VOL. 2, NO. 2, April 2013

International Journal of Economics, Finance and Management

http://www.ejournalofbusiness.org

Organizational Trajectory and Embedded Knowledge: Case Study of the French Industrial Cluster

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ABSTRACT

Research works have not yet shed much light on the performance of organizational trajectory, which is considered a crucial competitive asset for businesses. The aim of this publication is to highlight the link between knowledge embeddedness, the historical evolution of a cluster, and the performance of its consequential trajectory. Embedded knowledge may very well influence the performance of the trajectory. We put forward a conceptual model and a case-study carried out with an industrial cluster. Our research has led us to highlight some types of managerial behavior supporting the embedded knowledge which will ensure a long-lasting performance of the cluster.

Keywords: *Cluster, embedded knowledge, historical sequences, long-lasting performance, organizational trajectory*

1. INTRODUCTION

Very few recent publications (Sydow and Koch, 2009:689) provide references as far as clusters trajectory is concerned. Seen from that angle, Mahoney's model of a reactive trajectory (2000) provides a first idea of the influence of historical processes. However, these two theoretical trends of research do not answer the questions which may be raised concerning the specific features of some kinds of long-lasting trajectories. Therefore, a better understanding of the factors which may positively influence the performance of clusters trajectory is now considered an important subject of research work. (Arikan, 2009). Organizational approach based on knowledge has progressively become a more and more essential element in the explanation of a cluster's performance. (Eisenhardt and Santons, 2002). The research carried out with this approach in mind has focused on the study of contexts in which the contribution of knowledge is emphasized (Bassanini and Dossi, 2001; Child, 1997). The resulting studies highlight the embeddedness of the choices and actions made by organizations in their routines and practices, as embedded knowledge represents a "re-interiorization" of the knowledge accumulated in the past. In this perspective, a lot of research work has been carried out, resulting in the elaboration of the theory about clusters based on knowledge (Maskell, 2001). A cluster has then been conceptualized as a place where knowledge creation is stimulated. Studies have shown the benefits clusters draw from their innovation capacities, and which contribute to their competitive advantage. (Porter, 2000; Tallman and al, 2004). Many factors aiming at explaining the success of a cluster have been suggested. Taking this analysis as a starting point, the question which has prompted our reflection in this publication can be expressed in the following words: what is the role of embedded knowledge (whose perpetuation can be historically observed) in the evolution of a cluster's trajectory? In the first part of this publication, we shall define the concepts of cluster's trajectory and of knowledge embeddedness, in order to underline the fact that bringing the two concepts together is very significant as far as the performance issues of a cluster are concerned.

In a second part, we shall then put our theoretical reflections to the test, confronting them with a case-study carried out in a regional cluster. This research work aims at showing the influence of embedded knowledge on a cluster's trajectory. We shall then be able to submit our views to a discussion, and to underline the fact that there is indeed a link between embedded knowledge, the longitudinal evolution of a cluster, and the consequential performance of its trajectory.

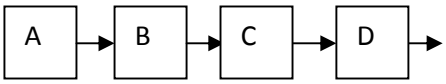
2. "CLUSTER'S TRAJECTORY" AND "EMBEDDED KNOWLEDGE": A PROFITABLE LINK

We shall define cluster's trajectory as the itinerary completed by a cluster when it has to face the social, cultural and scientific changes of modern times. Nowadays, it is unquestionable that a trajectory has to be defined and followed, and the actors' embedded knowledge may very well have an influence on its successful evolution.

2.1 Cluster's Trajectory

The study of a trajectory, which belongs to the sphere of exact sciences, is usually considered as a mathematical equation based on the fundamental principle of dynamics. Using this theory as a basis for his reflection and applying it to the social sciences, Mahoney (2000) puts forward a model of trajectory resting on a study of reactive sequences. These sequences represent a succession of events to be considered in their chronological order and which are causally linked. They are reactive in the sense that the occurrence of each event is partly a reaction to events which took place before. The trajectory is therefore specifically based on this succession of historical sequences during which causally linked events set institutional models in motion, whose trajectories consequently have specific features.

