another one puts the fertiliser, others spread manure, one opens the furrow, another chujchukea (flattens out the earth), seven people (*Alicia Katari*).*

When the seed does not belong to the farmer, it is obtained before the sowing from known or recommended people who provide seed as specificied by the farmer with reference to the form of the tuber, its culinary virtues and its freedom from diseases. The most used seeds are of second and third categories (*qolqe* and *murmu*) (Chino 2002).

The work of cultivation consists mainly in the *ch'ejtada* and the *jallmada*. *Ch'ejtada* means breaking up the earth or hilling up (*aporcar*) and supposes:

> *…the use of yokes, oxen and a wooden plough. For this practice a longer yoke is generally used and the oxen wear a muzzle so that they do not eat the foliage. This practice is carried out by the farmer alone or accompanied by a guide who is generally a male adolescent. He carries out this practice when the plant is 12 to 20 cm high and about three months old…the goal of the practice is to eliminate weeds, and loosen the earth. The furrows are used for irrigation and also for drainage of rain water (*Chino 2002:78*).*

Extracting weeds from the field can be seen almost as a furtive activity, a hidden operation which, it seems, not even the field must notice: "we take out the weeds like thieves" (Miguel Salas). Robbing the field, surreptitiously depriving it of something which is part of it, which it owns although it is damaging for the growth of the potatoes: a deprivation which should not be perceived by the owner - the field, the *chacra* (cultivated plot) itself. The intimate relationship with the crop is also seen in this phase of production, in which the potatoes demand great attention:

> *You have to remove the weeds, you have to hill up at the right time. We go to see how [the plants] are, if they're ill, if they're not ill or if there are worms, or want to be irrigated or need the weeds to be removed. There is, that relation exists, between he who plants and the plant' (*Juan Ruiz*).*

The next activity, the *jallmeada*, is carried out about ten or fifteen days after opening the furrows. It is a manual labour of loosening the soil which seeks to give sufficient support to the plant and permit tuber growth as well as drainage in the rainy season. This practice is carried out by the family and sometimes they make use of *ayni* when the plot is large. The tool used is the short handled hoe or *azadón.*

The highly recurrent idea in Quechua culture that delicate and fragile things are cared for as if they were children or babies also appears – again – in the care taken in cultivating potatoes.

> *We look after them as if they were our babies until they produce, nothing has to get in there, not even people ought to walk [over the field], while we work we have to watch them, that's how we produce good potatoes* (Concepción Dávalos*).*

> *You have to take care of it like a baby, yeah…you have to take good care of it, irrigate it with water, otherwise we get sad too when [the tubers] all turn black, when we irrigate it with water it flowers awful pretty, oh. That's why you have to look after the potatoes well like a baby, that way it's always all right, if it's not good, if we don't take care it dries up, without water…they turn really thin… (*Gregoria*)*

As important as the sowing and with a characteristic demand for labour, division of tasks and meaning, is the harvest. However, we will not develop its description here but in the next section which has to do with the transmission of knowledge, the intimate relations of the family group and domestic labour for subsistence production. The type of variables studied in this section demanded, principally, the technique of participant observation.

5.2.7 An afternoon at the harvest on the hillsides to the west of Qoari (brief ethnographic description)

Summer has been rainy, perhaps too much and too late. The fields are warm and damp, water runs on all sides going down in small torrents towards the rivers. The afternoon is sunny and in the sky great white clouds spread like cotton buds in a hurry. We climb up a slight slope with Remigio and his children. We are going to harvest one of their potato fields; all kinds of herbs and flowers, small but intensely coloured, have grown on the hard dry soil of winter. In a good literary description, like those of Flaubert, the objects of the exterior world, the landscape, are related to our conscience, our dreams and passions; they are found tangled in our history. Places precede and echo our mood or, in contrast, in their vitality and joy they can seem to oppose us but, above all, they seem to oppose us by their indifference to what we resent. A description of that kind is an accusation rather than gratuitous realism (Riegert 1971:51-53). Remigio, more than worried or careless and happy, walks as if he was dozing in the heat of this hour of the afternoon. He is not much inclined to talk and moves as if he had not finished emerging from a long siesta. The children, in their own world, do not need to ask about ours or that of their father.

In the month of March the main task is the harvest of *mishka* potatoes. In some years like this one the problem which is present is the excessive rain, since it makes the harvest difficult: the earth is too wet, if not muddy, which makes it very difficult to dig the potatoes. Waiting for the summer sun to dry it out a little can have fatal consequences: the potatoes would rot due to the excessive humidity or would be infected by fungi. The commonest disease, also the most feared by the farmers on these occasions, is the one called *jullu*.

Accompanied only by the sound of our breathing, which has grown stronger, we arrive at the foot of the field which, frankly, is not very large (about 25 metres long by 10 wide). Remigio tells Delfin (the agronomist who comes with us) and I that in these conditions you can harvest fields of up to 600 square metres. The peasants do not often take the risk of digging larger fields because it takes so much work. Without any apparent indication or sign, everyone starts to do their part. Remigio goes to one end of the field and with a pickaxe starts to dig, his oldest son, almost an adolescent, imitates him at another site;[77] the younger ones, two girls and a boy aged between five and eight, sit down and, as if they were marbles or little balls, start to collect the freshly dug potatoes. The two dogs who have come following us settle down in the part which seems to be hottest and less damp. With a certain hurry, given that this is participant observation, I take a hoe and also start to dig

[77] Digging potatoes is a male activity. In the course of an interview with TomásVillaroel, when he was asked who does the digging, he replied, puzzled by the question (because we had not realised that he, a man, was the one who did it), "I myself, you've seen me, haven't you?"

diligently[78] (not without surprise I find that the earth is not muddy, only damp; is this knowledge, or coincidence?), while Delfin goes up to Remigio with the intention of asking him a few questions.

While Remigio answers the questions in short pauses in his work, he tosses the potatoes he finds almost carelessly. After a while there are small heaps of potatoes in the field which seem to be scattered by chance but with a sufficient distance between them. The small children, without any hurry since they know that they will spend the whole afternoon doing this, collect the potatoes in gunny sacks. With the not very many potatoes I have collected, I doubt whether I should make my own heap, or if I should just toss them by chance onto any of the heaps that have been formed. I thought why couldn't Remigio have made just one pile so as to make things easier. I am afraid of seeming a fool if I ask Remigio where I should put my potatoes, possibly even the dogs would look at me with dozy scorn. I pay more attention to the little heaps of tubers: they are not all the same, the potatoes are of different sizes, shapes, and although covered with earth and mud seem to be of different colours as well. Having devised a question which is more intelligent and indicates shows someone who knows about potatoes, I go over to Remigio: how many varieties does he have in this field?[79]

There are three: *waych'a paceña, huayk'u* and, though it seems a little strange, the so called *colombiana*. As though by accident, while he chatted to Delfin, Remigio has been piling up the harvested potatoes according to variety. The eldest son, who seemed to be digging in a place he had chosen, was in fact going over the parts worked by his father in search of potatoes which had not been spotted on the first 'pass'. Even the dogs seem to know this technical itinerary well, since they have gone to lie down on the recently turned earth

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[78] Digging potatoes also implies a certain technique: "[you dig] from below to above, in order and behind the potato plant, taking care not to damage the produce" (Jorge Villaroel).

[79] Potatoes may be grouped together in the harvest according to variety, or, mainly, by size: "In what we call digging, to dig we make a *kayana*, there we select, we collect, we pile them up. Let's say, the qolque on one side, the ch'ili murmitu on one side; first of all must be the chapara, the largest ones, then qolqe…for sale. The murmu for seed, the smallest ones are for seeds. We call the tiny ones little angels, those little ones are for chuño" (Felicidad Escobar). "As the potato digging goes ahead the married women go selecting from one strip to another, where they pile the potatoes in heaps. They begin to select when they have passed the place, as they dig they continue until they pass the places where the potatoes are collected, that's where the women take advantage to select the potatoes" (Luisa J.). In a commercial plot, the selection by size is most important. In this selection what will go for family consumption also counts, what will be productive – as seed – and what will be transformed into *chuño*: "We dig the earth…for seed, we make another *k'airo* for food, another which will go to Quillacollo [market there], for *chuño*, another one for seed, we make a lot…" (Alicia Katari).

which is warmer, scented, soft and welcoming, their testimony has been a gruff growl-sigh of satisfaction.

The field, due to its size and location (situated on one of the 'productive limits') is a plot for family consumption. The presence of the Colombian variety is simply because "a bit of that seed was left over". The fact that there are no hired labourers or other adults in the harvest shows two things:[80] firstly, as already indicated, this is not a commercial plot; secondly, this is not only an activity at the end of the agricultural cycle, the harvest, but also a didactic application: we are attending a class where, personally, I am a student who just listens and will not have to take the examination at the end (or, beneath the suppositions of my research method, a pupil-observer); the children are the 'regular' pupils who will have to pass the course.[81] Due to the educational aims of the activity and the nature of the plot, nor do we comply, as can be seen, with that quasi 'law' which states that women select the potatoes during the harvest.[82]

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[80] The wife was not present because she is one of the women who have recently migrated, which has an impact on the kind of food we will be served in the work break.

[81] For the peasants, it is clear and also natural that agricultural activities are 'on-site schools'. In the case of the potato harvest we likewise find this notion of instruction: "right there, up the hill, where we all dig, we select, the children learn by watching us and doing the same, they learn by asking questions. We owners select" (Concepción Dávalos).

[82] If we think of real plots rather than didactic ones like this, such as large fields whose produce is mainly destined for the market, we find a stricter division of labour by gender and a more disciplined compliance with tasks. The practice of dividing activities by gender seeks, up to a point, greater efficiency and efficacy. It is better that the men should dig, given that if they were sent to select they could commit errors of "precision" and quality:
"The women do that selection, we men dig and the women select after us … after all they know, they select properly, they select all of the same size. We men sometimes get it wrong. It's because in the market the potatoes sell according to their appearance, well selected. Oh! If they're all big they sell straight off, if there are little ones (mixed in) you can´t sell them … that's why we have them do the selecting. It's easy work for the women. Digging is heavier, that work….ah! they sit selecting, selecting…we collect in the afternoon and we transport them in awayu [cloth for carrying loads on the back] after gathering them up...they [the women] have more patience in selecting, they pay more attention. Oh! The men hurry along, with the rush sometimes they put the split ones (*k'achis*), misshapen or diseased ones, because of the hurry; that's why, the women know more about selection" (Casimiro Ruiz).
From childhood, women are encouraged to specialise in selecting the harvested potatoes, thus closing their cycle of specialisation which begins with the sowing when, as *semilleras*, they place the seed in the furrow. It could be said that the women open and close the potato's productive cycle: handing to seed over to the soil as sowers and, finally, receiving it as selectors or distributors of the results of the harvest: "Women have always selected and the children learn and do the same. The women know, just like they were taught as children" (JorgeVillaroel)."The wives select, the women, it may be a day labourer or the wife or the daughters, but women select" (Justo López)

The dogs, lying peacefully, almost inert, seem however to dominate this contextual pedagogic landscape. Remigio, the teacher, points out with complete informality to us (Delfin and I), new and occasional pupils, that agriculturists who have irrigation can harvest in the month of March *mishka* potatoes (the second productive cycle after the year's sowing that is the principal crop).[83] According to him, the harvested potatoes are in good condition, which is not always the case.[84] In damp conditions like these, he tells us, one can harvest large fields with the help of a yoke of oxen and a ploughshare made by CIFEMA. When asked, not without a certain evil intent, about the practical usefulness of this implement, Remigio tells us "It works all right,[85] the technicians brought it about five years ago, but it's expensive, it costs more than 400 Bolivianos", that is to say, it is only profitable to use on large commercial fields. On the other hand, this ploughshare can make the field even muddier if the soil is too humid. Considering its advantages and observing the scene of apprenticeship of which we are a part, words like *quicker*, *easier* or *efficient* sound rather irrelevant, or at least strange. Is there a particular soberness, a moderation in the technological change taken up by the farmers – in Qoari and Boqueron as in other parts of the Andes – a containment which is not due solely to poverty, to the limitations of the market or the recommendations of certain development projects? What does not seem to exist is an explicit, conscious and dedicated defence of the old cultural values. Life, time, space and nature such as the farmers experience them in these highlands seem to establish, up to a point, how far they can go in changing the patterns of their knowledge. Rural peasant life as such seems opposed to the radical style of technification of modern life, in the sense proposed by Illich: "a process of rationalisation of means so as to obtain greater efficiency" (in Andoni 1996a: 89).

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[83] Although *mishka* potatoes (called *llojchi* in Morochata) ripens more rapidly, it is not suitable for seed, being of inferior quality to dry-farmed or rainfed potatoes: "what we dig up rainfed, that keeps…that's for seed; what's llojchi doesn't last, the worms eat it all" (Victoria Claure).

[84] In no sense does this mean that if the harvest is poor, the produce is thrown away. While in sowing bad seed returns to the seed as fertiliser, the harvest produce that does not comply with conditions for seed has other destinations: "during the selection, if they find misshapen potatoes it's discarded [as unsuitable] for seed, but not for selling and eating". There also exist local techniques which transform the produce for another type of consumption: "The women manage to save a lot of the potatoes which have been infected with *tizón* (*t'ojtu*). Some grind them up for dog food, but they wash them first". But not only animals eat these potatoes attacked by pests: Gregoria shreds the potatoes after washing them so as to cook them as ahogado [spicy sauce or thick stew], so as not to waste the potatoes infected with *tizón*.

[85] The ploughshare passes down the middle of the furrow, partially overturning the potatoes which are underground. The tubers are then collected by a man who stirs the ground a little more with a pick in search of the potatoes. This instrument makes the harvest easier and swifter, saving time and money from a mercantile perspective.

The food, when we take a break, is nothing to write home about: a few prickly pears which the children picked on the way to the field. Their empty green skins are left scattered around the field as if looking at us with their open mouths but without affecting the landscape, as if they were part of the earth and the weeds (unlike the plastic bags which have begun to invade the communities of the zone). Later on, when Remigio has decided it is time to go home, we walk through fields of potatoes with leaves yellowed at the tips. By way of conversation, Delfin tells me that these are this year's plantings whose vegetative cycle is near its end: the local farmers have planned to cut the stalks (*yura*) at the end of this month. The stalks are cut to induce an increase in the volume of the tubers, and once they have been cut this means that the harvest is near. The rainfed plantings in particular show above-ground growth with yellow tips, which is also a sign that the phyto-sanitary treatments have finished.

About to arrive in the community (it's not yet dark) I think about description and Flaubert, I try to establish links between mood and landscape, but only manage to see what there is, without any great feeling, as if absorbed by the homogeneous minuteness and diversity of these fields at the end of summer.

5.2.8 Technology and knowledge in the production of chuño

The women are in charge of the production of chuño, an activity in which they receive the collaboration of old people and children. Potatoes are converted into chuño in midwinter, during the months of June and July when it freezes and snows. Firstly, the potatoes destined to be transformed are separated in the course of the harvest (see above for the varieties involved).

One of the techniques of transformation consists in spreading the tubers out in a field and sprinkling them with water for a certain number of nights, to facilitate their freezing by the winter cold; the earth is covered with a sufficient quantity of straw to prevent the potatoes rotting. When the potatoes are adequately frozen, they are piled up in small heaps and the women, barefoot, set to stamping energetically on them with the aim of squeezing out the moisture and removing the skin. The whole process of transformation takes about 15 days, after which the obtained chuño is stored.

The other technique, to obtain a particular type of chuño, known as *tunta*, consists in carrying out the freezing process in water. To this end, the selected potatoes are left for several days on the bed of a stream, canal or artificial pond, and then trodden in small wooden troughs, as in the previous case, till they have been dried out and their skins removed, leaving them ready to be stored.

Given that it is winter in the mountains and the frozen produce has to be trodden repeatedly in bare feet, we can see how painfully hard this work is for the women. With reference to the technique, it can be seen that this has two fundamental stages: i) freezing the produce, sprinkling it at night or leaving it directly in the water; and ii) dehydrating it, extracting all the water and the skin with the pressure of feet. It is very common that the women of several families get together to make chuño, turning this artisan labour into a social event where one plays, chats, laughs and shares. Not every potato is good for chuño and local knowledge has established which are better suited to this transformation:

> *We use almost every [kind of potato] for chuño, but mainly the undersized ones, the little one. Mostly pali, luki, ajawiri, those [varieties]. We mix some varieties and not others because they're hard to freeze, others are seized [by the frost] more easily. For example, rainfed potatoes are hard to freeze, the llojchi is even harder. What comes from the wata tarpuy [main sowing] on the hilltops, that's more phasita (soft) for freezing, it makes chuño more easily* (Juan Ruiz, Piusilla*).*

The central importance of chuño in the highlands is its long shelf life (it can be stored for much more than a year) which converts it into a key food reserve for periods of shortage, but apart from this strategic role in food safety, it is a product which forms part of many everyday dishes.

5.2.9 Other uses of potatoes in local knowledge

As was shown earlier, there is a close relationship between potatoes and the feeding of domestic animals. The peelings are often given to the pigs, along with potatoes infected by *jullu* (late blight present in the tuber itself) and those which are found to be rotten (all of which is usually cooked before being fed to the animals). Dogs are also fed on potatoes attacked by *jullu.* Traditional dog food is a sort of porridge called *lawa*, for which the potatoes are soaked and then ground in a stone handmill (*batán*) before being cooked. Women are in charge of this secondary culinary activity as they are for cooking for the family. Potato leaves are given to oxen, horses and donkeys, although some farmers think that the leaves of the Toralapa variety may be harmful to their herbivores. The leaves of the waych'a variety are used especially as fodder. It is worth insisting that the peasants try to make use of every part of the potato plant, without wasting anything. If it were possible, they would even make use of the hollows of its 'eyes' (and in a sense they do, when they evaluate seed quality); they argue that "it costs us to produce" as a way of justifying this maximal utilisation.

Medicinal uses of the potato are also known, in particular of the 'cool' (*fresca*) varieties such as runa.[86] Therapeutic practices are not limited to local varieties; the peasants have discovered that the *runa toralapa* (introduced by PROINPA, which gave it the name of the experimental station where it was developed) not only possesses certain attributes for a sector of the market, but also has a wide range of medicinal properties. They use this potato for headaches, fevers and toothache, applying slices of raw potato to the forehead or the face. They argue that being 'cool' makes them stick to the place they are applied, reducing pain or swelling: "The grain [tuber] of the toralapa is useful for headaches – they say – for toothache, for temperature. We stick it (*lak'ado*) on the place where it hurts" (Leonor Córdova). Hence it is not uncommon to see adults or children in the fields with these vegetable plasters on their faces, turning them into potato-people.

Throughout this chapter, I have tried to show the most relevant aspects of local knowledge concerning potatoes and their cultivation in the communities studied. As Zimmerer (1996) has well shown, in the local knowledge of Andean peasants, in their techniques, practices and rationale, we find three fundamental elements: marshalling of farm resources, *kausay*-style subsistence, and innovative production strategies. Concerning the first element, there is a circle of use and management of potatoes as a resource, and of the basic resources for its production, such as soil and water, which correspond to the cyclical agricultural calendar. Everything begins at the end of the previous cycle (the harvest), with a first, initial selection which distributes or announces – according to the peasant pattern of perception and their knowledge – the destination of the excavated tubers: the market, the home or once again the earth (as seed). And it all comes to an end at the beginning of the new cycle with a final selection: namely varieties that will be

[86] All foods, drinks and medicinal substances (herbs, etc.) are classified as more or less "cool" (*fresca*) or "hot" (*cálido*). For example, sugar, cane alcohol, coca leaves and mutton are hot, whereas salt, beer, bran and pork are cool. One's diet should try to balance these qualities, as an excess of either is dangerous, although an excess of cool substances is always more dangerous than one of hot ones. The same applies to the environment, where "getting yourself passed with the cold" causes multiple illnesses, while it is rare for an excess of heat to be identified as the principal cause of illness. The illness itself is characterised by an excess of cold or of heat, more usually the latter (since many illnesses provoke a high temperature) and should be treated by medicines which correspond to the opposite category so as to restore balance. Since there are more hot illnesses, cool substances are the most used in curing.

used for sowing and in what proportion, the misshapen for animal food, and those which will return to the earth as fertiliser because they have rotted.

The third element will be debated in the following and last chapter. The second element is surely one of Zimmerer's best characterisations. Here we are not talking simply about livelihoods or making a living, but rather dealing with what, perhaps, best identifies the potato growers' local knowledge. If we begin at the end of the expression coined by Zimmerer ("*kausay*-style subsistence"), as in the agricultural cycle, we find that 'subsistence' refers to the poverty or at least austerity, temperance or moderation. If we turn to the beginning of the expression - *kausay*-style, we find that *kausay* is the verb 'to live': but this should not be confused with lifestyle, the lifestyle of the poor, of those who subsist. It should rather be read as a style which is life, a subsistence which follows the style of life, which follows the path of life and is life itself; a subsistence which is soberness and austerity but, at the same time, is inscribed in life, in its unmistakable style, in its breath. Of course, all this is relative and debatable.

SIX: Knowledge intersections: the contingent and unfinished reconfigurations of local knowledge

6.1 The strategic management of ignorance: the encounter of the expert and non-expert as an exemplary story of seduction

An unorthodox account of the interface between technicians and farmers could portray it as a sort of love affair. If such an unconventional, odd approach is accepted, then I would argue that this would not be the case if the role of seducer was given to the farmer. By and large this role of seducer has been conferred on the field officers, engineers, and development projects as such, since they offer -like the gentle lover offering flowers to the beloved- seeds, methods, loans, training, gender, sustainability, in sum development, to their clients. They try to conquer them (to raise their consciousness) with miraculous objects (discursive and material objects) never yet seen, with promises of a life full of welfare and progress if the seducer is followed and obeyed.

Nonetheless if we consider Foucault's insights on erotic knowledge (1994), which he depicts as "such cruel knowledge", we may discover that even though projects and their technicians are, apparently, the seducers (active conquerors laying siege to farmers' realms) at the end of the day the true seducers are those poor, naïve, harmless farmers waiting for the conquerors in front of their humble shacks. To Foucault, erotic knowledge displays four features which, possibly in accordance with some methodical order: to seduce, to corrupt, to deceive, and to tempt:

- To seduce: being experienced but feigning and thus encouraging ignorance by pretending to go along with things;
- To corrupt: having recognized the evil, where ignorance still discerns nothing but purity, and making the latter serve the former;
- To deceive: anticipating and arranging the outcome, as the profligate does when he prepares all the lures of the trap he sets for naïveté;

- To tempt: being 'in the know' and playing along, the better to spoil the game, when one has perfectly grasped the stratagem by which prudence, with its feigned simplicity, resists (1994: 57-58).

The management of ignorance supposes that it can take on diverse disguises and accomplish different roles. An assumed ignorance is an invitation to know more, an ignorance acted or performed is an invitation to question a proposition or theory[87]. Both recreate in some way philosophical and scientific methods: the first sort of ignorance is related to the mayeutic method from Socrates (to knowing by asking); the second to the falsification method after Popper (trying to find the shortcomings of some proposal, the 'lie' in some stated truth). But a feigned ignorance jointly with a performance of innocence can be useful and very strategic throughout the interfaces with projects, bureaucrats and engineers. An experienced farmer may subtly lead (somewhere) not ignorance in this case but a trained expert, while pretending to follow his honest technical instructions. In this manner the farmer may get important revenues or benefits: knowledge, seeds, chemicals, devices, commercial support, storage facilities, transportation, social prestige and a broader network, 'pretending to go astray' in the adventure of development[88].

To speak of corruption is to go too far but we can accept that the farmer, more often than not, find ways to serve his own goals by using those of development projects[89]. He recognises not the evil therein, but certainly the opportunity, there where development practitioners discern nothing but the purity of development ideals.

The farmer is not necessarily a profligate but he will prepare all the lures of small traps for the insufficiently cautious field officials, "anticipating and arranging the outcome" (Foucault) and, thus, deceiving them by acting as if

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[87] In another investigation a farmer asked about the options he could foresee as regards some productive problem threw back to us the question: "you tell me then, what can I do?"

[88] In a short document on so called "local agricultural research committees (CIAL)", from PROINPA, it is argued that Bolivian farmers "…have become mistrustful and very interested in material incentives" (PROINPA 1999: 5). They add –to stress that farmers are not evil or vicious at all– that this is so due to the "many frustrations" they have had to face.

[89] "Farmers quite easily divert or change the destination of CIAL revenues to other purposes different from research" (PROINPA 1999: 5). Basilio Rojas from ARADO complains about farmers' attitudes regarding their involvement in development projects: "One of the big problems when you work with farmers is, being you a development institution, that they are used to only 'receive' benefits all the time, so it is difficult to talk to them of the 'time of devolution' (…) When some institution comes the farmer thinks, first of all, that it is bringing money and that he will get it always, but that is not so. Thus it is quite difficult (*fregado*) to talk on accountability. From the outset the farmer believes that he is dealing with people meant just to offer benefits…"

he were a diligent and obedient pupil: promising, for instance, to follow a strict irrigation schedule, to take into account technical cues for seed selection, or to observe the established criteria for the discarding of plants (but, in the end, doing what he knows how to and on his own, not only having anticipated the outcome but adjusting his actions to the local constraints on water, seed or following his ideas on discarding, and so on[90]).

"Playing along, the better to spoil the game" shows how intense, conflictive and passionate the interfaces between farmers and technicians, promoters, facilitators can be. The farmer, within the limits of a human being, is almost all the time 'in the know', knowing very well the particularities of the game and what projects want him to do. 'Playing along', behaving as if the rupture with the project or its staff were imminent; showing convincingly that he is disappointed with the outcomes of his relation with the project, tempting the technician, extension agent or whoever in this manner to carry on playing the development game. Nevertheless –as happens in any game– the end result is unpredictable.

6.2 Reconfigurations

In characterising the encounters between farmers and engineers some authors have referred to them as 'encounters between colleagues' meaning thus that these encounters occur between people specialised in the same field, say irrigation or agricultural production. Nonetheless, such encounters are not really between 'colleagues' since engineers are not cultivators nor are cultivators engineers. Rather we could speak of encounters between 'experts': experts in engineering, agronomy, irrigation design, forest conservation, molecular biotechnology, animal sciences and so on; and the others, experts in agriculture, irrigation, animal breeding, but above all in poverty, the means in being poor, in living like the poor, not because they believe in poverty, or

[90] In the region of Punata an extension official instructed some farmer to irrigate a nice vegetables field (whose seeds had been provided by an NGO) twice a week. The farmer nodded deferentially. When the technician came back he found out that the farmer had not followed his instructions; asked why he had disobeyed the farmer "confessed" that he got water (from the irrigation system) only twice a month. Another farmer in Tiraque was asked to discard poorly developed potato plants from his field's borders, he agreed upon but when the engineer was back the "not well developed plants" were still there. Annoyed, the engineer started to pull out the alluded plants; behind him the farmer came re-planting the injured plants. The technician stopped, and resigned, looked at the diligent farmer, who told him that those plants were like his children (both cases are personal communications by agronomists working in rural development projects).

have democratically chosen poverty as a way of life[91] but because they are trying to make a living, to 'subsist' with scarce, few resources (with which others, without their expertise, would have perished long since), experts in knowing how to manage in the midst of dearth because the conditions in which they find themselves and live are like that.

The reconfiguration process of local knowledge in the communities of Qoari and Boquerón does not encompass all domains. In selecting seed, sowing, harvesting and the like they need no lessons. Moreover, there are different knowledge reconfiguration processes (not just one), which are also of different scope and depth. Speaking of which development projects have taught farmers about potato cropping, agronomist Carmen Camacho points out (referring to the more 'expert' farmers) that, although they have learnt valuable lessons' on other subjects...

> *...concerning potatoes … they have learnt nothing. Now he (Don Carlos) is an expert veterinarian, he removes parasites, castrates, does everything in reference to animals doesn't he? And the people from the community call him from one side or another to obtain his animal sanitary services. But with regard to knowledge on potato cropping I do not think any institution has been able to teach him anything.*

In the next sections we will take a look of the scope and particularities of reconfigurations.

6.2.1 What farmers do not see in the soil

Farmers' failure to 'see' soil pests indicates a real problem of lack of knowledge and perception. 'Ignorance' in this case it is not feigned or deployed strategically to obtain something. It deals simply with a lack of knowing something (or acknowledging something as Plato asserted), a simple ignorance, which notwithstanding can also be strategically organised according to some objectives. In relation to some kinds of perception, farmers are blind (like any one of us without a microscope). They cannot see with bare eyes, diseases in the soil, and as discussed in chapter one. This lack entails another, namely, 'the lack of perception of the lack of perception'. Thus, in its appraisal of local knowledge, technical discourse states that farmers are not able to establish the extant causal relationship between seeds and soil

[91] To avoid the idea of a condemnation or predestination for farmers we could state that poverty for them is at one and the same time a "structural condition" and a choice, a hard constraint and somehow an option (to know how to be a poor i.e. peasant –in a material sense, to be a rich peasant would be, to a large extent, a contradiction). Unless, like the stoics, they could opt for "leaving the chamber full of smoke".

degeneration, or the infections produced by viruses, which finally prevents them from rehabilitating their lands and producing seeds free from such viruses:

> *What limits farmers is that they do not know that seed degeneration as much as soil degeneration is brought about principally by virus infections, and that the more important virus vectors are the aphids. Due to that the possibility of using (successfully) their cultural practices to produce seeds free from virus and free their plots from diseases is minimal… (*Thiele 1997: 9*).*

Farmers do not see viruses, but they see other things (as for example nuance of soil colour. That is, they perceive the problem, but in a different way. To them the 'degenerated' soils are 'tired', and they do not see the direct material causes that produce such fatigue. To help farmers to see this more accurately, the new, more 'open, flexible and participatory' extension field schools of the nineties, concentrated their attention on how to teach the farmer or to allow him to discover for himself, "agro-ecological principles about a plague, or ways to control it; and to make use of his capacity for incorporating this new information into his production system … " (Thiele 1999: 1).

According to the spirit of these farmer field schools, the efforts of PROINPA technicians to communicate and teach farmers, led them to organise microscope sessions for farmers in order to allow them to discover viruses and realise that until now they had been blind in some way as to what had happened to their lands, under their feet or amid their crops:

> *For instance, a practical session was organised where farmers looked at infected leaves and sporangial liquid under the microscope. They themselves saw that they were dealing with a live organism. They could appreciate the development of the Phytophthora infestans fungus. Thus they were able to understand how the fungus grew up invisibly inside the plant before the symptoms became visible, and they accepted an early fungicide application requirement, like a 'vaccine' (*Thiele 1999: 5*).*

The use of the microscope with farmers and rural populations has been paralleled, in studies on colonialism, with the development and use of the biomedical episteme. Fisher and Arce (2000) argued that such uses were related to Western discourses on health:

> *This notion of healthy living was used to demarcate Western values from 'native contaminated' values, which were not capable of controlling pain, the spread of diseases, or the unhealthy 'dirty' conditions (*Fisher and Arce 2000: 74*).*

Giving their study a metaphorical title 'The spectacle of modernity' (spectacles is the more traditional word for glasses), Fisher and Arce argued that the widespread use of the microscope and other medical instruments

> *"brought about considerable dislocations in local societies in respect to community and spatial organisation, to people's understandings of the relationships between nature, the spirit worlds and witchcraft practices, as well as concerning their perceptions of the 'powers' of their colonial 'masters' (*2000:74*).*

The use of the microscope in Africa by the British meant an attempt to "modernise and 'purify' the African colonial subject"[92]. Purification of soils is also a central aim for breeders: infected and 'dirty' soils are not good for multiplying seed. They have to become, to some extent, aseptic, sterilised: freed from bacteria, viruses or germs. In this way so- called 're-creation of knowledge' through farmer field schools or local research committees means also dislocation or transformation of farmers' relationships with land, plants, plagues, the weather (i.e. with nature) but also with their beliefs, representations and meanings. However, this does not inevitably imply a shift of attitude, as we will see in the next section on potato diseases.

Farmers accept and incorporate into their knowledge new explanations (recall the old debate over explanation and comprehension), insights and even lexicon (see the next section) and thus reconfigure their knowledge with these new illuminated pieces of modern techno-science[93]. Having seen by means of the 'spectacle of modernity' (the microscope) the work of viruses, the idea of 'vaccine' is introduce and assimilated in relation to diseases, thus enhancing the farmer's cognitive repertoire. In this manner current extension sciences contribute decisively to the reconfiguration of local knowledge but, as argued in chapter one, this knowledge becomes *atopos*: a 're-bounding' knowledge which is no longer only peasant nor yet totally technical: a knowledge in between.

On the other hand, since the reconfiguration process is partial and fragmentary, farmers find other explanations or causes – beyond the lenses of

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[92] At first, similar to what happened with the "blind" Tiraque-Morochata farmers, the microscope made visible the unnoticeable cause of illness: "This optic positioned the previous invisibility of the illness to a specific disease form, and became central to verifying the existence of an epidemic" (Fisher and Arce 2000: 79). On the other hand, the microscope as an instrument or even weapon conferred (and still confers) 'expertise' and 'legitimacy' on 'doctors' (physicians, breeders, biologists and so forth): "In so doing, the microscope provided the Medical Officer with expertise and legitimacy (2000: 79).

[93] We should not forget –as Olivier de Sardan stresses– that what farmers receive from science and technology are just that - small pieces of knowledge.

the microscope – for the degeneration of their soils. Indeed they believe firmly that it is the chemicals that have exhausted and spoiled their lands. Further, in a holistic vision which does not separate good from evil, they think that the new introduced varieties appear with their own diseases[94]; and then it is the projects that have brought, alongside the new varieties, the new diseases that infest their soils. Departing from this we can state that it is false that local knowledge is unable to set up causal relationships. It establishes them without a shadow of a doubt, but they are of a different nature. They are manifold or, resorting to statistical jargon, 'multivariate'. In their traditional laboratory testing model (one-factor-at time[95]) technicians and researchers establish a 'bi-variate' relationship: viruses *cause* soil degeneration. Farmers may agree with this hypothesis (an alternative one since the null hypothesis would be that there is no relation at all between the two variables) but they see something further: namely that viruses – at least some of them – are linked to the components of technical packages, to the development projects that have introduced them into the community, to their methods (in the sense that if you do not follow them you favour viruses), to the intensification of commercial production (as the SEPA director pointed out, see below), to the scarce local resources or 'assets', to some ancient practices useless at present, to the greater amount of work and reduced spare time due to the increased number of cultivars. All this eventuates in soil degradation. Of course farmers know the easy expedient of blaming the other, the convenience of situating oneself on the innocuous side of innocence or ingenuity ("such cruel knowledge", as Foucault pointed out). But the problem of perceptive blindness persists.

Despite the ruses which farmers – to free themselves from guilt – might deploy, there are objects (discursive and material) that local knowledge cannot see (and not because farmers do not have microscopes to scrutinise their plots). Although they can, as any mortal or average citizen, understand the narrative of viruses and bacteria – which is even incorporated into their daily language – it seems that farmers, at least partly, cannot visualise how to relate such narratives either to the practices prescribed by the engineers[96] or to the 're-creation' of local knowledge from within. Nevertheless such a lack of perception of the techno-scientific narrative does not mean that they are not able to act upon plagues diverging from their local perception. It is true that viruses and bacteria become visible, relevant to them (or maybe not) once

[94] Something good like a child, or a new variety that enriches the local 'sum of diversity', also entails its evil aspects, its flaws and vices, its diseases.
[95] Czitrom (1999).
[96] Perhaps due to the fact that the 'pieces' obtained from technical knowledge are not meaningful all the time.

they are 'illuminated' about such organisms, but their actions have been largely based upon their local knowledge principles, compelled by their local perception 'since to perceive of is to act '(von Foester, see Chapter 1). The aphid technician's contention is that the results of farmer's cultural practices that aim to 'clean' soils of viruses are rather poor.

It is convenient to emphasise the importance of intensified production in soil degeneration. In the region of Tiraque, the *t'octu* (*Phytophthora infestans*) – didactically displayed to farmers by PROINPA microscopes – has always existed, but soils did not need any sort of 'purification' until development projects, fighting human poverty in those regions, paradoxically impoverished them. More harshly, the intensification of potato production, encouraged by projects, once the *t'octu* was defeated (by techno-science), infested the earth with numerous other soil viruses and bacteria. Unlike the colonial African experience depicted by Fisher and Arce, the 'contaminated values' and the 'dirty conditions' were not previously lying there in the domains of 'local societies'. On the contrary, and ironically, the colonial process of purification required at first the pollution of natives' land in order to purify them later. Projects, directly and indirectly, contributed to soil infestation and, as in other histories of colonial epidemics, to liberate people from epidemics first it was necessary to infect them.

