

Laboratoire d'Economie Appliquée de Grenoble

THE ROLE OF REGIONAL INSTITUTIONAL ENTREPRENEURS IN THE EMERGENCE OF CLUSTERS IN NANOTECHNOLOGIES

MANGEMATIN V. ; RIP A. ; DELEMARLE A. ; ROBINSON D.K.R.

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Institut National de la Recherche Agronomique - Université Pierre Mendès France
Unité Mixte de Recherche 1215
Domaine Universitaire - BP 47 - 38040 GRENOBLE Cedex 9
Tél. : 33 (0) 4 76 82 54 39 - Fax : 33 (0) 4 76 82 54 55
E-mail : vertier@grenoble.inra.fr - http://www.grenoble.inra.fr

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UNIVERSITE PIERRE MENDES FRANCE
Grenoble 2 Sciences Sociales

THE ROLE OF REGIONAL INSTITUTIONAL ENTREPRENEURS IN THE EMERGENCE OF CLUSTERS IN NANOTECHNOLOGIES[1]

Mangematin♥, V**., Rip, A***, Delemarle A*., Robinson, D.K.R***,

Abstract

In the case of new technologies like nanotechnology, institutional entrepreneurs appear who have to act at different levels (organizational, regional, national) at the same time. We reconstruct, in some detail, the history of two cases, in Grenoble and in Twente/Netherlands. An intriguing finding is that institutional entrepreneurs build their environment before changing their institution. They first mobilize European support to convince local and national levels before actual cluster building occurs. Only later will there be reactions against any de-institutionalisation caused at the base location. The Dutch case shows another notable finding: when mobilizing support the entrepreneur will have to agree to further conditions, and then ends up in a different situation (a broad national consortium) than originally envisaged (the final cluster involved a collaboration of Twente with two other centres). In general, an institutional entrepreneur attempts to create momentum, and when this is achieved, he has to follow rather than lead it.

Keywords: institutional entrepreneur, deinstitutionalisation, cluster, location, emerging technologies, promise, nanotechnology

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♥ Corresponding author

***** ESSEC (France) and GAEL (INRA/UPMF)***

****** Univ of Twente***

**** ENPC/LATTS, Paris***

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1. Introduction

Silicon Valley, the Boston Area, the Biovalley, Oxford and Cambridge are known as locations with concentrations of high tech industries. The history of a specific geographic area may explain the initial location. However, similar cluster elements (leading scientists, presence of firms, entrepreneurial culture, etc.) may involve different definitions of geography, and their genesis may be via contrasting trajectories. In this paper, we focus on the strategic action of visionary institutional entrepreneurs and how they go about building effective clusters in the new international business of nanotechnology.

As defined by Maguire, Hardy and Lawrence (2004), "institutional entrepreneurship represents the activities of the actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones". Cluster-institutionalising entrepreneurs are those who promote the creation and the institutionalisation of clusters. Rip (2002) emphasises the main dynamics of the constitution of geographic agglomeration: national and regional top-down policies enacted to encourage the emergence of specific clusters on the one side, and local bottom-up dynamics based on localised knowledge spillovers on the other. The key finding of this paper is that cluster-institutionalising entrepreneurs combine multiple-level processes (organisation, cluster, regional, national and supranational) to promote the cluster. In order to institutionalise the cluster, their activities may deinstitutionalise, even partially wipe out, existing organisations. Whereas institutional studies have been performed in relatively mature fields (for example Lounsbury, 2002) and in emerging fields (Lawrence, Hardy, & Phillips, 2002; Maguire et al., 2004), what we look at here is a mixed process. The emergence of nanotechnologies results from the convergence of the previous wave of new industries - microelectronics, biotechnology, informatics and instrumentation - opening up technological options and industry structures, creating opportunities that institutional entrepreneurs can grasp.

The analysis of emerging nano-districts (clusters in nanotechnology) in Grenoble and Twente (together with other Dutch centres) sheds light on the critical role of institutional entrepreneurs who bring together local, national and European policy makers, firms and research organisations (such as national labs and universities). Entrepreneurs may initiate a convergence amongst loosely coupled organisations (Bonaccorsi, 2002). Co-location in a cluster produces close ties, enabling informal meetings and bridging different networks (financial, scientific, academic and industry), and tending to stimulate a convergence of anticipations. However, actual physical co-location may not be an essential precondition, or

necessarily an outcome. Institutional entrepreneurs are those who create the necessary linkages and build momentum. Institution building co-evolves with the overall development of the scientific and technological fields, and path creation may occur (Garud & Karnoe, 2003).

This paper addresses the role of entrepreneurs who orchestrate the transformation of the social/institutional and technical organization, against a backdrop of emerging interactions and stabilising patterns. To understand the dynamics of cluster-institutionalising entrepreneurs, we use the theoretical framework proposed by Czarniawska & Joerges (1996) who identify three phases: (1) Articulation of goal and formation and selection of ideas, concluded by shift to determined action. (2) Mobilization of resources and of credibility, concluded by a first appropriation and decision to go ahead. (3) realization/materialization, including the concrete negotiations and implementations; and our analysis identifies these stages in its consideration of two contrasting case studies. Data collection is based on historical records, archives and interviews with the main actors, including in-depth discussions with the main entrepreneur figures. The analysis and presentation of the cases is sequential, in the sense that Minatec (Grenoble) is discussed in detail to show the translations made by the institutional entrepreneur working at different levels, while the Twente/Netherlands case allows us to consider further complexities, in particular how the entrepreneurs, because of the multi-level dynamics of their situation, had to accept shifts in their plans to achieve at least part of their goals.

The paper contributes first to the theoretical understanding of how the institutional entrepreneur defines tactics and activities to support their vision. It specifically highlights the process of enrolment around a vision. It shows how and when the critical questions are addressed so as to avoid weakening the emerging institution. One intriguing feature of the entrepreneurs' activities, as we will show in the case studies, is how their strategy includes, and sometimes gives precedence, to building an "exterior" of promising proposals and their acceptance, in order to be able to create a working "interior".[2] Second, it explores how the institutional entrepreneur handles a de-institutionalisation process within their own organisation for the benefit of the cluster. Third, our study illustrates the multilevel action of institutional entrepreneurs who build on their own legitimacy to access to resources at

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[2] ***This is a general feature of the activities of so-called moral entrepreneurs (Howard S. Becker,*** **Outsiders. Studies in the Sociology of Deviance***, New York: Free Press, 1963; Richard Rettig,* **Cancer Crusade***, Princeton: Princeton University Press, 1977).***

the local level, making sense of loosely coupled scientific actions to gain legitimacy for the physical development of cluster resources.

2. THEORETICAL ARTICULATIONS

In different geographic areas (Europe, North America, Asia, India, etc.), a number of locations are competing to become leading nanotechnology clusters, concentrating both public and private investments, as it happened with biotechnologies (Cooke, 2002; Powell, Koput, Bowie, & Smith-Doerr, 2002; Prevezer, 1997)[3]. The emergence of a specific area results from several factors, such as historical development and investments paths (Saxenian, 1990), presence of large firms (Agrawal & Cockbrun, 2003) or of star scientists (Zucker, Darby, & Brewer, 1998). However, the presence of such elements (leading scientists, presence of firms, entrepreneurial culture, etc.) will not be enough to guarantee a self-reinforcing – and ultimately successful - trajectory unless they are marshalled by an organising vision. We argue that the take-off of one amongst all the potential regional clusters results from the action of cluster-institutionalising entrepreneurs, who manage to play on actors' anticipations to bring local, national and international actors together.

