“Regional learning networks

in medium tech technologies and European integration”

Riccardo Cappellin* and Luigi Orsenigo**
* University of Rome “Tor Vergata”
** University of Brescia

cappellin@economia.uniroma2.it, luigi.orsenigo@uni-bocconi.it

Paper to be presented to the
46th European Congress of the Regional Science Association
Volos, Greece August 30 – September 3, 2006
Paper n. 334

IKINET
International Knowledge and Innovation Networks

for European Integration, Cohesion and Enlargement

Contract N°: CIT2-CT-2004-506242
http://www.economia.uniroma2.it/dei/ikinet/

IKINET partner institutions:

Università di Roma "Tor Vergata" (coordinator)

University of Wales, Cardiff

Ruhr-Forschungsinstitut für Innovations- und Strukturpolitik

Centrum Badan Przedsiebiorczosci i Zazadzania Polskiej Akademiiauk

Joanneum Research Forschungsgesellschaft mbH

Institut National de la Recherche Agronomique

Universidad Autonoma de Madrid

Applica sprl

1. Introduction

In this paper, we try to summarize and discuss some of **the main linkages** between**:**

- **the territorial dimension of the cognitive processes.**
- **the cognitive micro-foundations of agglomeration economies**

In particular, we focus attention on **the process of knowledge creation** which occur **in clusters specialized in medium technology sectors,** rather than in high-tech industries which have been more extensively studied.

Specifically, we argue that in this kind of industries the innovation process presents three important characteristics (section 2):

- it has an **interactive dimension**;
- it has a **re-combinative character**, i.e. it is largely based on the use of (often) already known concepts and elements, the recombination of which leads to original improvements in products and processes;
- it is mainly based on the use, transfer and creation of **tacit and local knowledge** through **informal searching processes**,

These properties of learning involve important spatial and relational dimensions, which go **far beyond the notion of localised knowledge spillovers**, which has been often used in economic models, and allow to consider **the forms of knowledge transfers within regional networks** and **the spatial factors of cognitive processes** (section 3).

Finally, we suggest that **regional innovation policies** should design appropriate methodologies in order to promote the creation of a "learning region" and that **the approach of Territorial Knowledge Management (TKM)** can be useful to this task (section 4).

Previous works:

Cappellin, R. (2003a), Networks and Technological Change in Regional Clusters in Bröcker, J., Dohse, D. and Soltwedel, R. (eds.), **Innovation Clusters and Interregional Competition**, Springer Verlag, Heidelberg, 2003.

Cappellin, R. (2003b), Territorial knowledge management: towards a metrics of the cognitive dimension of agglomeration economies, **International Journal of Technology Management**, Vol. X, n. X.

Papers presented at the 2006 ERSA congress, Volos:

Massimiliano Bianca, *Riccardo Cappellin*, *Eugenio Corti* (paper number 643):
Strategy for innovation and knowledge creation in the Aeronautical Industrial Cluster in Campania Region.

Riccardo Cappellin, Immacolata Caruso and Giuseppe Pace (paper number 458)
Intermediate institutions for interactive learning processes in a governance perspective: the case of aeronautic industry in Campania region

2. Innovation as the outcome of processes of knowledge accumulation and interactive learning

2.1 Some basic properties of learning: the contribution of cognitive economics

The **type** of the external **stimulus**
The **strength** of the external **stimulus**
The search for **consistency and integrity** and the process of adaptation
Innovation requires the search and the integration of **complementary resources and capabilities**
Interactive learning as a key process in knowledge creation
Knowledge creation is characterized by **path evolution**
The key **role of institutions** in the knowledge creation process

2.2 The role of tacit knowledge in interactive learning

The concept of tacit knowledge is usually defined in a residual perspective as it is **confronted to the concept of codified knowledge.**

However, tacit knowledge could be better interpreted as **a complex set of capabilities,** which are localized or **idiosyncratic and cannot easily be transferred**, rather than as a stock or a **resource**.

In particular, tacit knowledge may refer to competencies which explain **how each actor behave or how he interacts with other actors,** such as**:**

a) Tacit knowledge and the behaviours of the individual actor:

- **receptivity** or capability of **patternmaking and interpreting "weak information";**
- **attitude to risk taking,** entrepreneurship and forward looking;
- **creativity** and capability to **combine different fragments of existing knowledge** in an **original or creative way (**i.e. synthetic or propositional knowledge);
- **problem solving** and the capability to **combine different technologies in solving applied problems** (i.e. prescriptive or procedural or symbolic knowledge);
- **capability to learn,** through the **creation of new routines and heuristic procedures** and **combining "exploration" with "exploitation".**

b) Tacit knowledge and the interaction between different actors:

- **automatic coordination, as** actors jointly **react to external stimula in an automatic way** according to specific **"routines**";
- **learn together,** through **interactive learning processes**;
- **reputation and leadership/governance** capabilities based on esteem and thrust.

