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Comparative analysis of two case studies on Genetically Modified Organism research in Italy and the UK

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Comparative analysis of two case studies on Genetically Modified Organisms research in Italy and the UK

[Analisi comparativa di due casi di studi di progetti di ricerca sugli Organismi Geneticamente Modificati in Italia e Inghilterra]

Valentina Amorese

Abstract

This paper explores two research projects, the *Farm Scale Evaluation* (FSE) in the UK and *GMOs in Agriculture* in Italy. It asks what political, social or economic factors contributed to scientific responses to negative public opinion.

The data I use for this paper range from mass media reports, government documents, scientific papers, websites and interviews with journalists and researchers. Comparing these two case studies, I contend that there are six main factors that influence scientists' listening capacity. These include government, position and culture of science, private companies, types of publics, mass media and PUS academic debate. Finally, I contend that, as Wynne (2006) suggests, discourses of communication between science and society are positioned in close relation with the local cultures of science and policies.

Key words: Situational analysis, Public understanding of Science, Genetically modified organisms, Comparative analysis.

Riassunto

Questo articolo esplora due casi di studio di progetti di ricerca, *Farm Scale evaluation* e *OGM in Agricoltura*, sugli Organismi Genticamente Modificati, e si domanda quali fattori politici, sociali ed economici hanno contribuito a costruire le risposte della scienza alla resistenza del pubblico verso gli OGM. I dati che vengono utilizzati includono, articoli di giornale, documenti governativi, articoli accademici, siti web e interviste con giornalisti e ricercatori che hanno partecipato direttamente o indirettamente a questi progetti. Paragonando questi progetti emergono sei fattori dominanti che sembrano maggiormente influire sulla capacità degli scienziati di ascoltare il pubblico. Questi includono: il governo, la posizione della scienza nel contesto culturale italiano, le aziende private, i tipi di pubblico, il ruolo dei mass media nella comunicazione scientifica, e la natura del dibattito relativo al Public Understanding of Science. In conclusione, come suggerisce Brian Wynne (2006), i discorsi relativi alla comunicazione della scienza si collocano in stretta relazione alla cultura locale relativa alla comunicazione e politica della scienza.

Parole chiave: Analisi di situazioni, Public understanding of science, Organismi geneticamente modificati, Analisi comparativa.

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Introduction

The central question of this paper asks what social, economical, political or other factors impacted in the way GM scientists came to understand public opinion, and how? In order to address this question, I take a case study approach and focus on two GMO projects carried out in Italy and the UK. These projects reflect the similarities and differences between the two countries. Both projects were government-funded, with a comparable amount of money. Both took place right after public backlash against GMOs, and were publicized as a way to address public concerns about GMOs. The British project, *Farm Scale Evaluation,* focused on the environmental impacts of GM cropping, whilst the Italian one, *OGM in Agricoltura,* took a multidisciplinary approach.

I will start with a description of my data collection and methods. Then I will move on to analyse the two projects, recounting how the projects were developed and carried out. Ultimately, this paper tells us about the relationship between science and society and the actors implicated in this relationship. It provides a snapshot of the interactions between these different actors and how these impact on the communication process between science and society. In the last section of the paper, I reflect on the similarities and differences between the projects. This will allow me to identify six factors that impact on the ways GM scientists get to know public opinion: government, position and culture of science, private companies, types of publics, mass media and PUS academic debate. Ultimately, I agree with Wynne (2006), and position discourses of communication between science and society in close relation with the local cultures of science and policies.

1. Data collection

To do a case study of the two research projects, I used multiple data sources, including both coproduced and extant materials. The coproduced materials consist of the transcriptions of the interviews I conducted with individuals who were involved in or implicated by the projects. In Italy I met with one of the project organizers. I also interviewed two researchers who felt they had been intentionally excluded from the research. In addition I met with two journalists and scholars, who reported about the project. In the UK, I spoke with a researcher who participated in the project and two other scientists who were more broadly involved in the FSE. The general interview guide included a discussion of the project as well as a broader reflection on the nation's approach to GMOs. In preparation to each of the meetings, I also listed a series of topics that I meant to discuss with each interviewees according to their

specific relation to the project. Overall, I conducted eight semi-structured interviews, three in the UK and five in Italy.

In addition to this, I analysed different kinds of extant data. For the UK, this included popular press reports, scientific papers, government and policy documents, transcriptions of meetings of different kinds held by and with the numerous actors involved in the project, and recorded broadcast interviews with scientists, NGO spokesmen and MPs. The sample of public press reporting includes a collection of national newspaper coverage regarding the launch that publicized the field trial results in October 2003, I was given by one interviewee. I also searched for articles published in *The Independent*, the *Daily Mail* and the *Guardian* that contained the phrase 'Farm Scale Evaluation' and are listed in the Lexis Nexis database. This search provided a total of 61 articles, 8 in the *Daily Mail*, 24 in the *Guardian* and 29 in *The Independent*. As noted before, *The Independent* is considered the UK's opinion leading newspaper. The *Daily Mail*, on the other hand, is the UK newspaper with largest readership. I decided to include the *Guardian*'s articles on the FSE, as this newspaper tends to be associated with environmental groups and NGOs largely involved in the FSE. The scientific papers on the methods and results of the FSE were published in *Philosophical Transactions of the Royal Society* journal. I scrupulously analysed the websites that followed the project, which include the website run by one of the scientists who participated in the project[1], and various websites of government departments and Committees[2] that were involved in FSE. This strategy allowed me to access a variety of reports, transcriptions[3] and broadcast interview records [4] covering the FSE.

Material proved harder to find regarding the Italian programme. Particularly, I checked the archives of *La Repubblica* and *Il Corriere della Sera*[5], but I could not find *any* article

[1]http://www.rothamsted.ac.uk/pie/sadie/joe_general_work_GM_page_3.php (last visit 1 Feb 2010).

[2]http://webarchive.nationalarchives.gov.uk/20080306073937/http://www.defra.gov.uk/environment/gm/fse/, http://www.defra.gov.uk/acre/index.htm, http://www.gmsciencedebate.org.uk/report/default.htm, http://www.aebc.gov.uk/, http://www.parliament.uk/eacom/ (last visit Feb 1st, 2010).

[3]Advisory Committee on Releases to the Environment meetings transcripts, Science Review Panel reports, Agricultural and Environment Biotechnology Committee report on the FSE, EAC report on the FSE.

[4]Examples include BBC broadcast Measuring GM crops in *More or Less* series, BBC Radio 5Live programme broadcasted in July 2001 and the March 5th, 2003 respectively. In both shows, Joe Perry (Rothamsted Institute) discusses the FSE. Recorder interview at *Up All Night* recorded on March 5th, 2003 with Peter Ainsworth MP (Chair of the EAC), Joe Perry (Rothamsted Institute), Claire Oxborrow (Friends of the Earth) and Professor John Pidgeon (Brooms Barn Research Station). Recorded interview with Joe Perry (Rothamsted Institute) on Radio Saturday *Eureka!* This is New Zealand science magazine program hosted by Veronika Meduna. (April, 2004).

[5]They are the first and second most popular Italian newspapers (Dati Ads Accertamento diffusione stampa - media mobile gennaio-dicembre 2008.

containing the phrase 'OGM in Agricoltura'. *Il Sole 24 Ore*[6] published the only two articles in the popular press featuring the project (July 8th, 2007; July 22nd, 2007). I also analysed the press release of the second work-in-progress conference launched by INRAN (7th March 2006). In addition, through an online search, I collected three more on line articles that made some reference to the project[7]. Noticeably, the scientific press covered the project with two articles published in *Nature Biotechnology* (2007; 2008). Furthermore, I read the edited book that collects works by the scientists involved in the project (Monastra et al, 2007). Through an online search of the parliament website, I accessed three documents of correspondence between MPs and the Minister of Agriculture that either question, or defend, the project[8]. Finally, I carefully monitored the Institute of National Research on Agriculture and Nutrition (INRAN)[9] and SAgRI[10] websites, the only two that followed the project consistently.

2. Method

This paper is a comparative case study between two projects on GMOs, one located in Italy and one in the UK. The similarities and differences across the countries, listed in Table 1, have proven crucial to the selection of these cases as well as the analysis and final discussion.

[6]Il Sole 24 Ore is Italy's most important financial newspaper.

[7]The on line version of the magazine *Galieo* on science and global issues published an article on *OGM in Agricoltura* http://www.galileonet.it/dossier/8224/il-programma-ogm-in-agricoltura (last visit Feb 1st, 2010). Another article was published in the magazine *Agricoltura Nuova* (March 30th, 2006), mostly diffused amongst farmers. Last article was published in the Minister of Agriculture's on line magazine *Agricoltura Italiana* (http://www.agricolturaitalianaonline.gov.it/content/view/full/441/(offset)/60 (last visit Feb 1st, 2010).

[8]http://www.salmone.org/wp-content/uploads/2007/11/senato-della-repubblica.pdf (June, 6th 2006 and November 18th, 2007) (last visit Feb 1st, 2010).

[9]http://www.inran.it/

[10] SAgRI stands for SAlute, RIcerca e Agricoltura (Health, Research and agriculture). It is an NGO made up by Italian researchers and scientists http://www.salmone.org/chi-e-sagri/ (last visit Feb 1st, 2010)

Table 1: Similarities and differences between Italy and the UK, and the FSE and OGM in Agricoltura

	Italy and the UK	FSE and OGM in Agricoltura
Similarities	• Italy and the UK are both members of the European Union, which means that they have similar regulation for new technologies • In both Italy and the UK, public opinion was unsupportive of GMOs	• The FSE and the OGM in Agricoltura are two government funded projects that cost the governments a similar amount of money, £6 million for the UK and €6 million for Italy • Both these projects were developed in order to respond to public uneasiness towards GMOs and increase science knowledge
Differences	• The UK housed the modern debate on the Public Understanding of Science, while in Italy this discourse only came later on from the EU • Italy and the UK do not share the same 'cultures of science[11]' (Franklin, 1995) • Italy and the UK have different traditions in terms of regulation/policy of science and new technologies	• The UK published on line all the steps and documents related to the FSE. The OGM in Agricoltura did not, in any way, plan how to communicate the results to the public • The British project is expert-based and focuses on one topic only, while the OGM in Agricoltura is a 360° project that covers GMOs in a broad extent • The British government supported the FSE with a series of Committees and controls to guarantee the greatest level of transparency. The Italian government lacked any instrument to control/support OGM in Agricoltura

After collecting the majority of the data, I listed them and began reading the documents closely. The questions I asked included: what is the purpose of this document? And who

[11]Anthropologists of science introduced the idea that science is a culture and culture consists in 'the local practices of making sense' (Traweek in Franklin, 1995:174)

wrote/coproduced it? What is the story this document is telling me? And, finally, who are the actors included in, or excluded by, this document?

