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Volume 20, numéro 1, automne 2015

URI : <https://id.erudit.org/iderudit/1045363ar>

DOI : <https://doi.org/10.7202/1045363ar>

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Éditeur(s)

HEC Montréal  
Université Paris Dauphine

ISSN

1206-1697 (imprimé)  
1918-9222 (numérique)

[Découvrir la revue](#)

Citer cet article

Zong, Z. & Demil, B. (2015). From uncertainty to ambiguity: A discursive approach of emerging field. *Management international / International Management / Gestión Internacional*, 20(1), 163–175.  
<https://doi.org/10.7202/1045363ar>

Résumé de l'article

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# From uncertainty to ambiguity: a discursive approach of emerging field<sup>1</sup>



## De l'incertitude à l'ambiguïté : une approche discursive des champs émergents

## De la incertidumbre a la ambigüedad: un enfoque discursivo de los campos emergentes

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### RÉSUMÉ

Les champs organisationnels en émergence offrent l'opportunité d'étudier comment les organisations donnent sens à leur environnement. Dans cet article, nous adoptons une approche discursive pour étudier les discours produits concernant l'incertitude. Ces discours des acteurs publics et privés sont importants car ils participent à la construction de la régulation du champ. Nous étudions les discours produits dans le cadre d'une enquête publique menée en 2009 et 2010 dans le champ français des nanotechs. Notre analyse montre que l'ambiguïté est utilisée différemment par les acteurs du champ et que la rhétorique de l'incertitude vise différents objectifs.

**Mots clés :** incertitude, ambiguïté, analyse de discours, champ émergent, nanotechnologies

### ABSTRACT

Emerging fields offer an opportunity to study how actors are making sense of their environment. In this article, we adopt a discursive approach to examine the discourses about uncertainty. These discourses produced by state and non-state actors are particularly interesting as they participate in the emergence of the institutional framework. We study the discourses produced during a public inquiry led in 2009 and 2010 in the nascent French nanotech field to observe the use of discourses to influence understandings and meanings. We found that ambiguity is used differently according to the positions of actors in the field and that the rhetoric of uncertainty targets different goals.

**Keywords:** uncertainty, ambiguity, discourse analysis, emerging field, nanotechnologies

### RESUMEN

Los campos organizacionales en emergencia ofrecen la oportunidad de estudiar cómo las organizaciones dan sentido a su entorno. En este artículo, adoptamos un enfoque discursivo para estudiar el discurso relativo a la incertidumbre. Estos discursos de los actores públicos y privados son importantes porque participan en la construcción de la regulación del campo. Estudiamos los discursos producidos en el contexto de una encuesta pública llevada en 2009 y 2010, en el campo francés emergente de las nanotecnologías. Nuestro análisis muestra que la los actores del campo, dependiendo de su posición, utilizan de modo diferente la ambigüedad y que la retórica de la incertidumbre apunta distintos objetivos.

**Palabras Claves:** incertidumbre, ambigüedad, análisis discursivo, campo emergente, nanotecnologías

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The emerging industries differ from mature industries according to several original characteristics. Technological standards and production processes are only progressively established (Aldrich and Fiol, 1994; Kaplan and Tripsas, 2008). In a socio-cognitive view, actors also have to converge on several critical issues such as the product and its attributes, the boundaries of the activities, the legitimate actors participating in the market, the ways of measuring and of valuing the new goods and the rules governing relationships between actors (e.g., Benner and Tripsas, 2012; Callon, 1998; Fliegstein, 2001; Huault and Rainelli-Le Montagner, 2009; Khaire, 2014; Lamont and Molnar, 2002; Porac et al., 1995; Rosa et al., 1999). Due to all these characteristics, these emergent industries are characterized by evolving technologies and weak institutions regulating the behavior of actors. Consequently, these

contexts offer a particularly interesting opportunity to study how actors are making sensible their environment both for themselves and for other stakeholders, i.e. how they produce sensemaking and sensegiving (Hill and Levenhagen, 1995).

These last activities are conveyed by words and sentences which can be analyzed through the discourses produced by actors (Weick, 1995). These discourses are particularly crucial in the emerging industries as they participate in the emergence of a regulatory framework where state and non-state actors often interact and struggle for shaping the future institutional context by struggling for meaning (Grant and Hardy, 2004). In these struggles, discourses play an important role as they create the understanding of the world in which actors evolve by forging ideas, categor-

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1. Acknowledgments: The authors would like to thank the editor and three anonymous reviewers for their helpful suggestions and developmental advices. They provide useful feedback on earlier versions of this manuscript.

ies, labels, relationships and theories (Maguire and Hardy, 2006: 9). Thus, the lens offered by sensemaking and discourse analysis underlines that actors may institute –at least partially– their environment with discourses and enables to avoid considering uncertainty as a characteristic attached to and constitutive of the environment or a technology as it was traditionally the case when studying new or emerging industries. In this article, we adopt this discursive view to explore how organizations are making and giving sense of uncertainty in emerging industries. This lens requires moving from uncertainty of the environment to ambiguity in the discourses about the situation in which actors are immersed.

For this study, we select the case of nanotechnologies in France because it embodies an emerging field promised to impact notably multiple markets in the future. Moreover, a public inquiry led in 2009 and 2010 offers the opportunity to observe the tactical use of discourses to influence understandings and meanings (Grant and Hardy, 2004). The different contributions to this public inquiry materialize discursive interactions between actors and enable to study the polyphony and antagonisms of multiple discourses produced by different actors (Vaara, 2010). In this context, the “power of discourse” (Alvesson and Karreman, 2011) is counter balanced by the other discourses produced in the field.

Our focus provides different contributions. First, our analysis show that different kinds of uncertainty are evoked in the discourses and that these uncertainties may be related to different forms of ambiguity. Secondly, we show that, while ambiguity is present in the majority of discourses, some actors favor a “strategic ambiguity”, i.e. a voluntary ambiguous discourse, when others do not (Eisenberg, 1984). This result allows us also to reflect on the reasons why some actors avoid ambiguity when others not. Thirdly, we found that organizations categorize differently the new industry. Some of them tend to present it as something relatively familiar whereas others present it as an entirely new context. Finally, all the discourses we study use the rhetoric of institutional, technological, and market uncertainty relatively to the new industry. But opposite conclusions are drawn from uncertainty according to the position of the different actors in the field. Our paper illuminates the presence of two opposite discourses about nanotechnologies: a discourse of ‘sound science’ and a discourse of ‘precaution’ (Maguire and Hardy, 2006). These discourses adopt different stances towards science considered as producing knowledge to solve problems or producing ignorance concerning its effects (Pestre, 2013).