Farmers know very well this alternative hypothesis or narrative. They greatly appreciate the new varieties introduced by projects since they can yield in three months; indeed they call those varieties *quinsa quilleras* (three monthers). Accordingly, production cycles become shorter and eventually soils end up 'tired', due to the disappearance of fallow periods and of an appropriate cropping rotation. One might say that internalisation of 'commercial logic' could have blinded farmers and lured them toward a lucrative vision of potato agriculture, a narrow vision within which the theme of soil conservation became invisible (lodged in the blind spot). One might simplify the problem by hanging the bad master or, on the contrary, the bad pupil, but the problem is not so simple.

6.2.2 Potato diseases: good pupils willing to learn

As noted above, the new knowledge which a farmer acquires does not signify an obligatory change in attitude. But neither can it be denied that project teachings imply changes which, via language and discourse, are taken on as part of the farmers' perceptions and practices. Beginning with the first point, as an example of the persistence of deep rooted attitudes we have the logic, coming from long before the Green Revolution, that pests must be 'fought'.

This is not necessarily the case for Andean farmers. As Carmen Camacho, the agronomist who did her fieldwork in Tiraque, testifies with happy surprise:

> *You know, on that I can tell you that the peasant doesn't fight. The peasant lives together with the disease, because they say "[The insects] have a right to eat as well."*[97] *Now, when the level or the degree of infestation, let's say, gets to be too much, they say "Something has happened, someone must have had an abortion, someone has been thieving." It's a symptom of something gone wrong and they know that. So they ask in the meetings, and in the meetings one can talk [about everything] from matrimonial problems to a woman who might have had an abortion…let's say, they live together with the diseases.*

Notwithstanding, in relation to the second point – changes in peasant practices – the agronomist recognises, with certain disenchantment, that:

> *Now, well, in the region…there are N, a thousand products which the institutions have…they've taught them to use them, and in that sense there's a lot of damage because these days any old thing appears and they're already saying 'Let's use this, let's use that, let's spray it on.' Even though due to the altitude, there's not much infestation by insects to the cold. But there are soil problems, nematodes, bacteria, fungi and so they're already using chemicals…*[98]

Knowledge of potato diseases and their treatments becomes an actual conflation of knowledge systems. Indeed, pests and the new chemical 'weapons' with which to 'fight' them, seem to be a central topic for the reconfiguration of local knowledge:

> *as a cure for t'octu, I apply Tecto 60. I also use Perfectión to improve the leaves. I make more use of Perfectión because it also strengthens the roots. There are direct cures like Folidol, but they don't work any more. It's the opposite with Perfectión since it's systemic, it enters through the leaves (sucks), after a quarter of an hour it kills the disease'*[99] *(*Daniel Paz*).*

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[97] This expression reminds us of how a woman farmer from Morochata responded, almost annoyed, to the questions of an extension officer about pests: "If they attack our crops, it's because they have to eat too!"

[98] Despite these reconfigurations, the idea of 'eradicating an evil' does not seem to exist. Doña Salome, wife of Don Carlos, who keeps her seeds separated and stored in bags, on finding a very large worm (a *laqatu*) in the middle of them supposed that the worm must be hugely satisfied. She took it out and put it on the ground, saying "greedy thing, you've eaten your fill, now get away with you." There may or not be a lot of pests or worms but however the year turns out to be, 'there must be some reason'. If the potatoes are full of worm weevils, this is not a great problem as the peasants will eat them anyway. According to the agronomist Camacho, peasants lack the criteria of quality that is taught, for instance, in business schools.

[99] In the same way, the peasants from Morochata describe how they acquired new knowledge brought by the engineers: "*Yana onqo* is the worst, what we call *t'octu*, but now we know how to treat it, how to hold it back so that it doesn't spread [the disease is also a person who can

One sees ample knowledge of agrotoxins, which allows farmers to recognise and differentiate their properties. This knowledge comes to be critical and reflexive with respect to the 'previous' state of knowledge,[100] which is seen as the improvisations proper to an empirical amateur, a sorcerer's apprentice different from what can be achieved by a good student of the extension technicians. This can be appreciated in the following quotation, which preserves the names of the chemicals as pronounced by the peasants.[101] What is most important is that the final result should increase yields, which leads farmers to apply these methods to his or her own plots and not only on the demonstration plots:

> *Yes, for example, as to chemical treatments, you have to spray every fortnight or the diseases can get in (prevention), because if we only did treatments when the worms appear, we use gremsi, bayfolan, biofol, we applied those products, but not at the time and in the quantity (necessary). Now, technically, (the technicians) help us and we combine them. The results have improved, yields have gone up, above all with the waych'a. With the Dutch potatoes, the Alpha yields are only ordinary. Desirée doesn't produce here because this place is high up. I don't always practice with the institution's plots, I also practice on my own plots. Because the results are good[102] (*Cirilo Alvarado*).*

This new knowledge, expressed by Cirilo from Qoari Lgunillas, based on systematic extension methods, likewise helps peasants to avoid being

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be 'held back']. We're not sad any more … the engineers … have taught us to hold it back, have to treat it with systemics and contact, with that we put a stop to it" (Celestino Vegamonte).

[100] To recognise that one was mistaken, according to Popper's theory of falsification, is in fact to come to know more: "Long ago there were already some diseases like the 'rosary' and 'warts'. We thought that hailstorms caused this disease, but in fact it was the frost of the hailstorm which favoured the spreading of warts. So, according to the technicians, you have to burn these potatoes or else cook them and feed them to the pigs, because if you give them to them raw, it can continue living in the stomach just the same" (Cirilo Alvarado).

[101] The peasants include in their repertory and taxonomies not only the names of chemical products but also those of diseases (such as *risoctonia*) and the modern language of the health worker ('symptoms'): "Now the risoctonia is appearing here…with that disease, what we say are symptoms that catch hold of the plant to reveal that disease. That upsets us at times, yeah!" (Justo López).

[102] Concrete results are what, logically enough, convince the producers: 'Before, when we didn't know about treatments, we didn't know which *jamp'i* worked, and we caused the loss of almost 50 hectares, a whole *aynuqa* [extension of cultivated land divided into many individual plots but subject to communal rotation] let's say, all the potatoes were ruined and we didn't harvest them. Since those days things have changed, because after that the institutions arrived, the technicians. After they showed us we can now treat and cure and produce healthy potatoes. But there are always problems, because we can't cure those nematodes yet and we don't know what the *jamp'i* is for that. If we knew we could reduce them. Nowadays we collect plants after the harvest and burn them. With that we cut the nematodes down a bit but we can't get rid of them' (Juan Ruíz).

deceived by small town market traders who habitually adulterate the products they sell. Note that Don Cirilo refers to the chemical products not as medicines (*jamp'is*) but rather as 'poisons':

> *On the subject of poisons [he laughs], we use Perfectión, Tamarón, Espermin. Before we used to use Folidol, Metil Paratión but not any more, because they sell them to us changed in Punata. That's why we prefer to join the cooperatives, ARADO, because the products are still pure. Once, in a shop in Punata, I bought Luxan and Monocrotofos and when I tried them out they were mixed with Coca Cola,*[103] *the colour of those products is similar to Coca Cola. I discovered this when I was spraying and that's why I'm distrustful (*Cirilo Alvarado*).*

The peasants do not perceive knowledge brought by technicians as necessarily opposed or alien to them, but rather as useful and relevant, complementary to what they know, as upheld by Daniel Paz of Qoari Alto: "with what we know in practice and what the technicians teach us in theory, I agree with both of them and it's all right". It is all right but engineers' knowledge is seen as theoretical, that is to say, as a narrative whose effectiveness has to be tested in the practical arena, which is the domain of the farmers. In addition, this new knowledge has a cost. The farmers who now know about measures, proportions and so on, also know that chemical products are expensive: "Yeah, we do treatments here. With *Patafol*, three fifths for the *t'octu*, for the *piki piki*. We treat with *Karate*. Oh, I do the treatment, I spray with *Patafol* and *Pedicul*, but it's expensive" (Tomás Villaroel). The similarity of these treatments to injections or vaccinations – surely introduced by the technicians to make it easier to comprehend the logic of their action – recurs time and again.[104] But the methods and recommendations of the technicians are not the only important source, as we saw before in Chapter 4; relatives, friends and neighbours, those who make up the network of people known to one another and linked by kinship and friendship, are also very important for diffusion of new knowledge and reconfiguration of the old. This network relationship is not necessarily hierarchical – there is not a *techne* structured in Marglin's terms, between master and apprentice – but more horizontal.

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[103] It is hard to know how he knew this – perhaps he tasted it to check?

[104] "As they say, nowadays in Bolivia, all over the world, there are vaccines for children, for polio, tetanus, diphtheria, what isn't there for? And before [the illness] gets to them, they are vaccinated, right? The government vaccinates for free, right? So that's what you have to do, before it gets [to the plant], when it's small, say ten centimetres high, you have to vaccinate the potatoes, right? With any of those phytosanitaries, with any of those *jamp'is*, you apply it like a vaccine. They're called systemics, right? You have to treat them with those *jamp'is*" (Justo López).

> *Among friends we always talk about what's going on with our lands, for example, I didn't know about the globodera, about the rosary yes. The globodera turned out to be like a mustard seed. We tell our friends about these diseases, saying "the globodera doesn't let the potatoes grow". We talk in peasant union meetings as well, on the short courses at the institutions. But these things are understood by those who want to understand, for others it's just a load of nonsense (*C. Alvarado*).*

With reference to the origin of diseases (above all the new ones), as mentioned, peasants blame the projects and external agents. Don Cirilo goes a little further in this respect:

> *I would say, on the one hand, it bears thinking about, because might it not be the gringos who send diseases in the fertiliser? Because there used not to be diseases (worms) like now, because nowadays there are other worms, and weeds too, like the asna qhora which there's a lot more of. This weed reduces the production of potatoes, broad beans, and oats, because it overruns them and drowns them. They say this weed came with the fertiliser, they also call it mach'a qhora and it has white flowers.*

Apart from the hypothetical 'gringo' plot to introduce new pests in Qoari, one may say that just as proposed there is a co-evolution between pests and the chemical products that confront them (since the 1930s in the USA, as an annihilation strategy), one may also say that the reconfiguration or renovation of local knowledge acquiesces not only to contact with the novelties of technical knowledge, but also the appearance of new diseases and pests. A previous reconfiguration would have been irrelevant in their absence and under different climatic conditions. That is, if there are no diseases there is no need for treatment:

> *We didn't use treatments, there were no diseases, and it rained a lot as well. The rain was responsible for cleaning up any disease, the potatoes produced anyway. Nowadays the potatoes don't last, only with jamp'is [medicines], that's the only way they grow now, otherwise nothing. If they're not treated, the t'octu gets into them, it turns the plant yellow and then it doesn't grow. The llaja has appeared, those diseases have appeared because the sun has brought them, there's no water and it doesn't rain. So it's due to the lack of humidity, we could say, [the plants] don't grow either, unless they're irrigated (*Pedro Montenegro*).*

There is a widespread gender bias in the reconfigurations of knowledge promoted by development projects, which widen and strengthens the knowledge of farmers, but mainly that of men. In our case it could be said that the same thing happens, although, recalling what was proposed in the preceding chapter, the assignation of chemical products to men and natural fertiliser to women seems due not only to a bias introduced from without – which the projects are presently trying to overcome – but to symbolic criteria and beliefs with respect to the relations between men and women in the Andean world, with nature and the material world. Hence, the apparent masculine bias in the reconfiguration of local knowledge also has a cultural origin: *jamp'is* for men, manure (*guano*) for women (the *guaneras* or muck spreaders). In the following quotations, mostly from women, this 'bias' is clear:

> *Men* [treat with chemicals*], women don't know about that (*Julia López*).*

> *He does the treatment, we women don't do treatments. I never help him. It's ugly, the lluphi, but nowadays there's a medicine for that … I don't know, the potato growers know; as a woman I don't know which medicine it is, which one it would be (*Alicia Katari*).*

> *About potatoes? What I treat them with? Well, I don't know, men know about that, what they treat them with. I suppose they use barata [meaning cheap, but probably a mispronunciation of the widely used pesticide Karate], before that it was azulito. Whatever it might be, they don't produce, they only grow when they've been treated (*Julia López*)*

> *Women no, they don't even know which disease is affecting [the plants], they know other things. The man always checks if his potatoes are catching some disease. When we see that we go and buy the medicine and treat it straight away (*Jorge Villaroel*)*

Thus there is the idea that the plants only grow when they have been treated. What seems to have happened is that, since the *jamp'is* are also poisons, the projects recommended that the 'head' of the family should handle these products. So we were told by Juan Ruíz: "Before, even kids handled [chemicals]. Now we know that only men should do that". Hence, since the men are authorised to mix, combine and apply chemicals, they come to be the only ones who *know* about them, excluding women (and children) from this knowledge. It would seem, and Don Jorge Villaroel affirms this, that women ignore the diseases which the potatoes 'catch'. But this is not the case; as we saw (in Chapter 5). Women play a central role in establishing the meanings, representations and metaphorical perceptions of the potato, as so they do with respect to its diseases, and in this knowledge the importance of metaphors, description, onomatopoeia and diminutives[105] is fundamental to

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[105] Since there is no diminutive suffix as such in English, adding little or small as an adjective does not have the same significance. We have chosen to put [d] after each word which appears in diminutive (suffix –ito/ita in Spanish) in the original. The implication in Spanish may be that the object in question really is smaller than the normal, but it may equally well signify that the object is 'cute' or that the speaker is expressing affection towards it (as when, for example, one uses the name of a close friend in the diminutive). This is the most probable explanation for referring to the leaves or stalks of one's crop in the diminutive, and not that

understanding the peasant vision of the diseases and their amiable relationship with the natural world. Let's see some of these descriptions:

> *(The t'octu) may be just black, it appears on the leaves[d], on the stalks[d]…the white trousers can appear on the leaves[d], like a scatter of sand[d], that's how it appears, after that it spreads to the stalks[d] and they fall (*Felicidad Escobar*).*
>
> *The t'octu gets into the leaves, that's where the ch'aki jullu appears, oh, it's really nasty (libre milla)! (*Concepción Dávalos*).*
>
> *The disease nina jina k'asparqurin (it scorches like fire), in the heat [the plants] all wither up, even their leaves[d], it burns them black…the llaja is a worm, it makes it all old [as if worn out], its leaves[d], it leaves them like netting, it turns the leaves[d] red (*Victoria Claure*).*

Of course, not only women describe things in this way; men also show these rich descriptions:[106]

> *Lots of piki pikis eat holes in its leaves[d]* (JorgeVillaroel*).*
>
> *T'octu gets into it, oy, that black disease! We call that* t'octu, "p'aki p'aki", it cuts its bones[d] [metaphor for the stalk of the plant] *to bits (*SimónVásquez*).*
>
> *That risoctonia gets into it like snot, it collects in a nasty way inside the potatoes. And if it doesn't collect, it's a hard thing inside the potato, a little ball, it's not edible any more. I mean, it's a hole inside, sometimes, a coffee-coloured hole. To look at, it's OK, but when you knock it, it rattles: roc-roc-roc, it's no good any more to eat or to sell…there's piki piki as well, they're yana khuritos (little black worms). They make holes in the leaves[d] of the potato plants, they suck their flowers[d], they don't let their leaves[d] grow, they*

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these were really dwarf or immature plants. Only in the case where the reference does seem to be to small size have we used the adjectives.

[106] Although one can affirm that there are differences between men's and women's perceptions:

The differences in perception are not so great, but there are some with reference to tuber development. Women point more to the appearance of the potato plant, they give more emphasis to the aesthetics of the exterior part of the plant, such as its shape, thickness, size, quantity of flowers, number of stalks, number of berries, but without relating this to the quantity of tubers.

Men cite more diseases which damage the plant, the presence of insects and weeds which have a negative effect; the size of the flowers is not important, only their colour which distinguishes new varieties from native ones. Nor are the berries important to see, they think that diseases also enter by that route, the stalks are also important to them as diseases generally attack them. This because men are more taken by the courses which they were given in the past which were more directed to men and not to women, who only recently have been integrated into some groups where new knowledge to do with potato development is taught (Ordoñez 2003).

> *suck their nutriments…there's the llaja as well, they're kharkadores (scrapers), the piki pikis are jusk'eadores (drillers), the ticonitas cut the stalks (yuras), they make them fall down when they wither, the ticona (a kind of worm best known for infesting maize cobs) also gets into the potatoes. It uñacha (shreds) the flowers, it eats them before they bloom, it makes the buds fall off (*Justo López*).*[107]

To finish, it can be said that, due as much to the persistence of peasant practices (as habits which are not lost, as to the searches of the projects and development organisations for methods and inputs which are compatible with the environment, the final result is a combination of knowledge in the treatment of pests. For example, chemicals such as Folidol and Tamaron are combined with repellent herbs such as *muña*.[108] This last is burnt and spread over the soil, and its penetrating smell and bitter taste are effective against insects. According to the peasants, other practices such as constant irrigation, weeding, *k'urpeada* (breaking up clods), and mounding up give good results in soil conservation.[109] The double teaching, of tradition and 'new' technical knowledge, is reflected by Don Cirilo:

> *You have to apply the treatment once a fortnight in the plots for seed production. In the harvest, to store the potatoes properly so that worms don't get to them, you use muña, spreading it over the floor and covering it, you can use eucalyptus as well for storage. What you use for seed potatoes are wooden crates, because they're ventilated and they keep well till the next sowing. You can get them from ARADO.*

Now that we have seen the importance of chemicals as 'medicines', in the treatments which the peasants carry out on their fields, I turn to focus on their nature as 'poisons' and the problems this brings.

6.2.3 The problem of agro-toxicity

> *We were born with the jamp'is*
> Cirilo Alvarado

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[107] Technical knowledge also collects local knowledge concerning potato diseases, but in its "collection-translation" the charm, colour and savour of peasant descriptions are lost:

> When the disease first attacks the leaves, the farmers call it *lluphi* which means burnt by water, by the hot vapour which emerges from the soil. When the leaves turn black they call it *k'asparillo* which means 'burnt by fire'. When the pathogen attacks the stalk they call it *p'aqui p'aqui* which means 'break', because the infected stalk breaks easily. When fungus enters the tuber they call it *k'anura* because it has hard parts and cannot be eaten, or *chaqui jullu* which translates as dry rot (Salazar 1997:61).

[108] *Micromenea minthostachys*, an aromatic plant of the labiada family.

[109] This tendency to conflation can be observed from a statistical point of view in Chapter 4.

As the woman agronomist Camacho affirmed, at present there is a greater tendency to use agro-chemicals. According to Don Cirilo this use has intensified at present, while the old methods have been *forgotten*:

> *Nowadays they use [chemical] products a lot more, because they say that in the past they weren't used. For example, at the stage of hilling up the plants with the ox plough, they used to beat the sides of the plants with a plant called asna waych'a [a plant with a strong smell]. With that the worms fell away.*[110]

The phrase "they say" indicates that he himself did not see it or does not remember it. In practice, he is part of the chemical generation that consists of those who have grown up with the use of chemical inputs - with only the echo of the "beating plants" in his head:

> *We don't use this [asna waych'a] any more, because we were born with the jamp'is. So nowadays we only treat with the jamp'is, we don't use those qhajchanitas [beating plants] any more. And they say that they used to produce well and without fertilisers, but today it's different.*

The earth itself seems to have become used to the components of technical packages, as if it had acquired a new addiction, and when it fails to receive inputs such as mineral fertiliser, this translates into a poor harvest.[111] *Memory* informs the farmers that in the past – though it is hard to separate myth from reality – the fruits of the harvest were abundant, if not amazing. Today, production is a failure if it lacks chemical fertilisers, and the climate also seems to have changed. However, what is most striking is the dependence on mineral fertilisers:

> *Compared to previous years, potatoes and ocas yielded beautifully, they were large. For example, they were about 30cms long, you could tie them* [in a bundle] with a rope [and carry them like one does firewood] *Nowadays ocas don't want to grow either. Years ago there was plenty of production, but I didn't get to see it, it's just what they tell me. They had good harvests, they say: one plant [gave] fifty potatoes. Today it's fallen*

[110] Daniel Paz says that chemical fertilisers were not used: "when I was a boy they didn't use [chemical] fertiliser, only manure, but afterwards they applied more and more fertiliser until today, when they put half and half fertiliser and manure".

[111] "Because nowadays the earth has got used to the seed, to the fertiliser, to the *jamp'is*, but a lot of the time only the fertiliser and the seed. For example, when by accident the women muck spreaders don't put the fertiliser in the track of the plough or a furrow, and only put the [animal] manure, the production is very poor. The plant may grow to 15 or 20 cm high, not more, and will only give a few potatoes; while those that receive fertiliser and manure can grow up to 80 or 90 cm high, with foliage. Their potatoes are big as well. So that's because the earth is used to either the manure or fertilisers and the *jamp'is*. That is how I see it" (Cirilo Alvarado).

> *off a lot, it only produces with fertiliser - mejora.*[112] *The weather doesn't help either because it's all changed. It doesn't rain like it used to, because before when it rained, well, at the right moment, you could hill up. Nowadays the rains are disappearing and you can't carry out the same tasks (*Cirilo Alvarado*).*

Apart from the "addiction" that chemical fertilisers have produced in the earth, there is also the problem of "poison". The farmers themselves are now aware – although not in every case – of the risks to which they are exposed when handling and applying toxins for the treatment of pests.[113] Many studies have shown and widely distributed the extent to which peasants not only use highly poisonous and even prohibited products, but take no precautions in handling them. They often prepare cocktails of several products mixing them with their hands, and may even taste their flavour to check how "loaded" they are. One frequently encounters stories of suicide (especially of young people) by fertiliser poisoning in Tiraque. René Gutiérrez, a sociologist who worked with ARADO for several years confirms hearing several such stories which now circulate as well known local anecdotes. The "chemical problems" faced by ARADO[114] include cases of severe poisoning and even deaths, often caused, it seems, by confusing toxic liquids with milk or Coca Cola due to the fact that their colours are similar. Also, as we noted earlier, from time to time one comes across peasants whose skin colour is yellowish - a disturbing symptom of perhaps the misuse of chemical inputs. This often arises because of the incorrect use of spray backpacks, and their poor, worn-out leaky condition that permits chemical solutions to seep through onto the worker's body and clothes. It also results from poor work habits and irresponsible management practices.

All this has led ARADO to take several measures, from applying regular blood tests for farmers, through the purchase of masks, boots and gloves, to the visit of a doctor to advise them on the precautions to be taken with agro-toxins. What the doctor did in practice was to bawl them out severely for their

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112 M*ejora* means 'improve' and *mejorita* 'a little better' to refer to chemical fertiliser applied to the earth so that its productive capacity will be better.

113 "Well, I've learnt that you have to harvest the potatoes at the right moment, and to use 'carbodan' to kill the microbes before sowing. You put this product in the furrows, as if you were watering the seeds. Lately we don't use 'carbodan' any more, instead there's another product called 'actara', but it doesn't work so well. 'Carbodan' isn't used any more because it's very poisonous for the farmers" (C. Alvarado).

114 These problems are recognised but minimised by Basilio Rojas, technician at ARADO's centre in the region: "Nowadays, the producers make much use of the fertilisers which are brought in, looking for those which cost less, although there are a few problems with handling them, because they need training about doses and the way to store chemicals. There have been more than a few cases of poisoning because people didn't know how to handle the chemicals with care".

lack of criteria in the use of chemicals. The peasants were deeply impressed. Shortly afterwards they commented to René Gutiérrez, with a certain note of complaint, "you brought us a governor (*corregidor*)".[115]

What the above shows is an unfinished process of reconfiguration: the peasants learn very well the 'when', 'how' and 'why' of chemicals, the doses, mixtures and proportions, but they are slower to learn, if they learn at all, about the protective and preventive measures that should be taken. On the one hand, this may be due to the limits placed on them by costs: the chemical itself is expensive for them, but an adequate outfit with mask, gloves, helmet and so on costs several times more than the price of the chemical, which is in itself already an obstacle. On the other hand, the partial and fragmentary reconfiguration of local knowledge concerning agro-chemicals indicates that the vision of "productivist" projects is myopic, since it focuses principally on levels of crop production and the quality of the product. From this utilitarian point of view, the "chemical problem" (the risk of poisoning, pollution) is located in a blind spot and becomes largely invisible. Thus the peasant 'pupils' fail to see its significance. The *jamp'is* provide treatment and yields; they also poison, but this is viewed as a residual effect which we do not need to pause much to think about.

6.2.4 Gain and loss of genetic variability

In Chapter 4, we documented the progressive reduction, in number, of native varieties. The farmers *recall* the lost varieties with a mixture of regret and desire, the desire to be able to have them again. Thus, Julia López expresses her deep desire:

> *Oh! I'd love [to have] those floury potatoes* (jak'u papas), *they're lovely, they don't need salt (*kachi*) or anything, you can eat them just boiled whole with their skins on* (wayk'u*). They're not good for soup (*almuerzo, literally "lunch", but in the countryside this is understood to consist of soup*). They're black. Just as wayk'u, you don't peel them, they're tasty* (dulce, literally "sweet" but applied to anything which has a good flavour even if savoury*). You can eat them like that, we don't need to peel them.*[116]

[115] *Corregidor*, the colonial Spanish title for a provincial governor, now refers to a local level functionary in charge of administering justice and punishing badly behaved community members, imprisoning them in the 'calaboose' (*calabozo*) when their errors deserve it.

[116] Peasant women in charge of cooking from Compañia Pampa (Morochata), where native varieties hardly exist any more, show pride in possessing some native potatoes, which they try to preserve despite the circumstances.

With a certain feeling of guilt, she recalls the lost varieties:

> *In the past we always used to grow the floury lunka potatoes, lovely, like our imilla potatoes. They yielded just the same. The phureja potato was yellow[d] and oval[d]. Now we've caused it to get lost, we used to sow lots of it before. It was beaten by disease and we made it disappear, I think the Salas [family] are the only ones who have it. The same disease as ever, the yana t'octu, oh! If it's not the llaja, it gets taken over by tizón (t'octuparin).*

The disease "beat" or "won the fight" with this variety, but one could also say that it "beat" local knowledge – at least, the knowledge "possessed" by this family. This is evidence of the limits of local knowledge or the lack of attention and dedication to certain varieties. Jorge Villarroel also laments the losses suffered: "Earlier there was the *imilla*, we don't sow that any more…there aren't any *qoyllus* either. In the past we used to grow a lot of them, in the high fields. Most of them we've caused to disappear, most of them".[117] One also perceives in him a certain feeling of desolation and frustration when he exclaims: "Before, we used to produce [*qoyllus*] in the uplands. Most of us have caused its disappearance, we made it get lost. Looking at each other we've lost it all, all, it doesn't produce well".

As we saw in Chapter 5, the introduced varieties, mostly brought by development organisations and technological innovation, were Dutch varieties such as "Alpha" and "Desirée",[118] plus other foreign hybrids such as "gendarme" or "Colombian", and varieties created by the experimental station in Toralapa (directed by PROINPA) such as the "puka [red] toralapa". Thinking above all of the community of Boquerón, we also established that innovation is not solely due to project intervention but comes about in many ways. Victoria Claure explained:

> *Up above we only sow "toralapa" potatoes, "white toralapa", there's a red one too…that young man from Ticopaya made it appear. Young Juan brought it, we bought a little bit, and we reproduced it with that. Nobody else brought it, only him. There were no potatoes, the imilla potatoes were full of disease, they were finished, they didn't grow. After that we planted a piece of land as sharecroppers, just those potatoes up above, lower down they didn't give [any results].*

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[117] Peasants from Morochata also remember the lost varieties. "After the *waych'a,* the *mochila* (literally 'backpack') appeared. It produced beautifully, big with white eyes; it disappeared with the disease *t'octu*" (Tomás Villaroel). "We had another one, we made it get lost. [It was] like a pig's snout, but we caused its loss" (Casimiro Ruíz).

[118] "Some producers have preferred to work directly with 'Alpha' and 'Desirée', which are larger, we refer directly to large potatoes used for potato chips, with red and white [skin]" (Basilio Rojas, paratecnician at the ARADO centre).

At times local peasants are intrigued by the names and origins of these introduced varieties. Thus, Cristina Almanza from Compañía Pampa (Morochata) asked herself "Why should the "toralapa" have that name, eh? From where might it have come? Don Juan Urrutia made it appear, after that we made it appear, eh". In this sense, we find not only an incomplete reconfiguration, as in the case of chemicals, but one that is also partial in terms of age and gender: above all, the young, or relatively younger, producers, and the men, are those who acquire knowledge of the new varieties.[119] Julia López offers proof of this:

> *The engineers [agronomists] have brought the new potatoes. I can´t tell you about that, I can't get my head around it (mana chayta jap'inichu umaypi). I don't plant [those varieties], my son plants them, not me. Waych'a, just waych'a, imilla, that's all there is now.Nowadays there are no old-time potatoes (ñawpa papas).*

Older people's knowledge points to the past, to the old-time potatoes (*ñawpa papas*) which are tending to disappear. They can't "get their heads around" the names of the new varieties. This new knowledge doesn't "enter" their understanding; nor do they grow the new varieties. However, an interesting phenomenon is the re-naming of some varieties, such as the 'runa toralapa': in Tarija and Morochata this is known as *iskay achi* and in Qoari as *doblacha*. The original technical name for this variety is HH; *iskay achi* is "double H" in Quechua and *doblacha* is, in fact, the Spanish – "*doble ache*".

Another important phenomenon that occurs with new varieties is that not all of them "stay on", that is to say, not all of them are accepted, or adopted – like daughters, see preceding chapter – or appropriated by the farmers, above all for alimentary or culinary reasons, and of course for commercial motives. This seems to be what happened to varieties, such as "Perla", "Puquina", "India" and "Robusta", introduced by PROINPA, and with others introduced by SEPA ("Bajio", "Wayna", "Musuj") which were disseminated by the engineers.[120] What farmers, not surprisingly, recognise is the ample capacity of the new varieties to resist certain pests, which is one of the central aims of the technicians who work on seed improvement. For peasants, this new knowledge is tested empirically:

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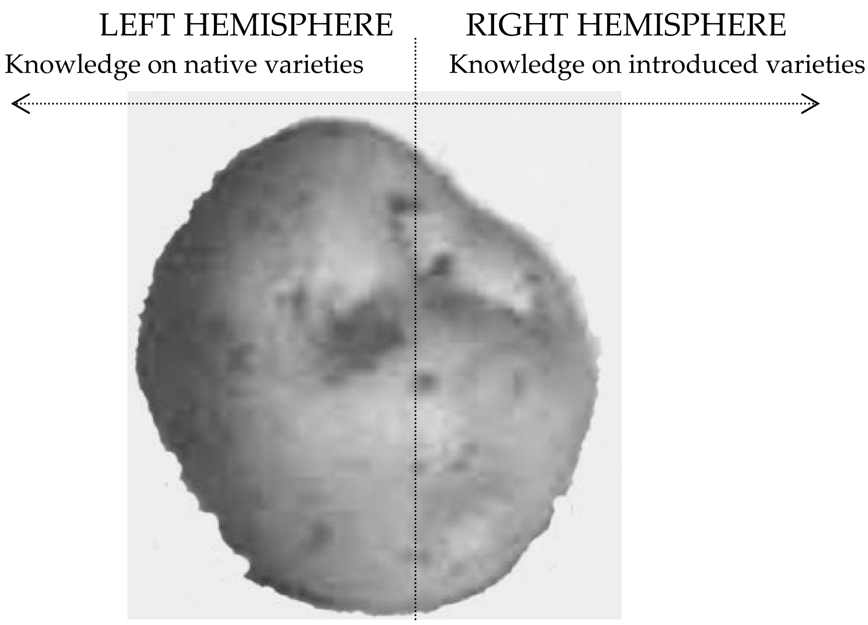
[119] Basilio Rojas confirms that those who take training courses are relatively young. They are more receptive and agree to work with the "unknown", which is always a risk. Older people are "less optimistic" about working with new varieties and are not happy to accept lessons from a young agronomist. "How is a *t'una* (literally 'a small piece, a broken piece': a child, a youngster) going to teach us what we learnt from our parents?"

[120] "The engineers brought the 'Robusta' potatoes, they made the 'Perla' appear as well, they brought the 'Puquina' too, they brought the 'India' as well" (Cristina Almanza).

> *The "Robusta" isn't much affected by disease here. It turned out to be really tough, the only thing that gets to it is the llaja, those little bugs…that "Perla" is a new [variety of] potato, hey. The engineers brought it. It's not affected by disease, only by the llaja, eh?* (Gregoria*).*
>
> *Oh, the waych'a gets sick more! The "toralapas", those are resistant, what? To the diseases (*Alicia Katari*).*[121]

What happened to potato varieties in Qoari and Boquerón, in the course of the lengthy process of intervention to which they were subjected, can be summarised by identifying three main tendencies: the tendency to reduce the number of native varieties; the tendency to increase the number of introduced varieties, and finally, the tendency of the latter to remain or disappear. For local knowledge, this process can be conceptualised in terms of a pattern of volumes, whereby farmer knowledge of potato varieties can be viewed as a geometrical figure divided in two parts, one corresponding to knowledge about native varieties and the other concerning introduced varieties. Let us suppose that local knowledge about potatoes in the communities studied takes the shape of a potato (see figure below):

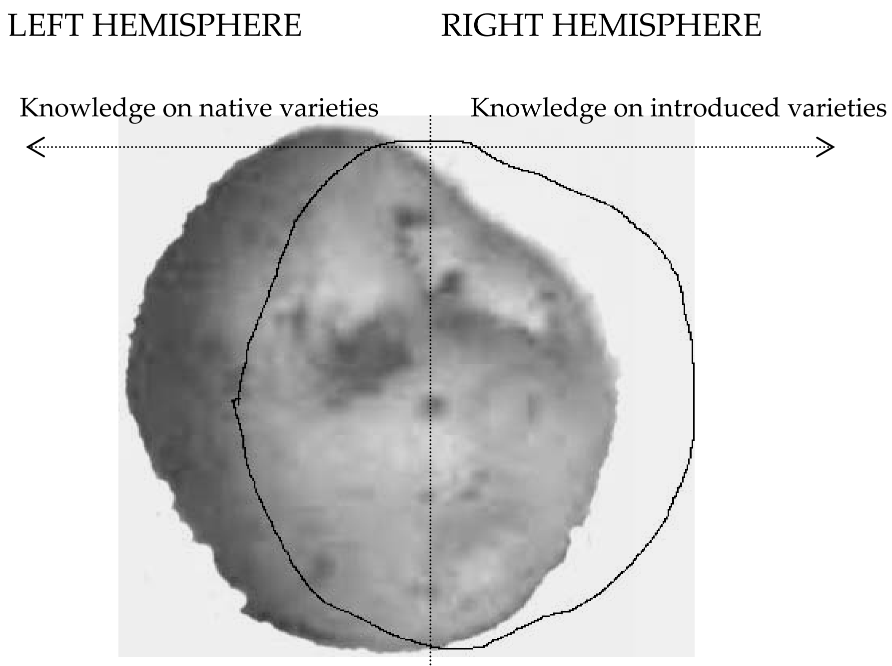
FIGURE 15
The "knowledge potato"
(BEFORE INTERVENTION)



[121] These properties are compared to those of resistant native varieties, but now – part of the process of reconfiguration – using the language of the engineers (referring to technical ideas of altitude): "*Luki* potatoes [would get sick] if they were at sea level, but they produce at 4,500 metres above sea level, that high up, *luki* is strong in the cold" (Juan Ruíz).

The potato form (knowledge about potatoes, that is to say, "the knowledge potato") is crossed by a dividing line which separates it into two "hemispheres": left and right. The left hemisphere depicts knowledge about native potatoes and points to the left – towards the past. This occupies the larger volume. The right hemisphere represents knowledge about introduced varieties and occupies the smaller volume – pointing to the right and, somewhat tendentiously, towards the future. The first of the changes promoted by development intervention is shown in the following figure.