Aldrich and Fiol (Aldrich & Fiol, 1994) examine the social processes surrounding the emergence of new industries, from the first pioneering ventures through the early stages of growth to the point where the structure stabilizes as the industry becomes established. Borrowing from institutional theory, we study the process of building two geographically localised nanotechnology networks. Aldrich and Fiol extend the theories linking legitimacy and industry creation. They analyse entrepreneurs as promoters of new meanings that eventually alter existing institutional norms. In that perspective, social contexts represent not only patterns of stabilised meaning but also sites within which meanings are renegotiated. Thus entrepreneurs, including private founding firms, are not only setting up new firms and organisations, but through their renegotiation processes, also promoting new institutions.

Institutional theory has been expanded to explain how institutions change in character and potency over time. As DiMaggio (1988) points out, "institutional theory tells us little about 'institutionalization' as an unfinished process". It also tells little about the characteristics

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[3] *Powell* et al. *show that more than 50% of American biotech firms are clustered in only four locations.*

of the institutions involved in the institutionalization process. The idea of institutional entrepreneurship is one entry point to explain the institutionalisation process, i.e. the process by which agents deploy resources at their disposal to create, shape and empower institutions. In such situations, the entrepreneur works in a heterogeneous situation, to mobilise resources from different angles and aggregate them into a persuasive and powerful whole. Such a framework of analysis may well apply to the building of districts on convergent technologies, where some of the elements - organizations, firms, universities and facilities - already exist.

Institutional-entrepreneur theorists identify three main characteristics in the institutionalization process. First, institutionalization is a socio-political process in which actors deploy enrolment strategies to improve their position in the struggle to capture and control resources. These battles mostly take place in a specific organisational field, at an intermediate level between organizations and society. Institutional entrepreneurs have a central responsibility in the creation, transformation and diffusion of institutions, based on the alignment of actors' interest (Callon, 1986). As underlined by Maguire, Hardy and Lawrence (2004), the concept of the institutional entrepreneur focuses on these struggles and the manner in which interested actors influence their institutional contexts (and unsettle their organizational field). "A new institution arises when organized actors with sufficient resources (institutional entrepreneurs) see in them an opportunity to realize interests that they value highly" (DiMaggio, 1988, p14). The emergence of a new institution is thus a political process that reflects organization's power and interests and the coordination of actors who are able to convince and enrol (align interests of) other actors for the shape of the new institution. However, institutional entrepreneurs not only promote the emergence of a new institution. They also transform their environment and challenge the existing institutions, in a process that can be seen as similar to the challenge of new entrants to incumbents.

Second, the institutionalization process is a cultural process in which legitimacy plays an important role. Garud et al. (2002) argue that institutional entrepreneurs create whole systems of meaning that tie disparate sets of organisations together. Assuming the role of champion, they energize efforts towards collective actions. Dacin et al (2002) note that the creation, transformation and growth of the new institution require legitimacy as an essential precondition. Hargadon and Douglas (2001) also emphasise the importance of embedding the innovation in designs which are both legitimate and familiar in order to better shape the outcome of contests between innovation and established institutions. In a

process of institutional change, legitimacy is a both antecedent and outcome.

Third, the institutionalization process implies the transformation of organizational fields. The action of institutional entrepreneurs might not always be a disruptive one. In fact, new institutions often emerge through diffusion or imitation processes, especially when they are embedded in stable organization fields where well-structured actor-configurations and identifiable patterns of interactions already exist (DiMaggio & Powell, 1983). For example, focusing on a small non-governmental organisation in Palestine, Lawrence, Hardy and Phillips analyse the process of creation of a new institution as a stage-by-stage institutionalisation of inter-organisational collaboration (Hardy, Phillips, & Lawrence, 2003; Lawrence et al., 2002). They argue that close and continuous collaboration acts as a source of change through the generation of 'proto-organisations' with new practices, rules and technologies that transcend a particular collaborative relationship.[4] Sufficiently diffused, they may develop into a new institution. In Hardy's case, the institutionalisation process not only generated a new institution but also transformed the institutional context through the internalisation of the collaborative relationship.

Maguire et al. (2004) point out the differences between emergent and mature fields. Mature fields represent relatively well structured configurations of actors that are aware of their involvement in a common enterprise. The patterns of interactions amongst actors are set: interactions are routinised, leading organisations and individuals are identified (Sherer & Lee, 2002) and actors' roles are embodied in their professions and status (Lounsbury, 2002). In contrast, in emerging fields, the list of actors, as well as the reasons behind their potential interest and involvement, is not yet clear. Networks overlap poorly and the relations amongst actors have still to be defined. The roles and positions are changing within and between organisations as institutions are unsettled and coordination amongst organisations (professional associations, lobbying organisations, etc.) are under-organised (Lawrence et al., 2002).

The domain of nanotechnologies, in which the two case studies are situated, has some mature sectors, with existing actors and institutions, while at the same time the emerging new science and technology create openings and uncertainties. The two main scientific

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[4] Such processes have been documented for the development and societal embedding of new technologies under the heading of 'strategic niche management'. See Hoogma, R., Kemp, R., Schot, J., & Truffer, B. 2002. Experimenting for Sustainable Transport. The approach of Strategic Niche Management. London: Spon Press., and for analysis of a range of cases about the introduction of electric vehicles, Remco

fields which feed nanotechnologies are microelectronics and life sciences. In both these fields, institutions and coordination mechanisms have emerged during the last 30 years: transformation of intellectual property rights, support for creating start-ups and spin-offs from academia, professional organisations etc. The cluster-building actions of the institutional entrepreneurs that we are studying entail the transformation of the regional institutional field, which requires legitimacy, resources and support. The entrepreneur does not build a proto-organisation from scratch: s/he is already part of institutionalised organisation. The specificity of his/her action as entrepreneur is that s/he orchestrates a highly complex process, in which his/her role in promoting a regional nanotechnology cluster may represent a challenge to his/her own organisation.

However, the entrepreneur's action cannot be taken as intrapreneurship (that is, an entrepreneur within a specific organization). Indeed, he is not creating a subsidiary company from his institution. He is rather creating a meta-level which federates different organisations, be they academic (National research centres and universities) public authority (Regional authorities and city councils) branches of multinational firms or start-ups. His/her action is an institutional one, with the three characteristics defined by Hardy et al: cultural process, socio-political process and transformation of organisational field.

Most authors studying institutional change focus on changes within a single firm or a single population of organisations – examples include publishing houses (Thornton, 2002), accounting organisations (Greenwood, Hinings, & Cooper, 1999; Lee & Pennings, 2002), business schools (Casile & Davis-Blake, 2002), Sun Microsystems (Garud et al., 2002) and law firms (Sherer et al., 2002). In each case, dominant forms are selected and the analysis reveal how the adoption of a revised practice is variously affected by organisational attributes or population characteristics (Dacin et al., 2002). The focus on clusters broadens the usual field level studies. Porter defines clusters as "geographic concentrations of interconnected companies and institutions in a particular field" (Porter, 1998, p 78). The focal point is no longer a single organisation but rather a meta-level of coordination amongst different types of actors: academia and industry, existing institutions like venture capital or technology transfer offices or incubators, research and production facilities like clean rooms or large and unique instrumentation (e.g. a synchrotron) (Meyer, 2005). The cluster is also at the crossroad of different public policy actions, regional of course, but also

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national and European.

