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THE ECOLOGIZATION OF AGRICULTURAL DEVELOPMENT AND THE TREADMILL OF SUSTAINABLE DEVELOPMENT. A CRITIQUE IN A STATE OF TRANSITION*

Abstract

This communication tries to shape and to ground the idea that Rural Studies and Rural Sociology have a particularly promising job to do in re-assembling the Social, the Natural and the Technical within the treadmill of sustainable development. It is argued that the cross-fertilization of the ecological modernization movement and Social Studies of Science and Technology (particularly Actor-Network-Theory) is giving the opportunity to establish a perspective that might enlighten and accompany the processes of making agricultural sciences and technology more ecological. But this requires specific conditions and ways of doing social studies in situations that include those processes.

Key words: Sustainable development, Actor-Network-Theory, modernization, biopolitics.

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INTRODUCTION

Following the important account of the ecologization of agricultural policy in Europe developed recently by Deverre and de Sainte Marie (2008), we would like to develop some ideas about the parallel life of Science and Technological Studies (STS) and Rural Studies (RS) during the 90’s. Doing so, we would like to underline the fact that there are already some existing or promising relationships in the multiple senses and narratives about ecological modernization, either in its early alternative agri-food system foundations, or in the booming eco-governmentalization of agriculture and rural space.

We would like to propose the idea that Rural Studies and Rural Sociology have a particularly promising job to do in re-assembling the Social, the Natural and the Technical within what critically thinking might be called today “the treadmill of sustainable development”.

More specifically, it is argued that the cross-fertilization of the ecological modernization movement and Actor-Network-Theory is giving the opportunity to establish a perspective that might enlighten and accompany the effective ecologization processes of modernized agricultures under certain requisite deliberative conditions.

1. THE TREND TOWARDS AN ECOLOGICAL MODERNITY

1.1. The ToP

The theory of the “Treadmill of Production” developed in the late 1970’s by the Schnaiberg’s group represents the pillar of a critique of the effects of capitalism on the environment as delineated by Catton and Dunlap (1978). Capitalism was compared to a treadmill in which accumulation processes generate a demand for consumption while at the same time industrial production leads to consumption of natural resources along with the addition of wastes to the environment – according to Max Weber, until the last ton of coal. This vision assumed an equivalence of the exploitation and rejection of labour forces on one side and the addition and subtraction of natural resources on the other.

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As Buttel (2004) had shown: the relative decline of this theory during the turn of century does not necessarily mean that there is a complete denial of its potentiality. Nevertheless, the debate that took place during 2004 in Organization Environment indicates that many issues are still difficult to integrate. Wright (2004) notably pointed out two questions to be addressed to the “Treadmill of Production”; they seem perhaps even more relevant today than when proposed:

- in light of the rise of direct consumption practices or green consumerism involvement, the predominance of entering in the treadmill through the temporality of production and not consumption is an important bias;

- in light of the eco-service economy and the deployment of eco-government processes and apparatus, the idea that the environment is only to be mined for natural resources or to be used as a trash dump, does not account for the economy of recycling or industrial ecology.

It would certainly be possible to justify the critique and the idea of a new treadmill of sustainable development. The sustainable development framework is born with international convention on natural resource use and protection, and it has promoted a conceptual framework and a grounded legitimacy for a new kind of individual or collective rights in relation to environmental justice. All these new rights are closely related to the material or immaterial realities of science and technology either depreciating or healing the environment. However, the use of S&T in a sustainable perspective requires a new political space (Latour, 1993) and a re-engagement of the social consequences (Redclift, 2005) to clarify the fact that a market governance of sustainability would mean addition and subtraction of environmental justice according to a non deliberated distribution of risk (Beck, 1992).

But let’s go back in the 90’s. While delivering a review of the sociology of environment, Buttel (1996) had already established a continuity between the quite pessimistic environmental sociology movement and the forthcoming positive considerations of the « ecological modernization school of environmental sociological thought in Northern Europe », as he named it. Quoting the early work of Spaargaren and Mol (1992) (Buttel, 1996: 70) , he was pointing out that « the development of environmental knowledge and social pressures were creating a basis for deflecting the course of modernity in the direction of ecological modernization ». At the same time, Schmidt (1993) was also using the notion of “ecologization” to point out the fact that environmental policies should pay attention to the social conditions that may be favourable or an impediment to an ecologization of the economy, such an economization being considered as a new phase of the civilizing process.
The quiet conflagration of those two contrasted positions about ecologization, reflects particularly well how the Rio Conference in 1992 might have shaped, at that time, the agenda of the new political-economic regime of post-industrialised countries while internalizing, in purpose, what the environmental and neo-Marxist critiques were starting to consider as a new frontier for intellectual fights and social movements.

