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Revitalizing Austria's anti-GMO culture in the midst of the EU's struggle to authorize the cultivation of GM 1507 maize

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Xingfei Zhong

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Stay hungry. Stay foolish.

(Steve Jobs)

ABSTRACT

Following the on-going disputes over the cultivation proposal of GM 1507 maize in the European Union, this paper aims to investigate how a small EU Member State, Austria, succeeded in unequivocally announcing the decision to firmly keep the maize out of its territory. Combining interviews and document analysis as main research methods, the focus of this research is to explore how the *precautionary principle*, Austria's guiding policy in dealing with GM matters, is understood by Austria's major stakeholders in this case; and how their different understandings, namely, *scientific understanding, economic-political understanding and normative social-critical understanding* of the precautionary principle are flexibly mobilized by the stakeholders so as to form valid arguments that buttress their anti-1507 maize stance. Besides the precautionary tool, I argue that a set of *sociotechnical imaginaries* and a *national technopolitical identity* in Austria, which have been established collectively through the making of a remarkable anti-GMO culture, may have profound influence on the nation's position in the 1507 maize case. In a word, a national decision of keeping GM 1507 maize out of Austria is not only justified by scientific rationales, but also arises from the nation's "anti-GMO" culture and its "GREEN" identity. In this view, I would argue that Austria expands the scope of *risk* in the GM regulation, thus blurring the boundaries between science, politics and values. This "blurring of boundaries" pleads for a move from *"risk governance"* to *"innovation governance"* in societies' handlings of risk technologies.

ZUSAMMENFASSUNG

Aufgrund des bestehenden Disputes über den Antrag zur Kultivierung von GM 1507 Mais in der EU, zielt dieses Papier darauf ab, zu untersuchen wie ein kleiner EU Mitgliedsstaat, Österreich, es erreicht hat eine einheitliche Meinung laut und klar zu vertreten und den gentechnisch veränderten Mais außerhalb seiner Grenzen zu halten. Mit Interviews und Dokumentanalyse kombiniert als Hauptrecherchemethode eingesetzt, liegt der Fokus dieser Arbeit auf dem Untersuchen des „precautionary principles“, welches Österreichs führende Richtlinie in Genmais Fragen ist, wie diese von Österreichs wichtigsten Stakeholdern in diesem Fall verstanden wird und wie deren verschiedenen Verständnisse davon, namentlich: wissenschaftliches Verständnis, ökonomisch-politisches Verständnis und normativ sozial-kritisches Verständnis flexibel mobilisiert werden um valide Argumente in deren Antihaltung zum Genmais 1507 zu untermauern.

Neben dem precautionary tool, behaupte ich das ein Set von „sociotechnical imaginaries“ und eine “nationale technopolitische Identität” in Österreich, welche durch das Schaffen einer beeindruckender kollektiven Anti-GMO Haltung etabliert wurde, möglicherweise einen tiefgreifenden Einfluss auf die nationale Haltung gegenüber dem 1507 Genmais Falles haben.

In einem Wort, eine nationale Entscheidung den GM 1507 aus Österreich fernzuhalten wird nicht nur mit dem wissenschaftlichen Grundprinzip gerechtfertigt, sondern erwächst auch aus der Nationalen Antigenmaiskultur und seiner „grünen“ Idendität. Aus diesem Blickpunkt würde Ich argumentieren das Österreich den Rahmen des Risikos in der Genmaisregulierung erweitert und daher die Grenzen zwischen Wissenschaft, Politik und Werten verwischt. Diese „Grenzverwischung“ verlangt nach einer Bewegung weg vom „risk governance“ und hin zum „innovation governance“ in der gesellschaftlichen Behandlung von Risikothemen.

TABLE OF CONTENTS

0. Introduction ----------1

1. State of the Art ----------5

1.1. Scientific uncertainty in risk assessment ----------7

1.2. Normative risk assessment ----------12

1.3. Precautionary principle: a means to manage uncertainty & risk ----------18

2. Theoretical Framework & Sensitizing Concepts ----------25

2.1. Collective expertise & relevant expertise ----------25

2.2. Sociotechnical imaginaries& national technopolitical identity----------28

3. Case Background: GM 1507 maize and its difficult entry into the EU ----------31

4. Research Questions, Materials & Methods ----------39

5. On the genesis of an anti-GMO "tradition" ----------46

5.1. Austria as a forerunner ----------46

5.2. Co-evolving with the European context------- ----------50

6. Empirical Investigations ----------54

6.1. Assessing scientific risk assessment----------56

6.1.1. Environmental NGOs: EFSA fails to conduct convincing risk assessment----------56

6.1.2. Environment Agency: biological science v.s. ecological science ----------62

6.1.2.1. A zoom-in investigation ----------64

6.1.2.2. A zoom-out examination ----------66

6.2. Scientific uncertainty gives rise to other criteria ----------71

6.2.1. Socio-economic criteria: conform to Austrian specifics ----------71

6.2.1.1. Taking into account the uniqueness of Austria ----------72

6.2.1.2. UBA tentatively forms Austria-specific socio-economic criteria ----------76

6.3. GMO on the radar of a GREEN Austria ----------80

6.3.1. Don't mess with Austrian Nature! ----------82

6.3.2. A preferred agricultural model is intolerant of GM intervention----------86

7. Discussions & Conclusions ----------94

8. Bibliography ----------104

0. INTRODUCTION

A piece of news in early November 2013 reopened a round of hot debates on genetically modified organisms (hereinafter referred to as GMOs) in the European Union (EU), where most of the consumers and national governments are exceedingly sensitive to this topic. On November 6, 2013, the General Court of the EU pronounced that the European Commission had failed to act on Pioneer's (an American biotech company) 2001 request to cultivate the insect-resistant *"GM 1507 maize"* in the EU, and it urged the Commission to deal with this request in a timely manner. In response to the General Court's requirement, the European Commission submitted a draft decision of authorization to the Council of Ministers and asked the Member States to agree on the cultivation of 1507 maize in the EU. However, during the meeting in early 2014, the Council of Ministers failed to garner a qualified majority to reach a decision in this regard, and according to EU regulation, the Commission was therefore now obliged to authorize this GM cultivation proposal.

In the midst of the fierce debate about whether to cultivate GM 1507 maize inside the EU or not, all eyes are now on the Commission's final decision: will it be "threatened" by the flood of anti-GMO voices and turn down the company's proposal, or will it go on to authorize the cultivation of the maize based on scientific risk assessment results and legal requirements? While authorities at the EU level and in many Member States are still struggling to draw an official conclusion on this matter, Austria, a small EU member almost immediately and unequivocally assured that it would exercise a national ban if the cultivation of GM 1507 maize were to be authorized by the Commission (Wienerzeitung, 11 Feb 2014).

It was Austria's amazing determination in this regard that impelled me to set about this research project in the first place. Wishing to understand how Austria formed such a strong stance to prohibit the potential entry of 1507 maize into its territory in the midst of the EU's struggle to authorize its cultivation, this piece will focus on the major stakeholders' anti-GMO "performance" in this case. Overall, I aim to present a vivid discussion in which the *precautionary principle* serves as the

guiding framework and *"scientific uncertainty & risk", "collective expertise & relevant expertise", "sociotechnical imaginaries"* (Jasanoff & Kim, 2009) and *"national technopolitical identity"* (Felt, 2013) become the key perspectives in the empirical examination.

Keeping in mind the main research question, I will structure this thesis in the following manner:

To begin, Chapter 1 will draw on insightful STS literature concerning GMO debates in Europe and beyond, to locate the major concerns in this GM case. From various discussions, I will pin down three key aspects, namely, *scientific uncertainty, risk assessment,* and the *precautionary principle*.

To supplement the aspects discussed in the previous chapter, in Chapter 2 I will bring in two groups of concepts, namely - "*collective expertise"* & "*relevant expertise",* and *"sociotechnical imaginaries" &"national technopolitical identity".* These notions will serve as conceptual leitmotifs underpinning the analysis of Austria's performance in this case.

Chapter 3 will lay out the background, in which I will introduce the characteristics of the main "actor" – GM 1507 maize – and chronologically present a decade-long attempt to cultivate this maize in the EU. In so doing, I intend not only to provide relevant information regarding the origin of the controversy, but also to set the overall EU backdrop against which Austria stages itself.

In order to allow myself to answer the main research question in a practical way, the following chapter will dissect this overarching research question into four sub-questions, which in turn will also keep the investigation in focus. In this chapter, I will also introduce in detail the methods employed in this research. Mainly, the empirical deliberations will draw on accounts interwoven by data generated via two qualitative methods, namely, *document analysis and semi-structured interviews*, and analyzed by the *grounded theory* approach.

Before turning to the actual empirical investigation, Chapter 5 will present a vivid historical account, which reveals how Austria came to construct a national anti-GMO position in the first place and how this position has been solidified through

several relevant exercises. A glance at this history will explain how an anti-GMO tradition can influence Austria's performance in the case of GM 1507 maize, and what an important role *tradition* plays in Austria - to the extent of reaching consensus among all the stakeholders in rejecting the idea of cultivating GM 1507 maize. I will argue that the revival of the tradition reminds people of their "Austrianess" in terms of dealing with GM matters, and of the importance of keeping the tradition alive in the face of threats brought by the various applications to grow GM foods.

Based on this seemingly ineradicable *tradition*, Chapter 6 will continue to follow the empirical investigation of this specific case by analysing relevant documents and interviewing representatives from the most active stakeholder groups, namely, environmental NGOs in Austria, the Environment Agency in Austria, the Ministry of Health and the Ministry of Agriculture. I will argue that the various defences revolve around the *precautionary principle.* Various accounts unanimously state that the precautionary principle is the guiding policy in the case of 1507 maize in Austria - that is, as long as there is uncertainty left in the scientific assessment of 1507 maize, the precautionary principle shall be applied to avoid potential hazards, which mostly leads to the rejection of this application. But as the first chapter will reveal, the definition of the precautionary principle is very ambiguous, thus it is in our great interest to examine what the precautionary principle will mean for the major stakeholders in the 1507 case, and how their arguments can embody different understandings of the precautionary principle. In short, I devote the empirical chapter to a detailed account of how the *precautionary principle* is understood and how it guides each stakeholder to defend an anti-1507 maize position.

After presenting how the major stakeholders "perform" in this case with the prop of the *precautionary principle*, the last chapter will highlight the main arguments drawn in this project, in particular, I will analyze how *collective expertise* and *relevant expertise* are at play, in a sense how Austria's stakeholders collectively form a set of *relevant expertise* that is different from the EU's relevant expertise, and how these stakeholders mobilize and make use of their own *relevant expertise* in order to build valid justifications for their position. Meanwhile, building upon a set of

pre-existing *sociotechnical imaginaries* (Jasanoff & Kim, 2009), I will argue that the cultivation of GM 1507 poses a risk to Austria's *national technopolitical identity* (Felt, 2013), which Austria has collectively established through various technological exercises in history. In such a view, Austria's approach to the GM 1507 maize cultivation proposal not only builds on scientific rationales, but also considers national political and cultural specifics. This "holistic" approach of risk assessment expands the scope of conventional "risk" which only concerns human/animal health and the environment and is identified by science. That is to say, the matter of GMOs has gone beyond scientific risk assessment. In the Austrian context, it brings in a set of broadened risk assessments pertaining to the economic structure, the landscape, the relationship between nature and agriculture, what is considered to be "public good" in society, etc. With this note, the piece ends by echoing the new take on risk technologies in modern society, that is, to move from risk governance to innovation governance (Felt, et al.,2007)

1. STATE OF THE ART

Since the outset, the application of GMOs in the food sector has been particularly controversial. Within a country, actors such as scholars, politicians, entrepreneurs, scientists, environmental NGOs, consumers, farmers and so forth have expressed different opinions towards it. Meanwhile, a horizontal look at the different parts of the world shows how the issue is being taken up differently: *Figure 1* shows the official status of GM food labelling laws in all countries in 2013. Interestingly, while there is no GM food labelling law in North America, all countries in the EU require the mandatory labelling of nearly all GM food with a very low threshold of 0.9-1% GM content. The difference between these two strongest economies is striking, leading to continuous inter-continental trade disputes. Also, focusing on the EU, *figure 2* shows a number of sub-regions, among them the nine municipalities in Austria, have declared themselves to be "GMO-free" and expressed their commitment to ban the use of GMOs on their territory. Although a "GMO-free" position as such is decided at the local government level and thus does not stand for a country's official GM status, these strong anti-GMO voices are nevertheless always taken into consideration in official decision-making processes. All in all, the divergent management of GM food in the world manifests the extreme complexity of this topic.

Figure 1: A map showing the different status of labelling laws on GM food in the world. Retrieved on September 1, 2014 from Center for Food Safety: http://www.centerforfoodsafety.org/ge-map/

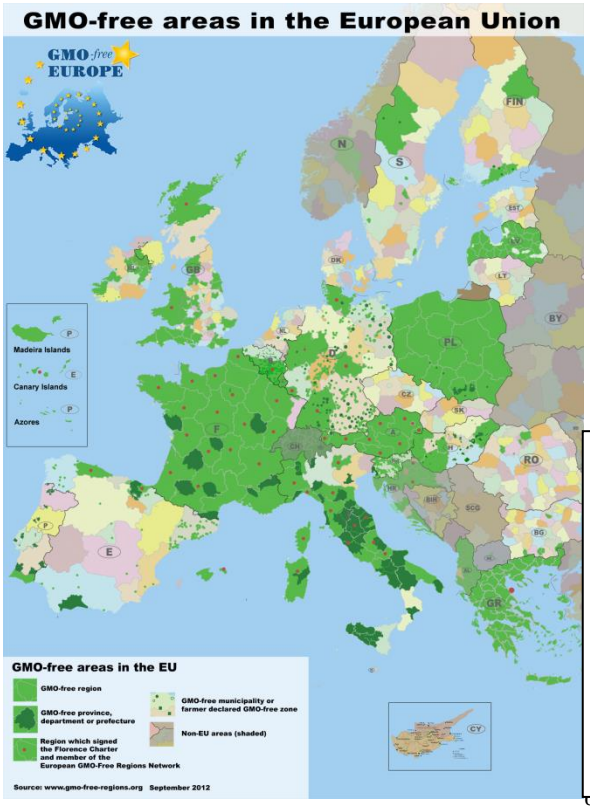

Figure 2: A map shows the GM-free areas in the European Union. A "GM-free" claim only represents local government's position, but is nevertheless taken into account in official decision-making. Retrieved on September 1, 2014 from http://www.gmo-free-regions.org/)

Opinions concerning the entry of GMOs into the food chain vary over time and space, and reams of documents with variegated storylines have been written and disseminated to defend the different stances. The field of Science, Technology and Society (STS) is also extremely rich in literature regarding this topic. Rounds of discussions lead to one conclusion, that is, the matter of GMOs is a hybrid consisting of scientific, economic, social, political, environmental and ideological concerns. This complexity thus blocks a definite way out of general GM disputes.

During the course of reading and self-reflection, I found the concept of "risk society" (Beck, 1992), which implicates that modern society organizes in response to risk, to be especially relevant. In this "risk society" context, the issue of GMOs for STS scholars is first and foremost related to scientific uncertainty - and the concurrent risks. Facing the escalating uncertainties and risks inherent in modern technologies, scholars of "reflexive modernization" such as Beck (1992) and Giddens (1999) suggest that the safest approach is to take preventative measures so as to decrease levels of risk. This precautionary approach applies to our handling of many risk technologies in today's modernized world. In this sense, GMOs are by no means a

special case.

Contemplating this "risk society", in which the issue of GMOs is becoming increasingly contentious, three key concepts, namely, **"scientific uncertainty", "risk",** and the **"precautionary principle"**, have emerged as the kernels of this discussion. These key concepts not only form the three major strands of STS literature that I will present in this section, but also form the gist of this research project. In particular, the discussion opened up by previous scholars on the theme of the "precautionary principle" will serve as the guiding framework for the whole empirical investigation of this project. Before divulging too much information here, let me first turn to the three strands of discussion extracted from the current body of literature, which gives rise to the major concerns expressed against the introduction of GM 1507 maize in Austria.

1.1. Scientific uncertainty in risk assessment

The primary reasons contributing to the controversies over GMOs boil down to the term "uncertainty" – "uncertainty" about GMOs' harm on human/animal health and the environment, about whether or not such innovations should be embraced, and about whether the right questions on GMOs are being asked. Within the EU's current regulatory system on science and technology, the most direct concern is the uncertainty about the impact of GMOs, which ought to be assessed by science. However, science is always called into question for it itself is often uncertain in the assessment process. Indeed, policymakers often blame "scientific uncertainty" in risk assessment for deferring regulatory measures on GMOs, and by requiring additional scientific knowledge, they attempt to overcome that "uncertainty" and thus put an end to the risk disputes. Requiring more scientific research due to the residual "uncertainty" in scientific assessment renders a *scientific understanding* of the "precautionary principle", which will be presented in detail in the third section of this chapter.

Such a concern about science's capacity to assess is rooted in the shifting trends

of society, in which the role or image of science is on the down grade. The sheer trust once attributed to "science" has turned into widespread uneasiness with "science" as well as science-based technologies. The European Commission has well acknowledged this shift:

"Today, science is no longer viewed unquestioningly as the harbinger of better times. Society's view of scientific inquiry has become more sophisticated and nuanced...People are not willing just to sit by and let the scientific community and the politicians set the agenda". (EC 2005b, cited in Felt, et al., 2007, p.13)

At issue is science's role in assessing the benefits and harms of certain science and technologies. What is called into question at first in the GM debate is science's "incapacity" to assess the risk GMOs may entail once they are out of the laboratory. Doubts as such about science's status in the GM debate can primarily be reflected in the methodological disagreement among experts about the appropriate criteria for evidence. Substantial STS criticisms follow this stream.

For instance, Brian Wynne, an expert who has long taken interest in technology and risk assessment, in his 1999 article for the Guardian newspaper clearly rebuked science's inadequacy in terms of fully addressing the labyrinth of GMOs. Arguing that the matter of GMOs is *"too important to leave to science alone"* (Wynne, 1999), he particularly puts into question the accountability of scientific farm-scale tests conducted to observe the risks of GM agriculture. In this article, he straightforwardly lists some of the most critical problems in the current scientific tests on GM crops, including: 1) the genetic specimens used in the tests are not necessarily identical with those produced industrially; 2) the duration of the tests is not long enough to allow possible cumulative changes to occur, which might happen over the long course of GM agriculture; 3) the "laboratory" like, single-farm test condition is highly artificial, which excludes other independent creatures in the environment and isolates GMOs' interaction with them. (Wynne, 1999) These key problems are of particular concern when we rely fully on these kinds of scientific tests to assess GMOs. Given the limitations of scientific methods as well as real-world variations, the "safety" claims concluded from such scientific tests thus cannot be completely extrapolated to GMOs'

behavior outside the "laboratory", resulting in the character of GMOs in real-world scenarios uncertain. Consequently, Wynne puts science's sense of responsibility in serious doubt: *"If unforeseen consequences are likely, who will be in charge of the responses to those nasty surprises? And can we trust them (scientists) to act in the public interest?"* (Wynne, 1999) In a word, by emphasizing the uncertainties about scientific methods, Wynne warns that releasing GMOs into the society and the environment based on current scientific justifications can be full of risks, for it involves further unknowns and uncontrolled effects, and once begun, could never return to the *"starting condition like laboratory experiments".*

Besides reflected in the discrepancies of the technicality of research methods, scientific uncertainty is also theorized as "value-laden" in social studies of science. Wynne holds that scientific uncertainty *"cannot be properly described as objective shortfalls of knowledge" (1992, p.20).* In his earlier account, he argues that the degree of uncertainty in scientific knowledge can also be influenced by social and cultural factors. In his own words, scientific uncertainty *"can be enlarged by social uncertainties in the context of practical interpretation, and it can be reduced by opposite social forces" (Wynne, 1992, p.20)*. Consequently, "facts" claimed by science can be reframed by social values. This analysis echoes with Jasanoff's (1993) statement that *"fact and values frequently merge when we deal with issues of high uncertainty"(p.123).*

Similarly, Beck (1992) argues that scientific uncertainty may become politicized. In his claim that scientific facts *"are nothing but answers to question that could have been asked differently" (p.166),* he implies that scientific "facts" are merely choices of presenting certain aspects of reality, and regulators' decisions on certain risk disputes are a *"mobilization of belief"* which has become *"a central source for the social enforcement of validity claims about science" (p.168)*.

In his work with Wehling concerning the "politicization of non-knowledge" (2012), Beck continues to cast doubt on science's knowledge to provide *"sufficient guarantees to show that the search for unknown effects is complete or that the spatial and temporal horizons of observation chosen in the process are appropriate" (p.39).*

In cases like GMOs, they argue that since we do not even know what we are supposed to be looking for or whether something unknown exists, disputing over "what is known and not known" after releasing GMOs into the environment is ultimately a political question, which invokes the knowledge gaps between those pro- and anti-GMOs. On the one hand, progressive scientists and biotech companies always stress that the usage of GMOs is "risk-free" according to scientific evidence and even the few "uncertain" aspects can be rapidly eliminated later through systematic research; on the other hand, critics from environmental NGOs, conservative politicians and in part from science, would permanently unsettle the case by emphasizing the "unknown unknowns" into the debate, which goes beyond the established scientific horizons of "knowns". So far, in the European context, the politics of science's "non-knowledge" has by far excelled the politics of science's "knowledge", for the conviction that knowledge concerning the use of GMOs and their risks is insufficient and the "unknown unknowns" extends beyond the domain of "knowns", has taken deep root among the majority of the European public.

Scott et al. (1999) in their special briefing on the "politics of GM food" for the British Economic & Social Research Council (ESRC) also clearly state that "*science cannot answer all the questions"(p.1),* emphasizing that science alone cannot identify the uncertainties and risks invoked by new technologies such as the one used to create GMOs. Despite science's attempt to be purely evidential, they stress that *"the way that scientific advice is used is heavily influenced by the way the official advisory system is put together" (p.5).* In this context, scientific judgments on risks and uncertainties of GMOs can be deliberately framed by "*unavoidably subjective assumptions about the nature, magnitude and relative importance of these uncertainties"(p.7).* Science thus cannot undertake the justification of such "framing assumptions" of uncertainties alone, rather, factors such as the "legitimacy of the institution" which makes justification, the "degree of democratic accountability" and the "ethical acceptability" of the assumptions must be taken into account equally.

Levidow (2001) follows the same line and agrees that the so-called "uncertainty" is constructed by a social context rather than simply given by the technical context.

He believes "uncertainty" also unintentionally embodies "strategies" of those making decisions, for instance, it can serve as *"a strategic argument among experts, not simply as a source of disagreement" (p. 846)*. In his case studies about various GM disputes, different stakeholders, representing different social interests, spontaneously claimed different types of "uncertainties" when making choices about what uncertainties to emphasize and what potential risks to prevent. Thus, "scientific uncertainty" in this regard can be considered as highly "value-laden".