FIGURE 16
The "knowledge potato"
(WITH INTERVENTION)
CHANGE 1



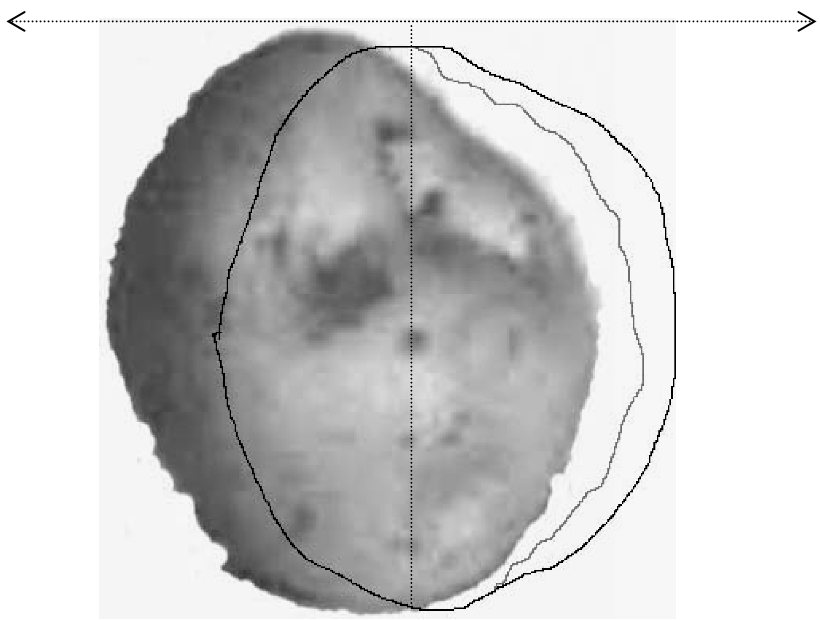
Change 1 in the volume of knowledge

The introduction of new varieties (hybrids, improved natives, etc.) by various development the projects has, apparently, caused the whole of the "knowledge potato" to move to the right (if the dividing line is assumed to be stationary), increasing the volume of knowledge of introduced varieties and reducing that corresponding to native ones. Of course, this is not a strict numerical relationship, because the number of introduced varieties is less than the number of lost native ones. Thus, we may say that, although intervention entails a gain in knowledge about new varieties, it also represents a loss (the 'destruction' of knowledge as Long expresses it, see Chapter One[122]) that is, as regards native varieties, greater than the gain. In consequence, what we have is not a shift of the potato as a unit, but rather a lesser growth to the right (in introduced varieties) and a greater shrinkage on the left (in native varieties). But there is a third movement, which is shown below, by reference to the total of diversity and knowledge.

FIGURE 17
The "knowledge potato"
(WITH INTERVENTION)
CHANGE 2

LEFT HEMISPHERE RIGHT HEMISPHERE

Knowledge on native varieties Knowledge on introduced varieties



Change 1 in the volume of knowledge
Change 2 in the volume of knowledge

In the above figure, we observe a retreat in the right hemisphere. Since not all the introduced potatoes "stay on", but some of them "leave", that is to say,

[122] Long (2001:189) maintains that knowledge is both constructive in that it incorporates ideas, beliefs and images, and destructive in that it undermines or destroys other frameworks of conceptualisation and understanding, whether belonging to the past or previous or possible.

are not accepted by farmers,[123] the volume of new knowledge about introduced varieties diminishes. Nor do we have a shift of the whole "knowledge potato" (whether to the left or to the right), but a genuine shrinkage of the whole cognitive tuber (as if it had been dehydrated): it loses a volume of knowledge on the left (there are no longer as many native potatoes as before) and loses volume on the right (some new varieties do not work out and they "leave"). In summary, at the end of the process, development intervention seems to have meant a "handling (or storage) cost" (*merma*), to borrow a term from the language of agricultural trade,[124] which has reduced in relative and absolute terms the volume of knowledge about potato varieties. Of course, the preceding allegory cannot be taken as definitive or totally valid. The projects are not the only agents who put in or take out potatoes from local knowledge. As we have observed, local experimenters, the market, neighbours, friends and the particular projects fetch and carry varieties from one place to another, widening or narrowing, at any one moment, local knowledge. Nevertheless, it seems evident that in Tiraque in general, and in Qoari and Boquerón in particular, the total diversity of potatoes has diminished[125] during the course of development intervention.[126]

6.2.5 The food problem of improved varieties

We have mentioned that one reason why introduced varieties are rejected has to do with culinary aspects and matters of taste. These aspects are of great importance and in one way or another also determine their acceptance and value in the market.[127] For peasants, the hybrids and improved varieties, in general, lack a good taste and are not good for cooking:

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[123] Jorge Villarroel expresses it thus: "According [to the particular case], we just sow the one which yields best, if it doesn't produce well then we leave off sowing it".

[124] *Merma* refers, for example, to the inevitable loss of weight that occurs while a product is stored until the eventual date of sale. The proportion of a load of fruit that gets damaged in transport and has to be discarded, etc.

[125] For the agronomist Carmen Camacho, local knowledge has suffered a serious loss: "I think that [knowledge] has been highly eroded. Families now have at most 11 or 12 varieties. They don't even know their names. I think it's greatly eroded".

[126] Don Basilio Rojas summarises very well the perpective of ARADO: "it's evident that a great number of native or original species has been lost, but nevertheless they didn't manage to satisfy market requirements…one can't say that the institution has collaborated with measures of species conservation, because the direction and the division of labour which corresponds to us is directed towards other objectives, among which stands out the search for better options for peasants offering a quality product".

[127] From the technical point of view, studies have also been carried out on the acceptance or rejection of new varieties by the producers. One very interesting study is that carried out in PROINPA by Thiele, Gardner, Torrez and Gabriel (1997), from which I will extract some results in order to compare them with the present investigation. One should emphasise,

> *The "white toralapa" is very watery, it's not floury like the imilla potato. That one (*the "white toralapa"*) upsets your stomach when you eat a lot of it, that's why we don't like it in soup, that's why we eat it peeled and dry* [boiled as part of a solid dish*]. It's not good for soup, it's* k'ayma *(tasteless) (*Victoria Claure*).*[128]

> *That waych'a potato that grows here is always floury. The improved potatoes are* yaku (watery) *potatoes. When we cook yaku potatoes for* wayk'u [boiled whole in their skins*] they are very* ñeque ñeque [gluey, full of mucous].[129] *It's not good. This waych'a potato is for eating as* wayk'u' *(*Julia López*).*

> *This "Perla" isn't good to eat, it's sour* (picante, literally 'hot, spicy' but includes unpleasantly sharp or sour flavours). *It's not good to sell either. They don't want it, they're not familiar with it* (Cristina Almanza*).*

Consistency (watery) and flavour (insipid or even sour) are the defects of the introduced varieties.[130] Moreover, we can pick out two aspects from what Victoria Claure and Cristina Almanza say. According to Victoria, the

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however, that although the study refers to the experience of "farmer involvement in selecting new varieties", authority and the power to take decisions remain firmly in the hands of the technicians:

> In 1995 social scientists and breeders evaluated clones with farmers on trials managed by breeders. Breeders determine which clones are selected and ultimately which are released as varieties and so the degree and nature of their interaction with social scientists is a major determinant of the impact of farmer evaluations' (Thiele et al.1997:276).

As regards the methods used, we may mention: time of evaluation (the evaluation was made during pre-flowering, flowering, harvest and boiling), evaluation technique (selection of clones with ribbons, open evaluation with form to record reasons for choice, verbal selection, written selection, closed evaluation with questionnaire, evaluation with matrix scoring), control of trial (researcher, shared, farmer – except for fungicide use).

128 "That 'toralapa' has absolutely no taste at all when you cook it" (Gregoria).

129 The potato has a heart and this is what takes longest to cook. While cooking, women comment that it takes a long time, or say the heart is not yet cooked: "*sonqhon mana chayanchu*". The *waych'a*, being more floury, needs more care: "I take the *waych'a* out of the water first because it's floury and it might *q'etayar* [burst, fall to pieces]. *Luki papa todosantuspi qosa wayk'opas porque abuelayanan*" (*luki* potatoes are good at All Souls [November, months after the harvest], more tasty because they have been kept for a long time [literally, 'they are grandmothers'])" (Luisa J.).

130 The abovementioned study investigated the culinary characteristics which farmers identified in ten clones. Several of them were classed as "watery", others were "insipid" or "bitter", but some were "floury", "good" or "very good". In the evaluation, on a scale of 1 to 3, the "Puquina" scored 2.71 (in Morochata) and 2.31 (in Tiraque), the "India" 2.57 and 2.25, the "Robusta" 2.52 and the "Perla" 1.81 and 1.44. As regards taste, in a subsequent evaluation, with a possible maximum of 24 points, the clones generally scored 8, with the highest score reaching 16. In general, peasants from Tiraque and Morochata, and the PROINPA technicians, agreed abour the most important points for selecting varieties. "Criteria broadly coincided across areas including yield, size and shape of tuber, skin colour and form of eyes" (Thiele et al. 1997:281).

"toralapa" "makes your stomach rumble", while for Cristina the "Perla" "isn't good to sell either". From the first reference, we may conjecture that one also digests as part of the process of reconfiguration, allowing one to evaluate the direct effects of consuming the new varieties. Can improved varieties cause damage? "Yes, the 'toralapa' is very *fresco* [local medical classification where *fresco* foods make one ill if consumed in excess], but the *waych'a*[d] isn't. The 'toralapa' is very *fresco*, it gives you diarrhoea" (Gregoria).[131] On the second point, with reference to how these varieties perform in the market, we find opinions that do not always agree. On the one hand, there are lapidary opinions about their commercial value: "Some varieties are no good to sell, they have a low price. Now, the 'runa toralapa', that has a low price, that's why we mostly sow *waych'a* to sell" (Juan Ruíz). Don Justo López has a harsher opinion:

> *Since the "toralapa" doesn't sell well, we don't want many of those improved potatoes, sometimes we just waste our time [planting them]. We would lose [the chance to] get more money [which we would have earned planting more marketable varieties instead]. We get less [money] sowing those improved potatoes. We sow them in vain. They're not saleable.*

Despite these judgements, others recognise that some new varieties have found a place in the market, generating a new demand:

> *When the "toralapa" yields, it's also good to sell. These days they easily take [buy] the "toralapa" potato, the white kind. Before they didn't use to want it, now they look for that, saying "Isn't there 'toralapa', the white potatoe?". They look for it. Those who cook [who sell cooked food] look for it more (*Victoria Claure*).*

Simón Vásquez sums up the double use that a variety should have: "For us, it should be useful to eat and to sell"[132]. But the farmers, as a rule, do not despise[133] or waste their produce. What local knowledge is not familiar with

[131] Other farmers think the same on this topic: "the 'toralapa' potato damages the stomach, it gives you stomach cramps (*k'ewichikun wisata*)" (Julia López). "For eating, definitely *waych'a* potatoes. 'Toralapa', no, it gives you diarrhoea" (Tomás Villarroel).

[132] According to the study of PROINPA, 'farmers often selected clones with coloured skins and deeper eyes because they resembled varieties of Andean origin (*Solanum tuberosum ssp. andigena*) which may fetch higher prices than varieties of European origin (*Solanum tuberosum ssp. tuberosum*). In 1995, when material was near to being released, farmers said they would sell some of the clones under the names of the existing varieties they resemble' (1997:284). This last comment indicates that they were going to rename them.

[133] Doña Victoria Claure declares across the board "I don't despise any of them". For Felicidad Escobar, the value of these new tubers is their resistance to pests: "Well, they're all useful. Some are resistant to disease". More dramatically, Concepción Dávalos refers to her subsistence needs: "I have to sow it anyway, even if it doesn't yield, else what am I going to eat?" Although the yields may be poor, Simón Vásquez feels particularly committed to the

(has not yet digested), it either transforms or finds other destinies and uses for it. Starting with the latter, animals are a good field for experiments on consumption: "What we don't know about, what doesn't yield well and isn't good to eat, we give straight to the animals" (Jorge Villarroel). Here they may discover that there are sub-products which are not suitable for their animals either: "The *aylinku* [berry] of the *waych'a*, which we *yurear* [pull up as weeds], we give that [as fodder]. [The animals] don't eat much of the "toralapa", it must be strong for the animals [i.e. they can only take a little of it at any one time]" (Julia López).[134]

Concerning knowledge transformation, one may say that a certain type of administration of ignorance also takes place here. When the peasants don't know what to do with a variety (they don't know what its characteristics are, they don't know what it is useful for) they transform it, they turn it into something else, or rather, into another "being"- *chuño.* In Chapter 5, we saw the implications of this transformation, from a woman – the fresh potato – into a man – the freeze-dried, blackened and withered *chuño*. The farmers have also discovered that, once harvested, improved varieties often become diseased or rot more easily:

> *The "toralapa" produces a lot but it rots straight away if you cut it (k'allusqa, that is, cut it accidentally with the hoe while digging it up). If it starts to go off, if it turns green, it infects the rest [of the potatoes stored with it] straight away. The waych'a isn't like that, if it's cut (k'allu) it dries up and keeps. In the improved potatoes the disease appears in the potato at that moment* (Justo López*).*

6.2.6 Broader reconfigurations in farmers' knowledge

Perhaps we have already insisted enough that farmers' local knowledge is not traditional in the sense of being repetitious, without renovation or experiments. The farmers of Qoari, Boquerón and other regions like Morochata, for example, are constantly experimenting, observing and evaluating the results of new experiences (induced or not).[135] The two peasant

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destiny of the new crops: "I feel sympathy with everything I sow, because it costs me work to sow it".

[134] "They don't eat much of the 'toralapa' because it must be spicy (*picante*)" (Justo López).

[135] It hardly needs to be said that these are not scientific experiments (otherwise, the farmers would be true colleagues of the "improving" technicians, as we argued at the beginning of the chapter). Peasants do not turn nature into something that can be strictly "calculated". For Heidegger, in the case of a science like physics, we find that it is experimental not because it carries out experiments with specific artefacts, but on the contrary, because physics makes nature into something which can be conceived of in terms of forces which can be calculated, and this is what makes experiments possible.

experimenters *par excellence* in Qoari are Don Carlos Alvarado and Severino "Severo" García; the first is now an elderly man, with prestige already earned, and recognised as an authority on the cultivation of biodiversity in potatoes, as much by the technology transfer projects as by the farmers themselves;[136] the second is young, as yet lacking in prestige, and almost feverishly devoted to his experiments.[137] The following passage from Long and Villarreal can be applied to both, though most of all to Don Carlos:

> *…certain individuals or groups often become the sociometric stars of a defined network of social ties, as well as the points of articulation with wider fields. That is, they operate as 'gatekeepers' or 'brokers' to structurally more distant networks and social fields. Gatekeepers play a strategic role in both facilitating and blocking the flow of certain types of information and thus are of crucial importance in understanding the functioning of knowledge networks* (Long and Villarreal 1994: 46-7).

Severo has experimented with the dung of cows, sheep, donkeys and chickens for cultivating vegetables, with the result that, as he argues, the dung of these animals supplies a good quantity of nitrogen. In this area of fertilisation, he has also tried mixing animal manure (*guano*) with ground lupin seeds (*tarwi*; specifically, the variety *q'ila tarwi*, whose name means 'it breaks easily'). He has used red beans to cure animal blindness. This same bean and the *wayruro* (the red and black seed of a wild subtropical bush of the same name) have been used by him to treat human facial paralysis, mixing them with deer horn and cow pancreas. When asked if he talks about his experiments with friends

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[136] Don Carlos, apart from being an expert veterinarian (trained by different institutions), cultivates nearly 100 varieties of potatoes, both introduced and native ones: "Yes, well, that one you see is the clone 99, next to it that's the *mishka imilla*." He does not always agree with the technicians' decisions: "That 'blower' for ventilation isn't in the right place, it ought to be on the other side but the engineer takes no notice. So it's going to stay there, then. I'm going to move it next year [when the engineer leaves]." The technology which PROINPA left him (some seed beds known as "protected beds"), which in theory should be used for potato seed, have been adapted by him to produce lettuces and carrots. He complies punctually with the development projects although, according to Carmen Camacho, "they are no use" to him: "Don Carlos has a weather station in his house, some project or other gave it to him and he never fails to take its reading for one single day. But it has never been any use to him. The way it is, is that everyone goes looking for signs [in the environment], and that's in August – the first two or three weeks of August – that's when they make observations, because at the end of August they start the sowing." As Engineer Camacho says, Don Carlos is a model farmer who all the projects want to work with.

[137] Although his experiments may look like shots in the dark, Severo's do not go as far as those which J. Swift entertained himself by mocking (what he was really mocking were the pretensions of the newborn scientific and technical knowledge), relating how in one of the kingdoms visited by Gulliver the aim was to soften marble to make pillows and other even more absurd things.

and family, Severo confesses: "When it works I tell them, otherwise I keep my mouth shut."

The case of Severo illustrates how local knowledge can be generated and disseminated. The points of articulation with wider fields mentioned by Long are important. They facilitate information flows, inputs and outputs of technical knowledge and connections with whatever agricultural extension systems exist. As Daniel Paz explains:

> *I don't work with the engineers, but my brother does work with ARADO, and he tells me how to sow, and I learn what the advisers tell him. Then I put it into practice as well, because you have to know. With their advice, I've changed, for instance, by putting less [chemical] fertilisers than guano, and putting the fertiliser beneath the guano, so that the potato sucks it up better until it reaches its roots.*

This indirect knowledge (via gatekeepers or directly taught by the projects[138]) can accompany 'folk' knowledge:

> *We always watch out to see if there will be frost, we already know that with a little bit of anticipation. We notice if the muña flowers earlier or later. If it flowers later, we [sow] later, if it flowers earlier, we sow a little earlier. Another thing we notice is a little bird called pichitankitu [Andean sparrow], when it [sings] clearly or whistles sharply, then it's a good year, if it's whistle is muffled it's not a good year. So we notice those things, that's knowledge too (*Daniel Paz*).*

"That's knowledge too". This claim makes it evident that, for the farmer, knowledge is multiple (or multilayered, as Long puts it) and is also valid and relevant. In the same way, the farmer may come to question the negative part of technical knowledge for its undesirable effects, as when Cirilo Alvarado warns us that, although he has obtained good harvest with certified and registered seeds, nevertheless:

> *…the problem is that with excessive fertilisation, they say we're poisoning the soil…it's killing some little worms which you can see through the microscope. It also kills the earthworms (kuyk'as) which soften up and improve the earth too. And that's why the soil doesn't want to produce any more.*

[138] "About soil problems, we always talk between companions. For instance, there was a course on irrigation, with that we've improved the irrigation. You have to irrigate with a little water without letting the water escape from the borders of the plot, then the 'little better' [chemical fertiliser] stays in the earth. But if we irrigate in a hurry and with lots of water, we cause it to take away the earth, and that irrigation is in vain." (Cirilo Alvarado).

Apart from obtaining sexual or botanical seed from the berries (*aylinku*)[139], farmers have also learned about pollenisation between different varieties,[140] a technique which they call "the wedding of flowers" and this therefore makes the farmers "godparents". Baptisms and marriage require godparents who then assist the couple and children whom they baptise. However, technicians do not understand this notion of a godparent relationship with flowers, but for peasants this is not just an illustration of a technique but a real relationship of caring that is enshrined in culture.

In relation to health, knowledge of the curative properties of tubers has been enriched with new knowledge about hybrids and improved varieties: "The *toralapa* fruit is good for headaches, they say it's for toothache, for fever, we stick it on where it hurts" (Leonor Córdova). The instructions for application may be more or less precise: "You put it right here [touching the cheek]" (Guillermina Rojas); "You have to *lak'arse* [stick it on you], so they say, but I don't know" (Miguel Salas). Some native potatoes do not have such properties of sticking to the skin: "toralapa for headaches, not the *waych'a*, it doesn't stick to the head, why ever might that be". The "Double H" is a good potato for these afflictions: "for headaches, for toothaches, for temperature, the *iskayachi* potato" (Dionisia Katari). These potatoes are also good for animals: "…for cow fevers, we grind it up and we make them drink it" (Concepción Dávalos).

One may say that, in general, the reconfigurations of the local knowledge of these communities are the results of the teachings of technicians and of the farmers' own experience, that is to say, "the teachings of their practice". In the first case, we have the example of instructions not to sow in soils contaminated by nematodes:

> *When there are sick potatoes in my land I collect them and keep them in the kayru in another place. I don't leave them over there. If I sow potatoes in the same plot again, they can contaminate, can´t they? The soil would get the disease, wouldn't it? Since the engineers have told us how to do it, we do it that way (*Celestino Vegamonte).

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[139] In one experience, the farmers remembered a technique for washing botanical seeds with ashes, which the technicians ignored. The nurseries were planted in different containers (tins, boxes, the wide flat tin or wooden *bateas* used for washing clothes, washing-up bowls) but the arrival of the principal sowing period led the farmers to leave off caring for them; they stored them under their beds or left them in the hands of their children who went off to school.

[140] "So you see, we can cross some varieties, right? It can be with these *qoyllus*, with 'Gendarme', 'Robusta', 'India', [the potatoes come out] with less eyes, to peel them more quickly, it's not so tiring" (Felicidad Escobar).

In the second case, the producers have proved the various effects of different types of local fertilisers:

> *You can also use wallpa wanu [chicken manure]... it yields well, but both the soil and the seed get used to it, I mean, when you sow with chicken manure the first time…and you sow that seed in another place with cow manure, the yields aren't good, so you have to carry on with just one, with chicken manure or with chemical fertiliser. If you only sow with chicken manure the soil turns soft and the potatoes are yellowish, even the rescatistas [bulk purchasers of produce] always ask if it was sown with chicken manure, because for cooking it's a bit k'ayma [tasteless] and they don't trust it; that's why I prefer to sow with cow manure mixed with fertiliser, which costs almost the same (*Cirilo Alvarado*).*

The farmers of Morochata have also discovered that chicken manure turns the *waych'a* watery (they won't eat it themselves), whereas the *waych'a* from the main sowing with cow manure is floury (and popular). Another problem which practice has provided new knowledge about is irrigation:

> *You apply fertiliser because the earth has already worked for a long time and has nothing to feed on (mikhunitan), like [you apply] potassium, phosphorus, nitrogen, that's what you apply fertiliser for, because nowadays the soil has little foodstuff [in it] and it's tired. Besides, since we didn't used to have irrigation, only the rain, nowadays, with the irrigation, the food [minerals] in earth is carried away and it turns k'ayma [tasteless]. We start to sow on the 24th until the 30th of September, and by All Saints the potatoes are already coming up, but there's no rain, only a little, it's not enough. So we have to irrigate, taking the flavour out of the soil again. You also lose the 'little better' [mineral wealth] of the soil when we soak it a lot, it doesn't stay in the potatoes but sinks down inside (*Daniel Paz*).*

These reconfigurations are not limited to techniques, inputs or the tuber itself, but include the tools used.

> *Lots of things have changed in the way of farming [potatoes], starting with the ploughs themselves. Before, they used heavy wooden ploughs brought from Punata or sold in Epizana. Now they use more the ploughs from CIFEMA, which are lighter…the peasants got access to the CIFEMA ploughs after the demonstrations and offers by technicians from the University of Cochabamba. Some associates tried them out and in a short while the rest of their neighbours in the communities began to use them (*Basilio Rojas*).*

6.2.7 The other reconfiguration: discontinuities in technicians' knowledge

Discontinuities not only appear in the cognitive repertory of the farmers. Given the interface between farmers and agronomists, the latter also suffer ruptures and breaks in their technical baggage, reconfiguring their knowledge and generating, in this way, their own local knowledge: *a-topos*, with its own arabesques and contradictions, with its dark and light zones. On the 'battlefields of knowledge' they, the technicians, seem also to have been affected by the crossfire of 're-bounding knowledge' (see Arce and Fisher, Chapter 1). The engineers who have spent most time in the countryside are the most cautious with respect to peasant knowledge: 'You can learn something from the peasants or you just have to respect what they know, and teach them new things. You can do both: look, as a technician I've learnt many things from them and they've learnt many things from me too' (Cerbando Lazarte).[141] As regards the dark facets of reconfiguration, their incomplete explanatory paths (arabesques), the same engineer tells us about the mysteries of local knowledge:

> *Due to irrigation, frosts, hailstorms, rain, the date of the sowing season has a very important role and you can't learn that from books, you learn it on the ground. Why don't they sow with a waning moon? They know why and why you should sow with a crescent moon. They link it up and it really seems to be something which coincides with the production. It's been proved. People who sow with a waning moon have had bad yields, people who sow with a crescent moon have had good yields. They can't tell you the explanations. You don't know…*

As regards the applicability of technical knowledge and the relevance of technical offers, the engineers have also learnt a great deal (leaving aside some topics, for example to do with gender[142]): José Pardo testifies to this very well:[143]

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[141] The agronomists of PROSEMPA, like Cerbando Lazarte, know that one must be very prudent in this respect. The problem arises with other professionals, like economists for example, who have not been reached by 'rebounding knowledge', as described by engineer Edwin Quintana, another technician of the now defunct PROSEMPA: 'at the level of our boss the position was always rather strict: the farmer was a man who knew nothing and the technician had to go and teach him everything…he used to say to us 'You're the capable ones, you're the ones who have to teach.' The boss had a fairly contrary position as regards professions...he was an economist and since we were all agronomists and several of us with lots of experience, we all knew what we were getting into. We can't go to the countryside as if we were a bunch of geniuses and tell them 'Gentlemen, we're coming to teach you,' that's stupid…however much you want to teach a farmer something, he'll always say 'Sir, I've lived for years in the countryside, ever since my grandparents, my great grandparents, and they've transmitted this knowledge to me'…in practice they know much more than we do.
What we do is complement the work they do year after year, that's the truth.'

[142] 'Look, I've spent three years involved with the same people and first of all I've learned to be patient. There are farmers who are definitely very patient, but they're very methodical in producing potatoes. Another thing I've learnt is that rural men are very little willing for their wives to take part in activities, it cost us a lot to get the women to participate' (José Pardo).

[143] Jonás Colque, technician in charge of ARADO, does the same when he says 'As regards new technologies, there have been few problems, because we always try not to say 'do this'

> *I've also learnt a lot from the technology in use. At times we get really bogged down as investigators and as transferors, trying to force farmers to take on the technological package which we propose. But you have to understand, you have to know how to comprehend that sometimes the technology which we generate isn't valid for certain areas. Sometimes the investigators latch on to some technology which has been tested in a particular place and they generalise it to a national level, but it's a mistaken generalisation. When, for example, we introduced fertilisation levels in the region of potato seed production in Pojo, not one case worked out. It was better to produce with the producers' technology, incorporating animal manure, which has better yields than the [chemical] fertilisers, and they made us understand that if you apply animal manure you can maintain the productive potential of your land, but if you applied [chemical] fertilisers to it, you could produce a nutritional mismatch in the soil. We proved it in another region closer to the valley, where there was an indiscriminate use of [chemical] fertilisers and the soil has definitely been impoverished and it can no longer be used for sowing potatoes, perhaps only for grazing. Sometimes we ourselves make mistakes and try to impose technologies that are perhaps not within with the economic reach of the farmers. We try to impose quality seed at 180 Bolivianos, which at times doesn't work out within their budget, and sometimes other varieties which don't have a market. Take the case of the varieties released by PROINPA. We validated them there but they weren't liked…PROSEMPA has realised that you have to make any change with a vision of the market, with a vision of making money; so the PROIMPA varieties weren't popular in the market nor in the community…*[144]

The consciousness or 'discovery' of the economic importance of a technological innovation for farmers, apart from 'tasting the flavour' as regards food consumption, is illustrated by Edwin Quintana.[145] The technicians have also had to incorporate an understanding of the subjective aspects of their own social and work interaction with peasants. Jonás Colque has had to listen to comments from peasants who say that 'the technicians are

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right off. So we have to coordinate both knowledges, what it is he knows and something that allows us to improve that knowledge, right? Not to say to his face 'you have to do this and that's it'. If you do that you're finished. So if we want to incorporate a new technology right off, we hold trials in small plots with the farmers and if they see that it works, they'll incorporate it the next year. In a sense, we have to make a preliminary evaluation, because if we plant a huge area at once with a new technology and it fails, then it's the technician who has mud on his face. So you have to just do it cautiously'.

[144] However, reconfigurations are also manifest among technical personnel of PROINPA:

'Whilst the direct influence of farmer evaluation on variety release has been only moderate, there has also been a considerable indirect impact. Breeders have followed and assimilated the results of farmer evaluations and now pay more attention to colour, form and size of tubers when selecting germplasm' (Thiele et al. 1997:288).

[145] '…when you talk to a peasant about how to earn more money, he opens his eyes and only then does he begin to value the technology which you're proposing to him…when the results are good, from that technology, he'll continue to repeat it for years and years. I went to my zone [where he had worked in the past] last year and what I had done with the farmers still existed…'

here thanks to us', 'thanks to me they have jobs'. And Jonás understands that there is a certain resentment or 'jealousy' on the part of peasants, because the projects get financed in their name. In the same way, when the technicians make closer links with the peasants and become friends and *compadres* (an important social relation between the parents of a child and the person or couple who have baptised the child, sponsored its marriage or high school graduation, etc.), rumours and negative comments may arise: 'Out there in the countryside, it's nice, you have your *compadres* and, all of a sudden, that gets out in the city. It reaches the directors with bad comments. But there are people like that in every institution, the ones we call *serruchos* [who 'saw' the floor out from under you], right?' Or, finally, there may be resentment on the part of peasants when the local technician is changed. Among other more everyday things, the engineers have had to learn that when the trial plots are a long way away, the peasants will not visit them, or that a good lunch motivates and animates people, and, one of the most important things, that knowledge is, for the peasants just as for the wise man Nagasena, a game: there are games and competitions of knowledge among them. Thus, Doña Guillermina says that the transplanting technique 'is fun, it's like playing', and in Don Carlos Alvarado's family, preparing the *llajwa* (hot sauce) which accompanies meals is the object of enthusiastic competition among family members, all wishing to play the game of who can prepare the best *llajwa*, under the intent observation and commentaries of the rest who evaluate the skills of the one who is grinding *llajwa* on the grindstone.[146] In these games, as in the old knowledge games, there is equality, tolerance, enthusiasm and fun.

6.2.8 The limits of the reconfiguration and some final remarks

The reconfiguration of local knowledge which has taken place in the communities studied can be said to be been permanent and constant (without an end), but also unfinished or incomplete (if we think of agro-chemicals) and partial (directed above all at young people and at men in general). The reconfiguration led by the projects has been in a sense fragmentary, given that producers often fail to turn up for the courses, due to their own productive itineraries (if it is their turn to irrigate, for example, they will miss the course: 'you don't leave off even to eat, irrigation needs a lot of control'). The local festivals interfere with the courses (or the other way round): 'some of them carried on drinking that day'.[147] On the other hand, there are difficulties with

[146] There are three types of *llajwa*: fresh, made with *locoto* peppers and fresh tomatoes; a second type, made with dried *locoto* and fresh tomatoes; and the third, darker in colour, made with dried giant chili peppers and fresh tomatoes (Rodrigo Quintana, ined.).

[147] The collisions with other activities are what most affected the courses: 'when we called a training course, they didn't all attend, some were always missing, since in Bolivia we're not

the courses themselves: not everyone knows how to read and write, and even for those peasants who do, they do not find it easy to take notes when the engineers write on the blackboard, because they themselves write much more slowly. For women, their own family obligations are what make the courses inconvenient. They leave early every morning to take the animals to distant pastures, and before this they have to see to the family, cook and send the children off to school. And, if there is no other activity that day, they return from the pastures at sunset.

But the reconfiguration has not only been produced via development projects. One may speak of a 'double teaching' given to the 'local knowers': that of the projects, already mentioned, and that which proceeds from their own practices (two guiding lights, as M. Serres says, which guide their steps, their navigation in the waters of innovation[148]). This particular double teaching leads to the conflation of knowledge proposed by Arce and Fisher, which ends up by making local knowledge something *a-topos*. At the same time, the conflation of knowledge is the result of the effects of rebounding knowledge, which not only has an impact on the farmers but also on the technicians, who structure, in a way which is almost imperceptible for them, their own local knowledge. Moreover, there is not merely a 'rebounding effect', since, to take an example, the appearance of new pests and diseases leads to a sort of co-evolution in this respect: as we said, so long as new diseases do not appear local knowledge does not seek to treat them. Hence reconfiguration must have some relevance.

Throughout this process knowledge is also 'digested', assimilating the new so as to overcome its limitations (the pests) or to satisfy their subsistence needs (food requirements). What cannot be digested is transformed – the administration of ignorance – into *chuño*, for example, or given other uses such as the case of animal fodder. Reconfiguration does not have a sole direction but rather, like a prism, has many faces: varieties, chemicals, soils, health, irrigation, commerce, etc.

To conclude this final chapter, let us return to the beginning – as in the agricultural calendar: from the harvest to the sowing – that is, to the first chapter, which, as the youthful Plato asserted (in a remark which intrigued Borges), 'to know is to recognise'. But, so as not to fall into the circle drawn by

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used to doing just one thing, but to undertake various activities. So those who were most interested turned up, while those who had various activities didn't attend. They thought they already knew but that wasn't the case' (Cerbando Lazarte).

148 This implies that Long's proposal that knowledge is 'multilayered' is also assumed by the farmers. They also do not necessarily see 'local' and 'technical' knowledge as opposed to each other.

this apparent aporia, we must stress the recognition of practice. Practice - in this case that of the farmers - is a form of recognition: to see something again, to visit a place once more,[149] once and several times, and this recognition which practice allows us, gives us or makes possible new knowledge. It makes us 'recognise' (i.e. *reconocer*, in Spanish, which has the sense of 're-know', from *conocer*, to know by experience, as one knows a person, a place, etc.). This is what happened with organic manures: the farmers repeatedly carry out the practice of fertilising with dung and in this everyday recognition of putting manure on the earth, they discovered that chicken manure gives rise to watery tubers whereas, on the contrary, cow manure gives rise to floury potatoes. It was the repetition of practice that made this small 'leap in knowledge levels' possible.

We also began this thesis by discussing *forgetting, ignorance* and *memory.* After the learning process that was embedded in the everyday experiences of carrying out this research, during which we were effectively 'instructed', that is to say, informed and taught, we came to realise that, above all for the farmer, *to forget* is not to pay attention, not to take care, not to be alert (as Joy Benson says, it amounts to 'a lack of urgency or vision'). One might contend that it is the market that causes the farmer to forget (recall the soil conservation example), but in reality it is akin to the way in which we forget something in a taxi: we are not alert to the object, we are thinking of something else and thus leave on the seat something valuable which it will be difficult for us to retrieve, like the soils contaminated by nematodes and other pests, and the repentance and sorrow is similar in both cases.

Ignorance is not to be able to ask oneself about something, for example about the existence of viruses and bacteria. Ignorance prevents us from enquiring about something and, as Heidegger said, the devotion of thought is asking questions - although, on the other hand, we cannot ignore the fact that ignorance may free us from thinking too much. When peasants ignore or do not know about something, then they cannot ask about it, at least not in the terms in which the technicians do (let's say, in terms of nematodes). However, this does not prevent them from having their own questions and, likewise, their own answers, in terms of how the earth has become tired or in reference to the impact of possible abortions within the community.

And to close the triad, memory is recall and to recall is to reinvent the same token each time (how to produce, how to preserve, how to obtain the same old taste and flavour). Memory allows us to return to our identity, to invent,

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149 The notion of recognizing a place, or the term 'recognition' itself, refers more to the repetition of a practice than to seeing once more something which is already known.

newly, what is ours. The knowledge we need to obtain the flavour which we seek in our food or in our lands (which have become *k'aymas* - tasteless). With memory we can recognise the old, the tastes and smells kept in the casket of culture, in the new. Thus, to reinvent and to recognise are not such different things, but rather something friendly related to each other.

CONCLUSIONS

This thesis has explored the relationship between farmer and expert knowledge by focusing on the production of potatoes in the Andean region of Bolivia. This focus on potatoes provides us with a window to explore issues of knowledge, technology and intervention in agriculture.

About local knowledge

What more can be said about local knowledge which has not already been said? Perhaps, we could insist on some things. That it is a knowledge which knows, but prefers not to talk much about this, not to speak openly about it, not to boast of it as may a knowledge which seeks to display itself and teach, as when the direction – declared as the only one – which we ought to follow is established. But it is also a knowledge which knows that it does not know many things and that it is not possible either to know much (or, as Olivier de Sardan puts it, it prefers not to know too much). This is how, then, that we encounter its facets of abundance, as when M. Mazoyer exclaims that “All the hunter-gatherers of the world knew plants to perfection. Only a few scholars can be better botanists than they are!”[150], and at the same time those other facets which question us with their glance, full of interrogations and doubts, making clearly visible their lapses and limits. On the one hand we find the farmer’s great knowledge of nature and its fields, and on the other, the relative ignorance of current problems in the environment, the economy and technology.