Concomitantly to the treadmill of production framework, the premises of the ecological modernisation were thus about to be shaped in Berlin, Netherlands and the UK during the end of the 1980’s (Mol and Sonnenfeld, 2000), and this inspiration was also found within rural sociology as a theory of non-centralised and unplanned change of social order because of environmental damages (Mol, 1992; Mol and Spaargaren, 1992). Many others also contributed to this theoretical emergence in Wageningen and Cardif (namely J.D. Van der Ploeg, H. Renting J. Murdoch, P. Milbourne and T. Marsden). Those colleagues took the establishment of environmental issues as a turning point and a set of concerns to frame a research program. It did so in relation to the definition of alternative solutions to the post-industrial agri-food system described by Allaire (1996) and the decline of the national food system linked to a national agriculture (Friedmann and Mc Michel, 1989).

The inevitability of the ecological modernisation process was then leading to a comprehensive and propositional agenda of social research with the explicit aim to develop a quest for ecological modernisation, which certainly did not mean, at that time, to take part to the greening of agro-chain strategies or agricultural policies (see notably Marsden, 2004).

Nevertheless, the early foundation of this research has possibly underpinned the role of farming techniques, of farmers’ reflexive account of ecological modernisation and what all the organisation of production means in relation to agro-chain management (see Deverre and de Sainte Marie, forthcoming). The reduction of ecological modernization to a type of alternative (local organic farming and local consumption) might have represented, for a while, an efficient framework but perhaps a counterintuitive position because what we called the treadmill of sustainable development was starting to improve its efficiency. But, it is also to be noticed that the general orientation of the ecological modernization model also contained a pragmatic promise: a constructive resistance to industrial agri-food system was also an alternative and a positive model associating very directly farm and rural development with innovative modes of food consumption, a “new rural development paradigm in Western Europe” as labelled by Goodman (2004). This is certainly why the “ecological modernization” theorizing has
somehow to be considered as continuous with the foundations of the critique of capitalism opened by the environmental sociology with the Treadmill of Production.

This “new rural development paradigm” had thus much to say and propose about how to socially engineer new paths of development with claims for more organic farming; claims for new social practices and institutional reframing involving more NGOs in governance structure and claims for the empowerment of local political élites (Mol, 2000). More recently, mobilizing the idea of a metabolic relation, some works brought evidence that alternative systems linking producers and consumers on a local scale not only represented a, so to say, political alternative but also an alternative that solved problems with the newness of the food system either because of food scares (Stassart and Whatmore, 2003) or because of market uncertainty related to globalization of the agro-chain (Lamine, 2008). The potential for exploration of the multiple benefits of an ecologized agrifood system has certainly not come to an end.

1.2. The competing narratives of ecological modernization

If, during the 90’s, the ecological modernization theory of rural sociologists has proposed a consistent theoretical framework, one could also say that it did not improve the comprehensive account of the ecological modernisation that was starting to take place within so-called conventional agriculture under local agri-environmental experiments and under the resources from the greening of agricultural policy. Ecological modernization started to include a variety of possibilities in terms of institutional arrangement of sustainable development (conventional, standards, labelling) and space (regions and nations). One has also to look at ecological modernisation as a manifestation of this profusion, and following York (2004: 355) to note that: what appears to be improving environmental performance as part of the modernisation process may not be due to a general trend toward sustainability associated with modernization but rather, due to a trend toward increased variability of environmental performance in institutions in late modernity. In this perspective, the variability makes it difficult to grasp what is really happening but the profusion represents primarily extreme cases that appear to be ecologically modernizing. This argument has to be seriously challenged because it considers ecology of knowledge and practices, which might echo our sensibility.

There are recent proposals to indicate a broad approach of the diverse rural worlds and a systematic account of pathways towards sustainability through
agriculture while also paying attention to the distributional consequences of dynamic changes in agriculture (Thompson and Scoones, 2009). In this kind of platform, the issue of ecologization is less oriented to alternative food system orientation; instead, it explores the various master frames and narratives that shape the political agenda of sustainability. Ecological modernization could mean, among other things, a rationalization process until the last acre is turned into “biofuel cropping”. The proliferation of narratives and public concerns about agriculture and rural life is certainly something to bear in mind. Lockie (2006) has acknowledged in newspapers the central role of narratives about organic food plays the double role of giving concrete answers and attesting to all types of controversial food-related issues.

