

Learning-by-changing in R&D activities

**A comparison of three R&D platforms
of an Agronomic Public Research Institute.**

Giovanni PRETE

PhD Student in Sociology of Organization
INRA and IEP-CSO Paris, France

Marc BARBIER

Researcher in Organisation and Sciences Studies
INRA - Paris, France

Contact

INRA SAD-APT, Bat EGER,
78850 Thiverval Grignon, France

Tel. +33 1 30 81 53 56

Email: barbier@grignon.inra.fr

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1. Introduction

Analysing the way organizations respond or not to external pressures for change has always been one of the major questions of organisation theory and one of the key issue of strategic management. Several works have focused on the way organisations react to contingencies such as the nature of the activities carried out or the market strategy chosen (Burns et Stalker 1961, Lawrence et Lorsch 1967). One issue in OT is to understand how organisations respond to external pressure for change, when at the same time their activities are embedded in a cultural and historical situation which entails norms, routines, competences and external relations (Blackler, 1995; Nicolini, et al., 2000; Gherardi, 2006) and which thus can not be changed easily if one do not pay attention to practice-based activities. This observation, which holds for many types of organisations, is becoming all the more justified and somehow “tricky” when one looks at organisation that are “knowledge intensive”, and particularly with organisations of scientific production. In such a research context for Organization Studies, the proximity and affinity of practice-based approaches with science studies represents a direction that we want to keep exploring after others (Miettinen, 1999).

The role of knowledge in organizations has been largely stressed in various literatures focusing on firms and administration and has been reasserted with the focus put on innovation in Knowledge society and the place of organization knowledge creation as an intangible asset (Nonaka, 1995). The reification of knowledge in commodities or in asset as in managerial tools has issued much considerations and debates about Learning in Organization and Organizational Learning (Huber, 1991; Easterby-Smith et al., 2000). Based on seminal ethnographic work of situated activities or systems of practices, the practice-based approaches have certainly brought novelty in the way knowledge and knowing have been considered and studied as something else than asset and commodities while paying attention to workplace, ordinary practices (Gherardi, 2000 ; Nicolini et al., 2003; Gherardi, 2006).

Shifting from Organization Studies about firm and large administration to inter-organizational arrangements or small organizational units of public service activities represents also a programmatic issue in order to reflect on the agentic properties of management settings in-between organizations (Barbier, 2004). Moreover, this perspective about organizational settings becomes particularly interesting when activities of Public Research organizations are concerned. Entities such as laboratories open to innovation, boundary organizations or platform of techno-scientific activities tend to develop “research collectives” as organizational

feature (Laredo and Mustar, 2004). This movement echoes what has been described as a Mode-2 regime of interactions between Science and Society (Gibbons et al, 1994).

Managing the scientific organization and the large variety of research practices inside organization and at its border is certainly becoming more and more complex when the growing and multiples effects of 'reverse communication' are transforming scientific activities according to new criteria of social robustness (Nowotny et al., 2001: 245-246). This difficulty is increased when they are exposed to societal controversies that have been particularly developed towards agricultural sciences during the last ten years (GMOs controversies, food scares, BSE) and they have great effects on the structuration on regime of innovation in agronomic research and scientific knowledge production in this scientific area (Agerri et al., 1998). Moreover the "Mode-2 discourse" is definitely becoming fashionable for normative discourses about the way scientific activities should be discussed and framed in a democratic order. It corresponds to a narrative that contributes to the building up of justification context for R&D activities re-engineering (Tell, 2004).

Consequently the Mode-1 / Mode-2 framework seems to undermine the necessity of analyzing the social and political dimension of regime of knowledge production in historical terms (Pestre, 2003) and its materiality meaning here the using of technical skills, of idiosyncratic instruments (Shinn and Joerges, 2002). Whereas the present governance of knowledge society tend to render the science studies critics of yesterday into positive discourses, some more comprehensive sociological approach of how new organizational settings of Public Research enact changes in the definition, the design and the organization of experimental activities is needed (Barbier et al., 2004; Barbier et al., 2005).

In this perspective the notion of boundary work is particularly relevant to capture the nature of those activities. The concept was first proposed in science studies with the view to analyse discourses and scientific practices attempting to demarcate science from non science (Gieryn, 1983). Star and Griesemer (1989) developed the concept of "boundary-object" in order to account for objects that facilitate the communication between different social worlds in scientific enterprise. In political science, S.Jasanoff and D.Guston have lately promoted the analysis of how certain type of new organisations (like advisory committees, science foundation or innovation agencies) act as boundary-organisations in the sense that they serve as mediators between policymakers and research systems and help to resolve agency problems in between. The concept of "Boundary organisation" is now largely used in various works having an interest in the organisation of scientific activities (Hellstrom and Jacob 2003). In the study of agricultural activities, it has already been used to analyse the United

States Extension Services and their role as intermediaries between Agricultural Scientists, Producers and private or public fund providers (Cash, 2001).

The scientific issue at stake is thus to look at pressures for change in an Organizational Learning perspective, which considers that changes in organization are the results of normative processes entailing more and more project management and “projectification” of the firm (Midler, 1995). Thus, our communication will not tackle the classical question of the implementation of a project in a given context of economic or institutional change. Instead, it will focus on an analysis of the practices of “projectification” taking place in three experimental units open to their local or global environment. It supposes to consider this particular context as relevant to consider the dynamics of knowing and learning in organization when those dynamics are institutionalised, matters of legitimating discourses that relay on intellectual production. It draws on a field study of a scientific department of the public agronomic research institute for agriculture, food industry and environment (INRA) considered in relation to the wider context of change in the public sector of research in France. Our purpose is to take into account the effects of normative discourses on the way research organisations reflect on the way they “should be managed” and “should change to adapt to their environment”. Thus, we will try to develop a practice-based approach of the effects of such institutional injunction on strategizing with the definition of activities.

2. Methodology

The introduction of the Project-Based Learning (PBL) as a scientific issue has been presented by DeFillippi (2001) as fuelled by at least four perspectives or even traditions in the sense that epistemological references and intellectual backgrounds deals with seminal insights towards a pragmatic approach of human action, action of the “people” in the field of enquiry and action of researchers in this field (action learning; action sciences, action research, emergent learning in COP, reflective practices). In our attempt to tackle with PBL as a scientific issue to be explored in organizational context we are associating two perspectives. On one side we are close to action-research perspective in the sense that we are – as researcher embedded in the organization under study- taking part to the reflection and animation of the “projectification” of R&D platforms. On the other we are adopting a classical comprehensive and empathic approach of actors at the work-place in order to reflect on those situations where project management and learning are associated in managerial discourse to enhance change with positive return on organization performance.

