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Effects of Participation on Using Evidence for Public Decision in Conservation Agriculture.

INTRODUCTION:

Participation is often evoked as a best practice to use evidence more efficiently and more democratically in public policies, especially when confronted with technological innovation and their risks. This paper questions this assumption and shows its limits by using contributions from the current reflections on Evidence-Based Policy or Evidence-Aware Decision approaches. These reflections give analytical tools that enable me to show that behind what seems to be a unique norm for more participation, there are numerous and opposed representations and practices on how participation should be defined and used for producing and validating evidence for action. Using a case study of the development of new technologies in Conservation Agriculture (CA) both in France and Brazil, I argue that these different representations and practices (analyzed as “doctrines”) go along with specific processes of validation of the evidence, which are related to opposed interests in agricultural development. As a consequence, some forms of participation may more or less highlight the various issues at stake in the development of the technology (emphasizing evidence of its efficiency or of its negative impacts on the environment for example). This has important consequences on the availability of the evidence for public decision and for the achievement of objectives of sustainable development.

In this paper, I will first replace my scientific question in the state of the art on participation and in relation with the current analyses on Evidence-Based Policy (EBP) and Evidence-Aware Decision (EAD). I will then present the method that I elaborated to achieve the results that I detail in the third section, describing four different doctrines identified in France and Brazil on how participation should play a role in producing and using the evidence on Conservation Agriculture, and attempting to synthesize the consequences in terms of validity of the available evidence. At last, I will draw a conclusion showing how the different doctrines on participation may be related with current evolutions of the regimes of knowledge for the decision in agriculture.

I. PARTICIPATION AND THE ISSUE OF EVIDENCE.

1.1. Participation: A norm for sustainable development.

There is nowadays a consensus on the idea that participation is a central tool for public action in renewing processes of decision and in particular in achieving goals of sustainable development and implementing environmental policies.

This can first be verified in normative literature of political theory. Participation and deliberation are described as ways of formulating decisions of better quality, both from a factual and ethical point of view (MANIN, 2011), and more specifically when scientific and technological choices are at stake in contexts of uncertainty (CALLON et al., 2001). Normative theory also promotes participation for being the solution to find innovative responses that sustainable development may demand (MANSBRIDGE, 2011; BURSZTYN, 2001). At last, participation is of course cited as a mean to democratize policy making and to better include alternative and marginalized points of view in public decision and formulation of policies (PATEMAN, 1970; BARBER, 1985). Analysis of policy making also demonstrate various benefits of participation as far as environmental issues and objectives of sustainable development are concerned. Participation appears to be a way to adapt public action to those objectives and to societies that are getting more and more complex and therefore harder to govern (BLONDIAUX, 2008; FUNG&WRIGHT, 2001). It is also an effective tool for mastering conflicts linked with environmental issues, by producing consensus and preventing oppositions (BLATRIX, 2002), and an effective tool as well for preventing and managing risks and uncertainty associated with development policies and projects of potential environmental impacts or with new technologies (HOLZINGER, 2001). At last, participation is sometimes evoked as a way for the State to make up for its lack of legitimacy (BLONDIAUX, 2008), as well as of competence and knowledge on some specific local or sectoral issues (DURAN, 1999).

In practice, there are numerous laws or rules and public policies referring to the notion as a norm for action and which are frequently linked with environmental and sustainable development issues.

In both national contexts studied in this PhD research, participation is associated to the establishment of renewed goals for public action, though in very different political traditions and contexts of course. In the case of France for instance, a series of laws and institutions have been created since the 1990s, as the BARNIER law in 1995 which makes consultation compulsory before any facility or industrial project that may have environmental impacts. This law also instituted the CNDP – National Commission for Public Debate, in charge with the organization of these consultations and independent administrative authority since 2002. In the 2000s, environmental policies were debated and meant to be reformed within the *Grenelle de l'environnement*, a series of national participatory conferences and workshops that gathered representatives from the State, environmentalist organizations, economical sectors, trade unions, and scientists. These conference generated laws and the implementation of public programmes, such as the *Ecophyto* programme which is the main French public policy for reducing the use of pesticides in agriculture. Other participatory initiatives were also organized on issues of great public interest, such as the citizens' conference on the use of Genetically Modified Organisms (GMOs) in agriculture. In the case of Brazil, participation is a key notion of the Constitutional reform initiated in 1988 at the end of the dictatorship period. This Constitution created a new institutional context in which deliberative arenas formed of partnerships between the State and civil society, are meant to elaborate and implement public policies. These arenas may take various forms from the national councils at the federal level to the local councils in the states and *municipes* that in some cases have the authority to collectively manage the programmes budget. As far as environmental policies are concerned, the National