Moreover, it is to be noticed in this short genealogy that over the past decade the achievement of sustainable agriculture has been a central narrative in the work of many organisations (governmental and intermediary bodies, NGOs, professional organisations and research institutions). Various political, technological or research programmes declare future targets and objectives to improve sustainability in various subsectors of agriculture (animal production, arable farming, glasshouse horticulture, etc.). Whether to develop organic farming or to develop an Integrated Production scheme, the relations between agronomic sciences, agricultural technologies and public or private expectations are at stake. This has led to claims for “slow innovation” concerning the purposes and ways of designing new technologies or new relations to old techniques. In fact, these claims indicate a need for a shift in the governance of research and innovation to achieve a sustainable future of the agrosystem for the 4 Fs: food, feed, fuel and fibres.

The competition of narratives thus does not concern only food production and the system of provision, but also includes increasing numbers of narratives concerning agriculture as a multifunctional and technological sector. The narratives also include objectives addressed to agronomic sciences in order to develop the regime of evidences that could ground the measurement of sustainable agriculture according to multifunctional objectives and globalized governance of carbon emission and storage. There is new promise in the paths for an ecologically intensive agriculture. This new promise presents itself as very technical and modernist, similar to how the green revolution had also been justified (Griffon, 2006). Brooks (2005) has suggested a stimulating comparison between the green revolution and the agri-biotechnology regime that will certainly have to be enlarged to this new narrative of ecologically intensive agriculture, possibly with GM organisms. The idea of a third Green Revolution has also been proposed to promote ecosystemic engineering based on ecological principles (Hastings et al.,
2008), and, thus, it is challenging agricultural research practices and objectives. This is not necessarily the type of challenge addressed by agroecology (Altieri, 1989); nevertheless, there are more paradigmatic and common approaches of farming practices there than with the type of Science and technology policy that has been promoted under the European Knowledge Based Bio-Economy (KBBE) for the last 5 years at least. But also, there are multiple meanings of KBBE (Coombs, 2007).

There is an asymmetric competition between different paradigms, as Vanloqueren and Baret (2009) have recently claimed, and certainly a biotech paradigm that has comfortably flourished under the CAP and consequently has locked-out agroecological innovation. One could easily feel that it could get even stronger under the new KBBE, based on innovation in molecular biology, in the use of biocatalysts and in crop breeding and management systems within sustainable objectives. It should be noticed that agroecology does not rely on the same type of scientific practices, regime of data collection or on the same type of sociotechnical arrangement to develop an innovative system, even when fibres or agrofuel are concerned. Thus as Vanloqueren and Baret (2009: 981) have announced, *This means not only a more balanced allocation of resources in agricultural research, but attention to the larger Framework that influences S&T choices.* Advances in Sciences studies and Science Policy Studies about the management of knowledge and transition in agricultural research is announced here.

With the development of a new green technology the notion of ecologization also addresses technico-industrial progress and innovation as well as political messages for governance and economic incentives for innovation in agriculture (Higgins, 2006). Looking forward, it seems then that there are different views and theoretical foundations of the ecological modernization promise. Also the debates about this notion and the competing knowledge systems that are exploring what sustainable development is are certainly providing new ways to redefine agriculture and rural development. Debates about the nature of science and technology are clearly crossing many boundaries.
2. SCIENCE STUDIES, ACTOR-NETWORK-THEORY AND RURAL & AGRICULTURAL STUDIES

2.1. ANT in the Rural

The purpose of the previous section was not to establish a full genealogy and academic review of ecological modernization. It was simply to clarify the debates about the dichotomy between Nature and Society that explicitly ground the “treadmill of production” framework and to explain “ecological modernisation” perspective had proposed to heal with alternative means. This is a limited account of technological and knowledge systems, and not much about how farmers, advisors, technical knowledge and even life sciences scientists are locking-in or even deconstructing the “treadmill” and rebuilding alternative farming practices. The opposition between the Natural and the Societal, which grounds the modernist agricultural project, appears to be criticized. But this critique does not address many Knowledge and Technical aspects despite the fact that it has brought human agency back into matters concerning environment and sustainability of agriculture.