Due to this double and contradictory condition, the researchers, technicians and development officials have documented their appreciations of local knowledge emphasising its poverty, irrationality and ignorance or, above all at present, celebrating its wisdom and depth, stressing its relevance and importance for sustaining the ecology, preserving biological diversity and as an alternative to the agrobusiness food industry which has already been proven to be unhealthy.

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[150] Pelt et al. (1999: 104).

In the first chapter of this thesis we found that local knowledge is intimately linked to memory, ignorance and forgetting. Although they are no longer the hunter-gatherers of the Neolithic, the inventors of agriculture, the myths of the great civilizations of antiquity recall this kinship for us, which would bring early scientific thought to the anxious topic of truth and methodological doubt, already incapable of maintaining the old contradictory links of knowledge in its desperate search for rationality. Truth and method thus became the crucial equation of Western scientific knowledge, thanks in large part to the "proofs" of technology in its role of *veracitas*; in so far as for the thoughts and knowledges which are unsystematic and lacking in "objectivity", as in literature, truth may be something lacking in imagination, that is, tedious (perhaps because it conceals a few primordial things and only that[151]).

In this chapter the question of what it is to know also emerges. Initially, sharing the intrigue and perplexity of Borges, we ran up against Plato's axiom that *to know is to recognize.* Unexpectedly, local knowledge and its range of practices will take us – almost as the teachings of Don Juan did Carlos Castañeda – to discover and understand that in effect it can be so, via the round of practices, of reviews which in this way bring it close to the wandering, pilgrim knowledge of Parmenides, but we will debate this later.

What has certainly contributed to the value of local knowledge has been the series of biological studies on perceptions, which display the relativity of the senses, and the act of perception or knowing as a compromised action which is not limited to registering a reality and which can lead to a new view or consideration of the paradoxical or contradictory situation which one faces (to make visible that which, up till that moment, was not seen, because someone loans a microscope to the peasants or because practice awards a "new glance" to the agronomists which the economists in the office do not possess, for instance – see chapter six of this work).

After having seen the evolution of ideas on local knowledge, we have briefly presented the principal aspects of the *actor oriented approach*. An important contribution of this perspective, which proceeds from social anthropology, is the consideration of local knowledge and other forms of knowledge, including science, without any prejudice or authoritarianly pre-established hierarchy, ignoring from the start any discriminatory "pedigree" and thus freeing the field of local knowledge from any kind of paternalist, mystifying or ethnocentric evaluation, as when a field is cleansed of undesirable chemical

[151] On the contrary, the search for truth may lead to the most fantastic and delirious visions, as noted by Lamparelli (1996: 22).

traces. Its preoccupation with how knowledge is produced and transformed, discarding any previous formula or high philosophical speculation, has allowed the study of the processes of struggle, negotiation and adaptation which succeed one another in the act of creating knowledge. Its most recent reflection on the encounter between dissimilar forms of knowledge (expert knowledge and lay knowledge) has provided concepts which are at the same time revelatory and challenging, such as that of *pseudopodia*, which applied to our case, shows that the encounters between knowledges are not merely additive, where one is added to another, but may give rise to dramatic losses, unexpected acquisitions or inevitable blends and confusions; *mutations*, in a language which is perhaps too biological for social sciences. The incorporation of the idea of a frictional nature of knowledge – actualizing the old opinion of Greek philosophers like Heraclitus, who early discovered the identity between logos and disagreement, the disassociating vocation of reason and language which conduce to divergence – and the notion of the re-bounding effect borrowed from Parkin, have been extremely useful in our work, as it has been possible to see, for analyzing, explaining and interpreting the meetings between peasant potato growers and the projects and their technicians who came to "talk" to them, no longer as the wise Nagasena who came to visit the king Menander – as Huizinga describes it – to play the sacred games of the enigmas, riddles and aporias, but rather provided with the concrete bets and challenges of development. And in the encounter of knowledges and discourses, the multiple rebounds that came and went, time and again, nobody escaped, everyone emerged disconcerted and changed because knowledge – now more than ever – no longer belonged to anyone in particular, becoming *a-topos*, remaining definitely like the Indoamerican Baroque, its blood totally mixed, impossible to attribute its identity to either of the groups.

Profane opinion

In chapter two, from the perspective of the human sciences, we have seen how Heidegger strips bare the "non technical" aspects of technology, making it evident that its content has nothing to do with what is "technical" and that it inexorably separates humanity from nature. We have likewise demonstrated the profound inclination of social theorists – from Marx, through Bourdieu, to Negri – for using the metaphor of the machine to refer to technified institutional schemes, and we gave way to the temptation of using this metaphor in the following chapter concerning development institutions.

Among the most recent contributions we have considered those of the Actor-Network Theory (ANT) and those of STS, tinting them with the ample debates and summaries which they have generated among scholars of different disciplines. We briefly mentioned the simplicity of economics with respect to the question of technology, which is taken as a simple datum (and until a short time ago was not even admitted as an explicatory variable in economic regression models). In the same way, we have summarized the relevant and certain criticisms of the *actor oriented approach* of simplistic and mechanical visions of agricultural extension, which observe flows and transport of meanings, but not those who carry them out or live them. Finally, we were able to prove that for a long time technology, for philosophers, historians, economists, sociologists, anthropologists, communicators and other social scientists, more than a worry has been an unrequited love. Attracted by it in a sort of “sympathy for the Devil”, without being able to be like it but without loving it wholeheartedly either.

The short life of institutional models and systems

Focussing on the more important findings of chapter three we can conclude that the existence of so called “agricultural knowledge systems” is possible under certain conditions; furthermore, linkages between farmers, extension officers and researchers can also develop. Indeed the experience of the DESEC group shows that an autonomous institutional circuit, decentralised and localised, can structure a knowledge system (with associated farmers’ organisation), which can work reasonably well – at least for a while. As the DESEC experience testifies, the lifespan is a central flaw within localised “knowledge systems”: they are hardly ever sustainable over time, with the weakest components tending to disappear after a period of time due to internal conflict. Nevertheless, the DESEC case reveals a relatively successful system, which is particularly interesting given the way its loose organisation contrasts with other systems endorsed by the state, whose centralised, bureaucratic, and politicised processes have traditionally limited the probability of success.

If we take into account what conceptually had been defined as the “agricultural knowledge framework”, we realise that it is even more fragile and ephemeral than other institutionally assembled models. In this case, the larger scale of organisation started a morphological process, in which machine-like organisations moved strategically to influence and control the path of local development and change. In this way we see how this regional framework managed to incorporate the activities of a large number of entities – both governmental and non-governmental – with diverse interests and sources of finance, some situated within the arena of “international co-operation”. In this context the arena of technology transfer – incorporating diverse and divergent technological perspectives – became part of a circus where fierce disagreements would manifest under the banner of assumed competence or expert authority. Technology, as the Master of Ceremonies, cannot unify the Bolivian peasantry or seek to lead them by the hand into the "modern world". It is therefore not surprising that such a context underlines an inherent tendency towards impermanence, as demonstrated by the regional "knowledge framework". Thus we have seen that the networks (or systems), which integrated the knowledge framework at the start, also generated centripetal forces, which in time were likely to draw components of the organisation apart. However, what actually provoked the ruin and fall of this institutional framework for potato development was the strategy followed by each institution at the Framework's core.

The venerable houses of development and their territorial struggles

At this point in the analysis, surrounded as I am by an age of competition, rivalry and institutional struggles, metaphorical notions of institutions as machines of development start to seem outdated. In this respect I would suggest that the notion of struggles between "houses" of development appears more apt and helps to encapsulate the importance of the territorial struggles for control and influence that are so important in the Andean region of Bolivia. At this point, an imaginative interpretation of territorial conflicts in ancient China and feudal Japan within different houses of power would surprise both Heidegger and Latour. Joking apart, the metaphor of houses of development, provides a point of reference to underline the political importance that territory plays, as a material field of influence, for institutions operating in the arena of development. This dimension implies control, resistance and conflicts and, in my view, still needs further attention in studies of human action and development.

As we have seen in the thesis, territorial conflict between different houses of development in Bolivia created a situation of uncertainty in which the knowledge frame containing regional institutional information and communication collapsed leading the houses to deploy strategies to ensure their own sustainability as institutions. Thus PROINPA not only invaded the technological territory of seed production, the "property" (in both senses: as ownership and a characteristic of an element within a system) of SEPA, but also started competing with it. PROINPA also entered into agricultural extension, in effect intruding into PROSEMPA's domain, affecting its interests and challenging it reasons of existence. On the other hand, SEPA did not apply the methods and techniques developed by PROINPA, but started to follow its own control and treatment procedures, arguing that it had the capacity to develop better methods.

These conflicts became manifest territorially, as different organisations sought to control different geographical areas of influence and people living within them. In the process, the knowledge frame started to fragment, with different institutions rejecting any perspective, ideas and actions that sought to reinforce and unify existing knowledge. Thus, as an example, we have seen that PROSEMPA did not provide sufficient feedback to PROINPA, blocking its work and making it difficult to situate its laboratory research in terms of what was happening in the field, in effect preventing the delivery of more appropriate and pertinent technology.

Such an overlapping of fields of expertise, based on institutional politics of control and survival, has generated conflicts between organisations who are members of the Framework, leading both to mistrust and to poor co-ordination, which has ultimately terminated the summer of good intentions that led to the construction of the regional knowledge framework for potato improvement.

Apprentices, amateurs and other followers not so happy

If we turn to enter the potato fields of Qoari and Boquerón, we have argued that native varieties have not disappeared despite the many long and sustained interventions in this Zone by programmes and projects seeking to promote technological innovation. Nor indeed has there been a real "invasion" of potato clones developed by centres and laboratories. Perhaps not surprisingly, this study verified that the transfer of innovation has not been at all homogenous for the productive units and households, although it has dealt with the same technological package. This finding is in keeping with arguments put forward in other studies of technological change. Encountering the diversity that exists on the ground prompted me to elaborate different categories and typologies regarding the adoption of technology. Thus I have split the households or units of production into four categories.

The first category – the smallest one – displays an increase in the sown area and the amount of seed; this category encompasses households which, having recently gained access to irrigation, enlarge the commercial production of (introduced) potatoes. The second category – second largest in size – shows a counter-tendency: reduction of introduced varieties and a shift in the type of fertilisation (from chemical/organic towards organic only). This suggests a withdrawal from technical innovation and from the market (for potatoes), addressing the problem of soil depletion ruined by a previous intensified production. This category comprises above all farmers from Qoari, the community that was the most targeted by development projects. The third category, the largest one, displays a small decrease in native tubers while maintaining the number of introduced ones that are grown. Farmers in this group are able to manage soil erosion and follow the combined fertilisation recommended by technicians.

The fourth and last category, which in size is between categories one and two, comprises the farmers from Boquerón who show an important increase in the production of native varieties (which could mean a strengthening of strategies for food security and bio-diversity), and also a smaller increase in introduced varieties (as cash crops); this cluster comprises also households who have benefited from the enlargement of irrigation systems, which ultimately has led to an increase of soil erosion.

Differences between communities as regards the adoption of technology

In relation to the differences between the two communities concerning technological change, we can conclude that there is no difference between them in terms of the level of innovation. Even though Qoari was continuously targeted by many NGOs while Boquerón remained refractory to those organisations, the latter benefited from technical packages in a similar way to the former, reaching the same degree of innovation. The innovator role in this case was played by crucial actors strategically situated in so called "knowledge networks", "influence networks" or what has more recently been termed "social capital": relatives, *compadres*, friends, neighbours, traders, truckers, etc. In this manner we can conclude that the community of Qoari was the formal focus for institutional innovation and the declared object of technical intervention. In contrast, Boquerón, the peoples' scenario for such innovation, became the non-expert locus of technical change. In the first case we meet institutionalised pupils and in the second case informal amateurs of social transformation.

One could pick out some important aspects such as the fact that the specialization of these communities with regard to the production of potatoes for consumption or for seed has been less than in others. Despite the intensification of intervention, native varieties have not disappeared although they have been reduced in number.[152] This claim should be relativised

[152] Although this is dealt with in the next subsection, it is worth recalling that the native varieties persist thanks to their "protective exile" in singular spaces known as *purumas*, which we have compared with the positive image of the labyrinth, proposed by Rella: a happy place which protects us from the law (that of the market and that of the institutions, we might add). This exile can be conceived of as a "no place" for interests linked to the market – more properly, for a mercantile vision – since that which does not imply large areas, high yields and a uniform production is a non existent reality for their reading of the farmer's productive

recalling that, although this is the general tendency, some families – those of the fourth category, for example – have increased their number of native varieties (although this may refer mainly to commercial native varieties such as the *waych'a*). Versus the erosion of "genetic patrimony" one may argue that traditionally, local knowledge has renewed native varieties and made new ones "appear", although the number of these new varieties and the rhythym of their appearance does not compensate those which disappear.

With regard to the area sown and the quantity of seed used, there are no great variations in the communities studied, which also shows that the level of intervention has been modest. The changes in the habits of fertilizer use, on the other hand (in the direction of the combination chemical/organic or a greater use of organic fertilizer) seem important, evidencing that there is a problem of soil quality which we shall treat later. The recent access to irrigation on the part of various productive units of some clusters has influenced the cultivation of more varieties (both introduced and native) and has eventually led to greater problems with erosion. The market, for its part, has responded by stimulating greater production. However, we can affirm that these communities have not yet entered in a pronounced process of differentiation, since both of them display a numerous middle stratum, which has a relatively good management of its productive systems (considering the variables of this study which were not especially directed towards the systems of production).

The negative consequences for the soils and, perhaps, the repeated falls in tuber prices have discouraged people and created, as we indicated above, deserters, disenchanted disciples of technical change. These people come above all from Qoari. The drop-outs – whether ex pupils of development (specifically, of the projects) or disillusioned empirical practitioners – show us the limits and critical aspects of innovation, in the sense of its reach and achievements as well as that of its relevance.

In conclusion, we can say that technical change or transference among "poor" peasant producers, such as those of these communities, always turns out only partially complete, in part due to the lack of resources and the restricted articulation with the market (we hardly need mention, in addition, the lack of support from the state). In the end, what we have are odd forms of relative

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sketch. Notwithstanding, to be outside or not to be considered means, in exchange, to gain that space, make it ours, thus increasing our autonomy and space for manoeuvres. External proscription (exile from the space of high productivity according to commercial criteria) signifies internal freedom or independence (winning over what is not considered or what is despised and making it ours).

adoption of technological packets, which are seen as a menu from which one can select what one likes and not necessarily a “complete service”. Such parsimony is also the result of the influence of social and cultural factors which are debated in the final chapters, as well as the defense or search for sufficient autonomy, of a margin for manoeuvre. Technological change, the particular forms of adoption and adaptation which it brings with it, brings with it problems and unexpected consequences: its own darknesses, one could add, since to shed light on one place is to deepen the shadows in spaces outside it.

The other *diversity*

In chapter 5, we found that another kind of diversity accompanies biological diversity, but the first is more intentional than the second. We are talking about the diversity of words or language, whose aim is to make familiar the diversity of the terrain, the diversity of biology. We refer to the names and denominations which the peasants use for their potatoes. We have seen that they make use of extremely rich metaphors and analogies in their comparisons and contrasts. But this art of denomination or baptism is not limited solely to sparks of meaning or unusual associations. It is closely related to nature and knowledge about it, to local institutions (as we could see in the story of the ‘daughter-in-law’s potato’ in relation to marriage practices). Baptising potatoes, giving them a name is, in fact, to make them relatives, members of the family, of the community; it is adoption, as when we agree or wish to be godparents. It has to do with cultural identity and the reciprocal relationships which are established between people, and between people and other animate or inanimate beings (merging, almost scandalously, Andean kinship criteria with the attributions of agency to ‘actants’ and other non human entities in the Actor-Network theory).

This kinship can also be seen in the notions, representations and images which the peasants hold of potatoes, seeing them as mother, sister, woman friend and also daughter. They can talk and hold conversations, and be deeply appreciated as, from the edge of the field, one admires their flowers. This does not mean that they are not seen at the same time as a product for the market, that is as a commodity and a source of income, and at the same time as a food resource.

Here it is worth recalling how the *poiesis* of transformation of the potato, the *techne* of local knowledge, converts it into chuño, into a man, a masculine entity which is the husband and hence father of the peasant woman or man. Thus, the Andean *techne* produces a transformation of gender and identity. This is demonstrated in the capacity of generation of masculinity. That is to say, more than just a technique or technology it really is a form of *poiesis*, whose transitive faculty become evident when the product or consequence of its activity gives us the new figure of the father or husband, and thus makes possible the appearance of a new being.

Soil as the organization of space

Soil, or earth, is the fundamental plane for the administration of space. In accord with it, its extension, its gradient, the organic material it contains, the perimeter of irrigation, the peasants establish and organize their dwelling houses, their fields, where to pasture animals, ponds and so on. In the management of plots, we have seen that the largest and flattest ones are destined for commercial varieties, which have short growing cycles (*kinsakilleras*) and higher yields than the native ones. These plots are more homogeneous than the others where native ones are found and which usually include several varieties in the same field. Such differences imply serious disagreements, opposed opinions and even passionate debates within local knowledge concerning the criteria for organizing a field. On the one hand are those who support the combination of varieties in the same plot; on the other hand, those who disagree and defend a clear separation between varieties. Each side has its arguments and justifications and – beyond what technical criteria may say on the topic – what is important is noting that local knowledge is not foreign to the *kata logon/kata erin* and likewise has its spaces of debate, disagreement and contrasting opinions. These are spaces like those of the sacred, enigmatic and symbolic debates of antiquity. By the way, we may mention that another field of debate and disagreement is the number of tubers that one should place in each hole on sowing. We have also seen that although the native varieties are excluded – almost socially – from commercial plots (or if they are admitted it is barely in marginal spaces), these varieties have their own spaces, their own privileged domain in the *purumas*.

The immanence of the purumas

The *puruma* plots are hidden cultivation spaces useful for sharing an exchanging plants with friends and relatives, but also important for food security organised under traditional and cultural patterns. *Puruma* plots are highly significant, partly in terms of the meanings and notions they enclose but also in terms of their practical features, their empirical functions and roles. I have labelled *puruma* plots as the "*confines productivos*" (productive verges) at the borders' of farmers' land, but they imply something else, because they are concealed or invisible plots, which represent farmers' autonomy *vis-à-vis* the market, development projects and even the state. These plots represent memory, the ancestors' knowledge and legacy, they are places kept safe and out of the reach of oblivion. They provide the "virgin" land that is able to protect and hostess the delicate and valuable native landraces. This is the land wherein peasants can respond to all the questions they can ask themselves: the place where ignorance is denied, not known, unacquainted with: ignorance of ignorance itself, which arithmetically means knowledge, namely, being familiar with it. If for Plato to know was to acknowledge or recognise, not to know what is not known also means to know. But first of all *purumas* are the place where local biodiversity can be kept, through a protective exile, becoming in this manner an invisible diversity source.

We may add that they are also the safest place for the native varieties which, if they were sown in soils contaminated by chemicals, would end by being burned up due to the elevated chemical content.[153] And this leads us to the following conclusion.

The social construction of destruction (of the soil)

The latter should not make us forget that, along other areas close to the road and with the complicity of projects, the market, the state, traders and so on, the land has been destroyed; land that was formerly appropriate for agriculture today is contaminated with nematodes and other pests. Paradoxically farmers practice in highlands the "*crianza de la chacra*" (bringing up the field) and *crianza* of bio-diversity but in the lowlands they have behaved distinctly, dissipating the land's wealth, damaging it for production, depleting the resource, exhausting it greedily.

This has meant that the spatial classification of high and low and their location has become more complex, even though – within Andean culture – these categories were already complex and paradoxical. As a consequence, a high place, which signifies that it is better, does not necessarily have to be sited at a high altitude, because there are high lands which are poor; but low lands which were high (that is, good) really have become low (bad) lands, although there are still some which are, on the basis of their quality, high. Another interesting thing is the use of colours to classify soils. Both the peasants and the engineers use these to differentiate types of earth. But they choose different colours: the peasants prefer to talk of strong, intense colours, while the technicians use dull, gentle colours. No doubt the technicians'

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[153] This phenomenon is nothing out of the ordinary. According to agronomical criteria of productive systems and plant domestication, if the same quantity of mineral fertilizers used today for commercial varieties were applied to the varieties of previous centuries, these would simply collapse to the earth, due to the continuous process of selection and adaptation of the varieties cultivated.

vision encloses a desire for precision while the peasants seek to sharpen the differences (to make them clearer). However, this means to say that peasant and technician each have a different vision, another glance in relation to each other; that they observe reality through different kaleidoscopes (finding different colours, elements and properties).[154]

The non technical affinities of the technical itinerary

In this chapter we have also accompanied the farmer on his or her technical journey, in the tasks and steps that follow from the preparation of the land to the harvest (or from the selection of seed for sowing, which can be seen simultaneously as the end of a previous cycle and the beginning of a new one). Initially, we debated – perhaps unnecessarily – the difference between techniques and practices, finding that the first is performance as domination of rules, and the second, performance which generates innovation and knowledge (which led us later to understand the true relation between practice and this last).

The steps and the tasks are not limited to being just that: activities programmed by an expert or the orders that a "soldier of production" ought to comply with; socially they have their relevance and meaning. To begin, with the very selection of seed[155] there is a conflict of directions and preferences: men often prefer to sow more market varieties, while women do not wish to leave aside (native) varieties for domestic consumption and feeding the family. If we recall the criteria of classification, these group varieties not only according to size (as is done for sale) but also by origin (native or introduced), destiny (consumption or sale), taste, consistency, mode of preparation (boiled with the peel on or cooked without it) and transformation (chuño, tunta). Soil preparation (here known as *barbecho*, not to be confused with the use of this term in some other regions where it may refer to the rest period between cycles of cultivation) is very important and is carried out between three and five months before sowing, applying manure so that the soil "heats up". For sowing, the night before a plan of "attack" is

[154] It is interesting to recall that the peasants also establish chromatic affinities between earth of a certain colour (for example, black) and seeds of another colour (for example, red), translating relations between colours into productive affinities.

[155] With referente to selection criteria, we have seen that the peasants, like the technicians, follow a meticulous observation of the plants and the tubers. They can recognize their potato (or other) plants – as Mazoyer claims for prehistoric peoples – as well or better than a botanist: the abundance of flowers, the shine and curl of the leaves, the number, size and depth of the eyes of the tuber… their metaphorical and descriptive depth never ceases to overflow; thus, a good seed is like a woman who is fertile with large eyes, while poor seed is like a man, shrunken and almost blind.

established, with tasks for each family member who will take part in the operation, which is gone over again in the morning before starting work. One of the tasks exclusive to women is to deposit seeds in the furrow, setting up a triple alliance – one could say – between their fertility, that of the seed and that of the earth. Since childhood, they have acquired such expertise in this labour and dominate the technique in such a way that it is difficult for men to replace them (due to female migration, the communities have been obliged to mutually borrow women, according to ritual kinship links, to cover their labour needs during the sowing period). In the same way, the task of depositing organic fertilizer, we presume due to their relationship with nature and especially with the flocks, is given to women. These routine and even mechanical tasks do not cease to be seen as particular relationships which are set up between the farmer and the field; thus we saw that, talking about weeding, they say "we take out the weeds like thieves". And care of the field, in general, is seen by them as taking care of a child. Finally, in the harvest, the man digs the potatoes and the woman, due to her patience and capacity to take note of details, selects tubers for seed. In this way, the person who opens and closes the agricultural cycle from sowing to harvest, placing the seed in the earth and receiving, selecting, ordering and disposing of the fruits of the harvest, is the woman.[156]

Farmers' practices, like intellectual constructs, may be contradictory and ambiguous. However the technical itinerary in which there is a constant iteration of tested techniques, constitutes also a continuous process of learning. Above all this is important for children and youngsters, commanding as it does the pursuance of practice in the ambience of a familiar "school" where the elder relatives are the teachers[157]. These didactic processes may lead to new discoveries and to the development of new techniques and conflicts.

A vivacious lifestyle

I have referred to the relationship or rather to the belonging of local knowledge to what Zimmerer defined as the "*kausay*-style subsistence", a lifestyle that is the style of life, a life not constituted by plenty of material things but plenty of life or rather plenty of living things. In this manner local knowledge is not only related to livelihoods, capitals, and assets but also

[156] In this chapter we also referred to other uses of potatoes in the light of local knowledge. One of these uses takes place in the field of health, for different illnesses (headache, toothache, fever, etc.) and once their therapeutic properties, above all of introduced varieties, have been discovered, the peasants habitually stick potato peelings on their faces, as if they were disguised as tubers to face up to the attacks of pain.

[157] As a peasant said, "they (children) learn by watching and doing".

related to living beings: bio-diversity. And, since it is the lifestyle of the poor, it cannot be taken as abundance but as temperance, the (subsistence) style that means austerity and soberness but which, at the same time, is completely immersed in the flow of life, a life entailing nature, society and deities.

The encounter between peasants and technology

In the last chapter, we proposed that in the interface which is produced between the farmer and the technician or expert, a sort of seduction takes place where the administration of ignorance assumes central importance. To take on the role of an ignorant person is always an invitation, whether to know more (learn by asking as in the Socratic mayeutic), to be more easily able to question an argument (searching for its falsehood like Popper), or – strategically – to arrive at some objectives or obtain certain scarce resources. In the interplay between projects and peasants, there is a theory or discourse which unites them: development, but practice can, simply, separate them (thus the projects complain of the diversion of funds or inputs, of how avaricious the peasants are today, or of the presupposition that the projects are there for the peasants' benefit without demanding responsibility in return). At the same time, there is a practical administration, if one may call it so, of agreements and compromises: saying "yes, it's fine" but then acting as one knows how to, due above all to the inevitable restrictions one suffers or a strong underlying rationale.

Loaning microscopes to change the view

Via the interfaces between farmers and agronomists we have aimed at determining which processes of reshaping take place in local knowledge. Firstly, we have found that the peasants do not manage to "see" what the pests (virus and fungi) which infest their plants are. From this we can conclude that the place of origin of ignorance – just as was proposed in the second chapter – is not the lack of understanding or information, but perception: in the capacity or condition of perceiving (*seeing* a cause, a consequence or whatever). Effectively, the narrative concerning nematodes and *tizón tardío* (as virus and fungi) is not relevant for the farmers until they are made visible when the technicians appear with microscopes to sharpen the lens of their perception. They enter the field of visibility for their perception, that is, not only for their eyes but for the "glance" of their understanding. One may argue, logically, that to *see* is not to *solve* but there are the agronomists and extension officers with the other narrative, that of the "vaccines", ready to join the fight against pests – a genuine crusade to purify soils and plants.

This last leads us to the terrain of the connotations which the ideas of purification, contamination or infestation proper to biomedicine (Fisher and Arce) bring with them, in the sense of "cleaning" or "decontaminating" the unhealthy and scarcely hygienic conditions or the deficient sanitation of the living conditions – and the soils, in our case – of the "natives". Paradoxically, we have found that, in a sort of localized re-run of the tremendous and bitter history of the epidemics and pests brought by the Europeans which assaulted and annihilated the indigenous populations of America, first of all the soils had to be infested so that they could then be purified. To use the vaccine first of all the patient had to fall sick. This is not to say that before projects and NGOs arrived there were no pests or diseases, but rather that, as this chapter explains, the induced specialization in potato growing, the intensification in market production, the uniformity of varieties and also a greater circulation of seeds with different origins, and the exhaustion of the soils (the peasants' argument) had serious consequences in terms of agro-ecological sustainability. Infestation took on "epidemic" dimensions, damaging soils for several kilometers either side of the roads by which development came.

Something important is that listening to and checking the stories from both sides – technicians and peasants – has allowed us to differentiate the relations of causality which they establish. The technicians concentrate on direct, lineal and immediate causes: virus, bacteria and fungi cause potato diseases. The peasants – some with enthusiasm – consider and value these causes in great measure, learning to see, one could say (and surely, for those who had the chance to see the fungi in action under the microscope, this would have been an unforgettable experience which will keep their amazement alive for the rest of their days). But these new causes include many others – direct and indirect – which may be more or less plausible (the greater circulation of seeds of unknown origin brought by the projects and the market, or the fact that someone in the community had an abortion). What should be pointed out here is the perspective of multiple causes – "multivariate" as we have called it, following the language of statistical models – which considers not only the immediate and direct causes but also, historically, the indirect and preceding causes (causes of the causes), elaborating a chain of causes which is coherent and fairly logical – in which even abortion or adultery have a place.

Living together with the enemy but fumigating as much as possible

The field of knowledge of potato diseases is surely that where the farmers have learned more and newer things, thanks to the agronomists' teaching. It is, in consequence, the field of knowledge where the reshaping of local knowledge has been deepest and most persistent. This does not mean that the peasants of the communities studied have entered into the logic of annihilation supposed by the chemical combat of pests. On the contrary, he or she knows that living with diseases is inevitable and that the bugs have to eat and feed themselves as well. This teaching of centuries or thousands of years of local knowledge – living together with what damages or causes problems for us – is convincingly upheld at present, since, the peasants have learned to live with the pests without falling prey to the puritanical and chimerical fever (proper to the chemical war and the biomedical episteme) of their total and definitive elimination. However, on the other hand, as a negative consequence of the teachings of the development and extension organizations, farmers in this region have become enthusiastic and cheerful fumigators who do not lose the least opportunity to apply some chemical product ("Let's spray it on") at the first suspicious indication of the presence of some "pathogenic agent".

The preceding has led us to propose that, in the course of the reshaping of farmers' knowledge, they follow two teachings simultaneously, that of the technicians and that of their own conceiving. Figuratively, they are two lighthouses which guide them as they navigate the stormy and treacherous waters of technical innovation. Thus we may conclude the following: a combination (conflation) of knowledges between peasant and expert knowledge; secondly, therefore, the peasants do not perceive – on the whole – that their knowledge and that of the technicians are opposed or adversaries; thirdly, expert knowledge has been visibly effective for the peasants in its results with pests and diseases; and fourthly, precisely these results, which are reflected in higher yields and harvests less affected by pests, are the main motive for the acceptance, and application of new techniques on the part of the peasants.

As is often proclaimed at present in the discourses of participatory development, a fundamental element for the conflation of knowledges has been a change of attitude or the rise of a new attitude, the openness of the peasants towards new knowledge. As one of the farmers testified, "But those things are understood by those who want to know, for others it's just a load of nonsense". Without being able to reject the temptation or invitation to make a paraphrase, we may note that to see first of all one has to wish to see, one has to desire to see, one has to be infected by that heuristic quest which has come to torture the Western spirit.

To touch a little upon the topic of gender, we have seen that the chemicals and the new lexicon of pests and diseases have been maintained as "men's affairs", with little interest for women who, almost with disgust, have also said "that's their business" (those new games with which they keep their heads occupied and so don't think about other foolishness). But we have also been able to show that women's knowledge about potato diseases is on the same level as men's.

A note, some points which cannot be left out concern agrotoxics or "poisons". The widespread use of mineral fertilizers for the soil and phytosanitary products for treatments has had two important consequences: the "addiction" of the soils to the first and problems of intoxication of producers with the second. This proof has led us to speak of an unfinished, incomplete or defective reshaping. Certainly, the farmers know much about systemic products, about contact, doses and mixtures but little – or they simply don't care – about measures of prevention and protection from these "poisons". Such a defective or biased reconfiguration carries the mark, the brand of the development and technical innovation projects which have worked in this region. In this case they have not made use – as PROINPA ingeniously did for fungi – of the didactic of the microscope, but on the contrary they have limited their view, their perception (as if they were covering the other with one hand) of a sole eye which, by chance, was the "productivist" eye,[158] which only sees high yields and "quality" produce.[159] The other war, that which calls to fight against pesticides and their noxious affects due to the deposition of nitrates and other chemical residues which contaminate the soil, the water and the air has not yet begun or has not been openly declared. Meanwhile, the farmers continue to play with mixtures and proportions without being able to know (this is another dramatic manifestation of ignorance: not being able to know something beforehand) what may be awaiting them in the future.

An arithmetic of biological diversity

In the last chapter we have also debated the topic of profit and loss in the "sum of diversity". We have known that there is a loss when the diseases gain and take with them beloved varieties, leaving behind only their memory in remembered fields. And we have faced the limits of local knowledge sharing the grief and laments of male and female cultivators who lovingly recall the attributes of their preferred varieties, perceiving with certain astonishment their insistence in appearing as accomplices in or guilty of their disappearance ("we made it get lost", "we caused its loss"), thus underlining their lack of attention, the forgetting of these varieties and in that way allowing them to go away.

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[158] These projects could be called "the cyclops of productivism".

[159] Limiting the argument on quality to its industrial version of mass marketing: the size and the appealing and perfect appearance; perhaps still not aware that in these days of mad cows, dioxins and avian flu the basic criterion of quality has become harmlessness.

We have likewise seen that the reshaping of local knowledge is not only defective or incomplete but also partial in relation to gender and age. In effect, like a women who prefers men and better if they are youthful, the reshaping has been directed toward or favourable to young men. To the desperation of the NGOs which for some time have been ordered to make women participate, women have not felt much of a call to take part in a "reshaping" of their knowledge, to follow the steps of the apostles of technical change ("I can't get my head around it", said an older woman concerning the names of the new varieties and the inputs and phytosanitary products, "that's what my son's for", to go and chat with the agronomists). Mature and old men, for their part, were left perplexed and upset when a young boy – the youthful engineer – wished to teach them something, to them who had learnt from their fathers and grandfathers. We have affirmed that as a consequence of this their knowledge is more directed to the past.

In relation to the "sum of diversity" there has been a tendency to a relative loss of native varieties. Thus I have proposed the metaphorical figure of the "knowledge potato", which shows how local knowledge may lose knowledge like a tuber loses water, drying out; loosing its memory and forgetting ancient varieties, their names, the taste they held, the ways they were cropped. New varieties enter farmers' plots and households but do not always stay, as transitory visitors who are not particularly welcomed by the palate (or stomach) or the market; they discreetly disappear taking with them elements of knowledge, which subsequently vanish.

One may then speak, as N. Long and others have done, of the dynamics of knowledge as processes which shoot in different direction: on the one hand they are constructive and incorporate ideas, images and techniques, but on the other hand, they carelessly erode and destroy schemes of understanding and value: the affective traditions of empirical experience.

In talking of interstices and discontinuities it is worth referring to the discontinuity in experts' rational and technical knowledge. In the crossfire of knowledge, experts are also touched by the rebounding effects of the encounter of knowledges and the consequences of their interplay suffering, in this way, ruptures and breaks in their technical baggage. They, technicians, also elaborate their own local knowledge that, like the twin, the local knowledge of farmers, becomes *a-topos* - without place. This new local knowledge, which is "enchanted" by farmers' knowledge and beliefs, has its own brilliant and dark facets, no longer as a potato – the "knowledge potato" of farmers – but as a mysterious moon with its phases of luminosity and darkness.

A terzetto *for a knowledge topology*

This work which has gathered potatoes, peasants and technicians in a group around local knowledge has turned constantly around another triangle made up of memory, ignorance and forgetting. To forget, we have seen, is not to pay attention, imprudently ceasing to care and almost foolishly omitting something, allowing the precious varieties to fall through a hole in our basket; and we have witnessed the grief and nostalgia for them. And we have also seen that not paying attention to the soils has led to damaging them and ruining them in an almost "unconscious" way (without being conscious of it). Forgetting is thus also ceasing to be conscious of something (like the old Indian god who forgot his condition and fell to earth).

Ignorance is to be unable to enquire or comment on something because one does not see it. The moment in which we perceive something, when we see it – fungi under a microscope or the effects of pesticides on our children and animals – is when we can begin to ask relevant questions. In this way, ignorance is likewise being unable to anticipate. If to perceive is to see (with our understanding), to anticipate is to fore-see – hearing the crystalline song of the *pichitankitu*, for example, to know that next year will be rainy. With reference to technology, neither peasants nor anyone else are in conditions to *fore-see* many of its consequences, since there is no bird which will warn us with its song. We all share, not a cultured philosophical ignorance – such as that described by Popper – but merely a simple, pedestrian ignorance.

To finish, there is memory, which, we have learnt, has two paths: recognizing and remembering. Recognising is entwined with revisiting and forms what we have called "practice". Practice, then, is to return to the same place, a place which we renew and make present with our knowledge and so, to know can be to recognize at last because from the field, from the land which repeatedly receives us we make something new with the radiance of knowledge, like the young experimenter Severino from Qoari who, revisiting the *wayruru* and the cow's pancreas, "recognizes" new therapeutic practices, "seeing" what he did not see until then.[160] To remember is also to revisit but the places here are times, it is to revisit our memories; and it leads not only to nostalgia but also to recreate or reinvent. To reinvent certain things such as the old flavours of the *ñawpa papas* or the lost taste of our soils. To reinvent what we produced, what we consumed, what we after all are and memory will, amiably, allow us to recognize ourselves in all of it.