Our empirical enquiry is based on the comparison of three Agricultural Experimental and Research units which belong to the same research department in a Public Research institute. These three units are embedded in very different rural and agricultural environments that bring contextual variation to our enquiry. The policy of this department has consisted in the last four years to promote and support a change of orientation for these three units in order to have them shifting from a status of experimental centres to what has been labelled 'R&D Platforms' more dedicated to partnerships and co-construction of innovation in context. This change is still a matter of discussion at many levels and functional sectors of this public department, and these three situations represent three different experiences to be compared.

The people working in these three centres (researchers, engineers, technicians and people of administration) are therefore living in a period of change which has consisted recently in a process of knowing and learning from their own context since they have been asked firmly to propose a project for the entire organization. Each project has been discussed, reviewed by a scientific external commission. After this period of rationalization of future activities in texts and of opening new perspective, time has come for enactment of "New way of experimenting and conducting experiments and applied research" with a tendency to promote innovation within new networks of partners for rural development as described by Eshuis and Stuiver (2005).

Starting during this period of project implementation, our empirical work has consisted firstly in a sociological account of how some people took part in the collective writing of the texts of those projects. A second empirical investigation has been dedicated to a sociological survey with about 20 persons in each of the three situations, some of them being stakeholders and partners of the activities of these three 'R&D Platform' (Brunelli et al., 2005). While analysing this corpus of interviews we have tried to focus on the description of the past design of activities and on the "projectification" of new organizational patterns of experiments and research in innovation process (Saari and Miettinen, 2001). We focused more specifically on the sense that was given to learning in the new organizing of activities within the light of each project. Our purpose is here to interpret the way people give sense to this period of "peripety" (Engwall and Westling, 2004).

Crossing these two approaches (one based on text building analysis, the other on a sociological survey), these materials allow us to analyze how people are linking changes in the definition and design of activities with expression of learning and training. The three situations under study allow thus to compare different projects of organizational settings of

R&D activities and to develop the idea of Learning-by-Changing crossing absorption and reflection concepts developed by Scarbrough et al., (2004). Keeping on with a comparative perspective of various projects within a same organization (Barbier, Cerf, Barrier, 2005), we attend to deliver evidences on how changes in public service agricultural R&D is also a redefinition of the kind of capabilities and collective expertise that a R&D platform may be made of, including the networking with partners and stake-holders as owners of issues for the research agenda.

We are going to present firstly some historical backgrounds and textual analysis of the policy of Experimental Settings of this research institute in order to understand how the notion of “R&D platform” is made available within the SAD research dept like a sense-making narrative (Deuten and Rip, 2000). “. Then we will propose a comparative description of the three Experimental units paying attention to the coordination of experimental activities and to the boundary work realised within their environment with actors of rural development. This will lead then to analyze a Formal Learning school that has been lately propose to technicians of the SAD dept. in order to help then to re-think and restructure the experimental activities and settings of Experimental unit in order to adjust to the “R&D Plateform” definition. Looking at this process of learning-by-changing which raised a lot of problems for actors of experimental units, one of which being the transformation of their activities under the injunction of discourse of changes toward a Mode-2 science/society co-evolution, we deliver some key salient issues emerging from the comparison and from the overall process in a PBL perspective.

3. Some historical and institutional background of the Experimental Disposal in INRA

The understanding of present situation of Experimental Unit in the SAD dept. requests the presentation of some historical backgrounds¹.

Carrying experimental activities is one of the historical missions of the INRA. The necessity not to separate research and experimentation for agriculture and food production was to be achieved as one of the main justifications to create a sector oriented research institute independent from the University system in 1946. Nevertheless, the function and place of experimental activities has long been a matter of debates within INRA. At stake has been the

¹ We mobilize here some institutional literature and reports about INRA, Cranney (1996). INRA - 50 ans d'un organisme de recherche, Paris: INRA Editions., and Aumont et al. (2002). Unités expérimentales. Rapport de mission, INRA.

question of the extent to which research activities should be oriented toward applications and should respond to the demands of farmers and food producers. One interesting way to look at the way this question has been treated is to analyze the transformations of the missions that have been attributed to the “Experimental units”.

During the 70’s a policy of integration of Experimental Units was initiated, and many contractual workers have been integrated within the public sector while a national commission to improve the management of experimental units in INRA was created. This change accompanied the institutionalisation of a difference between Experimental Units (EXpU), which were supposed to be directly related to scientific enquiry of Research Unit or Research programme, and on the other side the Experimental Settings, which were supposed to be less autonomous and more dedicated to deliver biological resources directly to a Research Unit.

In 1988, in relation to evolution of occupation policy in the public sector and in 1992 with the creation of a national commission of Experimental unit (CNUE), a discourse of efficiency and development of ExpU was established in order to “*develop the identity of Experimental units, develop responsibility and managerial competencies, increase efforts of modernization and re-structuring, develop experimental means and tools for distributed use and improve the procedure of resource allocation*” in Aumont et al. (2002: 40). During this period, which corresponds to a deep transformation of agronomic sciences with the generalisation of biomolecular genetics and various kind of biotechnology, former Experimental Units and settings became a matter of rationalisation. A typology of Experimental Units, still in use today, was defined at that time:

- type I Experimental Unit with an agricultural vocation meaning realization of experiments in a farm context and therefore a complex management of farming resources and experimental disposals;
- type II Experimental Unit as outland unit (like greenhouse or animal house) completely dedicated to scientific enquiry with large protocols;
- type III Experimental setting as specific experimental disposal closely linked to laboratory and dedicated to its research activities.

Within the development of a national policy for ExpUs, the managerial architecture of ExpUs has been standardized with a tendency to detach ExpUs from local orders or local scientific life and consider them as a common resource for experimental science. During the early 2000’s INRA have been exposed -like other public research institution- to a trend of reform. The General Director of INRA redefined the missions of the so-called “*experimental setting of INRA*” and tend to rationalise experimental activities according to three aims in relation

with the European Research strategy: 1. to implement scientific protocol and product matters of research while managing and conserving biological resources; 2. to realize agri-environmental observations and experiments, particularly within operational network or research networks; 3. to develop research and experimentation in relation to agricultural development and food industry. From 2001 to 2004 all INRA departments concerned with ExpUs had to organize reflection and mobilize people in or around ExpUs in order to develop a response to this national challenge, this policy concern about 3 600 agents directly (see table 1) and it is massive in terms of direct and indirect effects in terms of Human Resources management within a context of a public sector of research under pressure in France.