This article starts with a literature review on the concept of uncertainty in emerging industries. In a second section, we develop a discursive view of emerging industries as a situation where multiple interpretations are produced. The third section presents our empirical design. The results are then analyzed in the fourth section and discussed in the last section.

### Uncertainty in emerging industries

Emerging industries constitute an environment generally described as highly uncertain in the literature. Uncertainty

became a major topic in organizational literature from the 60’s when it was used to characterize the different environments in which organizations or individuals evolve and must adapt to (e.g., Burns and Stalker, 1961; Duncan, 1972; Lawrence and Lorsch, 1967). Uncertainty may encompass several forms but refers generally to two different things related to the incapacity to predict the future. First, it refers to a situation where a lack of information prevails concerning the existence of some factors affecting decision-making. Secondly, it refers to the inability to assign sure probabilities to the possible outcomes of a decision and to the way some factors will affect a decision. These two kinds of uncertainty have been recently designated as epistemic and aleatory uncertainties (Fox and Ulk men, 2011). Referring to the raid on a compound in Pakistan to capture Osama bin Laden in 2011, Fox and Ulk men point out that U.S. president Obama faced an epistemic uncertainty because he was not sure that bin Laden was in the compound when he launched the raid. The aleatory uncertainty reflects the fact that even if bin Laden was in the compound, it was not certain that the military operation would succeed.

Uncertainty is generally considered as negative for the decision-maker and the latter’s task consists essentially in reducing it or at least, manage it (Thompson, 1967). Weick (1995) or Milliken (1987) suggests that uncertainty can be generally “solved” by scanning the environment, gathering information or gaining expert knowledge to facilitate sensemaking. These solutions help particularly to counterbalance the lack of information. Other studies have also suggested various tactics to manage the factors participating in uncertainty. For instance, entrepreneurs can adopt dominant behaviors in their fields (DiMaggio and Powell, 1991), implement boundary-spanning activities (Thompson, 1967) or establish strong relationships with important stakeholders to better control the environment (Pfeffer and Salancik, 1978).

When scholars apprehend environmental uncertainty they traditionally use two kinds of measures. First, objective data may be collected to evaluate the level of uncertainty, such as the change of factors affecting a given environment or certainty of information. Secondly, scholars may use perceptual measures of uncertainty or certainty when managers are asked to position their perceptions on scales (Duncan, 1972). The first view rests on a positivist tradition of the environment considered as objective and measurable. It does not imply the manager’s judgment. In the second case, a more interpretivist view associates the language with the perceptions of managers evaluating their environment with words. However, this language is supposed to reflect reality. Another view of language considers that the discursive activity enacts reality. This point and its consequence for the study of uncertainty are developed in the next section.

### A discursive view of emerging industries

Previous researches on uncertainty have often adopted a positivist perspective by describing uncertainty as something ‘out there’, attached to the environment. In these

conditions, emerging industries would display high level of uncertainty when mature ones would display low level. A more socio-cognitive view of industries and market insist more on shared understanding by actors of what the product should be, how the relationships between actors are established and what are the beliefs about consumers' preferences (e.g., Benner and Tripsas, 2012; DiMaggio and Powell, 1991; Fliegstein, 2001; Porac et al., 1995; Rosa et al., 1999). In this view, mature industries would display a high level of consensus and convergence on meanings between actors whereas they would be low in emergent industries. This cognitive process of shared meanings renders the discursive activities particularly important and interesting to study in emerging industries. Indeed, these activities help social actors to claim definition of reality and to share conceptions in their field with multiple constituencies (Khaire and Wadhvani, 2010). This general view of sensemaking converges with the linguistic turn in management which emphasizes that discourses not only reflect social reality but also build, institute or enact it as suggested by numerous authors of various traditions (e.g., Austin, 1970; Krieg-Planck, 2012; Mantere and Vaara, 2008; Weick, 1995). Indeed, Paroutis and Heracleous (2013) -among others- underline that discourses are central in cognitive process as they provide labels, typifications or frames to interpret and understand the world. This reveals particularly important in unsettled industries because discourses and language are then disseminated in society and shared with others. For instance, metaphors may be used by entrepreneurs to represent the environment or to communicate new concepts in new activities (Hill and Levenhagen, 1995). These metaphors capture both sensemaking and sensegiving processes, in order to provide meanings for oneself and for others. But discourses are not only framing the reality but constitutes it as they 'bring into being' various social objects such as knowledge, identity, concepts, categories and so on (Alvesson and Karreman, 2000). By interacting and eventually opposing discourses, meanings of these new entities are negotiated by actors, underlining that "*meaning is a weapon in the struggle*" (Maguire and Hardy, 2006, p.24). They can compete or complete with positive or negative implications. And finally, this polyphony may produce enriched meanings and discussion or chaos and political conflicts (Vaara, 2010).

If social actors do not encounter a pre-existing reality but construct it through communication and meaningful interactions<sup>2</sup>, uncertainty loses interest as an intrinsic characteristic of the environment to study, in favor of the meanings and characteristics of the discourses produced by actors. Analyzing discourses is likely to reveal particularly the objectives of their producers, the targeted audiences and the intents of their authors (Sergot and Claret, 2011). Indeed, discourses can be considered as a form of organized action targeting someone else and not only as a representation of

the world. This view corresponds to the rhetorical tradition considering discourse as a way of influencing and of convincing others, insisting on its interactive nature even if the target is not physically present (Maingueneau, 2014). Thus, each discourse supposes the presence of the others to be constructed. Symmetrically, the discourse refers to the actor constructing an enunciation and cannot be disconnected from the enunciator (Maingueneau, 2014). Finally, each discourse refers also to a context. Words gain signification only through the particular context in which it is constructed.