If the "scientific uncertainty " mentioned so far - be it "technical loophole" or "value-laden" - derived from somewhat inevitable and innocent subjectivity, Elliott (2012) then invites us to examine some of the imperatives of scientific uncertainty, one of which he terms as science's "selective ignorance". "Scientific ignorance" emerges when we become *"selectively ignorant about different ways of understanding a single, complex research topic or phenomenon" (p.329)*. This sort of ignorance can stem from a wide variety of subtle research choices and specific interests. In other words, science sometimes tends to selectively emphasize certain aspects of "results" and ignore others, for instance, industry groups may *"purposely study the beneficial effects of their products while avoiding research that might yield negative information" (p.331)*. This is sometimes the case in GMO research, especially in corporate-funded risk assessment studies, where the claims are deliberately chosen to be "ignorant".

A case in point is Monsanto's 2005 study which showed the new type of GM Bt maize MON863 had significant harm (kidney abnormalities and unusually high levels of white blood cells) on rats fed on that variety, thus stirring up serious concerns about the impacts of GM food on human health. However, Monsanto tried to be ignorant of its result and suppressed its own study. When the European regulatory bodies obliged the company to present this study when considering the approval of the maize, Monsanto claimed that the study was "confidential business information" (Greenpeace, 2005) and attempted to hide it from the public. When it was finally made public, Monsanto then reasoned that the results were irrelevant and the negative effect of GM maize was at worst uncertain. In so doing, Monsanto's scientific study was taken advantage of by commercial interests, and science was forced to play the

"ignorant" card when it clashed with the company's sought-after interest. Such deliberate choice of "scientific uncertainty" in GM research greatly adds fuel to the anti-GMO voices, who consequently demand more independent scientific investigations on GM matters.

To conclude, "scientific uncertainty" has always been in the forefront of various GM debates, albeit the "uncertainty" can embody different forms. As the above STS literature has discussed, "scientific certainty" can be reflected in - but not limited to - the form of technical inadequacy, the "value-laden" feature, and the selective ignorance of scientific research. In the case of GM maize 1507, these manifestations of "uncertainty" are all at play: technically, the "risk-free" claims concluded by the company, the EFSA and the Competent Authorities in some Member States, are being widely disputed by the public, some governments and scientific bodies, who argue that the real character of this maize identified by current scientific research is not certain and thus request further research; socially and politically, different stakeholders with various values and interests have voiced concerns on different uncertainties of this maize; and some actors have also implied that research conducted on 1507 maize was intricately influenced by industrial interests. Overall, the above literature has provided a great insight into the discussion on the "scientific uncertainty" involved in this case, which will be sketched in detail in the empirical chapter.

1.2. Normative risk assessment

The overriding argumentation of the anti-GMOs follows the reasoning that first, science cannot know or is not able to know yet; second, if the nature of GMOs cannot be fully known by science, then once claimed to be safe and released into the environment, their effects are impossible to foresee because the operation of these GMOs will be literally unlimited both in space and in time - this "unpredictability" poses a great risk on mankind, animals and the environment. Indeed, once "scientific uncertainty" is successfully introduced into the GM debate, the term "risk" automatically comes to the fore, which in turn highlights science's inability and

aggravates the public's doubts over scientific authorities.

Contemporary society's shrinking confidence in science resonates with the concept of "risk society" (Beck, 1992; Giddens, 1999), which is closely associated with reflexive modernity. In Giddens' words, a risky society is *"a society increasingly preoccupied with the future, which generates the notion of risk," (p. 3),* while for Beck (1992), it is "*a systematic way of dealing with hazards and insecurities induced and introduced by modernisation itself" (p. 21).* Both of them hold that modern societies are exposed to risks resulting from the modernization process itself. In Giddens' definition, the risks mainly caused by human activities are called "manufactured risks", and in reflexive modernity, societies should be able to assess the level of risk that is being produced or is about to be produced and then alter the planned activities accordingly. Cases in point are nuclear energy, GMOs and other environmentally sensitive modern technologies, which entail risks invoked by human activities and need to be assessed and managed with extreme caution.

The current risk practice in the EU distinguishes "risk assessment" and "risk management" as "fact" and "value". As Felt et al. (2007) documented, "risk assessment" was, and *"continues to be envisaged as an exclusively scientific process of objective factual discovery, always conducted prior to risk management"*; "risk management" then *"introduces more normative questions about economic costs, ethical issues, and subjective social values and interests as well as the practical exigencies of implementation"(p.32)*. At issue is whether these two processes can be clearly separated, in particular, whether "risk assessment" can be taken as an "exclusively scientific process" which stands free from "normative" elements. STS scholars would argue that this clear demarcation between the "fact-based risk assessment" and the "value/interest-influenced risk management" is too simplistic in reality. Rather, similar with "uncertainty", the term "risk assessment" is composed of a complex hybrid of facts and values as well. At the forefront of the discussion, the notion of "framing assumptions" (Scott et al., 1999; Stirling 1999) achieves a significant position when dealing with the issue of "risk assessment". An array of STS literature has focused on the "framing" of risks in GM debates.

For instance, Levidow et al. (1997) examine the role of "framing" in the risk assessment of one herbicide-tolerant oilseed rape (canola) in Europe. In their argument, "assessing" risk is not purely hard-fact-based, rather, *"in seeking and organizing facts about risk, we make sociopolitical choices about what potential harms to prevent and what opportunities to forego" (p.474)*; in other words, we "frame" risk assessment. In their case study, through anatomizing the disagreements between EU Member States when deciding the market approval of this contentious GM crop, they carefully map out how the "framing" of risk assessment (took the form of "setting boundaries" in this case) helped the regulatory authorities reach a conclusion over this dispute. It is worth mentioning that they identified four contested boundaries the authorities drew to *"define the relevance of technical expertise and scientific knowledge for risk assessment" (p.496)* of this crop. They are: bounds of administrative responsibility, of causality, of acceptable effects and controls and of expertise and adequate evidence. The setting of boundaries reveals divergent framings of risk - different framings contain different emphasis, and each emphasis *"derived from the institutional basis of GMO regulation, its framing of biotechnological risk, and its model of the socionatural order."(p.496)*

In the same vein, Levidow and his colleagues (2007) re-examined the "socially constructed" character of risk assessment in the field of GMOs, albeit this time focusing on how a "science-based" risk assessment approach - "substantial equivalence" - changed over time in order to accommodate criticisms. "Substantial equivalence", a guideline of risk assessment framed by OEAD in 1993, says that

> *"If a new food or food component is found to be substantially equivalent to an existing food or food component, it can be treated in the same manner with respect to safety. No additional safety concerns would be expected." (cited in Levidow, et al, 2007, p.33)*

By unfolding some key processes in which the "substantial equivalence" was implemented, challenged, recast and then reinterpreted in EU practice over time, they argue that the concept of "substantial equivalence" has always accompanied the body of risk assessment to govern the social conflict and address legitimacy problems over GMOs. In particular, Levidow and colleagues analyze how different policy agendas

frame risks of GMOs with the "substantial equivalence" principle. According to them, risk in this GM debate is framed by three major policy agendas: the pro-agbiotech group who holds that risk over GMOs is readily testable and can be standardized across countries; the anti-agbiotech group who considers GM technology as inherently risky for it generates unknown hazards; and the mainstream consumer group who fears the uncertain risks GM carries and thus demands more rigorous methods. Accordingly, risk assessment in these frames is respectively tied to concerns over "regulatory efficiency", "wider industrial hazards" and "consumer rights", and as they argue, different policy agendas based their perception of "risk assessment" on their understanding of the "substantial equivalence" concept, and only *"together, these frames constituted the uncertainties (of GM food) to be debated and clarified"(p.54).* In this sense, the idea of risk is socially constructed, or framed, by different actors at different times.

Bonneuil et al. (2008) then carry the lens of the Actor-network theory (see Callon, 1986; Latour,1987; & Law, 1999) when approaching the risk assessment of GMOs. Taking the case of how GM-crop field trials was constructed to be a controversial social problem in France, they stress the significance of taking into consideration the *"movement of actors, objects, and discourses between various arenas of a structured mosaic public space"(p.227)* when examining this issue. In their paper, they present a detailed account in which different actors from diverse social arenas interact, negotiate and compete with each other in a heterogeneous public space to put forward alternative framings of problems. For instance, actors from policy, scientific, media, activist and legal arenas performed different framings over the issue, respectively focusing on keywords such as "ecological risk", "contamination of weeds or other crops", "right to information", "alterglobalist" and so on - these are what the authors call *"social evaluation of the risky character of the GMOs as technical artifacts"(p.225)*. However, this contest goes beyond the technical aspect of GMOs: it also brings more hidden elements relevant to this issue to the fore, e.g.: *"the scope of the precautionary principle, the legitimacy of civil disobedience, the governance of public research, and about the kind of world GMOs lead us to inhabit."(p.225)*. In the

end, as the framing of this debate shifted and the boundaries between science and society are continuously redrawn, different heroes and victims were made visible, heterogeneous networks were constructed and hybrids were produced. Through that, as they argue, *"not only has the framing of the GM debate been transformed as it erupted into a greater range of arenas, but those arenas themselves have sometimes been transformed, as new orders of justification replaced old ones as legitimate bases for credibility and action"(p.227).*

Other STS literature also sheds light on the importance of "actors" in risk framing in GMOs. For instance, Yamaguchi & Suda (2010) use an analytic framework known as "regimes of justification" to understand how GMOs have come to be viewed as problematic and risky in Japan. Guided by the concept that *"the social appropriateness of acts can be observed through the ways in which actors justify their interpretation" (Boltanski, 1990; Boltanski & Thevenot, 2006, cited in Yamaguchi & Suda, p. 384)*, they show how identified actor groups, i.e., scientists, officials, commercial operators, civil society including environmentalists, farmers, consumers' unions, etc. each used different languages and multiple evaluative criteria to justify their opinions on the risk of GMOs. In practice, actors from different social backgrounds, holding divergent interpretations and epistemologies, are usually drawn together by public policies to foster an environment in which they can interact and negotiate. For instance, GM food-labeling policies have brought heterogeneous actors to public arenas such as government-organized consultation meetings and public hearings, during which actors consolidated their different interpretations of risk. Moreover, by examining the changes in the collective sense of what is perceived as rational, they argue social order is *an emergent, interpretive, and constantly changing structure built on multiple layers of criteria whose legitimacy is collectively decided" (396)*. This changing interpretation of rational social order, plus the subjectivity found in "*the interpretation of scientific data" (p.383)*, reinforces the "socially framed" character of risk assessment.

Among all the players in the GMO disputes, one actor's role is particularly influential, that is the World Trade Organization (WTO), whose dispute settlement

procedure is considered as a key arena for establishing global legal norms. Halfen (2009) uses a recent GMO dispute case, in which the U.S. and two other countries filed a complaint against the EC for operating a de facto "illegal moratorium", to examine the WTO's risk framework and adjudication process. By reinterpreting existing WTO documents, Halfen presents how the WTO engages technical standards and constructs regimes in order to put in place a decision-making framework. For instance, the WTO does its risk framing by allowing only arguments that are narrowly concerned with the health/safety of humans/ environment, while limiting the sets of arguments that might restrict trade. Halfen thus refers to this framework as risk-based "policy-making" and argues that it is *"most appropriately viewed as a heterogeneous package of concepts and practices, rather than a logical category, regulation" (p.311).*

If the WTO can construct its own framework over GMO risk assessment, it is largely attributed to its ability to mobilize and re-stage scientific expertise. Bonneuil & Levidow (2012) refer to the same case to illustrate how the WTO settlement process constructs the kinds of scientific expertise and knowledge that are counted as reliable and relevant in its judgment through mobilizing them in particular ways. In the new global trade, science tends to be used by ruling institutions with multiple interests and values to *"provide a disinterested, objective 'view from nowhere' that lends epistemic authority to norm-making" (p.78).* In their analysis, the WTO uses various strategies to "manipulate" science for its own use, for instance, in its SPS(Sanitary and Phytosanitary Agreement) framework, science was imported to a legal arena: by setting up how experts were questioned, the answers they would give and the way their statements would complement the Panel's findings, the WTO successfully inscribed its *"legal epistemology"(p.80)* into science's functioning in this regard, which illuminated how scientific and legal expertise were co-produced within the Panel's framework. As such, in disagreement settlement procedure, the WTO treats science as a source of credibility to reinforce *"the standard narrative of a 'science-based' trade discipline" (p.94).* In so doing, it constructs a new scientific expertise for its own purpose. In a word, STS has taught us that science cannot stand

free from historical, political and cultural contents. The WTO's risk assessment over GMOs, which is to be adopted as an international standard for trade, is meticulously framed in accordance with its own political value and economic interest.

Overall, as Felt et al. (2007) emphasized, scientific risk is a "normative issue" for even the "sound scientific" questions of risk can be recognized as "*intrinsically shaped and framed by social values, sometimes embodied in routinized habitual ways of institutional thinking, and political interests"(p.34)*. Thus, the understanding of risk about GMOs, be it at the assessment or management stage, cannot stand free from normative values and/or social interests.

1.3. Precautionary principle: a means to manage uncertainty&risk

In the face of science's generic uncertainty in examining the character of GMOs and their impact on human/animal health and the environment, the EU is known for handling risk technologies with great precaution. When it comes to policy making regarding GMOs, the precautionary principle emphasizes uncertainty, broadens the scope of risk assessment, and in a way provides a means to tackle risk.

The intricate intertwinement of precaution and scientific uncertainty should be traced back to a declaration from the 1992 United Nations Conference on Environment and Development (UNCED) in Rio, which sowed the seed for today's widely-applied precautionary principle across the EU. The declaration stated that *"where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UN, 1993)* - that is to say, a precautionary strategy should be advised when there is visible risk emerging, regardless whether that risk is confirmed by science or not. On those grounds, in 1999, triggered by a wave of public protests against GMOs, EU Member States declared they would not authorize any further commercial GM requests in the EU until science could preclude the possibility of harm. Subsequently, Member States blocked a series of regulatory procedures, demanding a *de facto* moratorium in the EU. In response, EU institutions

developed a new policy framework called the "precautionary principle", aiming to incorporate scientific uncertainty as well as more diverse accounts of expertise.

In 2000, in an attempt to deflect international criticisms that the precautionary approach hindered fair trade, the European Commission issued a communication on how the precautionary principle should be interpreted and implemented. (Levidow, et al. 2005) The circumstance in which to apply the precautionary principle, according to the Commission, is *"when there are reasonable grounds for concern that potential hazards may affect the environment or human, animal or plant health, and when at the same time the available data preclude a detailed risk evaluation..." (EC: The Precautionary Principles, p. 8).* In other words, the definition of the precautionary principle operationalized under EU law is: during the decision-making process, when there are reasonable grounds for concern of the possibility of adverse effects on the environment or human health, which the available scientific information is not able to fully assess, then the provisional risk management measures, i.e., the precautionary principle, may be adopted, without having to wait until the reality and seriousness of those adverse effects become fully apparent. (von Schomberg, 2012)

A widely referenced report called "Late lessons from early warnings" is worth mentioning at this point. Compiled by staff from the European Environmental Agency (EEA) and some scientific advisers such as Brian Wynne, this 2001 report includes various case studies of historical instances ranging from issues like BSE to biological agents. Aiming to see what lessons can be extracted to benefit existing or future European policies with the help of hindsight, these cases are all in a sense negatives, in which authorities involved ignored warnings from scientific research and did not act in time to control the damages which occurred subsequently. Based on these alarming "lessons" from history, which show confident claims such as "no apparent harm" have had deadly consequences, the EEA report urges governmental bodies to be more cautious during the decision-making process concerning risk technologies.

The GMO cases were not included in this EEA report due to their brief history at that time, but the cases listed naturally raised the alarm for risk managers who are dealing with GMOs, whose evolution is highly similar to that of past negative events.

In view of this, the precautionary principle becomes a persuasive tool when handling GMOs. Although the official definitions leave considerable flexibility to interpret the concept, the precautionary principle is a normative reference for regulators when making practical decisions. The principle is easy to apply because it does not require establishing a direct causal link to potential harm, especially when "harm" also depends on "the chosen level of protection" (e,g. Christoforou, 2003) , that is, a norm of unacceptable effects. In a nutshell, precaution is defended with reference to science's limitation or inability to predict risks, thus its employment *"entails the identification of risk, scientific uncertainty and ignorance, and it involves transparent and inclusive decision making processes*" *(Raffensperger &Tickner 1999, cited in Myhr, 2007, p.457).*

Meanwhile, precaution can justify uncertainty, not simply vice versa. Levidow (2001) in his case study on the European GM disputes illustrates that precaution can change the criteria for evidence, and by so doing, it reframes uncertainty. Looking back at the trajectory of GM disputes in Europe, he argues that precaution offers a stronger means to raise new questions and thus to identify unknowns. Therefore, the uncertainty arisen from the GMO controversies cannot be simply explained by incomplete scientific information, rather, it was *"social conflict (that) increased and reframed uncertainty" (p.868).* Similarly, Stirling (1999) argues that precaution can highlight various unknowns in risk assessment. Exploring the notion of "framing assumptions", he argues that during the deliberative process in which assessors make value choices about how to frame unknowns and indeterminacies, the employment of precautionary principle can in turn highlight ambiguity and ignorance: *"In acknowledging that the problems of scope, incommensurability and ignorance in risk assessment are otherwise intractable, active stakeholder engagement in the appraisal process becomes a matter of analytical rigor." (p. 20)*

Von Schomberg (2012) identifies the interplay between predictive and normative uncertainties in the precautionary principle: *"the uncertainty of the science is related to the uncertainty of what still could count as acceptable in terms of health and environmental effects" (p.149).* In his opinion, the precautionary principle is by nature

a provisional means, and needs to be regularly reviewed when new scientific information emerges. In this sense, applying the precautionary principle is seen as a normative risk management exercise which builds upon scientific risk assessments. Meanwhile, the precautionary principle is a deliberative principle, whose application "*involves deliberation on a range of normative dimensions which need to be taken into account while making the principle operational in the public policy context"*, therefore, this framework *"facilitates in particular deliberation at the science/policy/society interfaces to which risk management is fully connected"(p.156).*

Indeed, the implementation of the precautionary principle involves a complex consideration of scientific, political and social concerns, resulting in the divergent interpretations of the precautionary principle. Different accounts can readily be found in key EU documents and expert practices other than the operational definition mentioned above. Levidow et, al. (2005) in their article describe how expert advice and regulatory practices correspond to different accounts of "precaution". According to the two accounts provided in their analysis, a narrower account, often advocated by biotechnology companies and the European Food Safety Agency (EFSA), often sharply defines the risk problem and evidential criteria, thus can more readily justify a regulatory decision. However, a broader account, interpreted by opponents of GMOs, always emphasizes a wider range of risk problems as well as the limits of available scientific knowledge. Therefore, they argue that it is through conflicts, rather than through an explicit interpretation or application of a prior principle, that "precaution" is given "working meanings" by different actors.

Not surprisingly, lacking a static definition, and often used to justify blockages of agbiotech, the precautionary principle has received particular criticisms from arenas that are economy- and trade-driven, among them being pro-GMO countries, the WTO and the agbiotech companies. On top of often being criticized as merely rhetorical or *"as a pretext for political agendas" (Levidow, et. al, 2005),* the precautionary principle is accused of impeding technological development and social interest, for it places *"additional regulatory burdens on GMO utilization, and thereby reduces*

returns from innovation, limits utilisation of GMOs worldwide and provides disincentives for research,"(Myhr, 2007, p.457). Critics also argue that it places a great burden on science and causes intractable legitimacy problems in the EU when deciding about the fate of GMOs.

In the STS arena, the precautionary principle has been prominently criticized for blurring the boundaries between science and politics (Torgersen & Bogner, 2005). Those who advocate a "sound science" approach in risk regulations criticize the precautionary principle as a *"politicization of decision-making where only scientific risk arguments should count" (Miller & Conko, 2001, p.303),* whereas for scholars such as Beck who contemplates on "reflexive modernization", *"a boundary blurring is an indication of a deep skepticism towards science"*, and accordingly, the precautionary principle indicates that *"the assumption in favor of the innocence of scientific-technical progress increasingly becomes problematic" (Beck et al, 2001, p.73, in Torgersen & Bogner, 2005, p.279).* These two divergent opinions stress the ambiguity in applying the precautionary principle.

However, despite the wide range of criticisms and ambivalence, the precautionary principle remains the most lethal weapon for EU regulators who are most concerned with science's role as a basis of decision-making in events such as GMO cultivation. When EU-level scientific expertise failed to reconcile national regulatory differences or to overcome the wide conflicts concerning the certainty of GMOs, the precautionary principle has offered a flexible means to cope with such conflicts and scientific uncertainty.

Austria is doubtlessly one of the most eminent supporters in terms of invoking the precautionary principle, regardless of its disputed character. Indeed, Austria advocates a precautionary approach during risk assessment, decision-making and risk management of GMOs (UBA, 2010). Although they unanimously share the understanding that the precautionary principle is a guiding tool in routine administration of GMOs in Austria, stakeholders from different institutions hold divergent interpretations of this tool. In their investigation, Torgersen & Bogner (2005) found that the precautionary principle even within the Austrian landscape is a

"political contingency". They discovered three understandings of "precaution" in the policy process vis-à-vis GM crops in Austria: ***A "scientific" understanding*** espoused by scientists and the Ministries of Research and of Trade, which implies that uncertainty must be reduced by means of new knowledge and the application of the precautionary principle means more research performed by those scientific disciplines that fulfill the criteria of (natural) science. ***A "political-economic" understanding*** that suggests criteria are not only scientific but can also derive from value judgments that are predominantly economic, political or ethical in character. This perception is advocated by the Austrian Competent Authorities as well as the Federal Environment Agency (UBA) and is the dominant understanding in their analysis. Another understanding is termed as ***"normative systems-critical"*** which is based on the normative concept of "nature" and "modernization". Expressed by NGOs and politicians from the Social Democrats and the Greens, this understanding compels the precautionary principle to make space for "holistic" decisions by taking into account non-quantifiable risks and long-term consequences, as well as slowing down the decision-making process. (Torgessen & Bogner, 2005)

Overall, the precautionary principle is a complex product of debates over risk technologies in modern society. In a way it provides a means for regulators to tackle scientific uncertainty and the risks within the assigned time, but, by doing so, it in turn puts uncertainty and risk in the limelight. Therefore, although best justified by uncertainty and risk, the invocation of the precautionary principle is always considered suspicious, for it is unavoidably associated with particular political motives. In a word, the above literature not only informs the intertwining relationship between scientific uncertainty, risk and the application of the precautionary principle, but also points out the ambiguity in definition and the controversial character of the precautionary principle as a preventive tool.

In conclusion, the above STS literature presents a multilayered, yet by no means complete picture of the intricate interplay between scientific uncertainty, the concurrent risk and, consequently, the precautionary principle as a means to tackle

uncertainty and risk in the GM debate. Overall, the three interrelated keywords come to form a complex landscape of disputes over GMOs, which inherently requires a holistic consideration of scientific content, social values and economic and political interests. In presenting the various social framings of uncertainty, risk and the precautionary principle, this section reminds us that the factors contributing to the current dispute over GM 1507 maize are simultaneously scientific, social and political, in the sense that it is a hybrid of facts and values. The concerns and tensions identified in the general GM disputes thus lead me to examine the issue at hand in an entangled rather than a unitary manner.