The multilevel creation of clusters is similar to creation of standards as an entrepreneurial act (Hwang & Powell, 2005). Actors play at the local level with a permanent reference to international categories to gain in legitimacy or credibility. Haas (Haas, 1992) describe these actors as being part of epistemic communities (i.e. group of actors sharing the codes in which theories are expressed) while Hakanson (Hakanson, 2005) underlines that the communities are needed as knowledge in the making is context dependent. Communities extend beyond individual organisations, span organisational boundaries to create and legitimise common codes and cognitive frames. These communities are often geographically concentrated in clusters, which encourages the circulation of sticky, informal and uncodified knowledge, although, as Knorr-Cetina points out, they can also be geographically more extended.(Knorr Cetina, 1999). One of the additional dimensions of standard settings is the deinstitutionalisation process that it involves, as organisations loose autonomy over the decision process and control of their technical choices.

However, the case of standard creation is somehow different from the creation of clusters: making standards is a process of "remaking of institutions" (Hwang et al., 2005) while in the actions of cluster-institutionalising entrepreneurs aim to set up a new meta-level institution, which can be in different organisational forms (incentive schemes, public policies, mergers amongst organisations, or building sharing). In that sense, such actions borrow from the creation of a new institution, in the model of Nouvelle Cuisine (Roa, Monin, & Durand, 2003) which arose as a critique of the "old school", making a clear break with it to 'recreate' the field of gastronomy. Cluster-institutionalising entrepreneurs not only bring together, as it were, the chefs of independent restaurants; they also put together actors from different spheres (academia, industry, venture capital, policy makers) to foster geographic concentration and the convergence of anticipations and investments, and to concentrate public and private investment in specific locations to reduce uncertainty. In such a framework, some locations will be able to attract additional actors and investors while others will not.

3. TWO CASE STUDIES

We use development of the Minatec and Twente clusters as our cases studies to examine how institutional entrepreneurs align public and private anticipations and to stimulate investment in leading regional clusters. The paper explores how such entrepreneurs

mobilise the support of their organisation to create the cluster and its consequences for existing organisations. Data collection is based on historical records, archives and interviews with the main actors, including, in both cases, in-depth discussions with the individual who appears to be the "entrepreneur".

3.1. Minatec (Grenoble)

To build the history and follow the emergence of the Minatec cluster, in addition to interviews and archives, we track the enrolment process through the 102 presentations (comprising more than 700 slides) given by Jean Therme, the institutional entrepreneur from CEA/LETI[5] (Grenoble) to audiences of different actors. His diary has also been scanned to identify which actors were met when, the meeting sequence and how negotiation results were integrated into slides. We used co-word analysis (Alceste software®) to identified the thematic in each presentation and their relative importance.

Czarniawska and Joerges' (1996) translation model framework, which conceptualizes translated elements as linguistic artefacts, is used to present our cases. They argue that ideas "are communicated images, intersubjective creations, and therefore the 'property' of a community rather than of a single person" (1996: 33). Ideas, therefore, need to be translated to travel across institutional contexts, and they describe the translation process as one of selecting ideas, objectifying them, and finally materializing them into new forms. New forms are quasi-objects - as it were a book, picture, or design - that can travel on to other social contexts. Selection refers to problem resolution: "Organizational actors, like a collective ant-eater, catch many, spit out most, and savour some [ideas], presumably on the grounds of relevance to some organizational problem" (1996: 25). Objectification consists in labelling ideas so that they may be understood at a collective level: "The simplest way of objectifying ideas is turning them into linguistic artefacts by a repetitive use in an unchanged form" (1996: 32). In the last step, materialization, ideas are transformed into practice: "This magic moment when words become deeds is the one that truly deserves to be called materialization, whether performed mostly by human actors or mostly by material artefacts" (1996: 41). We apply this translation model, and its three steps of selecting,

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[5] CEA (Commissariat à l'Energie Atomique) is the French equivalent of Department of Energy in the US. During the 90's, it diversified towards high technologies, especially microelectronics. CEA/LETI (or LETI) is one of the main divisions of the parent body CEA, dedicated to microelectronics.

objectifying, and materializing ideas, to analyze the contextualization that individual actors accomplish during institutional building process.

The opportunity for the Minatec cluster to emerge resulted partly from an initial 'outside event' which could be called "luck" (Cohen & Levinthal, 1994): the Grenole city council was looking out for realistic projects to use city land adjacent to the CEA site, thus offering the opportunity for expansion. Jean Therme, then in charge of the strategy at LETI, formed a vision of what the future of micro-electronics in Grenoble could be.

The journey of the Minatec idea can be described as follows:

(1) Articulation of goal, formation and selection of ideas

While the Grenoble region has a long history of excellence in science, technology and knowledge-based industry, for our purposes the advent of Minatec is a natural focus. As in all innovation cases, there are heroes, mythology and "development". Claude Gaubert, the vice-head of INPG (Institut National Polytechnique de Grenoble, the largest engineering department in University in France) explains it the following way: "looking at the projects on a map, there was our project on one side of CEA and the other project on the other side. They were next to each other. As head of CEA/LETI, Jean Therme saw that the two projects were deeply complementary and the cluster of innovation in micro and nanotechnologies was born!"

The concept of MINATEC has been maturing for about five years and it has been, and still is, promoted by CEA and mainly by Jean Therme, who was its spokesman since the very beginning. Appointed deputy head of LETI in October 1997, Therme knew that he would be taking over as CEA/LETI's leader within a few years. To gain a better insight into the full spectrum of LETI's technological fields, he formed (July 1998) an internal working group in charge of elaborating a strategy for LETI in 2000 called "LETI 2000-WG". This became an arena for him to test the possibility of LETI's scientists and engineers working in a more integrated manner with scientists working on more fundamental research. This mission gave him a lot of autonomy, as he was independent of the normal vertical hierarchy, and allowed him to explore possible perspectives of evolution within his organization and to benchmark the dynamics of the industry and competitors' activities.

Two additional elements of Therme's professional trajectory stimulated convergence of anticipations and the agglomeration effect. He had spent his entire career in different institutions at Grenoble (INPG - University, ST Microelectronics - Firm, and CEA) and he retained a high degree of credibility amongst previous colleagues who were by now in

strategic decision making positions. This personal legitimacy amongst his colleagues supported the credibility for the vision that he built during the MINATEC enrolment process.

During this period, ideas and projects were in the air. Academic deans, heads of national labs, as well as local policy makers and industrialists were confronting their visions and their anticipations in different meetings, at different levels, whether scientific, technological or political.

(2) Mobilization of resources, of legitimating/credibility.

In August 1999, Jean Therme was appointed head of CEA/LETI and joined the internal project team which was in charge of generating ideas for using the land around CEA.[6] It started in 1997 as a response to the city's willingness to use the vast unoccupied piece of land in downtown Grenoble. Jean Therme realised this represented an excellent opportunity for expansion. Exploiting his high credibility within the organisation following LETI 2000-WG he began to mobilize and negotiate resources with the other partners. He spent more than a year listening to partners and drawing insights from them, whether appreciating INPG's needs as a member of its board, or meeting the Mayor of Grenoble and other public authority representatives on the golf course or the ski slopes or at the Sunday market.

Therme's strategy was threefold:

Promotion of the concept as an 'institution-to-be' to convince people beyond CEA and INPG;

Giving rhetorical and administrative reality to MINATEC through presentations for the city council and National and European public authorities;

Starting to plan the site before defining what was to be put inside its buildings.