A critique of the Nature/Society divide within the ecological modernization project has been straightforwardly addressed to rural sociologists by Goodman (1999) and also by Human geographers (Murdoch, 1997). After some scholars had started to introduce ANT methodological considerations (Arce and Marsden, 1993; Bush and Juska, 1997; Whatmore and Thorne, 1997), Goodman (1999: 17) radically introduced the ANT points of view: *agrofood studies are weakened by their methodological foundations staying in the modernist ontology* and he proposed to “renounce the methodological erasure of nature and expose its foundations in the reductionist ontology of modernity” (op. cit., 1999: 18). To frame this critique, the notion of corporeality was developed and was to be understood as a metabolic relation, which is networking in practices, settings and intermediary-objects, the “on the land” production of food and the “in the plate” consumption of food. It is also metaphorical in the sense it covers what is performed in between. Thus, corporeality also signifies *organic, eco-social processes that are intrinsic to agriculture, to food, to agro food network and the hybrid constitution of the practices in the social worlds* (op. cit., 1999: 18). However, in order to make the concept adequate to the study of agro-foods networks, the notion of “second nature” is also introduced to reify agriculture and agrosystem and to define the nature of agriculture as being *produced in interaction with social labour; and*
the corporeal metabolism that describes the nexus of food and human bodies of production and reproduction (op. cit., 1999: 18).

As Higgins (2006) has also claimed more recently, more space has to be devoted to the centrality of the non-human in agri-food studies. Also the idea that there are modes of ordering (Law, 1994) that enable us to depict strategy and to move between actors and contexts; this framework has been mobilised by Lockie and Kitto (2000) to introduce ANT methodology in agro-food studies. Following the idea that we should go beyond the open-up and closing-down of controversies about the nodes of power relations within agro-chain, we should enter a more systematic programme of identifying and analysing the resources and contingencies of modes of ordering that are building agrofood networks in relation to science and to environmental management.

2.2. Issue of the agency of non-human objects

This defence for the reintroduction of the agency of non-human object and the issues of the politics of networks corresponds to an internal evolution of debates in the STS. We would like, at this point, to make a quick jump within the debates that have surged in the STS community about the methodological problems that contains or raised the ANT perspective.

Laboratory studies (Latour and Woolgar, 1978; Knorr-Cetina, 1982) and David Bloor’s strong programme are well known for having set the place of sociology of science and technology within a symmetry principle (that could even be applied to sociology itself for D.Bloor). The SCOT model of Bijker, Hughes and Pinch (1987) has developed a very clear methodological foundation to study the expressed, voiced and vested interest of social groups in problem definition and problem solving processes that take place in innovation processes. The perspective opened by this attempt contrasts with the emphasis put by localism and integrationist studies of scientific work and laboratory life represented by Star (1995). ANT was born in the attempt made by social studies of science to bridge the human and technical agency of laboratory life and the human and technical agency of technological innovation processes in society. The concepts of translation, intermediary object, obligatory point of passage, and immutable mobiles have been used by many to give an account of the co-construction of techniques used among all players in the script of simple technical objects or complex technical systems.

ANT scholars had received strong critiques about the consequence of the equivalence principle between human and non-human in the alignment of actor-
networks. To accept that non-humans could have agency and master human action (and have been designed for that purpose) was signifying that social interests, morale issues, and all democratic discussions about science and technology would be denied or pushed outside the boundaries of actors in networks if not translated into it. For many STS scholars this “tour de force” was reinforcing the modernist forces of techno-science; it did not Bruno Latour paint the scientist as a capitalist entrepreneur of efficient theory. But, early on, Law (1992) had anticipated the possibility of this critique. Nevertheless it is true that translations that are clarified, after a long process of negotiation with multiple sophisticated arrangements, are easier to study simply because they are more “visible” and sometimes they more “noisy” when socio-technical controversies had to be closed.

Anyway, thinking that ANT means the biopolitics of the “lonesome innovator” is misleading. The semiotic of the agrochain is, first of all, a methodological framework for the de-construction and understanding of power-relations, heterogeneous human and non-human agency, functional materiality and knowledge that are illuminated in networks. For example, Law and Mol (2008) described the collapse of the technique of boiling pigswill because of the FMD epidemic in the UK. Because the technique failed on a single farm, recycling feedstuff coming from any place in the world where FMD is possibly endemic has stopped; it has triggered a large epidemic and while the debates were taking place about the origin and the management of the early stages, the metabolic economy of recycling was not considered to be very important – for much and as in the BSE case the boundaries were taken to be far more important than sharing food a bit more equally. What we mean here with this case study is that ANT is enabling more than a flat description of innovation and allows discussion about human affairs.

