
How Can Information Contribute to Innovative Learning Processes? Insight from a Farmer University in Brazil

Emilie Coudel, Jean-Philippe Tonneau

EDITOR'S NOTE: Paper presented at the IAALD XIIIth World Congress, Montpellier, 26–29 April 2010 Scientific and Technical Information and Rural Development

ABSTRACT: Faced with the challenge of inventing new ways towards sustainable development, the capacity of societies to innovate appears as fundamental. A common assumption is that making more information available will encourage actors to develop new solutions. However, although science has never produced as much information as today and stakeholders have never had access to as many sources of information, this quantity of information sometimes appears as illusory. In fact, relevant information is often crushed by quantity, and stakeholders feel disabled faced with so much information, blocking their capacity to act. Moreover, among the increasing quantities of scientific and technical information, many are of limited application, having been produced in very specific contexts. Information cannot be used because it is not adapted and appropriated by the actors. It is necessary to invent new ways of mobilizing information in specific situations and develop the capacity of stakeholders to do so.

Literature often presents information as a key element of learning processes to enable innovation in development projects. Different learning theories formalize such processes, in which information is part of a dynamic cycle: actors construct new knowledge and develop competencies to then better use available information within ideal learning organizations or learning communities. But in practice, what are the factors which encourage such learning and innovative processes, in which information truly fosters innovation?

To contribute to reflexion, we will bring insight from a Rural University (Universidade Camponesa - UniCampo), which aimed at developing the capacities of community leaders in a territory of the semi-arid region of Brazil. Information, in such territories, raises some particular issues. Often, social and economical information is the monopoly of traditional elites, who still dominate politically these regions. Adequate agronomical information is inexistent, being only available for productive zones. Moreover, local knowledge detained by the populations is often disdained, the banks and technical advisory services imposing their views.

At UniCampo, a collective reflexion was engaged to discuss development models and suggest new ways. Information adapted to the context was produced through research and experimentation, simultaneously reinforcing the actors' knowledge and skills. The information build during this process, considered as legitimate by the actors involved as well as by other institutions in the territory, was used to suggest new development projects. Thus empowered, the community leaders started asking to be informed about the development policies in the territory, laying claim to accountability. Although several limits can be pointed to, the overall assessment of this experience shows that by enhancing the links between information systems, capacity build-

ing and governance systems, actors can learn to better mobilize and produce information and thus suggest innovative ways for the sustainable development of their territory.

RÉSUMÉ: Pour répondre au défi d'inventer de nouveaux modes de vie pour le développement durable, la capacité d'innovation des sociétés apparaît essentielle. Une affirmation commune est que l'information disponible favorise la recherche de ces nouvelles solutions. Cependant, bien que la science n'ait jamais produit autant d'information qu'aujourd'hui et que les acteurs n'aient jamais eu accès à autant de sources d'information, l'information disponible apparaît parfois illusoire. En fait, l'information pertinente est comme noyée par la quantité et les acteurs semblent écrasés par cette information, qui bloque leur capacité d'action. Une grande partie de l'information scientifique et technique est d'application limitée, car produite dans des contextes très spécifiques. L'information ne peut pas être utilisée parce qu'elle n'est ni adaptée aux situations, ni appropriée par les acteurs. Il semble nécessaire d'inventer de nouvelles manières de mobiliser l'information pour répondre à des situations toujours spécifiques et de développer la capacité des acteurs pour le faire.

La littérature présente souvent l'information comme l'élément principal des apprentissages qui permettent l'innovation dans des projets de développement. Différentes théories de l'apprentissage formalisent ces processus. L'information est "moteur" d'un cycle vertueux : les acteurs construisent de nouvelles connaissances et développent des compétences pour mieux utiliser l'information disponible au sein de communautés d'apprentissage. Mais dans la pratique, quels sont les facteurs qui permettent de tels processus d'apprentissage, où l'information stimule vraiment l'innovation ? Pour contribuer à la réflexion, nous analyserons une expérience d'université paysanne (Universidade Camponesa - UniCampo), qui a cherché à développer les compétences de responsables communautaires dans un territoire de la région semi-aride du Brésil. L'information, dans de tels territoires, renvoie à des défis particuliers. L'information sociale et économique est le monopole des élites traditionnelles, qui dominent toujours politiquement ces régions. L'information agronomique adaptée aux situations est inexistante, car produite et importée des zones plus productives. Les savoirs et connaissances locales sont largement méprisés, les banques et les services d'appui techniques imposant leurs vues.