Council for the Environment (CONAMA) was actually created before the reform of the Constitution, in 1981. Every three months, this council gathers representatives from federal organs, the states and *municipes*, the private firms and civil society. Along with technical groups of work, the council has to debate and establish a variety of norms regarding environmental quality and pollution and the definition of preserved areas, manage and evaluate the implementation of environmental policies, and support the local participatory councils. Other examples of this type of councils also exist in the area of sustainable agricultural development and for the implementation of specific policies for family agriculture. Great public issues can also have their own arenas in order to be debated - the CNTBio for instance (the National Committee on Bio Security) is where the use and regulation of GMOs in Brazilian agriculture is debated at the federal level.

At last, participation is also presented as a norm in research and development, especially in agriculture and for the development of more sustainable practices. Participatory methods are encouraged by those who conceive and fund programmes of development for efficiency and equity reasons. The methods are said to be more appropriate for producing evidence for action and sustainable development, as CORNWALL & JEWKES (1995) put it in an article of synthesis on the issue. Indeed, by using bottom/up approaches, they would make it possible to better identify local demands and specificities in order to produce relevant evidence, and would facilitate the identification and testing of local innovations produced by farmers. They may also enable a better representation of minorities or marginalized actors and of alternative techniques. Above all, participatory methods are said to be the tool to redefine relationships of power in processes of research and development (this may as well concern relationships of power between a scientist and a farmer, and relationships of power between groups of actors that have opposed interests in agricultural development). This redefinition is supposedly an efficient solution to find some new technical alternatives for a sustainable development in agriculture. In that case, participatory methods are usually promoted by research and extension institutes, as co-construction of knowledge and solutions enables learning processes between farmers and technical experts and makes it possible to take into account uncertainty and the different needs of farmers (CERF & HEMIDY, 1999). In Brazil, the Ministry for Agrarian Development (MDA) especially puts this method forward as a mean to formulate more efficient and relevant public policies, and promotes it also for extension adapted to family agriculture and small-scale farms.

1.2. The issue of evidence.

Rather paradoxically though, a review of the scientific literature on participation (LANDEL, 2011) established that there is no analysis of the kind and quality of the evidence produced for the decision, and therefore no evaluation of the actual capacity of participation to produce and use the best evidence possible in the achievement of objectives of sustainable development. This is due to a methodological choice of this literature, which focuses on the analysis of actors' strategies in participatory approaches and on the evaluation of their capacity to democratize processes of decision. It may also be related to the dominant belief in this literature that, by refusing to establish hierarchies of evidence (for example between scientific evidence and opinions), participation will be more democratic and will counter the perverse effects of inequalities between actors. As already evoked, participation would enable a larger mobilization of knowledge, good for both democracy and innovation in sustainable development (see for example CALLON et al., 2001). This belief seems to be adopted by programme designers too, as a documentary analysis that I realized for this PhD research

shows that public programmes that include participatory approaches either do not foresee any specific mean to access or evaluate evidence or report this responsibility on individual and designated experts or on existing human resources in public administrations.

Yet recent developments in both literature and practice on Evidence-Based Policy (EBP) or Evidence Aware Decision (EAD) have shown that the issue of evidence is crucial when facing with complex decisions. Uncertainty and decreasing influence of ideologies may make it more and more important to rely on scientific and sound evidence (NUTLEY et al., 2007). Abundance of knowledge and information may also be a problem. As LAURENT & TROUVE (2011) put it, environmental concerns in agriculture led to an increase in prescriptive norms and regulations in the European Union. In such a situation, the question of the validity of the evidence on which rely those prescriptions is an important issue, especially when the economical sustainability of farms is at stake. Actors may then need to adopt new logics of mobilizing and using knowledge in their decisions: collaboration is one of them, but accessing scientific evidence in order to know “what works” and which action shall be the most efficient possible, is of great importance. Therefore EBP or EAD approaches propose analysis and methods to promote the most judicious use of scientific evidence as possible.