Table 1

<p>Number of Agents in Experimental Unit Experimental Installation in INRA (2001) 3 600 agents are working in Experimental Unit of Experimental Disposal in INRA. 40% of those agents are working episodically within ExpU or ExpI which represent an amount of time of 20% Full-Time Equivalent. 3 Exp U in the SAD dept. with 75 agents directly involved</p>

4. “Projectification” of R&D platform : the SAD department response

In response to the corporate injunction to rationalize the experimental disposals, the policy of the SAD department², which is oriented towards action-research, technological support to innovation and human development in agriculture, has consisted in the last four years to promote and support a change of orientation for these three experimental units in order to have them shifting from a status of classical agronomic experimental centres to what has been labelled ‘R&D Platforms’. The use of this term indicates that those ExpUs should be more dedicated to partnerships and more embedded in their context. This policy is explicit in the 2001/2004 Strategic Document of the Department’s Scientific Board :

The three ExpUs of the SAD dept have developed an original way of functioning, which is consistent with the issues of the dept, and this allows us to call them ‘Platform of Research-Development’. The aim of these “platforms” is to analyze, to enhance, to empower innovation in technical systems [of farms]. They are the symbol of the involvement or INRA in dynamics of innovation, producing and testing innovations by themselves, particularly in the domain of cattle breeding and crop production, while proposing a recognised expertise for regional territory and agrochains. Those platforms of R&D are offering researchers of other Research Units (within or outside INRA) an

² The Department we studied is called “Science for Action and Development” (SAD). It is in charge of carrying research on agricultural systems at the level of the farm and the production area. Its particularity is that it gathers people having a life science background (mostly agronomists) together with social scientists (mostly sociologists).

“anchorage in the reality” which is necessary to succeed in finalised scientific field studies”. Strategic Scheme of Department, March 2004, p.21.

Ideally, a “platform of R&D” has thus been defined as entailing four characteristics:

- Strong relationships with the economic actors at the local and national level allowing for the co-construction of innovation programs.
- Realisation of systemic experimentations as opposed to analytic experimentations
- Elaboration of a scientific project in line with the Department research axes, with a quadrennial evaluation
- Human resources able to interact with Scientists on more fundamental issues.

The realization of the “projectification” of “R&D platform” has been launched in each ExpU. Changes at stakes in that perspective are still a matter of discussion at many levels of this public department. Texts describing the project of the Exp.Unit have been elaborated taking into account the Strategic Scheme of the Department but they also are closely linked to their specific context since they but also with they have been constructed with partners and external researchers (from the SAD dept., from INRA or outside INRA) who are interested with the activities of each ExpU.

From 2004 until today the realization and forthcoming evaluation of the “projectification” of R&D platform is at stake. Our study has been realized in relation to this context (see chronological table 1) and certainly affected by it. Nevertheless, processing the studies and delivery of results in a final report was absolutely not framed within a formal and normative procedure of evaluation.

Table 2. Chronological table : context and survey

Events in the field of enquiry	Our empirical work	Chronology
Triggering a national reflection on the future and renovation of the experimental diposal of INRA		2001
Report about all ExpUs of INRA		June 2002
The SAD chief dept. ask SAD ExpUs to reflect on their activity and to establish a of research-development promoting partnerships with stakeholders of rural development		2002
Phase of formalisation of project towards ExpUs dedicated to Research-Development (the future R&D plateforme project s)		End 2002
Phase of validation of Project between the chief of Department and the Chief of ExpUs, the Scientific Board of the SAD dept. is validating “R&D plateforme” projects.	Participation to discussions about the R&D Plateform in 2 ExpU	2003
The Strategic Scheme of SAD dept. is announcing the existence of a “R&D plateforme” policy		March 2004

Phase of external evaluation of "R&D platform project"	Negotiating the research study with a group of Master students	End 2004
	Surveys in 3 ExpUs and part. Observation in one ExpU	Dec. 2004 to Feb. 2005
	Discussion of the final report with the chiefs or the ExpUs	Spring 2005
General Assembly of the SAD Department – A focus on experimental activities in ExpUs is promoted and a Technical School is announced		May 2005
Technical School for technicians of all the Units of the department (45% from ExpUs)	External Follow up with discussions	June 2005
A Groupware for technicians	Submitting a communication to OLKC conference	2006

5. Experimental units as boundary-organizations

If the definition of what constitutes a boundary organisation varies among scholars, it has the advantage of underlining the importance of those organisations in charge of circulating of norms, knowledge and objects between different activity systems. Within the INRA, the "Experimental units" can be considered as boundary-organizations. Indeed, in a context that has been dubbed a "Colbertist Production Regime" by Historians of Science, the mission of ExpUs was to realize boundary work between Scientific and Research activities in the Institute and Agricultural economic actors. The ExpUs were encouraged to develop links with the organizations of their environment directly involved in agricultural activities, and to facilitate at the same time the transfer of scientific results to various technical and extension organisations funded by the Farmers and their associations.

Since the 1990's, several evolutions have rendered those traditional missions harder and harder to fulfil. The "agricultural production model" that framed the organisation of the Agricultural Research and Development system until then has been hardly questioned. In the same time, there was an increase of the research carried out at a genetic and molecular level that marginalized field experimentation as a necessary step in agronomical research. As a result, in France as elsewhere, the research priorities of the agricultural sector public research have been redefined with much paradox. The INRA has been urged to keep on contributing to the economic welfare of the country by responding to the need of agricultural economic actors and paying attention to the applicability of research results. In the same time, it has been asked to pay attention to a broader "public" comprising the food industry and the "public interest" and to develop unprofitable research and innovations, while having an interest on

ethical and environmental issues. Finally, the INRA has had to adopt a policy of “excellence”, which is encouraging its members to publish in international papers and to develop scientific networks in Europe.

In 2002, an internal evaluation report on the Experimental Units in INRA underlined the difficulty for ExpUs to take over their missions. Indeed, adaptation to those new missions entailed an important change in the nature of the Boundary work to be achieved. Firstly it entailed a broadening of the partners with which the ExpUs were supposed to be related to: not only the representatives of the professional organisations supporting a “modernised” and industrialised model of agriculture, but also organic producers’ representatives, or environmentalist associations. As we shall see, developing privileged relationships with actors having different –and sometimes opposed- visions on the rural development is a complex process. Secondly, it entailed a redefinition of the experimental priorities, calling into question the routines and working habits constituting the concrete action-systems of Experimental Unit.