Methodologically, I conceptualized both research programmes as 'situations' following Adele Clarke's (2005) situational analysis. Quite early in this process, I began developing situational maps and social words/arenas maps. These are two analytical tools included in Clarke's situational analysis method. Responding to one of the main critiques to grounded theory, which argues this analytical process results in theories that tend to remain suspended in time and space (Burawoy, 2003), Clarke developed situational analysis approach as a way to situate the process in question (Clarke, 2005). Accordingly, the situation, rather than the process, becomes the object of analysis (Friese, 2007). Clarke (2005) points out that situational analysis, as a method, allows scholars to open up the data and interrogate them in fresh ways. In addition, Friese's (2007) study on endangered animal cloning demonstrates the value of this methodological tool when comparing different situations.

Clarke defines *situational* those maps that 'lay out the major human, nonhuman, discursive, and other elements in the research situation of inquiry and provoke the analysis of the relations amongst them' (Clarke, 2004: xxii). I used those maps to lay out all the actors involved in and implicated by each of the projects. *Social worlds/arenas* maps are the ones that 'lay out the collective actors, key nonhuman actors and the arena(s) of commitment and discourse within which they are engaged in on-going negotiations – meso-level interpretation of the situation' (Clarke, 2004: xxii). Accordingly, I used social worlds/arenas maps to make sense of these situations in terms of which actors were representing social groups.

My next analytical step consisted in writing memos. Each of these memos referred to only one project at a time, either the FSE or the *OGM in Agricoltura*. The goal of the first 'wave' of memos was to put together all the pieces of the situation-puzzle in order and develop a detailed story of how the project developed over time. At this stage, I continually went back and forth to my maps. The latter alerted me of possible gaps, showing me where to search for the missing information. Continuing to focus on one project at a time, in the second 'wave' of memos, I asked: which kinds of social, political, economical or other factors were entrenched in the situation? And also, in which ways did these contribute to, or else limit, scientists' ability to respond to public opinion?

Finally, and in order to understand which social, economical, political or other factors shaped the way GM scientists got to know public opinion, and how, I systematically compared and

contrasted my maps and memos. This time, however, I abandoned the national boundaries and looked at Italy and the UK in parallel.

3. Case Study One: the *Farm Scale Evaluation* in the UK

As part of the data collection for this paper, in February 2008 I met with a British researcher, who worked with GMOs for several years. This was the first time one of my interviewees referred to the *Farm Scale Evaluation* project. The researcher, who is one of the statisticians who contributed to planning the trials and analysing the results, characterized this project as 'the largest experience of release of GMOs in the UK' (GR2, 2008). Following that interview, I met with two researchers implicated by the project and checked the on line material on the FSE. The latter proved to be extremely detailed, publicly accessible database of this key event. It includes broadcast interview programmes with scientists who worked on the trials, interviews with NGOs and MPs, scientific publications, popular press articles covering the FSE, NGOs and policy documents, government bodies' reports, and transcriptions of public meetings arranged by the Advisory Committee of Releases into the Environment[12]. I believed that my interviews along with this database would be sufficient to recount the evolution of the FSE.

> *[T]he Environment minister, Michael Meacher, confirmed to Parliament that much tougher checks would be carried out on GM products under a voluntary agreement with the industry […] Mr Meacher told a Lords select committee that no insect-resistant crops will be introduced to the UK for three years and pledged to provide much more information about the fast-developing business […]Mr Meacher said the Government's aim was to strike the right balance between protecting the environment and human health on one hand, and on the other maintaining the proper degree of certainty needed by business for the development of new products. […] The process will be underpinned by strict guidelines for best practice in using GM crops, he added. 'The results of these farm-scale evaluations will be carefully assessed before moving further.' Tony Juniper, of Friends of the Earth, claimed the new arrangements did not go far enough and the voluntary framework proved that the Government had buckled under pressure from the GM foods industry. (The Independent, 22nd October, 1998).*

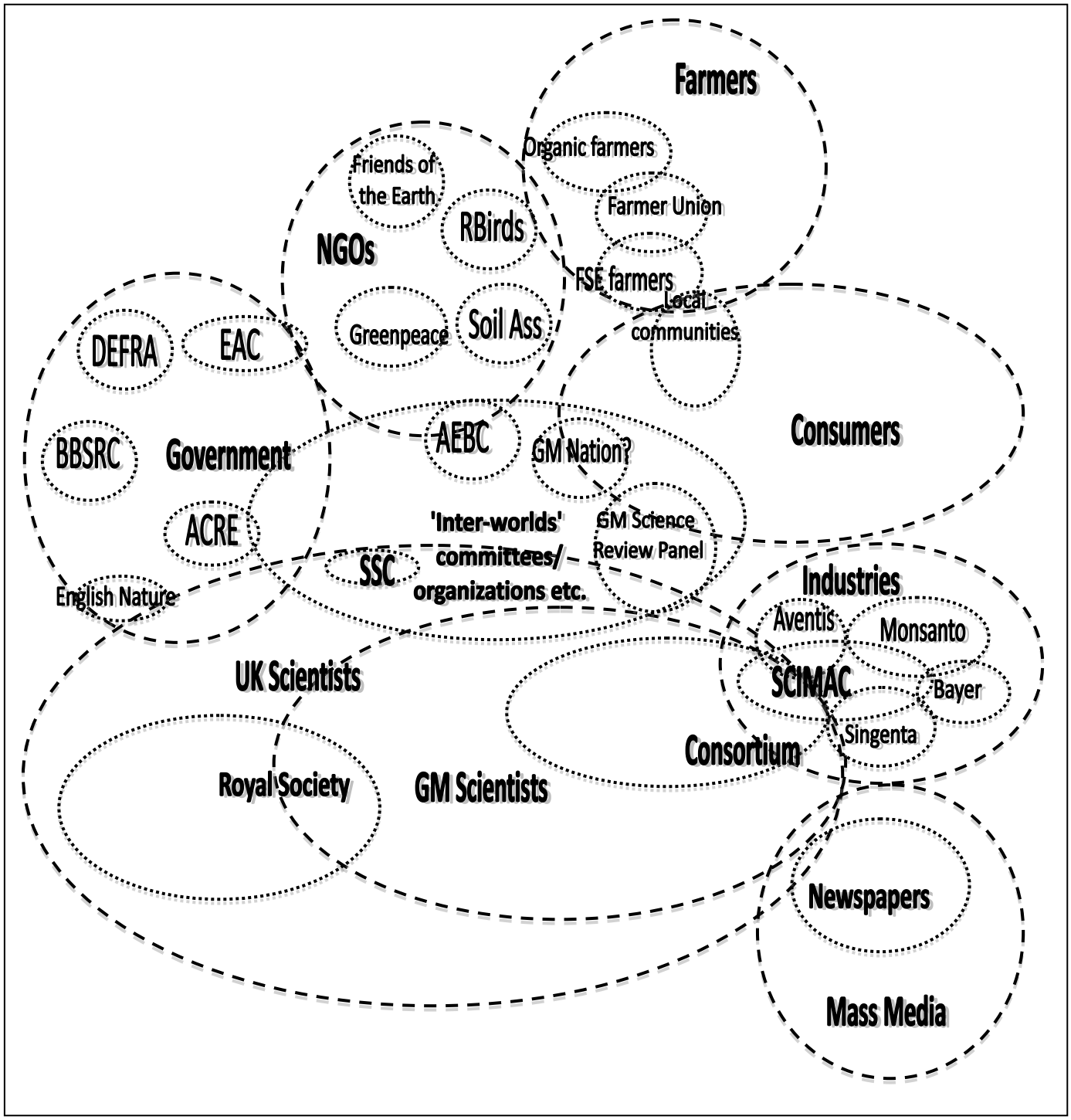
This is the first time that members of the public heard about the *Farm Scale Evaluation*. As we read in this article, the government launched the FSE in an effort to strike the right balance

[12] 'ACRE is a statutory advisory committee appointed under section 124 of the Environmental Protection Act 1990 (the EPA) to provide advice to government regarding the release and marketing of genetically modified organisms'
(http://webarchive.nationalarchives.gov.uk/20080306073937/http://www.defra.gov.uk/environment/acre/about/index.htm)

between the environmental and health concerns related to GMOs, on the one hand, and corporations' needs to develop new products on the other.

From the early staging of the project it was clear that, as a situation, the FSE touches numerous social worlds. Fig 1, which at first look might seem difficult to understand, will provide the reader a map to follow as I go on to unfold the FSE story.

Fig 1 Social Worlds Map Farm Scale Evaluation (1998-2003)



The historical sequence of events that ultimately resulted in the FSE began two years before *The Independent* article was published. In 1996, early signs of public uneasiness towards GMOs were emerging within the British landscape. At that time, NGOs including Friends of the Earth (FoE) and Greenpeace were launching national campaigns against this technology, while the ACRE and the Pesticides Safety Directorate (PSD) opened a discussion on the impacts of GM crops on the British environment.