(Mahoney, 2000:507). In a model of this kind, a central event B is considered the consequence of a previous event A, and at the same time the cause of a next event C … and therefore a trajectory emerges from this succession of reactive sequences:



Research work on trajectories has mainly dealt with the analysis of sequences whose main feature was the creation and the long-term reproduction of a given institutional model. (Mahoney, 2000:514, Sydow and Koch, 2009:692). The order in which changes take place along an organizational trajectory can therefore be defined as follows: it is the order in which important influences on the final result are exerted, even by events remote in the past (David, 1985:320). The above-mentioned elements shed some light on the existence of trajectories, but they are not exhaustive and may be debated. We think that the lack of theoretical documents dealing with the trajectory of an organization generally derives from a lack of understanding of the knowledge involved during its progression. In other words, the combination of historical elements on the one hand, and of knowledge sciences on the other hand, may enable the research worker to study the successive episodes of the cluster's trajectory.

2.2 Knowledge Embeddedness

Recent research work about knowledge embeddedness provides a firm foundation stone when one seeks for an explanation of how the constitution of business networks take place (Nielsen, 2005; Cowan and Jonard, 2009; Cowan and al, 2007; Rowley and al, 2000).

Firstly, knowledge remains embedded in a group of companies, for they preferably keep up with their former partners ties whose interaction validity has been historically proven. Cowan and Jonard (2009) maintain that companies holding a common knowledge use this knowledge similarity in order to form corporate alliances and to organize themselves so as to create innovative networks. As such strategic alliances are taking place, the relation embeddedness between the companies within the network plays an important part in the creation process of synergies concerning their knowledge (Nielsen, 2005). The constitution of such structural networks is closely linked to the historical embeddedness of knowledge and common relations. This relational and structural embeddedness exerts an influence on the incremental and radical extent of industrial innovation (Ferrary, 2008) and on the nature of the networks set up by the innovative companies within an industrial cluster (Cowan and al, 2007; Rowley and al, 2000).

Secondly the embeddedness of the companies' knowledge derives from the importance of tacit knowledge and of the necessity of face-to-face interactions, in order to create and spread new ideas (Audretsch and Feldman, 1996). A very compact regional structure allows companies to keep up a high frequency of the required interactions in order to establish a common language, as well as common definitions and solutions to heuristic problems which could never be codified otherwise. Von Hippel (1994) empirically demonstrates that tacit knowledge exchanges depend on long-lasting stable relations, and on shared language and tradition. These exchanges thus remain embedded in the local context of the companies concerned.

Thirdly, research workers and professionals underline the fact that knowledge embeddedness in manufacturing and services is a key-element in organizational successful performance (Arora and al, 2001). In many organizational circumstances, a great part of organizational knowledge is embedded in the people at work (Starbuck, 1992). Indeed, Milton and Westphal (2005) demonstrate that the dynamics generated by a close identification with members of another professional group, which is embedded in a wider social structure, increase the professional efficiency of both groups. This very significant identification, when it is combined with a wide range of expertise within a multidisciplinary and multifunctional professional group, stimulates the group's performance (van der Vegt and Bunderson, 2005). One of the main explanations of the reason why a great diversity of expertise has a beneficial influence is that knowledge diversity is an incentive for a more active research and learning behavior leading to innovative and adaptative solutions.

Finally, many studies demonstrate the geographic concentration of innovation, and prove that knowledge evolutions are very likely to take place in networks of companies which are geographically embedded in the same region (Audretsch and Feldman, 1996). This high frequency of face-to-face interactions between companies sharing a common activity not only facilitates a rapid regional circulation of new tacit knowledge, but also stimulates a localized innovation. Mc Evily and Marcus (2005) state in their conclusion that embedded links have a direct influence on the competitive capacities which are necessary for the preservation of an appropriate trajectory.

3. CASE STUDY AND ITS RESULTS

In order to assess all the elements resulting from the theoretical research work about the embedded knowledge which may influence a clusters trajectory, we shall now put forward a case-study, in order to submit our views to discussion and present possible fields for future research work. The nature itself of the purpose of our research work has led us to select a qualitative method when dealing with this case study (Yin, 1994). This method emphasizes the understanding of the existing dynamics inside one particular environment, and will focus on a specific field of investigation. In our strategy of

research, this case study is intended as a preliminary and preparatory approach. As a matter of fact, our research work is aiming at a more wide-ranging process of support of innovative projects. Its context is the regional cluster of aromatic and perfume industry located in Grasse, in the "department" of Alpes-Maritimes in France. In all, we have identified 91 aromatic SMEs coexisting within this cluster. These companies are 40 years old on average. This high average age is due to the presence of several businesses more than a century old, which reveals how deep aromatic industry is embedded in the local economy. This industry, in Grasse and in the area around Grasse, provides about 3,500 jobs which have nowadays been integrated into the aromatic pole of development. The companies in the area of Grasse are closely inter-related by family or business links. Indeed, numerous aromatic firms coexist, very close to each other, on a very limited territory. French and foreign multinational companies cohabit with independent family businesses. This regional cluster is remarkable as it had the capacity, through the ages, to appropriate new techniques as soon as they were invented. In order to describe the trajectory of this cluster, we have resorted to bibliographic sources (Périn, 1996), to the vast internal documentation of the companies, and to 35 semi-directive interviews. We have then been able to recapitulate the historical facts which highlight the decisive stages of this trajectory.