6. Coordinating experimental activities and setting relationships for boundary work

The analysis of discourses gathered in the textual agency (Cooren, 2004) of various papers describing the « R&D platform policy » or the R&D project themselves on one side, and the social agency gathered in interviews on the other side, leads to put emphasis on two important organizational aspects of this shift towards R&D platforms –the coordination of experimental activities and the relationships with external actors and stakeholders of ExpUs- and try to contrast the three ExpUs under study.

Table 3.

	Main Production System studied	Nb of technicians	Nb of engineers	Nb of administrative
ExpU A	Greenhouse Vegetable production (Tomato factory)	18	3	3
ExpU M	Milk-cow breeding and cropping hybrid production system (axis 1) and recent development of organic farming experiments (axis 2)	18	5	4
ExpU S	Cattle-breeding and cereal cropping system, biodiversity and ecological management, environmental planning	16	6	2

6.1. Platform of R&D and the coordination of experimental activities

Within the SAD, the pressure for change concerns three ExpUs with very heterogeneous and different characteristics. Outlining some of those will allow us to show that for each EU, becoming a “Platform of R&D” brings up idiosyncratic difficulties.

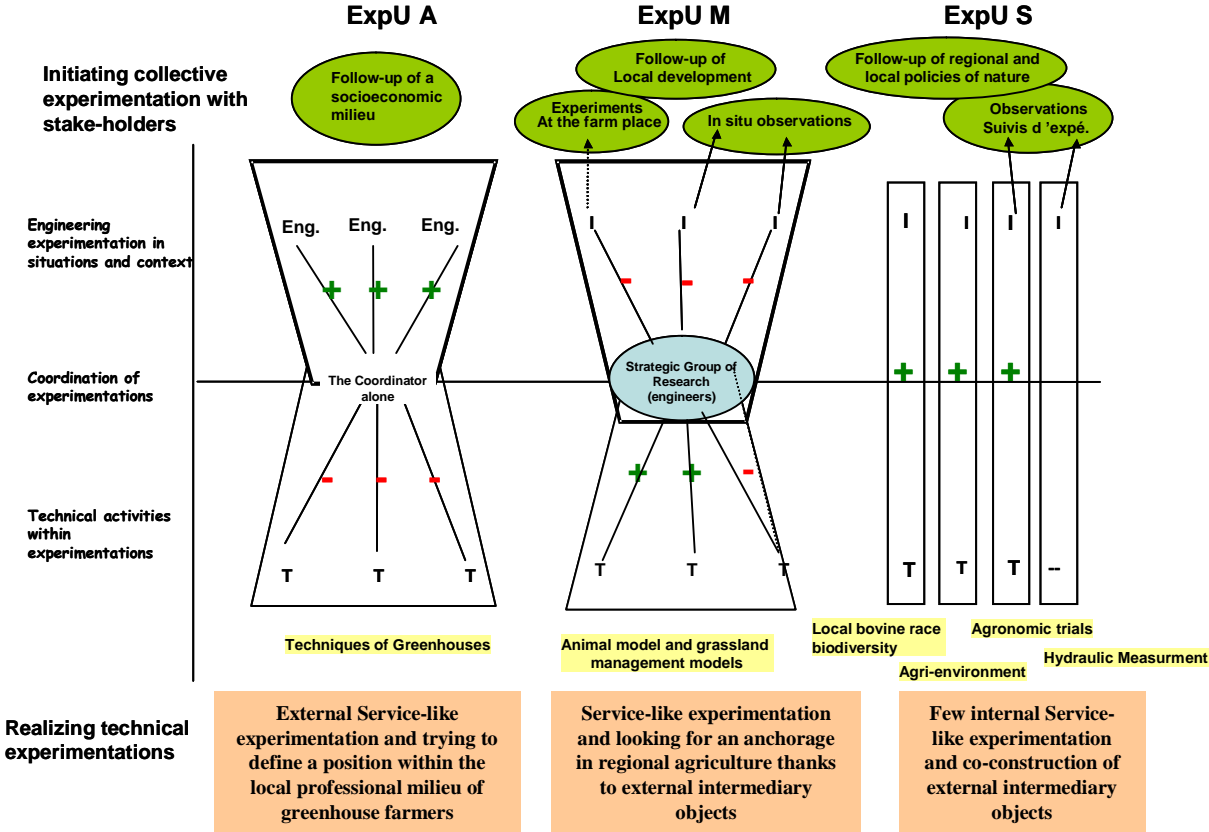
Table 4. Some elements of comparison between ExpUs

	ExpU A	ExpU M	ExpU S
Where do the experimentations take place	Inside the ExpU	Partly inside and outside the ExpU	Inside (for one program) and mainly outside the ExpU
Motivation characteristics of technicians	Motivation problem due to collective and monotonous work and feeling a lack of career perspectives	Good motivation due to work variety and to a challenging project with organic farming	Good motivation due to large working autonomy
Who coordinates the experimentations?	One technician in charge of the experimentations	Every engineers within is experimentation program	One technician in charge of the Experimental Unit
Where does the budget come from?	Mostly from the selling of the experimental production + research programs	Selling of the experimental production + Research allocation + Research Programs	Selling of the experimental production + Research Programs

In ExpU M and ExpU A both cases, engineers are managing “their” project in an autonomous way, thus their work is not subdue to a hierarchical approbation of the chief of Exp U. In ExpU S, engineers are also autonomous, but in this case there is not so many relations between them.. In ExpU A, technicians are forming a unified group, and this is reinforced by the fact that they are not affected to particular programmes but to technical tasks defined and planned each week. The same kind organization “by technical tasks” prevails in ExpU M. Thus, in ExpU A and M, the relation between experimental conducts and research programmes request a specific co-ordination taken in charge by a coordinator. In both cases, the status and role of the coordinator of technical task is characteristic of the design of experimental agronomy (it used to be called the “chief of culture”). In ExpU M the coordinator has done all his career in the ExpU starting from a position of technician while in ExpU A, he is “new” and is much more attached to the world of engineers than that of technicians as in ExpU M. In both cases, the coordinator is having power in a relational sense, a situation which denounced in between the lines by engineers. The organization is different in ExpU S where technicians are in general affected to a project run by a specific engineer, a situation which requests thus no general coordination of technical tasks. During the negotiation of the R&D Platform project, coordinators are key obligatory point of passage to

frame the possibilities of shifting towards new kind of activities. has been a. It is to be noticed that in the case of ExpU M, the coordination of experimental programmes is a matter of discussion within a group made of engineers and assistants of engineers. We represent the situation prevailing in the three ExpU in the following scheme 1.