During the first year (1999-2000) his human and financial resources were mostly internal to CEA/LETI and INPG. At the time, resources were being devoted to preparing projects for the EC 6th framework programme. The main goal was to promote Grenoble as a leader

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[6] Originally, the area was designed to answer some precise needs: (1) CEA's start-ups needing to stay close to their initial laboratory, (2) SMEs or start-ups wanting to perpetuate collaborations with Leti (3) SMEs or start-ups needed production facilities in clean rooms. Three technological fields are concerned with the project: materials, biotechnologies, microtechnologies.

or as a key partner within different projects, especially the most prestigious programmes i.e. Integrated projects and Networks of Excellence.[7] CEA and INPG shared the scientific leadership of these European projects.

(3) Realization/materialization, including concrete negotiations and implementations.

The two stages "Mobilization of resources" and "realization/materialization" have been strongly interrelated. Meeting all the actors potentially involved in Minatec informally, Jean Therme was able to quickly integrate their feedbacks in his presentation and thus to enrol them. Graph 1 displays the evolution of the J. Therme's strategy from September 1999 to January 2002. There were 102 presentations over a 28 months period.

Please insert Graph 1 around here

From the 102 presentations, we were able to isolate 760 different slides. Co-word analysis (Alceste®) on the slides titles and bodies has been used to visualise the thematic of each slide and their evolution. Alceste clusters the words which co-appear and allows classification of slides into classes. It has been possible to identify five clusters of words, labelled as follows:
Class 1: Minatec's position compared to other national or European clusters;
Class 2: Definition of the concept of the Minatec 'institution-to-be', without it being explicitly named;
Class 3: Scope of Scientific and Technological actors which could be involved in Minatec;
Class 4: Technical and financial concerns about the cluster (inc. Business plan.);
Class 5: Position of Minatec vis-à-vis the CEA institution.

Please insert graph 2 around here

The series of graph 2 displays the evolution of each theme. Even within a generic set of slides, Therme adapts the presentational themes that can be seen changing according to the

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[7] Integrated project and Network of Excellence are two European tools to foster Excellence in Europe.

audience and as the project matures. The following "abnormal" points on each graph can be detailed:

1. The positioning of Grenoble against other districts is not a major issue, and represents less than 15 % of the slides. One possible explanation is that presentations are made to audience who do not need to be convinced of the challenge that faced Grenoble: for example, Motorola who had installed a research centre in Grenoble in 1999, INPG, LETI's sparring partner, the French academy of sciences, internal CEA meetings or those presentations whose object is very specific (such as 25 business plan presentations). By comparison presentations to companies outside the field, or to public authorities, are more likely to deal with the project's positioning in comparison to others.

2. Only six presentations focused on the definition of the concept of Minatec. These presentations targeted audiences who need to be convinced that action had to be taken. They were people who could directly support the entrepreneur in achieving the project, by providing funding or political and/or institutional support. They included early presentations to INPG, as co-supporter of the project, presentations at CEA Grenoble general meetings, to regional public authorities and policy makers, to head of the CEA in Paris (whose agreement was mandatory if the project was to move on to any concrete reality), followed by CEA Grenoble management as soon as agreement had been reached with CEA Paris. One striking point is that the name "Minatec" appeared late in the presentation sequence, in December 2000: before that, neither the project nor its boundaries were given much definition.

3. Usually a fifth to a third of the slides of each presentation dealt with scientific and technological aspects. This proportion was higher for presentations to scientists (at universities, or to CEA's own scientists): perhaps more interestingly, it seems that, for other audiences, the actual content of Minatec was clearly not the main issue.

4. Financial and administrative aspects were also discussed only with selected audiences who were highly involved in the project. The first point signals the presentation to CEA's head in Paris, which was an important hurdle to overcome before the mobilisation process could begin. During the second half of the period, slides dealing with financial aspects represent a majority of the themes (presentation to city council and regional authorities and to INPG). The second point is the peak at presentation 25 (the first presentation to outline

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They are the most well funded programmes to support research.

the various dimensions of the project's realisation, especially funding).

5. Following the CEA Paris presentation, Therme had to convince the management and the employees at CEA Grenoble of the benefits of the emergence of Minatec: many saw the development as implying a threat to CEA/LETI and thus to their own jobs.

The slide presentations gave life and reality to the project, which was deliberately left indistinct at the very beginning, and were designed to enable each partner to position himself regarding the project and its agenda as the Minatec concept evolved. The appearance of the name Minatec was also a highly symbolic event, being unveiled at a meeting with CEA hierarchy, bringing further reality to the vision.

The second element which gave some material form to Minatec was the launch of the website, presenting not only the project, its partners and funding, but also pictures of what it could be in the future, including buildings, clean rooms, etc. The Minatec website offered a view of the future to mobilize the present, promoting Minatec as a concept, as a resource centre, as a training platform and as a science park for start-ups. It presented the potential of Minatec, as well as five key ingredients essential to success:

An integrated approach to innovation, from the exploration of technological breakthroughs to immediate industrial applications. This is essential to negotiate the transition from advanced microelectronics to nanotechnology successfully, for the evolution of heterogeneous micro components and to design tomorrow's smart devices and mobile terminals;

A high concentration of skills and resources, more than 3,500 engineers, researchers and academics would be working at Minatec;

International alliances and partnerships, which confirm Minatec's status as a centre of excellence;

An ambitious policy of ongoing investment: A total of €150m would be invested in Minatec between 2002 and 2005 to fund the new infrastructure, in addition to the €250m invested by CEA-LETI and INP Grenoble. Over the previous 10 years, the microelectronics industry was shown to have invested €4bn in the Grenoble-Isère area;

A talent pool dedicated to science and advanced technology: Minatec was associated with an estimated 17,000 jobs in scientific and academic research, 220 laboratories and five international research centres, 53,000 students and 10 engineering schools together with a powerful local microelectronics industry, comprising 13,350 workers (including 3,000 in research), 30 international corporations, and 20 high-potential start-ups launched in the last five years;

Intermediary conclusion

The graphs of the relative presence of the themes within the slide presentations depict the journey of ideas, and how Therme convinced his partners to climb aboard, even if the vessel did not yet exist. He first emphasised the international challenge to stimulate reactions and commitments. Showing how other clusters were emerging elsewhere was a way to push his potential partners to react, create a sense of urgency. "Look what they are doing, how they organise themselves to innovate. What will happen if we don't do anything"? Therme shared his view that "we must do something to stay in the competition". At the same time, he presented the main concepts of Minatec, which evolved from an indistinct picture to a more precise definition, with name, image and architectural plans.

As anticipations converged to make action a necessity, scientific and technological contents were discussed, as well as the impacts of Minatec on CEA/LETI. Finally, when anticipations were stabilised, contents defined and legitimacy enhanced by EC projects, Therme opened the discussion on financial aspects. He managed progressive lock-in, from creating a sense of urgency to do something, to defining the scientific and technological contents, aligning the relevant actors at each stage. Jean Therme and CEA/LETI appears to be a central actor, with clear leadership, profiting from available assets and managing them strategically. A building construction process is the central feature, which is legitimated by the important role of infrastructure and facilities. One striking point in this case is the relative absence of the national policy makers. Their mobilisation was only indirect, through negotiations with public authorities, CEA – Paris and through national programmes.[8]

3.2 Twente and the NanoNed consortium

The story starts in the region of Twente, in the east of the Netherlands, with an entrepreneurial university, active regional actors, and a world-level nanoscience and technology institute MESA+, with twenty start-ups (not all nanotechs in the strict sense) around it. The Director of MESA+, David Reinhoudt, and a small band of fellow

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[8] In 2005 the French government launched a programme to support centres of excellence. Minatec has been identified as one of five world class centre of excellence, which between them have been allocated 80% of the programme budget.

institutional entrepreneurs, took the lead in setting up NanoNed, a national consortium in nanosciences and technology, which acquired major funding through a government program for knowledge infrastructure. But this is not a linear story, there are twists and turns, and other actors play a decisive role in defining and shaping the eventual outcome.