This paper, building upon the above discussions, will feature the interaction between scientific uncertainty, risk and the precautionary principle in the GM 1507 maize case. In particular, with the hindsight of the three understandings of the precautionary principle observed by the previous researchers, it will focus on examining how the perception of the precautionary principle is taken up by major stakeholders. The empirical chapter is organized by reflecting how the three understandings of the precautionary principle (i.e., "scientific", "political-economic" and "normative system-critical") correspond to the arguments of the major stakeholders. Contrary to what Torgersen & Bogner (2005) have done to clearly allocate each understanding to specific representatives, my analysis will suggest that stakeholders tend to have mixed, not unitary understandings of the precautionary principle, depending on their specific expertise and political pursuits. Through this analysis, I will also reveal the paradox of applying the precautionary principle: on the one hand, due to its ambiguity and the imbedded political imperatives, it is difficult to regard the precautionary principle as a universally legitimized instrument for risk assessment and management; on the other hand, this very vagueness makes it a reasonable, workable, and to some extent "cheap" tool that can be taken up anywhere and at any time.

2. THEORETICAL FRAMEWORK & SENSITIZING CONCEPTS

The literature outlined above has already revealed some major perspectives to be examined in this case study, namely, "scientific uncertainty", "risk framing", and the "precautionary principle". In this section, I will give a brief preview of another two groups of concepts corresponding to my empirical dissertation; they are: "collective expertise & relevant expertise" and "sociotechnical imaginaries & national technopolitical identity". These concepts, together with the key perspectives, will serve as the leitmotif of the empirical investigation and analysis.

2.1. Collective expertise & relevant expertise

The uppermost task of addressing GMO risk issues falls upon scientific knowledge, therefore the opinions of scientific and technical experts are bestowed with particular credibility and trust. However, there is a kaleidoscope of scientific opinions in the GM debate. Held by experts from similar or different scientific arenas, most often the various kinds of expertise appear equally convincing and valid. So the question is: whose expertise is par excellence? One strand of arguments holds that experts' opinions tend to enjoy higher prestige when there is a consensus among different individuals or groups (Thomas, 2009). Put differently, if an opinion voiced by scientific personnel or an institution is echoed by more scientists or scientific organizations, then this opinion tends to overshadow those with smaller clusters of supporters. Thus, in order to outstrip other claims, expertise needs to be networked and presented collectively.

This collective sense of expertise can be seen in the account of Limoges (1993), who considers expertise is nothing more than a collective *"social learning process"* which involves a lot of "associations" or "networking". He states that all participating groups in a scientific-social controversy are mature actors, and there is no prior difference in terms of accountability of each kind of knowledge. What makes certain expertise more credible in a controversial context than others is the strength of the

networks with which experts are associated. In his case studies, he presents controversies as an arena where *"a significant diversity of worlds of relevance"* meets. This controversial space creates the conditions for the deployment of an interaction among different "worlds of relevance". Through the translation of controversy "managers", who play the role of brokers between different "worlds of relevance", the mobilization and association of different "worlds of relevance" is fulfilled and the ground for decision making is thus prepared. In this sense, the robustness of decisions can be *"predicted upon their ability to reflect associations, and upon the extension and heterogeneity of the network created through these controversies" (p.424).*

In echo, Nowotny (2003) also says that the persuasiveness of a specific kind of expertise *"lies in the nature and robustness of links it can build with other types of knowledge, other kinds of experience and expertise" (p.154).* In Allgaier's (2013) words then, "*how powerful and credible experts become in a particular controversy depends...on their ability to build networks and form associations with the other actors involved in the controversy" (p.300).* Therefore, the robustness and credibility of expertise situated in a particular controversy context develops in the interaction with other "worlds of relevance". In this sense, the expertise that is acknowledged more widely than other forms of knowledge is not an individual property but an outcome of networking and collective contributions.

But the question on expertise is not only restricted to "which scientific expertise is deemed credible"; it also expands to "what kind of expertise is relevant" in a particular context. After all, the debates over GMOs concern more than just scientific knowledge or technical details. The complexity of it lies in the fact that it is not simply a scientific/technical issue; rather, it is a "monster" that stirs up scientific, social and political controversies at the same time, thus making it particularly difficult to determine who can be seen as the relevant experts as well as who should decide what kinds of the expertise are relevant (Jasanoff, 2003).

Indeed, it is no longer the case that advice based on natural science is deemed as the sole expertise in public controversies; rather, other forms of counter-expertise emerge and are promoted by various well-equipped players (Massen & Weingart,

2005). For instance, STS scholars have showcased a range of studies which demonstrated that "lay" people can possess situated expertise that may be as crucial as, if not more than, applying abstract natural scientific knowledge to particular contexts and cases (e.g. Wynne, 1989). The notion "relevant expertise" indicates that among different kinds of seemingly convincing expertise, the one(s) that is deemed the most relevant in a controversial context becomes the crucial criteria for risk assessment.

In general, the relevant expertise that is associated with the strongest network then naturally acquires the dominant status when directing policy-making in public controversies. In my case study which features the contrasting decision-making concerning the cultivation of GM 1507 maize in the EU and in Austria, the concepts of "collective expertise" and "relevant expertise" will help explain the controversial situations in the two theaters. I will argue that the reason lies in the fact that there are two sets of "collective expertise" excelling in the two contexts, and the two contexts perceive different kinds of expertise as relevant: At the European level, since only arguments concerning GMOs' direct impacts on the environment and on human and animal health can be taken into account in the risk assessment practice, natural science then excels as the most robust, credible - and most importantly - relevant expertise. In this context, the conclusion collectively drawn by the EFSA and some influential national Competent Authorities, who mainly possess expertise of laboratory natural science, became the basis of decision-making at the EU stage.

However, in the Austrian context, because more profound environmental concerns and specific social values/images are deemed as particularly relevant for Austrians, a broader set of "relevant expertise", consisting of natural science, ecological science and social science, is brought into the risk assessment process. On this basis, relevant experts on the Austrian stage form a strong anti-1507 maize network, to compete with the pro-1507 maize network built by the EFSA and other national regulatory bodies on the EU stage. Meanwhile, the concept of "relevant expertise" will also be discerned within the Austrian context, in which stakeholders from different areas mobilize specific kinds of expertise to buttress their own argumentation. We will witness in detail this performance of expertise in the empirical chapter.

2.2. Sociotechnical imaginaries & national technopolitical identity

In international controversies about scientific and technological (S&T) policies such as the one concerning GMOs, an interesting question is why the GMO policy in Austria takes the form that is radically different from some countries within the EU or in other parts of the world. To make sense of the national policies supporting the development of science and technology (in this case, the development of GM technology in foods sector), the concepts of "sociotechnical imaginaries" (Jasanoff & Kim, 2009) and "national technopolitical identity" (Felt, 2013) can be used to explain this variation in Austria's national S&T policies.

Introduced by Jasanoff and Kim (2009), the concept of "sociotechnical imaginaries" embodies *"collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects"(p.120).* This idea follows Anderson's (2006/1983) statement that a nation can be understood as an "imagined community", *"whose coherence is created through specific sets of cultural, political but also techno-scientific practices" (Anderson, 2006/1983, in Felt, 2013, p.2).*

In their empirical study, Jasanoff and Kim argue that national S&T policies could only be fully understood by looking at the *"material and organizational resources"* nations deploy, as well as the *"imaginative resources"* throughout the development. Through a historical comparison of different uptakes of nuclear power in the US and South Korea, the two authors reveal that the two nations' technological engagements were deeply tied to *"state-society relations"* and the *"evolving understanding of democracy" (p.141)* in the specific context. In reality, primarily due to different imaginations of social life and order, the two nations diverged dramatically in engagements including framing risks, defining policy focus, articulating social and technical controversies, providing avenues and means of closure and so forth. Therefore, the notion of "sociotechnical imaginaries" suggests that a nation's technological choice is closely related to a collective form of *social life and order* and is co-produced *"along with the goals, priorities, benefits and risks of science and*

technology" (p.141).

Meanwhile, the "sociotechnical imaginaries" formed and stabilized in one technological choice can form a sense of "tradition" which can have profound influence on a nation's further and broader S&T policy development. Felt (2013) analyzes how pre-existing sociotechnical imaginaries can influence a country's further engagement of new technologies. Taking the concept of "sociotechnical imaginaries" further, she proposes the notion of "national technopolitical identity". Focusing on the Austrian context, Felt investigates how the nation achieved in creating a unique identity of technological engagement, or a *"specific form of innovation governance"*, that is, *"collectively keeping a set of technologies out" (p.3).*

Overall, she argues that this identity cannot be simply explained by the "technophobia" argument, rather, it stems from a "tradition", or a historical context, which makes *"parts of social life unchanging and invariant" (p.8)*. For instance, in the GM case, she ties Austria's anti-GMO position to the anti-nuclear power movement which took place a few decades earlier. She argues that it was the "sociotechnical imaginaries" stabilized throughout the anti-nuclear power movement that largely contributed to the GMO stance in Austria today. The elements featured in the anti-nuclear power movement, in her words, *"became important resources to feed people's imagination of potential relations between technological projects, preferred ways of living and social order" (p.15).* In turn, the imaginary elements involved in the anti-GMO movement enriched the pre-existing "sociotechnical imaginaries" and fed into the "tradition", which appears extremely attractive when making future S&T innovation choices such as on nanotechnology.

In a word, through assemblages of "sociotechnical imaginaries", Austria came to form a unique "national technopolitical identity" which highlights that, despite its size and place in Europe, *"Austria can manage to choose a different sociotechnical trajectory than its more powerful neighbors" (p.16).* Meanwhile, through continuous rehearsals concerning S&T policies, Austria's "national technopolitical identity" becomes more solidified.

On the whole, this group of concepts introduced will allow me to examine the

GM case with dimensions beyond scientific and technological development. Both "sociotechnical imaginaries" and "national technopolitical identity" suggest that technologies cannot be separated from their social, including political context; rather, these aspects are deeply intertwined. In particular, the notion of "sociotechnical imaginaries" will call attention to the fact that Austria's dealing with the cultivation of 1507 maize is inevitably connected to a wider vision of social order, of national technopolitical cultures, of social risk and benefit, of collective good, and of imaginaries about the future. And the concept of "national technopolitical identity" will lead to examine how GM technology matter in forming Austria's national identity and how this national identity in turn can influence the framing of GMOs governance. In this specific case, the notion will inform the importance of keeping up to "tradition" and retaining Austria's unique technopolitical identity in the midst of hot disputes over the cultivation proposal on GM 1507 maize.

Through the empirical analysis, we will witness how "imaginaries" and "identity" are vividly played out in this case. We' will see how Austrians' imaginations of social life, order, future and public good, as well as the established national technopolitical identity can influence and define major stakeholders' risk-framing, argumentation, and the overall policy-making concerning the cultivation of GM 1507 maize in Austria. In a word, this group of concepts brings in a broad and rich social dimension to assess scientific/technological innovations. Therefore, I will examine, on top of the scientific rationales, how the nation's pre-existing social imaginaries and technopolitical identity becomes a stronghold of the anti-1507 stance.

3. CASE BACKGROUND: GM 1507 maize and its difficult entry into the EU

In July 2001, the American companies Pioneer Hi-Bred and Mycogen Seeds (with the former taking the lead) submitted an application for cultivating GM *1507 maize* in the EU to the Competent Authority of Spain - Comision Nacional de Bioseguridad (CNB), in accordance with Directive 2001/18/EC of the European Parliament and of the Council on the deliberate release of GMOs into the environment. The next year, in compliance with the CNB's requirement, Pioneer submitted complementary information containing the environmental risk assessment, proposals for a monitoring plan and other supportive materials. Alongside the cultivation proposal submitted to Spain, a separate notification for food and feed was simultaneously submitted to the Netherlands, and was authorized by the European Commission in 2006 without facing much objection.

The maize product is described as *B.t. Cry1F maize line 1507*. Its genetic modification has made it both *herbicide-tolerant and pesticide-resistant*: the inserted gene *Cry1F* confers **resistance to certain lepidopteran insect pests** such as the notorious European corn borer, and the gene *PAT* makes it **tolerant to glufosinate-ammonium herbicide**. Given this character, the companies' application document suggests that 1507 maize is particularly suitable to be cultivated *"in environments where there is infestation from lepidopteran insect pests, such as Southern and Central Europe" (Pionner/Dow AgroScience, Summary of application, 2001, term f).*

In May 2003, CNB's risk evaluation concluded that *based on* the *current knowledge*, there was *no scientific evidence* to indicate that the imports, production, processing and cultivation of 1507 maize would pose any risks to human or animal health or the environment. Thus it approved that within the above scope of usage, 1507 maize could be used as the conventionally-bred maize, but under the unique identifier DAS-O1507-1 and with clearly marked GM labels on the relevant commodities. (Ministry of Environment of Spain, Assessment Report, 2003)

CNB's assessment report was submitted to the European Commission and the

Competent Authorities of other Member States in 2003. Since then some of the Member States raised and maintained objections to the cultivation of this GM product, contributing to the very difficult path of this cultivation proposal inside the European Union. The issued raised by Member States mainly featured concerns over *the molecular characterization of the maize*, the *inheritance and stability of the inserted DNAs, the changeable level of Cry1F over time and space*, *environmental risks* such as gene transfer and effects on *other non-target organisms*, and so forth.

In response to these concerns, the Commission requested the GMO Panel of the European Food Safety Authority (EFSA), an agency in the European Union responsible to provide *independent* scientific advice and communication on risks associated with food, to carry out a further assessment and provide a scientific opinion on whether placing 1507 maize on the market is likely to cause any adverse effects on human and animal health and the environment.

Upon request, the EFSA conducted an assessment by re-examining the relevant scientific data submitted by the applicant. After approximately two years' investigation, in 2004, the Panel concluded in its "Opinion" report that the maize *"will not have an adverse effect on human and animal health or the environment in the context of its proposed use" (EFSA Journal, 2004, p2).* Although in its "Opinion" it also indicated that *"the only adverse effect identified was the possibility that resistance to Bt toxin might evolve in corn borers exposed to 1507 maize following cultivation for some years"(p.26)*. Nonetheless, the Panel stressed the potential adverse effect would be sufficiently controlled by carrying out the monitoring plan developed by the applicant, as well as the appropriate risk management strategies accompanying the cultivation.

But certain Member States were not convinced by the EFSA's opinion. Especially clinching the potential adverse effects of 1507 maize, they raised concerns relating to the risk assessment of the product and requested a better explanation of the potential effects of the Bt toxin on non-target organisms and their monitoring. Environmental groups also strongly opposed the crop's introduction into the environment, worrying that maize 1507 would *"harm non-target species and lead to a*

surge in the use of a toxic herbicide to which maize 1507 has been made resistant"(ScienceInsider, 7 November 2013).

The Commission accordingly requested the EFSA again to complement its opinion by providing more specific information concerning the above mentioned concerns. In 2006, the EFSA complemented its opinion on non-target organisms and remained its conclusion that the maize was safe to be cultivated in the EU. Up until 2012, the EFSA has given this maize variety a green light in six "Opinion" reports, albeit with certain restrictions such as planting 20% of conventional maize as a "buffer zone" around a GM maize field in order to prevent contamination of non-GM crops with GM pollen (ScienceInsider, 7 November 2013). Thus it is clear that scientific evidence, at least that concluded by the EFSA, supports the approval of the cultivation of GM 1507 maize inside the EU.

In the light of Directive 2001/18/EC, the information submitted in the notification and the scientific opinion of the EFSA, the European Commission in its draft 2008 proposal drew the conclusion that there is *"no evidence to indicate that the placing on the market of line 1507 is likely to cause adverse effects on human and animal health or the environment in the context of its proposed use" (Draft Commission Decision, 2008, p. 3),* and stipulated that 1507 maize is safe to be placed on the market for imports, production, processing and cultivation purposes. However, at the end of its draft proposal, the Commission also emphasized that placing 1507 maize on the market should be accompanies by some conditions, including regular monitoring (especially on the resistance of the corn borer) by the consent holder as part of risk management strategies for best possible handling and use of the maize, and the maize shall not be used with glufosinate herbicides in order to minimize exposure of both target and non-target insects to Bt toxins. (Draft Commission Decision, 2008)

Standard decision-making in the EU involves various European institutions, in particular, the European Commission (represents the interests of the EU as a whole), the European Parliament (represents EU citizens) and the Council of the European Union (represents the individual member countries). The procedure is known as

"codecision", in which the European Commission proposes new legislation, and the Council and Parliament (dis)approve its legislation. (European Union: How EU decisions are made)

According to Article 5 of Resolution 1999/468/EG, the GMO regulation would be processed in the following manner: The European Commission submits its draft for a decision to the "Standing Committee on the Food Chain and Animal Health". The Committee may approve or reject the Commission's draft with a qualified majority[1]. If the Committee rejects the Commission's draft, or if a decision cannot be reached by a qualified majority, the Commission then must take its position to the Council of the EU and inform the European Parliament. The Council has 90 days to approve or to reject the draft with a decision made by a qualified majority. If the Council rejects the Commission's draft, the Commission must revise this draft. If the Council approves the Commission's draft, or if the Council's vote cannot reach a qualified majority, then the Commission's draft for a decision comes into effect. (1999/468/EC, Article 5)

Under this system, in early 2009 the Commission submitted its draft to the Standing Committee, consisting of experts from each Member State, to decide on the cultivation proposal of 1507 maize in the EU. However, with no qualified majority voting for or against the proposal, the Committee could not sign off this proposal. According to the regulation, the Commission then should have referred the matter to the Council of Ministers and the European Parliament. However, in this case, instead of putting it to the Council, the Commission sat on the file for a decade, ignoring the regulative procedure and Pioneer's 2010 action against the Commission for not having referred the proposal to the Council. After being kept in limbo for 12 years, in 2013, Pioneer fought that inaction in the EU Court of Justice. In September 2013, the court announced that the Commission failed to reach a timely decision in this regard.

In response, on November 6th, the European Commission finally made a step

[1] Treaty of Nice defines the term "qualified majority": Each Member State is allotted a certain number of votes according to its population. In order to reach a qualified majority, 232 out of 321 votes are needed. Additionally, a qualified majority must represent at least 62 percent of the EU population.

further: it proposed to authorize the cultivation of 1507 maize, provided that the EFSA had already submitted positive opinions on this request in all six reports. It submitted this draft proposal to the Council of Ministers and left the issue for the member states to decide. According to the regulation, the Council then had a 3-month period (beginning 12 November 2013) to act on the Commission's proposal. In parallel, the Commission called in the Council of Ministers for a new debate of its so-called "cultivation proposal", which was initiated in 2010 by the Commission, approved by the Parliament, but blocked in the Council. The cultivation proposal, based on the subsidiarity principle, would grant individual Member States freedom to choose whether to cultivate GMOs or not on their own territories. This means if the Commission says "no" to a cultivation dossier, then this GMO cannot be cultivated across the EU, but even if the Commission says "yes", individual Member States still have the right to refuse that cultivation on their own territories. In this sense, this proposal would enable a double-barrier for any GMO cultivation inside the EU.

Therefore, a draft proposal on the cultivation of 1507 maize in the EU and the 2010 cultivation proposal were put to the Council of Ministers, who was requested to initiate a discussion among Member States and take a decision on this matter at its Environmental Council Meeting on 13 December 2013. However, a day before the scheduled meeting, the Lithuanian presidency of the Council of Ministers declined to put this contentious issue on the agenda regardless of the request from the Commission - quoting from an EU diplomatic source, because *"there is no willingness among member states to re-open the GM issue" (EuropeanVoice, 12 December 2013)*. With that "unwillingness", the issue was deadlocked at the Council of Ministers. But according to the Commission's decision in November 2013, the Council only had 3 months to make its position.

After a month's silence, in January 2014, the European Parliament Environment Committee first spoke out against the approval of 1507 maize. On 16 January, in a resolution passed by 385 votes to 201 with 30 abstentions, the parliament echoed the concerns of environmental groups that the 1507 maize could harm non-target insect species; in particular, members denounced the Commission's proposal in that it *"fails*

to specify any conditions for protection of particular ecosystems/environments and/or geographical areas"(European Parliament, Motion for a resolution, 7 January, 2014, p.3) as required by the legislation. The resolution clearly opposed the adoption of the proposal and called on the Council to reject the Commission's proposal in its later meeting; meanwhile, it called on the Commission not to propose the authorization of any new GM varieties and not to renew old ones *"until the risk assessment methods have been significantly improved" (European Parliament, Motion for a resolution, 7 January, 2014, p.5)*. But the European Parliament does not have the decision-making power in this matter. The final decision was yet to be made by the Council of the EU, who delayed its discussion in December 2013.

On February 11, 2014, a few days before the assigned deadline, the Council of Ministers finally held a public debate on this issue. Voting among other issues, the Council did not reach a consensus: 5 out of 28 Member States, Estonia, Finland, Spain, Sweden, and the United Kingdom, approved the cultivation of maize 1507 on EU soil; while France, Italy, Austria, the Netherlands and Poland were among the 19 Governments who rejected the proposal; and 4 countries abstained, including weighty Germany, who has the biggest voting weight in the ministerial Council. According to the Council's regulation system, in which *"each country has a different number of votes in the ballot, depending on their population size, among other factors"(ScienceInsider, 11 February 2014)*, the 19 opponents did not reach the required qualified majority against the Commission's proposal to approve the cultivation of the GM maize 1507.

According to Article 5 of 1999/468/EC, as mentioned above, in the absence of a qualified majority at the Council, the European Commission now is obliged to authorize the proposal. The Health Commissioner Tonio Borg insisted that the Commission now should respect the rules and take action. Speaking to the media, Borg said that *"no one can say we rushed or pushed this file,"* while reminding Ministers that the application *"has been languishing for 13 years"* and that EFSA had ensured 6 times the safety of 1507 maize. Borg indeed went as far as to clarify that *"it did not make sense to block cultivation of Pioneer 1507". (BBC News, 11 February*

2014).

Thus, despite the fact that the majority of the Member States voted against the proposal at the Parliament, the door is left open for the Commission to go ahead and approve the very disputable cultivation proposal of GM 1507 maize. This seemingly awkward practice has caused many to criticize the EU's political system. However, even though the indecisiveness at the Council of Ministers has paved the way for the maize to be approved, the final decision cannot yet be affirmed. Since March 2014, the Council has been convening a working party meeting to examine the "cultivation proposal", which would allow Member States to individually decide whether to restrict or prohibit the authorized GM crop cultivation in all or part of their territories. If this proposal were to be approved, authorization of maize 1507 cultivation might have a more complex fate inside the EU.

Since the Commission has yet to make its final decision, many Member States and environmental groups have vehemently admonished the Commission not to act against the will of the majority of the EU citizens, as the 2010 Eurobarometer survey showed that 61 per cent of Europeans were wary of GMOs. The European Parliament is among the strongest critical voices. It warned that if the Commission were to authorize the cultivation of 1507 maize, it would be *"disregarding its own conclusions regarding the potential adverse impact on the environment (*acknowledged by the EFSA*) and in effect is authorizing the cultivation of a GMO on the basis of partial risk assessment" (EP, Parliamentary questions, 8 November 2013).* It also brought the precautionary principle to the fore, pointing out that the Commission would be flying in the face of this principle if it gives the green light to the cultivation of this GM crop.

The GM 1507 maize cultivation proposal has faced enormous obstacles in the past 13 years. Based on the storyline narrated above, I extract some key moments below for the sake of lucidity.