A l'UniCampo, une réflexion collective a été engagée pour discuter des modèles de développement et suggérer de nouvelles manières de produire. Une information adaptée au contexte a été produite par la recherche et l'expérimentation, renforçant à la fois les connaissances et compétences des acteurs. L'information produite est considérée comme légitime par les acteurs impliqués mais aussi par les différentes institutions et organisations du territoire. Elle a été utilisée pour définir de nouveaux projets de développement. Renforcés, les leaders communautaires ont revendiqué un droit de regard sur les politiques de

développement dans le territoire. Bien que plusieurs limites aient été identifiées, l'évaluation globale de l'expérience démontre que l'implication dans des processus qui allient systèmes d'information, renforcement des compétences et gouvernance, favorise les processus d'apprentissage et permet aux acteurs de mobiliser et produire de l'information pertinente et d'inventer de nouvelles voies pour le développement durable de leur territoire.

RESUMEN: La literatura a menudo presenta la información como un elemento clave de procesos de aprendizaje para permitir la innovación en proyectos de desarrollo. Diferentes teorías de aprendizaje formalizan dichos procesos, en los cuales la información forma parte de un ciclo dinámico: los actores construyen nuevo conocimiento y desarrollan competencias para luego utilizar mejor la información disponible dentro de organizaciones o comunidades de aprendizaje ideales. Pero, en la práctica, ¿cuáles son los factores que promueven dichos procesos de aprendizaje y de innovación? ¿Cuál es la información que verdaderamente fomenta la innovación? La Universidade Camponesa (UniCampo) buscó desarrollar las capacidades de los líderes comunitarios en un territorio de la región semiárida de Brasil. La información en dichos territorios plantea algunos

Introduction

Sustainable development is not an obvious policy to put into practice. It is a real challenge to change ways of life, production and management. Will we be able to do so? Every day, the complexities and difficulties of dealing with the contradictory objectives of production, preservation and social equality prove that sustainable development requires innovation to change thinking, to deal with uncertainty, to invent new processes and to adapt to change (Hall and Vredenburg, 2003; Veldkamp et al., 2009).

Scientific and technical information has a central role in innovation processes. For example, one of the main objectives of “innovation poles” has always been to promote the exchange of knowledge and know-how through networking and dissemination of scientific and technical information.

The concept of “Information Society” (Petit, 1998) which emerged in the 1990's, highlights both the dramatic increase in scientific and technical information and the extraordinary development of technological tools to better manage this information, classify it, diffuse it and target potential users. However, it appears more and more clear that the available information is not fully used in decision processes, in particular, to implement sustainable development. The information is usable, in the sense that it exists in an attractive form, but is it relevant and useful for the stakeholders? Do they have the capacities to mobilize it? And do their environments provide the conditions that enable them to use it?

These questions are partly reflected in the concept of “Knowledge Society” (Foray, 2004), in which scientific and technical information is not a product to be implemented but the basis for a capacity building process that can lead to innovation. Our purpose is to analyze under

temas particulares. A menudo, la información social y económica es monopolizada por las elites tradicionales, que todavía dominan políticamente estas regiones. La información agrícola adecuada, aunque disponible para las zonas productivas, no existe para la región seleccionada. Es más, el conocimiento autóctono retenido por las comunidades locales es, a menudo, menospreciado por los bancos y los servicios de asesoría técnica que imponen sus puntos de vista. En UniCampo se celebró una consulta de diversos grupos de interesados directos para tratar los modelos de desarrollo y sugerir nuevas maneras de intercambio de información. Se produjo información adaptada al contexto mediante la investigación y la experimentación, reforzando simultáneamente los conocimientos y las habilidades de los actores. Empoderados de esta manera, los líderes comunitarios empezaron a solicitar que fueran informados acerca de las políticas de desarrollo en el territorio. A pesar de diversas limitaciones, la evaluación general de esta experiencia indica que al mejorar los vínculos entre sistemas de información y sistemas de fortalecimiento de capacidades y de gobernanza, los actores pueden aprender a movilizar y producir información mejor y sugerir, por lo tanto, maneras innovadoras para el desarrollo sostenible de su territorio.

what conditions scientific and technical information may contribute to these processes. We will first identify the limits of the current model of information production and knowledge management and will discuss the importance of their integration in learning processes. We will then explore theoretical elements to understand the roles of information in the learning process. Using the case of a Farmer University in Brazil, we will illustrate how information production has been used to enhance the learning processes and enable the stakeholders to design projects for sustainable development.

With this insight, we hope to contribute to thinking about new ways of associating information production and capacity building within a shared learning process.

The limits of the current model

A massive production of scientific and technical information, but with what result? – Innovation is often presented as the product of interactions between research and stakeholders. In this interaction, scientific and technological information has a central role. In recent years, the flow of scientific and technological information has increased continuously. There have never been as many researchers, nor as many resources (NSB - National Science Board, 2010). Scientific output has multiplied. Furthermore, with the advent of Internet and with English as a common communication language, opportunities for access to information have increased dramatically.