(1) Articulation of goal, formation and selection of ideas

MESA+ evolved from an earlier conglomerate of groups and institutes in the University of Twente working in the general area of sensors, actuators and micro-systems. By 1999, further mergers with electronics, optics, and materials research groups led to the establishment of MESA+, with special investments in extensive clean room facilities and linked to a TechPark (itself building on predecessors from the early 1990s). MESA+ has high international visibility and is embedded in networks of excellence.

This gradual convergence and the eventual uptake of the label 'nanotechnology' had much to do with the availability of overlapping technology platforms and the possibility of their expansion – which required institutional entrepreneurship. Instead of attempting to expand and consolidate MESA+, which might have been problematic because of the small size of the university and the region, and the limited infrastructure (at the time, no major companies with an interest in nanotechnology were involved), the 'band of four' - David Reinhoudt and his fellow entrepreneurs, the business director of MESA+ and two regional actors – decided to pursue two tracks. One focused on start-ups and support for creating value and mobilising resources from relevant actors, including the national-level Ministry of Economic Affairs. The other focused on the possibility of developing a national-level priority for nano-science & technology. To be credible in pursuing this second track involved joining forces with the two other big centres in the Netherlands, BIOMADE (University of Groningen) and DIMES (Technical University of Delft).[9]. This action relates to a Royal Netherlands Academy of Science's policy of support for nano-science & technology, which had itself been prepared by the directors of the three centres. This dual-track approach highlights two interesting features: how regional cluster-building might require alliances with centres elsewhere, and how a multi-level situation allows positive feedback, i.e. preparing the ground at the national level, for subsequent institutional

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[9] The other two centres are comparable to MESA+ in terms of size, excellence, and links with small and large firms. Both had profited from funding under an earlier round of ICES/KIS, the government

entrepreneurship.

(2) Mobilization of resources, of legitimating/credibility.

In 2000, the three nanotech centres developed a "Masterplan Nanotechnology", following advice from the government Ministry of Economic Affairs, which also suggested funding possibilities, in particular through Dreamstart, a newly established scheme to support small innovative enterprises. Dreamstart embraced this opportunity to focus on nanotechnology to carve out a niche for itself, in a world where ICT and biotech enterprises already had their dedicated support schemes. However, despite early Ministerial support, Dreamstart's lack of linkages with the world of innovation and valorisation led to disappointing progress, and the scheme was reduced to a mediating program with a limited budget. The frustrated 'band of four' and the three-centre alliance had to look elsewhere for funding opportunities.

At the same time (2000) the Ministry of Economic Affairs was considering which themes should be highlighted in preparing for the third round of the ICES/KIS funding program for supporting knowledge infrastructure.[10] At first, nanotechnology was included under ICT, but advisers suggested it should be a separate theme (perhaps combined with micro-systems). The alliance of the three centres would be an obvious candidate to bid for this theme, even though it was more application-oriented than nanoscience and technology could be at the time. The Ministry – via an active senior official who was something of a bureaucratic entrepreneur – made it clear informally to the alliance that it was prepared to exert political pressure to get a nanotechnology proposal accepted, from them or from others. The cluster-building aspirations of the Twente 'band of four' now became secondary to the attempt to access ICES-KIS funding. This shift was reinforced when other actors (TNO, the big applied-research organisation in the Netherlands, and the Technical University of Eindhoven) claimed they should have access to ICES-KIS nanotechnology funding as well, and the Ministry of Economic Affairs accepted these claims and asked two consultants to check the quality and infrastructural capabilities of the various competitors. Their work (May-July 2001) was the starting point in the assembly of a consortium which

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program to support knowledge infrastructure.

[10] The ICES/KIS funding program is part of a general infrastructural support program designed to ensure that government income from sales of natural gas is used for in-depth investment rather than compensating short-term budgetary problems.

eventually had eight partners, rather than just three centres. In other words, the building of a Twente cluster was temporarily superseded by the attempt to secure ICES-KIS funding. The net effect was of stronger interactions at the national level, creating, in effect, a regional cluster (with an internal division of labour amongst the actors) at the national level (the Netherlands is a small country!).

The Expression of Interest for the ICES-KIS call, written and submitted in August 2001, still referred closely to the earlier plans and reports which were added as appendices. The Ministry, through its entrepreneurial senior official, continued its support by making special funding (Nano-Impuls, part of an Innovation Impulse funding programme) available to maintain momentum while the full proposal was written up for the March 2003 deadline. Just as for the Nano-Impuls application, the full proposal involved programs ("flagships") with research projects, as well as separate funding for knowledge infrastructure ("NanoLab") in the form of facilities in the three main centres.[11]

The historical data for 1999-2003 details the shifts that occurred to address resource mobilisation opportunities, as well as the 'boundary' work (defining and guarding the scope of nanotechnology) and the frequent political 'repair' work needed to keep the various actors aligned. In a multi-level situation, an institutional entrepreneur depends on actors at other levels: in this case, the entrepreneurship was shared with Ministry officials, who went out of their way to help realize a Dutch nanotechnology initiative.

Another effect was the need to achieve some semblance of coordination between partners who otherwise might see themselves in outright competition. Cluster participants were positioned according to their specializations with cross-cutting "flagships" at the consortium national level.

(3) realization/materialization, including the concrete negotiations and implementations.

By 2003, NanoNed played a coordination role as its Board was able to be selective in its decisions. Despite this, coordination would not be stable, as participants would grasp opportunities as they see them, while the NanoNed consortium has only restricted influence, as it finances only part of the ongoing work.

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[11] At a very late stage, Philips Company moved from an observer's position (as a Board member, and -with other companies - of the user committee) to that of a full participant of the consortium. Even after the proposal's positive assessment, this created further delays at Ministry and EC levels while checks were made as to whether the funding might lead to unfair competition.

Within the NanoNed consortium, an important part of the funding is allocated to investment in the Dutch nanotechnology experimental infrastructure. Funding worth €8.5M had already been awarded from the NanoImpuls programme and €45M was be made available via NanoNed. The NanoNed consortium agreement allocated funding between three locations in the Netherlands where large nanotechnological facilities are already in place: Delft (DIMES and TNO), Groningen (BioMaDe), and Twente (MESA+). Full co-ordination of this arrangement, enabling use by all consortium participants, was scheduled from 2005 onwards.[12]

The strong involvement of the Ministry of Economic affairs, through the ICES/KIS funding led to a shift from a regional cluster to a national consortium of interrelated specialised clusters. While the institutional entrepreneurs originally saw the consortium as perhaps the only means whereby they could develop their own operations, the consortium now has a life of its own, and the distributed coordination which emerged may turn out to have advantages. Tensions remain, however, and not just between the university groups. Philips Company, formally part of the NanoNed consortium, continues to pursue its own interests, such as the growth of the research campus it has created on its premises and its avowed goal to push for a micro- and nanotech triangle between Eindhoven (where major research labs are located), Louvain in Belgium (with IMEC) and Aachen in Germany.[13] However, Philips does recognize Twente as a centre of excellence for nanotechnology.