Key moments:

2001: Pioneer and Mycogen Seeds submitted the application for placing *1507 maize* on the market*;*

2001- 2003: Green light given by Spanish Competent Authority CNB;

2003- 2008: EC assured the crop's safety based on several EFSA assessments, but some Member States have remained hostile since then;

2009: EC drafted a proposal to authorize cultivation, but the Committee failed to reach a consensus internally with no qualified majority voting for or against;

2009-2013: EC shelved the file without referring the matter to the Council of Ministers according to the approved system;

2013, September: The EU Court of Justice slammed the Commission's irresponsiveness;

2013, November 6: EC submitted a draft proposal to the Council of Ministers which would allow the cultivation of 1507 maize; meanwhile it called for action on its "cultivation proposal";

2014, January 16: The European Parliament Environment Committee voted against the approval of 1507 maize in a resolution passed by 385 votes to 201 with 30 abstentions;

2014, February 11: The Council of Ministers held a public debate, in which the votes did not reach a required "qualified majority" with Germany's abstention. With the Council's indecisiveness, the final decision is again left to the EC;

2014, March 3: The Council held a fresh debate on the "cultivation proposal", aiming to bring this legislation to a close before the end of 2014;

To date, the cultivation of GM Maize 1507 is upheld in the European Commission while the "cultivation proposal" is being decided in the Council of the European Union.

In the midst of a wave of criticism, all eyes are now on the Commission's final decision. Will it be "threatened" by the flood of anti-GMO voices and refuse to authorize the cultivation, or will it go on to authorize 1507 maize based on the EFSA' scientific evidence and the legal requirements? Whichever decision the Commission ultimately announces, Austria, the focus of this thesis, has made up its mind: several of its ministers have loudly assured that they will exercise a national ban if the cultivation proposal of GM 1507 maize were to be authorized by the EC (Wienerzeitung, 11 Feb 2014). The stark contrast between the decision-making in the EU and in Austria reflected in this case forms the intriguing question of this research project, which is to be laid out in the next chapter.

4. RESEARCH QUESTIONS, MATERIALS & METHODS

The difficult path of the cultivation proposal of GM 1507 maize demonstrates that decision-making at the EU level in this regard has been struggling for more than a decade. Until now, although all the necessary legal procedures have taken place, the European Commission continues to procrastinate in announcing the final decision, although it is legally bound to authorize the proposal. Against this staggering EU backdrop, interestingly, Austria, as a member of the EU, has unequivocally proclaimed a national ban on the cultivation of the maize if it were to be authorized by the EU. It is this determined, against-all-odds stance that intrigues me in the first place: How, such a small Member State, managed to achieved a unified voice over the cultivation of 1507 maize among divergent stakeholders including political parties, NGOs, the public, scientific researchers, farmers, etc.?

To feed this curiosity, this research project aspires to examine this rehearsal moment in which the nation constructs and solidifies its anti-GMO position. The overarching research question for this project comes to the fore naturally: Facing the threat of the EU approval of GM 1507 maize cultivation proposal, how did Austria as an EU member form a strong stance to prohibit the potential entry of this maize into its territory and thus solidify its anti-GMO position? With the "precautionary principle" as a guiding framework, "scientific uncertainty" and "risk framing" as major perspectives, and "collective expertise & relevant expertise" and "sociotechnical imaginaries & national technopolitical identity" as key concepts, I examine this special moment of tenaciously holding the anti-GMO fort from the following perspectives:

1. Who contributed to the birth of Austria's national stance to prohibit the cultivation of GM 1507 maize?

2. How is the precautionary principle understood and practiced by different stakeholders?

3. What kinds of expertise are taken into account? And how is "risk" portrayed based on different expertise?

4. How do Austria's ready-made sociotechnical imaginaries (e.g.,imaginaries about risk technology, about Nature and culture, etc.) and national technopolitical identity (e.g., the identity of a green nation) influence the decision-making in this case?

In order to approach these research questions, the empirical deliberations draw on data generated via two qualitative methods, i.e. **document analysis and semi-structured interviews.** To note, these two methods are interwoven in my narration, and they are complementary and equally contributing in the empirical analysis. I shall now discuss in greater detail how these two approaches were applied intermittently to generate data:

Conducting formal, but semi-structured interviews is the ideal method to acquire necessary and substantive data in order to address the above issues. By "talking through" the above aspects of this matter with major stakeholders, I managed to get very insightful and well-rounded answers to some of the questions. However, via document analysis, the data was extensively enriched. In this empirical study, documents released by those stakeholders whom I could not contact due to various reasons, have provided equally sound answers. Meanwhile, for issues or aspects I did not touch upon during the interviews, complementary documents have enriched the accounts. Therefore, in combining data drawn from interviews and documents, I was able to get a substantive account so as to diligently address the research questions.

In practice, two categories of documents were put into use specifically. The first category includes documents mainly serving to narrate the trajectory of the cultivation proposal of GM 1507 maize in the EU (which has been provided in the earlier chapter) and the historical "making" of Austria's anti-GMO "tradition". The second category consists of major stakeholders' arguments and opinions which are complementary to data drawn from face-to-face interviews.

In parallel, I conducted three semi-structured interviews with actors representing major active groups in this case. These interviews were conducted throughout the

months of April and May in 2014, and lasted approximately one hour and a half. The conversations were recorded by audio recording device and were later transcribed for further analysis.

The identification of major stakeholders in Austria in terms of GM matters was made clear through the historical account below. In particular, due to the scope of this project and the accessibility of the actors, I only examined the significant stakeholders who were either easily reachable or had robust materials that were already available to the public. Although groups such as mass media, political parties like the Greens and farmers associations are intimately concerned with this issue and have played major roles in the general anti-GMO movement in Austria, they nevertheless have not been especially active in practice, except issuing press releases rebuking the cultivation proposal, thus I have only chosen those obviously engaged stakeholders, although by no means do I intend to downplay other actors' influence in this case. I may well have missed some part of the picture, but since my aim was not to present how each stakeholder has contributed to this matter, it is therefore reasonable not to include all of them in my case study. It should be also noted the interviewees have all agreed to be mentioned with their full names in this thesis, and to the use of direct quotes in the empirical analysis.

I started my journey by talking to Dr. Helge Torgersen from the Institute of Technology Assessment (ITA) in Austria. He is a researcher who was closely involved in the "making" of Austria's national GM position in the early days, thus has precious insights into the complex and largely veiled picture in this landscape. He has also done a substantial amount of academic work on the issue of GMOs in Austria, which has been extremely instructional in terms of discerning Austria's strategy in this matter, and forming the leitmotif and the investigative angles of this thesis. Moreover, the historical accounts provided by him not only enriched my understanding of the GMO situation in this country, but also revealed the major stakeholders who are still active in this matter, among them are *environmental NGOs, the Competent Authorities in Austria, and the Environment Agency in Austria(UBA)*. Overall, the face-to-face talk and reading his previous work have offered a comprehensive picture of GMOs in

Austria, both in vertical and horizontal perspectives.

Following this, I approached one of the most influential environmental NGOs which is particularly attentive to GM matters in Austria, that is, Greenpeace. I had the chance to talk to Dagmar Urban, an expert on GMOs and Sustainable Agriculture from Greenpeace Austria. Greenpeace's stance and argument in this case are extremely crucial, for indeed when discussing the issue of GMOs, one could hardly circumvent this non-governmental organization, which is an outstanding stakeholder in this matter and is extremely passionate and active in fighting against GMO's entry into food and feed sectors in all countries. In Austria, many scholars (e.g. Seifert, Torgersen, Levidow, etc.) have emphasized that since the late 1990s, through delivering various campaigns and protests which defended the "natural" environment, Greenpeace has played a significant role in forming a nationwide anti-GMO public opinion and in influencing the political decision-making process toward GMOs. Thus, it is doubtless that when facing the threat from the cultivation of GM 1507 maize inside the EU or in Austria, Greenpeace has been a vital and vigorous non-governmental actor in solidifying this anti-GMO position which it helped construct in the first place. Via interviewing Dagmar Urban, I grasped firsthand information about how this influential NGO frames risk in this particular case and how it perceives the concept of the precautionary principle to keep GM 1507 maize out of the Austrian, as well as the European territory. All in all, it has been extraordinarily fruitful and essential to hear what Greenpeace Austria had to say in this case.

I then turned to the Environment Agency in Austria (UBA), formerly a governmental agency but now an independent company which provides scientific and technical expertise for the Ministry of Health and the Ministry of Agriculture, the latter two being the Competent Authorities in Austria concerning GM matters. In the case of 1507, the Environment Agency was entrusted by Austria's Competent Authorities to conduct a complete analysis and investigation on dossiers submitted by the companies and documents released by the EFSA and other EU bodies. The Environment Agency, incorporating the latest scientific literature reviews and its

expertise in this regard, has provided scientific and technical evidence for precluding the possibility of cultivating this maize in Austria, thus has greatly informed Austria's official position in this regard. Therefore, it is of vital importance to talk to this actor who is behind the decision-making bodies. I had a chance to conduct a face-to-face interview with Dr. Michael Eckerstrofer (abbreviated as M.E.) from the Land Use & Biosafety unit, who was directly involved in the assessment of 1507 maize. He provided a great insight into the interplay of science (including laboratory natural science, ecological science and social science), politics and normative values on Austria's GM stage.

For various reasons, I did not manage to interview representatives from the Ministries of Health and of Agriculture, who are the official voices in this matter. Nonetheless they have provided me with instrumental documents, from which I have extracted sufficient, relevant and valid accounts that represent their stance and arguments. I therefore believe that I have collected sufficient information from these Ministries even though no interview was held. These documents, along with the interview accounts, indicated the major stakeholders' opinions and arguments in this regard and, thus became the essential source for the empirical analysis.

In addition, in order to provide an exhaustive account of what is GM 1507 maize, how this cultivation proposal has been tossed back and forth inside the EU, how the dispute has evolved and what are the major concerns in this case, I have carefully looked into numerous technical, political and discursive documents in this regard. First of all, to understand this GM variety and the situation of the cultivation proposal, I reviewed documents, including the application dossier submitted by the companies in 2001, the Spanish Competent Authority's assessment report in 2003, subsequently EFSA's six reports from 2004 to 2012, the European Commission's draft proposal in 2008 and 2013, the corresponding press releases of the Commission, the European Parliament and the Council of Ministers, as well as supporting legal documents such as Directive 90/220/EEC, Directive 2001/18/EC and other relevant regulations. To grasp the major counterarguments in this debate, I kept a close eye on the live debate of the Council's crucial vote on February 11, 2014 and various media reports in this

regard. To trace the "making" of Austria's anti-GMO "tradition", I have combined several literature reviews and some "talking" accounts drawn from the interview with Dr. Helge Torgersen.

On the whole, reading between the lines of these documents, and interweaving these accounts with the valuable information extracted from interviews, my narration tries to present a comprehensive, in-depth view of what major stakeholders in Austria hold against GM 1507 maize as well as other GM varieties, how they articulate their arguments and frame risks according to their expertise, how the precautionary principle is interpreted and used, and how science, normative values and politics are simultaneously brought into use to defend the anti-1507 position in this country.

Data collected from interviews and documents was coded and analyzed primarily by using the **grounded theory method.** A qualitative research methodology initiated by sociologists Glaser and Strauss (1965), the grounded theory method attempts to discover theory through the analysis of data. Thus, rather than beginning with a hypothesis in the traditional social science studies, the working process is more 'bottom-up'. Since there is no prior "hypothesis" or "theory" to start with in this empirical examination, this data analysis method appears suitable for this project. Moreover, as Glaser (2001) revealed that "all is data", grounded theory allows for a combination of different kinds of data, thus this approach of data analysis fits my research which drew data from interviews, documents, press releases, web content, etc., i.e. multiple data sources.

In practice, as listed by Charmaz (2006), the most important stages in grounded theory are the following:

- *Simultaneous involvement in data collection and analysis*
- *Constructing analytic codes and categories from data, not from hypotheses*
- *Constant comparative method, which involves making comparisons during each stage of analysis (Charmaz 2006)*

These stages involve a three-step process consisting of *initial coding, focused coding, and axial coding* in my research. First, data from interview transcripts

concerning stakeholders' opinions and arguments was coded paragraph by paragraph in order to generate a provisional set of notes and self-reflections. These primary notes formed initial codes. With the analytic guidance of these initial codes, I continued to develop core conceptual categories during the focused coding stage, which consisted of identifying the most frequent codes. In this case, the most significant codes identified included *risk, scientific evidence, uncertainty, the precautionary principle, environmental concerns, agricultural model, organic farming, Nature, Green Austria,* etc. These key concepts, arising from the initial stage were then used to segregate themes. Together with the themes already identified in documents, I then categorized them into boxes of three understandings of the precautionary principle. When everything was reviewed and a complete set of data acquired, I reached the axial coding phase in which I explored the relationship of categories and tried to make a connection between them. At this stage, I identified the interactive properties of the focused categories, from which the discussion concerning the interplay between scientific knowledge, economic-political arguments and normative values in risk technology assessment derived. Overall, this process of coding and analysis has been very beneficial in answering the questions posed in the beginning.

5. ON THE GENESIS OF AN ANTI-GMO "TRADITION"

This chapter starts to answer the question on how Austria reached such a rapid and clear consensus to prohibit the cultivation of GM 1507 maize on its territory. Before presenting actual field examination, I argue that today, Austria's performance in the GMO setting is first and foremost influenced by its strong anti-GMO tradition constructed through several exercises in history. Thus it is worthwhile to trace the "making" of this anti-GMO tradition first. In the following, I turn to narrating the historical backdrop in which an anti-GMO position came to the fore in Austria, through which the work of identifying major stakeholders in this matter is done as well. This narration, woven together by existing literatures and data drawn from the interview with Helge Torgersen (who was a participant as well as a witness in the "making" of the GM history in Austria; abbreviated as H.T.), reveals vividly the ups and downs the nation experienced during the process of forming a national position, and sheds light on how major stakeholders were involved at the outset.

5.1. Austria as a forerunner

Austria stands out among European GMO-opponents. Historically, the country was the first, along with Luxembourg, to issue a ban on the EU-approved maize *Bt 176* in 1997 (the ban was lifted in July 2008). Since then, in accordance with Article 16 of Directive 90/220/EEC and the later Article 23 of Directive 2001/18/EC, and justified by new scientific evidence, Austria has issued six ordinances to introduce safeguard measures, i.e., "import bans", for placing on the market of three lines of GM maize, including *MON810, T25 and MON863*, one GM potato *line EH92-527-1*, and of several GM *oilseed rape lines*. (Biosafety Clearing-House Austria, Safeguard Measures) Indeed, the country has issued more bans on GM varieties than any other European country. Although the "safeguard clause" specified in Article 16 of Directive 90/220/EEC does guarantee the right of a Member State to restrict or even prohibit individual GM variety authorized by the EU, it is only legitimate when it has

"justifiable reasons to consider that a product...constitutes a risk to human health or the environment". The Austrian Government submitted additional investigation materials to support its import bans, but the Commission did not acknowledge the validation of these new "evidences".

Although missing "justifiable reasons" for these bans, Austria uncompromisingly refuses to lift any of them. Besides being extremely cautious about importing GM products into its market, Austria vigorously pursues a policy of zero-tolerance of GM crop cultivation on its territory**.** This anti-GMO attitude, which is *"consensual across virtually all political parties, social interest groups and stakeholders" (*Seifert, 2007, *p.8),* leads to a quick and firm political decision in this case, that is, **ready to place a national ban on the cultivation of GM 1507 maize** regardless of the predictable criticism from the EU and the wider international community.

Today, Austria's wide and robust consensus regarding a GMO position might have well developed into, as Torgersen suggests, a "remarkable cultural identity" (H.T., 1). Although an anti-GMO position is very much solidified in Austria, it is important to bear in mind that this identity did not exist priorly, rather, it was collectively established over a decade through a series of uncertainties and experiments.

As modern biotechnology caught up during the 1980s in Europe, there were political struggles and public uneasiness about the industrial applications of medical biotechnologies, such as the insulin production in Germany. However, many progressive scientists advocated the application of biotechnology in agriculture:

> "They were saying that, well, irrespective whether these technologies might be dangerous or not, but the aim should be to improve agriculture, because that is more sought after, and it could be an opportunity for third world farmers as well, to improve productivity under difficult circumstances and conditions."(H.T., 1)

After the medical application became main stream, the agricultural application got a foothold in the US and other places, but it had little significance in Austria, a small European country with limited economic and political importance. Due to the lack of large domestic seed companies, the seed industry was reluctant to invest in biotechnology in Austria. Meanwhile, public awareness of biotechnology in general

was very low.

In the early 90s, debates were being held on how tight the regulation in the European Union should be. When the European Council came up with Directive 90/220/EEC of 23 April 1990 on the deliberate release into the environment of genetically modified organisms, no one was certain about it due to the lack of real-world experience. Austria also struggled to find a position that would fit into EU's regulation and its national condition since it was not an EU member at that time:

"It was clear that Austria needed a GMO regulation, the easiest thing would be taking the EU regulation, but from the legal point of view, this was not so easy because you would have to amend it in a certain way to make compatible to what was in place already in Austria. They (the official regulation-makers in this regard) didn't have an opinion but they were trying to accommodate to EU." (H.T.,2)

To this end, the Ministry of Health, who was in charge of GMO regulation at the time, started some working groups along with the 1992 Austrian Parliamentary Inquiry Commission (which ran almost a year), to take up the issue of genetic engineering in a broad sense.

Domestically, serious negotiations for a law on genetic engineering began in 1991, when the Ministry of Health prepared a draft that was initially criticized by different ministries, industry and environmental groups. Followed by several subsequent negotiations, the revised draft resulted in the 1994 Gene Technology Act (Gentechnikgesetz), which came into force in January 1995. Based on five principles, namely, *the precautionary principle, the principle of providing for the future, the step-by-step principle, the democratic principle and the ethical principle*, the Gene Technology Act was designated to regulate the main aspects of biotechnology and genetic engineering in Austria. (Mikl &Torgersen, 1996)

Meanwhile, an official stance was sought after by the Competent Authorities, which included the Ministry of Health and the Ministry of Science. During this process, the Federal Environment Agency, which at the time was a subsidiary scientific body of the Ministry of Agriculture and had far-reaching impact on the decision-making of the Ministry of Health, had the right to comment. While advocating a broader interpretation of Directive 90/220 by taking more account of

ecological impact, UBA's conservative attitude toward GMOs was obviously in collision with the progressive Ministry of Science. Thus, the Competent Authorities in Austria were not in an agreement; as a consequence, there was no official position on this matter (Mikl &Torgersen, 1996, p.199). During the process of establishing an official position as well as testing the EU regulation, the Ministry of Health, trying to mediate the conflicting pressures, staged three successive applications. Two were "designed" to fail (in the sense that they had clearly visible risks), but the Ministry hoped that the third, a potato with a modified starch content deemed as low risk, would succeed, since similar plants had been released previously elsewhere. However, in 1996, shortly before authorization of the GM potato application, an anonymous letter sent to the Ministry of Health alleged that the applicant had released 8,000 transgenic tubers without permission. This scandalous allegation was soon substantiated by NGOs represented by Greenpeace and Friends of the Earth who went to the press and indicated that there was illegal GMO cultivation occurring in Austria. Despite the company's defense, the proposal was ultimately turned down.

Meanwhile, NGOs "threatened" to occupy retailers' outlets if they found anything made from GMOs on the shelves. By controlling the small cluster of retailer chains in Austria, the NGOs successfully blocked the potential entry of GM foods into the market. Also, in light of the NGOs' notable success in various public activities, especially in the anti-nuclear movement, the Austrian Government did not dare to take an official stance that favored GMOs. In this way, the NGOs successfully recruited the Government as its ally. In fact, two days after turning down the GM potato proposal, the Minister of Health announced a two-year moratorium on all GMO releases in order to allow a public debate.

The investigation of Austria's public opinion on genetic engineering technology had already started in the early 1990s. Although the 1994 Eurobarometer survey had shown that gene technology was ranked by the public as the least-favored modern technology among solar energy, computer technology and others, the public's aversion toward GMOs was vague and their knowledge on this subject was in general very poor (Seifert & Torgersen, 1996). However, this tuber scandal disclosed by the

NGOs soon gave rise to fear and indignation and the Austrian public's aversion, which had heretofore been vague now, experienced a sharp increase. Following the protests against gene-technology invoked by the birth of the first cloned sheep Dolly in 1996, the NGOs, spearheaded by Greenpeace and Friends of the Earth and, heavily supported by the Green Party and the most famous tabloid press "Kronen Zeitung", launched a campaign in the 1997 referendum, demanding *"no food from genelabs in Austria; no release of genetically modified organisms in Austria; no patent on life" (Austrian Parliament, in Felt, 2013, p. 13)*. More than 1.2 million Austrian citizens were recruited to sign the petition that demanded a prohibition of GMO culture in Austria, making it *"the second highest score of all such initiatives since this instrument was installed in the sixties" (Seifert & Torgersen, 1997, p. 310)*. Public awareness and Austria's seemingly clear position on GMOs demonstrated environmental NGOs' huge success in this regard. As confirmed by Dr. Torgersen:

"The public opinion in the beginning was vague. It was not an issue at all…So what the NGOs really succeeded in was making it popular, with certain taste attached to it... Bring it to the notice of many people through the channel of tabloid press, as something to be opposed to." (H.T.,3)

5.2. Co-evolving with the European context

Aside from the painstaking effort to shield against the introduction of GMO domestically, the position-making process in Austria evolved closely with the general European atmosphere. At the European level, large environmental NGOs were not enthusiastic about embarking on the GMO issue in the beginning. In late 1995, however, after the pending import of non-labeled GM maize and soy from the United States, environmentalists in Europe started to tackle this issue. Among the influential voices was Florianne Koechlin, a Swiss environmentalist who traveled around, alerting the world that genetic engineering was like "a jumbo jet with bicycle brakes", and she helped organize the campaign for the famous Gene Protection Initiative in 1998, which proposed outlawing genetic research on plants and animals (BBC News, October 2002). This initiative was eventually rejected in that year's referendum which was taken over by biotech companies (e.g. Novartis) and progressive scientists.

Nevertheless, environmentalists as such became the *"hallmark of an anti-GMO movement at the European level" (H.T., 2).*

Triggered by a series of incidents which took place in countries such as Austria and Switzerland, and coincided with the eruption of the BSE crisis in Europe, the anti-GMO movement quickly spread to many European countries including France, the UK, Italy, Greece and so on. Public pressure prompted these governments to adopt restrictive policies on GMOs and even pushed them to place bans on GM varieties that had been previously approved by the EU. (Seifert, 2007)

In 1999, in the Council of Ministers, France and Greece, backed by Denmark, Italy and Luxembourg, later joined by Belgium and Austria, called for a *de facto* moratorium on new GMO approval. During the moratorium, the EU refused the experimental or commercial growth of new gene crops as well as imports of new GMO-based food products. Although the moratorium was supposed to last until 2004, in fact, Member States like Austria upheld it much longer. The moratorium ultimately brought about the EU's official adoption of the precautionary principle and drove the Commission to adopt tighter regulations in risk assessment and approval procedures, as well as traceability and labeling provisions (Torgersen & Bogner, 2005). The direct consequence of all these regulations is that, to date, introducing GMOs into European markets is a much more complex business than on the transatlantic continent.