However, it cannot be ignored that under-development and its consequences (resource crisis, industrial pollution, poverty, exclusion, etc.) are still present. We are reminded every day, with continual debates and declarations, about the limits of our development model: economic limits, environmental limits, social limits.

How can this paradox, between high productivity of

science and its low efficiency, be explained in terms of sustainable development? Has science become isolated, has it been cut off from reality, as some suggest? But science has never ever been as attentive to social demand (Grossetti, 2000) nor as preoccupied with its utility. According to Gibbons et al. (1994), scientific research is now mobilized by industry and governments to resolve issues.

If we consider science in reference to the overall social transformation process (Bessis, 1995), our hypothesis is that science is too often mobilized on technical issues and does not take into consideration the requirements of sustainable development nor the impact of evolving conditions such as climate change. Science is often limited to useful or utilitarian research, designed for specific applications, but with no real capacity to address the future. Achieving a social consensus on the ultimate aims of development of the society is a prerequisite for defining the technical interventions to reach those aims. Science is not only about inventing new technologies; it must also be involved in helping to guide social transformation and its aims.

The challenge of making information usable but above all useful – The challenge of the “information society” is to develop more efficient tools to store, share and reproduce information. Indeed, tools such as metadata, semantic web, intelligent agents, text-mining, or mapping systems, allow us to sort information intelligently and to better target its potential users. Usually, the purpose of these tools is to make information usable but this does not guarantee its usefulness.

Developing an efficient technical tool enables us to manage information, but the relevance of information may be at stake. And this relevance depends on the needs of the actors. The challenge is how to ensure the information meets a need which is often imperfectly or partially expressed. Will this information be useful? For whom is it relevant? Why is it relevant? Any information system designer faces the difficulty of mobilizing the potential users, both to make them express their needs and expectations (Reix, 1998) but also to bring this system to life by providing the necessary information. Such infor-

mation design is inseparable from an approach which places learning at its centre.

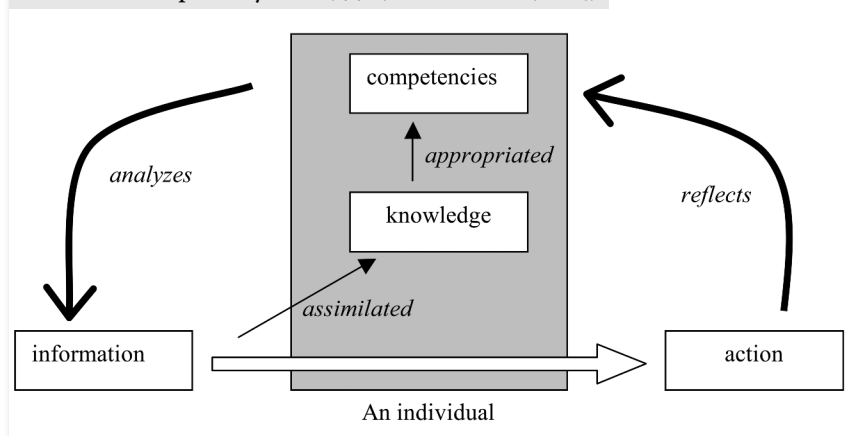
The notion of “knowledge society” associates information with learning: the issue isn’t only about quantities of information, but about how this information is used to create knowledge which can be used by stakeholders. In this concept, there is a difference between information and knowledge (Foray, 2004). Information is external to agents; it exists without them. It can be reproduced at almost no cost (for example, a photocopy of a book or a paper). On the other hand, knowledge is “internalized” information, that is, what an agent retains of that information and how he/she can possibly use it for future action. Knowledge only exists within the agent, in a tacit form. In this sense, knowledge is not reproducible without cost, and the cost is “learning”. Therefore, the challenge of the “knowledge society” is to encourage its agents to learn and develop new knowledge, using available information, and this will in turn create new information usable for others, through a dynamic learning cycle.

In this sense, information can become a tool for dialogue and debate, enabling users to take decisions for collective action. A group organized around a common project can become a “learning community” (Brown et al., 1989), within which a continuous learning process mobilizes information and produces competencies. The learning process is based on the assumption that no one knows where they are going and there is no pre-defined solution. The stakeholders are involved to learn and build the solution together. Encouraging such learning is always a challenge and there is no recipe. However, different theories provide a better understanding of these processes. We explore some of them in the following section.