When one leaves the language of technoscientific networks, there is a need to explain how networks fit or not, and under what kind of local, historical determination or contingencies to the area of practice or organisational setting the actor-network is relating. Akera (2009) recently made a very stimulating methodological proposal based on a metaphoric extension of an ecological view of knowledge in order to uphold the distinction between different scales of analysis while following actors of networks at different representational scales, corresponding to historical events, social institutions, occupations and disciplines, organizations technical knowledge, skilled practices, material artefacts, and human actors, (Akera, 2009: 418).
2.3. Biopolitics of actor-networks in the Bios

After this short attempt to justify – if needed – the desirability of the ANT perspective, what is more important to notice in STS is that many recent intellectual discussions are about innovation that presumably either directly or indirectly affects the human bios itself. These innovations may be in scientific practices (biomedical innovation, stem cells, cloning techniques) or human practices that affect and are self-transforming bodies (or ideas of natural bodies); the idea of what is natural and what is not is being reinvented (the Cyborg of Harraway, 1991). When STS scholars take biomedicine and biotechnology as a matter of inquiry (either into resistance to biopower or into the pathways of innovation), what life sciences researchers or clinicians do to the human bios is frequently questioned in terms of social control, surveillance, knowledge and ethics. This also raises questions about the status of gender in debates that are partly ontological and partly political in STS. Moreover, and it is a particularly important point, the question arose regarding how STS work and knowledge could be or should mobilized in those public and political debates about governing societies with technoscience affecting the bios (the Paris 4S/EASST was clearly very much concerned by this issue).

The scientific and public issues of food scares, of GMO controversies, of animal welfare in husbandry, and lately about biosecurity and climate change indicate that the Science-Technique/Society divide was hiding the fact that the politics of Nature were also at stake within the technoscientific project. We could even say a “second nature,” to go back to Goodman’s (1999) “second agriculture”: a first Nature, for example, with locally selected seeds and with GMO as technoscientific artifacts extended from the laboratory to the farm; and a second Nature of organic products or GMO as being metabolised in the environment or in human corpus. This second nature has been at stake and a matter of controversy and regulation in the EU, whereby the US regulation had consecrated the nonexistence of it because of the principle of substantive equivalence.

Within an ANT framework we could say that domesticated animals or plants for the food supply have at least three political voices: one as represented in the human work to breed them and put them into a metabolic relation (from farm...
to plate); another as represented in the human work to select or transform their
genetic characteristics and the human agency that results from being able to
engineer changes by techno-scientific and/or breeding practices; and finally the
fact that their ways of being in rural spaces are increasingly a matter of monitoring
for sanitary and environmental advantages and, why not soon, according to their
efficient contribution to global warming and CO2 storage.

What we see here is the development of three political layers to discuss and/or
contest the performance of the politics of natures: farming, technoscientific and
monitoring practices and expertise of the Rural.

3. THE JUNCTION OF THE DIVIDES AND AFTER

3.1. Parallel lives of 2 Divides

At this point of my reasoning I would like to sketch the idea that Rural
Studies and Rural sociology on one side, and Science and Technological Studies
on the other have been evolving quite separately: The divide between Science or
Technique and Society has only recently confronted the issues of the politics of
Nature3 for STS; and the divide between Nature and Society has hidden the
politics of Technology in the ecological modernisation project as I discussed
in the first section on Rural Studies. The existence of those parallel divides is,
I guess, why ANT has been slow to find its way into agrofood studies
(Goodman, 1999: 26). As Murdoch (1997) had already proposed, a non-dualistic
and symmetrical perspective on nature and society has to be grounded with the
ANT early observations. As far as those divides are recognised and also identified
as sources of questions, problems and new scientific issues, we think that there are
two directions for social studies involved in the matters of cultivating, engineering,
transforming, managing, and governing “Nature”.