[160] And keeping a tactical and prudent silence when things do not turn out as he hoped.

REFERENCES

Adorno, T. (1951), *Minima Moralia.* Madrid: Taurus

Aguiló, F., (1992), *Etnias andinas de Bolivia*. Culturas aborígenes de América. Cochabamba: ODEC-AROL

Andoni, A., (1996a), "Ivan Illich: hacia una filosofía de la tecnología", in: A. Andoni *et al.* (coord.), *Para comprender ciencia, tecnología y sociedad.* España: Ed. Verbo Divino

– (1996b) "Lewis Mumford y la historia de la máquina", in: A. Andoni *et al.* (coord.), *Para comprender ciencia, tecnología y sociedad.* España: Ed. Verbo Divino

Antezana, F. (2000), Estrategias familiares y recursos colectivos en un ámbito rural: estudio de caso en comunidades de las provincias Arque y Tapakari (ined.)

Arce, A. (1993), Negotiating agricultural development: Entanglements of bureaucrats and rural producers in Western Mexico. Wageningen: Landbouwuniversiteit

– (1997), Research proposal on social security and insecurity. Wageningen

– (2000), *Knowledge and rural livelihoods*. Paper for discussion. Wageningen

– (2001), Value contestations in development interventions: Community development and sustainable livelihoods Approaches. Draft (Later published in Community Development Journal. Vol 38, number 3, July, 199-212)

– (2002a), "Experiencing the modern World: Individuality, planning and the state", in: P. Hebinck and G. Verschoor, *Resonances and dissonances in development. Actors, networks and cultural repertoires.* The Netherlands: Royal Van Gorcum

– (2002b), The policy community and collective action: Power, agency and knowledge. Draft

Arce A. and N. Long, (1992), "The dynamics of knowledge. Interfaces between bureaucrats and peasants", in: N. Long and A. Long (eds), *Battlefields of knowledge. The interlocking of theory and practice in social research and development.* London and New York: Routledge

– (1994), "Re-positioning Knowledge in the Study of Rural Development", in: D. Symes and A. Jansen (eds.), *Agricultural Restructuring and Rural Change in Europe.* Wageningen: Grafisch bedrijf Ponsen & Looijen b. v.

Arce, A., N. Long, (eds.),(2000) Anthropology, development and modernities. Exploring discourses, counter-tendencies and violence. London and New York: Routledege

Arce, A. and E. Fisher, (1999), "The accountability of commodities in a global market place: the cases of Bolivian coca and Tanzanian honey", in: R. Fardon *et al., Modernity on a shoestring. Dimensions of globalization, consumption and development in Africa and Beyond.* Leiden and London: EIDOS

– (2000), *Encountering the pseudopodia nature of knowledge: Illustrations from Bolivia and the United Kingdom*. Paper for ASA 2000 Conference: Participating in development: Approaches to indigenous knowledge

Arnold, A., (1992), The corrupted sciences. Challenging the myths of modern science. Great Britain: Paladin

Ayestarán, I., (1996a), "Modernismo reaccionario y técnica: Heidegger frente a Nietzsche y Jünger", in: A. Andoni *et al.* (coord.), *Para comprender ciencia, tecnología y sociedad.* España: Ed. Verbo Divino

– (1996b), "Industria cultural: La Ilustración como engaño de masas (Horkheimer y Adorno, más allá de Habermas), in: A. Andoni *et al.* (coord.), *Para comprender ciencia, tecnología y sociedad.* España: Ed. Verbo Divino

Attar Ud-Din Farid, (1994), *La conferencia de los pájaros.* Buenos Aires: Lozada

Bachelard, G. (1951), L'activite rationaliste de la physique contemporaine. Paris: Presses Universitaires

Beck, U., S. Lash and A. Giddens, (1994), *Reflexive modernization.* California: Standford University Press

Bernard, H. R., (1991), *Research methods in cultural anthropology.* Newbury Park, London, New Delhi: Sage Publications

Bhaskar, R., (1998), "General introduction", in: M. Archer *et al.* (eds.), *Critical realism. Essential readings*. Centre for critical realism, critical realism: interventions. London and New York: Routledge

Black, M., (1966), *Modelos y metáforas.* Madrid: Tecnos

Blanc-Pamard, Ch. et al.(1992), Techniques et pratiques: a la jonction du naturel et du social. CNRS

Blaug, M., (1963), "A survey of the theory of process innovations", in: *Economica*. Frevier. Paris

Borges, J. L. (1985), *Prosa.* España: Círculo de Lectores

Bourdieu, P. (1981), "Men and machines", in: K. Knorr-Cetina and A. Cicourel (eds.), *Advances in social theory and methodology. Toward an integration of Micro –and Macro- Sociologies.* USA: Routledge and Kegan Paul

– (2001), *El campo político.* La Paz: Plural

Box, L., (1989), "knowledge, networks and cultivators: cassava in the Dominican Republic, in: N. Long (ed.), *Encounters at the interface. A perspective on social discontinuities in rural development.* Wageningen: Landbouwuniversiteit

Cabo, J. M., (1996), “Maquinaria, alineación y economía en K. Marx”, in: A. Andoni *et al.* (coord.), *Para comprender ciencia, tecnología y sociedad.* España: Ed. Verbo Divino

Callon, M., J. P. Vignolle, (1976), “Organisation locale et enjeux societaux. Le cas d’un centre de recherche”, en: *Sociologie du travail*. Vol. 3: 233-255

Callon, M., Law and Rip, (1986), Mapping the dynamics of science and technology. Sociology of science in the real world. United Kingdom: The MacMillan Press Ltd.

Callon, M., J. Law, (1989), “On the construction of sociotechnical networks: content and context revisited”, in: *Knowledge an society: studies in the sociology of science. Past and present*, vol. 8, pp. 57-83

Cassirer, E., (1973), *Mito y lenguaje.* Buenos Aires: Nueva visión

Chino, S., (2002), Identificación y monitoreo de prácticas campesinas de manejo de suelos y agua en ladera de la zona de Qoari. Provincia Tiraque. UMSS (BSc. thesis)

Cockburn, C. (1994), “Caught in the wheels: the high cost of being a female cog in the male machinery of engineering”, in: D. Mackenzie and J. Wajcman (eds.), *The social shaping of technology.* Philadelphia: Open University Press

CIDETI (Comité Interinstitucional para el Desarrollo de Tiraque), (1991), *Diagnóstico socioeconómico de la microregión Tiraque*. Vols. 1, 3. Cochabamba: CIDETI

CIPCA (Centro de Investigación y Promoción del Campesino), (1995), *Diagnóstico socioeconómico de la microregión Tiraque.* Cochabamba: CIPCA

Crawford, E., D. Baker, (1993), “Farming systems research and economics”, en: G. H. Navarro y J. P. Colin (eds.), *Sistemas de producción y desarrollo agrícola.* México: ORSTOM-CONACYT

Crivisqui, E., (1993), *Análisis factorial de correspondencias. Un instrumento de investigación en ciencias sociales*. Laboratoire de methodologie du traitement des donnees. Universite Libre de Bruxelles. Edic. de la Universidad Católica de Asunción

Czitrom, V., (1999), “One-factor-at-a-time versus designed experiments”. Teacher’s corner, in: *The American Statistician*. May, vol. 53, No. 2. USA: American Statistical Association

Davidson, D., (1995), *De la verdad y de la interpretación.* Barcelona: Gedisa

Dozon, J. P. et G. Pontie, (1985), “Développement, sciences sociales et logiques paysannes en Afrique noire”, in: P. Boiral, *et al. Paysans, experts et chercheurs en Afrique noire. Sciences sociales et developpement rura.l* Paris: CIFACE-KARTHALA

Dufumier, M., (1993), “La importancia de la tipología de las unidades de producción agrícolas en el análisis diagnóstico de realidades agrarias”, in: G. H. Navarro y J. P. Colin (eds.), *Sistemas de producción y desarrollo agrícola.* México: ORSTOM-CONACYT

Durbin, P. (1996), “La transferencia de la tecnología, una breve historia crítica”, in: A. Andoni *et al.* (coord.), *Para comprender ciencia, tecnología y sociedad.* España: Ed. Verbo Divino

Durkheim, E. (1982), Las reglas del método sociológico. México: FCE

Eco, U. (1995), *Il nome della rosa.* Milano: Bompiani

Eliade, M. (1975), *Myth and Reality.* New York: Harper

Ellis, F., (1993), Peasant economics. Farm Households and agrarian development. Australia: Cambridge University Press

– (2000), *Agricultural policies in developing countries*. Wye studies in agricultural and rural development. Great Britain: Cambridge University Press

Engel, P., (1995), Facilitating innovation. An action-oriented approach and participatory methodology to improve innovative social practice in agriculture. Wageningen (PhD. thesis)

Escobar, A., (1998), Encountering development. The making and unmaking of the third world. Princeton: Princeton University Press

Escofier, B., J. Pages, (1990), Analyses factorielles simples et multiples. Objectifs, methodes et interpretation. Paris: Dunod

Fairhead, J. (1993), “Representing knowledge. The ‘new farmer’ in research fashions”, in: J. Pottier (ed.), *Practising development. Social science perspectives.* Great Britain: Routledge

Felipe, L., (1987), *Antología poética.* España: Alianza

Fernández M., H. Salvatierra, (1990), “Participatory technology validation in highland communities of Peru”, in R. Chambers *et al.* (eds.), *Farmer first. Farmer innovation and agricultural research.* Great Britain: Intermediate Technology Publications

Fisher, E., and A. Arce, (2000), “The spectacle of modernity. Blood, microscopes and mirrors in colonial Tanganyika”, in: A. Arce and N. Long, (eds.),(2000) *Anthropology, development and modernities. Exploring discourses, counter-tendencies and violence.* London and New York: Routledege

Flichy, P., (1995), L’innovation technique. Récents développements en sciences socials vers une nouvelle théorie de l’innovation. Sciences et societé. Paris: Éditions La découverte

Foerster von, H. (1998), “Construyendo una realidad”, in: P. Watzlawick *et al. La realidad inventada.* Barcelona: Gedisa

Foucault, M., (1994), “Un si cruel savoir”, in: *Dits et ecrits.* Gallimard: Paris

Galjart, B. (1976), “Une problematique fausse: le moderne et le traditionnel”, in: P. Rambaud, *Sociologie rurale.* France: Mouton

Galopo, E., (2002), “Desertificación y conservación de suelos”, in: G. Zambrana (ed), *Desarrollo de los ecosistemas de montaña y biodiversidad en Bolivia. Memorias del encuentro.* Cochabamba: Poligraf

García-Pelayo, R., (1985), *Minilarousse ilustrado.* España: Círculo de Lectores

Glaserfeld, E. (1998), "Introducción al constructivismo radical", in: P. Watzlawick *et al. La realidad inventada.* Barcelona: Gedisa

Geertz, C., (1983), Local knowledge. Further essays in interpretive anthropology. New York: Basic Books, Inc.

Giddens, A., 1990), *The consequences of modernity.* USA: Polity Press

Golinski, J., (1998), Making natural knowledge. Constructivism and the history of science. USA: Cambridge University Press

Gordillo, J., V. H. Blanco y P. Richmond, (1995), *Diagnóstico de la vivienda en la conurbación de Cochabamba.* Cochabamba: CEP-IIA-CERES

Greace, H., (1991), "Lógica y conversación", in: L. Valdes (ed), *La búsqueda del significado.* Madrid: Tecnos

Habermas, J., (1986), *Ciencia y tecnología como "ideología".* Cuadernos de filosofía y ensayo. Madrid: Tecnos

Hammersley, M., P. Atkinson, (1983), *Ethnography. Principles in practice.* London and New York: Tavistock Publications

Heidegger, M., (1997) *La pregunta por la técnica.* Santiago de Chile

Hobart, M., (1993), *An anthropological critique of development.* London and New York: Routledge

Huizinga, J. (1996), "El juego y el saber", in: *Homo ludens.* España: Alianza/Emecé

IBTA-PROINPA, (1996), *Generación y transferencia en PROINPA.* Cochabamba: IBTA-PROINPA

INE (Instituto Nacional de Estadística), (2002), *Censo nacional de población y vivienda 2001* (La Paz: INE)

– (2002), Mapa de pobreza 2001. Necesidades básicas insatisfechas. La Paz: INE-UDAPE

Jacq, C. (1998), La sagesse vivante de l'Egypte ancienne. Paris: Robert Laffont

Jardiel Poncela, E., (1983), *Máximas mínimas.* México: Ed. García

Jansen, K., (1998), Political ecology, mountain agriculture, and knowledge in Honduras. Amsterdam: Thela Publishers

Janvry de, A. *et al*., (1989), "Agrarian structure, technological innovations, and the state, in: B. Pranab (ed), *The economic theory of agrarian institutions.* Oxford: Clarendon

Jeyaraja, S. (1990), *Magic, science, religion, and the scope of rationality.* Cambridge: Cambridge University Press

Katz, E., (1971), "The social itinerary of technical change: two studies of the diffusion of innovation", in: W. Schramm and D. Roberts, *The process and effects of mass communication.* USA: University of Illinois Press

Lakoff, G. Y M. Jonson, (1981), "La estructura metafórica del sistema conceptual humano", in: D. Norman (comp.), *Perspectivas de la ciencia cognitiva.* Barcelona: Paidós

Lamparelli, C., (1996), *Il libro delle 399 meditazioni Zen.* Italia: Oscar Mondadori

Lao-Tzu, (1994), *La regola celeste. Il segreto della virtú nell'agire senza agire.* Ferlina: Demetra

Latour, B. (1995), *La science en action*. France: Gallimard

Latour, B., and S. Woolgar, (1986), *Laboratory life. The construction of social facts.* USA: Princeton University Press

Lebart, L., A. *et al.* (1995), *Statistique exploratoire multidimensionnelle.* Paris: Dunod

Long, N., (ed.), (1989) *Encounters at the interface. A perspective on social discontinuities in rural development.* Wageningen: Landbouwuniversiteit

Long, N., (1997), "Agency and constraint, perceptions and practices. A theoretical position", in: de Haan and Long (eds.), *Images and realities of rural life. Wageningen perspectives on rural transformations.* The Netherlands: Van Gorcum

− (2001), *Development sociology. Actor perspectives.* London and New York: Routledge

Long, N. and M. Villarreal, (1993), "Exploring development interfaces: from the transfer of knowledge to the transformation of meaning", in: F. Schuurman (ed), *Beyond the impasse. New directions in development theory.* London, New Jersey: Zed Books

Long, N. and M. Villarreal, (1994), "The interweaving of knowledge and power in development interfaces", in: I. Scoones and J., Thompson (eds.), *Before farmer first. Rural people's knowledge, agricultural research and extension practice.* London: SRP

Mango, N. A. R., (2002), *Husbanding the land. Agricultural development and socio-technical change in Louland, Kenia*. Wageningen (PhD. thesis)

Marcuse, H. (1993), *El hombre unidimensional.* Buenos Aires: Planeta-Agostini

Marglin, S., (2000), *Perdiendo el contacto. Hacia la descolonización de la economía.* Cochabamba, Villarroel

Marx, K., (1980), El capital. T. I. México: FCE

− (1994), "The machine versus the worker", in: D. Mackenzie and J. Wajcman (eds.), *The social shaping of technology.* Philadelphia: Open University Press

Menchaca, E., (2002), *Procesos de intervención en la provincia Tiraque*, UMSS (BSc. thesis)

Ministerio de Desarrollo Humano, (1995), *Mapa de pobreza. Una guía para la acción social.* La Paz: UDAPSO-INE-UPP-UDAPE

Miranda, B. (1994), *Transferencia de tecnología para el desarrollo rural: retos, problemas y perspectivas.* Managua: PASOLAC

Morrée de, D. (1997), *Diagnóstico rural rápido: los datos son confiables?* Serie investigaciones. Sucre-Bolivia: PIED ANDINO

Negri, A., (1988), *Fine secolo. Un manifesto per l'operaio sociale.* Milano: SugarCo Edizioni

Olivier de Sardan, J. P., (1995), *Anthropologie et developpement. Essai en socio-anthropologie du changement social.* Marseille-Paris: APAD-KARTHALA

Ordoñez, C., (2003), *Género, conocimiento y métodos participativos en las comunidades de Piusilla San Isidro y Compañía Pampa* (Provincia Ayopaya), UMSS (BSc. thesis)

Ortega y Gasset, (1998), *Meditación de la técnica y otros ensayos sobre ciencia y filosofía.* Madrid: Alianza Editorial

Parente, D., (2000), *La metáfora como instrumento cognitivo* www.favanet.com.ar/ratio/diego.htm

Parkin, D. (1995), "Latticed knowledge: eradication and dispersal of the unpalatable in Islam, medicine and anthropological theory", in: R. Fardon (ed.), *Counterworks. Managing the diversity of knowledge.* London and New York: Routledge

Pelt, J. M., *et al.*, (1999), *La plus belle histoire des plantes. Les racines de notre vie.* Paris: Seuil

Ploeg van der, J. D., (1989), "Knowledge systems, metaphor and interface: the case of potatoes in the Peruvian highlands", in: N. Long (ed.), *Encounters at the interface. A perspective on social discontinuities in rural development.* Wageningen: Landbouwuniversiteit

– (1990), *Labor, markets, and agricultural production*. USA: Westview Press

– (1997), "On rurality, rural development and rural sociology", in: H. de Haan and N. Long (eds), *Images and realities of rural life. Wageningen perspectives on rural transformations.* The Netherlands: Van Gorcum

Ploeg van der, J. D. and N. Long, (1989), "Demythologising planned intervention", in: *Sociologia Ruralis. Journal of the European Society for Rural Sociology*. USA: Blackwell Publishing

Popper, K., (1970), "The sociology of knowledge", in: J. Curtis and J. Petras, *The sociology of knowledge. A reader.* Great Britain: Gerald Duckworth & Co. Ltd.

– (1994), *Conjeturas y refutaciones. El desarrollo del conocimiento científico.* Barcelona: Paidós

PROINPA, (1999), *Los comités de investigación agrícola local (CIAL).* Investigación participativa para la agricultura – IPRA. Cochabamba

PRONAR (Programa Nacional de Riego), (1996), *Proyecto de mejoramiento de riego Yanakhocha. Provincia Tiraque.* Cochabamba: PRONAR

– (1999), *Documento de trabajo.* PRONAR

Quintana, R., (2002), *Cultura y saber local en la producción de Papa. Estudio de caso de la Comunidad de Qoari, Provincia Tiraque*, UMSS (BSc. thesis, draft)

Rella, F. (1989), *Asterischi.* Milano: Feltrinelli

– (1994), *Limina. Il pensiero e le cose.* Milano: Feltrinelli

Rengifo, G., (1987), *Agricultura tradicional en los Andes, manejo de suelos, sistema de labranza y herramientas agrícolas.* Lima: Horizonte

Richards, I., (1969), *The philosophy of rhetoric.* New York: Oxford University Press

Richards, P., (1990), “Agriculture as a performance”, in: R. Chambers et al., *Farmer first. Farmer innovation and agricultural research.* Great Britain: Intermediate Technology Publications

Riegert, G., (1971), *Madame Bovary. Flaubert.* Politiers: Hatier

Rip, A. and R. Kemp, (1998), “Technological change”, in: Rayner, S. and E. Malone (eds), *Human choice and climate change.* Columbus: Battelle Press

Rivera, C., (2003), *Género y seguridad alimentaria en las Alturas de Tiraque (comunidades de Qoari y Boquerón)*, UMSS (BSc. thesis)

Rogers, E., (1983), *Communication technology, the new media in society.* New York: The Free Press

Sahli, M., (1996), *Changing forest management strategies in Sudan, a challenge for forestry educational systems.* Wageningen (PhD. thesis)

Sahlins, M. (1995), *How “natives” think. About captain Cook, for example.* Chicago, London: The University of Chicago Press

Salazar, M., (1997), *Evaluación inicial del grado de adopción de la estrategia para el control químico del tizón* Phytophthora infestans (Mont.) de Bary *en seis comunidades de Morochata*. UMSS (BSc. thesis)

Savater, F., (1995), *Invitación a la ética.* Barcelona: Anagrama

Scoones, I. and J., Thompson (eds.), (1994), “Knowledge, power and agriculture-towards a theoretical understanding”, in: I. Scoones and J. Thompson, *Before farmer first. Rural people’s knowledge, agricultural research and extension practice.* London: SRP

Sebillote, M., (1978), *Itineraires techniques et evolution de la pensee agronomique.* C.R. Acad. Agric.

Serres, M. (1992), *Eclaircissements. Entretiens avec Bruno Latour.* Paris: Éditions Francois Bourin

Sorrensen y Montoya, (1989), “Conservación de suelos”, in: Primer seminario nacional: *Conservación de suelos y agua en la agricultura. Experiencias sobre la investigación y extensión.* Cochabamba: PEIRAV

Temple, D., (1995), *La dialéctica del don. Ensayo sobre la oikonomía de las comunidades indígenas.* La Paz: Hisbol

Thiele, G., (1997), *Sistemas informales de semilla de papa en los Andes: ¿Por qué son importantes y qué hacer con ellos?* Unidad de Innovación Tecnológica. PROINPA

– (1999), *PROINPA: ayudando a los agricultores manejar mejor el tizón de la papa.* PROINPA

Thiele, G., G. Gardner, R. Torrez, J. Gabriel, (1997), *Farmer involvement in selecting new varieties: potatoes in Bolivia*. Expl Agric., vol 33. Great Britain: Cambridge University Press

Todorov, T. y O. Ducrot, (1972), *Diccionario enciclopédico de las ciencias del lenguaje.* Buenos Aires: Siglo XXI

Varela, F., (1996), *Invitation aux sciences cognitives.* France: Editions du seuil

– (1998), “El círculo creativo. Esbozo históriconatural de la reflexividad”, in: P. Watzlawick *et al. La realidad inventada.* Barcelona: Gedisa

– (1999), *Ethical know-how. Action, wisdom, and cognition*. Writing Science. Stanford: Stanford Univesity Press

Vattimo, G., (1997), “The nihilistic vocation of hermeneutics”, in: *Beyond interpretation. The meaning of hermeneutics for philosophy.* UK: Polity Press

Vekemans, R. *et al.*, (1969), *Hacia la superación de la marginalidad. Algunas sugerencias.* Santiago de Chile: DESAL

Vico, G., (1968), *Ciencia nueva.* Buenos Aires: Aguilar

Vilain, L. (1999), *De l'exploitation agricole à l'agriculture durable : aide méthodologique à la mise en place de systèmes agricoles durables.* Dijon: Ed. Educagri

Watzlawick, P. *et al*, (1998), *La realidad inventada.* Barcelona: Gedisa Editorial

Whorf, B., (1956), *Language, thought, and reality*. Selected writings. Massachusetts: MIT

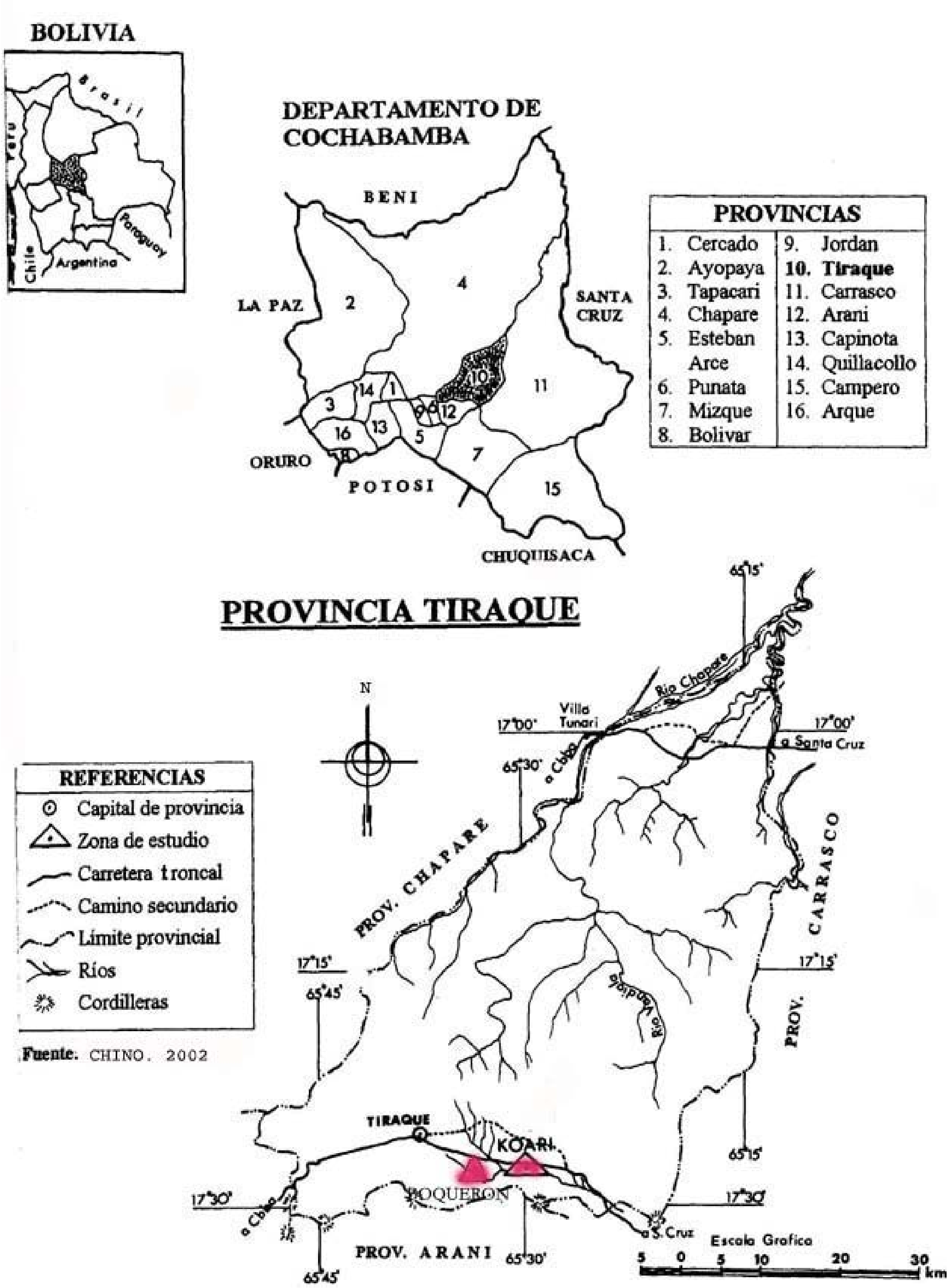
www.chez.com/patder/histoire

Zimmerer, k., (1996), *Changing fortunes. Biodiversity and peasant livelihood in the Peruvian Andes.* Berkeley: University of California Press