One of the contributions of this literature that I will need to use in this paper is that who proposes analytic tools to study the cognitive content of debates and to evaluate and rank the available evidence used in decisions. LAURENT & TROUVE (2011) summarize some of the debates and suggest the following classification of different level of evidence, in relation with their usefulness for public decision. This classification, may it be a model, will enable me to analyze and present my results in the last part of this paper. First of all, evidence may be differentiated relatively to their empirical validity, that is to say relatively to their degree of factual soundness. LAURENT et al. (2009) draw the following ranking from least to most reliable evidence in agricultural and environmental fields:

<i>Level 1.</i> Opinions of respected authorities, based on practical experience, descriptive studies or expert panels.
<i>Level 2.</i> Evidence obtained from historical or geographical comparisons.
<i>Level 3.</i> Evidence obtained from cohort studies or controlled case studies.
<i>Level 4.</i> Evidence obtained from gathering data on representative situations for hypothesis testing and statistical validation of the robustness of results.
<i>Level 5.</i> Evidence obtained through randomized controlled trials.

Table 1. Ranking of empirical evidence. Source: LAURENT et al., 2009.

LAURENT & TROUVE (2011) also emphasize the importance of analyzing the different degrees of relevance of the evidence. Evidence may be differently relevant according to the objectives of an action/decision. For instance, evidence of the efficiency of an innovation will be useful for an actor to decide if he will invest in a new technology. Evidence of the harmlessness of this new technology towards the (environment of human health) will be helpful for public actors to decide if they will support its development or not.

At last, evidence may also be differently relevant according to the public it is addressed to or which it concerns. In other words it is differently relevant for the stakeholders, in relation with their interests, and it is also differently relevant according to the contexts of application. Another example of this could be related to evidence on the efficiency of a technology in agriculture: evidence of its efficiency on great-scale farms in Brazil may not be relevant for French small-scale farms.

Thanks to this theoretical background on evidence my purpose is now to show that behind what seems to be a unique norm for more participation, there are numerous and opposed representations and practices on how participation should be defined and used for producing and validating evidence for action, and that this phenomenon leads to produce knowledge and innovations that may not be properly evaluated before being used in public decision and action. This raises a problem of efficiency as regards the different objectives of sustainable development. In order to analyze these representations and doctrines, I will use the notion of “doctrines” as defined by PERRAUD (2004). A doctrine should here be understood as a set of notions that actors claim to be true and which are used to give an interpretation of facts, to orientate and lead the action. Understanding these doctrines will then enable me to discuss how evidence is available and used in practice, and how controversial or uncertain aspects of new technologies and innovations in agriculture may be put forward or dissimulated for public debate.

I will first present the method I used to achieve such results.

II. MATERIALS & METHODS.

II.1. A case study : Conservation Agriculture.

Conservation Agriculture (CA) is a technical model of production in agriculture based on no tillage or minimum tillage practices and the respect of 3 principles (as promoted by the FAO): minimum soil disturbance, permanent soil cover and crop rotations.

Scientific studies bring evidence of several advantages of these techniques. They help prevent or reverse soil erosion, especially in dry climatic conditions (SCOPEL et al. 2005), and can facilitate water retention (CAROF et al. 2007). They are proved to ameliorate soil fertility and the production of organic material (LABREUCHE et al. 2007). They are also put forward as a way to stock carbone in the soils, with a great variation in the results though, according to climatic conditions (evidence of results are more accurate in the case of Brazil, BLANCHART et al. 2007, and weaker in the case of France LABREUCHE et al., 2007). These techniques also enable farmers to lower their costs of production since they are supposed to use less force of work and less fuel by stopping tillage (DE TOURDONNET et al. 2007).

Nevertheless, scientific studies show that controversies and doubts still exist. DE TOURDONNET et al. (2007), for example, make it explicit that there is a global lack of data on the yield and efficiency obtained with conservation agriculture. The main problem though lies in the observation of a dependence of these techniques on the use of herbicides, and even in some cases of an increase of this use, more specifically of the glyphosate (LABREUCHE et al., 2007, GOULET, 2008). The capacity of conservation agriculture in having a significant impact on reducing greenhouse gases emissions is also an issue of debate (ARROUAYS et al., 2002).