Information and learning processes: theoretical perspective

Information as part of a knowledge cycle – Learning, in psychology studies, is seen both as a cognitive process (acquiring knowledge) and a behavioural process (changing behaviours/practices through a trial and error process, learning in action). Learning can be formalized in a cycle, such as in organizational studies or knowledge management theories (Reix, 1998; Rivoire, 2004) where information becomes knowledge as it is internalized, and knowledge becomes competency as it is appropriated. In our sense, competency is the capacity to act according to a given situation and to decide what knowledge to mobilize in this situation. Figure 1 represents this cycle. It is important to understand

FIGURE 1 – Information and the knowledge cycle (by the authors, inspired by Reix (1998) and Rivoire (2004))



the components as being part of a common learning process.

Information is an important element of this knowledge cycle, and can be used in different ways, implying various learning processes:

- 1) At the simplest level, an individual receives information and acts accordingly, almost by reflex.
- 2) *Information that is internalized* by an individual, becomes knowledge, and can then be used later to carry out actions.
- 3) By reflecting on the result of these actions, the individual will learn to adapt his knowledge to the situation, developing competencies. He is then capable of *giving meaning to the information* available.
- 4) According to his needs in a given situation, an individual can *search for information* from his environment to help guide his action.
- 5) An individual can also *create new types of information*, if none is available which fits his needs. For this, he needs some vision of what information he wishes.

In these different processes, there is an increasing interrelation between the actor and his environment, which frees him from existing information and enables him to produce the information necessary to his action. It is through this process that adaptation or innovation capacity can be created.

Learning loops theory helps to explain the complexity in the relationships with information according to the works of Bateson (1972) for individual learning or Argyris and Schön (1996) which formalizes group learning processes. Single-loop learning occurs when new knowledge is acquired and transformed with the aim of improving a process. Double-loop learning goes further: new knowledge is used to gain a new perception of issues and problems, leading to a new way of solving them. More recently, some authors have added new loops (Romme and van Witteloostuijn, 1999): zero-loop learning occurs with a direct transfer of information, which does not imply true appropriation by the actors. In triple-loop learning, a group redefines itself and new collective frameworks, especially for learning together, which often gives them the possibility to challenge social rules or dominant paradigms and introduce new ones (Foldy and Creed, 1999; Turcotte et al., 2007).

This theory enables the actor to understand what type of information may be necessary in a given situation and what competencies the individuals or the group must build or mobilize to be able to act. In the case of a well defined project, single-loop learning is sufficient for carrying it out and the actors need *codified information* to build their knowledge and competencies from which they can suggest new *adapted information*. But when current strategies are not working, the actors need to define new ways of acting and new values. For this, they need information to build a common understanding within their group so they can interact more effectively.

We call this *framing information*. In a less well-defined project where there is a situation of uncertainty, as may occur in sustainable development, it may be necessary to develop triple-loop learning, to find new frameworks for thinking. And for this, actors need to be able to explore and build new information. We call this *exploratory information* is often based on *comparative information*. We will discuss these aspects in the next part.

Learning to use and build information within projects – Actors will mobilize different types of information, depending on the outcomes expected for their project, which will help them learn together and carry out the project. How to empower actors so that they are capable of using available information? How do they know what kind of information they need in a given situation? How can we encourage them to gather new information when necessary?

In our experience, these questions can be answered by understanding how the production of information is integrated into the learning process. There are two key questions: what information is needed for the project? And who is involved in the production of information?

In situations of uncertainty, actors' needs may change and require constant redefinition throughout the life of the project. Identifying this information is all the more difficult if power relationships are involved: all actors do not have the same interests or willingness to share information. In many situations, not only in developing countries, civic exclusion of a part of the population is a reality. The relationship with politics are crucial in many projects (Pasquier et al., 2007).

These issues raise the question of ethics. The concept of "citizen science" "recognizes individuals as authors of their decisions and capable of thinking or having control over their actions, whatever be the time and situation" (Bouilloud, 2000). This choice presumes a situation where knowledge production is democratized, within a "cognitive democracy" (Ghora-Gobin, 1993). The guiding principle is that no population should be excluded from the discussion around the project and that everyone should be able to participate in the design and choose how they wish to be involved. In concrete terms, the discussion is open to all and continuous throughout the project cycle.