Clearly, both joint and competing institutional-entrepreneurial activities will continue while the NanoNed consortium materializes and becomes a going concern.

4. DISCUSSION AND CONCLUSION

The stories of Minatec and Mesa+/NanoNed reveal the emergence of two clusters built at the convergence of existing technological, economic and institutional paths. Clusters do not appear from scratch - they result from long term investment in sciences, technologies, firms and institutions in areas interrelated to nanotechnologies. Several clusters have emerged in

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[12] The programme has a national orientation, and investment decisions link to national objectives. The agreement confirms that the parties together with the boards of NanoNed and NanoImpuls compare proposed investments with the objective of creating this NanoLab NL: local interests are secondary.

[13] "Initiatives by governments, industries and knowledge institutions are rapidly transforming the region between Aachen, Leuven and Eindhoven from an industry-based area to a technology- and knowledge-based economy with potential to rival some of the world's most prestigious regions of excellence." **Philips Research Password***, 19 (April 2004).*

the Netherlands and France (around Toulouse, around Paris, and Strasbourg). In the two countries, the situations were different: the Netherlands emphasising the coordination through the specialisation of each cluster, while in France regions have been competing. Minatec and Mesa+ did not emerge as leading clusters by chance or from a natural process of agglomeration. They resulted from specific cluster-building actions by institutional entrepreneurs who combine different projects into one converging cluster. In both cases, the institutional entrepreneur plays an architectural role to combine blocks of interests from different actors to shape a meta level which coordinates existing organisations. To mobilise actors, they focus on promises, far in advance of the current situation, building on an initially indistinct project outline to create progressive lock-in, as growing numbers of actors become increasingly involved. Inevitably, once cluster materialisation begins, there will be counter-pressures: institutions federated under the cluster umbrella will start to re-assert their specific interests (Grenoble) and/or pursue other alliances and resource mobilisation strategies (NanoNed).

1. Architectural role of Cluster-institutionalising entrepreneur

Table 1 compares the bottom-up building of the clusters in Minatec and Mesa+.

Table 1: Comparison of the process of Minatec and Mesa+ emergences

	Minatec	*Mesa+*
Articulation of goal, formation and selection of ideas	***- Available space close to CEA, open space for projects*** ***- Existing groups to explore different possibilities, in which CEA is involved*** ***- High visibility at the European level***	***- Existing conglomerate in electronics, optoelectronics etc.*** ***- High visibility at the European level*** ***- Alliance with two other Dutch groups (DIMES, BIOMADE) with similar high profile***
	Existing groups which are looking after and designing projects	
Mobilization of resources and credibility	***- High internal commitments of managers at CEA to build the cluster*** ***- Leading of prestigious European projects (Networks of Excellence and Integrated project)***	***- Entrepreneurial univ. of Twente which promote a nanotechnology network*** ***- National incentives to enrol more participants*** ***- At a later stage: Leading of prestigious European projects (Networks of Excellence and Integrated project)***
	Mobilisation of internal resources from the leading organisation ***European project (Network of Excellence and Integrated Project) as legitimacy enhancer***	
Realization/materialization	***- Work on the contents and emergence of the identity (name and website)*** ***- Virtual reality with pictures*** ***- Discussion of funding when the project does already exist*** ***- Cement and equipment before managerial questions*** ***- dissociation of the project management and the management of Minatec***	***- Work on the contents to define the boundaries of the cluster*** ***- Networks rather than cluster, but similar dynamics: coordination and division of labour on paper, before funding materializes***
	Contrasting role of the national level (high in Mesa+ and low in Minatec) -	

Table 1 compares the three stages for Minatec and Mesa+.

Catching an opportunity and building on it

In both cases, institutional entrepreneurs identified spaces where the project could be developed. At Grenoble, it is a physical location, in land around the existing CEA site. In the case of Mesa+, it was the new area of nanotechnology which required coordination, and the result was a 'virtual cluster', where nation-wide co-ordination replaced the 'classic' model of a regional cluster based on physical proximity. Cluster-institutionalising entrepreneurs try to fill spaces which cannot be filled by one single institution. In Grenoble, an extension of one organisation i.e. CEA/LETI would have been seen as an illegitimate hegemony of CEA against academia. In the Mesa+ case, the University and the region of Twente were too small to be able to develop an ambitious nanotechnology programme, but national public authorities stimulated the creation of a network to coordinate research and development on nanotechnologies. In each case, the process of selection of ideas is a process of 'catching an opportunity', and the idea which finally emerges is the one which is broad enough to create convergence amongst different existing projects and is not incompatible with the main stakeholders' goals.

Cluster-institutionalising entrepreneurs are those able to identify such an opportunity, and to build their project on it (Cohen et al., 1994). They mobilize resources from their own institution during the preparation phase and to institutionalise it. Both Reinhoudt and Therme occupy leading positions in their organisation, and thus enjoy legitimacy within their own institution to drive their visions. However, they also depend on others. CEA/LETI's involvement in the project and their support had to be validated by the head of CEA, and MESA+ could only continue only when the Ministry of Economic Affairs facilitated new funding pathways. In addition to their leading institutional positions, their scientific legitimacy and their professional trajectory, allowed them to gather a team of people in leading positions around them. With these contacts, they are able to broadcast their vision around them to leaders of different institutions and mobilise public authorities when they need to, locally in France, nationally in the Netherlands.

These institutional entrepreneurs were able to build on the scientific and technological excellence assessed through the prestigious Network of Excellence and Integrated Project programmes at the European level[14]. The role of the institutional entrepreneur here is not to build such frameworks himself, but to aggregate existing and on-going projects and

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[14] These new instruments in the EC 6th framework programme are designed to identify and support clustering around European centres of excellence.

actions which have been created by different regional or sector leaders, making sense of disconnected projects and activities to underline their convergence and to nurture the activities of the cluster-to-be. Minatec has a geographic basis, within the natural boundaries of Grenoble, while NanoNed is a national network, but still with good geographical proximity of the participants. For Mesa+, the delineation of those who are part of NanoNed and those who are outside was part of the game in terms of mobilising additional resources, especially access to national support structures.

Cluster-institutionalising entrepreneurs develop an incrementalist strategy to be able to surf on any opportunities to promote their specific project (Balogun & Johnson, 2005). Legitimacy from European projects boosts their visibility, and they can take advantage of their position in their own organisation to mobilise resources. During the two first stages, the main role of institutional entrepreneurs is to combine projects and interests to give shape and definition to the project. At the start of the process, boundaries become defined step by step, according to who decides to participate and support the project. Thus the process of selection of ideas is also a process of selection of allies and enemies. The institutional entrepreneurs simultaneously shape definition of what is meant by nanotechnology and the boundaries of the new institution. They shape and reshape rules and coordination, building an institutional architecture (especially institutional frontiers) according to the blocks of interests they need to include.

Context appears to precede content. In Grenoble, Therme acted to give reality to his cluster before its actual existence. First came the name and the website, then virtual images and film of the buildings. Subsequently Minatec's visibility included buildings of thousands of square meters, ensuring the vision had some concrete existence before funding, agreements and management principles were finalized. In the NanoNed history, arrangements such as division of labour were drafted in order to mobilize funding but, to be credible to sponsors, started to take effect before actual funding and subsequent work began in 2005.