The Department of Environment Food and Rural Affairs' (DEFRA[13]) historical account of the events that lead to the FSE argues that, by 1998, different Genetically Modified Herbicide Tolerant (GMHT) varieties of maize, oilseed rape and beet were on the verge of entering the UK market[14] (2000:1). Earlier that year, the British Department of Environment and Transport (DETR) 'had started in depth discussions with English Nature to lay the ground for development of policy to address wider biodiversity issues related to GM crops. English Nature (EN), with other statutory nature conservation bodies, called publicly for a moratorium on the commercial use of genetically modified herbicide tolerant (GMHT) and genetically modified insect resistant (GMIR) crops until further research was carried out. They were specifically concerned about the continuing impact of farming practices on farmland wildlife. GM crops could exacerbate wildlife declines if they encouraged higher levels of weed control than necessary, which in turn would reduce invertebrate and bird numbers' (2000: 2).

The following summer was characterized by intense discussions across the numerous government bodies touched by GMOs. By October 1998, the DETR called for a moratorium on the commercialization of GMOs. This possibility was rejected by the government, which in turn announced an agreement with GM corporations. The latter were going to postpone the introduction of GM varieties into the British market until the completion of a four-year research programme that would study the impacts on the environment of specific GMHT varieties, i.e. spring oil-seed rape, fodder maize, sugar and fodder beet. This moment signaled the beginning of the FSE.

After the decision to run the trials was taken, the government invited 15 organizations to tender for research contracts and test the null hypothesis that 'no significant differences between the biodiversity associated with the management of GM winter oilseed rape/spring

[13]The DEFRA was founded in 2001, when the Ministry of Agriculture, Fisheries and Food (MAFF) was merged with part of the Department of Environment, Transport and the Regions (DETR) and with a small part of the Home Office

[14]file:///D|/Msoffice/Winword/home%20page/new%20stuff/History%20of%20the%20FSE%20to%202000.htm

oil seed rape/maize crops that are tolerant to herbicides and comparable non-GM crops at the farm scale' exist. (Interim to SSC 1: Introduction).

Following close consultation with NGOs and EN, on April 15th 1999 the government appointed the successful Consortium, which included three publicly funded research institutes, led by the Centre for Ecology & Hydrology (CEH), alongside Rothamsted Research and the Scottish Crop Research Institute (SCRI). Meanwhile, the DETR finalized the practical agreements with the Supply Chain Initiative on Modified Agricultural Crop (SCIMAC), which represented the group of industries implicated in the FSE[15]. It was decided that SCIMAC was going to provide the locations and the GMHT seeds necessary for the trials.

The representations of, and reactions to the FSEs were different accordingly to the position occupied in the project by each of the actors. For example, one of the researchers who took part to the FSE argued that this project 'had nothing to do with food safety or gene flow, it was purely in terms of the environment' (GR2, 2008). Les Firbank, coordinator of the Consortium, highlighted that the FSEs were not meant to study GMOs as such, but rather 'the effects of crop management systems on biodiversity and the other management systems associated with herbicide-tolerant crops' (Les Firbank, 2004:3). Nonetheless, the government sponsored this project as the British strategy to answer public concerns about GMOs and balance with the potential benefits of GMOs (DEFRA, 2001). Meanwhile, NGOs such as Friends of the Earth portrayed the FSEs as the government and industries' way to *show* Conservation Agencies and members of the public that *something* was being done with regards to GMOs. They claimed the government used taxpayers' money to fund a project needed by agricultural corporations in order to finalize the ongoing introduction of specific GMHT products into the British market (Diamand, 2003: 2).

The contrasts between the official interpretation of the project given by the government and the ones provided by other actors implicated in the FSE, elicit questions about the relation between the FSE and public opinion. Specifically, what kinds of public concerns, if any, did the FSE answer? And how did the choice of research question reflect the priorities of some groups over others? On the other hand, the reconstruction of the early stages of this project suggests an attempt to reconcile the needs of science and industry with the concerns both the government and conservation bodies had with GMOs.

Two important actions were taken in the early stages of the project. These choices impacted

[15]SCIMAC includes Monsanto, Aventis, Bayer and Singenta

the way the project was carried out. First, to foster transparency of the trials and facilitate public engagement with science, the Research Councils encouraged scientists to discuss their work with the public. In response to this suggestion, the FSE team decided to make all the material of the trials available on line for public consultation. In addition, in May 1999, the government decided to appoint a Science Steering Committee (SSC). The committee, which included scientists and ecologists, was meant to advise both the government and the Consortium throughout the entire trial period.

The first outcome of the collaboration between the Consortium and the SSC consisted in the decision to write the results of the project in the format of scientific papers (1999, Interim 1)[16]. The underlying logic was that peer review by scientific journals would strengthen the validity of the trials. In some extent this requirement conflicted with the desire for transparency to foster public engagement. In order to find a balance, members of the FSE program combined openness with regards to the methodology and the ongoing discussions of the project, with confidentiality with regards to the FSE results. This strategy embodies the ways in which British science culture and institutions champion expertise, while addressing and fostering public dialogue and engagement.

The main objective of the pilot year (1999) was to define a methodology that fits the requirements of the project. Overall, a total of four trials with maize and three with oilseed rape were undertaken in that time frame. Of these, protesters greatly damaged two, while one was taken out by the farmer. Scientists immediately blamed the mass media and NGOs. Specifically, scientists claimed the FSEs were misrepresented in the public sphere and attached to issues that include food safety, countryside quality and the relationships between consumers, corporations, science policy and democracy (1999, Interim 1). Typically, the Consortium felt these issues went far beyond the FSE's area of competence.

Responding to this situation, scientists involved in the trials increased their engagement with mass media. Essentially, they decided to use this strategy to communicate to the British public their views of the FSE. In addition, the government encouraged the Consortium to regularly meet with members of the local communities involved in the trials. These meetings gathered scientists, NGOs and members of the local communities, and were usually described by scientists as 'talks to' the public (GR2, 2008). Notably, both these strategies and also the vocabulary used to describe them are entrenched in the deficit model and corresponding assumptions regarding an ignorant public. Furthermore, the communication process with the

[16]Overall the Consortium wrote a total of seven reports to the SSC, approximately one every six months.

public is framed as a top-down process that reiterates the deficit model assumptions, while opposing dialogue and public engagement discourses. Wynne (2006) has argued that projects like the FSE gather *invited* publics, like local community members and NGO representatives participating to the Consortium public meetings, but also *uninvite* others. The FSE uninvited NGO members and other protesters who destroyed field trials.

In November 1999, the Consortium agreed to introduce a fourth variety, namely winter oilseed rape, and add a further 60 trials to the original plan. The negotiation happened between SCIMAC and the government. Noticeably, the latter offered to cover the extra costs related with the tests for winter oilseed rape in full. Similarly to the other three GHMT varieties, SCIMAC provided the locations and the seeds for the trials.

In March 2003 the Environmental and Audit Committee (EAC), which aims to contribute the environmental protection and sustainable development of the UK and was first established in 1997 as part of the incoming Labor Government, published a document commenting on this decision. This argued that '[w]hat passed in the months between this agreement by the SSC in June 1999, and November 1999, when the new agreement was reached between the Government and SCIMAC on GM crops, is unclear […] It is regrettable that the Government failed to be transparent about the nature of any deal made with the industry over the inclusion of beet. Given the public's concern and suspicion on matters relating to the GM industry we would expect greater openness' (EAC, 2004: 11). Similar comments came from NGOs like FoE and Greenpeace. In addition to issues of transparency, these discourses elicit questions about science policy and democracy, i.e. which actors are invited to the table of the debate when discussing science policy? And also, which of the invited actors is listened to, and who is silenced?

Following the pilot year, as the programme entered full force, intentional damages to the trials decreased. In the third Consortium interim report to SSC, we read that researchers were satisfied by the site selection for that year, which provided 'representative samples of the geography and style of management for the crops' (2000, Interim 3:3). This relaxed atmosphere suddenly changed during the summer of 2000.

In June 2000, scientists announced that conventional beet seeds, whose offspring were supposed to be used as control group against the GMHT variety, were GM-contaminated. The *Daily Mail* covered this episode with a detailed feature where members of both NGOs and the Green Party were interviewed. Whilst these groups called for the government to intervene and halt the trial, scientists argued the incident did not compromise the validity of the project (Daily Mail, 21 June 2000). Ultimately, a few days later, the Scottish Executive decided to

allow the Consortium to carry on with the study.

Three month later, the field trials were back into the media agenda. This time it was a jury in Norfolk's decision to clear 28 Greenpeace activists who, a year earlier, had raided William Brigham's GM maize field, which captured the media's attention. This episode generated opposing reactions. Particularly interesting was Mr Brigham's comment on the episode. Here is a quote from *The Independent* article that features an interview with Mr Brigham.

> *Greenpeace is a massive environmental pressure group […] We are a small family farm. It used bully boy tactics to get its own way and today the bullies have won. (The Independent, Sept 21st, 2000).*

In this excerpt, NGOs, which are normally framed as small organizations fighting against big corporations, are turned into bullies fighting against small family farms. Furthermore, these few lines highlight that FSE farmers do not necessarily agree with NGOs' actions. But does this mean that some members of the general public may have felt supportive of the trials? Unfortunately, the large pile of data available ignores the general public's views of the project. This gap in the material forces further reflections on the interventions carried out by FSE actors to engage members of the public. It supports the idea, proposed by other scholars (Wynne, 2006; Ellis et al, 2009), that scientific and political institutions construct images of the public, that not necessary reflect people's views on one particular issue. As Ellis et al (2009) note, when imagined publics are the object of institutionalized forms of public engagement these experiences might be detrimental to the process of democratization of science by which they are inspired.

On May 22nd, 2001, the attention shifted on SCIMAC's decision to include the Warwickshire village of Wolston under the trials' umbrella. It was argued that, since this location was excessively close to the Henry Doubleday Research Association (HDRA) organic gardens at Ryton, organic crop varieties were going to be put at serious risk of contamination. Following conservation bodies and NGOs' protests, SCIMAC removed this location from the trials (*The Independent*, May 22nd, 2001). Commenting on this episode, the former Minister of Agriculture, Michael Meacher, stated 'he was very pleased by SCIMAC's decision, which is very sensible, because of the work and indeed the uniqueness of the HDRA' (*The Independent*, May 22nd, 2001). This event exemplifies the striking contrasts between the positions occupied by corporations and scientists, invited guests at the table of the debate hosted by the government, and members of the public, who have to impose their voices to get heard by any of the other actors implicated in the FSE.