Many donor institutions now base their programs on management theories (Dearden et Kowalski, 2003) which describe four steps of a project cycle:

- involving the actors
- helping the actors define a project
- implementing the project
- assessing the project and defining new orientations for the project

Each step corresponds to different learning dynamics, and therefore, requires different types of information. Empowering stakeholders to mobilize information is inseparable from enabling them to develop learning dynamics

TABLE 1 – Learning dynamics and information

Step	Learning dynamics	Type of information
<i>Involving the actors</i>	Actors must feel involved in the project and accept to engage in it with other actors (<i>double-loop</i>)	<i>Framing information</i> : helps understand other points of view (language, context, etc.)
<i>Defining a project</i>	Once the group exists, the actors must develop the consciousness that they want to do a project, choose a direction, build values together (<i>double-loop</i> ; <i>towards triple-loop</i>)	<i>Exploratory information</i> : evolution, tendencies, visions, wishes
<i>Implementing the project</i>	Actors must develop the competencies to implement the project, by acquiring knowledge (<i>single-loop</i>)	<i>Codified and adapted information</i> : technical information adapted to the context, laws, regulations
<i>Assessing the project</i>	Actors must be capable of evolving, making a critical assessment and learning from it (<i>triple-loop</i>)	<i>Comparative information</i> : before/after, this project/other project, meaning

during the process. This assumes that the conditions for this learning have are known: which actors, what type of facilitation, in what context, etc. In this process, information is both a condition to the learning and a result of the learning: if the appropriate information is available, it can enhance the learning, and through learning, the actors will be able to seek more information they need for their project. Table 1 presents step by step the dominant learning dynamics and type of information that is necessary for each step of the project.

The link between production of information and the learning process was studied in the Farmer University project, discussed below. This case provides useful insights on how to characterize the learning process and its impacts.

Case of a Farmer University in Brazil

The Farmer University aims at developing the capacities of community leaders in a territory of the semi-arid region of Brazil. Information, in such territories, raises some particular issues. Often, social and economic information is the monopoly of traditional elites, who still politically dominate these regions. Adequate agronomic information is available for the more productive zones but non-existent for this region. Moreover, local knowledge retained by the communities is often ignored by the banks and technical advisory services who impose their views.

This training project, situated in a marginalized region with many excluded actors, aimed to reinforce the capacities of local stakeholders by helping them to produce their own knowledge within their own projects. Projects were classified as territorial projects, individual production projects or collective service projects. We will analyze this experience to bring some practical perspective on the following questions:

- What was the role of information in the learning process?

- Was the actors' capacity to mobilize project information strengthened?

UniCampo: organization of the learning process –

At the beginning of the year 2000, several institutions, including universities in Brazil and CONTAG (the National Agricultural Workers Union), started discussing the project of a Farmer University for Brazil. The objective was to train rural actors to enable them to combine professional integration, sustainable community development and involvement in local public policies (Caniello et al., 2003). The idea was to develop a network of initiatives, federated around common principles. In 2003, CIRAD and the Universidade Federal de Campina Grande (UFCG) implemented a pilot project, "UniCampo", (short for Universidade Camponesa), in the Cariri territory, in partnership with several local organisations.

The Cariri territory was chosen because UFCG already had several contacts with local organisations, with which it was able to establish partnerships to implement UniCampo. This territory comprises 31 municipalities, covers an area of 12.260 km² (20% of the Paraíba state), and has a total population over 190,000 (SIT/SDT, 2008). Cariri is located in the semi-arid region of the Northeast (Figure 2) named *Sertão*. It has long been representative of a traditional agricultural land system based on large *fazendas* or plantations. Production was formerly based mainly on extensive cattle breeding and more recently, on cotton. The great land owners (known as *coloneis*) dominated the economic and political arenas and most of the population was employed by them as agricultural workers or as land tenants.

After the cotton crisis in the early 1980s and the failure of intensive irrigation systems, most land owners abandoned cotton. A nonconflictual land reform occurred progressively, opening spaces for family agriculture. However, intensive use of soil and deforestation of the forest cover of the semi-arid region has led to extensive soil erosion and subsequent land degradation. The Cariri is now one of the territories considered to be most threatened by desertifi-

FIGURE 2 – The Cariri territory in the Northeast region of Brazil



The pilot course, which lasted for three years from 2003 to 2005, was put together progressively in three periods, and adjusted step by step to meet the students' demands. The first period (in 2003) enabled the participants to become aware of the mechanisms of underdevelopment that affect the semi-arid region. The second period (in 2004) was centred on training through research (analysing situations in the Cariri). The third period (in 2005) encouraged individual and collective development projects and adapted technical and practical training to the needs of each project. Projects ranged from individual hen raising, to collective gardening with women or introducing haying to many farmers in the territory.

After this pilot course, plans were made to implement new courses

based on the same principles. To draw the lessons from this first experience, a doctoral research project assessed the learning dynamics and their impact on the students and on the development of the territory (Coudel, 2009). Several projects have been undertaken after UniCampo, with a similar philosophy, both in the Cariri territory and in other territories. However, UniCampo was the most ambitious program, and we will therefore focus our analysis on the learning dynamics and impacts which occurred during this first pilot course.