In conclusion, initiated by a group of environmentalists and later encouraged by certain political parties, Austria's aversive attitude toward GMOs not only succeeded in raising a European-wide anti-GMO movement, but also brought about a resounding victory which solidified Austria's initially rather vague anti-GMO stance. While in the 1990s most political parties were still somewhat ambivalent about a straightforward anti-GMO policy and the agricultural interest groups were still uncertain as to whether to keep the option of resorting to gene-technology open, after the EU enacted the *de facto* moratorium, a prohibitionist stance appeared clear to them. The Austrian Government soon adopted an extremely precautionary policy on GMOs, and agricultural policy makers started to stress the economic advantage of adopting an organic farming model in Austria. (Seifert, 2007) Today, all its nine Bundesländer are

very determined to remain GMO-free municipalities (GMO-free regions, 2012) and, although organic farmers are still somewhat of a minority group among Austrian farmers, the organic farming model has gradually risen to become the favorite of the Austrian agricultural policy makers.

Above, in retrospect I have traced some historical episodes that vividly reveal how Austria came to construct a national anti-GMO position throughout a short period in history. Besides resonating to the European-wide anti-GMO movement, the emergence of an anti-GMO position in Austria may see its roots in its domestic environment, which has come to nourish a "national technopolitical identity" (Felt, 2013). Standing upon its "Austrianess" which acquired its symbolic status through the collective memory practices of historical events and several rehearsals concerning a techno-scientific future in Austria, the anti-GMO movement inherited its spirit to a large extent from the earlier events. In particular the anti-nuclear movement in the 1970s, whose tactics and elements *"became important resources to feed people's imagination of potential relations between technological projects, preferred ways of living and social order" (Felt, 2013, p.15).*

Therefore, the historical account of the "making" of an anti-GMO position serves as a rich backdrop for Austria's performance in the case of 1507 maize, which offers the chance for the nation to revitalize its anti-GMO "tradition". Revisiting "tradition" reminds people of their "Austrianess" in terms of dealing with GM matters and of the importance of keeping this "tradition" alive throughout time and threats. Inheriting the anti-GMO "tradition", it is doubtless that Austria would firmly preclude the possibility of 1507 maize cultivation on its own territory, thus a national ban does not sound at all surprising. In this context, I argue that *living up to the nation's "tradition"* was one of the "HOWS" which helped Austria achieve consensus among all the stakeholders in making the cultivation of GM 1507 maize in Austria impossible.

Meanwhile, from a glance of the history, we have also identified several influential stakeholders who made "anti-GMO" as the official Austrian stance and are still active in the GM landscape in Austria. I hereby list those who are the most active and relevant in this case: *First and foremost, the environmental NGOs represented by*

Greenpeace and Friends of the Earth - they usually serve as a primer for an aversive attitude toward certain GM varieties and further disseminate their position with the help of mass media. *At governmental level the Ministry of Health (Bundesministerium für Gesundheit), and the Ministry of Agriculture, Forestry, Environment and Water Management (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft; hereinafter referred to as the Ministry of Agriculture)* - the Ministries are political forces who make national choices while taking into account different voices. *The Federal Environment Agency (Umweltbundesamt, abbreviated as UBA)* - formerly affiliated with the Ministry of Agriculture, it scientifically informed the Ministries' decisions in this case.

Today, the Ministry of Health is responsible both for contained use and deliberate release applications submitted by industry and research institutions with the exception of universities (the Ministry of Science and Research is responsible for applications from universities and federal research institutions), as well as for GM food and feed applications. The Ministry of Agriculture is involved as an additional Competent Authority concerned with the environmental aspects of deliberate release and for placing GMO-products on the market. It is supported in its function by the Environment Agency. (Biosafety Clearing-House Austria, CA in Austria)

Building upon this identification, the intriguing question is, what precisely are the arguments this time, the arguments that not only stand up to the European/ international regulations but also live up to the Austrian anti-GMO identity? To this specific end, I immersed myself in volumes of documents and materials retrieved from respective stakeholders and, in parallel, I tried to meet representatives of each decisive stakeholder group when possible. I then synthesized these accounts into a multidimensional picture that serves as the leitmotif of this thesis, which reflects the intricate kinship between science and risk, politics and culture. The detailed analysis follows in the next chapter.

6. EMPIRICAL INVESTIGATIONS

In the previous chapter, I argued that Austria's profound anti-GMO "tradition" has laid a strong foundation to prevent the entry of GM 1507 maize into its territory. Following this seemingly ineradicable "tradition", in this chapter, I will focus on the empirical investigation of this specific case and continue to answer the question *"how did Austria achieve a consensus among its stakeholders to keep GM 1507 maize out"*. As mentioned, the analysis will be based on data drawn from relevant documents and interviews with representatives from key stakeholder groups.

Focusing on analyzing different stakeholders' arguments that support their anti-1507 maize stance, I found that various defences arrived at the same end, that is, the **precautionary principle** approach. This is surely not a coincidence. Compared with its American counterparts, the more cautious EU embraces the precautionary principle as a general policy on GM matters, and Austria has indeed spearheaded this principle in its various national bans on GM varieties which had been assessed positively by the EU. As a matter of fact, as reams of documents have revealed, and as all the members I interviewed have unanimously stated, the precautionary principle is the **guiding policy** of GM matters in Austria; that is, as long as uncertainty is revealed in scientific GMO assessments, the precautionary principle will be applied to avoid potential hazards, which of course normally leads to the rejection of certain GM applications. For instance, in Greenpeace's report in 2005, it is clearly stated that since there are many irregularities in the 1507 genome caused by the genetic engineering process itself, *"these (irregularities)by themselves, on the basis of the Precautionary Principle, should be ground for rejection of 1507 as they can give rise to unintended and unexpected effects"*. (Greenpeace 2005 report, p.2)

Indeed, the invocation of the precautionary principle first of all serves to reverse the burden of having to obtain scientific evidence, but its actual functionality goes far beyond scientific concerns. In the following analysis, I will show how the precautionary principle remains as the backbone of each strand of argument, be it scientific, normative, economic or political. Specifically, with the guidance of three

understandings - *scientific, economic-political and normative social-critical* - observed by previous researchers (Torgersen & Bogner, 2005), I will categorize the major stakeholders' arguments into three themes.

The first section will feature a *scientific understanding* of the precautionary principle, in which I will present in detail how Austria's stakeholders use scientific arguments to suggest that cultivating GM 1507 maize in Austria is not advisable. In particular, their arguments revolve around the "flaws" of the EFSA's risk assessment or the loophole in the current scientific risk assessment process, thus requiring more rigorous scientific studies to be undertaken in this regard. This approach of being cautious about the role of scientific knowledge in the current risk assessment of scientific/technological innovations renders a *scientific understanding* of the precautionary principle.

The second section will consider an *economic-political understanding* of the precautionary principle. In this case, I will draw particular attention to *socio-economic criteria* in assessing the appropriateness of scientific/technological innovations. This dimension of criteria, initially practiced in Norway, is strongly advocated by Austria's stakeholders, who strive to bring the country's economic, social and political specifics into the risk assessment scope. Although these criteria are not specifically prepared for this case, they are nevertheless crucial aspects in stakeholders' formulation. Thus I will first present how the socio-economic criteria are used by different stakeholders to support their anti-1507 maize stance, and then I will narrate in detail what socio-economic criteria could specifically mean for Austria in the GM cases.

The third section then reflects the stakeholders' *normative social-critical understanding* of the precautionary principle. Focusing on Austria's endeavor to become the "greenest nation" inside the EU, I will present stakeholders' statements which indicate that the cultivation of GM 1507 maize is clearly an obstacle to Austria's pursuit of that identity, because it collides with the image of Austrian Nature, as well as Austria's preferred model of agricultural development. These arguments derive from major stakeholders' normative orientation about nature, national image, agricultural model, etc., thus corresponding to a *"normative systems-critical"*

understanding of the precautionary principle.

Through the above analysis, I will also reveal that the precautionary principle in the case of 1507 maize has seen an interesting interplay of different understandings by the major stakeholders. Based on informative materials retrieved from interviews and documents provided by powerful stakeholder groups who initially contributed to the construction of Austria's anti-GMO position and continuous contribute to the maintenance of this national identity, we are able to gain a clear picture of how Austria came to form a strong opinion in this case and how it succeeded in solidifying its anti-GMO culture through this exercise, which aimed to collectively keep 1507 maize out of its territory. Overall, I devote this chapter to an in-depth account on how the precautionary principle is understood and how it guides each stakeholder to defend an anti-1507 decision.

6. 1. Assessing scientific risk assessment

6. 1.1. Environmental NGOs: EFSA fails to conduct convincing risk assessment

The role of environmental NGOs has been highly esteemed with respect to the making of Austria's national anti-GMO position. Indeed, when the nation-wide GM position was still in debate within the Government, international NGOs came into play as a strong and determined actor. Ansell et al. (2006) have underlined their importance:

"The NGOs that comprise the anti-GMO movement have taken center stage in the European contestation over genetic engineering and the politics of food. Their influence has been pervasive. They have cut down GM crops on test sites, pressured major food retailers to go GM free, demanded the application of the precautionary principle in approving new GM crops, monitored nations and companies for compliance with the moratorium, staged media-savvy symbolic protests against the genetic patents, lobbied all levels of government in favor of a GM ban, and challenged the scientific claims of private industry and government agencies." (p.98)

In the Austrian context, as Seifert and Torgersen (1996) commented, these NGOs exaggerated fears and imposed aversion on a scientifically illiterate public. However, as mentioned previously, the 1994 Eurobarometer survey suggested that public

opinion had shown negative attitudes even before NGOs took interest in this whole issue, so this argument does not really hold up when one keeps the historical sequences in mind. Thus, although the NGOs' role in the construction of an anti-GMO tradition in Austria has been remarkable, they *"didn't seem to invent or impose such attitudes on the public; rather, they brought them to light" (Torgersen ,2002, p.176).*

NGOs also exerted great influence to make the cultivation of 1507 maize case unfavorable in Austria. Based on accounts drawn from my personal encounter with the **Greenpeace GM expert Dagmar Urban** (abbreviated as D.U.), and my reading of **three NGOs' documents**, i.e., *"Greenpeace report 2005: EFSA fails again"; "Greenpeace briefing: environmental and health impacts of GM crops - the science"; "Friends of the Earth 2013 report: why GM maize 1507 should be banned"*, the following deliberation hopes to present the scientific understanding of the precautionary principle perceived by the environmental NGOs.

"Science is used to justify the existence and deployment of environmental threats, such as nuclear power and genetically modified organisms. Our opposition to these technologies has led to accusations that Greenpeace is 'anti-science'. This is far from the case. We depend on science and technology to provide solutions to environmental threats." (Greenpeace Science Unit: About Us)

To defend against criticisms such as "anti-science" and to facilitate the specific requirements of campaigns, Greenpeace founded a science laboratory at Exeter University in the UK (initially at London's Queen Mary College) in 1987, which enables the organization to carry out scientific research and analysis in-house. At a time when scientific evidence is considered the cornerstone for risk assessment in the EU and across the world, turning science into discursive equipment is certainly an advisable move for Greenpeace. In its various reports aiming to convince the EC to ban the cultivation of GM 1507 maize, Greenpeace's major arguments have indeed relied on **"scientific evidence".**

Closely following the EFSA's first assessment report in 2004 regarding the safety of 1507maize, Greenpeace released a rather comprehensive report in 2005 to counter EFSA's assessment based on the literature reviews done by the Science Unit. Entitled

"EFSA fails again", Greenpeace accuses that EFSA's risk assessment as "woefully inadequate" and "disregarding scientific evidence" in the light of the existing literature reviews and Greenpeace scientists' own expertise. It focuses on criticizing the EFSA for not taking seriously the *scientific uncertainties and unknowns* regarding the impact of GM maize on the environment, human and animal health. In a very professional manner, this technical report analyzes in total eight aspects that indicate the various scientific unknowns, and thus the potential hazards 1507 maize contains.

To begin, it brings in the argument that the inserted Cry1F and PAT genes in 1507 maize may cause additional unintended gene fragments, which is a known fact in genetic engineering. What is unknown is where these unintended gene fragments would end up within the maize's genome. The concern is that this could interrupt the plant's own genes or regulatory elements, which can result in two substantial open reading frames (ORF - in molecular genetics, it contains no stop codons), thus producing unintended RNA or alter proteins. According to new scientific research, Greenpeace says that minor changes to protein structure could cause a significant effect on the toxicity of an organism, which is a dangerous modification to the plant. The FESA in its 2004 risk assessment acknowledges that it is possible that ORF could alter protein but, it denies the possibility of relevant adverse effects on the plant if this were to occur. In this view, Greenpeace perceives that it is an EFSA "failure" not to give prominence to the unknown implications of these genome irregularities in 1507.

In the same vein, Greenpeace exposes a number of other "failures" in the EFSA's risk assessment: Inter alia, Greenpeace scientists bring to the fore the compositional difference between 1507 and non-GM maize, which is in clear contradiction to the EFSA report. Other significant concerns focus on the unknown toxicity of 1507 to non-target European lepidoptera (e.g. butterflies), the unknown adverse effects on non-target soil organisms due to the accumulation of Cry1F in the soil; the genetic contamination of neighboring crops; and the inadequacy of the proposed monitoring plan which lacks a recommendation to test the adverse effects on Lepidoptera and the wider environmental effects of the Bt toxin in 1507 maize.

In response to such complaints from NGOs as well as Member States about the

inadequacy of the EFSA's 2004 risk assessment, the European Commission requested the EFSA to complement its opinion by providing more specific information concerning the above points. However, as mentioned in the case background, in 2008 EFSA stressed that further investigations did not provide evidence that would suffice to change its previous risk assessments conducted on maize 1507.

In 2011 the Science Unit issued another report to brief on the environmental and health risks of GM maize based on scientific research. In this report, it argues that scientific evidence is mounting that GM crops kill specific pests by secreting Bt toxins, e.g. *"long-term exposure to pollen from GM insect-resistant maize can cause adverse effects on the behavior and survival of the butterflies…and beneficial insects" (p.1).* Consequently, the potential adverse effect of 1507 maize on the environment is thus very high, provided that it is both herbicide-tolerant and pesticide-resistant. Meanwhile, on the human and animal health side, it reflects the ongoing scientific controversy surrounding the assessment of GM crops for consumption, arguing that *"we simply do not know if GM crops are safe for human or animal consumption" (p.2).*

In echo, Friends of the Earth (FOE) in its 2013 report that explains why 1507 should be banned, also focuses on the "failings" of the EFSA's test. It argues that the EFSA does not sufficiently assess the risk impact of the 1507 maize on the environment. On the one hand, the FOE report conveys great anxiety about the environmental impacts of the herbicide-tolerant character of1507 maize and its adverse effects on soil organisms, on which the EFSA has not undertaken any studies. On the other hand, when it comes to the adverse effects on non-target organisms such as butterflies, bees and aquatic organisms, the FOE report argues that the EFSA's assessment does not present sufficient evidence to assess the impacts, because the information it relies on is either outdated or merely based on results derived from lab tests instead of real-world field tests.

In view of the above scientific inadequacy noted in the EFSA's risk assessment, in November 2013, Greenpeace and Friends of the Earth, along with the International Federation of Organic Agriculture Movements (IFOAM), the European Community

of Consumer Co-operatives, and some other 50 European, national or regional organizations, wrote a joint letter to the EC Commissioner, Tonio Borg, urging the Commission to decide against the authorization of GM maize 1507 for cultivation. (A joint letter by Greenpeace and other organizations to the EC, 2013)

In addition to pointing out the omissions in the EFSA risk assessment, Greenpeace, in a 2011 report, also criticizes the EFSA's response towards uncertainties which emerged from the data, which often features vocabulary such as "unlikely" or "not of biological relevance". Such phrases not only raise doubts about the EFSA's capability to offer trustworthy scientific advice on GM matters, but also underline the scientific uncertainties inherent in risk assessment. Meanwhile, it criticizes the affiliations several scientific researchers have with the GM industry, indicating that scientific evidence in this matter could have been skewed by industrial interest and as such was not entirely reliable. (Greenpeace report concerning the cultivation of maize 1507, 2005)

The 2013 FOE report then accuses the EFSA of confusing the roles of risk assessment and risk management: As a scientific risk assessment body, the EFSA in the 2012 assessment report states that Cry1F toxin in 1507 maize may present a risk to lepidopteran species, but "due to a lack of knowledge" it is not certain about which kinds exactly, thus it suggests collecting such data as part of the post-market monitoring (EFSA 2012 report, p.32). This suggestion, in FOE's opinion, falls into the purpose of risk management rather than risk assessment, while the latter should be conducted before the cultivation even starts. Therefore, the report warns the EFSA to limit itself to assessing risks, and not to meddle in the risk management process, which involves more than scientific concerns.

More generally, NGOs are uneasy about the fact that, even within the scientific community, there is no agreement on how to conduct reasonable long-term risk assessment. The scientific uncertainty and inadequacy in this regard poses a great disadvantage to scientific risk assessment bodies, leaving the door wide open for NGOs to organize legitimate anti-GMO statements such as:

"If the scientific community hasn't agreed on how to do that kind of studies (long-term risk

assessment studies on GMOs), and they are not being done, and even industrial people accept this, then we will see uncontrollable problems if we have dozens of GMOs authorized for food uses before we even have their risks tested out adequately!" (D.U., 8)

As the above three reports have shown, the NGO's anti-1507 maize arguments lean heavily on science: either scientific evidence has proved the existence of certain risks in this maize, or current scientific knowledge is unable to prove that certain risks do not exist. The NGOs argue so assertively that it seems that scientific perspective dominates their view of risk assessment. Their whole reasoning has been based on anatomizing the EFSA's assessment. They not only cross-examine the "failures" in one specific report, but through comparison of the EFSA's different reports, they argue that the very fact that the EFSA has changed its opinion six times by adding new information and suggesting more refrained cultivation conditions, signifies its inconsistency and lack of thoroughness. The EFSA's seemingly evolving opinion also emphasizes the possibility that given an expanded investigation timeline, it might one day find fundamental and concrete problems in the cultivation of this maize.

In various accounts, the EFSA indeed looks embarrassing for, as a scientific expert on risk assessment it, on the one hand, seems unable to deliver sufficient evidence required by opponents and Member States and, on the other hand, it still concludes the maize is safe for cultivation while acknowledging that information is lacking and that the maize poses potential risks. In this view, the EFSA's self-contradiction is simply unacceptable for NGOs.

However, the NGOs' self-contradiction adds to this paradox. On the one hand, they are particularly unconvinced by the EFSA's "safety" conclusion on the maize, arguing that EFSA's assessment data is mainly based on lab-environment tests, which cannot be synchronized to Europe's real-world environment. On the other hand, their persistent refusal to allow the maize to be cultivated in Europe precisely precludes the chance for it to be tested in real-world scenarios! Therefore, to some extent, the NGOs' "obstinacy" has left the EFSA in limbo, as well as 1507 maize. Nonetheless, the responsibility for addressing this deadlock does not fall on the NGOs' shoulders; rather, the blame is on science. Although many had high hopes on scientific evidence, science failed to offer convincing and sufficient evidence to address this "catch-22"

situation. In bringing science's "disappointing" outcome to light, the NGOs quickly validate their recommendation to apply the precautionary principle in this case, which sounds like a more reasonable approach, but would keep maize 1507 in "research" longer or perhaps even permanently.

6.1.2. Environment Agency: biological science vs ecological science

The Federal Environment Agency (UBA) was founded in 1985 by the then Ministry of Environment and Agriculture amidst Austria's endeavor to establish a national GM position. In 1995, due to budget reforms in the Federal Government, the UBA became an independent agency, albeit its major task is still to provide supportive service to the government. It mainly offers expertise on the condition of the environment and environmental changes as well as on measures to avoid or reduce environmental pollution in Austria. It plays a key role in the implementation of federal environmental laws, EU directives and regulations, and provides expert advice to federal and other institutions. (Circle 2, EAA)

A specialist institution assigned with the task of carrying out research in support of the Ministries, including the environmental impact of GMOs, the UBA was the first to gain expertise and to establish contact with the Competent Authorities in other countries. Thus its actual role in determining the fact of GMOs in Austria went far beyond its designated task which was only to comment. As Seifert and Torgersen (1996) indicated: *"UBA's 'in-house experts' elaborated the backbone of the Austrian paradigm and its type of precaution early on" (p.7).* This type of precaution always kept an eye on the protection of the environment. Mainly holding expertise in ecological science, the UBA has its own framework for acceptability in terms of environmental impact. Under this risk framework, it constantly expresses doubts over predictability claims based on molecular biology, analogies, and complexity reduction. (Seifert and Torgersen,1996)

Despite being an independent agency now, the UBA plays an authoritative scientific role in Austria in terms of GM risk assessment. When evaluating the risk

assessment of commercial applications of GM varieties that are to be released into the environment, the Ministries of Health (as the core CA) and of Agriculture mainly resort to the UBA for consultation. Indeed, the UBA's expertise has become a major justification for the Ministries' decisions. In the case of 1507, the UBA also greatly contributed to defend Austria's anti-1507 stance. What are the various framings of "scientific evidence" the UBA presents in this case then?

According to Article 23 of Directive 2001/18/EC, a Member State may provisionally restrict or prohibit the use and/or sale of a consented GMO on its territory, on the basis of additional scientific knowledge which gives detailed grounds that this GMO constitutes a risk to human health or the environment. This loosely defined Article renders one of UBA's functions, that is, to look for reasons to justify an objection:

> "If a country wants to use a safeguard clause according to Directive 2001/18/EC, it has to indicate that new scientific evidence is supporting its concern against the conclusions of the risk assessment conducted for the specific application. A full risk assessment is not required. In this context, Austria only needs to submit the reasons for concerns, including the scientific evidence underpinning these concerns."(M.E., 3)

With this understanding, the UBA's main task is thus to identify the flaws in the risk assessment conducted by the EFSA. Consisting of both trained molecular biologists and ecologists, the UBA's Land Use & Biosafety Unit is adept at employing scientific expertise and evidence to evaluate risk assessment made at the EU level. It often combines molecular analysis on a micro scale and the environment risk assessment at a macro level. Accounts concerning the UBA's scientific investigations and general considerations regarding the EFSA's reports have been drawn from two sources: firstly, I read the **EFSA 2004-2 Newsletter,** which listed **Member States' official comments under Directive 2001/18/EC** on the 1507 maize. From this document, I retrieved the comments submitted by the Austrian Competent Authority - the Ministry of Health, whose technical reasoning was by and large supported by the UBA. As a side note, I had wished to analyze more recent comments from the Ministry, but unfortunately the latest "reasoned objection" report will only be available to the public after the final decision on the maize is made. Nevertheless,

reading into the 2004 comments, we are able to get a glimpse of what constituted Austria's concerns and how these concerns were officially argued. Secondly, I gathered information from a face-to-face interview with **Dr. Michael Eckerstrofer (M.E.)** from the UBA, who has been directly involved in the assessment of 1507 maize. I have tentatively dissected these materials into macro- and micro- scopes, from which I wish to present various framings of "evidence" which allow the UBA to offer "scientifically reasoned objections" to 1507 maize for Austria.