By September 2001, the Agriculture and Environment Biotechnology Committee (AEBC), published a report on the FSE. The committee, which was set up in June 2000, and includes experts and non-experts on GMOs, was meant to advise the government on the social, ethical and scientific issues related to these biotechnology products. In order to familiarize themselves with the topic, AEBC members decided to focus their first report on the FSEs, 'evaluate the role of the trials in the regulatory process, […] the data they [the FSEs] were expected to produce and the gaps which might still remain – and, in particular, try to understand and explain the evident public concern' (AEBC, 2001:7).

The report written by AEBC members is significant for two main reasons. First, the AEBC suggested the British government organize a broad public debate to investigate Britons' opinions with regards to the commercialization of GMOs. This called institutions' attention to the weaknesses that characterize the programmatic interventions of public engagement realized vis-à-vis the FSE, up to this moment. In addition, by recommending the government develop an independent body[17] that complements the FSE, the AEBC exposes the scientific limits of this project (AEBC, 2001). Members of the Consortium have always argued the FSEs were not the final piece of evidence before a decision on the commercialization of GMOs was to be taken (GR2, 2008). However, the AEBC suggestion takes a step further. It opens questions about the relevance of this project within the GM field, i.e. how does this project fit in the GM field? And who is this project addressing (i.e. scientists, the government, corporations, members of the public)? Previous interviews in this field show there were numerous issues beyond the FSE that GM researchers considered more urgent. If the answer to the last of my questions is not to be found within the science community, three possible candidates remain: the government, corporations and the general public. However, I would exclude the public from this list, as from what we said above institutions implicated in the FSEs largely ignored, and in fact only imagined, the nature of public concerns about GMOs, and furthermore, the FSEs were not even focused on GMOs per se, but rather the cropping management of specific GMHT varieties.

By the end of 2002, the Consortium had completed trials for three out of four GMHT varieties, for a total of 58, 67 and 66 sites for maize, beet and spring oilseed beet respectively (Haves et al, 2003). The following 10 months saw researchers actively engaged in the analysis of the data and preparation of the papers, which were published, on October 16th, 2003, in

[17]This body will be known as the Science Panel Review. It will gather 'scientists from a spectrum of disciplines and perspectives, two lay representatives a social scientist and a leading scientist with cross membership with the Public Debate Steering Board' (http://www.gmsciencedebate.org.uk/panel/default.htm) (last visit Feb 17th).

Philosophical Transactions of the Royal Society.

In summary, the Consortium found evidence that, when planted under the FSE's conditions, the three GMHT varieties on trial (fodder maize, spring oilseed rape and beet) were likely to affect the British farm-wild life. However, while the impacts for GMHT maize were proven to be positive for the environment, GMHT beet and oilseed rape were found to be detrimental. In this context, scientists underlined that these effects should not be related to the nature of the crop, but rather the different treatments imposed by the specific varieties (Squire, ACRE meeting 2: 5).

Interpretations of these results were further complicated following the EU's decision to withdraw three triazine herbicides[18] (atrazine, cyanazine and simazine) from the market (October 10th, 2003). Obviously, this event impacted significantly on the representations of this project. It should be noted that 3/4 of the conventional maize trials used triazine herbicides. When setting out the trials, scientists chose atrazine herbicide because, at that time, it was the most popular British herbicide control system with maize, and it was important to them to stick as closely as possible to the national cropping strategies. The latter, and not the GM variety, were the object of scientists' inquiry. When atrazine was withdrawn, scientists refused the possibility that the results had been compromised, while suggesting some adjustments to the final interpretations given to the GM maize portion of the data. On the other hand, opponents of the trials argued the use of atrazine had been a wrong choice from the beginning. They suggested scientists chose this herbicide *because*, and not *in spite*, of its detrimental effects on wildlife. They claimed scientists knew atrazine was going to be withdrawn from the EU, but they also knew that any other cropping system, even GMHT ones, would have easily performed better in comparison to atrazine. Mr Meacher, who was disposed as Minister of Environment on June 13th, 2003, was one of the more vocal about this issue. Below is an excerpt from the reactions to the launch of the FSE results taken by the *Daily Mail*. The article combines comments from the former Minister of Environment, Greenpeace and Friends of the Earth. Broadly speaking, these actors suggested the results of the FSE leave no room for GMOs within the British agricultural system.

> *'Greenpeace said: 'For years, GM corporations have claimed their crops would reduce weedkiller use and benefit wildlife. 'Now we know how wrong they were, Tony Blair should close the door on GM crops for good.' Michael Meacher, sacked*

[18] Triazine herbicide is a family of herbicides which includes atrazine. Atrazine is a broadspectrum herbicide. Its use is controversial because of its effects on non-targets species, and contamination of water. Although it has been banned from the European Union in the fall 2003, it continues to be one of the most widely used herbicide in the world.

by the Prime Minister as Environment Minister because of his scepticism towards 'Frankenstein farming', said: 'GM oilseed rape and beet should not be grown in Britain.

'The effect of using broad spectrum weedkillers that kill everything - the network of lice, insects, worms, butterflies as well as weeds - was significantly worse than conventional weedkillers.' He added: 'The trials showing GM maize was better for the environment are invalid.' Friends of the Earth said: 'Going ahead with the commercialisation of any of these GM crops would be totally unacceptable. Information collected at public expense now confirms that GM crops harm the environment, make no economic sense and are deeply unpopular." (Daily Mail, October 17th, 2003).

In November 2003, scientists in the Consortium went over the results again and used the four trials that did not use atrazine to make inferences about the overall results on maize. On January 27th, 2004, *Nature* accepted the Consortium's paper that discussed the case of atrazine which concluded that 'the comparative benefits for arable biodiversity of GMHT maize cropping would be reduced, but not eliminated, by the withdrawal of triazines from conventional maize cropping' (Perry and Firbank et al 2004).

Meanwhile ACRE organized two public meetings to publically discuss the FSE results, one in Edinburgh and one in London. In preparation for these meetings, ACRE members asked interested parties to submit potential topics. From the 60 written submissions, ACRE selected 14 contributions to be heard in person. The selection process aimed at providing a range of opinions concerning the implications of the FSE results, with a focus on submissions that the Committee found relevant to their deliberations. In addition, ACRE invited FSE researchers to present their position at the meetings. At the end of each meeting, ACRE planned a discussion period with members of the audience. When reading carefully the transcriptions of these meetings, it emerges that, for the majority of the time, members of the audience listened to the presenters. Only in Edinburgh did participants get the chance to ask a few questions of the invited speakers.

Does this mean that ACRE did not consider the audience's opinions relevant to the discussion? On the one hand, ACRE did invite members of the public to send their submissions and participate in the public events. On the other hand, ACRE settings did not allow the audience to actively contribute to the debate. This, which, as Davies (2009) shows, might be due to the lack of institutions' familiarity with spaces for dialogue, suggests ACRE failed to engage the FSE audience, and ultimately silenced members of public. In addition, it embodies a culture of scientism, which is typical of the UK and as Wynne (2006) argues idolatrizes science and expertise.

Following these events, ACRE published its formal advice to the government (January 13th, 2004), which was in favour of the cultivation of GHMT maize, and against the commercialization of GHMT oilseed rape and beet. The EAC report on the FSE was published on March 2nd, 2004, and was extremely critical of this project (March 2nd, 2004). In addition to issues of secrecy, which I have already commented on earlier in this section, the EAC formalize critiques to the use of atrazine, which had been already moved by NGOs members and other opponents of the FSEs. First of all, EAC members noted that '[s]ince atrazine was such a devastatingly efficient herbicide, almost any other herbicide used, however potent, might still appear beneficial when in comparison' (EAC, 2004: 21). In addition, EAC members condemned that the phasing out and replacement of atrazine raised serious doubts on the value of the forage maize trial results. The timing of this report, which was published a few months later Nature accepted scientists' evidences in favour for GHMT maize cultivated without atrazine, shows that at that time the debate around this issue was still open.

On March 9th, 2004, Mrs Margaret Beckett, the new Minister of Environment, announced to the parliament the government's final decision with regards to the first three GHMT varieties analysed through the trials. Essentially, the government opposed the commercial cultivation of GM beet and oilseed rape anywhere in the European Union under the same conditions of the Farm-Scale Evaluations, while it supported that of GMHT maize. Notably, Beckett clarified that GM maize could only grow in the UK under the same management regime enforced during the trials. In addition, and with regards to the upcoming phasing-out of atrazine, Beckett suggested that those farmers/corporations who were about to cultivate such crop should also carry out further scientific analysis on the effects on wildlife of conventional maize coupled with non-atrazine herbicide management (Interviews recorded online).

Commenting on the government's decision, one of my interviewees argued that the Consortium was pleased with Beckett's interpretation of the results, which shows the government's commitment to an expert-based approach, in which each crop is assessed on case-by-case basis (GR2, 2008). Disappointed by this decision, a group of MPs were surprised that the government decided to dismiss the EAC advice, and claimed the government failed to even read it[19] (minutes, House of Lords, 2003). Along these lines, on February 20th, 2003, twenty days before Beckett's announcement, *The Independent* published

[19]http://www.rothamsted.bbsrc.ac.uk/pie/sadie/reprints/HoC_9_march_2004.pdf

an article stating '[t]he Government knows that the case for authorising herbicide-tolerant GM maize is weak, but it is a sufficient fig-leaf to give the biotech companies what they want' (*The Independent*, 2003). These comments open important questions with regards to science policies, but also democracy, when this is to be realized in modern biosocieties.