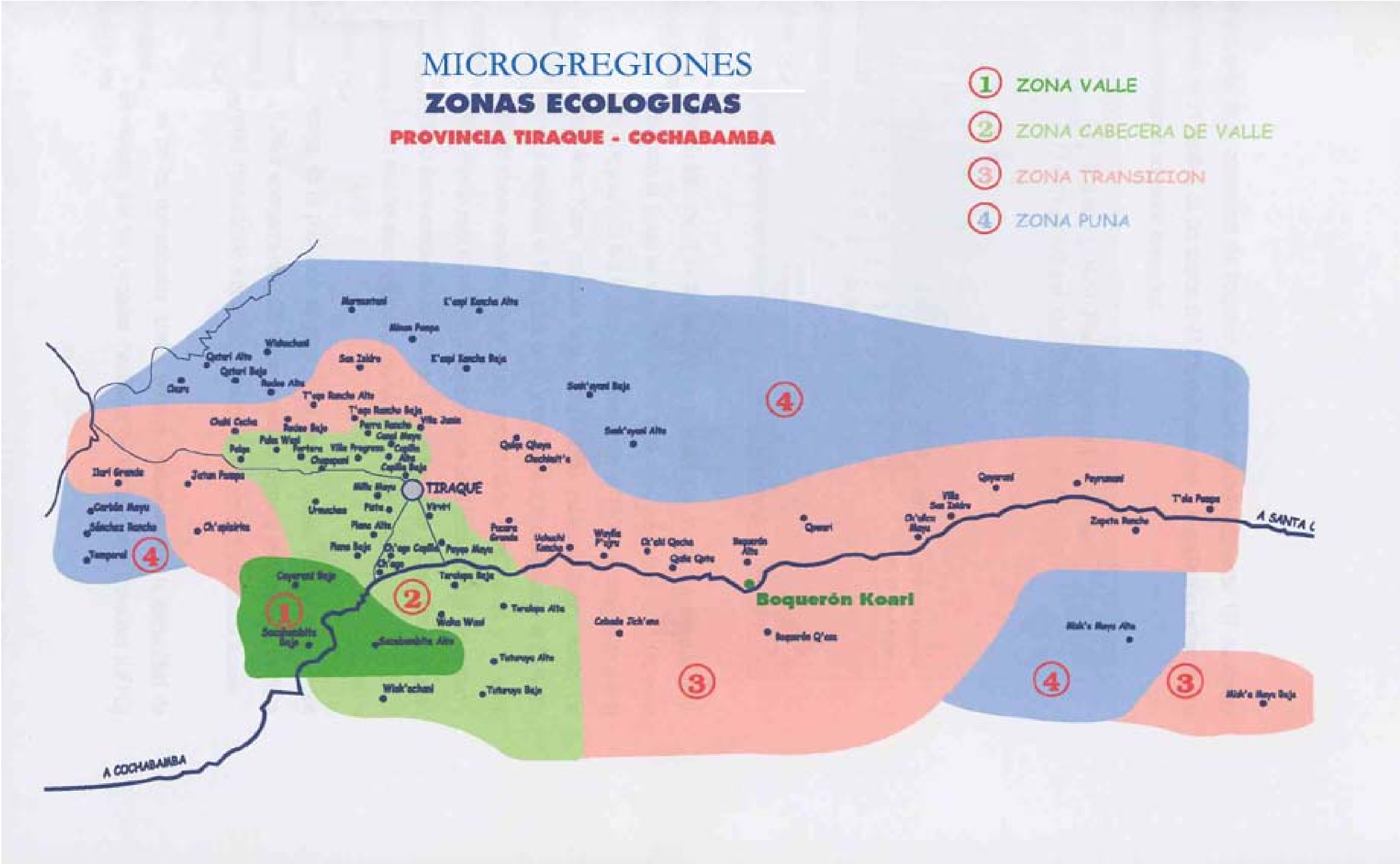
ANNEXES

ANNEX 1 GEOGRAPHICAL DESCRIPTION

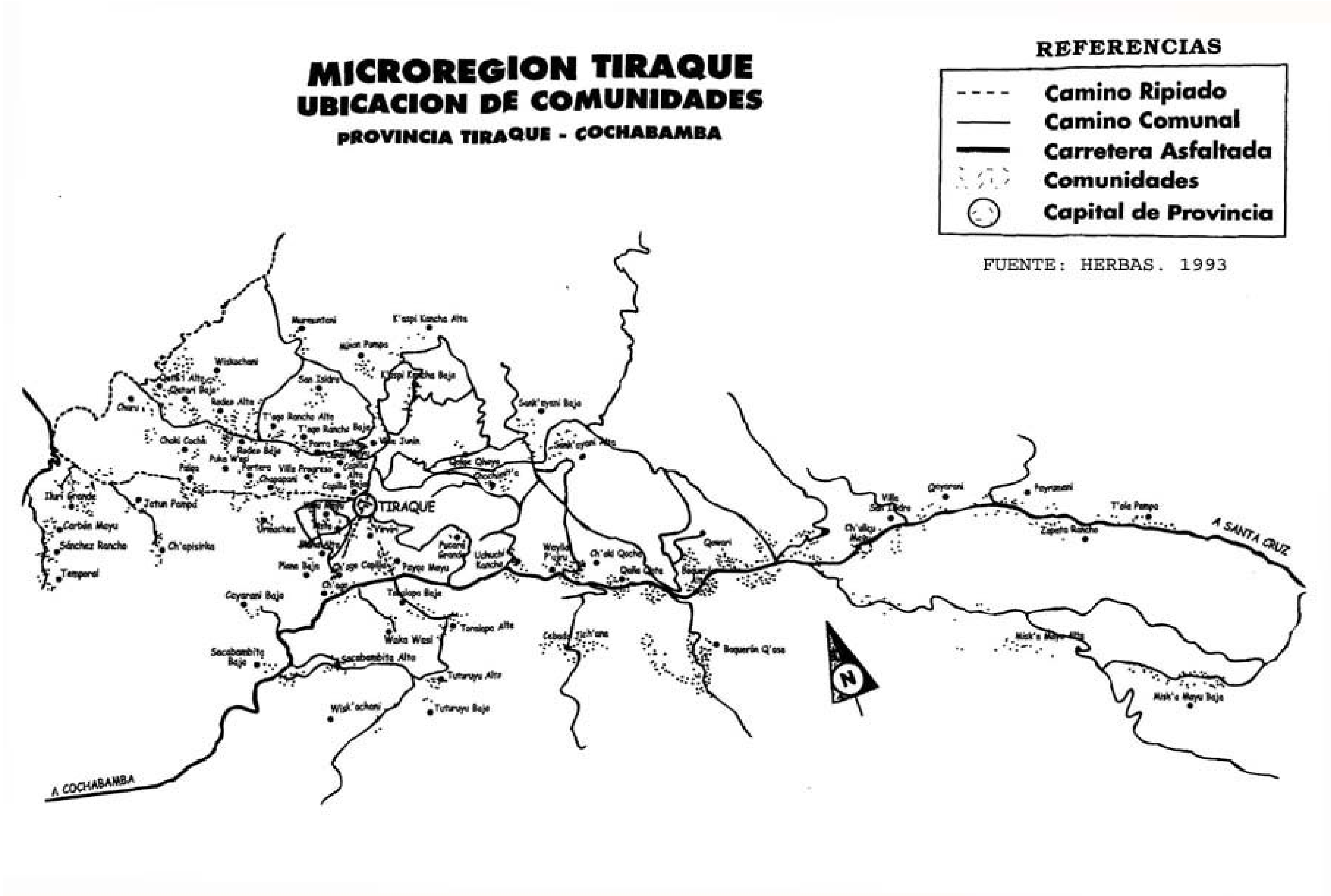
Annex 1A MAP 1: THE PROVINCE OF TIRAQUE



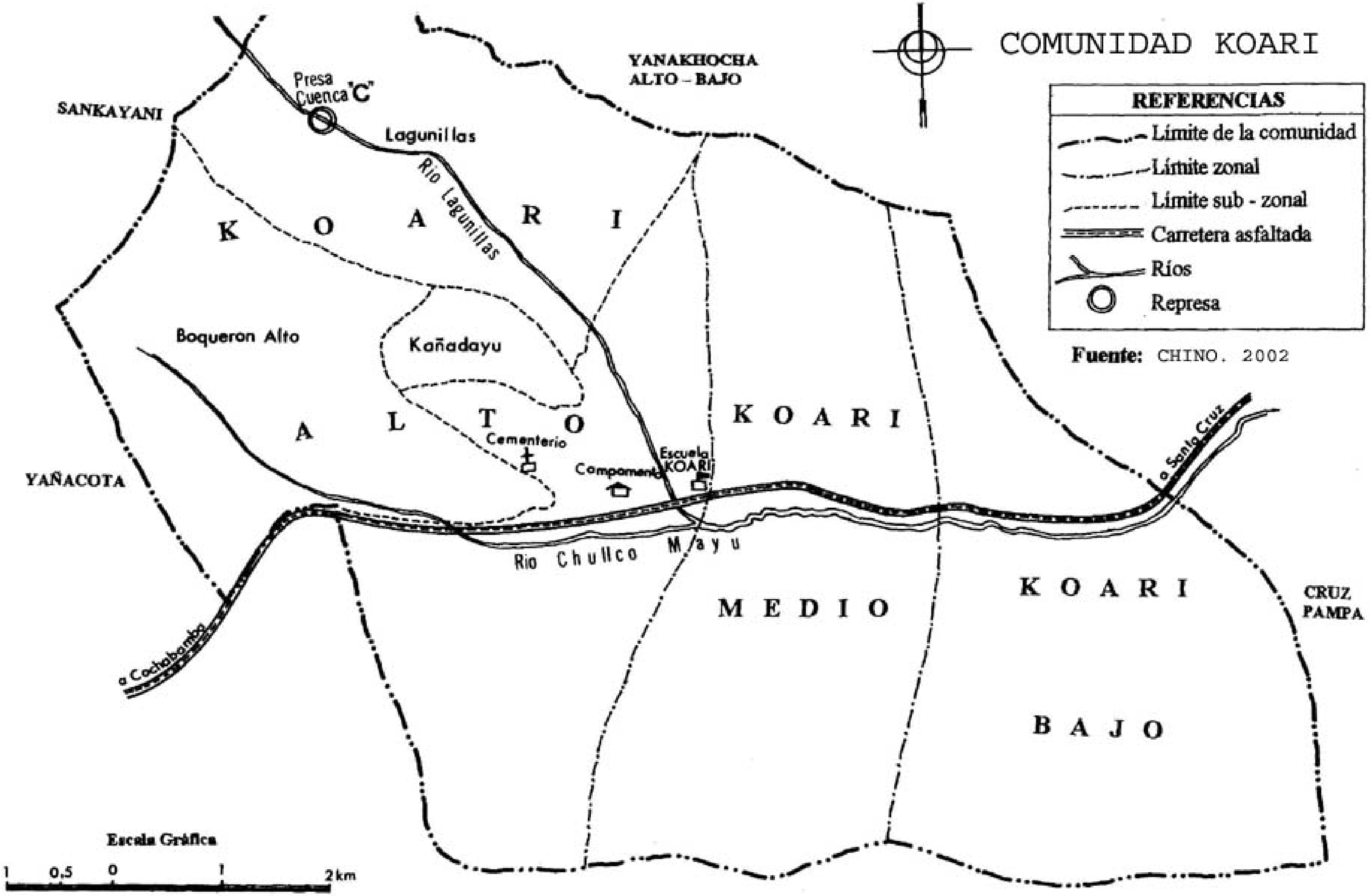
ANNEX 1B. MAP 2: MICRO-REGIONS AND ECOLOGICAL ZONES



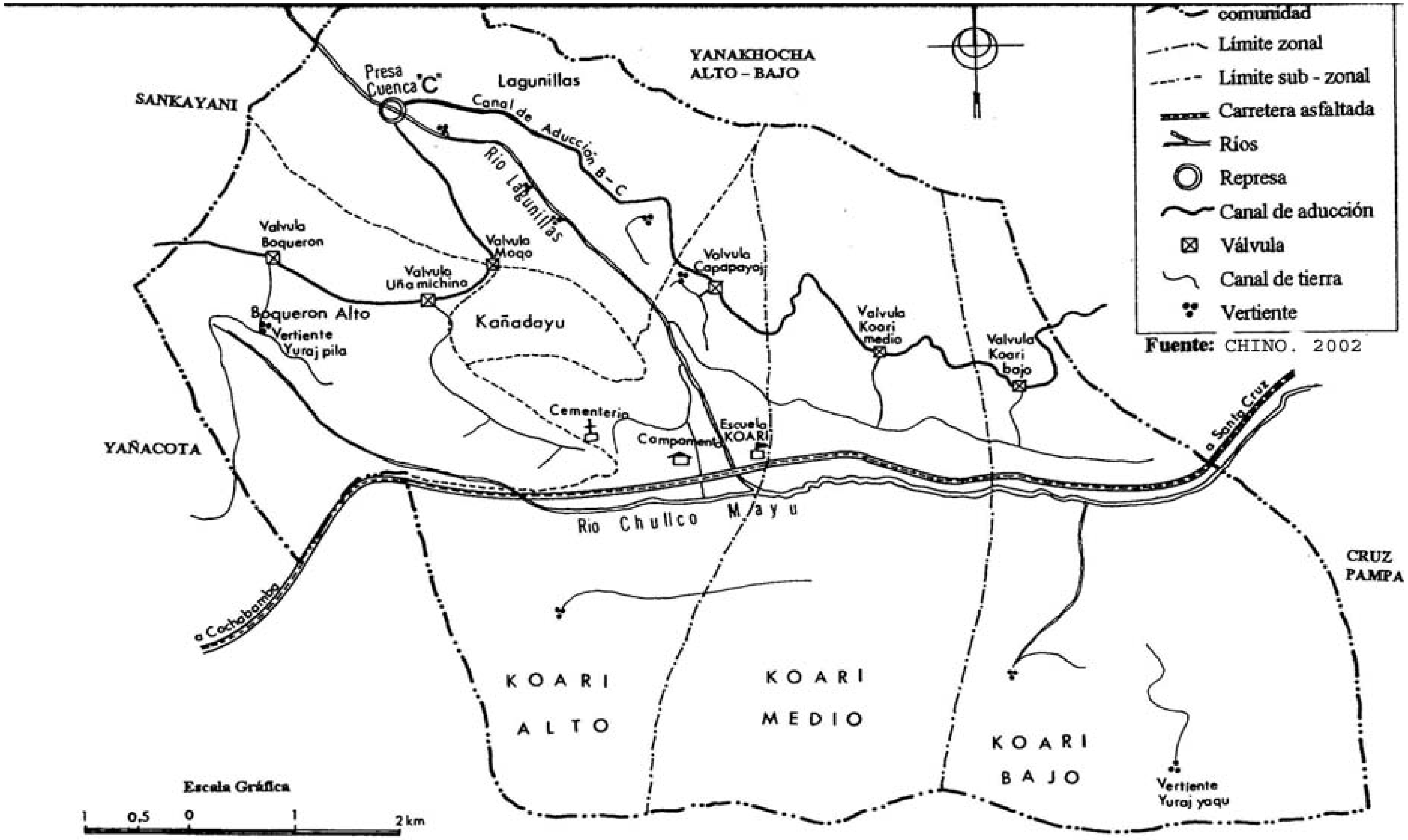
MAP 3: THE COMMUNITIES OF QOARI AND BOQUERON



MAP 4: THE COMMUNITY OF QOARI



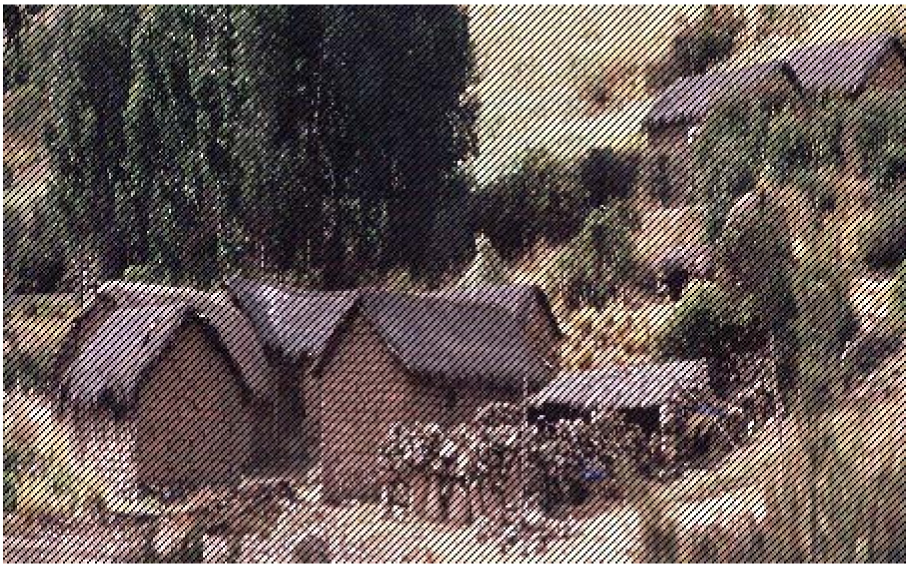
MAP 5: THE IRRIGATION SYSTEM


comunidad
Límite zonal
Límite sub - zonal
Carretera asfaltada
Ríos
Represa
Canal de aducción
Válvula
Canal de tierra
Vertiente
Fuente: CHINO. 2002
YANAKHOCHA
ALTO - BAJO
SANKAYANI
Presa
Cuenca "C"
Lagunillas
Canal de Aducción B-C
Río Lagunillas
Valvula
Boqueron
Valvula
Moqo
Valvula
Uña michina
Valvula
Capapayoj
Valvula
Koari
medio
Valvula
Koari
bajo
Boqueron Alto
Vertiente
Yuraj pila
Kañadayu
Cementerio
Campamento
Escuela
KOARI
YAÑACOTA
a Santa Cruz
Río Chullco Mayu
CRUZ
PAMPA
a Cochabamba
KOARI
ALTO
KOARI
MEDIO
KOARI
BAJO
Vertiente
Yuraj yaqu
Escala Gráfica
1 0,5 0 1 2 km

COMMUNITY OF QOARI

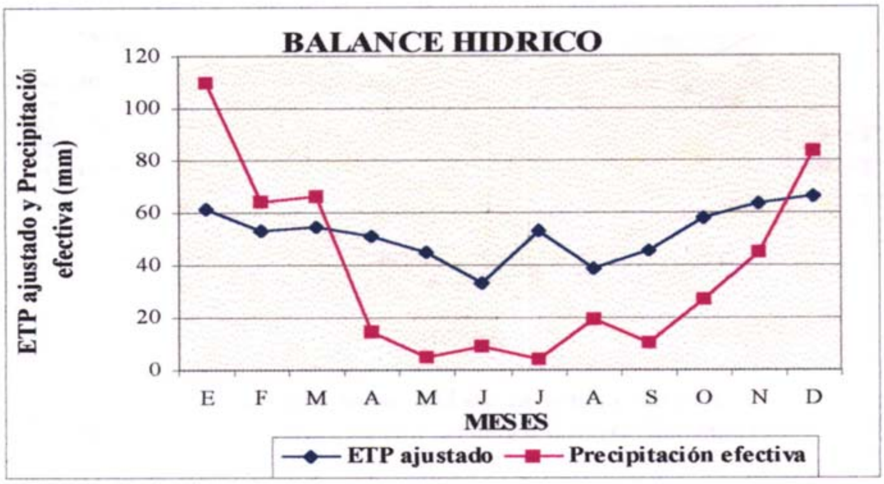
COMMUNITY OF QOARI

COMMUNITY OF BOQUERON



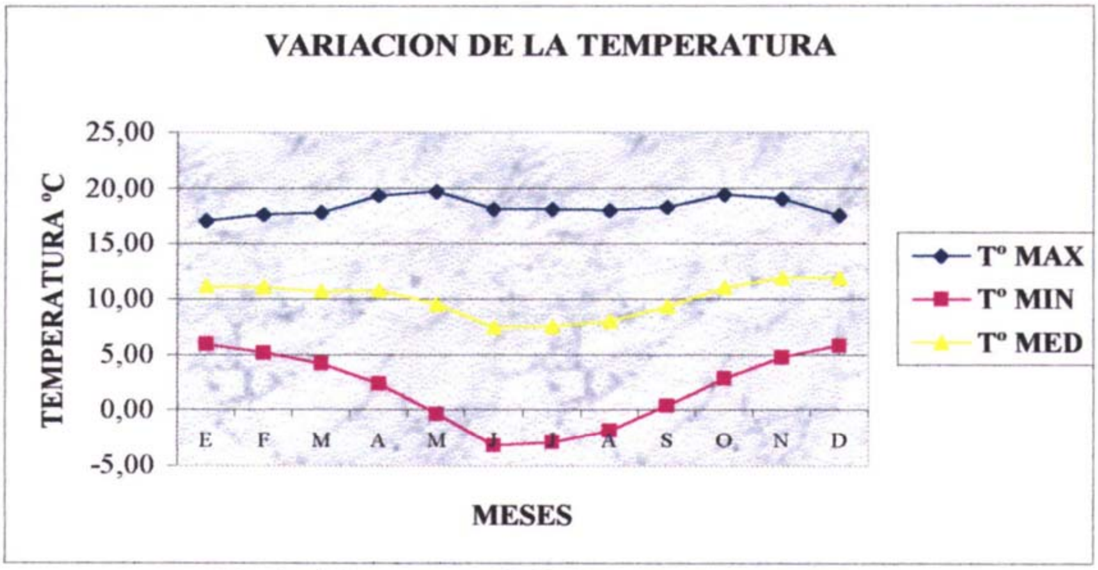
ANNEX 1C

FIGURE 1
WATER BALANCE



Balance hídrico de la comunidad Koari.
Fuente: CHINO. 2002

FIGURE 2
MONTHLY TEMPERATURE VARIATION



Variación mensual de la temperatura
Fuente: CHINO. 2002

Climate

In the Andean zone of Tiraque, the climate is cool-temperate and sub-humid according to the Holdrige system. The climatic cycle is marked by two seasons: one cold and dry, in the months from April to September, and another rainy, from October to March. In general there are sudden falls in temperature, with frost in the night and before dawn, in the months of June and July. In some years there are late frosts in the months of August and September, and early frosts in the months of January and February. The annual average relative humidity is 44.6% with variations from 69% in January to 30.4% in October. The annual average rainfall, over the period from 1959 to 1990, reaches 807mm, with an average maximum of 176mm in January and a minimum of 1mm in June.

Water balance

Based on the climatic data of the meteorological station of Toralapa, a water balance was calculated for the zone of Qoari and Boqueron, using Thornthwaite's method (see Table 1 in Annexo 1).

Observing the water balance, it can be seen that there is a deficit during the months from April to November, which gives rise to the need for irrigation during the entire growing period, with greater emphasis in these months (which only have 2.76 and 23.33mm respectively). For this reason the farmers of the zone have recourse to water from springs and dams, with the aim of satisfying water needs, principally for potato and broad bean cultivation.

Temperature

The temperature is almost constant for a large part of the year, falling during winter in the months of March to August, as far as an average of 10.02C (1991-1997), with an extreme winter minimum of –3.15C; the average maximum temperature us 19.66C. These temperatures impact as limits for agricultural production, due to the winter frosts in particular (see Figure 1 for temperature variation in Annexo 1).

The following table shows us the periodicity of frosts. The months from April to August show the greatest frequency of frosts.

TABLE 1
Frequency of frosts

Month	J	F	M	A	M	J	J	A	S	O	N	D
Days with frost	0	0	2	10	21	22	24	11	8	2	0	0
Greatest frequency of frosts												

Source: Chino 2002

The months of June and July are those which present the greatest frequency of frosts, with 22 and 24 days respectively. The farmers take advantage of these months to make *chuño*[161] with that year's potatoes, for which they use the smallest tubers.

Soils

The agricultural soils are distributed in the area of influence of the Chullco Mayo river and at the foot of the hills shaped by glacial processes and hills which surround the area. The material whence these soils originate is composed, in geological terms, of sandstones, quartz and other material from the Ordovician period. Quaternary sediments (from alluvial and coluvio-alluvial formations) which correspond to the irrigated area, have originated from the constant deposition of sediments, mixed with some gravel and stone (PRONAR 1996).

The presence of developed soils has been verified in the area, which are taxonomically correlated with alphisoles and others of recent formation such as inceptisoles. The soils have an effective depth superior to 1.5m, mainly in the alluvial terraces and piedmont, and a moderate depth of 65cm on the lower slopes of the hills and the alluvial fan, product of the processes of erosion which are more active than those of the formation of horizons via other processes (PRONAR 1996).

Physiography

The physiography of Tiraque province is notably varied, ranging from snow peaks between 4,500 to 5,035 metres, to the subtropics between 500 and 250 metres. Physically, Qoari includes alluvial terraces, piedmont, lower hill slopes and alluvial fans, formed by the sedimentation of alluvial materials in the river and the coluvio-alluvial deposition of material from the hills and mountain ranges which surround the area.

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[161] See chapter 6 for a description of this.

The alluvial terraces tend to be flat, with slopes not greater than 3%. The piedmont, which display slightly undulating and sloping relief, has slopes which vary between 3% and 4%. The lower mountainsides have slopes not superior to 8%. The alluvial fans or cones of deposition show slopes of 4% (PRONAR 1996), and the hills and mountain chains which surround the area, have slopes steeper than 10%. The following table presents a summarised description of the soils.

TABLE 2
Physiography, topography, effective depth and drainage

PHYSIOGRAPHY	TOPOGRAPHY	EFFECTIVE DEPTH	DRAINAGE	STONINESS
Alluvial terraces	Almost flat with slopes less than 3%	Deeper than 1.5m	Moderately well drained and imperfectly drained	Very few stones
Piedmont	Lightly undulating and sloping with slopes of 3-4%	Deeper than 1.5m	Moderately well drained to imperfectly drained	Very few stones
Lower mountain slopes	Slopes greater than 8%	0.65m	Moderately well drained to imperfectly drained	Fairly stony
Surrounding mountains	Slopes greater than 10%	Less than 0.65m	Moderately well drained to imperfectly drained	Very stony

Source: Chino 2002

Soil types in the communities of Qoari and Boquerón

With reference to texture, the soils in the zone studied display a franco or franco-clayey texture in the different horizons. Their depth is variable according to the physiography of the zone. These soils present stones and gravel on the surface and vary from very few stones to extremely stony, above all on the lower mountain slopes and the surrounding mountains. For this reason, when new plots are opened for farming in virgin soils (*puruma*) it is necessary to pick the stones out of them (*despiedrado*).

The colour of the soil, in the uppermost 25cm, is brown dark-grey (10 YR 3/2) to dark brown (10 YR 5/2), in the soils classified as of a dark brown colour. The black patches along the Chullco Mayo river display a black colour (10 YR

2/0) when damp, and finally the yellow soils vary from brown yellowish (10 YR 5/4) to clear brown yellowish (10 YR 6/4).

The following information is available concerning soil reactions. On analysing the physical and chemical properties of the soil at depths from zero to 25cm in different sites within the zone under study, one observes that the texture of the soil varies from franco to franco-clayey. The dark soils (of a brown grey colour) present moderately acidic pH, from 4.0 to 5.6 at a depth of 0-25cm. The brown yellowish soils are also moderately acidic, pH 4.5 to 5.5; the black soils have pH 4.8 to 5.8, signifying moderate acidity. As can be seen, the soils in this zones do not vary much in their pH. Their moderate acidity can affect the cultivation of potatoes, broad beans and others (Chino 2002:53).

The electrical conductivity (CE mmhos/cm) in the arable layer (0-25cm) in the zone studied shows little variation (0.04-0.18), considering that these are not saline soils and there is no restriction on cultivation due to the presence of salts. The presence of organic material in the soils of brown grey colour is moderate (0.03-4.89%), with a few exceptions where there is an elevated level of organic material (16.5%), possibly due to recent fertilization. The black soils also show a moderate presence of organic material (3.13%). The low levels of organic material (0.63%) correspond to the brown yellowish soils. The total nitrogen content (Nt) at a depth of 25cm is high (0.10 to 0.66%) in brown grey, dark and black soils The low level (0.067%) corresponds to the brown yellowish soils. The level of available phosphorous in the dark brown grey soils varies from low to high (8.8-33.9 ppm). The black soils have a low availability (9.1 ppm). In the brown yellowish soils the level of available phosphorous is very low or else available phosphorous is entirely absent (for a comparison with farmer soil taxonomy see chapter six, especially concerning soil colours).

The type of vegetation, according to the Holdrige system, is humid subtropical montane forest. The natural vegetation mainly consists in bushy and low plant species. In the areas close to the roads, the main cultivars farmed are potatoes, broad beans, oats and, in lesser degree, quinua. There are also small areas of introduced cultivars such as peas, wheat and vegetables. On the lower mountain slopes and the surrounding mountains the existing cultivars are barley, oca, papa lisa and lupins. According to the availability of irrigation water, some farmers cultivate carrots, lettuces and artichokes.

TABLE 3
Native and introduced vegetation

Native species	Scientific name	Introduced species	Scientific name
Quewiña	Polylepis	Eucalyptus	Eucaliptus spp.
Muña	Satureja boliviana	Pines	Pinus spp.
Tola	Baccharis mierophylla		
Ch'illca	Baccharis latifolia		
Ichu	Stipa ichu		
Kellu kellu	Berberis boliviana		

Source: CIDETI 1994

Hydrography

The Yanakhocha basin is limited to the Tiraque mountain range, in one of the sub basins of the Condoraño river, a tributary of the Chullco Mayo river, which later joins the Lope Mendoza river, leading its waters toward the region of the Chapare. The Yanakhocha basin has an area of 3.65 km2, with a maximum altitude of 4,640m and a minimum of 4,250m, with a cold climate typical of the mountains. The slopes of the basin vary from 5% to 40% and the terrain is gently undulating (PRONAR 1996).

This basin is pat of a larger system, that of the Punata-Tiraque irrigation system (Totora Khocha). The waters of the basin are used in part to irrigate the communities of Qoari Alto, Qoari Medio, Qoari Bajo, Chullco Mayo and Rodeo.

General description of the administration of irrigation

The zone possesses springs for irrigation, human and animal consumption, complementing the availability of water from springs with the lake of Yanakhocha which is shared with the communities of Chullco Mayo and Rodeo.

Lake Yanakhocha captures waters from about twenty springs within the basin, with flows that range frm 0.1 to 1.0 litres per second; springs also exist with flows of 50 to 60 litres per second at the end of the rainy season. In the three zones (Qoari Alto, Qri Medio and Qoari Bajo) there are springs with flows varying from 3 to 12 litres per second, according to the season. The organisation of the irrigation system is based on the peasant unions of Qoari Alto, Qoari Medio, QoariBajo, Chullco Mayo and Rodeo, linked to the matrix of Sub-Associations of Irrigation (see maps 4 and 5 in Annexo 1).

Population and economy

Demographic characteristics

Population

According to the 2001 Census, Tiraque province has an approximate population of 35,017 inhabitants. In 1992 the population was approximately 31,315 inhabitants, which shows that between 1992 and 2001 there was a 12% increase. The urban area has 4,291 inhabitants and the rural area, about 30,726, 12% and 88% respectively. This shows that Tiraque's population is overwhelmingly rural.

TABLE 4
Tiraque: population according to Census year

Total population		Urban area		Rural area	
		Men	Women	Men	Women
Census 1992	31.315	1.536	1.613	14.402	13.764
Census 2001	35.017	2.069	2.222	16.002	14.724

Source: prepared from data of the Instituto Nacional de Estadística

To continue with the data in this table, the male population is about 18,071 inhabitants versus 16,946 women, giving us 52% of the population as male while 48% is female. On the other hand, the density of population in Tiraque is 20.14 inhabitants per square kilometre, a density which has increased since in 1992 a density of 18,01 inhabitants per km2 was registered.

The following table shows the distribution of the population according to communities. To this end we have only included the communities studied or their respective peasant unions (*sindicatos*).

TABLE 5

Population by community and sex

Community	Total inhabitants	Men	Women
Comunidad Boquerón Alto (sub central Kañacota)	272	136	136
Boqueron Qoari	213	108	105
Qoari Alto	338	170	168
Sindicato Fidelia (Sub central Boqueron Kasa)	110	48	62
Sindicato Qoari Bajo (Sub Central Koari)	192	88	104
Qoari Bajo	88	41	47
Qoari Bajo Incayan	104	47	57
Sindicato Qoari Medio (Sub Central Qoari)	246	112	134

Source: prepared from data of the Instituto Nacional de Estadística, 2004

In the community of Boquerón Alto (Subcentre Kañacota), there are 272 inhabitants, 50% male and 50% female. The community of Boquerón Qoari has about 213 inhabitants, of which 51% are male and 49% female. Qoari Alto is the largest community in this group, with 338 inhabitants, 51% male and 49% female; the Qoari Medio union has 246 inhabitants, 46% male and 54% female, while the least populous community is Qoari Bajo with 88 inhabitants, 47% male and 53% female.

Language

According to the 2001 Census of Population and Housing, the language most spoken in Tiraque province is Quechua, spoken by 75% of the tiraqueños. Only 52% of this same population speaks Spanish, while 2% speak Aymara, the third language in this province. The following table gives more information concerning the languages spoken in the region.

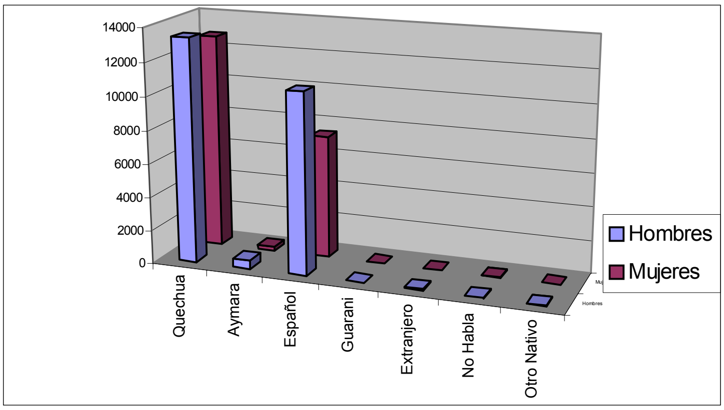
TABLE 6
Tiraque: population aged 6 years or more according to language spoken

Language	1992	2001
Quechua	23749	26209
Aymara	745	756
Spanish	14916	18165
Guarani	3	27
Foreign	41	101
Do not speak	0	50
Other Amerindian	3	31

Source: prepared on the basis of data from the Instituto Nacional de Estadística, 2002

The following diagram displays the same information in the form of a bar chart and divided by sex of speaker.

FIGURE 3
Tiraque: population aged 6 years or more according to language spoken and sex



Source: prepared on the basis of INE data, 2002

Of the total population which speaks Quechua, 51% are men versus 49% women; of Spanish speakers, 59% are men and 41% women, while 69% of Aymara speakers are men versus only 31% women.

The following table shows the levels of monolingualism, bilingualism and other combinations of languages in Tiraque. About 58% of the population speaks Spanish and some other language; 0.3% speak other languages without knowing Spanish, just 6% are monolingual in Spanish and 35% is monolingual in native Amerindian languages.

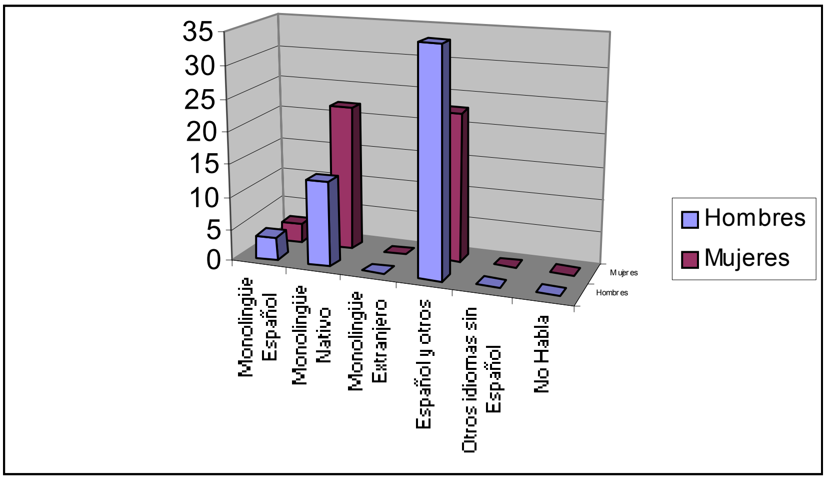
TABLE 7
Tiraque: population aged 6 years or more according to number of languages spoken

Language(s)	Number of speakers	%
Spanish only	1837	6.484750071
Amerindian only	10013	35.34665349
Foreign only	0	0
Spanish and others	16328	57.639085
Others without Spanish	85	0.300056481
Does not speak	50	0.176503812
Not specified	15	0.052951144

Source: prepared on the basis of INE data, 2002

The following diagram shows the population aged 6 years or more and the number of languages spoken according to sex. 35% of the population consists of bilingual men who speak Spanish and another language, while 23% are bilingual women who speak Spanish and another language. 13% are men monolingual in a native language versus 22% who are women in a similar situation. 3% are men and 3% women who are monolingual in Spanish.

FIGURE 4
TIRAQUE: population aged 6 years or more according to number of languages spoken and sex



Source: prepared on the basis of INE data, 2002

Self-identification with native peoples (*pueblos originarios*)

According to the 2001 Census of Population and Housing, 86% of the inhabitants of Tiraque consider themselves members of the Quechua people, 2% identify themselves as Aymara and 11% do not identify with any 'original'[162] or indigenous people:

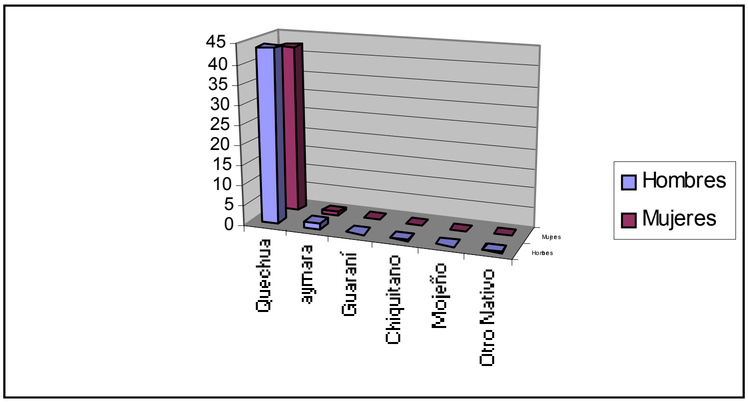
TABLE 8
Tiraque: self-identification with native or indigenous peoples among the population aged 15 years or more

Population aged 15 years or more	No. inhabitants	%
Quechua	17008	86.46230492
Aymara	426	2.165624523
Guaraní	32	0.162676021
Chiquitano	20	0.101672513
Mojeño	6	0.030501754
Otro native	53	0.269432159
None	2126	10.80778811

Source: prepared on the basis of INE data, 2002

This identification with the Quechua people is greater among men: 44% of the population aged 15 or more is male and identifies as Quechua, versus 43% who are women self-identified as Quechua. Diagram 4 shows an analysis of ethnic identification according to sex.

[162] *Pueblos originarios*, which can be translated as 'original peoples', is at present the politically correct term for Amerindians in Bolivia; 'Indian' (*indio*) is considered insulting. The use of *pueblos originarios* is similar to that of the expressions 'Native Americans' in the USA or 'First Nations' in Canada.



Source: prepared on the basis of INE data, 2002

FIGURE 5
TIRAQUE: self-identification with native or indigenous peoples of the population aged 15 years or more, according to sex

Education

The level of literacy in Tiraque is 77.41%, which is to say that about 27,106 inhabitants know how to read and write. The indicators show us that 88.6% of the men in Tiraque know how to read and write while only 65.5% of the women have these skills. These indicators are lower in the rural area of the province, where 75.99% of the population is literate; 87.8% of the men and 63% of the women.

TABLE 9
TIRAQUE: literacy levels of the population aged 15 years or more according to area and sex (in percentages)

	Total	Hombres	Mujeres
Total	77,41	88,62	65,5
Urban area	87,53	95,17	80,89
Rural area	75,99	87,81	63,08

Source: prepared on the basis of INE data, 2002

Apart from the levels of literacy, it is also important to consider the levels of schooling of the inhabitants of Tiraque, to which end the National Census of Population and Housing in

2001 took into account the population aged 19 years or more. The greater part of this population (66%) had primary schooling as the highest level of education which they had reached, followed by 22% who had never been to school, 8% who had been to high school and just 3% who had entered higher education.

TABLE 10
Tiraque: population aged 19 years or more according to educational level and sex

	Total	Hombres	Mujeres
Total	16872	8628	8244
No schooling	3628	1012	2616
Primary school	11077	6178	4899
Secondary school	1422	1040	382
Higher education	519	289	230
Others	101	64	37
Not specified	125	45	80

Source: prepared on the basis of INE data, 2002

Economic characteristics

In Tiraque province, agriculture is the main occupation and source of employment, as Table 12 shows: 9,482 inhabitants work in agriculture, herding, hunting and forestry, the most important group in the region.

Servicing extraterritorial organisations and organs is also a very important activity within this region: 1,227 people work in this category. On the other hand, wholesale and retail commerce, as well as repairing motor vehicles and domestic artefacts are also important generators of employment in Tiraque, with 955 people employed in these categories. However, the majority of the population (13,081 people) did not reply to the question about the type of economic activity they carried out (one cannot fail to be surprised by the high level of abstention in replying to this question, although it may be imagined that a good part of the abstainers work in agriculture, given that this is a region mainly inhabited by peasants).

TABLE 11

TIRAQUE: number of people according to economic activity

Economic Activity	**Number of people**
Public administration, defence and obligatory social security	217
Agriculture, herding, hunting and forestry	9,842
Wholesale and retail commerce, repairing motor vehicles, personal property and domestic artefacts	955
Construction	529
Education	301
Exploiting mines and quarries	4
Manufacturing industry	430
Financial services	O
Fishing	4
Production and distribution of electricity, gas and water	5
Servicing private homes which hire domestic servants	251
Servicing hotels and restaurants	299
Servicing extraterritorial organisations and organs	1,227
Community, social and personal services	95
Real estate, business and rent services	57
Social and health services	61
No reply	13,081
Transport, storage and communications	331

Source: INE National Census of Population and Housing, 2001

Just as agriculture is the main activity which generates employment, it is also important for the money it provides: the total value of agricultural and herding production in the microregion is almost US$7,822,000. Agriculture, as the source of value of production (86% in the microregion), predominates in the four zones. Herding contributes a maximum of 17% of value in the valley head zone and a minimum of 11% in the valley zone. Only 19% of value due to herding proceeds from animal derivatives (milk, eggs, wool).

In all the zones, annual crops occupy the first place: 79% of the total value in the microregion as a whole proceeds from them; the second place is occupied by herd animals, with a maximum of 13% in the valley head region. The distribution of the value of production according to zones follows closely on the distribution of the volumes produced: in the valley heads, transition and puna, the small differences seem to be due to the differences in the importance of the combination of potatoes and broad beans as part of the volume produced (between 77% and 90%). In the valley zone, potatoes are largely displaced by onions. The distribution is more biased with respect to the number of households.

TABLE 12

Tiraque: total value of agricultural and herding production, according to source and zone

Source	Valley	Valley head	Transition	Puna	Total
Annual crops	175,000	1,388,000	3,537,000	1,152,000	6,202,000
Fruit trees	18,000	39,000	13,000	2,000	72,000
Fodder	13,000	119,000	229,000	64,000	425,000
Herd animals	24,000	230,000	505,000	152,000	911,000
Animal derivatives	2,000	72,000	113,000	25,000	212,000
Subtotal agriculture	206,000	1,496,000	3,779,000	1,218,000	6,699,000
Subtotal herding	26,000	302,000	618,000	177,000	1,123,000
Total	232,000	1,798,000	4,397,000	1,395,000	7,822,000
%age	2.97	22.99	56.21	17.83	100
%age TM	3.05	24.33	55.55	17.07	100
%age household	4.11	28.26	52.61	15.02	100

Source: Diagnosis of the Tiraque market, in CIPCA 1995

In the Tiraque region it is possible to cultivate, and effectively people do cultivate, tubers, principally potatoes, ocas and papa lisas. Other crops such as barley, oats, lupins and quinua, are sown in ravines and small valleys protected from the cold and the winds. If the fields are irrigated it is possible to sow broad beans, peas and wheat, and also to obtain two potato crops a year. The valley zone is more temperate and has more irrigation, which permits more intensive cultivation of potatoes, barley, lupins, broad beans, peas, wheat and maize. In Vandiola, which lies to the north of the mountainous zone and is characterised by a tropical climate and vegetation, until it was abandoned around 1970, hot peppers, coca and fruit were grown. The construction of the new highway to Santa Cruz via Sacaba, crossing the town of Shinahota in the extreme north of Tiraque province, made it easier to arrive in the tropical zone of the province via that road and led to its being effectively separated from Tiraque town which continues to be formally the capital of the entire province.

With reference to the levels of poverty and satisfaction of basic needs in the province, we encounter the following dynamic on the basis of the last two national censuses and the maps of poverty which were prepared using their data. In 1992, the department of Cochabamba displayed the following characteristics with reference to poverty:

TABLE 13
Incidence of poverty in the population in the department of Cochabamba, according to area of residence, 1992

Department/area	Total population	Poor population	%age poor
Cochabamba	1,027,212	726,664	70.7
Urban	538,410	267,002	49.6
Rural	488,802	459,662	94.0
City of Cochabamba	380,755	169,166	44.4

Source: 'Map of poverty', Ministry of Human Development, La Paz, 1993

In this context, Tiraque province had a incidence of poverty higher than the departmental average, as the following table shows.

TABLE 14
Incidence of poverty in the population in Tiraque province, 1992

Province	Total population	Poor population	%age poor
Tiraque	29,086	28,237	97.4

Source: ibid.