Scheme 1. A comparison of the coordination of experimental activities



6.2. Relationships with external actors and stakeholders of ExpUs.

We previously insisted on the possibility of analyzing the experimental Stations like boundary organisations. Indeed, if the Experimental activities realised in the ExpUs are carried out to satisfy the specific objectives of the ExpU project, they must also meet aims shared with external actors that are not necessarily rationalized within the project and may be despite the project. Thus, experimental activities entail important exchanges of information, material, and ideas between the ExpUs and their environment.

The kind of partners involved in those relations and the patterns of those relations vary and characterize strongly the studied experimental units as being muddled by the relation to their environment. Thus, we can expect that those relations influence the way technicians and engineers have been translated their practices in the “projectification” of R&D platform. Consequently, we can characterize the external relationships of each station and doing so, we

will pay a particular attention to the relations involving the two kind of actors traditionally considered as the obvious partners of the agricultural public experimental stations: Research actors and agricultural economic actors (producers associations and firms).

Relationships with Researchers

The Scientific Board of the Research Department SAD asks the engineers of ExpUs to publish in reviewed journals and prompts the Scientists from the Research Units (ResU) to set up Research Programs involving ExpU's members (and thus quoting them in authorship). In that context, one could expect strong collaborations between the ExpUs and Research Unit's researcher. Yet, an empirical investigation of the concrete actor systems involved in experimentation activities show that collaborations between ExpUs' actors and ResU's actors are all but obvious and are very heterogeneous.

In the ExpU A, Engineers are maintaining relations with Research actors that are rather unstable and slender. Their first work is to take into account the relevance of their experimental activities for economic actors. Participations in collaborative scientific settings implying Research actors exist but are rarely proactive, and are punctual and opportunistic. The main interest that ExpU Engineers declare about the nature of collaborations is the opportunity to publish with scientists. But at the same time, to get involved in a collaborative relationships with Research actors is said to be problematic by those engineers. They consider that the « basic scientist's » questions are not relevant and « disconnected » with what is important for the producers and for greenhouse production.

« It is often difficult to collaborate, because they (the external Scientists) have not in mind the crops cycle. Those cycle are essential on the way we work. We have spring programs, autumn programs...whereas they, they would not try to give their results according to those cycle, what interest them is their article. » An Engineer.

Interviewed on the kind of relationships that could be developed within a project of R&D Platform, the ExpU A's agents express their difficulty to know what should be the basis for such collaborations and how it would be possible to make it interesting for the scientists to work in the station.

In the ExpU M, the situation is rather different. Engineers consider that their experimental activities have to be integrated with external scientists of national research programs.

« The station must 1) understand the questions raised by the environment 2) transform those questions in scientific issues and be able to transfer those research issues to other scientists » An Engineer.

For long, many research activities have taken place within this ExpU itself since it was previously composed both of an Experimental Unit and of Research Unit in the same place. Today, the agents of ExpU M feel that the R&D orientation towards organic milk production is quite uneasy to put in practice since this shift has stirred up the interest of external scientists, but has not led yet to any concrete collaboration. They are all the more sceptical since numerous external scientists had been invited to the meeting organised in the ExpU to reflect on a R&D platform project.

«We made a Tour of France of the ResU which worked on questions not too remote from ours.[...] We met ResU, some evoked the relevance of converting the station to organic farming.» Engineer.

Today, relationships with scientific actors occur essentially within one well-defined and long-lasting program, which entails experimental activities outside the station on water management.

The case of the ExpU S is more ambiguous. There, as in the ExpU A, the relationships with the agricultural economic associations are considered as very important. But in the context of the progressive taking into account of the environmental issues, the engineers try now to take into account the expectations of the local economic actors, of the environmentalist associations and of the Research partners when elaborating the experimental programs. Like in the other ExpUs, engineers express a difficulty to set up partnerships with external scientists, considered as too « disconnected from the agricultural reality ». But the orientation towards the treatment of environmental issues and naturalistic observation tend to create a link between local issues and European programmes which link together the local and the global, and natural resources and biodiversity management to European Research network on ecological issues.

Relationships with actors of Agricultural organizations

The ExpU A has always had frequent and very formalised relationships with Farmers Representatives, Technical Institute, Extension services through experimentation agreements, outsourcing activities. The large majority of ExpU A workers are expressing the importance to take into account the interest of the producers and of the agricultural economic organisations and they expect their experimental programs to be helpful in this respect.

« We are closely linked with the station. The INRA for us, it is the Station. We have very few contact with other Experimental or Research centers (...) [the Expu A] is a considerable asset for the region and for the fruit and vegetable production”. A technical advisor of a producers’ organisation.” Technician of local economic farmers association.

The fact that the INRA's ExpU A has a quasi-monopolistic situation in terms of greenhouse experimental capacities in the local region is supporting the possibilities of such discourse. This proximity with the agricultural actors is strengthened by the funding structure of the Experimental unit. Half of the budget of the station comes from the selling of its production (tomato) to a local marketing company. As a consequence, the experimentation must allow for the production of tradable products which respects the market standards. During the interview, the ExpU A's agents expressed their fear that becoming a R&D Platform would compel them to move away from tomato producers' interests.

In the ExpU M, relationships with the agricultural economic actors are less formalized and less important. Contrary to the ExpU A, the ExpU M possesses no monopolistic experimental capacities in the region. The Agricultural chamber or the Producers companies can rely on other organisations to meet their need of experimentation results. The potential agricultural partners of the ExpU M have underlined that they meet difficulties when trying to assess the experimental capabilities of the "recently re-conversion of the ExpU to organic farming". For them, the ExpU support is especially useful when they have –mostly because of regulatory pressures- to elaborate legitimizing discourses on more sustainable agricultural practices (for instance when they have to enrol the producers in a more sustainable nitrate management system). Interviewed on how they view their relationships with the agricultural economic actors within a project of R&D, the ExpU M members express their desire to take into account the need of the producers. But this wish is less central than in the ExpU A, and, so far, has had no concrete outcome.

« On that topic I have no clear vision, I do not know on which basis we can set up collaborations with the producers. We have had discussions between us on that topic, but without any result. We are here...it is a very important issue of this project...an issue whose treatment has not been satisfactory. » An engineer

Historically, the ExpU S has developed links with agricultural organisations on agronomical and cattle-breeding issues. Those links continue to exist and are considered as very important by the ExpU workers. But they are based on few individuals who will shortly be retired.

Other collaborations are more recent (since the beginning of the 1990s), the ExpU S has broadened the scope of its partners. It has a privileged and very formal relationship with an association whose aim is to promote the conservation and development of a race of cow, the *Maraîchine*. It has also stated less formal collaborations with environmentalist associations such as the League of Birds Protection (LPO). Those new directions are not always positively

evaluated by the agricultural economic organisations and it is certainly create a state of tension.