6.1.2.1. A zoom-in investigation

Between the years 2001 to 2003, the UBA, upon request from the Ministries, conducted initial assessment of the basic information package on cultivating 1507 maize submitted by the applicant. According to Dr. Eckerstrofer, the UBA's overall critique was that the application dossier provided insufficient data concerning the environmental risk assessment and that the conclusions of negligible effects of 1507 maize were based on assumptions rather than hard-facts (M.E., 2). Pioneer then submitted complementary information accordingly. In May 2003, the CNB then concluded that based on its risk assessment, there was no scientific evidence indicating that the intended use of 1507 maize would pose any risks to human or animal health or the environment. Member States were then given a three-month period of consultation to decide for or against this decision.

In early 2004, opinions and comments were submitted to the EC. According to the document *"Competent Authority under Directive 2001/18/EC comments",* among all other CAs, the Austrian Ministry of Health, supported by the UBA's technical evaluation, presented the strongest comments. From a molecular perspective, the Ministry questioned several aspects concerning the cultivation of 1507 maize. Since an additional copy of the Cry1F gene was inserted into the maize and its location and size in the 1507 genome is unknown, the Ministry thus questioned the molecular characterization of the maize. In its "Comments", it argues that according to the data submitted by the applicant, whether the additional copy would increase expression

levels of the plant and alter the tissue preference remains unclear. This argument stands in contrast to the EFSA's assessment that *"the molecular characterization and expression analysis of 1507 maize revealed that both intended genes are intact within the transgenic event" (EFSA 2004 Report, p.4).*

Furthermore, it judged the EFSA's assessment on 1507 maize's allergenic and toxic effects to be *"not convincing proof of potential harmlessness*". Firstly, the EFSA's allergenic assessment was carried out on *isolated* proteins produced from the inserted genes; secondly, even the isolated proteins were not the ones expressed in 1507 maize but produced in micro-organisms. Thus, it argues that *"no experimental tests with the GMO itself have been conducted"* and that the 1507 maize's allergenic potential cannot be accurately predicted according to the current scientific risk assessment. The comment on the assessment of allergenic effects was equally applied to the toxicological assessment, which demands that an in-vivo toxicological risk assessment, using the genetically modified plant itself, be conducted. The Austrian Ministry "en passant" promoted a *"standardized and harmonized approach"* recommended by the UBA concerning the assessment of toxicology and allergenicity of GM products.

These micro-scale "reasoned objections" expressed Austria's dissatisfaction with the CNB's assessment of the characterization of the plant itself, namely, the molecular uncertainty and the allergenic and toxic effects. With the very technical details provided by the UBA, such scientific arguments well justify Austria's concern over the cultivation of this maize: if science is not even certain about the genetic character of the maize, how can the maize be released into the environment without being fully known? Apart from the molecular-scale technicalities, the Ministry of Health also identifies issues concerning the environmental impact and EFSA's changing opinions.

6.1.2.2. A zoom-out examination

From a zoom-out perspective, the Ministry, based on the UBA's investigation, expressed its main concerns over the scope of the use, the environmental impact and

the fact that the EFSA updated its opinion in a constant fashion.

1) Scientifically unknown environmental impact

Firstly, with regard to the unique identifier *DAS-Ø15Ø7-1* proposed by the notifier for 1507 maize, the Ministry in its 2004 "Comments" indicates that the notifier should be more precise on points such as who will be informed by the notifier and how it can be assured that this information will reach all relevant stakeholders. It also insists that this information must be provided before market introduction as disseminating the information takes time. Also, with regard to the intended use of the product, it questions the vague expression of "GM plants for food use", which left unclear whether raw consumption for animals and human beings is intended, despite the CNB's 2003 assessment report clearly says *"use of this maize for human consumption is considered out of scope of this Notification"(p.3).*

On a more environmental aspect, the Ministry in the "Comments" criticizes the notifier's half-baked investigation on the environmental effects of 1507 maize, particularly on non-target organisms. Firstly, since the ecotoxicity studies were conducted on an isolated protein, not on the maize itself, it is difficult to draw the conclusion that the whole plant is "harmless". Moreover, the Ministry argues that maize 1507 would most likely harm the survival of some larvae species because recent scientific research has shown an increased mortality rate among the green lacewing larvae which were fed on the CRY1Ab protein. Since none of these recent controversial findings were mentioned or discussed in the dossier, it demands additional investigation on the environmental risk of this herbicide-tolerant crop.

Another major point regarding the impact assessment on the non-target organisms, according to Dr. Eckerstrofer, was that the consideration of local environment was totally omitted in the assessments of both the notifier as well as the EFSA. For example, the UBA argues that the testing species, including those endangered species present in the Austrian ecosystem were not tested sufficiently in the EFSA assessment.

Even with the species that were tested in the EFSA's risk assessment, the UBA

argued that certain testing organisms were not sufficiently exposed to the Bt. ingredient. It was thus difficult to draw a conclusion on whether or not the Bt. has a negative effect on the non-target organism, for it could simply be that the test organism had not consumed enough Bt to react.

2) The EFSA's challengeable expert position

The critique is not only restrained to the detailed technical flaws in the dossier or in the EFSA's specific assessment reports; rather, the very fact that over the years the EFSA has updated its assessment report six times makes the agency's scientific credibility doubtful. Although in six reports the EFSA always drew a general "safe" conclusion, the recommended conditions for authorization have changed significantly, from literally no concrete recommendations listed in the first assessment report - *"no data has emerged to indicate that maize line 1507 is any less safe than its non-GM comparators"(EFSA 2004 report, p.15),* to the most recent assessment, twice as long as the first, which acknowledges a potential hazard to lepidopteran larvae when their host-plants neighbor the maize 1507 field and thus recommends imposing a "buffer zone" of 30 meters from the closest GM maize crop. In a word, the conditions for the company's use of this maize become more constrained as the investigation evolves, and as a consequence, the recommendations for management and monitoring are also more elaborate in the EFSA's most recent report. This trend leads the UBA to speculate that new evidence on this maize seems to be evolving all the time, thus it is irresponsible to close this case before a complete set of evidence is examined, which would require more scientific research over a longer period of time.

In particular, the UBA is wary of the uncertainty revealed in the EFSA's latest assessments. The fact that the EFSA announced that the cultivation of maize 1507 *could* have adverse effects on the environment suggests that it could not conclude firmly on certain parts of the risk assessment due to insufficient data. If the EFSA is aware of the potential discovery of more uncertainties in its risk assessment, why would it still jump to the "safe" conclusion? This self-contradiction leaves much room for reflection. Dr. Eckerstrofer attributed this shortcoming to the unspoken politics of

the EFSA:

"The politics of EFSA is complicated as well. If EFSA has concluded a positive evaluation based on a prior state of scientific information and guidance, which was updated in the meantime, it is very hard to overthrow such conclusions at a later step. So it is easier for EFSA to stay with an overall positive evaluation, but supplement it by recommendations for specific conditions of use, and that is what they did in this case."(M.E., 2)

Against this backdrop, the EFSA's final conclusion is not purely scientific after all. Although the assessment reports were conducted on a scientific basis, its final claim may well be influenced by its internal politics, if not also affected by EU political pressure.

Therefore, the UBA challenges the wisdom of the EFSA as the only scientific expert body in terms of GM risk assessment. One of the critiques is that some of the EFSA's conclusions are not based on the most updated research data (e.g., neglecting the recent research on green lacewing larvae fed by CRY1Ab protein), indicating the tests done on maize 1507 might be insufficient or ineffective. Thus, the UBA casts doubt on the EFSA as the only scientific expert in this regard, and the Austria Government demands a new risk assessment on the cultivation of 1507 maize incorporating the latest scientific data.

To take a step back, the UBA argues that even if the EFSA's assessment is credible, the European Commission's proposal in 2013 to authorize this maize is still not acceptable. The conditions for cultivation in this proposal, according to the UBA, are not in full conformity with the recommendations in the latest EFSA opinion:

"You will find that it (the EC) is not implementing all of EFSA's recommendations. The conditions are in a way unworkable because some of them are contradictory in themselves, and it is not sticking to the monitoring plan recommended by EFSA." (M.E.,6)

With this reasoning, it appears perfectly legitimate not to grant the cultivation of 1507 maize on European soil, for even granting the EFSA with full credibility, the Commission's proposal still does not entirely live up to the EFSA's standard, which, based on the myriad of problems connected the assessment, is already deemed very low. Therefore, if the cultivation condition of this maize cannot even meet EFSA's low standard, then let alone Austria's national standard, although the latter is not required in this particular evaluation:

"It is not even about national standard. If you find the conditions for use are contradictory, and are not fulfilling the recommendation of EFSA, then you have the situation that after the authorization is granted, the consent-holding company won't be able to fully implement these conditions appropriately. Thus, surely the Austrian Ministry won't allow its cultivation here."(M.E., 6)

Based on the above examination, I extracted several framings of scientific evidence the UBA presented on behalf of the Competent Authorities in Austria: From a micro-level scanning, the evidence includes the unknown molecular character of the maize caused by the additional CRY1F gene, and the uncertain allergenicity and toxicity of the maize itself. On a macro-level, evidence diversifies to encompass the immeasurable environmental effect of the plant due to insufficiencies in the EFSA's risk assessment, the challengeable credibility and scientific position of the EFSA resulting from its constant updates of the risk assessment report while continuing to uphold a "safe" conclusion, and the unacceptable and unworkable cultivation conditions proposed by the Commission due to discrepancies with the EFSA's standard. Overall, from molecular problems to the flaws in the general EU assessment, these framings, scientifically and technically robust, was instrumental in equipping Austria to forge a strong anti-1507 maize position. Requested by the Ministry of Health and based on the technical findings, the UBA also prepared a report to justify a national ban if necessary. This report is unfortunately not yet available to outsiders, since a final EU decision on the 1507 maize has not been officially concluded. Therefore, announcing a national ban is premature. Nonetheless, Austria is well prepared to place a national ban on the cultivation of 1507 maize in terms of scientific justifications, despite the fact that both Greenpeace and the UBA openly stated that the decision on GMOs is ultimately political.

To conclude, first and foremost, due to the uncertainties and discrepancies identified in the above scientific risk assessments, the precautionary principle brought into play in the 1507 case is primarily borne of a "scientific" understanding, which demands further scientific assessment. The "scientific" understanding of the precautionary principle in this case is widely shared by the environmental NGOs, the UBA and the Ministries. Moreover, since the counter-arguments concerning the

cultivation of 1507 maize have by and large derived from "scientific" arguments as shown in the previous chapter, it seems a "scientific" understanding of the precautionary principle is the most tenable one. Since there are so many uncertainties, be it in the maize itself or the impact on the general environment, it virtually goes without saying that maize 1507 should not be released into the environment, at least not yet.

Simply put, the process of constantly asking for more scientific information to be submitted while criticizing the present scientific research method& result, is in itself a practice of a scientific understanding of the precautionary principles. For stakeholders including the NGOs, the UBA and the CAs in Austria, the current scientific evidence shown in the 1507 cultivation proposal is simply not convincing enough, thus, more extensive research should be conducted, *and "a reassessment should be done"(M.E.,4)* before closing the case. Overall, the above analysis has revealed that there is a unanimous voice in Austria which calls for leaving the case open until more scientific data is available in order to prove the *nonexistence* of risk associated with cultivating GM 1507 maize. The Austrian stakeholders' precautionary attitude is primarily legitimatized by resorting to *scientific evidence*.

6. 2. Scientific uncertainty gives rise to other criteria

The above account has suggested that science in this case is either uncertain or could be misused by authoritative bodies, therefore, risk assessment in this regard cannot rely on scientific knowledge solely. Other measures apart from scientific wisdom must be considered when studying the appropriateness of cultivating 1507 maize in particular countries. Beyond requiring more scientific research, the precautionary principle in the case of 1507 in Austria is also manifested in a "political-economic" understanding that requires a consideration of the "socio-economic criteria". The following analysis is based on accounts drawn mainly from the **two interviews** with Dagmar Urban from Greenpeace and Michael Eckerstrofer from the UBA, and supplemented by **two relevant documents** including one report issued by the Ministries of Health and of Agriculture on assessing socio-economic impacts for policy development, and a catalog of socio-economic criteria specifically developed for the Austrian context.

6.2.1. Socio-economic criteria: conform to Austrian specifics

GM authorization in the EU is mainly regulated by Directive 2001/18/EC and Regulation (EC) 1829/2003. Both documents touch up the socio-economic aspects of assessing GMOs. Preamble 32 of the Regulation stipulates that "*it is recognized that, in some cases, scientific risk assessment alone cannot provide all the information on which a risk management decision should be based, and that other legitimate factors relevant to the matter under consideration may be taken into account*". Although there is no concrete definition for the term "other legitimate factors", it can be expected that any risk consideration that doesn't directly refer to human health or environmental aspects, which are perspicuously mentioned in the documents, could theoretically fall into the category of "other legitimate factors" and be taken into account by the Commission in the decision-making process.

Preamble 62 of Directive 2001/18/EC refers to the term more clearly. For each category of GMOs authorized to be placed on the market, it requires the European

Commission to issue a report *"taking into account the information provided by Member States regarding the socioeconomic advantages and disadvantages...which will take due account of the interest of farmers and consumers"*. However, the Directive does not provide a further definition of what is encompassed by "socioeconomic" aspects; thus no specific methodology for assessing the socioeconomic impact that is parallel to the environmental assessment is indicated.

Against this legal background and confronting science's controversial role in risk assessment, the socio-economic aspects of GMO assessment are getting increased attention in discussions at the European level. This is of particular interest to Austria, whose various stakeholders are not satisfied with the current EU risk assessment system which enthrones the EFSA's scientific opinions only. The trend seems to be shifting toward introducing new criteria in the risk assessment of GMOs which challenges the EFSA's authoritative status with regard to risk assessment.

6.2.1.1. Taking into account the uniqueness of Austria

For NGOs such as Greenpeace, the fundamental criticism is that the EFSA's scientific assessment is far from being complete in assessing the risk of GMOs. This attitude is supported by the 2008 EU Council decision, where there was a unanimous call from all agricultural ministers for a basic reform of the EU authorization process on GM applications. During the conference in December 2008, the EU Environment Council of Ministers agreed to improve GMO regulations, including the recognition of the key role of Member States, to take into account specific national or regional characteristics and to consider socio-economic criteria with a view to the application of the precautionary principle (Council conclusions on GMOs, December 2008). The NGOs are nonetheless disappointed by the EU since despite the unanimous call for reform, very little has actually taken place. Consequently they strive to introduce the socio-economic criteria in the risk assessment of GM 1507 maize.

Thus, in addition to scientific arguments, the economic aspect is the one of the element to be included in the environmental NGOs' persuasive discourse to prohibit

1507 maize. The cultivation of this maize, with the aim of decreasing the negative effects of the corn borer and thus enhancing productivity, is ultimately born out economic considerations; however, the NGOs rationally argue that the cultivation of 1507 maize, as with other GM crops, is not necessarily beneficial for Austria's economy:

"Because Austria is a small country with a lot of mountains. If you have co-existence of GM crops and non-GM crops, would it even be theoretically possible to separate them without huge economic losses?"(D.U.,7)

At issue is the "contamination" problem, which poses the concern that GM crop will "contaminate" the neighboring non-GM crops. According to the EU regulation, there should be a "buffer zone" between these two kinds of crops, but this "buffer zone" is considered to be economically not viable for Austria, where most of the agriculture farming is exercised on small mountainous plots of land, which cannot afford any "waste". Greenpeace argues that neglecting Austria's unique landscape in the general EU decision-making system could ultimately harm Austria's agricultural economy and is thus a major concern for Austrian stakeholders. Such negligence of Austria's economic situation to some extent also invites ridicule:

"You have a society that runs after economy in general, but when it comes to GMOs in specific countries, economy doesn't matter at all. Then you let this narrow definition of science which is not based on long-term studies decides the whole GMO destiny. It is paradoxical." (D.U.,7)

The UBA shares the same concern about the geographical uniqueness of Austria. It conducted a study in which it calculated the potential economic losses if Austria were to cultivate GM crops. Taking into account the average field sizes and the required "co-existence distance" between GMOs and non-GMOs, it proposed different scenarios for how much land would actually be "lost" because of the distance, and concluded that it would indeed be economically "devastating" for Austria to cultivate GM crops. Such a potential economic disaster could also be brought about if Austria were to cultivate 1507 maize.

Besides the uniqueness of the landscape, the UBA further points out that the cultivation of 1507 does not make much economic sense for Austria due to its relatively cold climate, in which the target organisms of 1507 - the European corn

borer, does not cause a major damage to corn in Austria. In countries such as Spain, where the climate is warmer and corn is planted more than once in a year, the corn borer can multiply generation after generation, thus necessitating the use of pesticides. Whereas in Austria, the situation is very different: farmers only plant corn on a yearly basis due to the relatively cold climate. There can only be, therefore, maximum one generation of corn borer, and the damage caused by this pest is not at the level of forcing farmers to use pesticide. In this context, the UBA argues that economically speaking, comparing conventional maize cultivation to 1507 maize cultivation in Austria, *"it won't make sense (to plant 1507 maize) in a small scale farm system unless you change your overall agriculture policy to support further intensification of production, for instance, by planting corn after corn" (M.E.,5).*

The economic aspect goes beyond the "geographical feature" argument. Even if geography was not a problem for Austria, the question remains whose economic interests are to be taken into account. The NGOs point out that the cultivation of GM maize is detrimental to the economic interest of certain stakeholders, for instance, that of the organic farmers, who have a remarkable reputation on the Austrian agricultural landscape. Lessons learnt from Spain where MON810 maize is cultivated raised red flags in Austria. According to Greenpeace's field investigation in Spain, producers had to abandon organic farming or even went bankrupt in areas where MON810 was planted. They could no longer sell their maize as "organic" due to "contamination". Such lessons set off alarm bells on sensitive issues such as morality and inclusiveness in this modern society. The argument is, when the economic interest of giant enterprises becomes the yardstick for social development, precaution must be borne in mind to prevent potential social unrest.

For environmental NGOs, the 2001 EEA report "Late lessons from early warnings" also serves as a powerful weapon in all risk matters. The past events are living lessons in which huge costs for the society and the environment were caused because the precautionary principle was not properly or timely implemented. These lessons apply perfectly in the case of 1507, where risk cannot be precluded, and *"if you choose to ignore the potential risks and not deal with them with precautionary*

principle, then you will see really huge cost on society later". (D.U.,6) In this view, for the sake of society, the matter of 1507 maize should be handled with extreme caution.

The UBA, who has a particular affiliation with government bodies, has more insight into the political uniqueness in this regard. When reviewing the 1507 maize application dossier, there was a special request from the Ministry of Health to the UBA *"to make sure a very high standard of safety is taken into account for risk assessment and management" (M.E.,5)*. Although this so-called "high standard" is incorporated in Directive 2001/18/EC together with the precautionary principle, this "standard" is not explicitly defined in the law, thus leaving it flexible for individual countries to define their own standards. This ambiguity leads to different national standards:

> "The existing EU Biosafety laws are not specifying 'limits of concern' for environmental harm, therefore the environmental risk assessment is not based on quantifiable thresholds, which could be applied similarly in all EU countries. Rather, the non-quantifiable criteria require to take into account the different environmental conditions in the individual Member States. Thus different risk assessment outcomes are not necessarily unscientific." (M.E.,5)

That is to say, theoretically there could be variegated standards between Austria and other EU members. Different standards require not a one-size-fits-all regulation, and Austria's "high safety standard" as a social character should be respected by the EU.

In 2010, the Ministry of Health, together with the Ministry of Agriculture, presented *a report on assessing socio-economic impacts* in the EU's policy development concerning GMOs. Motivated by the conclusion of the 2008 EU Council meeting which invited the Commission to explore the possibility of considering other criteria such as socio-economic benefits and risks in GMO authorization, the two Austrian Ministries drafted a 100-page report to identify and explore the relevant issues. Arguing against the challenges identified in the current literature, legal backdrop and international trade, it considers the possibility and necessity to include socio-economic criteria in the EU's GMO authorization. Speaking on behalf of the Austrian context, the report incorporates the uniqueness of Austria's landscape, climate and agricultural structure and argues that the co-existence of GMOs and

non-GMOs in Austria would be very difficult. Moreover, taking into account the demands of Austrian consumers, it suggests that cultivation of GMOs is in general socially and economically not advisable for Austria.

Overall, besides scientific criteria in GMO risk assessment, Austria's stakeholders argue that the specifics of each country should be taken into account and the responsibilities of individual Member States should be strengthened concerning the evaluation and authorization of the cultivation of 1507 maize. Interestingly, the call to take into account countries' differences concurs with the "cultivation proposal" which allows each country to decide GMO matters unilaterally. Based on the subsidiarity principle, this "cultivation proposal" could directly give rise to other criteria such as socio-economic considerations. The concern is that this proposal, if approved by the Council, would legitimate most of the safeguard clauses issued by individual Member States, which in turn would literally put a chokehold on the majority - if not all - of the forthcoming GMO applications in the EU.

6.2.1.2. UBA tentatively forms Austria-specific socio-economic criteria

The issue at hand then is how to calibrate such socio-economic aspects which are by and large under-defined in each country in order to prevent abuse of such criteria. Earnestly seeking to bring the socio-economic criteria into the EU regulatory picture, Austria spearheaded the experiment to identify and classify the socio-economic criteria of relevance to it. In 2011, the UBA, delegated by the Austrian Ministry of Health, presented **a catalog of socio-economic criteria** that are of major relevance to Austria, attempting to bring official recognition to aspects that are beyond conventional scientific criteria.

It should be noted that Austria did not invent the socio-economic criteria in this regard. Norway did. Back in 1993, Norway established a Gene Technology Act that considers examining the socio-economic impact of the use and production of GMOs. Aside from requirements stipulated in the EU regulation that the deliberate release of GMOs should not have detrimental effects on human/animal health and the

environment, the Norwegian Act also emphasizes the ethical and social aspects of GMOs prior to their cultivation, import and use as food or feed in Norway, suggesting that the introduction of GMOs should *"represent a benefit to the community"* and *"enable sustainable development" (Factsheet of Norwegian Directorate for Nature Management, 2011).* Astonishingly, since 2005 when regulations pursuant to the Gene Technology Act were established, not a single GMO application was approved by the Norwegian Government (Hofverberg, 2014).

In this context, the UBA borrowed from Norway's successful experience and developed an Austria-specific catalog of socio-economic criteria based on the pillar of sustainability. The focus was to identify possible risks of GMO cultivation, not only regarding *economic* issues but also regarding potential *societal* influences as well as *ecological* impact. The relevant criteria identified for Austria are thus assigned to these three aspects with respective categories.

Regarding the ***economic aspect*** of GMO cultivation, three categories covering potential negative impacts on productivity, the tourism economy as well as cost development are deemed relevant for Austria. Under the category *"productivity"*, the UBA points out that the cultivation of GMO could potentially harm profits in the agricultural sector (e.g. reduce the price of products due to contamination problems and the profit of special products such as organic food). Employment would also be affected, especially in the rural areas, due to intensification of agriculture, for example, which would also lead to reduced income.