Based on the same principles, a doctoral research project assessed the learning dynamics and their impact on the students and on the development of the territory (Coudel, 2009). Several projects have been undertaken after UniCampo, with a similar philosophy, both in the Cariri territory and in other territories. However, UniCampo was the most ambitious program, and we will therefore focus our analysis on the learning dynamics and impacts which occurred during this first pilot course.

To assess the learning dynamics after the course, different methods were used: interviews with all the actors involved (students, teachers, partners), group reflections, or the use of tools such as collectively constructed branch diagrams to analyze what factors most influenced the learning (Coudel et al., 2009).

This assessment shows that as a result of the progressive planning of the course, the learning dynamics were adapted to the needs of the students and different types of information were mobilized. During the first period, the students, from different backgrounds and geographic areas learned to understand each other's realities, exchanging information on respective activities and cities. The teachers brought general information, including historical and political information, which generated questions and enabled a discussion on development models (such as the green revolution model). Both these dynamics contributed to define new values within the group, similar to a double-loop learning process. In fact, the students created an association after this first period, consolidating their group identity.

- Seven key questions guided the process:
- Who are we?
 - What resources do we have?
 - How do we use these resources?
 - How can we use what we have more effectively?
 - What project do we want?
 - How can we implement the project?
 - How can we manage the project?

The second period continued this dynamic: the research process enabled the students to search for information on their territory and produce new information,

TABLE 2 – Learning dynamics at UniCampo Farmer University and information mobilized

Period	Learning dynamics	Type of information
PERIOD 1 <i>Involving the actors</i>	Students discover each other and exchange, as well as they learn to discuss with teachers (<i>double-loop</i>)	<i>Framing information</i> : mapping the territory, field visits
PERIOD 2 <i>Defining a project</i>	Research projects to understand their territory and define how they want to act (<i>double-loop</i>)	<i>Exploratory information</i> : methods for research, main issues in the territory (social, environmental, educational, cultural)
PERIOD 3 <i>Getting ready to implement the project</i>	Actors must develop the competencies to implement the project, by acquiring knowledge (<i>single-loop</i>)	<i>Codified and adapted information</i> : Visits to farms to understand techniques, technical writing and statistical analysis, project assessment
AFTER TRAINING <i>Towards new projects</i>	Ex-students discover the other organizations of the territory and must learn to act with them (<i>triple-loop</i>)	<i>Comparative information</i> : information about other projects, networking on agroecology

adapted to their needs, in order to define their own project, individually or collectively. This information allowed them to explore the possibilities and define what they wished to do. This consolidated the double-loop learning-the project being a way to make their new values come true.

In the third period, the students expressed a need for competencies to develop their projects. They wanted technical information (for example, how to milk goats or how to raise hens), but also methods on how to write up their project results (for example, technical writing and statistical analysis). They initiated a single-loop learning process, to implement their projects. They were able to use information produced during the research process which was adapted to their own context.

After the UniCampo course, the students continued to share amongst themselves and to undertake new development projects in the territory thanks to the the association that they had created. During the process they became aware of other organizations in the territory and had to consider how they would interact with them. Eventually, this may lead to triple-loop learning, in which the students would define new frameworks for acting in their territory in relation to other institutions. For this, the ex-students need to develop a capacity for critical analysis of the information they receive on other projects developed in the territory and learn from others' experiences.

When the UniCampo Farmer University capacity building process is analyzed with the learning loop theory (Table 2), it is clear that each period featured specific learning dynamics, similar to a project cycle. The teachers were careful to always encourage the students to not take anything for granted, to look for the information they needed and to produce new information that would be required for their projects. Information and knowledge production was an important part of the learning process, but did it prove to be usable and useful for the actors after the training?

Importance of the information after the training –

The post-training assessment also included evaluation of the actors' capacity to apply what they had learned during the training to their every day activities (Coudel et al, 2008). Interviews were carried out with the students and the local organizations of the Cariri territory and different interactive methods (cognitive maps, card games, diagrams) were used to assess the different types of learning that had occurred and how this was used by the actors.

The information and knowledge produced was indeed usable-the actors emphasised how much they had used it for their projects. The knowledge was understandable since it had been created and internalized by the actors, themselves, through interactions with the teachers,. The seven key questions had an important role in determining this usability; because the actors created new knowledge for their own projects, it was relevant and well adapted to the context. Moreover, the information was usable not only for their personal projects, but also for their communities. Many students tried to pass on their knowledge to others.