One direction is to consider that there are disciplinary ontologies to be
maintained despite the divide. For instance, after a review of the literature
of the Nature/Society debate, Goldman and Schurman (2000) confessed that
they recognise the usefulness of considering nature-culture hybrids in order to
understand the new political identities, tools and strategies of new biotechnologies;
but they concluded that «sociology remains at its best when it tries to understand

3 This is not the case of Latour (1993) and certainly many other works about environmental
controversies in STS, my views might looks like a caricature, but I find that the “bio political turn”
is recent and perhaps also very European. This should be clarified and challenged.
how new and enduring structures, institutions, and practices exploit and dominate people and nature, as well as reveal new strategies for emancipatory politics. We believe that once scholars begin to rethink the framework of the society-nature divide, other cherished but flawed ideas will also reveal their weaknesses. We hope that from this process, a new sociological imagination will spring» (op.cit. 2000: 578). ANT would thus only be an exotic trip or something like the night diary of Bronislaw Malinowski, and then Bruno Latour would be happy to say that the Moderns definitely speak for forked tongues.

Another direction is to consider that there will always be enough scholars to take care of the disciplinary pillars of academic knowledge- important because some elements of traditions are necessary to shape meaningful points of view. There is thus no intention to fight with academic knowledge. More urgent in this second direction is to take the risk of recognising the divisions that ground our modernity (Latour, 1993), and thus our position towards: (a) people who are not thought to be modernized enough and (b) our responsibility for the tremendous effects of modernity on climate and biodiversity, as the ToP might have explained it in its own way.

The "primitives of our modernity" are not defined anymore by colonial and post-colonial science. Thinking about agricultural development in terms of divides has always been raising unproductive questions. Who has to take the blame of under-development? The peasant as the technocentric and modern narrative is always doing when technology are not adopted (Handy, 2009). Who is the patient when environmental and sanitary damages are advocated as public problems that directly question the type of technological package engineered by agronomists: The farmer or the agronomist engineer? There is here a possible turn in defining what is normal and pathological for society (Mol, 1998), and there are scientific claims made by STS colleagues that agricultural science and technology is locked in a technological paradigm that tends to exclude other approaches: ecological modernization has also become a matter of the ecologization of agriculture science and technology.

But it would be too easy to trigger a science-war-game with Sokal-like hoaxes, playing one good sustainable science against another. It seems that the dynamic of S&T in agriculture could quickly find different pathways that promote the need of ecosystem engineering (Hastings et al., 2008), conservation techniques (Goulet, 2008) and financial assets based on biodiversity conservation, while at the same time supporting organic food and slow innovation. Clearly we do not
know what is going to happen though we know the many skills of entrepreneurs that lead them to take advantage of the possibility of scarcity.

At least, we are sure that ecological modernisation is having its “second nature” since the accelerating proliferation of eco-governality and ecosystem services in the past 5 years call for much more work on the treadmill of sustainable production. Moreover, the concrete sustainability schemes are frequently require participatory mechanisms in order to design more robust technology. The contestability of the promises of techno-science as well as the contestability of technologies deployed in society both call for new ways of governing the process of innovation in societies, especially when there is collective risk. The development of studies about participation and participatory design in the field of STS clearly indicates this trend (Lengwiler, 2008), either in the macro biopolitics of expertise (climate change, biodiversity notably) or in the micro biopolitics of innovative design. For social or biotechnical research in and on the rural and agriculture, participation is of course a matter of getting into biopolitics with the treadmill of sustainable development, but it is also a matter of professional attachment to the situation, place and social worlds where – through participatory programmes, scheme, project, etc.- scientists are going to get close to the materialisation of biopolitics in dispositif (Barbier, 2008).

3.2. Conditions for a junction of the Divides

So what to do with the two divides we have presented? I guess two things.

1. First of all to recognise the idea that there is a co-production of technology, nature and society; and that a ANT-like methodological approach in this co-production provides a unique flat vision of socio-technical hybrid constructs, which are controlling society in particular ways, and are grounding this controlling separate ‘natural’ characteristics (Jasanoff, 2004: 21). Pestre (2003) suggested that during the past thirty years this coproduction has corresponded to changes in the forms of regulation of knowledge production, particularly with the decline of the national states regulation system and with the intensification of infra or supra state regulation in the form of standards that operate at the international level and with the existence of international civic epistemologies.