Thus, instead of looking for uncertainty in a situation where a lack of information or ignorance prevail, the discursive and sensemaking approaches favors the study of ambiguity<sup>3</sup>, understood as a situation where several different potential interpretations coexist and eventually conflict (Weick, 1995). Discourse analysis considers ambiguity as a resource for the actors both the enunciator and the receiver (Krieg-Planque, 2012). Thus, equivocality is less a problem to solve than an object to analyze. It takes several forms in the discourses: use of polysemous words, unsaid things, or incompleteness of enunciation. A part of equivocality lies in the natural language itself which is full of words, expressions or sentences creating multiple possibilities of interpretation. But another part may be voluntarily produced. It enables for instance to send different messages to different audiences in the same discourse, to neutralize potential conflicts or to smooth ideological oppositions (Abdallah and Langley, 2014; Eisenberg, 1984; Leitch and Davenport, 2007). In the next section, we develop our research design to present the discourses we analyze and how we analyze them.

## Research design

### CONTEXT

Our empirical study concerns the French nanotechnologies (NT) field. Despite some divergences among definitions, NT can be generally understood as the ability to intentionally manipulate materials of nanometer scale (one-billionth of a meter) and are considered as a new field revolutionizing multiple industries such as biotechnology, microelectronic, chemistry or medicine (Juanola-Feliu, 2009; Linstone, 2011; Walsh, 2004). Since it offers promising economic opportunities, public authorities have generously subsidized research all over the world, stimulating the formation of clusters and encouraging firms to invest in NT. Private actors are also actively using the label nanotech as 10,499 companies have published or patented in this field between 1998 and 2008 (Mangematin et al., 2011).

NT provide a good opportunity to study an emerging field having a potentially large economic impact. Indeed,

2. Despite an absence of consensus in discourse analysis field, all approaches are sharing at least a social constructionist ontology and epistemology (Phillips and Oswick, 2008; Vaara, 2010) and consider the functions and structure of discourses as their object (Maingueneau, 2014) and its importance for organizational life (Phillips and Oswick, 2008).

3. Or equivocality. For Weick (1995, p. 94-95), equivocality and ambiguity are similar in designating situations where two or more competing interpretations are present. But he notes that ambiguity is "often ambiguous" as it can refer to a lack of clarity, making it quite similar to uncertainty. Consequently in this article we assimilate equivocality and ambiguity.

NT are considered as a motor of future economic growth in the world. Today, the global market for NT is estimated at between 150 and 3.1 trillion dollars over the coming years according to various estimations (Palmberg et al., 2009). Despite the huge economic potential that NT represent, their development is particularly marked by controversies. One significant example relates to the 17 public debates in France about NT organized by the CPDP (*Commission Particulière du Débat Public*/ Special Commission for Public Debate) from October 2009 to February 2010. These debates were organized at the request of eight French ministries and constituted the first French experiment of a citizen's debate on technological choices. During the debates, NT were vigorously contested by opponents for toxicological, eco-toxicological and ethical reasons.

#### DATA COLLECTION

In this study we explore primary and secondary data of discourses to capture how different actors interact and struggle for the meaning of NT and consequently construct the new field, as we suppose that language is one of the main drivers of organizational field construction (Philipps et al., 2004). This analysis enables us to study how actors give sense to the new field and the meanings and interpretations that they ascribe to NT.

On a general level, discourses include a set of oral or written practices designed to make sense of a social object for a particular audience (Phillips et al., 2004; Sergot and Claret, 2011). In order to enrich and contextualize our analysis, we carried out 22 semi-structured preliminary interviews with diverse actors in the field from 2009 to 2012, including representatives of big companies, start-ups, public authorities, public labs and NGOs (see Appendix 1). Each interviewee was asked to describe his or her organization, give a definition of NT, identify several key players in the NT field and discuss their position regarding NT. These interviews provide contextual information, discourses for our analysis and enable us to interpret our results.

Discourses can be studied empirically by examining the texts. In this vein, our second source of data consists in the

actors' memos provided during the CPDP debates. Indeed, during these debates, each participating organization was incited to express its position. This open process led to the participation of numerous national and regional organizations that provided short memos to express their vision of NT. These 4-page written texts constitute an interesting source of data for several reasons. First, they were provided by a large diversity of organizations thus allowing us to analyze the polyphony and the eventual antagonisms of discourses (Vaara, 2010). Indeed, 51 organizations (e.g., NGO, unions, scientific organizations, administrative authorities) or meta-organizations (e.g. professional associations), both regional and national, participated in the debates by posting official memos to present their positions. We grouped these actors into six large categories according to their specific concerns: representatives of firms, unions, citizen NGO, public administrations, scientific organizations, and pro-environmental organizations (see Table 1). This diversity allowed us to avoid restricting sensemaking and sensegiving of the emerging field to companies alone and to include other kinds of actors belonging to the emerging institutional environment. The second interest of this source of data is that these memos were provided on a voluntarily basis and were publicly available. Consequently, they reflect the positions of interested and active actors in the field who are supposed to be acquainted with the topic and who were keen to deliver a message to multiple audiences. Due to the official characteristic of their participation, we are confident that these messages have been constructed to reflect the position of their emitter. Finally, these memos were provided in a 4-page standardized form that enabled us to have similar volumes of data to compare for each actor. This particular characteristic helped us evaluate the weight of the different topics and issues contained in these memos and lead to a comparison between the different groups.