Stirring up the mayonnaise

The cluster-institutionalising entrepreneurs use the threat of competition to create a sense of urgency, which they then use to motivate different blocks of interests (academic ones, public policy ones, economic ones) to combine under a common umbrella - the cluster. They are somewhat in between a cook and an architect. The main engine of institutional entrepreneurs is the long term vision that they develop of what the cluster could be if they succeed in taking the various actors along with them. They thus redefine tactics and

rephrase the formulation of existing activities to nurture the cluster and increasingly validate its constitution through progressively enrolling and locking partners in. As in preparing a mayonnaise, they create linkages and emulsion between separated and disconnected components. They have to manage the critical moments: when to stir it up and when to negotiate, to create lock-in and irreversibilities. The cluster becomes institutionalised as buildings, rules (cooperation principles, access to equipments, and mobilisation of human resources), coordination (sharing equipment, etc.), funding and organisation (offices, technology transfer mechanisms, etc.) sign up to the vision. Lock-in appears at different stages of the emergence of the clusters: as the idea takes shape, entrepreneurs negotiate with actors to integrate blocks of interests, reshaping rules, coordination mechanisms and cluster frontiers in the process. Such creation requires that the entrepreneur create institutional linkages, bridging across structural holes to connect separated elements.

2. King of the backyard versus Duke of a continent

Cluster building entrepreneurs tend to extent their span of control (to become a Duke of a continent) even if it leads to a loss of influence of their organisation (Kingdom). They develop a twofold strategy: delaying consideration of effects on parent organisation until it's too late to withdraw and trade off of 'buying' acceptance of the cluster in the parent organisation by giving it an important role, and its managers significant positions, in the cluster.

As institutional entrepreneurs focus far forward, tensions with their institution remain weak as there is no immediate threat. All interest is mobilised around the promised vision, and discussions on the potential effects on the institutions are postponed. The strategy to overcome potential resistance was an incrementalist strategy built around promises. Agreements on promises delay the discussion of the potential consequences for the institution. Only few actors have a clear enough vision of what the future could be to anticipate potential problems within organisations – but they are likely to be those who are promoting the cluster (Hailey & Balogun, 2002). However, as the project becomes more precise and more real, it also becomes more challenging for the organisation, which must then enter into a sharp negotiation with the institutional entrepreneur who appears to be a traitor, playing for the interests of the cluster rather than defending those of his own employer-institution.

During the institutionalisation process, there is a bargaining between a partial dissolution of the organisation's identity and influence to the benefit of the cluster and in return a leading position for managers of the organisation (Univ of Twente and CEA) in the cluster. For CEA or University of Twente, deinstitutionalisation means de-alignment of actors within the organisation to be able to strengthen the alignment of actors in the cluster. However, the relations between the institutional entrepreneur and his institution are facilitated as they are based on mutual trust. J. Therme and D. Reinhoudt have experienced different positions in the organisations involved in the cluster at different stages of their careers, and thus have internal credibility and networks to rely on. In addition to their individual mobility within their regional organisation, the Cluster-institutionalising entrepreneurs benefit from networks of the managers who were their colleagues. David Reinhoudt has been the leader of a small band of fellow institutional entrepreneurs while Jean Therme has a group of 5-6 managers with whom he has been working for more than 5 years at least. During the emerging phase of Minatec, all of these managers were in charge of one of the project's dimensions, according to their professional or political competencies (one of Therme's colleagues was a political decision maker in Grenoble).

3. Overall conclusions

The paper analyses institutions in the making. The two cases studies describe the emergence of two clusters, from the idea or the vision of a band of leading people to its transformation into buildings, funding, structured networks and scientific projects, R&D facilities and an attractive location for R&D departments. Institutional entrepreneurs build on opportunities when new possibilities create openings. Both entrepreneurs mobilised resources from their institutions to enrol actors around their vision, and to establish their legitimacy for leading the project. Their long-term vision highlights the gap between the existing situation and the potential future, emphasizes the need to act so as to remain in a competitive worldwide position, and allows them to bypass immediate resistances. Their strategy to bring the promise of nanotechnology to reality entails building their new institution from the 'outside' in order to be able to create a working 'inside', and delaying the confrontation with existing institutions until the third phase. They build on the strength of their own existing institution in the first phase, but eventually it will have to change for the new institution to be realized. The de-institutionalisation process is never addressed directly until after it becomes a fait accompli. In both cases, Minatec and Mesa+ are

presented as a chance to make the organisation bigger, more visible, and to leverage resources. Each organisation involved in Minatec or Mesa+ is presented as the leader of one dimension, be it scientific, economic or technological.

The nature of the new institution is different in the two cases: a new lab is built in Grenoble while in the Netherlands a new level of coordination and funding allocation is created. The process of institutionalisation i.e. articulation from the beginning (Grenoble) vs. emerging articulation (Twente) – does differ, but less strikingly so than we thought originally. Jean Therme is not the lone hero conquering all, and David Reinhoudt does have his continuing goals that he tries to realize. The shape of the coordination achieved will be different because of the geographical openness of Twente and the naturally enclosed region of Grenoble. Although such local and regional elements can sometimes have significant effects, both Twente(+) and Grenoble are active and visible nationally and internationally, since strategic science and matters of ongoing nanoscience and technology have became globally important (Bathelt, Malmberg, & Maskell, 2004; Rip, 2002).

The paper illustrates the multilevel action of institutional entrepreneurs who build on their own legitimacy to access resources at the local and group levels, make sense of loosely coupled actions to illustrate the reality of the potential institution, and thus mobilise international resources and legitimacy to finally secure national funding.

As they create institutions which structure networks (Brass, Galaskiewicz, Greve, & Tsai, 2004), institutional entrepreneurs are part of path creation dynamics. As new institutions emerge, their founding entrepreneurs lose control of their trajectories, and go from leading evolution to being led by the emerging momentum. Ironically, this phenomenon is already visible: to succeed in the Netherlands institutional entrepreneurs had to mobilise resources and allies which have then shifted the thrust of the original intentions,[15] while in the new buildings at Grenoble scientists have tended to re-erect borders between Minatec's constituent organisations.

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[15] Similar dynamics in political mobilisation, cf. Schattschneider, and the specific examples in Petersen & Markle, Expansion of Conflict in Cancer Controversies, where the expansion, necessary to create political support, allowed other actors and other considerations in which undermined the thrust which the (political) entrepreneur started out with. James C. Petersen and Gerald E. Markle, Expansion of Conflict in Cancer Controversies, in Louis Kriesberg (ed.),* Research in Social Movements, Conflicts and Change*, Vol, 4, JAI Press, Fall 1981, pp. 151-169.