What happened next enhances our understanding of the relations of power existing between the government, scientists and corporations. At the time of the trials, Bayer held the UK license to grow GMHT maize. On March 30th, 2004, the company stated that the government had placed 'several ill-defined new regulatory hurdles in the way of commercialization, delaying it until 2006-2007, […] making an already ageing variety economically unviable' (*The Independent*, March 30th, 2004). In other words, Bayer decided to not pursue the commercialization of GMHT. This meant that no GMHT varieties were going to be commercialised until 2008 at the earliest. The disappointment of the business compound in front of the government's final decision is clear and contrasts especially with the support showed by the experts. Does this mean that in situations of scientific uncertainties, forced to decide between scientists and corporations, the British government opts for the experts?

The last piece of the puzzle on the implications of the use of atrazine came on April 2nd, 2004, when ACRE sent its advice to the government. The Committee found the work provided by Perry et al (2004) sufficient to support the hypothesis that 'conventional herbicide regimes used in the FSEs that did not involve the triazine herbicides (such as atrazine, simazine and cyanazine) lead to a similar impact on weed populations as the management regime associated with GMHT maize' (ACRE, April, 2004).

Finally, on March 21st, 2005, the Consortium published the last portion of the results, with regards to winter GMHT oilseed rape. According to these, there was enough evidence to demonstrate that this variety would have had a negative impact on the UK environment. Even if this news did not generate as much newspaper coverage as the other crops on trial did, *The Independent*, which used the image of a coffin to describe the British GM industry, took this chance to underline that GM food had become a rather unlikely possibility in the UK landscape.

> '*Yet another nail was hammered into the coffin of the GM food industry in Britain yesterday when the final trial of a four-year series of experiments found, once more, that genetically modified crops can be harmful to wildlife' (The Independent, March 21st, 2005).*

This episode concludes the story of the FSE. The careful chronology of how these trials were carried out in the UK strongly supports the idea that science depends on both society and politics (Leach et al, 2005). It unveils the complex web of interactions between the government, science, corporations and members of the publics. This suggests that GMOs are not a neutral technique, but co-produced (Jasanoff, 2004) in the society they are part of. In this context, the government functions as the host, while scientists and corporations can be described as invited guests. Paralleling previous studies (Jasanoff, 2005), this case shows that in situations of uncertainties, like the ones raised by GMOs, the British government opted for a science expert-based approach. This, which embodies a culture of scientism (Wynne, 2006) that champions science, contributed to further strengthen of relations between government and science.

A separate discourse deserves to be developed with regards to the public. According to the government, the FSE responds to public concerns about GMOs; however, careful analysis of the project's aims showed that the FSE was not directed to the study of GMOs, but rather the environmental consequences of GMHT cropping. Noticeably, the latter were specific concerns of the government itself and conservation bodies. Wynne (2006) has distinguished between invited and uninvited publics, a distinction that is analytically useful here. Invited publics are those to which institutions direct public engagement experiences, i.e. the public attending ACRE open meetings. Uninvited publics, on the other hand, can take different forms - NGOs, journalists, or even government committees can fall under the umbrella of uninvited publics, as can anybody in society who decides to express his or her opinion on an issue without being invited to do so. As this case shows, the actions of uninvited publics (i.e. NGO members' protests) have proven crucial to spark changes in the relation between science and society. While the FSE was in response to the sparks generated by the NGOs, such actors were not invited to participate in the FSE project per se. Finally, this study supports other scholars' findings, according to which contemporary institutionalized forms of public engagement are still entrenched with deficit model assumptions regarding public ignorance and mistrust for science (Wynne, 2006), and have in turn consistently failed to democratize science (Ellis et al, 2009; Reardon, 2007).

In *Acting in an Uncertain World* (2009), Callon, Lascoumes, and Barthe propose an explanation of why these failures occurred. They argue that delegative forms of democracy, like the ones characterizing Western countries, are grounded on a double 'break' between a) science and society, and b) politicians and citizens. These breaks contradict with the ideas of public engagement and science democratization, by putting politicians and scientists in

positions of control. In the face of scientific uncertainties, like the ones raised by GMOs, members of the public have been challenging these 'breaks' and the power of scientists and politicians. In order to protect their positions, those in power have developed a series of strategies that made these 'breaks' more bearable and contemporaneously moved away the possibility of democratizing science.

With the FSE, new engagement interventions barely camouflaged deficit model assumptions and reiterated the separations between science and the public, and politicians and citizens.

4. Case study Two: *OGM in Agricoltura* in Italy

During the period I was setting up my project, Italian newspaper *Il Corriere della Sera* organized an online forum to discuss the topic of GMOs with two GM experts[20]. I contacted both scholars and asked their help to familiarize myself with the Italian GM research field. They suggested I speak to a couple of journalists, who have been following the GM case over the past decade. I eventually met with both. During one meeting, the journalist mentioned the *OGM in Agricoltura* study. She argued 'if you are really interested in understanding the policy of GMOs in Italy, you should consider this study in detail. It is just so typical of this country' (J1, 2008). She went on to give me her personal account of the project and allowed me to use her archived material regarding the study. This included all the press releases related to the project and her articles on this topic. Finally, she invited her husband, who participated in the press conference that launched a large portion of the project's results, to join us.

While working with my transcriptions of this interview, I noted that the journalists had recurrently made references to the people involved in this project, but also to the group of GM researchers excluded by the study. I decided to schedule a few more interviews with members of both these groups. I also thought it would be useful to try to contact the former Minister of Agriculture and ask for a meeting. I successfully met with a researcher involved in the overall organization of the project and two of the researchers who were indicated as excluded. Notably, some of the scholars included in the project turned down my interview request, while Giovanni Alemanno, former Minister of Agriculture at the time of *OGM in Agricoltura*, never responded to my numerous attempts of contacting him.

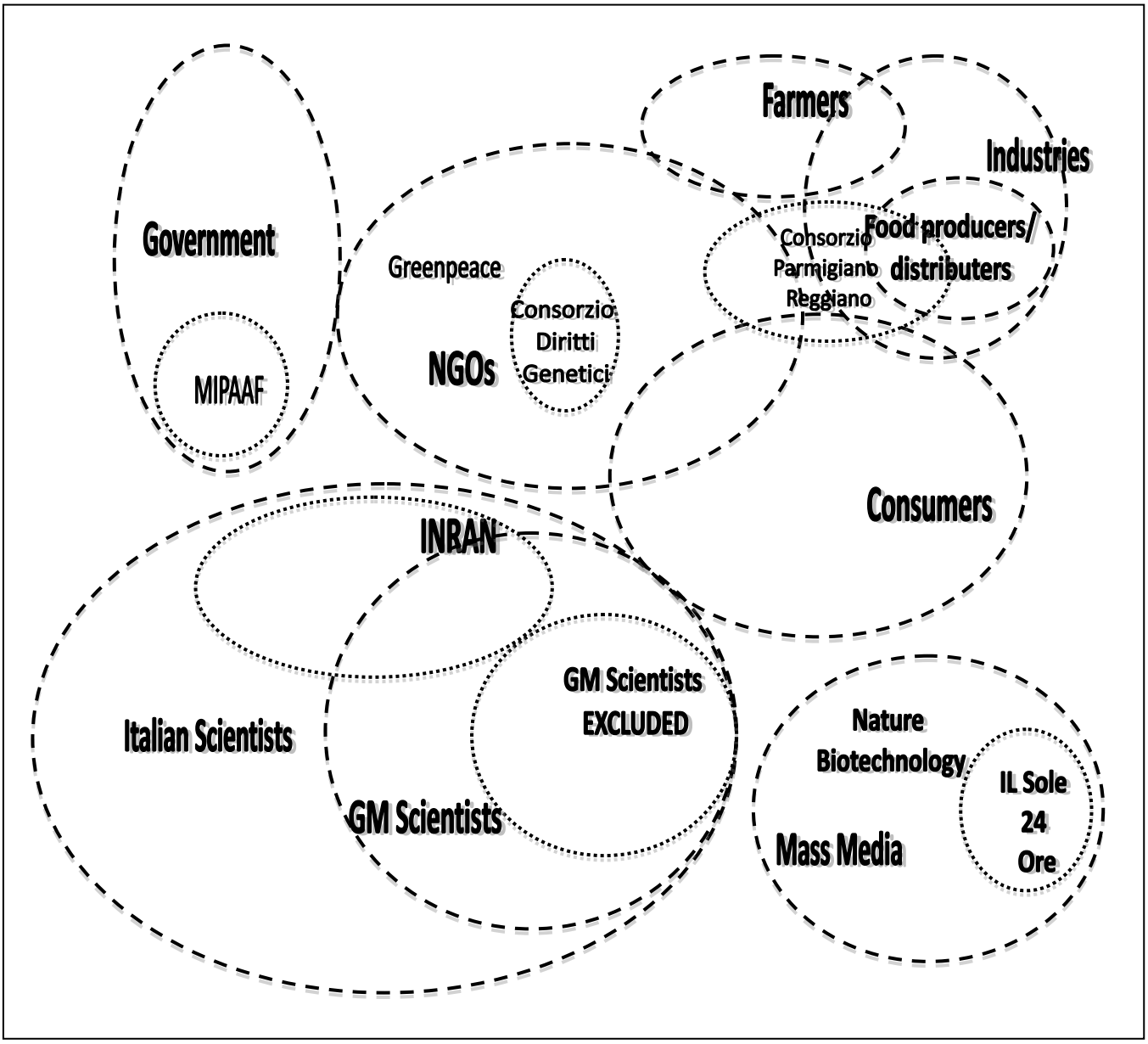
In order to fill the gaps in interview data, I sought further information regarding this project online. In doing so, I immediately noticed that the study hardly made its way into the popular

[20] http://www.corriere.it/salute/esperto/esperto_risponde_20fc930e-1aa2-11dd-b32c-00144f486ba6.shtml

press. Checking the archives of the *Il Corriere della Sera* and *La Repubblica*[21], I found that neither of the newspapers mentioned the phrase 'OGM in Agricoltura'. Following further searches on the web, I collected a total of two articles from the popular press, two from scientific publications, and a further three from online magazines. I also found two websites that consistently referred to this project. The first one is the web site of the Institute of National Research on Alimentation and Nutrition (INRAN), which coordinated the project. Here, I found a series of documents and press releases on the study. The second website that covered this project is a blog called Salmone.org. It is the website of SAgRI, an NGO made up by Italian scientists and researchers. Following a meeting with a member of SAgRI, I regularly monitored the blog. In addition, I was given an edited book that covers the results of the project. Through an online search, I also found three correspondence documents between MPs and the former Minister of Agriculture that mentioned this project.