Behind the general definition and the review of the scientific evidence, there is a large diversity of practices and actors involved in the development of conservation agriculture. Two groups can be distinguished, which summarize the main existing controversies. A first group associates no tillage practices with what is called “agro ecology”, and defines them as one of the possible technical innovations to achieve more autonomous and sustainable systems of production, along with other options, including organic techniques of production. In France, we can here cite the examples of an

association of farmers leading the promotion of conservation agriculture (BASE). In Brazil, this definition of CA is carried by the Ministry of Agrarian Reform (MDA), responsible for implementing policies for family agriculture. Another group defines conservation agriculture as the next technological model to be diffused in order to cultivate greater surfaces and produce eco systemic services. This model depends on the use of technological packages, including herbicides, machines, and genetically modified organisms (GMOs). It is also characterized by the role of private firms in its development (GOULET, 2008). In France, the Institute for Sustainable Agriculture (IAD) promotes such a model of CA. In Brazil, this model is already predominant especially in soy cultures, and is heavily supported by public programmes.

A last characteristic of Conservation agriculture is that it is being developed thanks to participatory approaches, or at least by organized actors claiming to be participatory. The innovation itself indeed demands participatory approaches for its development, as it has to be adopted to local conditions of production, and since the solutions are still to be invented sometimes, thanks to processes of co-construction of knowledge between researchers and farmers. The discourse on the benefits of participation is therefore repeated by the variety of actors involved in the development of the techniques: associations of farmers, groups of technical exchange and extension, cooperatives, lobbyist organizations promoting CA, public authorities.

II.2 Why a comparison with Brazil?

The method of comparison in social science is a way of having a “control case” in order to test an hypothesis. In my research, the case of Brazil enables me to demonstrate that perverse effects of participation on the use of evidence for public decision are indeed to be related with certain forms of participation, and are not caused by specific conditions and national contexts. In other words, comparison allows me to draw more abstract and general conclusions by offering a mean to rigorously eliminate irrelevant explanations – as in the “most different systems design” described by PRZEWORSKI (1970).

The choice of Brazil as a case study for comparison shall be justified from a double point of view. First, the idea of participation is of a greater and different importance than in the case of France since it is defined as a principle for public action in the 1988 Constitution. Thus Brazil is regularly cited as an example for the implantation of participatory approaches and policies, included by the scientific literature in political science. It is therefore relevant to use this exemplary case as an element of comparison. Another reason justifying this choice is that Conservation Agriculture is currently becoming a dominant model of development for agriculture and especially for mechanized crops of soy and corn. No tillage techniques have been developed there since the 1970s and are often heavily associated with the use of herbicides and GMOs (“technological packages”). Since 2009, a National Programme for Climate Adaptation in Agriculture (*Programa ABC* – Programme for Low Carbon Agriculture) promotes the adoption of the innovation through facilitated credits for investments.

II.3. Data collection.

The main source of information for data collection are semi-directive interviews realized with a series of actors (see table below), selected according to their participation in the debates or the development of Conservation Agriculture, and thanks to a network analysis. Interviews are here

chosen as a main source of information since the purpose is to analyze doctrines, which are identified from discourses and representations of the actors.

Number of interviews: 43 (n=29 in France; n= 16 in Brazil).

Types of actors interviewed: public administrators in State agencies in charge of environmental or agricultural policies; political representatives dealing with issues of development in agriculture; administrative executives in Ministries for the Agriculture and the Environment; technical advisors from extension services and executives in technical institutes; farmers developing CA and participating in organized groups promoting CA; representatives of private organizations (firms, cooperatives, associations of lobbying) promoting CA; members of NGOs (Non Governmental Organizations); representatives from the trade unions of farmers; scientists.

Table 2: Types of actors interviewed.

A questionnaire was established and systematically used for each interview, in both national contexts. Specific questions were asked on the benefits and disadvantages of participation on producing and using evidence for innovation in agriculture and for the development of CA. Actors were also asked about their knowledge of scientific controversies about CA, and about their sources of information on these matters and more generally on their means of access to scientific evidence.

III. RESULTS IN FRANCE AND BRAZIL: FOUR DOCTRINES PRESENTING DIFFERENT FUNCTIONS OF PARTICIPATION IN THE PRODUCTION AND USE OF EVIDENCE FOR DECISION.

III.1. When “participation” means partnerships with the private sector to produce evidence for political lobbying and diffusion of technological packages.