Despite the interest of this data, two potential limitations should be mentioned. Some actors, especially some radical NGO, refused to participate in the debate because they argued it was a masquerade and that public authorities had made important decisions for several years without consulting anyone. The "exit" position on the part of some NGO

**TABLE 1**  
The 51 organizations having participated in the French national public debate during the period 2009-2010

<b>Trade Unions</b>	AFOC, CFDT, CFE-CGC, CFTC, FO, INDECOSA-CGT, UNSA <b>(7)</b>
<b>Representatives of firms</b>	ANIA, EPE, FEBEA, LEEM, MEDEF, SITELESC, UIC <b>(7)</b>
<b>Scientific organizations</b>	Académie Nationale de Pharmacie, Académie des Sciences, Académie des Technologies, Académie Nationale de Médecine, APPA, CNISF, CNRS CEA, INSERM, INRIA, INRS, IRESP, SFSP <b>(12)</b>
<b>Citizen NGO</b>	Association Française Trans-humaniste, Association Sciences et Démocratie, CENG, CLCV, FIDEA, FMSD, Familles Rurales, Fondation Sciences Citoyennes, ORDIMIP, Vivagora <b>(10)</b>
<b>Public Administration and Public Authorities</b>	AFNOR, AFSSA, AFSSET, CESE, CNIL, Conseil Economique et Social régional Bretagne, Conseil Economique et Social Régional Franche Comté, Conseil Régional Ile de France, Conseil Economique et Social Régional Rhône-Alpes, INC, INERIS <b>(11)</b>
<b>Pro-environmental Organizations</b>	FNE, Les Amis de la Terre, Les Verts, SEPANSO <b>(4)</b>

did not prevent the participation of some more moderate organizations. Indeed, given the content of some memos, we are confident that negative views regarding NT are largely represented in our data. Secondly, our empirical material allows us to capture only an organization's discourses and opinions and not its actual behaviors. Despite this limitation, the material corresponds to our theoretical stance that institutionalization of emerging industries is above all a question of shared meanings enacted by actors (Khaire and Wadhvani, 2010), as suggested by Phillips et al. (2004) when they argue that *'Using a discursive perspective, we conceive of institutions as constructed primarily through the production of texts, rather than directly through actions'* (p. 638).

#### DATA ANALYSIS

We adopted an inductive approach in analyzing our empirical material, which consisted of 204 pages of memos (4 pages × 51 actors). This analysis was conducted in three steps (Mantere and Vaara, 2008; Phillips and Hardy, 2002). In a first step, we carried out a thematic analysis of the memos to identify central themes emerging in the discourses. This analysis helped us understand which kinds of issues are debated and how different actors envisage the field. In other words, this first content analysis deals with the question of

“what a discourse says” (Krieg-Planque, 2012). The most important topics (in occupied space in the memos) include risks and opportunities created by this emerging field, defining NT, the specificities and similarities of NT compared to other existing fields, uncertainties, and proposals for ways of dealing with the situation. These themes cover more than 90% of our material. We also rapidly found that typical words or groups of words were associated with the topics evoked (see Table 2). Thus, special attention was paid to the vocabulary used to label the different semantic units.

For representatives of firms, we create a specific label called “no risk”. Indeed, the evocation of risks by firms was mitigated by this category. It does not refer directly to opportunities but to units that we did not observe elsewhere and which evoke risks, but with the specific purpose of convincing other stakeholders that NT are under control. In other words, this is a category designed to demonstrate that there is no real risk. So, risks are evoked at length but in a reassuring manner. Finally, we validate this list of themes by comparing our written corpus with interviews conducted before analyzing the data. As illustrated in Table 2, the themes evoked in our interviews were similar in open-ended discussions with multiple actors in the field.

**TABLE 2**  
Coding guide with emergent themes

	TYPICAL WORDS ASSOCIATED WITH THE LABEL *	EXCERPTS FROM MEMOS *	UNITS ILLUSTRATING A LABEL FROM INTERVIEWS *
<b>Risks generated by NT</b>	risks, danger, dilemma, worries, impact, fear, threat	“The results of these researches will increase awareness of <b>the risk associated with exposure to engineered nanoparticles</b> ” (INSERM) “Humanity is not eager at the point that willing to have <b>these technologies be developed as soon as possible even by taking huge risks</b> ” (French Trans-humanist Association)	“Since there are rules yet to be established, several manufacturers are exiting from this area (NT) <b>because they realize that this is very dangerous, it is risky for staff, it is risky for consumers</b> ” (I5) “[...] when creating the Minatec, the difficulties encountered with the uprising of the population, <b>facing a fear of these nanotechnologies</b> ” (I7)
<b>No risk (only representatives of firms): explaining why the risks are under control</b>	(strong) regulations, exist, control, no use, prohibited, inoffensiveness, evaluation, evaluated, avoid, (proven) danger, safety, already established, approved, absence, safety,	“According to regulations [...], all food must ensure the safety of consumer. <b>The release on the market of dangerous products is therefore prohibited.</b> ” (ANIA) “[...] <b>some of them (NT) have already demonstrated their safety.</b> ” (EPE)	“Today in Europe and in particular in France, <b>products that are released in the market are products which followed already rules that protect them from acute hazards</b> [...] We do not put anything on the market.” (I6) “ <b>No study till now shows that any disease is related specifically to the nanoscale</b> [...]” (I9)
<b>Opportunities in the new field</b>	promise, (to) benefit, progress, development, improvement, advantages, increase, contribute to, solve, innovation, market, to come, help, hope	“They also represent an <b>important potential for economic development</b> ” (Economic Council of Rhone-Alpes) “Continued progress already underway and <b>new opportunities [...] allow taking care of new disease and generate huge and legitimate expectations</b> ” (LEEM)	“In the case of nano medicine, <b>we see that applications of nanotechnologies can provide an improvement for existing methods of diagnosis and therapies.</b> ” (I2) “Why did we introduce silica (nanostructure)? ... <b>This is something that can reduce the fuel consumption significantly</b> ...So, we have a lower fuel consumption, therefore a CO2 emission reduction...” (I14)