[21]These are the two most popular Italian newspapers.

Fig 2 Social Worlds Map OGM in Agricoltura (2003-2007)



I carefully read all my data and began mapping the project. The figure above represents the social worlds of the actors touched by the Italian study. It will be used as a reference in recounting the case of *OGM in Agricoltura*. Despite the gaps in the material, I felt confident I had enough information to write a narrative of this project that would serve for my analysis of the factors implicated in the way scientists listen, or fail to listen, to public opinion.

> *In the current debate about GMOs, it happens frequently that confused and disordered messages prevail. This has not helped to make clarity, while Italian citizens wish to know more, and from valid sources, about this technology.*

> *Consumers, farmers and other food producers would like to understand the consequences, either positive or negative, of using GM varieties within the Italian agricultural system. They would like to understand the advantages and disadvantages of a choice that so far has been biased by personal preferences. Thus, there is a need to further study this technology, possibly without previous bias. In order to respond to such need, the Ministry of Agriculture, under the guidance of the Minister Giovanni Alemanno, has strongly wanted and financed the project OGM in Agricoltura, with 6.2 million Euros. The project, which began in 2003, is a 360-degree study on the numerous issues related to the cultivation of GMOs in Italy.* (Monastra, 2006).

According to this extract, taken from the presentation of the second work-in-progress conference held in 2006, *OGM in Agricoltura* is a project designed by the government to respond to Italian citizens' concerns about GMOs. The emphasis on bias is prominent in the document. From the quote above we learn that the project started in 2003, and was funded by the government with 6.2 million Euros. It was promoted by the Ministry of Agriculture and former Minister Giovanni Alemanno. In the paragraphs that follow this excerpt, the readers learn that the government has assigned the coordination of the project to the Institute of National Research on Alimentation and Nutrition (INRAN), and specifically the Institute's director Giovanni Monastra. It is also explained that the project focused on two varieties of plants, MON810[22] and GM tomato. Scientists looked at the safety of these crops and their environmental impacts. The study of the techniques of DNA detection into food to control GM contamination was also included under the project's umbrella. In addition, scholars involved in the project studied the economic and social impact of these technologies in the Italian context, while contemporaneously trying to develop better strategies for communicating science to the public (Monastra et al, 2007)[23].

[22] MON 810 is a variety of genetically modified maize developed by Monsanto. It contains a gene from the bacteria *Bacillus thuringiensis* that expresses a toxin (Bt toxin) poisonous to some pest insects. It was approved for use in the European Union in 1998.

[23] Here a more detailed breakdown of *OGM in Agricoltura's themes:*

1. *Create a database that collects all the information on the research that has been done so far on GMOs*;
2. *Update and develop new strategies to track transgenic traces into foods that are meant for both animal and human consumption*;
3. *Study the impacts of GMOs on the Italian economy, with particular attention to comparing what it is that GM cultures allow that we cannot already do with traditional varieties*;
4. *Evaluate public perception with regards to DNA recombinant techniques in the Italian agricultural setting -especially with regards to a few symbolic products- and understand the processes that lead to the acceptance or resistance to GMOs*;
5. *Develop a system that improves public communication and public debates, citizens' awareness of these products and informed choice*;
6. *Improve DNA detection techniques into seeds/foods to trace the presence of GM sequences*;
7. *Analyse nutritional profiles of certain GM products (i.e. MN810 and GM tomato with increased levels of beta-carotene), with particular interest to the parameters usually neglected by the literature, and analyse the effects of GM diet on animals*;

> *The story of OGM in Agricoltura is almost impossible to tell. Alemanno was very clever, he did not want to show his blunt opposition to GMOs, and so he decided to fund this project, which allegedly is on GMOs. When looking carefully, though, you can see this study is actually just trying to prove the risks of using GMOs. It is extremely weak in scientific terms, as always happens in this country, and cost the government an incredible amount of money. (J1, 2008).*

Here we see a very different interpretation of *OGM in Agricoltura*. In the first account, this study is portrayed as the government's response to public concerns about GMOs. In the second statement, however, the project, which contributed to construct Alemanno's public image, is exclusively directed to study the risks of GMOs. Both stories make sense, and it is relevant that both of them were produced. However, is there one that better describes what happened when the Italian government set up the project *OGM in Agricoltura*?

Lets us start from the beginning. We already know that the project started in 2003. At that time, Giovanni Alemanno was the Minister of Agriculture, a position he held until 2006, when Paolo De Castro replaced him. Alemanno has never kept secret his skepticism towards GMOs, in general, and with regards to the introduction of these products in the Italian agricultural system, in particular. Notably, under Alemanno's legislation all government funding to GM projects was halted, with the exception of *OGM in Agricoltura*, a project the Minister assigned to the Institute of National Research on Alimentation and Nutrition. There is no explanation of the process that brought the government to choose INRAN. According to one of the journalists I interviewed, the government allocated the funding to the Institute *before* the project was even outlined. Supporting this possibility, one of the GM researchers excluded from *OGM in Agricoltura* underlined that 'there has never been a public call for this project, and I never had the chance to be involved in it, or at least try to participate' (UR4, 2008). These accounts suggest a tension within the science community, which distinguishes those included in the project from those excluded from it. It opens up questions about the logic behind this exclusion, i.e. why INRAN, what is it that makes this institute more qualified than other research centres, and why wasn't there a call for research? Finally, it introduces issues of secrecy and calls for further reflections on the relation between science and Italian politics.

8. Study the impacts of certain GM plants (i.e. MN810) on the soil (Monastra et al, 2006: 13).

The first time the mass media covered this project was in relation to the first work-in-progress conference on October 5th, 2004. Noticeably, this event was held 22 months after the project's launch. As we read in the article published in the Ministry of Agriculture's online magazine, which is also the only media featuring the event, the conference revolved around three main points[24]. First, according to INRAN, studies on the Mediterranean diet showed the integration of GMOs might prove detrimental to the local diet. Second, INRAN expressed concerns about the spread of allergens associated with gene transfer techniques that would compromise consumers' safety. Finally, it was noted that, as part of the project, INRAN was in the process of developing a database of all publications on GMOs to be made publically available[25].

Describing exactly who was invited to the first *OGM in Agricoltura* work-in-progress conference, and who was excluded, remains unclear. Was it closed to the researchers working on the project? Was it open to all members of the scientific community, and perhaps the mass media? This gap in the data raises questions about the lack of media attention that characterizes this project. Was it specific of this study, or this is lack of reporting characteristic of GMOs or, perhaps, of the way the Italian popular press covers scientific topics?

On March 7th, 2006, INRAN scheduled a second work-in-progress conference to release a large portion of the project's results. Importantly, the popular press largely ignored this episode, which was barely mentioned in a few newspaper articles (see below). According to the INRAN press release, a significant section of the conference dealt with MON810. Specifically, INRAN found one case of instability in MON810 (Bogani, 2006) and *certain alterations* (this is not specified in further detail) in the immune system of tested laboratory animals fed with this GM variety (Buiatti, 2006). INRAN did not find any difference with regards to the nutritional composition of traditional and GM maize, except for the higher values of lignin in MON810 (Maiani, 2006). In addition, the open release of GM maize showed that MON810 produces greater yields when compared to its traditional equivalent. Finally, some differences were found with regards to the impact of GM cropping on microorganisms (Mocali and Pietramallara, 2006). A second group of studies regarded GM tomato. INRAN found increased levels of beta-carotene in the GM variety, when compared to the traditional variety (Palozza, 2006). Finally, other topics discussed during the conference included new methods for detecting foreign DNA sections in conventional foods, the results of the database collection on GM research, and socio-economic studies on the introduction

[24] http://www.agricolturaitalianaonline.gov.it/content/view/full/441/(offset)/60

[25] Noticeably, as of February 2010, no such database has been activated.

and commercialization of GMOs. With regards to the latter, it is interesting to note that a public perception survey on GMOs was discussed that indicated 62% of the respondents were against the introduction of GMOs, 87% of the interviewees suggested there were still many uncertainties with regards to GM products, and 76% showed concerns with regards to GM safety for human consumption (Saba, 2006). Notably, *OGM in Agricoltura* found that only 18% of the farmers interviewed were willing to cultivate GMOs (Veri, 2006).

Somewhat surprisingly, considering the wide range of results I just described, what mostly captured the attention of members of the GM community was a set of data on the cultivation of GM maize that was omitted from the conference. Tommaso Maggiore, professor at Universita' degli Studi in Milan, and supervisor of the Angelo Menozzi research centre[26] was excluded from this conference. The Angelo Menozzi research centre housed the open release of GM maize for the *OGM in Agricoltura*. According to Maggiore's data, 'MON810 corn contained 60 or fewer parts per billion of fumonisin, whereas non-GM varieties contained over 6,000 parts per billion' (Nature Biotechnology, 25/12/2007). Fumonisins 'are toxins that are produced by fungi able to infect plants through lesions caused by the corn borer' (Nature Biotechnology, 25/12/2007). According to EU law, fumonisin levels cannot exceed 4,000 parts per billion. These data were relevant because they showed that GM crops have lower levels of fumonisins, and contemporaneously indicated that the levels of this toxin in conventional varieties of maize were unsustainable under the current legislation. Nevertheless, these results never made their way to INRAN's conference. Why did this happen? Was this intentional, or are there other possible explanations? What were Maggiore and INRAN's views on this episode? I contacted Maggiore to try to address these questions; an interview was scheduled, however, for personal reasons, we were not able to meet. However, this event interested many of the scientists I spoke with who were excluded from the research program. Using this material in conjunction with written record, I was able to reconstruct the episode as follows.