This doctrine is shared in both France and Brazil by private institutes or cooperatives developing Conservation Agriculture and doing political lobby for its promotion. These organizations gather representatives of great-scale farmers, sometimes involved in what is currently called “agro business” in Brazil (responsible for the production of soy and corn, two main crops in Brazilian agriculture), and actors from private firms selling direct-seeding machines and inputs (herbicides and GMOs). These actors are transnational and found in the networks present in both countries. The doctrine is also dominant in the Brazilian Ministry of Agriculture (MAPA), responsible for the implementation of the ABC Programme on reducing carbon emissions in agriculture.

In this doctrine, participation means the gathering of private actors in collegial structures or informal networks who share convergent interests in the agricultural model to be supported and who aim at building common strategies to develop the technology.

This gathering can take an organized form of partnership (competitive clusters, associations, private institutes), and can also be more informal in leading actions of political lobby for the promotion of the technology. It mostly concerns actors from private firms involved in the production of knowledge and technologies in agriculture (multinational firms selling inputs, and cooperatives). These actors may associate with NGOs and farmers in order to legitimate their lobbying. Public research and public policies may also be called upon to support this collaboration and the development of the technology.

As far as the production and use of evidence is concerned, participation here means close collaboration between economical actors in the agriculture field to produce evidence and efficient technologies adapted to a particular model of conservation agriculture. Farmers or representatives of cooperatives may express their needs in terms of amelioration of the technologies to the private firms that produce them. They may also share the innovations they themselves produce in the field to the firms who test them and transform them into technological outputs – mostly in a commercial perspective.

This collaboration also aims at demonstrating the economical efficiency of the technology to political makers, in order to obtain their support and the implementation of public policies enhancing the development of CA.

III.2. When “participation” means producing evidence for political consensus on technical matters.

This doctrine was identified in the case of France, in processes of consultation organized by public authorities and dealing with formulation and implementation of environmental public policies, in particular of regulations of the use of pesticides and development of more sustainable practices in agriculture (like the *Grenelle de l’environnement* and its programme *Ecophyto*). It has also been identified in the case of the official evaluation of environmental impacts of no-tillage techniques, which was financed and realized by a State agency but proposed for public debate with representatives of the main farmers’ associations developing CA.

For this doctrine, participation is here meant in the more “classical” sense in political science. It is defined as the creation by public authorities of participatory institutions where technologies are supposed to be democratically debated with representatives of civil society, or where great orientations for environmental policies or agricultural development are negotiated. Representatives of concerned actors (that is to say, representatives of the State, trade unions of farmers, environmental non governmental organizations, private sector and scientists) are invited to express their opinions on the subjects and try to influence the decisions.

According to this doctrine, all evidence should be considered equal, respecting a democratic principle and in coherence with a political discourse that recognizes the stakeholders’ expertise, along with scientific expertise. Therefore complementarities between the different types of evidence are neither thought nor organized in the debates.

The aim of participation here, as far as producing and using evidence are concerned, is to generate political consensus on technical issues.

III.3. When “participation” means involving alternative or marginal evidence in debates and decisions.

This doctrine has been identified in the case of the participatory councils implemented in Brazil mostly since the end of the dictatorship. These councils are instituted at different levels of public action (federal, regional and municipal) and they play different roles in public debate, being places of negotiations, claims, or even political decision. They are an important tool of the democratization of public debate and of the restoration of the link between the State and civil society after the dictatorship. As evoked before, the representation in these councils is mostly foreseen by the Constitution, and it includes representatives of the State (namely of the concerned Ministries and administrations or agencies), representatives of the organized civil society (political movements, NGOs, associations), and the private sector.

Participation is here a means to balance problems of political dialogue and representation in the processes of decision and formulation of agricultural and environmental policies. Participatory councils were created to regenerate a democratic space of expression for civil society, after the authoritarian period. Since the 2000s, they also aim at giving more representation to opinions from the minority or from popular and social movements. In the domain of agriculture, they are a tool for representatives of family agriculture and social movements to counter the historical influence and economical weight of the Ministry of Agriculture in defining policies.

As far as the production and use of evidence are concerned, participation is used to give voice to specific knowledge and claims on particular publics (family agriculture, ethnic minorities, social movements). Aiming at a better political representation and usually having few resources, actors use any type of evidence - may they be scientific or not.