<p><b>Issues of definition</b></p>	<p>definition, (NT) include, cover, encompass, nanoscale, (NT) are</p>	<p>“<b>Nanotechnologies cover</b> all the tools, instruments, techniques that allow study, manipulate, manufacture and measure objects in the <b>nanoscale</b>, but they also <b>include</b> derivative applications” (Economic and Social regional Council of Bretagne)</p> <p>“<b>Nanotechnology encompasses</b> a large number of technological fields whose common denominator <b>nanoscale</b> structures (a nanometer = 10<sup>-9</sup> m)” (Familles Rurales)</p>	<p>“ (<b>Nanotechnologies</b>) are technologies that use the <b>control</b> of material at the <b>nanoscale</b>” (I6)</p> <p>“The answer I give is always based on the ISO’s <b>definition. (Nanotechnologies) are control of material between 1 and 100 nanometers</b> in order to obtain new properties” (I9)</p>
<p><b>Specificities of the NT field</b></p>	<p>(new) revolution, specific, specifically or specificities, change, new, (in) particular or particularities, distinctive, different or differentiated, in this field, adaptation, adapted to (nanoproducts) or to adapt to, (major) innovation, (new) world, boundary, breakthrough</p>	<p>“We ask for the <b>creation of a High European authority dedicated to Nanotechnologies, independent from political authorities and open to civil society</b>, which is the only way to ensure the long-term harmonious development of “nano”” (UNSA)</p> <p>“The AFOC advocates for an official recognition of the uncertainty of nanotechnologies and <b>recommends establishing an independent administrative authority dedicated to nanotechnologies</b>” (AFOC)</p>	<p>“Present and future developing technologies, are <b>necessarily nano, otherwise will no longer exist</b>” (I9)</p> <p>“(…) with nanotechnology, we should look at the architecture definition and structure of materials (...) <b>which give new properties that make the product significantly different</b>” (I1)</p>
<p><b>Similarities with existing fields</b></p>	<p>previous, in general, as..., compare to, other sectors concerned, to extend, together, apply to (nanotech), relate to, natural, conventional, existing</p>	<p>“MEDEF believes that <b>the existing regulatory framework is very complete</b>” (MEDEF)</p> <p>“<b>Comparing</b> the potential development of the NT to computer science in the 70s (...)” (FO)</p>	<p>“(…) the development of new drugs through NT <b>is comparable to conventional development of new drugs</b>. So there is <b>nothing very special</b> about it (...)” (I2)</p> <p>“ (...) and the <b>European Reach regulation, chemicals registration cover nanoscale products fairly well</b>” (I9)</p>
<p><b>Uncertainty in the field</b></p>	<p>(scientific) uncertainty, lack of (objective) information or studies, definition, nomenclatures, potential, knowledge, debate</p>	<p>“The <b>central issue lies in the uncertainty in which scientists are to evaluate all the impacts</b> of nanotech on our environment and our lives” (AFOC)</p> <p>“ To date, there is still <b>no official definition of nanomaterials</b>” (ANIA)</p>	<p>“The <b>rules are not defined precisely</b>, that’s the problem” (I1)</p> <p>“But with nanotechnologies, <b>we do not know how to measure the nanoparticles we breathe, so we do neither know how to establish thresholds, nor how to take protective measures or prevention.</b>” (I3)</p>
<p><b>Propositions for the future</b></p>	<p>recommendation, suggest, should, strengthen, anticipate, advocate, propose, I think/do not think</p>	<p>“Afsset <b>recommends</b> the implementation of best practices described by the expert group” (Afsset)</p> <p>“CFE-CGC <b>proposed</b> for several years the systematic implementation of a ‘curriculum laboris’ ” (CFE-CGC)</p>	<p>“ We should <b>separate what is fashion and what is substantive problems</b>” (I6)</p> <p>“For nanoelectronics, <b>I don’t think that we need specific regulations at this point of time</b>” (I19)</p>

\*Our translation from French to English

In a second step, we conducted a textual analysis focusing on the most important sources and manifestations of uncertainty in these discourses. We identified firstly three dominant dimensions in our data: institutional (concerning legislative issues and norms), technological (concerning scientific potential and evolution), and market (mainly concerning information from the demand side). We analyzed then in detail the way social actors talk about NT regarding these three major dimensions of uncertainty prevailing in discourses. This kind of discourse analysis helps us to understand “how things are enunciated” (Krieg-Planque, 2012).

Finally, we performed a comparative analysis to distinguish the dominant discourse used by different categories of actors as we supposed they reflect their authors’ intents (Sergot and Claret, 2011). As the memos were standardized

(4 pages) the size of the text dedicated to each label provides a good clue regarding the general tone of the memos and the intent of each actor. A memo can insist on risks or opportunities, similarities with other markets or specificities, according to the place dedicated to each label in the discourse. So, we compare the discourses within the same category of actors and between the categories of actors to understand if a dominant vision of the new field emerges for each category of actors.

## Findings

In our case study, three dimensions of uncertainty are evoked in actors’ discourses. Social actors, enunciating these multiple uncertainties, develop in the meantime positive or negative interpretations regarding NT and ambiguous ele-

ments in their discourses. Ambiguity takes different forms according to sources of uncertainty emphasized in discourses. Moreover, some social actors, especially corporate representatives, take advantage of the high level of uncertainty underlined in discourses by intentionally introducing ambiguous elements.

#### DISCOURSES REGARDING THREE KINDS OF UNCERTAINTY

Our analysis illustrates that one of the major issues evoked by all categories of actors is the existence of a high degree of uncertainty in the emerging field. More specifically, following the thematic analysis, this uncertainty underlined in discourses can be split into three different dimensions: institutional uncertainty, technological uncertainty and market uncertainty. Institutional uncertainty, according to actors, includes the absence of conventional definitions of NT and of dedicated legislative institutions dealing with their potential impact and the construction of norms and laws. Technological uncertainty concerns especially the lack of knowledge concerning the toxicological and ecotoxicological effects of NT. Most of the time, actors underline the lack of scientific studies on which to base decisions since NT are still in their infancy and largely fed by scientific knowledge. Finally, market uncertainty refers to the lack of information about the demand side, the level of demand in different sectors or the potential applications of NT in various industries or products, whether current or future.

These different dimensions of uncertainty create a favorable context for sensemaking (Weick, 1995) and invite actors to give their interpretations of the situation. Social actors may give different interpretations according to their positions. This coexistence of multiple interpretations about the uncertain context of a nascent field leads to a frequent use of ambiguous elements in discourses.

#### MAKING SENSE WITH AMBIGUOUS DISCOURSES

Besides the multiple kinds of uncertainty, our analysis shows that actors develop discourses where positive or negative interpretations of NT and ambiguity prevail in the same time. In the discourses, we identified three different forms of ambiguity (see table 3) pointed out by the previous research of Abdallah and Langley (2014): structural duality (the juxtaposition of two contradictory elements in the same text), linguistic equivocality (the use of specific words that relate to different meanings) and content expansiveness (the vagueness of proposals in discourses).