Fifteen months after the conference that omitted Maggiore's data, a group of MPs wrote to the former Minister of Agriculture. They asked the government for clarification regarding the allocation of funding for this project, the affiliation of the project with Consiglio dei Diritti Genetici[27], and the exclusion from the project of some of the most esteemed GM researchers in Italy (June, 2007). They also questioned INRAN's decision to communicate scientific data

[26] http://www.inran.it/inran/stampa_e_relazioni_esterne/comunicati_stampa/OGM_com.pdf

[27] Consigli dei Diritti Genetici is an NGO that widely campaigned against GMOs in 2007

not yet submitted for peer review to the public. Finally, they denounced INRAN's omission of Maggiore's data and asked for further explanation regarding this episode.

This document is relevant in three main ways. First, it is interesting that it took MPs fifteen months to comment on INRAN's work-in-progress conference. Why did they wait so long? What does this say about the position of science in the Italian landscape? Second, this document foregrounds the lack of clarity that characterizes the way the government handled the project from the beginning, which ultimately climaxed with the omission of data on fumonisins. Finally, and in addition to the decision of the government to assign to INRAN the coordination of the project, MPs introduced a new question - why did the government not think to include GM researchers academically known for their expertise in the field of GMOs? Questions like this support discourses of exclusion, pointing to the tension between two groups of GM researchers, i.e. those inside and those outside the project. Trying to answer this question, the financial newspaper *Il Sole 24 Ore* argues that the criteria that informed this selection was the researchers' position with regards to GMOs. In other words, participation in the project, which also meant conspicuous funding, was guaranteed to those scientists whose personal views on GMOs aligned with the government's anti-GM position.

> *Why have outsiders of the GM community been involved in the project, instead of Salamini, Sala, Delledonne, Defez, Ruberti, Costantino? In other words, the best Italian GMO biotechnologists. I propose an answer to this question. Several articles [included in the INRAN edited book] were published by researchers who have always been ideologically involved in anti-GM campaigns.* (Corbellini, 22/07/2007).

In the same month parliamentarians wrote to the Minister of Agriculture, a group of scientists sent a letter to the government. Below is my translation of two particularly salient paragraphs.

> *It appears strange that the only GM release in the field conducted over the last few years in Italy has produced extremely interesting data with regards to the fumonisin content, yet has not been publicized. The data show that, as well as an increase of approximately 40% of yields, the content of fumonisin in GM maize is 100 times lower than that of its conventional equivalent.*
> *Thus, it can be argued that the GM option represents a potentially valid option for Italian farmers, and also the consumers, who would have a better quality of products. Nevertheless, the impossibility of studying GM products without limits and biases that characterizes the present situation of Italian public research leaves this option in the hands of a few politicians who have their own interests and are not particularly attentive to consumers' safety.*[28] *(SIGA, June 2007).*

[28] 'Appare strano che nell'unica prova in pieno campo con OGM condotta in Italia negli ultimi anni siano stati ottenuti dei dati molto interessanti sulla riduzione nel contenuto di fumonisine nel mais OGM, ma che tali dati

Paralleling the MP's document, scientists raised questions about the lack of transparency that characterized the way INRAN handled Maggiore's data. However, the scientists went one step further and denounced the impossibility to carry out unbiased research on GMOs vis-à-vis the government's anti-GM position. This elicits important questions about the role of politics in this country and its impact on science practices.

In December 2007, *Nature Biotechonology* published an editorial on a conference that took place on November 13th 2007 and was organized by SagRI to publically disclose the data on fumonisins. Below is a paragraph taken from the editorial, which introduces discourses of transparency in relation to science and science policy, in arguing that GMO science in Italy has been heavily influenced by the government's anti-GM approach.

> *There were new data from Italy in mid-November but, oddly, they were largely ignored. Usually, the slightest evidence derived from potatoes loaded with toxins or caterpillars force-fed in sandwich boxes can be apparently accorded significant media merit if there is a sniff of genetic modification around the protocol. Similarly, highly predictable observations on gene transmission are heralded as surprising and deep if the DNA involved has been anywhere near a ligase in vitro in its past 1,000 replications. The reason the new Italian data—from the only field trial of Bt maize in Italy since 2000—was ignored is simple: it showed GMOs in a positive light embarrassing to the coalition. (Nature Biotechnology, December 2007).*

Similar arguments also featured in *Il Sole 24 Ore* (Corbellini, 22/07/2007). Notably, *Il Giornale* and *La Stampa*, two other popular Italian newspapers, also briefly covered the conference organized by SAgRI, whilst, according to *Nature Biotechnology*'s editorial, the periodical *L'Espresso* decided against running the story as the fumonisin data contrasted with the editorial anti-GM position (*Nature Biotechnology*, 2007).

Setting out to prove that INRAN occulted Maggiore's documents, SAgRI published online the email exchange between Maggiore and INRAN. The content of these emails was in turn denied by Monastra on *Nature Biotechnology* over the spring of 2008.

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non sono stati divulgati. I dati ottenuti indicano, oltre ad aumenti di produzione del 40%, una riduzione di 100 volte nel contenuto di fumonisine nel mais da OGM rispetto ad un mais tradizionale.

L'opzione OGM si evidenzia quindi come una opzione potenzialmente vincente per gli agricoltori italiani e nutrizionalmente più sicura per i cittadini, ma l'impossibilità per gli Scienziati Pubblici italiani di studiare gli OGM in pieno campo senza condizionamenti e senza pregiudizi, come avviene in tutta Europa, lascia questa partita nelle mani di pochi politici legati ad interessi di categoria che hanno dimostrato scarsa attenzione per la sicurezza alimentare dei cittadini' (http://www.siga.unina.it/Appello_OGM.html)

> *[Maggiore] claims he sent Gianni Pastore of INRAN a letter by e-mail on February 23, 2006, with a file containing his data on fumonisins, but we have carried out a careful check and have no record of such a letter. Both the INRAN server and Pastore's computer do, however, show that on February 27, 2006, a report was received from Maggiore. In the accompanying letter, he apologizes for the delay in submitting his report, and he also writes that it does not contain the data on fumonisins, which he had not yet analyzed. Not only do we have no record of the letter dated February 23, but it is hard to understand why, if he had sent a report including the fumonisin results to INRAN on that date, he would have followed it four days later with a second letter that makes no reference to the earlier one, informing us that he had not yet carried out the analysis (Nature Biotechnology, April, 2008).*

The position of INRAN was that Maggiore had never been asked to produce the data on fumonisins. In addition, the coordinator of the project noted that INRAN did not receive the data in time for it to be discussed during the second work-in-progress conference. When the data finally reached INRAN, the Institute decided that, because they were unique in their genre, they needed further confirmation. This elicits questions about the criteria used by INRAN with regards to the communication to the public of scientific data. We already know that the Institute had communicated data before peer review. However, it remains unclear how they discriminated between the data to communicate and the ones to not communicate. The scientists I interviewed who were excluded from the project claimed that INRAN only communicated those findings that fit with the idea that GMOs are risky to society (GR2, 2008), or else the government's view on this topic.

On November 18th, 2007, the former Minister of Agriculture, Paolo de Castro, wrote a letter to the Italian Parliament that fully supported INRAN's position with regards to Maggiore's data. Noticeably, De Castro substituted Alemanno as Minister of Agriculture. Nevertheless, it seems that this did not change the government's position on GMOs. This suggests the government's view on this issue goes beyond the person in charge, and the parties he, or she, represents.

This event closes the fumonisin episode, which is important for three main reasons. First of all, it is significant that GM scientists excluded from the project found it appropriate to act as a minority group, i.e. they created an NGO, wrote to the government, and organized public protests (a contra-conference to publically disclose the data on fumonisins). This raises questions of transparency, scientific practices and the government within the Italian landscape. According to bioethicist Gilberto Corbellini, science is politically irrelevant within the Italian context. It has become a political tool used by MPs to gain more authority and

support personal views (Corbellini, 2008). Omitting these data would make sense in this context, because they were not paralleling the positions of those in power.

The most recent update on *OGM in Agricoltura* was in December 2007, which is also when MPs sent a new complaint letter to the Minister of Agriculture. In this document, INRAN asked for a one-year extension to be able to complete the project. During 2007, INRAN failed to obtain the authorizations for open releases of MON810, which meant they could not carry out the studies on fumonisins. On this occasion, INRAN declared that several other works were on the verge of being finished, and could benefit from this period of extension. With regards to socio-economic issues, the report notes that the project was halfway through. After gathering information from experts on GMOs, which were in turn discussed with scientific journalists, researchers had began developing participatory exercises that would include the public and GM stakeholders in scientific decision making. In the following excerpt, researchers describe aims and methods of this subproject.

> *We are now organizing a series of participatory processes that include all the stakeholders that are relevant for the future of GMOs. These will allow new forms of communication between science and society to emerge, including and surpassing the ones we had in the past. It is our aim to improve the quality of the public debate on GMOs in the Italian landscape… a debate that will gather all the stakeholders touched by GMOs and is now in the process of realization. This will take the form of an online debate and will include farmers, corporations, NGOs and consumers. It will be closed to the public, and the access to the forum will be password restricted. In the end, we aim to construct a website that will summarize all the various stages of the participatory exercise to the large public. (Summary project, 2007).*

Even if written in the language of public engagement, ideas regarding the separation between science and society, nested in the deficit model, continue to be prominent in this participatory project.

The INRAN web site does not report any other information on *OGM in Agricoltura*. There is no further data available on the results of the project in the media; there are also no other scientific publications that can be associated to this research. Only SAgRi is continuing to monitor this project, and from time to time writes articles about it. This leaves open important questions, i.e. which subsections of the project were completed, and which remained unfinished? What was the final outcome of the portion of the works completed? Was INRAN able to provide further evidence to support the idea that GM products could be risky for human consumption? And finally, what kind of participatory exercises was INRAN able to

organize?