Co-ordinating boundary work in ExpUs

In each ExpU of the SAD Research Department, relationships with the « environment » have not the same characteristics. Those relationships do not involve all the agents of each experimental unit. They rest on a limited number of actors, who mediates the relationships with the external environment. The pattern of this mediation depends strongly on the experimental capabilities of the stations and on the internal relationships between technicians and engineers (see a synthetic comparison in table 5).

Table 5.

	ExpU A	ExpU M	ExpU S
Privileged partnerships	With local agricultural organisations, Agricultural advisers and farmers.	Axis 2 :With remote development organisations involved in water management ; Axis 1: to be defined	Mixed
Relationships between Engineers and technicians	Tensed	Tensed	Good and personalised
Links with research actors	Difficult to put in place and considered as problematic, viewed mostly as an opportunity to publish	Numerous, expected to define the activities	Existing, mixed opinion
Links with the local agricultural organisations	Intense and formalised collaborations, feeling that those collaborations could decline with the increase of experimentations on environmental issues	Few and informal collaborations, uncertainty on the basis of their development	Varying according to each experimentation program,
Who mediates the relationships with external partners?	Only the engineers	Mostly the engineers	Engineers (research) and technicians (development organisations)

The external collaborations of the ExpU A are essentially mediated through Engineers. The technicians are in charge of the monitoring of the experimentations, which are almost all realised within the station's domain. They rarely participate in the exploration of partnerships or in the diffusion of experimental results. In the ExpU M, the external relationships also rest

on the Engineers and the Director of the station. The technicians working in the Experimental Unit have very few contacts with external actors. In those two ExpU, the relationships between engineers and technicians are not direct. They are mediated through a person in charge of the realisation of experimental activities. In the ExpU S the situation is different. Indeed, technicians are as much involved in external relationships as the engineers. Both technicians and engineers realize most of their activities outside the station's domain. Technicians and Engineers develop close relationships within separated experimental programs. Engineers take in charge the management of the programs and set up collaborations with the agricultural economic organisations and with the Research Units. Technicians take in charge the relations with local economic organisations and producers. .

7. Toward a classical configuration of Organizational Learning

7.1. The Technical School of SAD dept.

The “projectification” of R&D platforms has been analysed according to a comprehensive approach of the coordination of experimental activities and of the mediation of boundary work towards researchers and stakeholders. During the year 2005 the SAD dept. organised its General assembly (more than 150 persons during a 2 days convention with plenaries and groups) in order to explore the conditions under which the Strategic Scheme should be implemented. During this convention an emphasis was put on the technical aspects of research activities and the future development of Experimental units was clearly evoked. Some months later, and as a consequence of the identification of an uneasy feeling among the group of technicians and engineers, a technical school was organized for technicians of the SAD dept., among whom almost 50% are coming from ExpUs.

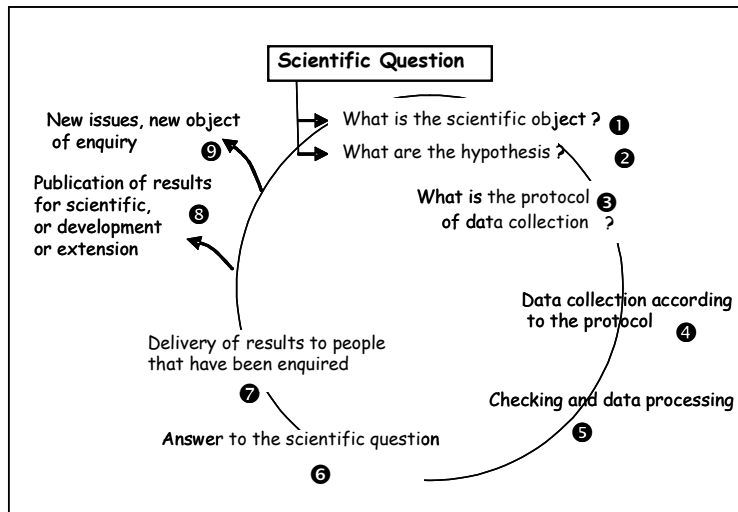
It is to be noticed that the kind of problems identified during our empirical work as been recognised by the chief of ExpUs, though they did not agree necessarily on some part of our analysis. The organization of a Technical School was clearly addressing some of those problems and aiming at identifying ways of approaching the new activities of in situ observation and surveys to be realized outside the ExpU directly in farming context. In this section we analyse some of the papers and slides presented during this school which was organized on the basis of plenaries and group sessions. The chief of SAD dept. was present and active during this “School” and some engineers also contributed to deliver their knowledge about *in situ* surveys.

7.2. Technicians are back to School!

For this communication we shall deliver a quick overall and preliminary look at the content and discussions of some of the key elements that have been presented as rather Formal and authoritative knowledge in a classical stance where technicians were facing engineers as somehow teachers.

The figure 2 is reproducing the scheme that has been presented by the chief of SAD dept. to the technicians in June 2005 as an overall introduction to the “Technical School”. It was accompanied with a discourse aiming at introducing the idea of a reinforcement and/or redefinition of skills and object of experimental activities due to the shift from classical ExpU to R&D platform.

Scheme 2. The wheel of scientific production based on in situ technical enquiry and surveys



Translated from JMM-June 2005

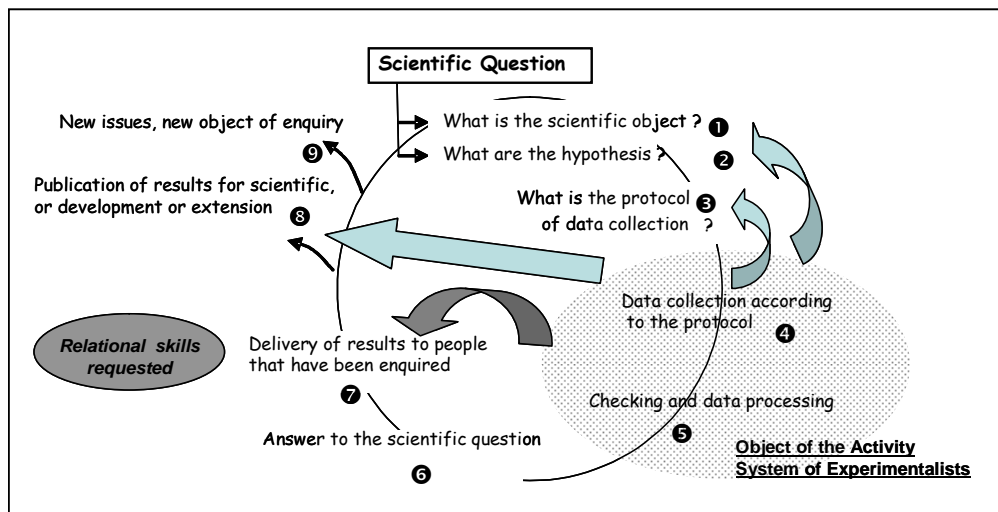
The discourse was in fact based on a classical and formal description of the routines of experimental science in agronomics in the form of a wheel of scientific fact production, but enlighten with consideration about a agronomy discipline, largely based on concepts developed by the French agronomist M.Sebillotte³. The presentation was purposely presenting the flux of those routines in a quite linear process as it is often presented in scientific articles, routines that request protocol observations and data collection in controlled experimental settings of ExpUs, but also *in situ* (meaning outside-the-ExpUs) with protocols of data collection in fields, forest, landscapes, and all kind of targeted environment related to farming