3.1 The Main Stages of the Trajectory

The following presentation of the trajectory of the Grasse regional cluster, which appears to be a succession of clearly distinct phases, should not screen the way these successive changes actually took place. These changes took place in almost continuous succession. We have described the course of these changes by dividing them into distinct phases as we meant to identify the most characteristic sequences of the whole evolution. Therefore, our graphic presentation (diagram 1) leaves aside the continuous aspect of the evolution, whose progression took place in a flow rather than in a succession of distinct punctuated stages.

- The first documents about a perfume manufacturing process were written about 300 B.C. Théophraste d'Érossos described the effleurage process, a technique to extract the perfume of fresh flowers on a fixed greasy support. This technique is the oldest known extraction process (Gontier and Ellena, 2003). The process of cold effleurage of roses on sesame seeds is first described in the 11th century in Persia. The starting point of the trajectory is the day when the Iranian doctor and philosopher Ibn Sină, known in the western countries as Avicenne (980-1037), invented the still.

- Perfumery as a craft appeared between the 17th and the 18th century. A royal patent letter (with the royal seal stamped on it), dated January 1614, acknowledged the craftsmanship of glovers and perfumers, who could then be called "masters glovers" and "masters perfumers": this letter represents another landmark on the trajectory. On 11th February 1729, the Corporation of glovers – perfumers is officially ratified by the Provence Parliament.

- The gradual specialization of the craftsmen in perfumery brought about a beneficial reorientation of the trajectory thanks to the expansion of distillation (transfer of fragrant molecules carried along by steam). Peasants used to travel all over the country in order to distil aromatic plants they had harvested in the wild, using a heated iron still fixed on a cart. The spreading of the old effleurage process on crushed oleaginous seeds (cold effleurage) in the 1750s led to the manufacturing of high-quality perfumed pastes or powders. Fargeon, a perfumer from Grasse, then became the official perfume provider of Queen Marie-Antoinette.

- Aromatic industry in Grasse started between 1820 and 1900; at the same time, the cultivation of aromatic plants developed and the workshops moved from the town centre to its suburbs. As the cold effleurage techniques used fresh flowers, the cultivation of these flowers was moved next to the factories. The creation of some of these factories, which still exist today, dates back to those days: Roure-Bertrand-Dupont (1820), Robertet (1850), Payan-Bertrand (1854).

- Another decisive curve of the trajectory took place in 1860, as the stills were modernized: as they functioned better, floral waters of higher quality were made. This period, when the production of the required plants for perfume making was in great expansion, brought about a clear upward curve of the trajectory: there were 61 perfumeries in 1846 and 79 in 1866. The perfumery products made in the Grasse industrial cluster were exported worldwide.

- The first experiment of extraction of fragrant substances with ether as a dissolving agent took place in 1835: it was a revolutionary innovation which had a significant impact on the evolution of the cluster's trajectory. The ancient and long-acknowledged craftsmanship became obsolete, the effleurage techniques gradually disappeared. The trajectory leading Grasse to the status of world capital city of perfumery was decisively influenced by the four following innovations:

    - In 1869, Laurent Naudin perfected a high-performance device for the extraction and distillation of the solvent containing fragrant substances,
    - In 1870, Louis Roure, a Grasse perfumer, first experimented the use of benzene for the extraction of fragrant substances,

- In 1898, Léon Chiris initiated the first workshop for an industrial exploitation of the process of extraction with solvents. This new technique prevailed over the effleurage technique which had become too expensive. The extraction with solvents led to an internationalization of the market of raw materials, and resulted in the progressive disappearance of the local productions of perfume plants,
- In 1904, Charles Garnier, from Grasse, conceived a rotary device for the extraction with solvents, and started to open workshops abroad.