The knowledge created has also equipped the actors to engage with other organizations (associations, administrations, unions), and to involve themselves in local and territorial policies. In fact, this knowledge gives the actors a new legitimacy, as it appears to be legitimate knowledge. This legitimacy is both internal and external. Since the actors produced this knowledge, they consider it as valuable and worth defending and promoting for their own projects, for their community projects (for example, convincing their neighbours) or for the territory (for example, in negotiations on local policies). And since UniCampo became quite recognized as a result of the pilot course, the other actors of the territory also considered the knowledge produced there as legitimate. However, the other territorial actors did not always want to recognize the students as legitimate to act more widely with this knowledge and often considered they should have limited themselves to their own projects.

Indeed, this learning process has introduced change. It has fundamentally changed the way actors carry out their projects, introducing a new way of perceiving and creating knowledge and enabling new forms of interaction between actors. For example, ex-students who became technicians can no longer consider themselves as holders of 'universal' knowledge, but discovered that they need to build this knowledge jointly with the farmers based on the farmers' practices.

Ex-students trained to question conventional modes of knowledge transmission have encountered some problems getting involved in development organizations: they are either simply not hired because they are seen as potential disturbers of the established order; or they do not have the opportunity within the organisation to make use of this new methodology, which often leads to frustration. This reveals the limits of individual empowerment and the need to consider another training target: territorial organisations.

The knowledge, created within a cohesive group, was linked to the creation of new values (double loop learning). The students did not always realize this, and often, when trying to discuss new knowledge with neighbours or with other organizations, they were frustrated because others could not understand it, as they did not share the "founding" values. Spreading the information and knowledge outside the initial group and making it understandable by others is still a challenge. This is where understanding better the conditions which enable triple loop learning would be important.

Discussion and perspective

Sustainable development requires innovation; innovation requires relevant and useful information. Our hypothesis is that information can only be useful and useable if information production is linked to capacity building in a shared learning process.

The learning-loop theory formalizes how information can be best adapted to enhance the learning processes. To avoid utilitarian projects without perspective, reflexion about paradigms and values is necessary. This corresponds to triple loop learning, defining new frames for common action. Double and single loop learning are necessary to define collective group values and competencies that contribute to an effective project. And, to do so, it is necessary to also apply simple information (zero loop).

At UniCampo, information has been an important element of the learning process, promoting change and dialog to empower actors and develop capacities to identify or to produce relevant information. In fact, the learning process was not only an educative process. There was also an objective of change, to use these capacities to build new projects that more effectively contribute to sustainable development. The challenge is to mobilize both capacities and information in projects.

To enable this interaction between information, capacity building and action, the learning process at UniCampo was organized around three projects:

- A territorial project to encourage the actors to define a social consensus towards sustainable development;
- Individual projects to enable practical involvement of every actor in the territorial project, by inventing new forms of production and new activities;
- A collective project to invent new forms of governance and provide services (credit, technical assistance) to translate the territorial project into collective actions and eventually in public policies

UniCampo provides an interesting example of how information production can serve learning dynamics to enable development processes, both among the farmers involved in the project and within the overall Cariri territory. In 2009, an extended campus of the UFCG was built in the town of Sumé, after a strong lobbying campaign by the students, local politicians and the teachers of UniCampo, bringing long term institutional change to the territory. Moreover, the student association, now an NGO, is often mentioned by local organisations and also by governmental institutions, such as the Ministry of Agrarian Development, as a success story of how family farmers can bring their voice to the political arena.

Nevertheless, some limitations of the UniCampo project can be identified. To enhance territorial development, the learning process should better interact with the territorial governance process, so that the students are not isolated from the other actors in the territory. The lack of interaction with the actors in charge of territorial policies has been highlighted in various assessments. The political elite, legitimate because elected, is only marginally interested in an alternative process that could question its dominance. In this context, it has already been quite a challenge for the students to defend their collective vision and their territorial project within the wider territorial forum, in order to share those projects and mobilize resources from existing public sources of support.

The students may have produced usable information at UniCampo, but its usefulness often depends on the context. This recalls Sen's theory on capabilities (Sen, 2003): to act, an actor needs more than capacity, he also need opportunity. Information may seem appropriate, usable, relevant, but it can only be useful if the actors have the capacity to use it and if their environment offers them the opportunity to use it.

References

- Argyris, C. and Schön, D. 1996. *Organizational learning II: Theory, method and practice*. Reading (Mass): Addison Wesley.
- Bateson, G. 1972. *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*: Chandler Press.