³ In this scientific tradition, the agronomist is focusing on technical activities and their effects through time on living productive and organized entities (cropping field, farming system, regional space) within a natural and physical milieu and resulting from decisions taken under constraints by farmers.

practice. But the discourse of the Chief Dept. wanted also to address, with the same scheme, the issue of *in situ* surveys and enquiries based on observations and discussions at the farm place with farmers or advisors of extension services but also environmentalists, naturalists, users of nature, or even consisting in delegating the description of technical activities to farmers.

This new context of experimental conducts is requesting new skills in order to go beyond the formal and theoretical assignment of function and workplace of technical activities in scientific production. Based on the “wheel”, our figure 3 intends to indicate the overflows from the normative stance of “experimental activities” that are necessary in order to realize experiment in practice.

Figure 3.



Adapted from JMM-June 2005

On one size technician are having skills that are in some contingent ways mobilized and often silently mediated in the definition of protocols and even in upper stream in the definition of hypothesis and objects; they are also mobilised in making sense of data according to their level of reliability. On the other side the open up of experimental settings to *in situ* surveys and observation in R&D platforms is questioning the existence of capacities and skills in ExpUs to face the socialization and embeddedness of scientific data production, not only because the making-of-scientific-data is becoming thus social and somehow political, but also because thinking technical activities situated in a R&D platform requests thus relational skills in everyday experimental activities (including reporting afterwards about what was done with previously collected data) with the view to carry on general goals of embeddedness in local rural society and assuming a neutral position towards the variety of stakeholders about

new innovation regime in agriculture (environmental issues, biodiversity, political critics of life science and the like).

Moreover, in addition to this underlying prescription of new skills, one must underline that discourse which accompanied this kind of “wheel of scientific production” was also included considerations about the necessity of adjusting precision, relevance and reliability in processing data for scientific proof establishment, advocating for usual consideration about the practice of experimental data collection and processing in agronomic science.

7.3. Elements of debates emerging from the technical school

Being a technician from INRA means also to carry a lot of paradox and ambiguities of scientific and technical practices in a risk society and assuming the Mode2-bis orientation that was evoked in discussions during the “technical schools”. Those discussions have followed systematically the formal and authoritative type of presentation of “how to realize in situ agronomic surveys” in plenary session and groups. Texts, slides and either kind of communicational tools have been assembled in a Groupware dedicated to the Technical Schools and more generally to the discussion of issues that had been pointed out during the 3 days of this school⁴.

Table 7. Issues emerging during a debate

- | |
|---|
| <ul style="list-style-type: none">• the fact that “old technicians” have many skills that are lost when they retire and the claim that those skills and knowledge from experience should be elicited to new comers;• the fact that when shifting the experimental stance from ExpU to in situ observation and delegation of traceability and description of technical acts to farmers is raising different and new problems of reliability of data collection and thus question the simplicity of the “Wheel”;• the fact that the SAD dept. is supposed to have a specific area and culture of scientific production within INRA that tend to promote complexity and emerging problems within is difficult to marry with more regular and classical experimental design that define the kind of normal scientific experimental activities in general at INRA level ;• the fact that exploring complexity and emerging problem may also lead to classical experimental conducts and that in that case technicians have to exist in two epistemological areas: one reductionist and the other constructivist;• The fact that being in contact with actors in rural space – and not only farmers- is creating new area of responsibilities for technicians when they are in contact with actor that are waiting from results and advises directly from the “authority of science”;• The fact that co-producing or even co-constructing data or protocols with actors of extension service or engineers of Technical Agricultural Institute raised difficulties and tension in the appropriation of knowledge and intellectual property of scientific results. |
|---|

⁴ It is to be noticed that we have had personal exchange with the organizer of the Technical School during its preparation and we also delivered the factual report we have realised thanks to the survey on the three ExpU.

- The fact that some technicians are expressing quite clearly that they want to keep being technicians and not to turn into some kind of ethnographer or field social technicians since in situ observation with relational skills is explicitly convoking a shift in occupations and activities at the work place.

Many months after this technical school it seems that the forum of this Groupware is not used. The discussion of the Chief Dept.'s presentation raised questions and threads of debates. What happened during this Technical School looks like the enhancement of collective learning-by-reflection (Scarborough et al., 2004) grounded in each situation of R&D platform project. All these elements of debate clearly indicate that technicians are expressing considerations that do not refuse the redefinition of their practices through normative scheme of experimental conducts but tend to identify a set of various considerations about their own identify in ExpU in relation to the desired new identity of R&D platform. Doing so they tend to make the task of managing the shift from Experimental Unit to R&D platform much more complex and certainly more demanding.

8. Discussion

Knowledgeability and temporality

Practitioners of experiments express their own difficulties to enter in a Formal Learning perspective. We interpret this as phenomenon a problem of “knowledgeability” of their own situation *hic et nunc* which is at the same time retroactive and prospective, reflexive and injunctive. Moreover, eliciting this knowledge means the reorganization of the flow of practices that defines the reality and materiality of ordinary life at work. But they can not stop every activities, think about their future, define a common goal, re-engineer every thing and then work again in the R&D platform: while their activities are changing, the show must go on ! This is what we call here learning-by-changing. As pointed out by Dougherty (2004) there is a type of organizational knowledge which is located in the ongoing actions and interactions of practice. It seems to us that when organizational change is imposed by institutional injunction, the manageability of practices with the view to mangle ongoing action and interaction in a certain direction seems problematic, and convokes possible situation of double bind.