Under the *"costs"* category, account is taken of potential increased costs which could occur during the production chain, including costs on increased herbicide use, resistance management, coexistence management or higher seed prices for producers, specific costs for ensuring GMO-free cultivation, and costs resulting from "de-contamination" measures. The UBA further includes the indirect costs which would be generated by keeping a GMO-free image, and from changes in the welfare system in rural areas due to higher unemployment resulting from GMO cultivation.

In the *"tourism"* section, the UBA argues that the cultivation of GMOs would potentially harm Austria's tourism economy for it could change the landscape in

which it takes pride, and the resultant monocultures would not be attractive to tourists who expect to visit a typical GMO-free country. In addition, GMO cultivation poses the risk of hindering the implementation of the "sustainability" concept in rural areas, which might also give a bad image to tourists.

In a word, the UBA presents a very detailed, but seemingly realistic dimension to measure the economic impact of GMO cultivation in an Austria-specific context. Under these three categories, it sets up criteria including "profit", "prosperity", "costs incurred during the whole production chain", "indirect cost", "tourism expectations", and "possibility to implement regional policy", in order to provide the foundation for introducing in a practical sense the economic criteria into the GMO cultivation assessment procedure.

As for the ***social aspect***, four categories concerning the potential negative impacts on individual's health and welfare, freedom of choice, social cohesion and preservation of cultural heritage are elaborated. Under the *"health and welfare"* category, the UBA raises the concern that GMO cultivation would affect the quality of Austrians' lives due to, for example, decreased income in rural areas as discussed above and poorer health as result of wider pesticide usage; and it could influence food sovereignty and availability since GMO-free products might cost more.

Within the *"choice"* category, the UBA argues that the cultivation of GMOs could potentially harm consumers' freedom of choice for GMO-free products if the labeling is not clear, farmers' freedom of choice to cultivate non-GM crops because of higher cost and less availability of GMO-free seeds, and researchers' freedom to work on innovation due to patents on breeding techniques and genetic resources.

Under the *"cultural aspects"* category, the concern is that GMO cultivation could damage the preservation of cultural heritage, for instance, traditional production techniques or crop varieties might be squeezed out and the autonomy of local population regarding decisions about GMO-free production would be negatively affected.

Within the *"social cohesion"* category, the UBA raises the concern that GMO cultivation would change conventional agricultural practice, which would cause a

negative impact on social structures - especially in rural areas, where the survival of small enterprises and agricultural holdings would be at risk. This could further lead to conflicts between people benefiting from GM technology and those who do not, and even between neighboring farmers, which would not be beneficial for social stability and inclusiveness.

All in all, these social criteria, including "quality of life", "organic food availability", "freedom of choices for consumers, farmers and researchers", "preservation of cultural heritage" as well as "social cohesion" matter very much to Austrians. Thus, the UBA, on behalf of Austria's Competent Authorities, suggest that these criteria concerning societal development should equally be taken into account together with the scientific criteria and the economic concern in the 1507 maize case, or in any other attempts to cultivate GM crops on Austrian soil.

To conclude, these economic-social-political aspects revealed in the NGOs' arguments, Ministries' recommendations and the UBA's proposal concern social benefits and value judgments rather than scientific evidence. These criteria, predominantly economic or ethical in character and in need of political backing, can, by and large, be evaluated by social science. Thus, the proposal to introduce socio-economic aspects is trying to overthrow natural science's dominance in GMO risk assessment and to expand understanding of the precautionary principle. Beyond scientific uncertainty, the social-economic criteria increase the underlying uncertainties and nuances in each society with a unique economy, culture and natural environment, and call for a more thorough and cautious examination of these important properties when undertaking risk assessment on GMOs. This strategy, in concert with a "political-economic" understanding of the precautionary principle, was proposed prior to the 1507 case, but it is still effective and potent in opposing the cultivation of this maize in Austria.

It should be noted that the UBA includes the ecological aspect in the socio-economic criteria as well, but since ecology concerns nature, which embeds a "normative system-critical" understanding of the precautionary principle. I will therefore leave this aspect to the next chapter.

6. 3. GMO on the radar of a GREEN Austria

In the above two sections, I have made an exhaustive presentation of the stakeholders' major concerns over the risks that cultivating GM 1507 maize will pose on health and on the general environment as well as on economic and social pursuits. In this section, I will focus on the normative aspects of this topic, which concentrate on the notion "monoculture" - "monoculture" of nature's appearance, and "monoculture" of national choices over an agricultural development model. Mentioned particularly often during my interview with the Greenpeace representative, this concern was primarily expressed by environmentalists, but it has gained a wide range of supporters among various stakeholders across the globe.

Ultimately an outcome of globalization and modernization, "monoculture" has become a popular counterargument for opponents targeting the production and use of GMOs. One of the most prominent voices is represented by the influential environmental activist Vandana Shiva, who deems that the entry of genetically modified seeds changed the paradigm of agriculture - from holistic and ecological to one which is fragmented and mechanistic. In the latter paradigm, corporate interests, through patents, manage to get power and ownership over seed, *"circumventing all ecological and social responsibility of the impact of monopolies" (Shiva, 2013, p.3)* and threatening nature and people. Shiva attributes such a threat to the *"Monoculture of the Mind"*, which tries to model all diversities into the privileged categories and concepts of *"one class, one race and on gender of a single species"*, thus eliminating diversities.

For environmentalists, biodiversity, emphasizing that all life on earth is an equal part of an interdependent system and has the right to survive, is crucial for the sustainable development of the natural environment as well as human society. Shiva defends the *"rights"* of nature and seeds, arguing that patents on seeds and insertion of genes violate the law of the nature and seed, for *"seeds are not invented by simply putting a gene into them, and adding a toxic gene should in fact be counted as 'pollution', not as 'creation'"(p. 6).* Calling for a paradigm shift from uniformity to

diversity, Shiva holds that it is ecologically essential to respect the "rights" of all species and, politically imperative to replace "centralization" with "decentered control". Diversity, for Shiva, is *"a way of thought and a way of life",* is what is needed to *"go beyond the impoverished monocultures of the mind."* (Shiva, 1993)

Striving to combat "monoculture", such an advocate of "diversity" corresponds to a more recent buzzword which is "Green". Although the word itself is vaguely defined and always appears with suffixes, e.g. "green growth", "green economy", "green development", "green business", etc., it nevertheless always carries one metric, that is, the measurement of *"environmental friendliness",* or in other words, *"respect for Nature".* An essential component of Austria's anti-GMO stance derives from the conservation of a **"Green Austria",** which implicates meanings of both nature and politics. In this context, the cultivation of 1507 maize particularly corrodes with, one, the image of Austrian Nature, and two, the preferred model of the nation's agricultural development.

Specifically, the concern over Austria's Nature is the result of "*environmental ethics"* that are based on a normative concept of Nature, and the perception of a preferred agriculture model stems from a *"modernization-critical position" (Torgersen & Bogner, 2005, p.280)* which is against increasing economic disparities in agriculture caused by GM technologies. Both lines of thought, resulting from the major stakeholders' normative orientation which promotes *sustainability* and *inclusiveness* in Austria, lend themselves to a *"normative systems-critical"* understanding of the precautionary principle. It should be noted that although an agricultural model is also political, it inherently stems from a normative concept of Nature and represents an attitude which is resistant toward large-scale industrialized agriculture. Consequently, I categorize it under the "normative systems-critical" understanding of the precautionary principle.

In this section, I will mainly analyze how the perceptions of Nature and agriculture form a strong position that prevents the cultivation of 1507 maize - and literally all GMOs alike, from entering Austrian territory. I will present how, in addition to scientific and economic arguments against the current GMO risk

assessment system, normative imaginaries about Austrian Nature and agriculture become a remarkably influential factor in the national GMO position. In this sense, in contrast to what Torgersen and Bogner have concluded in their research that the "*economic-political"* understanding of the precautionary principle is the dominant one, I argue that the *"normative systems-critical"* understanding, which embodies the sociotechnical imaginaries of Austria and is imbedded in Austria's national technopolitical identity, is equally significant to - if not more influential than - the other two understandings in Austria's national decision on the cultivation of GM 1507 maize and other GMOs. This analysis is mainly built upon accounts drawn from the **three interviews**, information on **official websites** and **several documents** provided by the major stakeholders on the themes of biodiversity and organic farming in Austria.

6.3.1. Don't mess with Austrian Nature!

Austria takes pride in its natural environment. A landlocked country in Central Europe, it has an exceptionally diversified landscape: with 47.2% of the land covered by forests, 10% by the Alps, and 34% by agricultural areas, vineyards, and gardens, it is one of the greenest countries in Europe. Along with approximately 45,000 animal species and over 1,000 plant species, it stands out as a country rich in biodiversity. (Ministry of Agriculture, 2004) Loosely stretching outwards, the landscape is famous for its charming idyllic scenery which attracts tourists from Europe and across the world, giving prominence to the undisputed recreational value of Austria's nature, among its economic, ecological and cultural values.

Possessing such a natural environment, Austria has developed a unique relation to its Nature. Felt (2013) argues that Austria's specific reference to the Nature developed through positioning the country towards certain technologies, for instance, the GM technology, and this reference to the Nature in turn can be used to defend its future technological positions. In this sense, the concept of Nature and national identity on GMOs are "coproduced". In 2009, the country successfully made use of the "Nature protection" argument to legitimize its national ban on the cultivation of

one GM crops - MON810 maize. In response to the European Commission's complaint about Austria's national safeguard clauses prohibiting the cultivation of MON810 maize, in 2009 the Council rejected the Commission's proposal to lift the ban, on the grounds that prohibition measures are possible in specific cases in order to *"ensure biodiversity protection in fragile ecosystems and/or in regions with specific agronomical and environmental characteristics"* (Council Press release, 2928th Council Meeting, March 2, 2009).

With this victory in mind, it is doubtless that Austria will attempt to employ the same argument concerning "nature preservation" to prohibit the cultivation of maize 1507 within the legal framework. Various stakeholders have mentioned the term "nature" or "biodiversity", but the most vigorous voices are from the environmental NGOs and the Ministry of Agriculture, for the issue of Nature directly links with their normative values and political motives. For NGOs, deliberately inserting genes into organisms and releasing them into the environment is regarded as *"messing with nature" (D.U., 1)*. This line is identical to the defense held by the Catholic Church in Austria: for both parties, a divine Nature exists (although NGOs do not mention the origin of this Nature), and it is to be treated cautiously by the human race. Therefore, environmental NGOs loudly proclaim that the release of GMOs into the environment is "genetic pollution" and forms a major threat to nature, and in particular its diversity due to the irreversible effect of GMOs once released into the environment.

In the case of maize 1507, one of the NGOs' major concerns is the negative effect that pesticide to be used on this maize would have on many species, including harmless non-target species, beneficial insects, soil organisms, aquatic life and so on. For instance, among the non-target organisms, European butterflies have become a particular concern, because in America, where large scales of GM maize have been planted, research has revealed that long-term exposure to pollen from GM insect-resistant maize can cause adverse effects on the behavior and survival of the Monarch butterfly. Although few studies have been conducted on European butterflies, it could be reasonably analogized that 1507 maize could also harm them.

With regard to beneficial insects, the health and survival of bees are

predominantly relevant in the Austrian context. This concern concurs with the "Bienenschutz" (Bee protection) campaign which environmental NGOs, including Greenpeace, have been launching in full swing in recent years. Stressing the significance of bees and other insects for pollination, which affects the food supply of human beings as well as the whole ecological system, they argue that the decline in bees has posed a great threat to global agriculture. Alarmingly, the number of bees has been in great decline in the past decades, reaching as high as 85% in some industrialized countries. Although it is widely acknowledged that such a drastic decline of bees is a complex combination of causes and cannot be blamed on a single factor, environmental NGOs nevertheless attribute the main reason to modern agriculture, which they argue relies too much on chemical intervention and has turned Nature into a more dangerous habitat for bees. For instance, in Greenpeace's campaigns, it loudly proclaims that *"a destructive, chemical-intensive agricultural system promoted by several multinational companies"* is the major cause for the situation. Also, the companies bringing biotech into agriculture are referred to as "bee-killing companies", not only threatening the bees but also putting food security and diversity at risk (Greenpeace, May 2014).

The genetic modifying technique is perceived as one of the "contaminating" or "killing" tools. With regard to GM maize, at the center of the debate is whether one GM maize variant called "*Bt corn*", a category 1507 maize falls into, has a negative impact on the well-being of bees. So far several scientific investigations (e.g. Jena research) have come to the conclusion that bees collect very small quantities of maize pollen(less than 3%) and there is no scientific evidence that pollen from *Bt corn* has a toxic effect on the bee population. However, the NGOs cling firmly to the counterargument which states that some research has revealed that *Bt corn* can have a negative impact on bees. For instance, Ramire-Romero et al. (2008) have shown that toxin Cry1Ab in maize 1507 affects the learning performance of honeybees. Even the Jena experiment which by and large denies Bt corn's toxic effect on bees, suggests that by sheer chance, when the bees were infested with a parasite, *"a significantly stronger decline in the number of bees"* occurred among the insects that had been fed

with a highly concentrated *Bt* feed. This "sheer chance" simply cannot be overlooked.

Other concerns include the problem that maize 1507 poses a threat to the soil system because Bt crops can secrete toxin from their roots into the soil, as well as a risk for aquatic life because leaves and grain from the maize can enter water where the *"toxin can accumulate in organisms and exert a toxic effect"(Greenpeace report 2011, p.1).* Overall, although not scientifically confirmed, these potential adverse effects of GM 1507 maize on various organisms would form a significant threat to the biodiversity or the Nature in Austria.

As a nation, Austria ratified the United Nations Convention on Biological Diversity (CBD) in 1992 and is a party of the Cartagena Protocol on Biosafety which entered into force in 2003. Its government has thereby committed itself to conserving and sustainably utilizing nature's resources and the environment. About 35% of Austrian territory is currently classified as protected under various categories (CBD: Austria). The CAs, including the Ministries of Health and of Agriculture, have publicly acknowledged the significance of biodiversity, stating that *"each species is the guardian of an enormous amount of genetic information" (Ministry of Agriculture, 2004)* and genetic intervention in plants is a threat to nature's biodiversity.

In July 2014, the UBA, together with the German Federal Agency for Nature Conservation and the Federal Office for the Environment of Switzerland, officially published a joint report on the results of a study, which concludes that the existence of herbicide-resistant, genetically modified crops accelerates biodiversity loss. The report draws on cases in North and South America where the cultivation of herbicide-resistant (e.g. Glyphosate resistant) GM crops has resulted in a more intensive application of herbicides. As a result, the quantity of herbicide-resistant farm weeds has increased while the biodiversity of arable land and adjacent areas has declined considerably. Based on this field research, it could well be concluded that the cultivation of herbicide-resistant GM crops such as 1507 maize, would directly cause significant decline in biodiversity.

Meanwhile, as mentioned in the previous section, the socio-economic criteria proposed by the UBA overlaps with the "normative" understanding of the

precautionary principle because it largely concerns Nature. In this "socio-economic criteria" proposal, the UBA's criteria for risk assessment on the environment focuses on the potential negative impact GMO cultivation has on the general functioning of the ecosystem (preservation of resources and environmental quality) as well as the conservation of biodiversity in both uncultivated and cultivated areas. Within the category *"ecological limits and ecosystem functioning"*, it lists several issues concerning the negative effects of GMO cultivation on natural resources, on energy use and on environmental quality including soil, water, and air. In terms of biodiversity, the criteria also proposes an assessment of the risk on *agro-biodiversity*, including seed diversity, habitat diversity associated with cultivated areas, and the effects on biodiversity on various levels (genetic, species, habitats, ecosystems) in uncultivated areas. In this context, the UBA, emphasizing that the release of GMOs into the environment is ultimately a matter of intervention in Nature, brings the precautionary principle to a "normative systems-critical" understanding in which Nature itself is considered to have a say and deserves serious consideration.

6.3.2. A preferred agriculture model is intolerant of GM intervention

The viewpoint of Austria's agriculture and environmental standards is a crucial aspect in the debate. One thing that makes Austria stand out in the GMO debates is that the country has always seen agricultural practices as an integral part of GMO risk assessment since agricultural practices are *"a major determinant of environmental impacts" (Torgersen & Bogner, 2005)*. Despite the overriding EU regulation which stipulates that only concerns over *"human and animal health and environment impact" (Directive 2001/18/EC)* can be taken into consideration during the course of risk assessment, this strong national position has doubtlessly made a major contribution to the GMOs' "mishaps" in Austria. In the rest of this section, I analyze how an imaginary of the "right" agricultural model for Austria virtually precludes the possibility of the co-existence of GMOs and non-GMOs on the same soil.

Simply put, the issue of GMOs is especially relevant for Austria because of its

small-structured agriculture and high percentage of organic production, although less than 1/5 of the land is utilized agricultural area, out of which 19.5% is used for organic farming (Austrian Ministry of Agriculture, 2013 Green Report). The 1998 Delphi foresight study stated that organic agriculture was among the promising developments where *"Austria may have the opportunity to achieve leadership over the next 15 years" (ITA, 1998, In: Torgersen & Seifert, 1996).* The predominant understanding of "competitiveness" in this study is in striking contrast to the one promoted by biotechnology, which implies that "to be competitive" means to catch up with industrial development. Exacerbated by the BSE scandal and the controversy over imports of GM soybean and maize, distrust in industrialized agriculture in the EU has been growing. Meanwhile, the common perception is that GMO cultivation will lead to intensified agriculture, which is better suited for countries with large farms. Therefore, lacking the competitiveness in farm size due to unfavorable geography, organic agriculture offers an ecologically sound solution as well as an economically feasible market niche for the relatively uncompetitive Austrian agricultural sector.

In this context, the Austrian Ministry of Agriculture has implemented a set of agricultural policies to advocate a model of *"sustainable agriculture"*, in which organic farming is given particular favor. Organic farming by definition, according to the Austrian Ministry of Agriculture, is *"the most environmentally compatible form of agriculture"*, yet it means more than just farming without chemicals. Rather, the principles of organic farming are *"a holistic philosophy and a farming cycle as complete as possible, with a diverse structure"*. Meanwhile, it requires an *environmentally sound* usage of natural resources, which are to be preserved for future generations (Ministry of Agriculture: Organic farming in Austria, 2009, p.3). In a word, organic farming corresponds to a set of normative imaginaries about what is best for Austrian Nature and agriculture.

Organic farming in Austria started in the early nineties. Since then, all arable areas have experienced an organic boom. The number of organic farmers has been stable for several years at a level of approximately 21,000, accounting for 16.5% of

all farmers in Austria (see Facts of Austria Organic Production in Graphic 3). In relative terms, it ranks first among the European countries in this sector (Ministry of Agriculture: Organic farming in Austria, 2009). Sales of organic food in retail trade accounted for 6.7 million Euros in 2012 (Ministry of Agriculture: 2013 Green Report, p.8). The remarkable position of organic farming among all agricultural practices is mainly attributed to the policies implemented by the Ministry of Agriculture. Supported by heavy subsidies, Austrian farmers have been encouraged to turn to organic production for it is simply more rewarding.

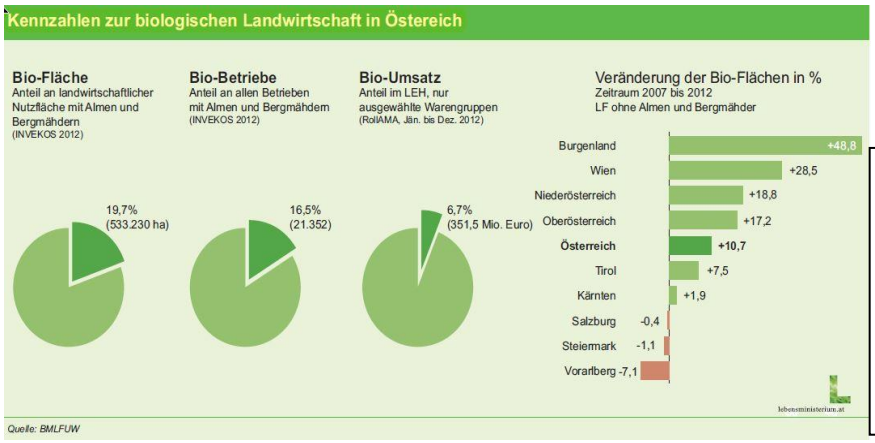

Figure 3: Data on organic farming in Austria.

Retrieved on August 1, 2014 from "Ministry of Agriculture: 2013 Green Report"

According to the statistics in the 2013 Green Report published by the Ministry of Agriculture, in 2012, *2,132 million Euros of agricultural budget* from the EU, the federal government and provinces were spent on agriculture and forestry, out of which approximately *74%* was allocated to two measures: one is the *"Compensatory allowance for less-favored-areas"*, the other the *"Agri-environmental Programme (ÖPUL)"*. With 110,274 farm holdings (accounting for *76%* of all Austrian farms) participating in the programme, the ÖPUL, which intends to enhance the *environmentally benign management of agriculture*, received *526.33 million Euros* in total. The Organic farming sector, which falls under the ÖPUL programme, used *26%* of the total ÖPUL funds (more than *100 million Euros).* The justification for that significant amount is *"the production of organic products is more labor-intensive, the costs of feeding and stables are higher, and yields are lower…all this makes the production of organic products more expensive" (Ministry of Agriculture: Organic farming in Austria, 2009, p.30).* In addition, organic farming also receives subsidies

granted from other sources, including the investment subsidy called *"bio-bonus"* for stables particularly well-suited for animals.

Consumer preferences in Austria also support the organic option. A survey conducted before 1996 already demonstrated that *"freshness" and "naturalness"* are a priority for consumers, while genetic engineered food is viewed negatively (Dietrich and Greimel, 1997, In: Torgersen & Seifet, 1997). In 2008 the share of organic products in total Austrian food sales amounted to about 6%, worth approximately 900 million Euros (Ministry of Agriculture: Organic farming in Austria, 2009). To meet the increasing demand for organic food, retail chains have created various organic brands, among them are "Ja Natürlich", "Natur Pur", etc. These brands cater to the consumers' preference for "natural food" and their demand that the food industry should guarantee products free from biotechnology. (Torgersen & Seifert, 1996)

On the other hand, environmental NGOs have also actively contributed their part. Besides advocating organic farming over the years, recently, within their mandates, Greenpeace, Friends of Earth/Global 2000, BIO Austria (one of the organic farming associations) and other stakeholders in Austria have been working on the promotion of an absolute *GMO-free* food production. One of the endeavors is to create a general framework for a stricter and traceable labelling system. The Austrian label *"Produced without GMO"(Ohne Gentechnik hergestellt)* is unique in Europe, for it offers a comprehensive system of producing food without GM intervention from the beginning to the end. The current EU labelling system only requires labeling of products that contain *directly* modified organisms, which means it does not require feed to be indicated on the end-products. For example, if the chickens sold on the markets were fed by genetically modified soy beans, the information about the "GM feed" does not have to appear on the label. This missing piece of information is unsatisfactory to the NGOs, who argue that it violates the public's right to know and is undemocratic:

"I mean, if Austrians are against GMOs, they should also see that (feed information on the label) and have the chance to say YES or NO…Not only the chance to buy the product or not, but also the chance to bear the costs and take the responsibility to support absolute GMO-free production."(D.U.,2)

So far this label has been successfully implemented on milk production as well as eggs on the Austrian market.