The lack of information with regards to this data leaves many possible scenarios open, i.e. a) INRAN is still working on the subprojects and in the process of publishing their results, and b) INRAN was unable to conclude the project and has moved on; c) INRAN has concluded the project, however it failed to find the results it was expecting and decided to not inform Italian citizens.

I began the story of *OGM in Agricoltura* with two possible storylines. One was the official story, while the second one was drawn up by a journalist and represents her point of view of this project. Both storylines portray a relation between the public and *OGM in Agricoltura*. However, in one case, the government developed this project to respond public opinion, while in the second case the project represents a tool for ending GMOs in Italy. The historical account of this project shows that, apart from one press release document, there is no other verbal or written evidence that supports the idea that this project responds to public opinion concerns about GMOs. For example, it was never explained which public concerns this study was exactly responding to. This supports the idea that public servants and scientists construct imagined forms of publics (Wynne, 2007; Ellis et al, 2009). On the other hand, the fact that, throughout the entire narrative of this project, the different actors implicated in the project made constant references to issues of transparency supports the second possibility.

Callon's theory of the double breaks that characterize delegative forms of democracy challenged by the uncertainties associated with GMOs helps me to think about what happened with *OGM in Agricoltura*. However, in order to fully understand this study, it is necessary to place it into its national and cultural context. In other words, I argue that the way this project unfolded only makes sense vis-à-vis the marginal position occupied by scientists within Italian society.

In his book *Why scientists are not dangerous* (2009), Corbellini argues for a cultural imbalance between human and natural sciences that favors the former and is typical in Italy. In this context, he suggests natural sciences have become politically irrelevant and are only called into question if they can support public figures' views on selected issues. This would explain why Maggiore's data, which clashed with the government's view on GMOs, never made it into INRAN's conference. In addition, the analysis of *OGM in Agricoltura* shows how this practice might be detrimental to the unity of the science community. It also opened important questions about the impact of politics into science practices.

5. Comparison and discussion

I began this paper by asking which social, political, economic and other factors shape the way scientists get to know public opinion, and how this happens

I mapped the stories of two projects on GMOs, the *Farm Scale Evaluation* and *OGM in Agricoltura,* which I chose both for their similarities and for their differences. In this section, I bring together the two case studies, which I compare and contrast.

Asking which social, political, economic and other factors shape the way scientists get to know public opinion requires focusing on the human, non-human, individual, and collective actors I encountered through the paper. In order to do so, I began with an analytical exercise and compared the two social world maps in figs 1 and 2. For one thing this exercise pointed to the complexity of the relation between science and society, which has been popularized under the name co-production. In addition it allowed me to identify a list of six factors which I believe influenced the ways scientists got to know public opinion, i.e. the government, position and culture of science, type of publics, private companies, mass media and PUS academic debate. In the following, I will systematically discuss each of the factors separately.

Paralleling other scholars (Bauer et al 2007; Burchell, 2009; Reardon, 2006; Wynne, 2006), this study shows that the government occupies a relevant position in the relation between science and society. It is the government that funded the two projects I am analysing, and it is the government that encouraged, or failed to encourage public engagement interventions. In other words, as Reardon (2006) suggests, the capacity to hear and learn from the public would require institutional support and specific policies that encourage scientists to genuinely engage with the public.

A second important factor that impacts the way scientists get to know public opinion is the position occupied by science. I suggest this is strictly related to the national culture of science. It can be argues that Italy and the UK have a different culture of science. In one case, the UK, we find a society that championed science and expertise. In the case of Italy, the situation is completely different and in fact science is marginalized and located at the bottom of society (Corbellini, 2009). Nevertheless, it is interesting to note that both countries use science to legitimize policy, even if the policies science is supporting is in one case in favour and in one against GMOs. As Wynne (2006) showed, societies that use scientific facts to support policy tend to be entrenched with deficit model assumptions of ignorant publics who mistrust science. This ultimately ends up increasing the distance between science and society, and limiting the listening capacity of science. In addition, the lack of authority of Italian scientists

and their marginalized position in society meant that Italian scientists act as a minority that is more interested in gaining support from the public, rather than engaging or communicating with citizens.

A third factor that affects the way scientists listen to the public is made up by the kinds of publics that are implicated in, and co-constructed vis-a-vis GMOs, or more precisely the FSE and the *OGM in Agricoltura*. This study shows, as Wynne et al (2007) pointed out, that there are different kinds of publics, i.e. invited and uninvited ones. Both these publics have been relevant for the development of the FSE in different ways. When the publics are uninvited, like in the case of the NGO protesters who destroyed the farm scale trials, they impact on the relation between science and society differently from the way invited publics (i.e. those who participate in the meetings organized by ACRE in the UK) were able to. In addition, this study pointed to the lack of interest shown by both scientists and institutions towards the images, thoughts and opinions of the publics with regards to both the FSE and *OGM in Agricoltura*. This supports the idea that scientific and political institutions own specific images of the public and public opinion, according to which they shaped public engagement interventions (Ellis et al, 2009; Wynne, 2007). I suggest this study indicates that communication problems might arise in those occasions in which imagined publics misrepresent the ideas of the individuals who constitute the public for that particular technology, or project. Thus why it is so crucial that science and institutions of other kinds, which are implicated in the relation between science and society, abandon preconceived ideas about the public and shift their attention from 'talking to' towards 'listening to' the publics. Of course this will only help if not pre-limited by preconceived ideas of the public.

Notably, the fact that a project, like *OGM in Agricoltura*, failed to gather both invited and uninvited publics, suggests that, where science is marginalized, science is also deprived of its publics.

The fourth factor on the list is the mass media. Several scholars have explored the mediating role played by the mass media in the relation between science and the public (Bauer et al, 2002; Gutteling, 2005; Mazur, 1981, Petts et al, 2001). Previous findins indicate that Italian GM scientists look at the mass media as the main form of communication with the public. In light of this finding, it is striking to note the lack of coverage that characterizes *OGM in Agricoltura*, which is especially evident when compared to the considerably higher coverage gathered by the British project. Does this mean Italian scientists implicated in this project were not interested in communicating to the public? If that is the case, why did this happen? Does this have something to do with the negative attitude towards GMOs that characterizes

OGM in Agricoltura participants?

Furthermore, both projects show how the mass media can act as uninvited publics. *The Independent*, in the UK, and the Italian website SAgRI exemplify how this happens. The former of these two uninvited publics, which followed the FSE step by step, continued to elicit questions about the legitimacy of this project and the use of GMOs in the British landscape. Similarly, SAgRi systematically reported about *OGM in Agricoltura* and denounced the project's failings. Overall, this suggests the mass media role in the relation between science and society is not limited to the transfer of information from science to the public, but can contribute to the construction of interactive forms of public engagement.

Another factor that contributes to shape the way scientists listened to public opinion has to do with agrifood private companies. This factor only emerges if looking at the UK context, where a consortium of private companies producing GMOs has been supplementing the FSE. One possible explanation for this difference might lie in the projects' nature that in the UK was meant to exclusively test GMOs into the field, and needed a significant quantity of GM seeds, while in Italy included multiple purposes, and only a few field trials. Focusing on the UK context, we see that corporations occupy a primary position together with the government and scientists. This leaves members of the public in a second order position, which makes any communication process with scientists unbalanced. In addition, this situation contributes to increase the distance between science and the public.

The last factor that impacts on the way scientists listen to the public is related to the academic attention towards the modern PUS debate. This cross-country comparison features a nation (the UK) that housed the modern PUS debate, to a country (Italy), that only experienced the ripples of those PUS discourses emerging in the EU. The analysis of these two case studies suggests that, where there is less academic experience, attention and interest towards the issues related to the modern PUS debate, discourses about dialogue find more difficulties to circulate. *OGM in Agricoltura* did not simply fail to engage the public, but it did not even try to do so. In the UK, where PUS discourses have by now become constitutive of the local culture of science and policy making, society is put face to face with crucial questions about the role of science in society and the role of the public on the process of knowledge construction. This, which does not mean that the UK succeeded in engaging the public, has yet created a space for reflectivity that is crucial to improve the current forms of communication with the public and facilitate how scientists get to know public opinion. This space is only just now emerging in Italy.

Ultimately, by comparing and contrasting Italy and the UK, this study helps brake down the complexity of the relationship between science and members of the public. This points to six factors that include the government, the position and culture of science, the types of publics, the mass media, private companies and the extent to which PUS discourses are circulating in the national academic debate. In this context, significant attention goes to the government, which proposed and funded both these projects. Nonetheless, this project shows that albeit the governments' efforts to use these initiatives as a way to democratize science these projects ended up marginalizing some members of the public, as it happed in the UK, or excluding citizens, as it happened in the Italy. Overall, this study supports Reardon (2007), who argues that calling for democratization of science is not enough to democratize science. Finally, I agree with other scholars (Jasanoff, 2005; Leach et al, 2006; Wynne 2007) and position discourses of communication between science and society in close relation with the local cultures of science.

6. Conclusions

The main questions of this paper ask which social, economical, political or other factors have impacted in the way GM scientists get to know public opinion, and how so. The projects on GMOs carried out in Italy and the UK that I analysed tell two different stories, which nonetheless share some similarities. In one case, there is a project that was carried out to study the environmental effects of GMHT cropping. This project came together with public engagement interventions encouraged by the government that typically failed to democratize science and did not make it easier for scientists to listen to public opinion. In Italy, on the other hand, scholars planned a study that looked at GMOs from multiple perspectives. Also, in this case scientists failed to listen to public opinion. Importantly, here the government did not encouraged, nor discouraged public engagement exercises. In addition, the analysis of this project opened up important questions about the influence of politics on the way scientific research is carried out in this country.

Comparing the two projects, I have identified six factors that impact, in specific ways, on the listening capacity of science. These include the government, the position and culture of science, the types of publics, the mass media, private companies and the extent to which PUS discourses are circulating in the national academic debate. The analysis of these factors shed some lights on the dynamic interactions between science and society that is typical of co-produced technologies.

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