- From the year 1935 onwards, considerable progress in the analysis of organic substances was achieved, which made it possible to identify the constituents of natural essences. The techniques based on chemistry of synthesis were prevailing at that time in Grasse. At the beginning of the 1950s, the Grasse area controlled 95% of the world market of aromatic raw materials.
- While decolonization, as well as the developing European markets of parallel importations of raw materials in London and Amsterdam, could have inflected the trajectory, its itinerary was maintained and boosted by another series of innovations:

- As early as 1960, the great development of food aromas in Grasse followed the progress of farm-produce industry and the evolutions of the way of life.
- From 1965 onwards, the development of the activity of perfume making is linked to the process of decolonization. The decline, and therefore the downward curve of the trajectory following the declining Grasse production of aromatic plants, became inexorable, though this decline was slowed down by the excellent quality of local raw materials.
- In 1970, the technique of “headspace” which was originally used in the search for oil was first resorted to in order to analyze and reconstitute olfactory molecules.
- Finally, weighing robots started to develop in Grasse in 1990. The latest innovations, which have always been closely linked to a natural way of life, are to be regarded in relation with sustainable development. For instance, in 2007, the discovery of artificial dermis resulted in the ending of animal tests, and the cluster then turned towards the preservation of biodiversity. Its turnover, in constant progression, reached 650 million euros in 2012.

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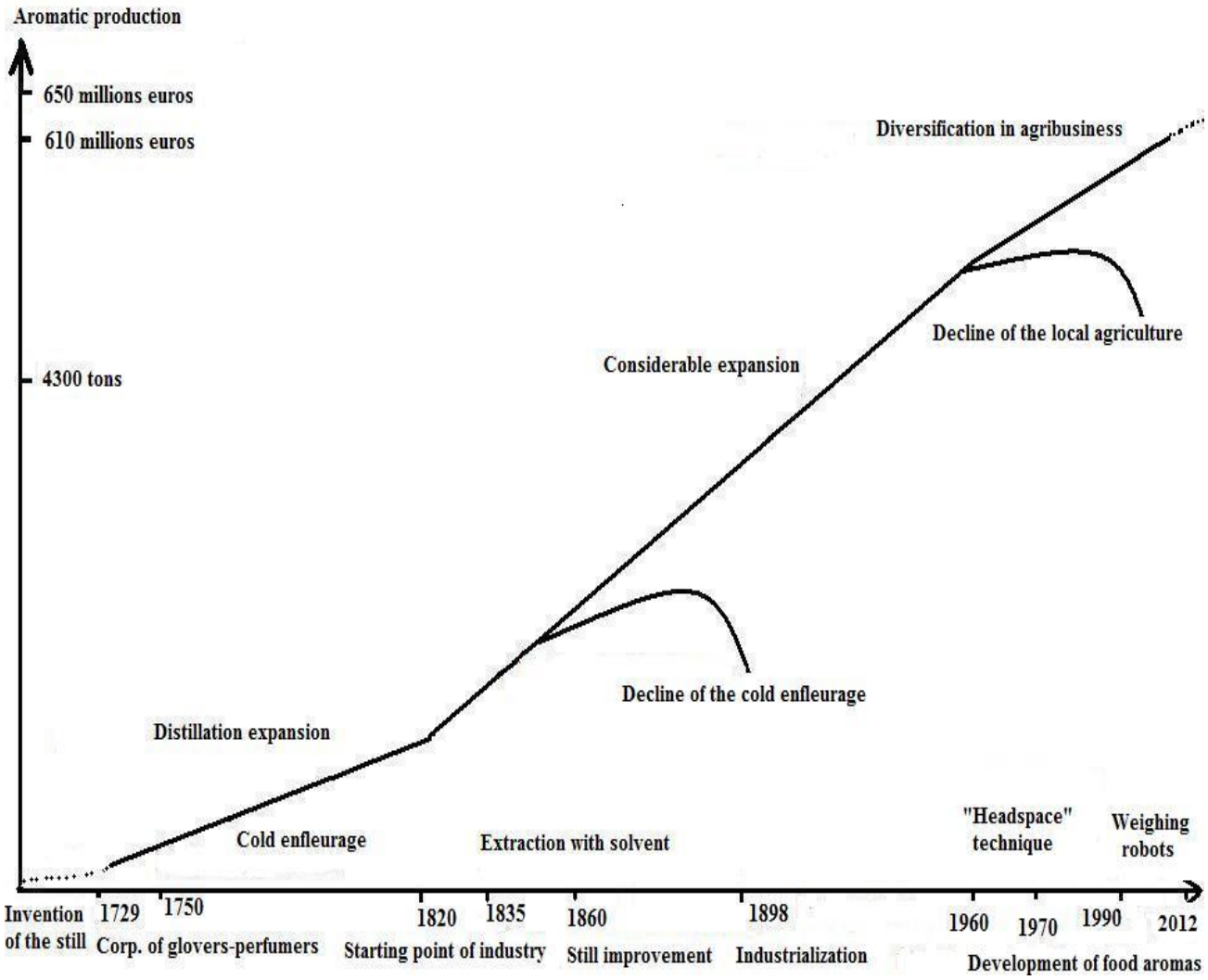