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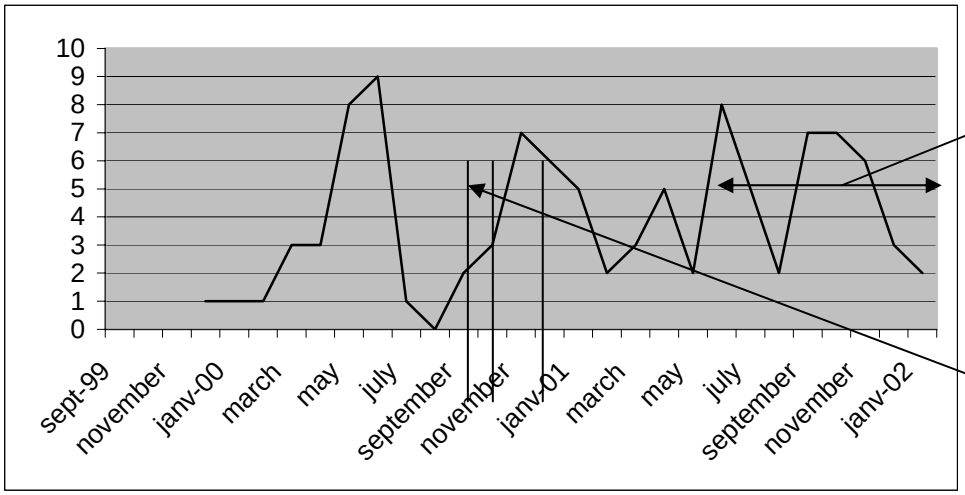
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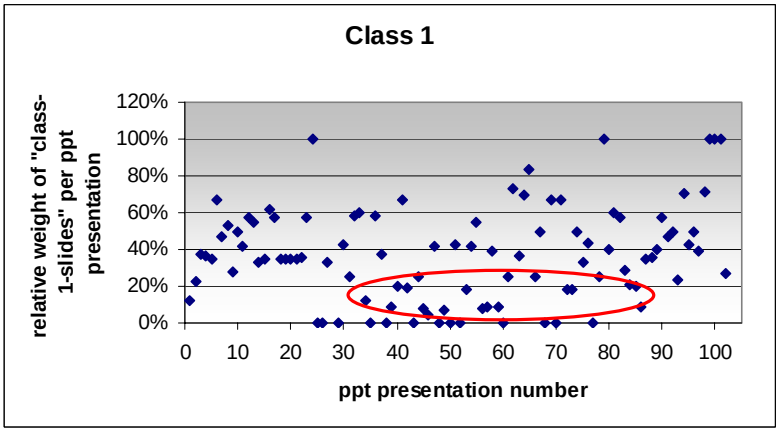
Graph 1: Number of presentations during the emergence phase

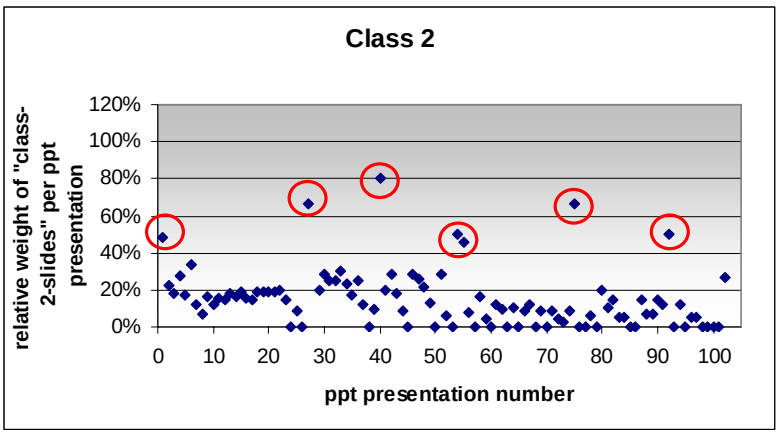


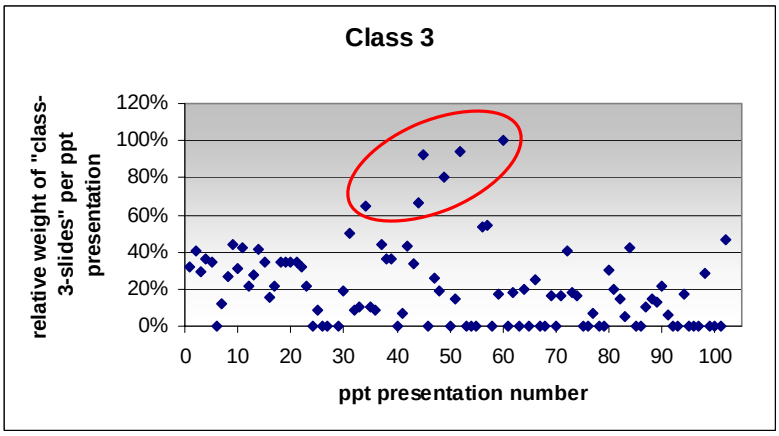
Intense meeting period in Therme's agenda. From June 01 on, there are 2 to 3 meetings per week directly in relation to Minatec (it is also the time when a Minatec team appears.

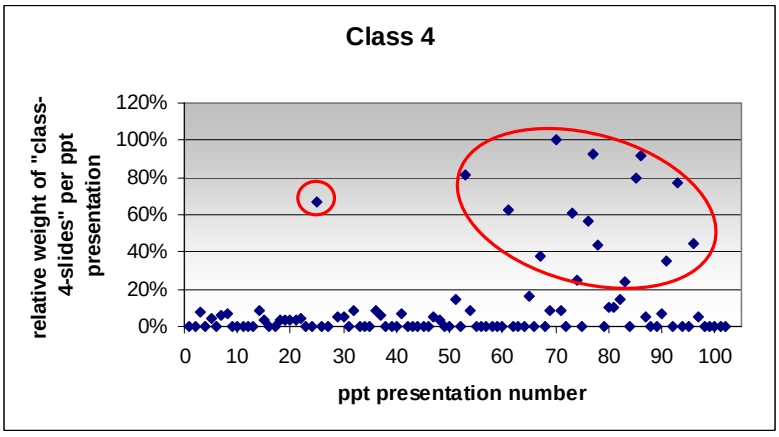
Convention version. The sept/oct activity is linked to the presentation of the project to A Costes from the French ministry of research early October

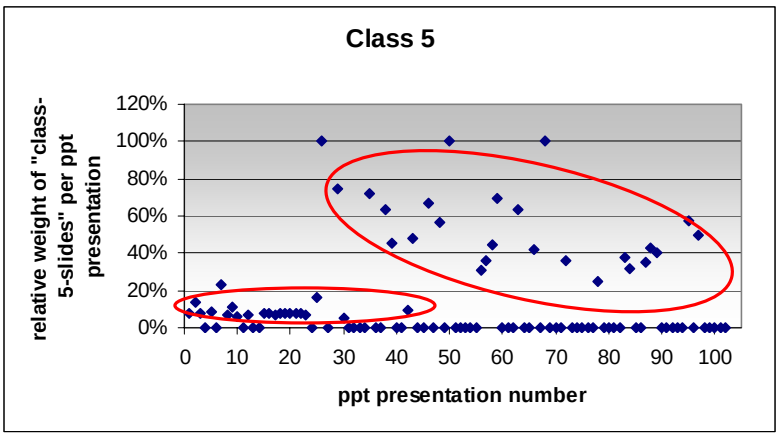
Graph 2: Evolution of themes importance




Class 2
relative weight of "class-2-slides" per ppt presentation
120%
100%
80%
60%
40%
20%
0%
0
10
20
30
40
50
60
70
80
90
100
ppt presentation number


Class 3
relative weight of "class-3-slides" per ppt presentation
120%
100%
80%
60%
40%
20%
0%
0
10
20
30
40
50
60
70
80
90
100
ppt presentation number


Class 4
relative weight of "class-4-slides" per ppt presentation
120%
100%
80%
60%
40%
20%
0%
0
10
20
30
40
50
60
70
80
90
100
ppt presentation number



Class 1: MINATEC's position compared to other national or European clusters;

Class 2: Definition of the concept of the Minatec 'institution-to-be', without being explicitly named;

Class 3: Scope of Scientific and Technological actors which could be involved in Minatec;

Class 4: Technical and financial concerns about the cluster (inc. Business plan.);

Class 5: Position of Minatec vis-à-vis the CEA institution.