Most of the actors pointed out the coexistence of risks and opportunities in the emerging field, explaining the global presence of structural duality in their discourses. Except for this structural ambiguity, unions, citizen NGO and pro-environmental organizations develop a relatively clear position regarding NT without ambiguity. They insist above all on the distinctive characteristics of NT in a negative tone, by indicating specific potential risks that NT entail. Therefore, they call for specific regulations regarding NT as a new technological and social area, or request a moratorium

before the enactment of particular regulations. On the other hand, scientific organizations also have a homogeneous vision of NT, but depict a rather positive future. For them, NT differ from other activities, on the one hand, by representing a solution to issues such as scarcity of resources, environmental problems, health and, on the other hand, NT are considered as an inevitable technological development.

Corporate representatives and public administrations simultaneously show several different kinds of ambiguity in their discourses. For firms, besides the structural duality between risks and opportunities, NT is sometimes considered as a distinctive promising field and at other times as a similar field to existing ones when regulations are evoked. These ambiguous elements help firms gain greater social and cognitive legitimacy by linking NT to existing sectors and, in the meantime, avoid any specific regulation of their activities. Companies also frequently use linguistic equivocality by employing some fuzzy terms which may have different meanings such as “revolution” or “responsible approach” to NT. For instance, the LEEM (*Les Entreprises du médicament*, trade union of pharmaceutical companies) claimed that NT are revolutionizing medicine. The UIC (*L'Union des Industries Chimiques* / trade union of chemical industries) also pointed out in their memo that they have adopted a responsible approach to NT. Saying that NT are revolutionary or firms are acting responsibly may lead to different interpretations. Finally, we identified that discourses produced by firms often introduce vague content, especially concerning potential risks generated by NT and ways of dealing with them.

Public authorities also develop a relatively ambiguous discourse by displaying an especially high level of structural duality and content expansiveness. First, at the structural level, they highlight, at the same time, the considerable economic opportunities as well the potential risks of NT. Secondly, like corporate representatives, public actors prefer making vague proposals for courses of action concerning NT. Like firms, the will of French authorities to present broad propositions without giving details can be understood as a strategic use of ambiguity to reconcile different institutional logics (Eisenberg, 1984, 2007) which coexist in the emerging field of NT.

Besides the multiple forms of ambiguity, our analysis also shows that some social actors display strategic use of ambiguity discourses while others not. Indeed, all categories of actors display ambiguous elements in discourses containing opposite views of the nascent field (structural ambiguity). However, the different categories of ambiguity are not present the same way in all discourses. Some discourses display multiple forms of ambiguity whereas others have few or none at all (see Table 3).

#### FROM UNCERTAINTY TO AMBIGUITY

Our empirical studies allowed us not only to confirm the presence of the three forms of ambiguity pointed out recently by Abdallah and Langley (2014), but also to propose



**TABLE 3**  
**Different manifestations of ambiguity in actors' discourses**

		<b>STRUCTURAL DUALITY</b>	<b>LINGUISTIC EQUIVOCALITY</b>	<b>CONTENT EXPANSIVENESS</b>
Trade Unions	AFOC	x		
	CFDT	x	x	
	CFE-CGC	x		
	CFTC	x		
	FO	x		
	INDECOSA-CGT	x		
	UNSA	x		
Representatives of firms	ANIA	x	x	x
	EPE	x		
	FEBEA	x		
	LEEM	x	x	
	MEDEF	x	x	x
	SITELESC	x		x
	UIC	x	x	
Scientific organizations	Académie des Sciences	x	x	
	Académie des Technologies	x		x
	Académie Nationale de Pharmacie	x	x	
	Académie Nationale de Médecine	x		
	APPA	x		
	CNISF	x		
	CNRS-CEA	x		x
	INSERM	x		
	INRIA	x		
	INRS	x		x
	IRESP			
SFSP	x			
Citizen NGO	Association Française Transhumaniste	x		x
	Association Sciences et Démocratie	x		
	CLCV	x		
	FMSD			
	Familles Rurales	x		
	Fondation Sciences Citoyennes	x		
	Vivagora	x		
	CENG	x		
	ORDIMIP			
FIDEA	x			
Public Administration and Public Authority	AFNOR	x		x
	AFSSA			x
	AFSSET	x		x
	CESE	x	x	
	CNIL	x		x
	INC	x		
	INERIS			
	Conseil Economique et Social régional Bretagne			
	Conseil Economique et Social régional Franche Comté	x	x	
	Conseil régional Ile de France		x	
Conseil Economique et Social régional Rhône-Alpes	x			
Pro-environmental Organizations	FNE	x		
	Les Amis de la Terre		x	
	Les Verts	x		
	SEPANSO			

a linkage between different forms of ambiguity and sources of uncertainty emphasized in actors' discourses.

All the groups of actors display more or less structural duality in their discourses. The core duality exists especially in two dichotomies: risks/opportunities represented by NT, specificities/similarities of NT compared to other existing markets. Most actors systematically evoke the two contradictory dimensions of risks and opportunities, even organizations that have a clear position against NT such as NGO and pro-environmental groups. For instance, the CLCV (*Consommation, Logement et Cadre de Vie*, a French NGO for the protection of consumers and users) stated that NT are "*indicators of considerable progress according to some, sources of unpredictable risks for others*". A high level of technological uncertainty of NT is often quoted as the essential explanation of this dichotomous view. As a representative of labor union (I3) pointed out in an interview "*...with NT, we do not know how to measure the nanoparticles we breathe, so we do neither know how to establish thresholds, nor how to take protective measures or prevention*".

This lack of scientific knowledge about NT has been evoked also in another way by corporate representatives. Besides this risks/opportunities duality, corporate representatives are the only ones to frequently use another conflicting dimension: the similarities and specificities of NT compared to existing markets. By associating selected similarities and specificities, companies advocate for minor adaptations of existing norms regulating NT and, in the meantime, call for more public investments to develop the promising nascent field. For example, the ANIA (*Association Nationale des Industries Alimentaires / National union of food industries*) noted in their memo "*insofar as these techniques (NT) present potentially real benefits, it is necessary to encourage research and development in this area*" and further in the same document "*it does not seem necessary to set up specific legislation for NT, nevertheless it is important to be aware of existing texts and adapt them if necessary*." In summary, the structural duality represented by both dichotomies of risks/opportunities introduced by NT and specificities/similarities of NT are referred when actors try to emphasize technological uncertainty of the nascent field.