New regimes of power-relations are then appearing within the legitimacy that the protection and value of environments had gained in discourses. It comes to the point that the notion of biopower itself has to be re-problematized (Lazzarato, 2000) since the co-production of science, nature, technologies and social order seems to have reached new frontiers with issues of global change
and sustainability. It is not only the integration of biological life into politics that matters; beyond that, the contestations and moreover the disputability (either legitimized or in civil disobedience) of this integration has produced a public problem to design policies and to participate in politics regarding bio-risks, threats, diseases, etc. This integration may define the governance of science and technology in a much more hands-on conception of biopolitics, where practitioners, regulators, stakeholders and activists do not conceal the fact that they are making history in a state of vulnerability and that irreversibility follows from decisions or non-decisions. Governmentality is certainly also starting to be driven as much by pastoral power as by what could have been labelled pastoral surrenders during the 70’s.

2. Bearing in mind this type of current post-Foucauldian and govermentality studies (Lemke, 2001; Dean, 2006), a pragmatic approach of the “use of our knowledge” in this turn is an obligation that we cannot escape. We shall not only produce ontology and methodology to get the Social Sciences right, we also must perform the re-assembling of the social, the technical and the natural. This is perhaps the condition that we have to address in disciplinary points of view such as Goldman and Schurman (2000) have delivered. And this, we cannot do from our desk.

But, there are conditions of possibility for this re-assembling in the light of our exploration of STS and RS. I mean that it seems difficult not to be present, as social scientists in the “field”, whatever the intensity of this attachment. It also seems difficult not to “invite” those who create knowledge and technologies on one hand and not pay attention to those who have concerns, ideas or oppositions on the other. Thus, the systematic treatment of the dynamics of coproduction and the re-assembling of the social, the technical and the natural is something that can take place in specific conditions and *kairos*.

This means a pragmatic and pluridisciplinary oriented programme, which many scholars of rural studies, rural sociology but also certainly many STS scholars have in mind, which consists in taking part into participatory research or projects with interdisciplinary challenges and scientific objectives, as well as political surface and stake-holders (see an example of mobilizing Interactive Technology Assessment in the case of biotechnology in Marris et al., 2008).

It also means that the re-assembling of the Social, the Technical, the Natural can only happen in defined circumstances of entering collective experiments where matters of concern and matters of facts (Latour, 2004) are simultaneously at work in specific *dispositif* or promising organizational arrangement, which might have certain properties (see Barbier et al. 2004):
to involve situations and practices of cooperative design between scientists, engineers and practitioners;

to involve a certain level of worrying without tolerance about the re-framing of occupations and identities in systems of practices (farmers, land managers, R&D engineers, scientists, etc.)

to involve a certain level of hybridity and openness in order for claims and concerns about producing “Natural” goods (first of second agriculture) to be translated.

What we mean here is that the re-assembling of the social, the technical and the natural is requesting a dense milieu of heterogeneous practices, a collective exploration of the potentiality of innovative design and of course to cross many of the organisational and institutional layers that new arising networks will cross (Joly, 2005).

In this perspective, Grin (2007) brought back the notion of reflexive modernisation from Beck (1992) and the structuration theory of Giddens to consider the re-structuration as the interrelated transformation of structure and action through structuration processes guided by the deliberated re-orientation of modernization. A reflexive modernisation in this way is not to be considered as “re-modernisation”. Bos and Grin (2008) applied this framework to a pig husbandry research project dealing with the side effects of first modernisation and trying to get out of a narrative about a successful project, to establish the idea that participatory research is possible crossing reflexive design methodology to supply the instrumental and describes the necessary institutional conditions to facilitate re-orientation of modernization. I think we could easily replace this kind of pig husbandry with any ecological experiential setting in organic farming or integrated production.

Indeed, a variety of new sociotechnical “system innovations” are coming to match – and even create – the sustainability challenges in various agrofood systems; and we know that the promotion of narrative about green technical change will not be enough to answer the challenges of civic epistemologies or sustainable consumerism. But, one must also not forget the willingness to change towards sustainable solution that is growing in agricultural R&D organizations and technical centres (Barbier et al., 2005).

The enormous challenges of sustainability (and precisely because it is an oxymoron) will also require new regulations, changes and transition management, and necessarily institutional “hybridity” (Allaire et Wolf, 2004) and reflexive governance (Voss et al., 2006; Elzen et al., 2004). Such changes and transitions are taking place at the level of systems of production, distribution and consumption and are related to societal tensions, political purposes, economic expectations
that can take place within a given sector or in the interplay between different sectors. There is an enormous amount of work in the treadmill of sustainable development.

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