Here the aim is to achieve a better taking into account of specific issues and claims.

III.4. When "participation" means implementing participatory methods in research and extension so that farmers, technicians and scientists co-construct relevant and adequate evidence for a diversity of conditions of production and of diversity of agricultures.

This doctrine corresponds to strategies of research & development promoted in both studied countries by public authorities (French Ministries of Agriculture and the Environment in France; Brazilia Ministry of Agrarian Reform and representatives of the extension services). These strategies aim at building closer relationships between public or private services of research and extension and farmers, in order to produce, test, validate and diffuse evidence and technical references for the development of cultural techniques that reduce the use of pesticides and are adapted to a variety of farming systems.

Participation therefore means collaboration for the local co-construction of evidence for the development of new practices in agriculture, as well as for their experimental test at a more scientific level. The definition of participation here implicates the reflection on the complementarities between evidence for technical decision in the field and evidence relying on statistical and representative data to have a global knowledge on the technology. Influenced by the literature on participatory research and development, those methods aim at efficiently producing evidence for action and may also include a democratic perspective, as in the case of Brazil where they help recognizing the specificity of traditional knowledge or alternative farming systems.

As far as production and use of the evidence are concerned, participation here means equality between practitioners (farmers) and scientists or technicians in the process of production of technical references for the application of the technology, and for the identification of innovatory practices. It recognizes the specificity of different types of evidence: knowledge from farmers' experience is necessary to adapt or ameliorate technical references; and scientific competencies are useful for testing and validating innovations.

III.4. Synthesis: Consequences on processes of validation of the evidence and availability of the evidence on controversial aspects of CA.

The following tables are an attempt to synthesize the analysis of the evidence for each doctrine. They show what process of validation of the evidence is promoted in each doctrine, and which kinds of evidence are available on several controversies on CA. They also present an analysis of the relevance of these evidence.

	<i>Doctrine 1. When “participation” means partnerships with the private sector.</i>
<i>Validation of the evidence :</i>	Evidence is valid when it is carried out by experts (<i>i.e.</i> scientists or farmers who are pioneers in developing CA) and when it demonstrates the efficiency of technological packages and systems of production.
<i>Available evidence on the controversies :</i>	
<i>Use of herbicides:</i>	No available evidence (use of herbicides is not considered a problem)
<i>Consequences on human health:</i>	No available evidence.
<i>Economical risks:</i>	Experts’ opinions ; evidence from geographical comparison; evidence from studies produced by private firms.
<i>Relevance of the evidence</i>	Evidence is relevant for the production of technological packages and prescriptions adapted for their diffusion in great-scale farms producing grain. They are also relevant for political lobbying in favour of CA.

	<i>Doctrine 2. When “participation” means producing evidence for political consensus.</i>
<i>Validation of the evidence :</i>	Evidence is valid when it is carried out by actors who are recognized by public institutions or by scientific experts, and when it reaches consensus in arenas of debates and the formulation of public policies.
<i>Available evidence on the controversies :</i>	
<i>Use of herbicides:</i>	Evidence obtained from geographical and historical comparisons; Evidence obtained from controlled case studies in experimental stations; Reviews of the scientific literature funded by public administration.
<i>Consequences on human health:</i>	No available evidence.
<i>Economical risks:</i>	Experts’ opinions (evidence from farmers’ practical experience or descriptive studies); evidence from cohort studies produced by technical institutes).
<i>Relevance of the evidence</i>	The evidence produced may be relevant for any type of farms, according to the resources of power of their representatives in the places of debates and decisions, including in the scientific institutions. Evidence is also relevant if it contributes to the elaboration of a model of development for the agriculture that may resolve political contradictions and facilitate the government of contradictory issues (such as in the case of the different objectives of sustainable development).

	<i>Doctrine 3. When “participation” means involving alternative or marginal evidence in debates and decisions.</i>
<i>Validation of the evidence :</i>	Evidence is valid when it is representative of an organized political or social movement standing for marginalized interests.
<i>Available evidence on the controversies :</i>	
<i>Use of herbicides:</i>	Experts’ opinions; Descriptive studies; Review of the international scientific literature.