Linguistic equivocality and content expansiveness are also largely present as other forms of ambiguity in discourses concerning the NT field. Since the emerging field is characterized by a weak level of institutionalization, several ambiguous expressions regarding especially institutional arrangements such as "principle of precaution", "responsible approach" are repeatedly used in different discourses without detailed explanations. According to the actors' interests, these expressions allow for significantly different interpretations. For instance, the "principle of precaution" when applied to NT can be understood either in its strictest sense – uncertainty regarding the impact of NT means they should be banned or restricted - or in a much more tolerant way where negative effects should be proven first before applying the principle of precaution. Even the term "nanotechnologies" is often used in an ambiguous manner without

a conventional definition. Representatives of firms generally attribute a narrower sense to NT than other stakeholders. As confirmed by some informants during interviews, a narrower definition may allow firms to deny the direct link between their activities and NT and therefore escape from constructing specific regulations.

In the same way, some other ambiguous expressions such as "NT market" are also used to evoke the market uncertainty of the NT field. For example, different actors talk about the global NT market's estimation with different figures. According to various sources, the field of NT can present a worldwide market from 150 to 3.1 trillion dollars (Palmberg et al., 2009). This huge difference can be not only explained by the different versions of NT's definition according to social actors, but also results from the perspectives more or less optimistic hold by actors concerning the evolution of the establishing NT's market. As underlined by the AFSSA (*Agence française de sécurité sanitaire des aliments/ French agency for food safety*) in their memo "*the commercial reality of these applications (NT) remains elusive since most of them are still in the R&D stage*". A high level of market uncertainty according to actors leads some actors to produce ambiguous discourses.

In a similar manner, corporate representatives and public actors advocate for adapting existing rules for the emerging NT field instead of elaborating specific regulations by using the content expansiveness. They usually evoke suitable or necessary adaptations in order to take into account the features of NT without specifying the degree of modifications or which rules are concerned. Similarly, some other actors, e.g. several scientific organizations, suggest creating a guide of best practices in order to avoid toxicological problems related to NT, but without providing more details on what it should include or which practices are considered good or bad. On the other hand, pro-environmental organizations and NGO present some much more explicit and concrete proposals such as the creation of a special independent authority to control NT or listing nano-ingredients on product labels.

It is finally interesting to notice that the last two forms of ambiguity: linguistic equivocality and content expansiveness used by social actors in our case are closely linked with institutional and market uncertainties emphasized by these actors. Firms and public authorities develop some vague content and fuzzy words in their discourses to take advantage of the uncertain context at the institutional and market levels. We can summarize these linkages between different forms of ambiguity in discourses and different sources of uncertainty emphasized by actors in the table 4.

## Discussion

The competing discourses produced by actors are important in emerging institutional contexts because they define an in-flux reality and influence how the new industry will be governed later (Phillips et al., 2004). In these contexts, "*(...) discursive activity is a form of political activity because of the way in which it changes understandings of a social situa-*

**TABLE 4**  
**Relationships between different forms of ambiguity and sources of uncertainty emphasized in discourses**

FORMS OF AMBIGUITY	SOURCES OF UNCERTAINTY EVOKED
Structural duality	Technological uncertainty
Linguistic equivocality	Institutional and market uncertainties
Content expansiveness	

tion which, in tum, shape particular experiences and invoke certain practices” (Hardy and Phillips, 1999, p. 6). Indeed, during this phase, actors have opportunities to influence and eventually impose shared meanings and create particular interpretations that serve their interests (Maguire and Hardy, 2006). The case of French NT offers an opportunity to study an emerging field highly connected with research and technology, where multi-dimensional uncertainty prevails and a public consultation was organized to collect various opinions on these new technologies. Studying various discourses produced during this consultative phase for future regulation enables to underline the coexistence of high level of uncertainty and ambiguity in the discourses.

Of course, our study has some limitations. It consists in a single case study which implies limitations concerning generalizability, but we are confident that some of our findings could have been observed in other settings such as GMO or biotech. However, this case is a unique one concerning the consultation process the French government organized for debating new technologies. A specificity of our empirical setting consists in focusing on the discourses produced mainly by meta-organizations and much less on organizational discourses. For instance, we have no idea concerning the discursive strategies of individual firms, only their representatives. The discourses we studied have some validity as these meta-organizations are official spokespersons but they may potentially display ambiguities because they may reflect a large internal organizational diversity. More importantly, another limitation consists in not studying the outcomes of this consultative phase. Yet it could be interesting to study how ambiguities remain (or not) in the final decisions made by the government or follow-up texts produced by the actors. An interesting avenue suggested by this research would be to analyze, for instance, how the “risk avoidance” position defended by unions, NGO or pro-environmental organizations and the “risk management” position defended by corporate representatives could eventually be reconciled in subsequent texts and discourses. Finally, our study corresponds to a cross-sectional analysis and not to a longitudinal study as other authors have interestingly provided (e.g. Abdallah and Langley, 2014, Maguire and Hardy, 2006). It reflects a crucial event in the emergence of the NT field, a unique opportunity to allow an open and public confrontation between various actors. This limitation is rooted in the data we used, produced only at a given point in time.