Considering the magnitude of poverty in the provinces at a national level at that time, Tiraque was No.52 out of a total of 111 provinces in the whole country. In general, Tiraque, together with almost all the provinces of the department of Cochabamba, showed poverty levels of more than 80%. Following this type of indicator and leaving aside the debate on their true value, we can look in more detail at the 'indices of poverty' and the level of satisfaction of basic needs in our province, starting from an ordering of provinces in a hierarchy of magnitude of poverty.

TABLE 15
Indices of poverty and failure to satisfy basic needs in the home, according to area of residence, Tiraque province, 1992

Province	Position[a]	Total homes[b]	Poor homes	Magnitude P1-HxI	Incidence H	Intensity I
Tiraque	52	6,850	6,604	44.6	96.4	46.3

Housing[c]		Access to services[d]			
Materials	Spaces	Basic sanitation	Energy	Education[e]	Health[f]
84.4	73.1	92.2	97.5	89.2	60.0

Source: ibid.

The national census of 2001 also permitted the elaboration of tables showing the magnitude of poverty and the difficulties in satisfying basic needs, although with some variations. Firstly, we can look at the changes which took place in the population whose basic needs were unsatisfied at the level of the department of Cochabamba.

TABLE 16
Cochabamba: changes in the population with unsatisfied basic needs, 1992-2002 (in percentages)

Department	Urban area			Rural area		
	1992 Census	2001 Census	Difference	1992 Census	2001 Census	Difference
Cochabamba	50,0	33,2	(16.8)	94.3	85.7	(8.6)

Source: extracted from INE 2001

[a] In the national hierarchy of provinces.
[b] Those homes which failed to reply concerning at least one of the variables corresponding to the indices measuring poverty have been excluded.
P1: average level of failure to satisfy basic needs in poor homes with respect to minimun standards of living.
H: percentage of poor homes
I: average level of failure to satisfy basic needs in poor homes with respect to minimum standards of living
[c] Materials refers to the materials used in floors, roofs and walls. Spaces refers to the availability of rooms in relation to the number of household members.
[d] Sanitation includes the availability of water, sewerage and/or elimination of excrement. Energy refers to the availability of electricity and/or the type of fuel used for cooking.
[e] Education refers to completed years of schooling, school attendance and/or illiteracy.
[f] Health refers to attendance at health centres and social security.

Observing the figures for the rural area, we can find that there is a general difference of slightly less than 10%. According to the 2001 Census and specifically for the province of Tiraque, there is a total of 5,387 inhabitants who are 'not poor' (15.9%), whereas the 'poor' reach a figure of 28,575 inhabitants (84.1%). Comparing this with the previous census, for Tiraque province we have the following.

TABLE 17
Tiraque: population with unsatisfied basic needs, 1992-2001 (in percentages)

Province	1992 Census	2001 Census	Difference (1992-2001)
Tiraque	97.5	84.1	(13.4)

Source: extracted from INE 2001

If we compare the difference shown in this table with Table 16, we can conclude that Tiraque is not one of the provinces which showed little change in their levels of satisfaction of basic needs. In effect, Tapacarí, the province which showed least change, had a difference of only 0.1% over this period, but the provinces which have advanced most in satisfying basic needs reached a difference of 31%. Among the 16 provinces of the department, Tiraque is above 9 of them (that is, it is virtually in the middle of all the provinces). As regards the condition of poverty, we have the following information:

TABLE 18
Tiraque: population according to condition of poverty, 2001 Census (in percentages)

Province	Total	Not poor		Poor		
		Basic needs satisfied	Threshold of poverty	Moderately poor	Indigent	Marginal
Tiraque	100.0	1.4	14.4	58.9	25.3	0.0

Source: extracted from INE 2001-UDAPE

What is worth pointing out in this table is, on the one hand, the concentration of the population in the category of 'moderately poor'. The extremes have a minimal presence; although there is no population classified as 'marginal', only 1.4% is registered as having satisfied all their basic needs. If we consider the components of the index of basic needs we obtain the following table:

TABLE 19
Tiraque: population with inadequate levels of satisfaction of basic needs, according to components of index of satisfaction, 2001 (in percentages)

Province	Housing		Services and energy		Insufficient education	Inadequate health care
	Inadequate materials	Insufficient space	Inadequate water supply and sanitation	Inadequate energy supply		
Tiraque	76.3	72.7	69.8	81.0	78.1	25.6

Source: extracted from INE 2001-UDAPE

Within a general context of deficient housing, basic services and education, health care is the one context which displays an important improvement; adequate care now reaches three quarters of the population. To close this section, we will look at data concerning the poor population according to area of residence in the province.

TABLE 20
Tiraque: population with unsatisfied basic needs according to area of residence, 2001

Province	Total		Urban area		Rural area	
	Poor population	%	Poor population	%	Poor population	%
Tiraque	28,575	84.1	2.042	49.2	26,553	89.0

Source: extracted from INE 2001-UDAPE

What can stand out in this table is that the percentage of the population considered as 'poor' continues to be high in the rural part of the province; although the percentage is much lower for the urban population, given its scarce numbers this has little impact on the general percentage of poor population for the province as a whole.

ANNEX 2

METHODOLOGICAL SUPPLEMENT

PART ONE

MULTIPLE CORRESPONDENCES ANALYSIS

TABLE 1
Description of the third factorial axis

DESCRIPTION DU FACTEUR 3
PAR LES MODALITES ACTIVES

ID.	COORD.	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
CS05	-3.16	SE_MA	SEMILLA	5.00	1
CS06	-2.96	SUP_MA	SUPERFICIE	5.00	2
CR03	-1.18	crie_sr	Cambio riego	6.00	3
CS01	-0.76	SUER_SC	SUP. EROSIONADA	28.00	4
CS01	-0.70	SUP_GD	SUPERFICIE	8.00	5
			Z O N E C E N T R A L E		
CS02	0.72	SUP_MD	SUPERFICIE	7.00	35
CS01	0.74	SE_MD	SEMILLA	4.00	36
CS05	1.22	SUP_PA	SUPERFICIE	5.00	37
CS02	1.40	SUER_PA	SUP. EROSIONADA	8.00	38
CP01	1.59	PN_GD	PAPA NATIVA	3.00	39

DESCRIPTION DU FACTEUR 3
PAR LES MODALITES ILLUSTRATIVES

ID.	V.TEST	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
CO02	-3.10	Boqueron	Comunidad	50.00	1
MI03	-2.31	NM_8-13	MIEMBROS	25.00	2
			Z O N E C E N T R A L E		
MI02	2.14	NM_5-7	MIEMBROS	41.00	14
CO01	3.10	Q´oari	Comunidad	59.00	15

TABLE 2
Description of the fourth factorial axis

DESCRIPTION DU FACTEUR 4
PAR LES MODALITES ACTIVES

ID.	COORD.	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
CS05	-2.02	SUP_PA	SUPERFICIE	5.00	1
CP04	-1.59	PI_MA	Cambio variedades introducidas	7.00	2
CS05	-1.12	SE_MA	SEMILLA	5.00	3
CS04	-1.10	SE_PA	SEMILLA	20.00	4
CS02	-0.57	SUER_PA	SUP. EROSIONADA	8.00	5
			Z O N E C E N T R A L E		
CS02	0.87	SE_PD	SEMILLA	24.00	35
CT01	0.94	cte_d	Cambio terrenos erosionados	15.00	36
CS03	1.16	SUP_PD	SUPERFICIE	14.00	37
CS01	1.37	SE_MD	SEMILLA	4.00	38
CS03	2.99	SUER_MA	SUP. EROSIONADA	3.00	39

DESCRIPTION DU FACTEUR 4
PAR LES MODALITES ILLUSTRATIVES

ID.	V.TEST	LIBELLE MODALITE	LIBELLE DE LA VARIABLE	POIDS	NUMERO
			Z O N E C E N T R A L E		
ED01	2.14	age_jo	Edad del jefe del hogar	38.00	15