- Bazin, F. and Cardim, S. 2003. Plano de Desenvolvimento Sustentavel para o Cariri Paraibano, PCT MDA-FAO, Campinas.
- Bouilloud, J.P. 2000. Sciences sociales et demande sociale. Pour une méthodologie. *Sciences de la société (Production scientifique et demande sociale)*, 49: 167–178.
- Brown, J.S., Collins, A. and Duguid, P. 1989. Situated cognition and the culture of learning. *Educational Researcher*, 18(1): 32–42.
- Caniello, M. and Tonneau, J.P. 2006. A pedagogia da universidade camponesa. *Rede de Educação do Semi-Árido*, 1(1): 11–29.
- Caniello, M., Tonneau, J.P., Leal, F. and Lima, J. 2003. *Projeto Uni-Campo: pela Universidade Camponesa. Campina Grande*: UFCG.
- Coudel, E. 2009. *Formation et apprentissages pour le développement territorial : Regards croisés entre économie de la connaissance et sciences de gestion. Réflexion à partir d'une Université Paysanne au Brésil.*, Thesis: Montpellier SupAgro, 386 p.
- Coudel, E., Rey-Valette, H. and Tonneau, J.P., 2008. Which competencies and learning facilitate the involvement of local actors in territorial governance? The example of a Farmer University in Brazil. *International Journal of Sustainable Development*, 11(2/3/4).
- Coudel, E., Tonneau, J.P. and Piraux, M. 2009. Formation, compétences et territoire : enseignements de deux expériences de formation pour le développement territorial dans le Nordeste du Brésil, *Entre projets locaux de développement et globalisation de l'économie : quels équilibres pour les espaces régionaux ?*. LXVI Colloque Association de Science Régionale de Langue Française, Clermont-Ferrand, France, 06-08 juillet 2009, ASRDLF: 19 p.
- Foldy, E.G. and Creed, D., 1999. Action learning, Fragmentation, and the Integration of Single-, Double-, and Triple-Loop Change. *The Journal of Applied Behavioral Science*, 35(2): 207–227.
- Foray, D. 2004. *The Economics of Knowledge*: MIT press.
- Freire, P. 1974. *Education for critical consciousness*. New York: Continuum International Publishing Group.
- Ghora-Gobin, C. 1993. Crises de la ville et limites de la connaissance théorique. Pour une conceptualisation de la mise en œuvre. *Sciences de la société*, 30: 171–180.
- Gibbons, M. 1994. *The new production of knowledge: the dynamics of science and research in contemporary societies*: SAGE, 192 p.
- Grossetti, M. 2000. Sciences et “demandes sociales” au tournant du siècle. *Sciences de la société*, 49: 3–10.
- Hall, J. and Vredenburg, H. 2003. The Challenges of Innovating for Sustainable Development. *Sloan Management Review*, Fall: 61–68.
- NSB -National Science Board. 2010. Science and indicators 2010 <http://www.nsf.gov/statistics/seind10/>.
- Pasquier, R., Simoulin, V. and Weinstein, J. 2007. *La gouvernance territoriale. Pratiques, discours et méthodes*, Collection Droit et Société, Vol. 44. Paris: LGDJ, 240 p.
- Petit, P. 1998. L'économie de l'information au crible des théories de l'information, In: *L'économie de l'information. Les enseignements des théories économiques*, Petit P. (ed.), Paris: La Découverte et Syros, 341–406.
- Reix, R. 1998. *Systèmes d'information et management des organisations*. Paris: Vuibert.
- Rivoire, G. 2004. La compétence, résultat de la connaissance inscrite dans les processus. *JDN*, http://solutions.journaldunet.com/0404/040423_chro_bpms.shtml.
- Romme, G. and Van Witteloostuijn, A. 1999. Circular organizing and triple loop learning. *Journal of Organizational Change Management*, 12(5): 439–454.
- Sayago, D. 2006. Territorio do Cariri/PB Relatório de trabalho de campo, IICA SDT/MDA, Brasília.
- Sen, A. 2003. Development as capability expansion, In: *Readings in Human Development*, Fukuda-Parr, Kumar S. (eds.): Oxford University Press, 3–17.
- Turcotte, M.F., Antonova, S. and Clegg, S. 2007. *Managing learning societally*, Les cahiers de la CRSDD, Collection Recherche, Vol. 14-2007. Montréal: Université du Québec.
- Veldkamp, A., Van Altvorst, A.C., Eweg, R., Jacobsen, E. Van Kleef, A., Van Latesteijn, H., Mager, S., Mommaas, H., Smeets, P.J.A.M., Spaans, L. and Van Tripj, J.C.M. 2009. Triggering transitions towards sustainable development of the Dutch agricultural sector : TransForum's approach. *Agronomy for Sustainable Development*, 29(1): 87–96.

Contact Information

Emilie Coudel
UMR Innovation
CIRAD-INRA-SupAgro
FRANCE
E-mail: emilie.coudel@cirad.fr

Jean-Philippe Tonneau
UMR Tetis
CIRAD
FRANCE
E-mail: jean-philippe.tonneau@cirad.fr