Diagram 1: Trajectory of the Grasse regional cluster

3.2 Knowledge Embeddedness

As the analysis of its trajectory shows, the Grasse industrial cluster has a high potential for adaptation. Knowledge embeddedness, which has followed the trajectory all along, then appears to be a constant element of crucial importance. Indeed, knowledge develops (table 1) according to Clark's typology; it is preserved or transformed as innovations are under way. Upstream knowledge is applicable to the initial part of the production line: the cultivation of fragrant flowers, the extraction and refinement methods of the products obtained. Downstream knowledge is applicable to the final stage of the production line: research and development, creation, perfume composition.

Table 1: Evolution of the knowledge of the cluster (described according to Clark's typology, 1987:62)

Upstream knowledge	**Downstream knowledge**	
	Preserved	**Transformed**
Transformed	*Upstream* - Distillation (transfer of fragrant molecules carried along by steam) -Cold effleurage	*Revolutionary* Extraction with solvents
	Innovation	
	Normal Specialization of tanners in	*Downstream* - Specialization in food aromas

Preserved	the making of fine gloves	-Specialization in perfume composition -"Headspace" technique - Weighing robots

As they are used to living and working together on a small geographical territory, the professionals of the Grasse cluster have gathered the knowledge required to sustain the trajectory of their industry.

4. DISCUSSION

Clusters have become a widespread structure of industrial organization, and their innovative capacities are considered a key source of profit in regional and national competition. The research work recently conducted raises the following crucial issue: if the capacity of a cluster to create new knowledge varies in time, how can the cluster maintain this capacity at a high level in the long run? (Arikan, 2009). Our overall research work has demonstrated that it is significant to appeal to knowledge embeddedness to answer this question. Our research work admittedly is not representative of all existing organizational trajectories followed by clusters, but it highlights some elements which can be used as a basis for debate.

The basic idea of this research work is that companies within a cluster have issues to face as far as their knowledge is concerned, which they have to answer in order to preserve their performance in the long run. As we have adopted the theory about clusters based on knowledge, we have been led to consider the managerial behaviors which may support the existence of some embedded knowledge. In our study, the principles of management remain respectful of the values inherent in regional and relational macro culture; they are concerned about the preservation of the high-level social capital. As a matter of fact, managers, as well as their executives and technicians, hold and perpetuate the same knowledge, which became embedded as it was transmitted from one generation to the next.

Other investigations would be required in order to ascertain a generalization of these results. For instance, the study of the interrelation between the performances of a trajectory and embedded knowledge could be extended to other types of clusters which have been prosperous for several centuries. As an example the cultivation of vineyards and wine-making rest on tacit and highly contextualized knowledge, and may represent a potential subject for further research.

We have conducted our study with three objectives. Our first objective was to elaborate a model in order to obtain a better understanding of the impact of embedded knowledge on an organizational trajectory. The second objective was to put forward an empirical test in order to highlight the influence of knowledge on the sequences of a trajectory. The third objective was an approach of the link between knowledge embeddedness and the longitudinal evolution of a cluster, which results in a certain degree of performance of the consequential trajectory.

The results of our research work have led us to the following conclusions:

Knowledge embeddedness in companies which are highly concentrated in the same region results in and depends on the frequent occurrence of face-to-face interactions, and a high level of the actors' collective efficiency. Our case study underlines the fact that knowledge embeddedness stimulates the interpersonal exchanges which are required for the transmission of tacit knowledge. The sources of innovations therefore spring from some specific tacit locally exchanged abilities, and from localized skills. Our research work describes the impact of a succession of innovations on the longitudinal evolution of a trajectory; it then submits to debate the link between knowledge embeddedness, the longitudinal evolution of a cluster and the performance of the consequential trajectory.

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