Meanwhile, organic farmers have their organizational representatives, who are responsible for representing the farmers' voices and interests. Two thirds of the approximately 21,000 organic farmers in Austria are members of one of the organic farming associations, which are usually the first point of contact for farmers wanting to switch to organic farming. Among the various organic farming associations, the largest one in Austria, as well as in Europe, is BIO Austria. Uniting more than 13,000 member farms in Austria, BIO Austria offers expertise in organic farming practices as well as product marketing to member farmers, and plays an important role in networking among *"consumers, processors, retailers, politics and media on federal and provincial levels"*.(EcoFarming Austria, 2010)

Overall, heavily subsidized by the Ministry, supported by the general consumers, and endorsed by environmental NGOs and active organic farming associations, organic farming enjoys a great esteem in Austria. To date, there are more organic farmers in Austria than in other EU Member States altogether, and organic farms comprise a large proportion of agriculture in Austria. Indeed, as the former Minister of Agriculture and the Environment Niki Berlakovich said, organic production has become the *"top rider of the Austrian way towards further 'greening' of agriculture" (Ministry of Agriculture: Organic farming in Austria, 2009)*, and is a means to reconcile divergent demands including niche-market strategy and protecting the natural environment as well as rural structure.

Another issue has to do with the ownership of farms in Austria. Although by and large Austrian agriculture is dominated by big producers, there is a significant share of small farmers who usually run family farms on a part-time basis. Interestingly, Austrians are very fond of a certain image in terms of agriculture, as the Austrian saying goes, *"everybody has a relative in the countryside and a great uncle as a farmer",* thus everything that has to do with agriculture is *"a sensitive issue"(H.T.,3).* Small farm owners stay in the countryside and become the symbol of Austrian agriculture. Such an imaginary of how agriculture should be practiced is very

important for the conservative party, namely, the Austrian People's Party(ÖVP), which is one of the two major political parties in Austria and runs on a platform of traditions and stability of social order (Wikipedia: ÖVP). Thus a picture of family-run farms fits into the party's political pursuits:

"It (the conservative party) always tries to keep their foothold in the countryside, which means they try to keep people in the countryside, and they also try to establish what they call 'Flächendeckende Landwirtschaft', which means agriculture should be everywhere. They do not like family farms to be abandoned."(H.T.,3)

This political preference partly renders the composition of farmlands as well as the structure of agriculture in Austria. At a time when many countries have given up farming conducted on a small-scale and/or in geographically unfavorable areas due to low productivity, Austria allocates a large amount of its budget to subsidize these farming practices in disadvantaged areas such as high-mountain farms, so as to keep up the unique image of "Austrian agriculture".

Another strategy in Austrian agriculture is to combine organic production with regional origin. The Ministry of Agriculture, in cooperation with the initiative "Genuss Region Österreich" (Austria Region of Delight), successfully promoted a picture of *regionalized agriculture*. A widely-known advertisement for the organic brand "Ja! Natürlich", in which a little pig speaks in the Carinthian dialect, says a lot about the Austrians' imaginary of its own culture of agriculture. The Austrian public seems to particularly favor the *naturalness* and *the locality* of their food. Although it might be hard to trace who planted or initiated this imagination in the first place, public opinion today is reciprocal with arguments held by other stakeholders, including the NGOs, media, food producers and political parties. The quote below from Greenpeace illuminates the amazing mindset of the public perceived by other stakeholders:

"It is very clear what kind of agriculture the public wants. When I talk to them, they want something produced by small-scale family farms...In some countries people see agriculture and nature as divided, whereas in Austria this is very much combined. Austrian people want *agriculture* that produces food *in harmony with nature*, you know, if you go for a walk in the farmland, it shouldn't be a monocultural picture, but should be this beautiful land, cows drinking from the creek…So GMOs really don't fit in this overall picture." (D.U.,10)

Austrian people's mindset concerning what kind of agriculture they prefer, and

where nature and agriculture should stand, seems to be amazingly clear and advanced. Although it would be hard to prove statistically to what extent such understandings about public perception hold, they are generally held by both official and non-official bodies, and this in turn feeds into other stakeholders' agendas and pursuits. *"If consumers want it in this way, then let them have it" (H.T.,4)*. Based on such an understanding of "democracy", the NGOs, political parties, the food industry and other relevant actors are all on the path to push these concepts and practices further, but GMOs, along with the ideology they bring, are clearly in the way. In this sense, GMOs are seen as obstacles that need to be eliminated.

In conclusion, as Austria strives to become the *"greenest"* country, or the *"NO.1 eco-country"* (Minister of Agriculture, 2009) in Europe, there is a consensus that cultivation of GM 1507 maize does not fit into the larger picture, where the importance of preserving the natural environment is a priority and the agricultural policy favors an "organic", family-run model over the industrialized, large-scale farming model. The latter is ultimately what GMO farming will bring. Moreover, the agricultural policy has an eye on eco-tourism, and this objective might be hindered by the negative effect on the landscape due to increased monoculture resulting from the cultivation of GM 1507 maize. In this normative and political context, the cultivation of 1507 maize is regarded as an intervention, a threat to the "organic farming" method and the overall pursuit of the "green country" image. The GREEN attempt is a strong argument for Austria, and, to some degree, it even overrides any other justification. This is indicated by Greenpeace's final remark on the fate of 1507 maize:

> "Besides all the scientific evidence, Austria wants to be GREEN. I think this overall image that we want to be a GREEN Austria says that everything that doesn't fit into has to be kept out…So I think it's not even so much about whether the technology is safe or not in this case, it is about how GREEN it is." (D.U.,10)

Since maize 1507, like all other GMOs, does not fit into this general imaginary of Austria, namely, the "GREEN" blueprint, it is therefore not tolerated in this country. "Being GREEN" is a cultural identity of Austria, to which the industry and science has to correspond accordingly. Therefore, it is not hard to imagine that the Competent Authorities in Austria, in response to the NGOs' campaigns and the

imagined consumers' choices, do not welcome the entry of 1507 maize into the Austrian market, much less into Austrian soil. In this sense, regardless of all the legal, scientific, and commercial justifications, the cultivation of 1507 maize is doomed to be a "no-go" in this country.

7. DISCUSSIONS & CONCLUSIONS

Coming back to the curiosity that initially drove this research project: while the EU and many Member States are still pending on the final fate of GM 1507 maize, what made Austria the only country that has openly and unequivocally claimed to place a national ban on the cultivation of this maize on its territory if it were to be authorized by the EU? To this end, this research aspired to conduct an in-depth analysis based on data obtained from *semi-structured interviews* and *documents* and analyzed by *the grounded theory* approach. In this concluding section, I wish to emphasize the key points revealed in this empirical analysis.

To begin, by historically tracing how Austria managed to establish a national anti-GMO position in the 90s and continued to solidify this technological position through several events, I argue that Austria's decision on the cultivation of 1507 maize is largely influenced by this well-established anti-GMO "tradition". To a degree, allowing 1507 maize to be cultivated in Austria would mean overthrowing this "tradition". And "overthrowing tradition" would not be well-received and might be disturbing for many in Austrian society. Thus, standing against this rich cultural heritage and solid foundation, I argue that the endeavor to *keep the anti-GMO tradition alive* has impelled the nation to take a united stand in keeping 1507 maize out of its territory.

Meanwhile, the 1507 maize case can be seen as yet another opportunity for Austria to rehearse the nation's anti-GMO "tradition" - in the sense that, through the collective performance regarding 1507 maize, this "tradition" is revitalized and the "Austrianess" in terms of dealing with GMO matters cannot be ignored. Therefore, this specific case is seen as a moment of "identity work", which states that a "tradition" has to be rehearsed again and again in the face of threats and difficulties. In a word, this anti-GMO "tradition" drove Austria to find another justification to keep 1507 maize out; and in turn, through the anti-1507 performance, the anti-GMO "tradition" is kept alive and the national technopolitical culture was once again solidified.

Impelled by this anti-GMO tradition, Austria has employed the *precautionary*

principle as a legitimate and concrete tool in guiding its policy in this case. Although as revealed in the "State of the Art" chapter, mainly due to its ambiguity, the precautionary principle has been widely criticized, e.g., agri-biotech companies criticize it as anti-progress; the WTO criticizes it for blocking free trade; regulatory bodies criticize it for placing an additional burden on GMO regulation; those who believe in "sound science" criticize it for blurring the boundary between science and politics; etc., it nevertheless has served as the directional strategy in Austria. Whether reflected in scientific evidence, in economic-political framings, or in socio-normative arguments, the precautionary principle is the backbone in justifying Austria's adverse stance in this case. Guided by the categorization proposed by Torgersen & Seifert (1996), I have presented in great detail how the precautionary principle was perceived by different stakeholders:

Firstly, my analysis revealed that all the stakeholders reached a *scientific understanding* of the precautionary principle, including environmental NGOs, the UBA and the Ministries of Health and of Agriculture. Indeed, "scientific uncertainty" has been in the forefront of this GMO debate in the EU as well as in Austria. This "uncertainty" is manifested in several forms: one, uncertainty about the characteristics of 1507 maize; two, uncertainty about its negative impacts on human/animal health and the environment; three, uncertainty about whether or not current scientific knowledge is able to fully assess the characteristics and impact of cultivating 1507 maize. In the accounts of all the stakeholders, the various scientific and technical inadequacies spotted in the applicant's dossier and in the CNB's and EFSA's scientific risk assessments on the cultivation of 1507 maize, form the main arguments. Their criticisms towards the risk assessments conducted in this case mainly cover the following aspects: the behavior of the genes inserted into the maize is uncertain due to inappropriate testing; the scientific investigation was conducted over a very short period in a laboratorial instead of in a real-world scenario; the EFSA's assessment did not take into account the latest scientific research results; many tests (e.g. concerning the maize's allergenicity and toxiocity) were not done on the maize itself; the assessment did not examine thoroughly, or not at all, the impact on many non-target

organisms; the EFSA's dominant role in the current risk regulatory system and, its unspoken internal policy reflected in the fashion of constantly updating its risk assessment reports...

In a word, the stakeholders argue that scientific research in this case has not been done thoroughly, properly or in a trustworthy manner, with the consequence that the real character of this maize and the risk of its cultivation are uncertain or unknown. The exposure of "scientific uncertainty" then validates the stakeholders' position that the cultivation proposal ought not to be agreed unless it can be proven that there are no substantial risks involved. This epistemology indicates that the stakeholders remain predominantly in a classical risk assessment paradigm, where science is seen as the major criteria. All in all, through exposing the lack of thoroughness, the failure to use the most recent data and the inappropriateness of the scientific assessment conducted in this case, and through demanding more scientific research and more convincing scientific evidence precluding the existence of risks, Austrian stakeholders aim to block the cultivation of 1507 maize in the country on a scientifically "rational" ground. Therefore, this approach vividly reflects the stakeholders' *scientific understanding* of the precautionary principle.

Following a *scientific understanding,* an *economic-political understanding* of the precautionary principle comes to the fore. Since science fails to assess risk convincingly, the stakeholders argue that other aspects such as economic, social and political rationales should be considered. The NGOs, the UBA and the Ministry of Health have clearly proposed evaluating *socio-economic criteria* in the GMO risk assessment process. In this framework, the uniqueness of Austria's geographical features (e.g. mountainous farms and relatively cold climate), economic structure (e.g. organic products and ecotourism), national standards, social values (e.g. preservation of tradition and social cohesion), etc., should all be respected and cautiously taken into account in the general policy-making on GMOs. To put these criteria into practice, following Norway's lead, Austria spearheaded on a national-specific catalog on how to employ the socio-economic criteria in the process of assessing and regulating GMOs.

By emphasizing the uniqueness of Austria, and the importance of taking into account Austrian specifics in the risk assessment scope, the socio-economic criteria invite regulators to examine those aspects stemming from value judgments that are inherently economic, political and social. Next to a scientific understanding of the precautionary principle which demands more scientific research, the socio-economic criteria proposes to make GMO regulation not only on a case-specific basis, but also on nation-specific grounds. This would most likely mean refusal of any GMO applications in Austria, as it has been the case in Norway. In this sense, the socio-economic criteria carefully set up an extra barrier to block GM1507 maize, as well as any GM crops, from entering Austria. While allowing each stakeholder to vigorously proclaim that the cultivation of the maize is economically, socially and politically unadvisable for Austria, the socio-economic criteria manifest an *economic-political understanding* of the precautionary principle.

The *normative systems-critical understanding* of the precautionary principle in this case was mainly embodied in the image of a "GREEN Austria", which precludes cultivation of GM 1507 maize. This concept concerns Austria's perception of Nature and agriculture. Firstly, all the stakeholders expressed their concerns over the impact of the cultivation of 1507 maize on Austria's biodiversity, in which the nation takes great pride and strives to preserve. I argued that the concern over biodiversity resulted from "environmental ethics" that are based on normative concepts about what is Nature and how it should be preserved. In seeking to maintain green landscape and the diversity of everything in it, this understanding is also in line with an anti-monoculture mindset.

Secondly, driven by the unique landscape and niche-market considerations, the NGOs, the Ministry of Agriculture and the perceived public opinion all endorsed an organic farming model, which aims to keep Nature and agriculture in harmony. Although not economically advantageous, as the Ministry of Agriculture has stated above that "*...the production of organic products is more expensive" (Ministry of Agriculture: Organic farming in Austria, 2009, p.30),* this agricultural model has flourished and gained remarkable status both in terms of funds and the market. This

preferred agricultural model stems from normative values such as the relation between Nature and agriculture and to whom farms should belong, and it also insinuates Austria's critical position towards a GM-technology-led, industrialized agricultural system that increases economic disparities in the modernized world. All in all, the major stakeholders' "GREEN Austria" argument builds on their normative orientation which promotes sustainability and inclusiveness in Austria, thus concurring with a *normative systems-critical* understanding of the precautionary principle.

The above detailed account also reveals that different stakeholders in this case have a mixture of understandings of the precautionary principle. In contrast to Torgersen & Bogner's (2005) assertion that the three understandings were clearly assigned to particular stakeholders, e.g., a scientific understanding to the Environment Agency, an economic-political understanding to the Ministries, and the normative systems-critical understanding to the environmental NGOs, there seems to be no such clear demarcation in this case. Rather, different stakeholders, with specific expertise, concerns and political motives, mobilize a blend of understandings of the precautionary principle for their own use.

Specifically, the environmental NGOs, eager to present scientific evidence, to emphasize Austrian specifics, and to protect biodiversity and organic farming, have demonstrated all three understandings simultaneously; the UBA, serving as the technical expert body in Austria and proposing the socio-economic criteria, has presented a scientific and economic-political understanding of the precautionary principle; whereas the Ministry of Health and of Agriculture, "outsourcing" the scientific expertise to the UBA and keeping a keen eye on what GM maize could bring to Austria's economy, politics and Nature, have also perceived the three understandings of the precautionary principle simultaneously.

Meanwhile, in contrast to what Torgersen and Bogner have identified that the "*economic-political"* understanding of the precautionary principle was the dominant one, my empirical analysis above suggested that the three understandings have been equally significant in contributing to the anti-1507 maize stance. In fact, it is only

through mobilizing a combination of understandings which are supportive to various arguments, that the stakeholders could at utmost justify their position to forbid the cultivation of GM 1507 maize on Austrian territory.

Also, it should be noted that although I have clearly categorized the three understandings of the precautionary principle and tried to fit various accounts into these boxes, we have to be aware that these understandings sometimes overlap due to the *social-ness* embedded in all of them. Firstly, although science is seen as detached from social interest or values, STS scholars (e.g. Latour & Woolgar, 1986; Shapin, 1995, 1998; Jasanoff, 2006; Bijker & Law, 1994…the list is long) have reminded us that scientific evidence is "socially constructed" and scientific views, political will and normative values are always intertwined in practice. In terms of Austria's stance on GMOs, as some have argued, it is *"determined by the selection of scientific views that fit its norm of un/acceptability for potential effects" (Torgersen & Bogner, 2005, p.5).* My interviews and document analysis also suggested that the *"scientific risk"* of 1507 maize is framed and socially constructed by major stakeholders who mobilize their expertise and motives to form solid and legitimate arguments.

Meanwhile, the link between *economic-political* understanding and the *normative systems-critical* understanding is even harder to sever, for the former inherently stems from the latter, and the latter is manifested in the former. For instance, the concern regarding agricultural practice results from a certain imagination of Austrian Nature, but it is at the same time associated with political planning; also, an eye on tourism concerns both the economy and Nature. This overlapping character further indicates the *vagueness* of the precautionary principle. However, this *vagueness* also enables stakeholders to mobilize these understandings flexibly, allowing different values to enter into the assessment of what is regarded as "public good". This in turn suggests that in order for the precautionary principle to be workable in different contexts, a universal and tangible framework may hardly be feasible.

Following the analysis of the precautionary principle, I also drew attention to the *collective expertise and relevant expertise* at play in this exercise. The contrasting decision-making concerning the cultivation of GM maize 1507 in the EU and in

Austria suggests two sets of *collective expertise* stood out in different contexts: At the European level, the EFSA and the national Competent Authorities in some Member States, who mainly possess knowledge of laboratory natural science, form an association of expertise that claims maize 1507 is safe to be cultivated inside the EU. This "safe" claim collectively drawn by the EFSA and some CAs stands out as the most robust and credible criterion in EU decision-making. However, in the Austrian context, relevant experts, including the environmental NGOs and scientific bodies (in particular the Austria Environment Agency), form a strong network that is resistant to the EU network. Relying on a different kind of expertise which mainly derives from ecological science and social science, this set of *collective expertise* claims that GM 1507 is a risk to the environment, to human/animal health and to social values in Austria. It not only stands out in this case, but also greatly contributes to the anti-GMO stronghold in this country. Clearly, these two networks of expertise are in stark opposition in this debate, thus highlighting Austria against the EU backdrop.

The two sets of *collective expertise* excelled at the two stages are closely affiliated to the concept of *relevant expertise*, which can be analyzed at two levels in this case. Firstly, *relevant expertise* is at play between the EU and Austria: In the EU, because the current EU regulatory system only allows consideration of foreseeable impact of GMOs on human and animal health as well as the environment, which can be addressed primarily by natural science, the EU considers natural science as the sole *relevant expertise* in the risk assessment of this case. On the other hand, the *relevant expertise* in the Austrian context is not restricted to natural science; rather, it goes further to include ecological science and social science in the risk assessment of GM 1507 maize. While acknowledging the vital role of natural science in the risk assessment process, Austrian decision-makers also consider environmental issues and social concerns to be of particular relevance for Austria. In this view, Austrian stakeholders broadened the scope of *relevant expertise* in the GMO risk assessment.

Meanwhile, *relevant expertise* can also be discerned within the Austrian context. Although the ultimate aim is the same, that is, to keep GM 1507 maize out, different stakeholders nevertheless show different kinds of expertise given their specific roles:

• Greenpeace perceives itself as an organization with expertise in natural science thanks to the establishment of the Science Unit. It also has expertise in ecological science for its political pursuits ultimately concern the environment/nature. In addition, based on knowledge mainly drawn from case studies, it claims to hold expertise in social science and thus evaluates the GM matter in social and economic manners.

• The UBA, as an entrusted technical body, holds relevant expertise in ecological science (mainly) and natural science, thus it is able to provide scientific evidence from these two aspects for the Competent Authorities. Its expertise in social science should not be taken into consideration since it is solely a technical body. Nonetheless, entrusted by the Ministries, it "spills over" its expertise into the social science field which enables it to examine the socio-economic criteria of GM risk assessment on behalf of the CAs.

• The Ministries have their in-house experts responsible for various issues concerning GMOs, although sometimes they delegate certain expertise to external agencies such as the UBA and the Austrian Agency for Health and Food Safety (AGES). However, when it comes to expertise in political science, they are the authorities who set the political agenda and make the decisions in terms of risk conclusion and an agriculture model, for example.

In a word, as the empirical analysis has revealed that with the aim of establishing valid justifications for their anti-1507 maize position, four major stakeholders have presented and made use of different kinds of *relevant expertise,* namely, *expertise in natural science, social science, ecological science and political science,* to frame different or similar arguments in uncertainties and risks, as well as to express different or similar concerns toward the cultivation of GM 1507 maize in Austria.

Besides expertise, we also discern the significance of *sociotechnical imaginaries* and *national technopolitical identity* in this case. To some extent, the primary reason for Austria's anti-1507 stance can be boiled down to the nation's pre-existing *sociotechnical imaginaries* and *national technopolitical identity*, which are intrinsically built upon "tradition". Austria's approach to the 1507 maize case suggests

that a nation's scientific and technological choices are deeply intertwined with the economic, cultural and political context, which concurs with what *sociotechnical imaginaries* and *national techopolitical identity* are trying to ultimately convey. Specifically, the notion *sociotechnical imaginaries* called attention to the fact that Austria's handling with the cultivation of 1507 maize is inevitably connected to the nation's wider imaginaries regarding social order, Nature and agriculture, risk, collective good, the future, etc. The concept of *national technopolitical identity* signifies the importance of keeping "tradition" alive and cultivating Austria's unique nationhood regarding GMOs when facing threats and disputes.

Indeed, imaginaries and the pursuit to maintain a national technopolitical identity have greatly influenced and, to some extent defined, the major stakeholders' risk-framing and argumentation, as well as overall policy-making in this case. As Greenpeace suggested:

> "I honestly think you don't have to know many technical details about GMOs, there is just this consensus that it doesn't really work here. I think it is verified to say that Austrians are against GMOs because it doesn't fit into the larger picture. Same with the nuclear-energy, we really don't need it. It's in the culture. We are cautious about the risk technologies…"(D.U.,10)

Therefore, the issue of GMOs has gone beyond the scope of scientific examination and has been entrenched in culture. Clearly, for Austria, the cultivation of 1507 maize poses a risk to the "anti-GMO" (even "anti-risk-technologies") culture and a chosen "GREEN" future, and thus it has to be kept out.

In a word, supported by scientific rationales, Austria's precautionary approach to the cultivation proposal of GM 1507 maize keeps a close eye on the preservation of culture and identity. In this view, Austria broadens the scope of *risk* in the GM risk assessment process, in the sense that the cultivation of GM 1507 maize *may be* harmful to the health of humans and animals, to the landscape and biodiversity, to the economy and political planning, but it would *definitely* pose a risk to the "anti-GMO" culture and the identity of a "GREEN" nation. This definite risk to culture and identity greatly encourages Austrian stakeholders to vigorously defend their anti-1507 maize position.

In this context, questions concerning GMOs are no longer merely on whether

science can identify and address potential risks, but are now more on whether this technological innovation makes sense for society as a whole. Thus, the boundaries between science, politics and normative values seem to blur in this view of risk assessment, making the present narrow understanding of scientific/technological innovation, in which science is the only "judge", obsolete. With the "expanded understanding of risks" and the "blurring of boundaries", it is time, as many scholars on Innovation Studies have pleaded, for the EU to transform from *"risk governance"* to *"innovation governance"*, in which scientific/technological innovations are governed by more *"socially distributed, autonomous and diverse collective forms of enterprise"(Felt, et al, 2007, p.10),* and in which variant rationales, references and values are taken into account.

THE END

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