TABLE 3
Relative weight of active modalities

```
ANALYSE DES CORRESPONDANCES MULTIPLES
APUREMENT DES MODALITES ACTIVES
SEUIL (PCMIN)   :      1.00 %       POIDS:       1.09
AVANT APUREMENT :      9 QUESTIONS ACTIVES        39 MODALITES ASSOCIEES
APRES           :      9 QUESTIONS ACTIVES        39 MODALITES ASSOCIEES
POIDS TOTAL DES INDIVIDUS ACTIFS :    109.00
TRI-A-PLAT DES QUESTIONS ACTIVES
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
         MODALITES          | AVANT APUREMENT |          APRES APUREMENT
IDENT      LIBELLE          |  EFF.     POIDS |  EFF.     POIDS       HISTOGRAMME DES POIDS RELATIFS
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
    3 . PAPA NATIVA
CP01 - PN_GD                |    3       3.00 |    3       3.00  **
CP02 - PN_MD                |   18      18.00 |   18      18.00  **********
CP03 - PN_PD                |   46      46.00 |   46      46.00  **************************
CP04 - PN_SC                |   21      21.00 |   21      21.00  ************
CP05 - PN_PA                |   17      17.00 |   17      17.00  **********
CP06 - PN_MA                |    4       4.00 |    4       4.00  ***
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
    4 . SUP. EROSIONADA
CS01 - SUER_SC              |   28      28.00 |   28      28.00  ****************
CS02 - SUER_PA              |    8       8.00 |    8       8.00  *****
CS03 - SUER_MA              |    3       3.00 |    3       3.00  **
CS04 - SUER_SI              |   70      70.00 |   70      70.00  ***************************************
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
    5 . Cambio terrenos erosionados
CT01 - cte_d                |   15      15.00 |   15      15.00  *********
CT02 - cte_sc               |   66      66.00 |   66      66.00  *************************************
CT03 - cte_a                |   28      28.00 |   28      28.00  ****************
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
   10 . Cambio control y tratamientos
CC01 - ccon_sc              |   20      20.00 |   20      20.00  ************
CC02 - ccon_c>q             |   22      22.00 |   22      22.00  *************
CC03 - ccon_si              |   67      67.00 |   67      67.00  *************************************
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
   11 . Cambio riego
CR01 - crie_cr              |   73      73.00 |   73      73.00  *****************************************
CR02 - crie_ar              |   30      30.00 |   30      30.00  *****************
CR03 - crie_sr              |    6       6.00 |    6       6.00  ****
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
   12 . Cambio en fertilización
CF01 - cfe_a>o              |    3       3.00 |    3       3.00  **
CF02 - cfe_sc               |   66      66.00 |   66      66.00  *************************************
CF03 - cfe_o>a              |   40      40.00 |   40      40.00  ***********************
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
   13 . SUPERFICIE
CS01 - SUP_GD               |    8       8.00 |    8       8.00  *****
CS02 - SUP_MD               |    7       7.00 |    7       7.00  ****
CS03 - SUP_PD               |   14      14.00 |   14      14.00  ********
CS04 - SUP_SC               |   34      34.00 |   34      34.00  *******************
CS05 - SUP_PA               |    5       5.00 |    5       5.00  ***
CS06 - SUP_MA               |    5       5.00 |    5       5.00  ***
CS07 - SUP_SI               |   36      36.00 |   36      36.00  ********************
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
   14 . SEMILLA
CS01 - SE_MD                |    4       4.00 |    4       4.00  ***
CS02 - SE_PD                |   24      24.00 |   24      24.00  **************
CS03 - SE_SC                |   21      21.00 |   21      21.00  ************
CS04 - SE_PA                |   20      20.00 |   20      20.00  ************
CS05 - SE_MA                |    5       5.00 |    5       5.00  ***
CS06 - SE_SI                |   35      35.00 |   35      35.00  ********************
----------------------------+-----------------+-----------------------------------------------------------------------------
--------
   15 . Cambio variedades introducidas
CP01 - PI_PD                |    9       9.00 |    9       9.00  *****
CP02 - PI_SC                |   43      43.00 |   43      43.00  ************************
CP03 - PI_PA                |   50      50.00 |   50      50.00  ****************************
CP04 - PI_MA                |    7       7.00 |    7       7.00  ****
----------------------------+-----------------+-----------------------------------------------------------------------------
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TABLE 4
Co-ordinates, contributions and square cosines of active modalities

COORDONNEES, CONTRIBUTIONS ET COSINUS CARRES DES MODALITES ACTIVES
AXES 1 A 5

MODALITES			COORDONNEES					CONTRIBUTIONS					COSINUS CARRES				
IDEN - LIBELLE	P.REL	DISTO	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
3 . PAPA NATIVA																	
CP01 - PN_GD	0.31	35.33	-0.41	2.13	1.59	0.18	0.38	0.1	5.1	3.6	0.0	0.2	0.00	0.13	0.07	0.00	0.00
CP02 - PN_MD	1.83	5.06	-0.65	-0.19	-0.12	0.12	1.01	2.0	0.2	0.1	0.1	10.1	0.08	0.01	0.00	0.00	0.20
CP03 - PN_PD	4.69	1.37	-0.48	-0.02	-0.02	-0.11	0.10	2.8	0.0	0.0	0.3	0.2	0.17	0.00	0.00	0.01	0.01
CP04 - PN_SC	2.14	4.19	0.18	0.00	-0.43	0.48	-0.88	0.2	0.0	1.8	2.5	8.9	0.01	0.00	0.04	0.06	0.18
CP05 - PN_PA	1.73	5.41	1.31	-0.05	0.49	-0.43	-0.50	7.7	0.0	1.9	1.6	2.3	0.32	0.00	0.04	0.03	0.05
CP06 - PN_MA	0.41	26.25	2.21	-0.31	-0.21	-0.04	0.77	5.2	0.1	0.1	0.0	1.3	0.19	0.00	0.00	0.00	0.02
				CONTRIBUTION CUMULEE =				18.0	5.6	7.6	4.6	23.1					
4 . SUP. EROSIONADA																	
CS01 - SUER_SC	2.85	2.89	-0.46	0.22	-0.76	-0.41	-0.48	1.5	0.5	7.8	2.4	3.5	0.07	0.02	0.20	0.06	0.08
CS02 - SUER_PA	0.82	12.63	0.91	1.85	1.40	-0.57	-0.78	1.8	10.4	7.5	1.3	2.7	0.07	0.27	0.16	0.03	0.05
CS03 - SUER_MA	0.31	35.33	-0.15	1.75	-0.22	2.99	-0.98	0.0	3.5	0.1	13.7	1.6	0.00	0.09	0.00	0.25	0.03
CS04 - SUER_SI	7.14	0.56	0.08	-0.37	0.15	0.10	0.32	0.1	3.7	0.8	0.4	4.0	0.01	0.25	0.04	0.02	0.19
				CONTRIBUTION CUMULEE =				3.4	18.1	16.2	17.8	11.7					
5 . Cambio terrenos erosionados																	
CT01 - cte_d	1.53	6.27	-0.05	1.69	-0.34	0.94	-0.29	0.0	16.2	0.8	6.7	0.7	0.00	0.45	0.02	0.14	0.01
CT02 - cte_sc	6.73	0.65	-0.54	-0.32	0.04	-0.13	-0.01	5.2	2.6	0.0	0.5	0.0	0.46	0.16	0.00	0.02	0.00
CT03 - cte_a	2.85	2.89	1.31	-0.15	0.10	-0.21	0.18	12.7	0.2	0.1	0.6	0.5	0.59	0.01	0.00	0.01	0.01
				CONTRIBUTION CUMULEE =				17.9	19.0	1.0	7.8	1.2					
10 . Cambio control y tratamientos																	
CC01 - ccon_sc	2.04	4.45	-0.60	-0.76	0.29	-0.24	-0.39	1.9	4.4	0.8	0.6	1.7	0.08	0.13	0.02	0.01	0.03
CC02 - ccon_c>q	2.24	3.95	-0.73	0.53	-0.47	-0.42	0.59	3.1	2.3	2.4	2.0	4.1	0.13	0.07	0.06	0.05	0.09
CC03 - ccon_si	6.83	0.63	0.42	0.06	0.07	0.21	-0.08	3.1	0.1	0.2	1.5	0.2	0.28	0.00	0.01	0.07	0.01
				CONTRIBUTION CUMULEE =				8.1	6.8	3.3	4.1	6.1					
11 . Cambio riego																	
CR01 - crie_cr	7.44	0.49	-0.40	-0.27	0.07	-0.06	-0.02	3.0	2.0	0.2	0.1	0.0	0.32	0.14	0.01	0.01	0.00
CR02 - crie_ar	3.06	2.63	0.88	0.62	0.06	0.08	-0.04	6.2	4.3	0.1	0.1	0.0	0.30	0.14	0.00	0.00	0.00
CR03 - crie_sr	0.61	17.17	0.41	0.15	-1.18	0.34	0.47	0.3	0.0	4.0	0.3	0.7	0.01	0.00	0.08	0.01	0.01
				CONTRIBUTION CUMULEE =				9.5	6.3	4.2	0.6	0.8					
12 . Cambio en fertilización																	
CF01 - cfe_a>o	0.31	35.33	0.59	-1.00	0.14	0.46	1.63	0.3	1.1	0.0	0.3	4.4	0.01	0.03	0.00	0.01	0.08
CF02 - cfe_sc	6.73	0.65	0.27	-0.07	-0.25	-0.03	-0.09	1.2	0.1	2.0	0.0	0.3	0.11	0.01	0.10	0.00	0.01
CF03 - cfe_o>a	4.08	1.73	-0.48	0.20	0.40	0.02	0.02	2.5	0.6	3.1	0.0	0.0	0.14	0.02	0.09	0.00	0.00
				CONTRIBUTION CUMULEE =				4.0	1.8	5.2	0.4	4.7					
13 . SUPERFICIE																	
CS01 - SUP_GD	0.82	12.63	-0.30	0.25	-0.70	0.63	1.21	0.2	0.2	1.9	1.6	6.4	0.01	0.00	0.04	0.03	0.12
CS02 - SUP_MD	0.71	14.57	-0.66	-0.09	0.72	-0.40	1.71	0.8	0.0	1.8	0.6	11.3	0.03	0.00	0.04	0.01	0.20
CS03 - SUP_PD	1.43	6.79	-0.76	0.69	0.18	1.16	-0.13	2.1	2.5	0.2	9.5	0.1	0.09	0.07	0.01	0.20	0.00
CS04 - SUP_SC	3.47	2.21	-0.61	-0.40	0.25	-0.29	-0.47	3.4	2.1	1.1	1.5	4.0	0.17	0.07	0.03	0.04	0.10
CS05 - SUP_PA	0.51	20.80	0.18	2.50	1.22	-2.02	0.31	0.0	11.8	3.6	10.4	0.3	0.00	0.30	0.07	0.20	0.00
CS06 - SUP_MA	0.51	20.80	-0.20	0.81	-2.96	-0.45	-0.83	0.1	1.2	20.9	0.5	1.9	0.00	0.03	0.42	0.01	0.03
CS07 - SUP_SI	3.67	2.03	1.07	-0.39	-0.06	0.11	-0.04	11.0	2.0	0.1	0.2	0.0	0.57	0.07	0.00	0.01	0.00
				CONTRIBUTION CUMULEE =				17.6	19.9	29.5	24.3	24.1					
14 . SEMILLA																	
CS01 - SE_MD	0.41	26.25	-0.31	1.90	0.74	1.37	0.07	0.1	5.4	1.0	3.8	0.0	0.00	0.14	0.02	0.07	0.00
CS02 - SE_PD	2.45	3.54	-0.58	0.06	-0.01	0.87	0.70	2.1	0.0	0.0	9.1	6.5	0.09	0.00	0.00	0.21	0.14
CS03 - SE_SC	2.14	4.19	-0.75	-0.57	0.36	-0.18	-1.09	3.1	2.6	1.3	0.4	13.8	0.13	0.08	0.03	0.01	0.29
CS04 - SE_PA	2.04	4.45	-0.37	0.82	0.31	-1.10	0.35	0.7	5.1	0.9	12.4	1.3	0.03	0.15	0.02	0.27	0.03
CS05 - SE_MA	0.51	20.80	-0.38	0.49	-3.16	-1.12	-0.33	0.2	0.4	23.9	3.2	0.3	0.01	0.01	0.48	0.06	0.01
CS06 - SE_SI	3.57	2.11	1.14	-0.45	-0.02	0.15	0.01	12.1	2.7	0.0	0.4	0.0	0.62	0.10	0.00	0.01	0.00
				CONTRIBUTION CUMULEE =				18.3	16.3	27.2	29.3	21.9					
15 . Cambio variedades introducidas																	
CP01 - PI_PD	0.92	11.11	0.37	-1.08	-0.22	0.17	0.39	0.3	3.9	0.2	0.1	0.8	0.01	0.10	0.00	0.00	0.01
CP02 - PI_SC	4.38	1.53	-0.39	-0.14	0.41	0.29	-0.40	1.8	0.3	3.4	1.9	3.8	0.10	0.01	0.11	0.06	0.10
CP03 - PI_PA	5.10	1.18	0.19	0.23	-0.29	-0.06	0.23	0.5	1.0	2.1	0.1	1.5	0.03	0.05	0.07	0.00	0.05
CP04 - PI_MA	0.71	14.57	0.60	0.59	-0.12	-1.59	0.30	0.7	0.9	0.0	9.0	0.4	0.02	0.02	0.00	0.17	0.01
				CONTRIBUTION CUMULEE =				3.2	6.2	5.7	11.1	6.4					

TABLE 5
Co-ordinates and test-values of illustrative modalities

MODALITES			VALEURS-TEST					COORDONNEES					
IDEN - LIBELLE	EFF.	P.ABS	1	2	3	4	5	1	2	3	4	5	DISTO.
8 . Edad del jefe del hogar													
ED01 - age_jo	38	38.00	1.5	-1.8	0.2	2.1	0.7	0.20	-0.23	0.03	0.28	0.09	1.87
ED02 - age_ma	37	37.00	0.6	0.4	1.1	-1.5	-1.5	0.07	0.05	0.14	-0.21	-0.20	1.95
ED03 - age_vi	34	34.00	-2.1	1.5	-1.3	-0.6	0.8	-0.31	0.21	-0.19	-0.09	0.12	2.21
9 . Educación del jefe de hogar													
ED01 - ed_an	18	18.00	-0.9	0.7	-0.8	-1.5	-1.1	-0.20	0.14	-0.18	-0.32	-0.23	5.06
ED02 - ed_bi	56	56.00	1.9	0.8	0.9	0.3	1.0	0.18	0.08	0.09	0.03	0.09	0.95
ED03 - ed_bc	23	23.00	-0.8	-1.2	-0.1	0.5	0.2	-0.16	-0.21	-0.02	0.10	0.03	3.74
ED04 - ed_mi	10	10.00	-0.8	-0.6	0.1	1.0	-0.3	-0.24	-0.19	0.04	0.31	-0.09	9.90
ED05 - ed_mc	2	2.00	-0.3	-0.1	-1.0	-0.9	-0.5	-0.18	-0.06	-0.72	-0.65	-0.34	53.50
2 . Comunidad													
CO01 - Q´oari	59	59.00	-1.9	0.7	3.1	-1.0	-0.2	-0.17	0.06	0.27	-0.09	-0.02	0.85
CO02 - Boqueron	50	50.00	1.9	-0.7	-3.1	1.0	0.2	0.20	-0.07	-0.32	0.10	0.02	1.18
6 . MIEMBROS													
MI01 - NM_1-4	43	43.00	0.0	-2.9	-0.1	0.8	-1.2	0.00	-0.34	-0.02	0.10	-0.14	1.53
MI02 - NM_5-7	41	41.00	-0.3	0.7	2.1	-1.6	0.3	-0.03	0.09	0.27	-0.20	0.04	1.66
MI03 - NM_8-13	25	25.00	0.3	2.5	-2.3	0.9	1.0	0.05	0.44	-0.41	0.16	0.18	3.36
7 . Sexo del jefe del hogar													
SE01 - sex_H	93	93.00	1.8	2.3	-0.3	-0.4	2.3	0.07	0.09	-0.01	-0.01	0.09	0.17
SE02 - sex_M	16	16.00	-1.8	-2.3	0.3	0.4	-2.3	-0.42	-0.52	0.06	0.08	-0.53	5.81

FIGURE 1
Active and illustrative modalities on factors 3 and 4

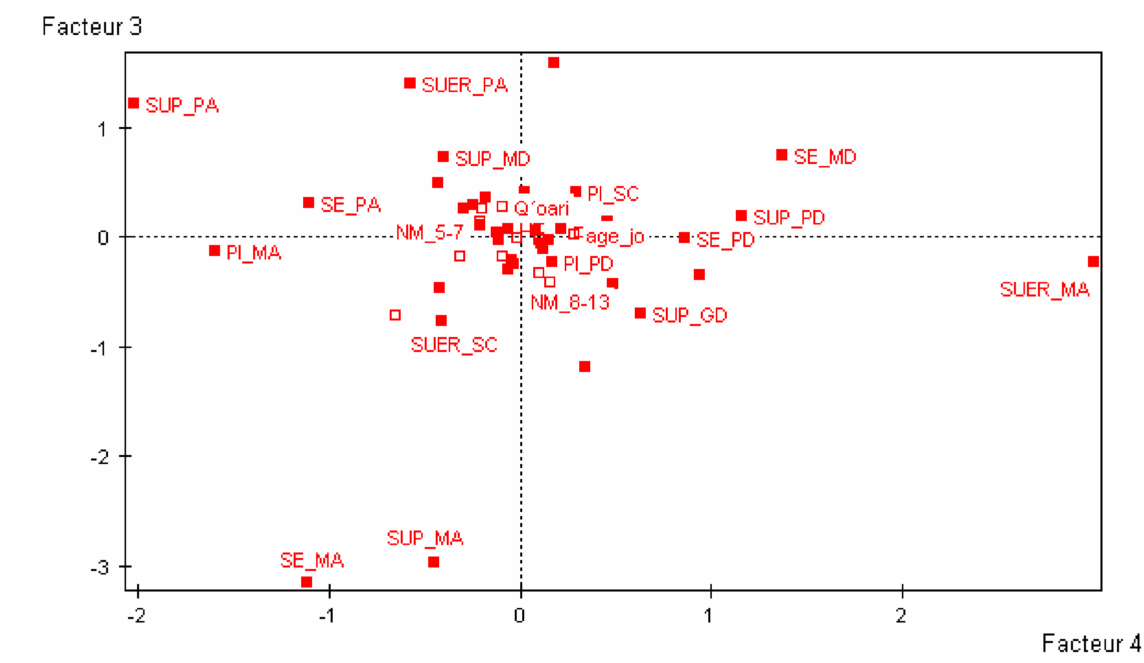


TABLE 6
Division of the hierarchical tree in four categories

ARRET APRES L'ITERATION 4 L'ACCROISSEMENT DE L'INERTIE INTER-CLASSES
PAR RAPPORT A L'ITERATION PRECEDENTE N'EST QUE DE 0.000 %.
DECOMPOSITION DE L'INERTIE
CALCULEE SUR 2 AXES.

INERTIES	INERTIES AVANT	INERTIES APRES	EFFECTIFS AVANT	EFFECTIFS APRES	POIDS AVANT	POIDS APRES	DISTANCES AVANT	DISTANCES APRES
INTER-CLASSES	0.5040	0.5177						
INTRA-CLASSE								
CLASSE 1 / 4	0.0278	0.0355	12	14	12.00	14.00	1.3676	1.1471
CLASSE 2 / 4	0.0716	0.0339	33	24	33.00	24.00	0.0529	0.1291
CLASSE 3 / 4	0.0424	0.0515	47	53	47.00	53.00	0.3058	0.2673
CLASSE 4 / 4	0.0088	0.0161	17	18	17.00	18.00	1.3181	1.2838
TOTALE	0.6547	0.6547						

QUOTIENT (INERTIE INTER / INERTIE TOTALE) : AVANT ... 0.7699
APRES ... 0.7908

TABLE 7
Paragons per category

PARANGONS

CLASSE 1/ 4

EFFECTIF: 14

RG	DISTANCE	IDENT.	RG	DISTANCE	IDENT.
1	0.02757	Individu n° 60	2	0.06691	Individu n° 74
3	0.09812	Individu n° 5	4	0.13240	Individu n° 84
5	0.13240	Individu n° 86	6	0.14404	Individu n° 6
7	0.14833	Individu n° 85	8	0.17804	Individu n° 3
9	0.25025	Individu n° 109	10	0.33317	Individu n° 9

CLASSE 2/ 4

EFFECTIF: 24

RG	DISTANCE	IDENT.	RG	DISTANCE	IDENT.
1	0.00358	Individu n° 70	2	0.00627	Individu n° 52
3	0.02977	Individu n° 10	4	0.03385	Individu n° 45
5	0.03623	Individu n° 73	6	0.03623	Individu n° 75
7	0.05739	Individu n° 48	8	0.07226	Individu n° 49
9	0.07226	Individu n° 50	10	0.10012	Individu n° 23

CLASSE 3/ 4

EFFECTIF: 53

RG	DISTANCE	IDENT.	RG	DISTANCE	IDENT.
1	0.00151	Individu n° 28	2	0.00395	Individu n° 100
3	0.00459	Individu n° 30	4	0.00625	Individu n° 40
5	0.00890	Individu n° 102	6	0.01129	Individu n° 17
7	0.01261	Individu n° 29	8	0.01353	Individu n° 78
9	0.01353	Individu n° 79	10	0.01444	Individu n° 37

CLASSE 4/ 4

EFFECTIF: 18

RG	DISTANCE	IDENT.	RG	DISTANCE	IDENT.
1	0.00543	Individu n° 62	2	0.00543	Individu n° 87
3	0.00543	Individu n° 88	4	0.00543	Individu n° 107
5	0.00543	Individu n° 106	6	0.01880	Individu n° 65
7	0.01880	Individu n° 108	8	0.02079	Individu n° 104
9	0.05998	Individu n° 64	10	0.05998	Individu n° 90

TABLE 8
Characterisation of the categories by the variables

CARACTERISATION PAR LES QUESTIONS DES CLASSES OU MODALITES
DE COUPURE 'a' DE L'ARBRE EN 4 CLASSES

CLASSE 1 / 4

V.TEST	PROBA	QUESTIONS CARACTERISTIQUES	KHI-2	DEG.LIB
		aa1a - CLASSE 1 / 4 (POIDS = 14.00 EFFECTIF = 14)		
6.63	0.000	5 . Cambio terrenos erosionados	49.55	2
4.95	0.000	13 . SUPERFICIE	40.50	6
4.24	0.000	4 . SUP. EROSIONADA	25.69	3
2.97	0.001	14 . SEMILLA	19.61	5
2.62	0.004	6 . MIEMBROS	10.86	2
2.41	0.008	11 . Cambio riego	9.69	2

CLASSE 2 / 4

V.TEST	PROBA	QUESTIONS CARACTERISTIQUES	KHI-2	DEG.LIB
		aa2a - CLASSE 2 / 4 (POIDS = 24.00 EFFECTIF = 24)		
3.25	0.001	12 . Cambio en fertilización	14.92	2

CLASSE 3 / 4

V.TEST	PROBA	QUESTIONS CARACTERISTIQUES	KHI-2	DEG.LIB
		aa3a - CLASSE 3 / 4 (POIDS = 53.00 EFFECTIF = 53)		
4.82	0.000	5 . Cambio terrenos erosionados	28.26	2
3.82	0.000	13 . SUPERFICIE	28.76	6
3.21	0.001	14 . SEMILLA	21.48	5
3.10	0.001	11 . Cambio riego	13.90	2
2.68	0.004	3 . PAPA NATIVA	17.47	5

CLASSE 4 / 4

V.TEST	PROBA	QUESTIONS CARACTERISTIQUES	KHI-2	DEG.LIB
		aa4a - CLASSE 4 / 4 (POIDS = 18.00 EFFECTIF = 18)		
6.27	0.000	5 . Cambio terrenos erosionados	44.91	2
6.09	0.000	3 . PAPA NATIVA	51.92	5
4.95	0.000	14 . SEMILLA	38.06	5
4.59	0.000	13 . SUPERFICIE	36.50	6
3.46	0.000	11 . Cambio riego	16.43	2
2.69	0.004	10 . Cambio control y tratamientos	11.28	2
2.48	0.007	2 . Comunidad	7.38	1

TABLE 9
Characterisation of the categories by the modalities

CARACTERISATION PAR LES MODALITES DES CLASSES OU MODALITES
DE COUPURE 'a' DE L'ARBRE EN 4 CLASSES

CLASSE 1 / 4

V.TEST	PROBA	---- POURCENTAGES ---- CLA/MOD	MOD/CLA	GLOBAL	MODALITES CARACTERISTIQUES	DES VARIABLES	IDEN	POIDS
				12.84	CLASSE 1 / 4		aa1a	14
5.97	0.000	73.33	78.57	13.76	cte_d	Cambio terrenos erosionados	CT01	15
4.14	0.000	100.00	35.71	4.59	SUP_PA	SUPERFICIE	CS05	5
2.83	0.002	30.00	64.29	27.52	crie_ar	Cambio riego	CR02	30
2.73	0.003	32.00	57.14	22.94	NM_8-13	MIEMBROS	MI03	25
2.67	0.004	35.00	50.00	18.35	SE_PA	SEMILLA	CS04	20
2.36	0.009	50.00	28.57	7.34	SUER_PA	SUP. EROSIONADA	CS02	8

CLASSE 2 / 4

V.TEST	PROBA	---- POURCENTAGES ---- CLA/MOD	MOD/CLA	GLOBAL	MODALITES CARACTERISTIQUES	DES VARIABLES	IDEN	POIDS
				22.02	CLASSE 2 / 4		aa2a	24
3.16	0.001	41.67	62.50	33.03	SUP_SI	SUPERFICIE	CS07	36
2.80	0.003	40.00	58.33	32.11	SE_SI	SEMILLA	CS06	35
2.70	0.003	66.67	25.00	8.26	PI_PD	Cambio variedades introducidas	CP01	9
2.41	0.008	43.48	41.67	21.10	ed_bc	Educación del jefe de hogar	ED03	23
2.34	0.010	100.00	12.50	2.75	cfe_a>o	Cambio en fertilización	CF01	3

CLASSE 3 / 4

V.TEST	PROBA	---- POURCENTAGES ---- CLA/MOD	MOD/CLA	GLOBAL	MODALITES CARACTERISTIQUES	DES VARIABLES	IDEN	POIDS
				48.62	CLASSE 3 / 4		aa3a	53
7.74	0.000	77.27	96.23	60.55	cte_sc	Cambio terrenos erosionados	CT02	66
5.07	0.000	65.75	90.57	66.97	crie_cr	Cambio riego	CR01	73
4.65	0.000	82.35	52.83	31.19	SUP_SC	SUPERFICIE	CS04	34
4.21	0.000	90.48	35.85	19.27	SE_SC	SEMILLA	CS03	21
3.64	0.000	72.50	54.72	36.70	cfe_o>a	Cambio en fertilización	CF03	40
3.62	0.000	88.89	30.19	16.51	PN_MD	PAPA NATIVA	CP02	18
3.00	0.001	67.44	54.72	39.45	PI_SC	Cambio variedades introducidas	CP02	43
2.39	0.008	75.00	28.30	18.35	ccon_sc	Cambio control y tratamientos	CC01	20
2.39	0.008	63.04	54.72	42.20	PN_PD	PAPA NATIVA	CP03	46

CLASSE 4 / 4

V.TEST	PROBA	---- POURCENTAGES ---- CLA/MOD	MOD/CLA	GLOBAL	MODALITES CARACTERISTIQUES	DES VARIABLES	IDEN	POIDS
				16.51	CLASSE 4 / 4		aa4a	18
6.70	0.000	60.71	94.44	25.69	cte_a	Cambio terrenos erosionados	CT03	28
6.56	0.000	51.43	100.00	32.11	SE_SI	SEMILLA	CS06	35
6.45	0.000	50.00	100.00	33.03	SUP_SI	SUPERFICIE	CS07	36
4.83	0.000	64.71	61.11	15.60	PN_PA	PAPA NATIVA	CP05	17
3.86	0.000	26.87	100.00	61.47	ccon_si	Cambio control y tratamientos	CC03	67
3.60	0.000	40.00	66.67	27.52	crie_ar	Cambio riego	CR02	30
3.26	0.001	100.00	22.22	3.67	PN_MA	PAPA NATIVA	CP06	4
2.74	0.003	28.00	77.78	45.87	Boqueron	Comunidad	CO02	50
2.74	0.003	28.00	77.78	45.87	PI_PA	Cambio variedades introducidas	CP03	50

PART TWO

QUALITATIVE METHODS

Some remarks on qualitative field methods

In this second part of Annex 2 some aspects of the qualitative information and ethnographic methods used in data collection are summarized.

The work undertaken in the peasant communities was based extensively on interviews with farmers, men and women. This research technique was utilised jointly with other qualitative methods which allow for validation and for deepening the information gathered. Thus, in each community focus groups were organised to get feedback on the findings obtained from interviews. Some households were chosen as case studies in order to follow up activities and practices along a 'technical itinerary'; and plots were visited to register their agricultural and other activities In so doing we also deployed direct and participatory techniques of observation. The results obtained from the application of these different techniques were then the object of further analysis and discussion.

Notwithstanding, having acquired a considerable amount of information, I selected for this thesis what I thought was the most relevant and of greater interest, regarding the research goals[163]. One has to acknowledge that field data accrues sometimes at a greater rate than one can readily systematise and process[164].

As regards the selection process of households and farmers to be interviewed, I followed diverse sampling criteria. As traditionally recommended I started with a random sample (the number of the units–communities and households– led me to choose 'simple random sampling' as explained in Chapter 4), which I used for the survey. Based upon this initial sample a second sampling method was utilized that combined quantitative and qualitative criteria, known as 'quota sampling'. Following the patterns established by the method, and taking the initial sample as the 'mother' population (determined with a 95% confidence interval and 5% of error), a

[163] I have left out, for reasons of the constraints of space, interesting material, on food security and representations for example.

[164] Other results and data are included in theses produced by students who since 1996 collaborated with the author in the area under study - research reports from two annual workshops; six BSc. sociology theses; and one BSc. agronomy thesis). The research was also backed up by the technical advice and useful comments of some engineers (agronomists).

second sample of 34 farmers was obtained for the interviews, with quotas for variables of sex and age. Half the respondents were female and half male. These groups were in turn were split with respect to age (half young and half older farmers) though the proportions were difficult to control. However, we achieved a sample with some diversity in relation to age, and this proved telling for the purposes of the thesis since, as the last chapter shows, age was highly relevant for knowledge reconfiguration concerns. The table below displays the sample interviewed by gender and community.

Table 1
Farmers interviewed according to the survey results

COMMUNITY	PEOPLE INTERVIEWED	
	WOMEN	MEN
Qoari	1. Pastora garcía	1. Bernardino García
	2. Gregoria…	2. Severino García
	3. Pascuala Mejía	3. José Villarroel
	4. Sabina Salazar	4. Carlos Alvarado
	5. Benedicta Mejía	5. José Castellón
	6. Cristina Salazar	6. Remigio Soto
	7. Albina Salazar	7. Daniel Paz
	8. Manuela Alvarado	8. Cirilo Alvarado
	9. Salomé...	9. Pedro Montenegro
Boquerón	10. Luisa Córdova	10. Constantino Dávalos
	11. Guillermina Rocha	11. Moisés Rivera
	12. Concepción Dávalos	12. Constantino herrera
	13. Margarita Hinojosa	13. Andrés Ricaldez
	14. Tomasa García	14. Teodocio Mamani
	15. Cristina Almanza	15. Quintín Montenegro
	16. Luisa J.	16. Hilarión Parra
	17. Leonor Córdova	17. Simón Vásquez

With the aim of contrasting and enriching the results achieved in the communities of Qoari and Boquerón, we also interviewed some farmers from the communities of Piusilla and Compañía Pampa (province of Ayopaya). The list of farmers interviewed in Piusilla and Compañía Pampa is presented in table 2.

Table 2
Farmers interviewed in Piusilla and Compañía Pampa

COMMUNITY	PEOPLE INTERVIEWED	
	WOMEN	MEN
Piusilla	1. Cristina López	1. Juan Ruiz
	2.Guillermina Ruiz	2. Casimiro Ruiz
	3. Julia López	3. Casimiro López
	4. Guillermina Rojas	4. Miguel Salas
Compañía Pampa	5. Victoria Claure	5. Justo López
	6. Dionisia Katari	6. Tomás Villarroel
	7. Felicidad Escobar	7. Jorge Villarroel
	8. Alicia Katari	8. Celestino Vegamonte

Keeping in mind that a probabilistic sample would not allow us to find necessarily those particular cases of great importance for our work (like Don Carlos, the paradigmatic and illustrative 'sociometric' star, as Norman Long has termed this type of actor; or like Severino, the young, diligent and junior 'farmer-researcher', and other farmers who had worked with development projects), I opted also for a purposive sampling technique widely applied in ethnographic studies by which one hopes to learn about the range of variation in respect to farming and household organisation. In this way a number of farmers and households were picked out for a more in depth observations and interviews. The farmers chosen were: Carlos Alvarado, Severino García, Bernardino García, Luisa Córdova, Constantino Dávalos, Moisés Rivera. Incidental information was recorded at various moments of being in the field observing activities. At moments too, we sought to test out the validity or the meaningfulness of the interview data by asking neighbours or people just passing about the same topics or collecting their opinions on the statements of interviewees.

We included also as key informants engineers Carmen Camacho and Jonás Colque, and the technician Basilio Rojas. They were of paramount value and usefulness for the research work. The interviews with farmers were carried out almost exclusively in *quechua,* bringing on the old problem of translation. Some farmers were interviewed just once, others twice and even three or four times. Thus another and unintended process of selection was triggered when, for moving from the local knowledge as such to the issue of encounters and reconfigurations of knowledge –that is from chapter five to chapter six–, we had to pull out from our lists the farmers considered the most interesting and relevant for our purposes at this stage of research.

I have to stress that we not only take into account the "farmer version" or "farmer vision" of things but also the views of the technicians working in development and technical organisations (those working "in the field" as much as those working in the city). This material was valuable for the problem of knowledge interfaces and reconfiguration (Chapter 6). In addition we also organized a regional seminar (see Chapter 3) with all the institutions devoted to technical innovation and transfer. Such a seminar can be taken as a sort of "extended focus group", where the institutional representatives were put to debate and phrase their opinions following the "script" set up by the objectives of the seminar. The list of the technicians interviewed is presented below.

TABLE 3
List of technicians interviewed

INSTITUTION	TECHNICIANS INTERVIEWED
DESEC-ARADO	Juan Demeure (DESEC)
	Jonás Colque (ARADO)
	Basilio Rojas (ARADO)
CEDEAGRO	Germán Lazarte
SEPA	Augusto Urquieta
PROINPA	Rolando Oros
PROSEMPA	Cerbando Lazarte
	Edwin Quintana
	José Pardo
	Victor Hugo Román
	Jaime Rocabado
(Without institution)	Carmen Camacho

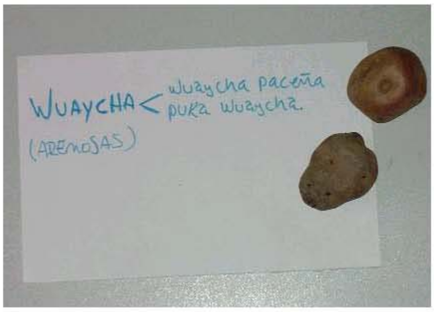
ANNEX 3

POTATO VARIETIES AND REPRESENTATIONS

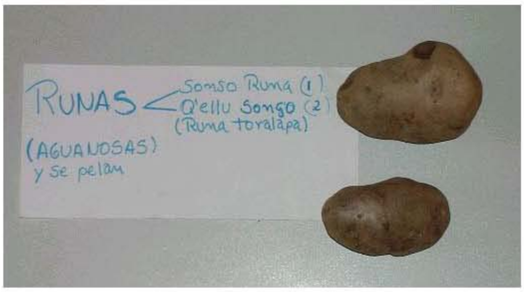
Wawapapa

Harenosas

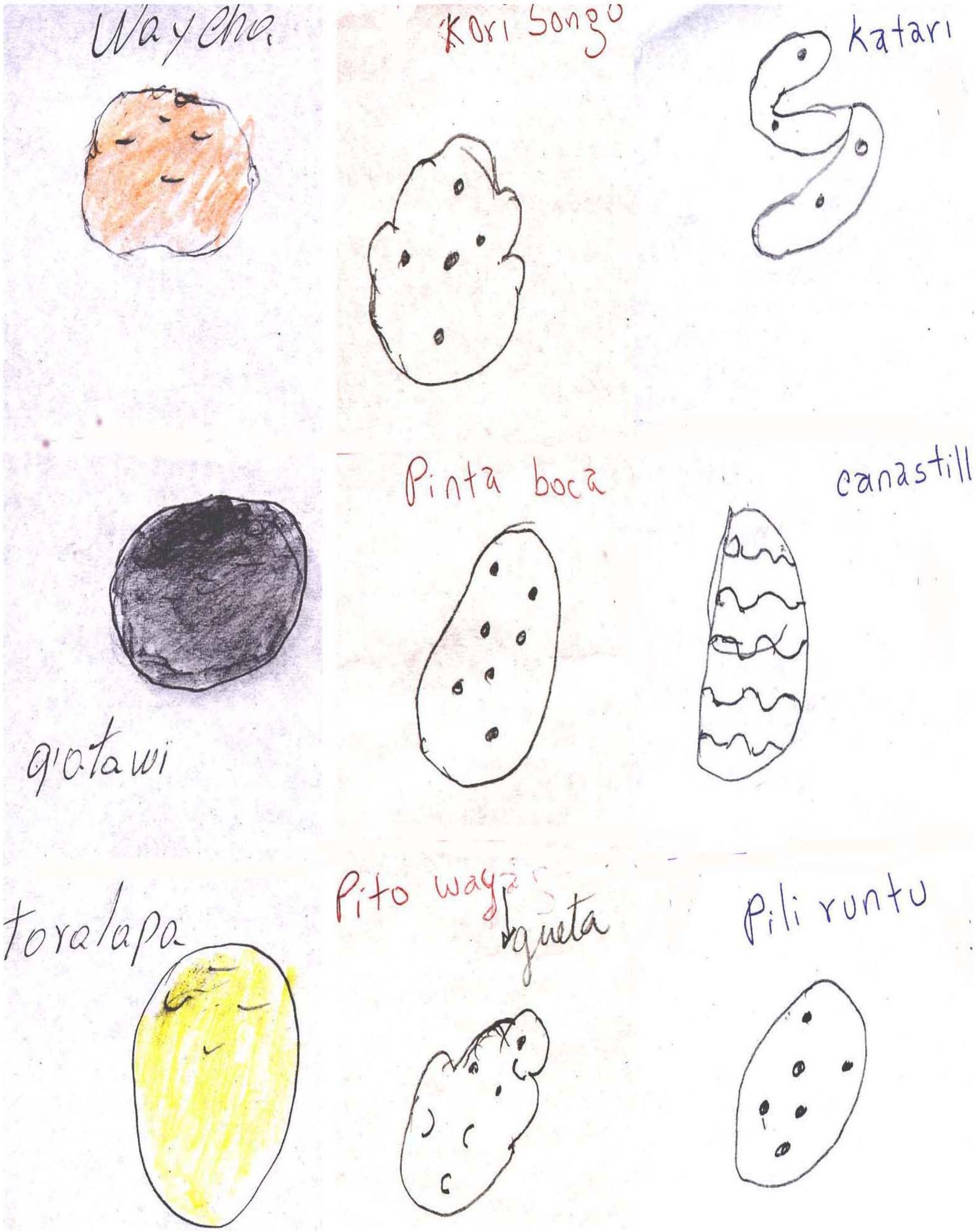
Nojch_a



Wuaycha

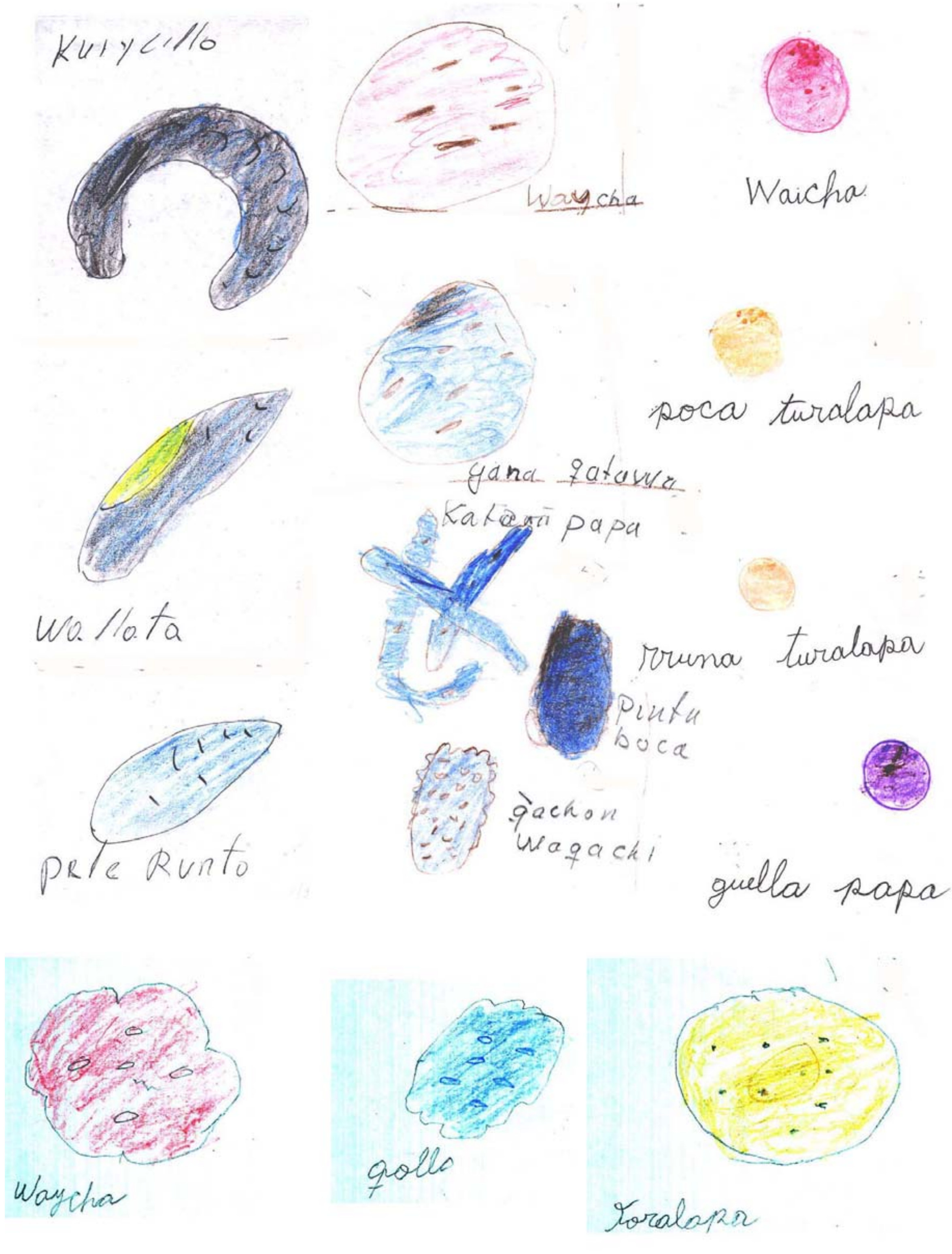


Runas

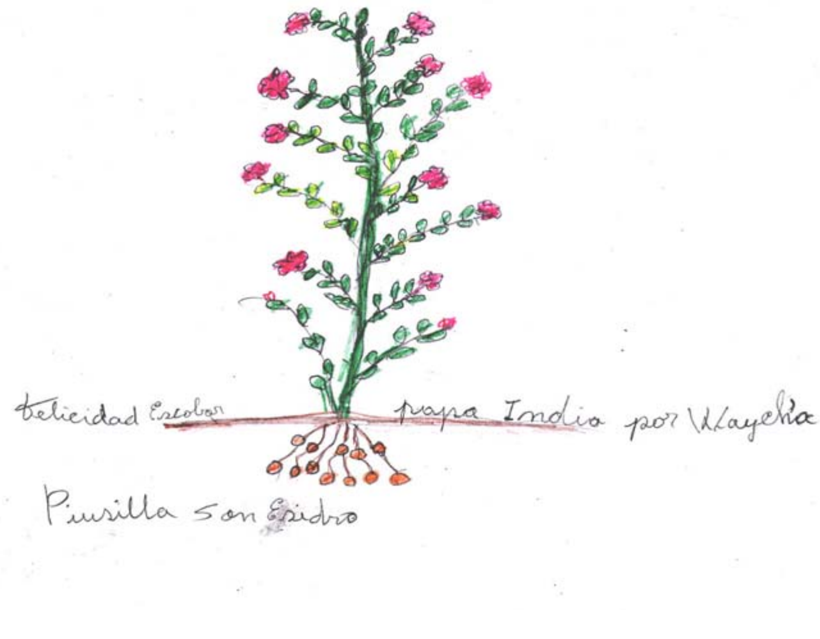

Waycha
Kori Songo
katari
Pinta boca
canastill
q'otawi
toralapa
Pito way
queta
Pili runtu


uaycha
peleronto
LOKA
Kátawi
Luki
Agawiere
Hagawiri
Cuchillo
AZUL LOKA
turalopa
Canost

Pilaroto
Waych'a
waych'a
Kacllo
qollo
Runa toca
Lare hagacito
Robesta
Katawi


Kuiycillo
Waycha
Waicha
poca turalapa
Wallata
runa turalapa
pintu boca
qachon Waqachi
qulla papa
Waycha
qollo
Toralapa

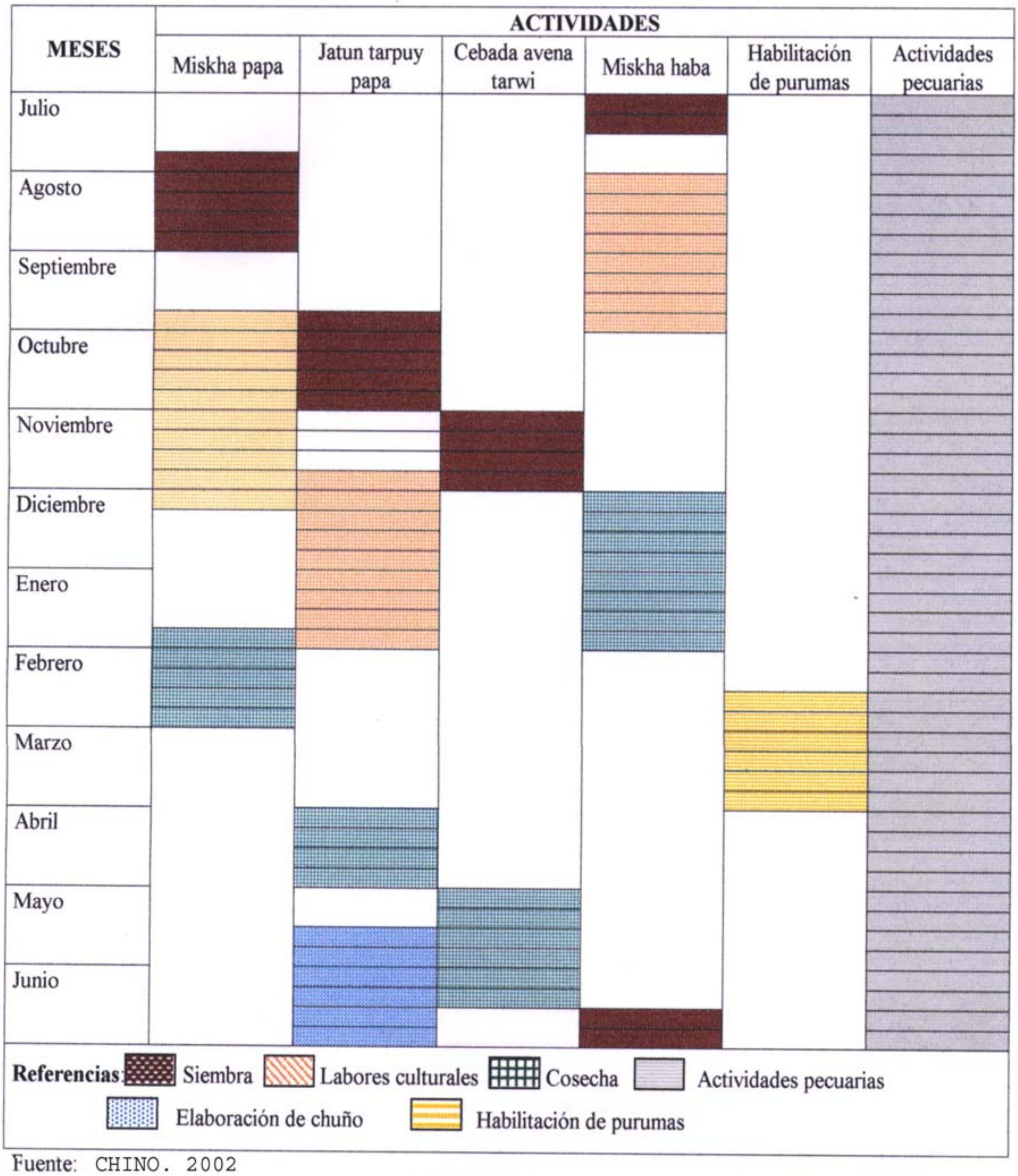
POTATO PLANTS



ANNEX 4

Farmer agricultural practices and techniques

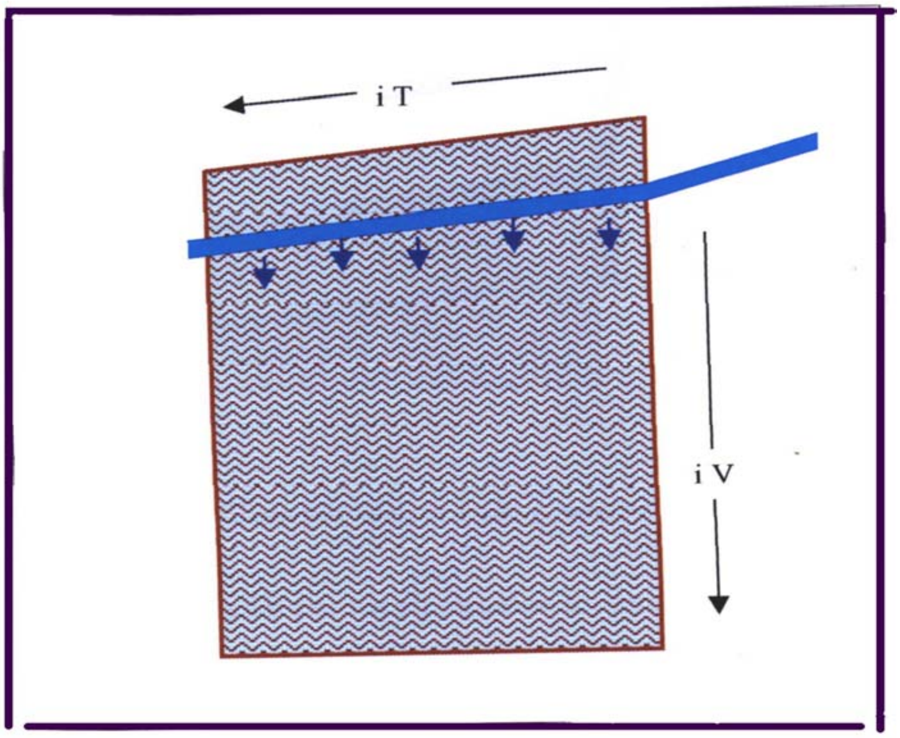
AGRICULTURAL TIMETABLE



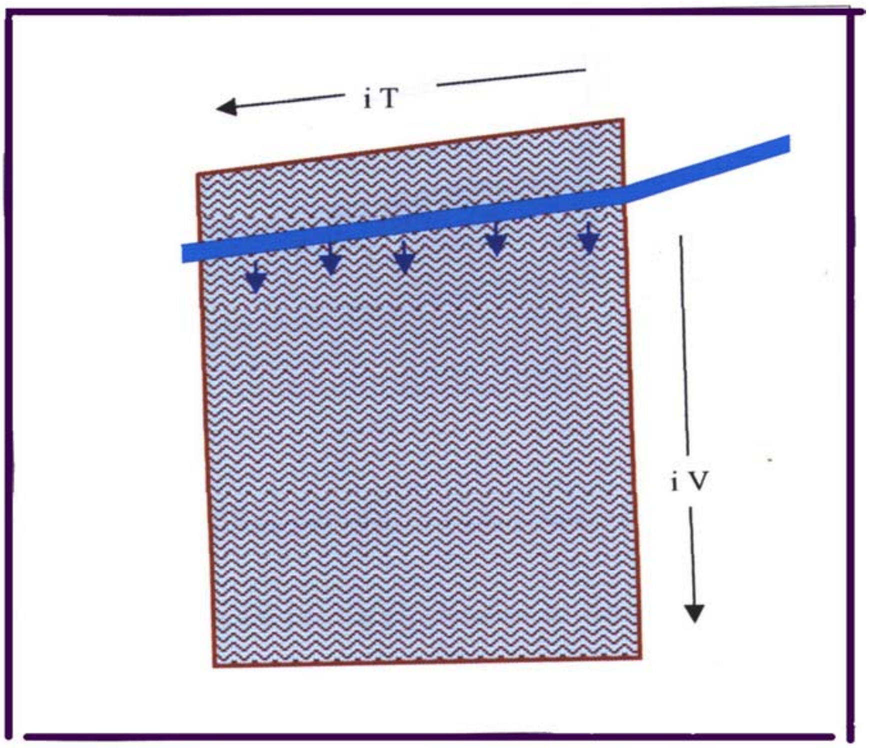
Fuente: CHINO. 2002

N. B. All the next figures and pictures come from Chino and Sociology research workshops conducted by the author.

EMPANTO IRRIGATION METHOD



IRRIGATION BY _BANCAS_ FOR PREPARING THE FIELD



POTATO SOWING

CHEJTADA

JALLMADA

IRRIGATION BY BANCAS WITH MINIMAL WATER QUANTITY

CHUÑO COLLECTION

SEED SELECTION

OTHER PICTURES

Summary

The aim of this work has to do with knowledge and, particularly, with the encounter between different traditions of knowledge, which – through potato cropping – take place between farmers and experts.

In this way the present research makes problematic the fact that knowledge is something that is socially constructed or de-constructed through encounters or intersections between different forms of knowledge, and more specifically through processes of institutional intervention in development. The initial questions that guided this research made reference to the dynamics and results of a long intervention process of technological innovation in the cultivation of potatoes, both at the mezzo and micro levels. At the mezzo level the analysis has focused on the entities and the networks fostering innovation or technological transfer at a regional level (Cochabamba), networks which are also considered to be regional systems of knowledge, or frameworks of agricultural knowledge. At the micro level, the analysis has focused on the two communities of potato growers chosen for fieldwork (Qoari and Boqueron). On the other hand the research questions also referred to the modes of persistence of local knowledge of potato cultivation and to the reconfigurations of this local knowledge in its encounters with techno-scientific knowledge. This research has attempted to attain the following goals:

- To establish the role of knowledge, in terms of its diversity, dynamics and intersections, in the implementation of international development programs in Cochabamba.
- To analyse and conceptualise how knowledge is configured and managed within an institutional and cultural context focused on technological innovation, and
- To determine the implications of this innovation, both in the knowledge and practice of local agricultural producers.

The theoretical perspective upon which this research widely draws is the Actor Oriented Approach. The thesis has put forward the notion that the relationship between knowledge and rural development is not simply a

bipolar one (between knowledge and development) but multipolar or multiplex; between development and other forms which are linked to knowledge namely, “memory”, “forgetfulness” and “ignorance”.

I assumed in this research that it could be interesting to contrast the traditional forms of knowledge with the scientific spirit and rationale, at least regarding its central aspects. For instance, with the problem of methodological doubt, which steers to the problem of truth, a problem I have tried to avoid but which remained as a shadow, above all in the footnotes. Closing the circle, I outlined its historical background and subsequently I have summarised the Actor Oriented Approach contributions to knowledge and rural development.

To have a better grasp of the problem of technology I have drawn on work done in the fields of social anthropology (Long, Arce, Fisher, Villarreal, Olivier de Sardan, Geertz, Latour, Callon and others), philosophy (Heidegger, Negri and Rella) and sociology (Habermas, Bourdieu and Giddens). One aim of the study was to analyse how knowledge si configured and managed within the set of organisations working in technological innovation in Cochabamba. Here I have tried to respond to such questions as who are those who take on the mission of bringing about technological innovations for potato production in the region, ultimately, in what way do they structure institutional frameworks at the mezzo level for organising the unfolding of their intervention strategies. As I have showed in this study, the history of the planned intervention, particularly in the province of Tiraque, for improving potato cropping displays a lot of unexpected events, contradictory facets and even revealing anecdotes.

The communities studied demonstrate that the long experience of technology introduction in both communities become interesting for research. It is described the extent and variants of the innovation process that took place in these communities, since each follows a different path as far as technical innovation is concerned, and at the same time each displays a different history concerning its relationship with the organisations that promote technical change. The characterisation of this change is done on the basis of a statistical method of multiple correlation, which allows for the elaboration of farmer typologies and variable correspondences. Beyond of the technicalities of the method, what is interesting is that it has led me toward an extensive interpretation of the innovation process, establishing the main differences between producer groups, as well as between communities. This interpretation or assessment of the extent of the technical change constitutes the basis for the in-depth analysis of the local knowledge on potatoes and its reconfigurations in both communities.

Finally the study deals with the intersections or interfaces between farmers and technicians, and therefore with the reconfigurations that take place in farmers' knowledge a much as in their agricultural practices (regarding soils, diseases, pest control and so on). The issue of loss or gain of biodiversity is also mentioned together with issues of culinary practices and market flaws and the introduction of new varieties. After summarising these changes in other domains of local knowledge and taking into account that encounters between farmers and experts, the study concludes that discontinuity and "rebounding" of knowledge are part of an analysis of what I call the "other reconfiguration". This means the development, partial and fragmentary, of farmers' local knowledge, which is equivalent to the technicians' "local knowledge".

Samenvatting

Het thema van dit boek is kennis, vooral de ontmoeting tussen verschillende tradities van kennis die plaatsvindt tussen boeren en experts bij het telen van aardappelen.

Het onderzoek problematiseert het feit dat kennis sociaal geconstrueerd of gedeconstructueerd wordt door middel van ontmoetingen of intersecties tussen verschillende vormen van kennis en in het bijzonder door processen van institutionele ontwikkelingsinterventie.

De oorspronkelijke vragen van dit onderzoek richtten zich op de dynamiek en resultaten van een lang interventie proces van technologische innovatie in de teelt van aardappelen op het meso en micro niveau. Op meso niveau richtte de analyse zich op de eenheden en netwerken die innovatie of overdracht van technologie op het regionale niveau (Cochabamba) stimuleren, netwerken die ook beschouwd worden als regionale systemen van kennis, of kaders van landbouwkundige kennis.

Op micro niveau heeft de analyse zich gericht op de twee gemeenschappen van aardappeltelers die waren geselecteerd voor veldwerk (Qoari en Boqueron). Aan de andere kant richtten de onderzoeksvragen zich ook op de manier waarop de lokale kennis van de aardappelteelt standhoudt of zich wijzigt in de ontmoeting met technowetenschappelijke kennis. Het onderzoek had de volgende doeleinden:

- Het vaststellen van de rol van kennis - in termen van diversiteit, dynamiek en intersecties - in de uitvoering van internationale ontwikkelingsprogramma's in Cochabamba.
- Het analyseren en conceptualiseren van de wijze waarop kennis is samengesteld en wordt beheerd binnen een institutionele en culturele context gericht op technologische innovatie, en
- De implicaties bepalen van deze innovaties, zowel in de kennis als in de praktijk van lokale agrarische producenten.

Het onderzoek is gebaseerd op het theoretische perspectief van de Actor Oriented Approach. Deze dissertatie laat zien dat de relatie tussen kennis en rurale ontwikkeling niet simpelweg bipolair is (tussen kennis en ontwikkeling) maar multipolair of multiplex, tussen ontwikkeling en andere factoren die verbonden zijn met kennis, te weten "herinnering", "vergeten" en "onwetendheid".

In dit onderzoek ging ik er van uit dat het interessant kon zijn traditionele vormen van kennis te vergelijken met de wetenschappelijke logica, in ieder geval met betrekking tot de centrale aspecten. Bijvoorbeeld met betrekking tot het probleem van methodologische twijfel, dat aan de basis ligt van het probleem van waarheidsvinding, een probleem dat ik heb geprobeerd te vermijden, maar dat als een schaduw bleef bestaan, vooral in de voetnoten. De cirkel sluitend, heb ik de historische achtergrond van de Actor Oriented Approach uiteen gezet en vervolgens een samenvatting gegeven van de bijdragen van deze benadering aan kennis en rurale ontwikkeling.

Om meer grip te krijgen op het thema van technologie heb ik studies gebruikt in het veld van de sociale antropologie (Long, Arce, Fisher, Villarreal, Olivier de Sardan, Geertz, Latour, Callon en anderen), filosofie (Heidegger, Negri en Rella) en sociologie (Habermas, Bourdieu en Giddens). Een doel van deze studie was het bestuderen van de wijze waarop kennis wordt gevormd en beheerd binnen de groep organisaties die werken aan technologische innovatie in Cochabamba. Hier heb ik geprobeerd antwoord te geven op vragen zoals: wie zijn degenen die de taak op zich nemen om technologische innovaties voor de aardappelteelt in de regio te brengen? En uiteindelijk, op wat voor manier structuren ze institutionele kaders op meso niveau voor het ontplooien van hun interventie strategieën? Zoals ik heb laten zien in deze studie gaat de geschiedenis van geplande interventie, in het bijzonder in de provincie van Tiraque, gepaard met veel onverwachte gebeurtenissen, tegenstrijdige feiten en veelzeggende anekdotes.

De bestudeerde gemeenschappen laten zien dat de lange ervaringen met de introductie van technologie in beide gemeenschappen interessant zijn voor onderzoek. De mate waarin en variaties van het innovatie proces is beschreven voor beide gemeenschappen, aangezien elk een ander pad van technische innovatie volgt. Tegelijkertijd laten ze elk een verschillende geschiedenis zien met betrekking tot de relatie met organisaties die technische verandering bevorderen. De typering van deze verandering is gedaan op basis van een statistische methode van multiple correlatie, die het mogelijk maakt typologieën van boeren te maken en overeenstemming van variabelen. Deze methode heeft het me mogelijk gemaakt een uitgebreide interpretatie te maken van het innovatie proces, waarbij de belangrijkste verschillen tussen groepen producenten, evenals tussen de gemeenschappen zijn vastgesteld. Deze interpretatie of beoordeling van de mate van technische verandering vormt de basis van een diepte analyse in beide gemeenschappen van de lokale kennis over aardappelen en de wijzigingen die daarin plaatsvinden.

Uiteindelijk behandelt deze studie de intersecties of interfaces tussen boeren en technici, en daarmee de wijzigingen die plaats hebben in zowel de kennis als praktijken van boeren (betreffende bodems, ziektes, controle van plagen en dergelijke). De kwestie van het verlies of de winst aan biodiversiteit wordt ook genoemd samen met kwesties van culinaire praktijken en marktonvolkomenheden en de introductie van nieuwe variëteiten. Na een samenvatting van deze veranderingen in andere domeinen van lokale kennis waarbij de ontmoetingen tussen boeren en experts in acht worden genomen, concludeert de studie dat discontinuïteit en "terugkaatsing" van kennis onderdeel zijn van een analyse van wat ik de "andere reconfiguratie" noem. Hiermee bedoel ik de ontwikkeling, gedeeltelijk en gefragmenteerd, van lokale boerenkennis die gelijkwaardig is aan de "lokale kennis" van technici.

Curriculum vitae

Andrés Uzeda Vásquez born in Cochabamba, Bolivia on 4th November 1959 is a graduate of San Simón University where he obtained a BSc degree in Sociology in 1986 and later on, in 1995, a MSc degree in Management of Agricultural Knowledge Systems (MAKS) at Wageningen Agricultural University. In 2003 he obtained an specialization in statistics and in 2004 a diploma in higher education.

After graduating from San Simón University he worked with some NGOs and afterwards started a teaching career at the mentioned university. From 1993 to date he has worked as researcher-lecturer at the same university, at first with the PEIRAV Programme (a research-teaching programme for the study of Andean irrigation) in the Agronomy Faculty, and from 1999 on with the IESE (Institute of Social and Economic Studies) in the Faculty of Economics. A number of his academic works have been published in different periodicals and books.

In 2000 he was awarded a PhD scholarship through the NERUDA network from the European ALFA programme, and in 2001 he registered for the PhD training at Wageningen University. He obtained also important support from the PROMEC Project and the IESE Institute for conducting his research.