<i>Consequences on human health:</i>	No available evidence.
<i>Economical risks:</i>	Evidence issued from practical experience and testimonies.
<i>Relevance of the evidence</i>	Evidence is relevant for the defense and the representation and small-scale farms' interests in political debates. They support the claim for the development of a variety of strategies of development in agriculture.

	<i>Doctrine 4. When "participation" means implementing participatory methods in research and extension.</i>
<i>Validation of the evidence :</i>	Evidence is valid when it is both tested in practice by farmers in their fields and through scientific methods.
<i>Available evidence on the controversies :</i>	
<i>Use of herbicides:</i>	Evidence obtained from practical experience, cohort studies/controlled case studies or from review of the scientific literature.
<i>Consequences on human health:</i>	No available evidence.
<i>Economical risks:</i>	Experts' opinions (exchange of experience between farmers); evidence co-produced with technicians at a local level.
<i>Relevance of the evidence</i>	Evidence is adapted to the diversity of the situations and farms since produced or tested locally. It is relevant with the various objectives of sustainable development.

IV. DISCUSSION & CONCLUSION

Analyzing the different doctrines on the role of participation in producing and using evidence for the decision concerning CA enabled me to highlight the fact that evidence may be more or less valid or relevant according to the different interests at stake and the objectives pursued by the actors formulating those doctrines. For the first doctrine for example, it appears clearly that evidence of efficiency, with a high level of proof, are produced for the interests of a consortium of actors linked with agro-business. Evidence and their quality are a core issue for this doctrine, but they serve specific interests and do not aim at taking into account environmental or social risks. For the third doctrine, empirical validity and relevance of the evidence may also be a core issue since they aim at developing family agriculture, but they are firstly used for political claims in arenas of debate and negotiation where resources of power between actors are unequal. The case of the second doctrine is different: the question of the level of evidence is not raised since the logic is of production of consensus for government. This is different from the fourth doctrine, which is the only one reflecting upon the complementarities between different kinds and levels of evidence.

As an element of discussion, I would like to argue that those doctrines actually have to be linked with the current evolutions of what can be called "the regimes of knowledge". A regime of knowledge may be described as the evolution of the set of rules, arrangements and resources that determine how evidence is produced for different kinds of objectives, and how it is made available for the State and other actors. It is an institutional output issued from power conflicts and adjustments but also from economical and societal tendencies that the State does not control. In my opinion, each

doctrine that I presented refers to a representation of how the regime of knowledge should evolve in the domain of agricultural development and innovation. Each of them carries different projects of reform of this regime of knowledge and therefore of the way evidence, and in particular scientific evidence, should be produced, used and made accessible for action. In these dynamics of evolution the idea of participation indeed plays an important role.

The first doctrine implies a greater involvement of private firms in the production and ownership of scientific evidence and new technologies. It also goes along with a redefinition of the role of public services of research and development, as they have to answer more closely to the needs of the collaboration between farmers and private firms. At last, it also promotes a renewed role for the State, as it does no longer guarantee the control and validity of the evidence, but is rather supposed to organize the collaboration between economical actors for the development of the technology.

The second doctrine emphasizes the need for a reform of the knowledge regime for public decision through a greater implication of the stakeholders. It foresees various procedures and institutional innovations to guarantee a democratic representation of these stakeholders' interests, points of view and knowledge. As far as mobilization and use of the evidence is concerned, the traditional way of referring to experts is still dominant, even though policy makers are usually aware of the limits and biases of such practices. The State here has to organize and regulate the relationships between actors in order to formulate political objectives based on consensus and therefore governable.

The third doctrine aims at democratizing the regime of knowledge for political decision, by better taking into account alternative or non scientific evidence (such as opinions and local experiences and testimonies). It can therefore either promote better complementarities with scientific evidence or radically question the specificity of scientific knowledge when this knowledge represents the interests of political opponents.

At last, the fourth doctrine aims at organizing the complementarities of different kinds of evidence (evidence issued from farmers' experience and innovative practices and evidence issues from scientific experimentations and tests) in order to better control the risks linked with technological innovations. These complementarities are nevertheless quite complex, since each actor (for example, a farmer and a scientist) pursue its own objective when producing evidence (a farmer will need proof of efficiency, when a scientist may be more interested in proof of causality for example). The role of the State in giving means to differentiate the evidence according to various objectives of action (for example giving technical references for the development of the technology, accumulating scientific evidence, furnishing knowledge for political decision) might be of a great importance.

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