Despite these limitations, our study suggests three main results. Firstly, at the level of each individual discourse, our study underlines that ambiguity is present in all the dis-

courses but that this ambiguity takes on different forms according to the positions of actors. Our analysis detects that structural ambiguity (Abdallah and Langley, 2014) largely prevails in almost all the discourses and is reflected in the coexistence of conflicting and potentially contradictory views of the field. However, some actors, such as corporate representatives, display more varied and stronger ambiguity. One explanation of this use lies in the multiple audiences to satisfy. Their discourses clearly try to minimize the potential risks of the new technologies by reducing the specificities of NT whereas, at the same time, they underline the huge opportunities and how NT will revolutionize economic activities due to their specific characteristics. Thus, they have to admit simultaneously the specific and unspecific characteristics of NT, to make them simultaneously extraordinary in their perspectives and familiar in the way they operate. Indeed, new field suffer from a lack of familiarity and legitimacy among resource providers and a weak institutionalization of the field itself (Aldrich and Fiol, 1994). This line is difficult to maintain theoretically but is necessary if we consider that firms need to ensure a minimum threshold of legitimacy for their activities regarding other social groups, while obtaining financial and regulatory support from political and administrative bodies. In this context, strategic ambiguity, i.e. the voluntary use of ambiguity (Eisenberg, 1984) solves partially this aporia by allowing opposite views to cohabit. This strategic use of ambiguity can be underscored when compared with the clear-cut discourses from less powerful actors such as NGO, unions or pro-environmental organizations. Compared to corporate representatives, these actors develop a clearer anti-nano stance and have no need to satisfy multiple audiences with contradictory expectations. They have to avoid ambiguities to make their signals as audible as possible. But this line may also be difficult to maintain because social actors have to avoid an exaggeratedly negative picture of NT. In some sense, these actors have also to admit ignorance and consequently display a minimum level of ambiguity in their discourses as a sign of honesty and credibility. Indeed, a discourse without any ambiguity could be considered as a caricature. Thus, our results suggest that whatever their objectives, organizations have an interest in displaying some level of ambiguity in their discourses and in modulating a balance between clarity and ambiguity but for different reasons.

Secondly, ambiguity is a traditional tactic that lobbyists have used for a long time in multiple sectors such as tobacco, asbestos or pesticides (Foucart, 2013). While ambiguity helps to satisfy several different audiences through

communication activities, it also helps to cast doubt on opponents' positions in social debates by proposing multiple models of interpretation in these debates to avoid any clear-cut interpretation. In this view, ambiguity can be considered as a resource (Krieg-Planque, 2012) and is not an involuntary consequence of ignorance or uncertainties, but a voluntary choice using lack of information as a resource to fuel ambiguity. This statement suggests that the two concepts of ambiguity and uncertainty are different but connected, whereas they are traditionally studied separately (except in Weick's work where they are both opportunities for sensemaking but, when uncertainty means a lack of interpretation, ambiguity entails multiple potential interpretations in a situation). The first difference underlined through our thematic analysis is that uncertainty is a category by itself, evoked largely in "natural language" by social actors, whereas ambiguity was not directly evoked. This point suggests a differentiated position of the two concepts: uncertainty is "experienced" by actors and can be referred to when they talk about their environment, whereas ambiguity is less visible and emerges from interactions and communicative activities. A second difference concerns the sources of uncertainty –considered as a lack of information- evoked in the discourses. Indeed, uncertainty depends largely on an "external" environment such as the amount of scientific knowledge accumulated or such as the decisions by administrative and political organizations concerning the institutional uncertainty, contrarily to ambiguity. However, we may argue that ambiguity is connected to uncertainty because the more uncertainty is underlined in various dimensions of a new field (technological, institutional and economical), the more it opens the door to multiple and eventually contradictory interpretations. In our case, a high level of uncertainty favors high levels of various forms of ambiguity. This point converges with the view that researchers have to avoid a complete disconnection between discourse analysis and context (Phillips and Oswick, 2012).

Finally, all discourses about scientific field –such as nanotech– mix knowledge and ignorance (Pestre, 2013). Actors insist on one of the two elements according to the context and their interest. Industrials are often accused to promote ignorance in a lot of situations to maintain their positions and may adhere to a 'discourse of uncertainty' (Pestre, 2013, chap.3). For instance, it was the case during a long time for the cigarette or pesticide industries. This strategy entails to cast systematically doubt concerning scientific studies and to underline imperfect scientific knowledge to continue to make business. At a meso-level, our paper illuminates the presence of two opposite discourses about nanotechnologies: a discourse of 'sound science' and a discourse of 'precaution' (Maguire and Hardy, 2006). When the first one is confident about the capacity of science to fix problems, evaluate accurately risks and finally control the emerging technologies, the second underlines uncertainty and uncontrolled risks of new technologies. When the first believes that science help to manage risks, the second defends that science entails potential risks. The "no risks" label that we identify in the discourse of companies refers exactly to the idea of recognizing the existence of risks but that these risks are under

control at the same time. So, our analysis suggests that companies in an emerging field could be prone to adopt a 'sound science' discourse while in a more mature one they could be more precautious. In a nutshell, promising new activities are promoted by confidence in science when criticized mature activities require the opposite position: a systematic doubt on scientific knowledge.

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**APPENDIX 1**  
**Interviewees' profiles**

<b>CODE</b>	<b>FUNCTION</b>	<b>COLLECT PERIOD</b>	<b>DURATION OF THE INTERVIEW (MINUTE)</b>	<b>CODE</b>	<b>FUNCTION</b>	<b>COLLECT PERIOD</b>	<b>DURATION OF THE INTERVIEW (MINUTE)</b>
I1	NGO's representative	Nov. 2009	35	I12	Head officer in the French Statistic Office	July 2011	35
I2	Coordinator of an European network in NT	July 2010	50	I13	Engineer in a NT related large company	July 2011	50
I3	General secretary of a labor union	July 2010	130	I14	Project manager of nanomaterials in a NT related big company	July 2011	70
I4	Risk expert of CEA (public French research center)	July 2010	65	I15	Scientific manager in a nanochemical large company	Sept.2011	65
I5	Sociologist of science	Sept. 2010	50	I16	Project manager in C'Nano (network of research centers) and manager in a NT related big company	Sept.2011	50
I6	NT research program's director in CEA (public French research center)	Sept. 2010	45	I17	Researcher in NT of a public lab	Oct.2011	45
I7	CEO of a start-up in NT	Dec.2010	60	I18	Risk manager of NT in a large company	Dec.2011	70
I8	Civil servant of the Ministry for Finance and Economic affairs	Jan.2011	90	I19	Director of an industrial association in nanoelectronics	April 2012	70
I9	Normalization group's president and scientific director of a firm in NT	Jan.2011	95	I20	Senior officer in the Ministry for Industry	May 2012	60
I10	Research center's director in a public lab of nanoscience	June 2011	65	I21	CEO of a start-up in NT	Dec.2012	60
I11	Civil servant of the French Statistic Office	July 2011	20	I22	CEO of a firm in nanobiotech	Dec.2012	40