In our case study we are completely up-side down in comparison to the international literature, since Agronomic research is, in many respects, born and has developed itself as a

sectorial space of knowledge and innovation in the so-called today Mode-2⁵. So then, the issue with the “projectification” of R&D platform is clearly inscribed in the Mode-2 perspective and legitimization of change and of the activities that are supposed to define new activities at the boundary of ExpUs. We rather suggest that this attempt looks like aiming at establish a kind of Mode-2bis, where the co-evolution of science and society has also to be a mode-1 for the reason of excellence in science-making (publish or perish!), and it has also to respond to economic demand of farmers and their organizations while facing at the same time - and within the same area of legitimating discourse- the questions raised by controversies about life-science and biotechnology. The network of those different strategic areas tend to make the enactment of new practices of R&D platform particularly difficult when practitioners of experimental settings have to face the injunction of change to confront and render classical agronomic experiments into a Mode-2bis including boundary-work with farmers, stake-holders for environment protection and territorial policy-makers. There is a paradoxical injunction in that this kind of multiple boundary-work must, at the same time, fit with the production of “excellent” scientific knowledge.

Professionalism and managerial orientation of change

This tension is extremely high in the local agenda of ExpUs and in all cases either reluctance or desire for change or is associated with a demand to maintain or to re-define a real professionalism. What is meant there by many technicians and employees of experimental work is nothing else that this injunction for change has a managerial flavour. We acknowledge here for the same constitutive tension between the managerial work and the professional work within the transformation of UK public sector in medicine, social work and education. Exworthy and Halford, (1999:125-130) suggest to analyze and to ascertain the nature of change in professional-managerial relations to consider three dimensions: the *abstract dimension* dealing with the conceptual and ideological aspects of bridging professionalism and managerialism in public sector; the *collectivity dimension* referring to the social structuration of profession/professional and management/manager; and the *individual dimension* dealing with the practices and identities of practitioners at workplace and in their careers. Those analytical dimensions are coherent with our preliminary results in three cases. In each case this tension is at work and regulated by key reluctant or innovative actors of the

⁵ In France at least, but we reasonably presume that this is much more common in many countries see Cerf et al., (2001).

R&D platform, a regulation enounced by an actor but which is much more the enunciation of a local compromise toward a certain orientation and the result of the capacity of a collective to make sense, in different ways and also contexts, of the managerial injunction for change.

Injunction for change and the ongoing practices

These three cases represents an exemplification of the same injunction for change towards what was labelled “R&D platform”, and in each case the question of articulating managerial purpose in relation to wider changes in French public research with the making up the identity of a new organization – thus with new practice, sense-making and sociality is at stake. In all the cases discourses of practitioners about the R&D platform are stressing the importance of the level of discourses and thus the performative and agentic effect of the “projectification” as it was issued in a written project with issues, targets and procedures. As pointed out by Gustav and Clegg (2005:28) the rhetoric in use that stresses the role of learning is certainly recognized and mangled with the purpose of constructing the “*appearance of having capabilities that demonstrate ‘fitness for the knowledge age’*”. But, the voice of the employee is still calling at the back of the stage for professionalism in practices and training for boundary-work. The situation stands very paradoxically for the people of these ExpUs who had always been thinking themselves in what they did not know yet as a Mode-2. A second paradox relays in the fact that becoming a R&D platform calls for some specific and perhaps very new practices of activities realised in experimental settings at the boundaries of form experimental facilities.

Postmodern shift and bureaucracy

The kind of learning we have explored in this paper is radically linked to the project form as an organizational pattern which is also a managerial institution with elements of bureaucratic and hierarchy through responsibility even though it has been popularized as postmodern and radically new (Clegg and Courpasson, 2004). In the world of science the project-like form of organization is central to the way empirical investigations to solve a problem is structured in time and space. Researchers of all disciplines define what they do as corresponding to “research project” that represent also the organizational entities which aggregate resources, skills, ideas, theory and goals. But, perhaps because of this ordinary way of organizing knowledge production in practice, French research organization are far from being post-modern as far as the project management type of organization is concerned. As institutions it

would be much more realistic to see them as divisional and disciplined by the scarcity of resources and the constraints of bureaucratic principles of the Public sphere. But the changes of the French system of public research has introduced the project-like-form as a relevant level of internal mobilization and external lever for control of many organizational unit of research activities (from the most local – the team- to the most global the department or sector of research). There for in this context the capacity and also ability to design, enact and self-evaluating organizational project at those various levels is becoming an art of science management.

In this context of institutional change Project-Based learning is becoming very complex, crossing processes of knowing and learning at the heart of research activities and processes of knowing and learning at the heart of the institution of research. The interdependency of this two level is of course a political issue about the control and the professionalization of public research activities. This is this complexity which we want to keep exploring in a specific area of scientific knowledge production – *id est* agronomic knowledge- and in a specific organizational context.

8 .Conclusion

A focus on project-based knowing and learning requests to think comprehensively about practices in projects within a framework that includes the structuration character of organizational learning (Berends, et al., 2003). A problem raised by the exploration of learning processes in PBL is the fact that project management is having a much higher level of isomorphism in-between firms and organization – even if organizational settings for project management have their particularities- than have the organizational contexts in which projects take place. Thus, is the comparison of interplay between PBL and organizational knowledge always methodologically difficult because of contingency, and even though in a comprehensive approach of PBL. In our three case studies, the influence of prior knowledge and institutional backgrounds on the way the “projectification” is at stake in Exp U is determinant. When PBL is a matter of learning-by- reflection within the Technical School one can notice that the identity of occupation and the sense of what makes the project is putting at the first place.

Relaying on the works developed on the fact that OS entities are becoming intermediary-object of management of innovation with OL purposive effects (Swan et al., 2002; Gustav and

Clegg, 2005), it seems relevant to question the management of experimental activities in our context since those activities are shifting from the classical experimental settings to more decentralized and situated experimental activities in context of rural development. When daily work in groups tend to be conduct in loosely cohesive team of work and often muddled by bureaucratic and local strategizing the possible reification of Community of Practice has to be balanced with consideration about the specialization of skills and the specification of task in time and place (Lindkvist, 2005). We shall take the particularity of our research context as an opportunity to reflect on this issue since it deals with a public sector research organization open to boundary work and hybrid activities under a managerial discourse of Mode-2 with injunction of scientific production and excellence in a Mode-1. As studied by Tuunainen (2005) in the case of a hybrid research group purified into two entities (public and private) the work on boundaries realized by actors in practices as much to say about the reality and the possibility of Learning-by-change in a frequent injunctive atmosphere of projectified organizations (Courpasson and Clegg, 2004).

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