Tacit knowledge is both the result and **a factor facilitating the process of interactive learning**. In particular, tacit knowledge plays **a key role in the informal process of searching** for a solution to local problems, which is **particularly important in the innovation adoption by SMEs or in medium technology sectors** and which is different from the formal search characterising the R&D activities.

It may be argued that **tacit knowledge**, while being more difficult to transfer among distant agents, **might be easier to recombine than codified knowledge**. If the "codes" inherent in different bodies of codified knowledge are **excessively stringent**, they can impose univocal interpretations and therefore **rigidities** in the use and modification of knowledge itself. Moreover, the codes underlying different bodies of knowledge can be **incompatible with each other**. In these cases, recombining knowledge from different agents, sectors, disciplines and countries can be easier when the tacit component is very strong.

On the other hand **tacit knowledge can not be transferred at long distance such as codified knowledge,** as **it requires personal contacts** and a deep reciprocal knowledge.

However, in some cases, **the lack of geographical proximity may be compensated by adequate organizational or institutional proximity** and that allows to transfer tacit knowledge at large distance.

3. The local nature of learning: geography

The emphasis on tacit knowledge and on interactive learning provides **a suggestive analogy**, – albeit still quite broad and generic – between the **cognitive analysis of learning processes** and **the analysis of innovation in specific geographical areas**.

Indeed, much of **the literature on innovative and productive clusters** is based on the recognition that **the local, tacit and interactive nature of learning constitutes an essential constituent of agglomeration economies**.

Three fields of economic literature seem to be provide an useful contribution:

a) industrial economics and econometric studies,

b) regional economics,

c) cognitive economics.

The contribution of industrial economics and econometric studies: local knowledge spillovers

To a considerable extent, and especially in the **econometric literature**, this intuition has been operationalised through **the concept of knowledge spillovers**.

However, **we still know very little about how these processes**. In many cases, **the definition of spillovers that is used includes only physical proximity (physical distance) to universities or research centres**, although other studies extends the definition of spillovers to include also the proximity of a high number of firms belonging to the same sector (see among others, Autant-Bernard (1999)).

More generally, in the previous stream of literature, the nature of **the process of knowledge creation is apparently a-spatial**, or **space is conceived as a pure physical variable**.

The contribution of regional economics: relational space

Other studies, mainly in the field of regional economics, have attempted to go beyond this simple representation. **Regional economics** for its **special interest on territorial structure and spatial flows (i.e. migrations, investments, information, exports)** has traditionally focused on the **tight complementarity between different types of spatial flows (labour flows, client-supplier relationships, spin-offs, financial control) and the process of diffusion of innovation**, both within industrial districts/clusters at the local level as also between the centres of the urban system at the national and international level.

Physical space is therefore coupled with **"relational" space**, made by all the different relationships built among local actors. For example, **the well-known concept of "milieu innovateur"** refers to this more complex concept of space (Capello and Faggian 2005).

3.2 The contribution of cognitive economics: spatial dimension of the cognitive processes

A third field of literature which may be relevant is represented by the **studies of cognitive economics.**

In fact **cognitive processes only apparently have a a-spatial character**, while they **implicitly underline the spatial nature of the process of knowledge creation**.

It might suffice to emphasise that **both the combination of complementary pieces of knowledge and the interaction between various complementary actors are facilitated by a closer geographical proximity and greater cognitive proximity.**

The tight correspondence between	
Components of cognitive processes	**Spatial/local dimension of cognitive processes**
The **type** of the external **stimulus**	Firms respond to **new needs in local markets** and aim to solve problems of **local users**
The **strength** of the external **stimulus**	**Low cognitive distance** facilitates the identification of weak signals and collaboration
The search for **consistency and integrity** and the process of adaptation	Actors aim to preserve the **integrity of the local environment**
Innovation requires the search and the integration of **complementary resources and capabilities**	Firms initially look for the **support of local suppliers**. The **diversity of metropolitan areas** or the **specialization of industrial clusters** facilitate the identification of complementary capabilities.
Interactive learning as a key process in knowledge creation	**Networks** are a form of organization which **facilitate interaction and flows** of information and knowledge are **constrained by spatial distance**
Knowledge creation is characterized by **path evolution**	The **local selection environment** both facilitates the identification of **new emerging needs** and also may create obstacles and lead to **lock-in effects**
The key **role of institutions** in the knowledge creation process	Local history, common culture, **values, norms, visions, trust** are the component of **local social capital**. **Intermediate institutions** decrease the cognitive distance between different actors.

3.4 The different nature of networks

Networks may have different characteristics and they may be distinguished in the following three types (Cappellin 2003b):

'Ecology networks', sometimes assimilated to **'agglomeration economies'**. They are characterised by strong interactions. Ecology networks are made by relationships of **objectively observable stable interdependence**. They are also based on behavioural adaptation, strong specialisation, complementarity and idiosyncratic relationships and lead to various forms of traded and untraded interdependencies or spill-over effects. Basically ecology networks are **the result of geographical agglomeration** and they characterize the areas of concentration of the firms belonging to the same sector or urban area. They are the result of external economies and technology spill-over, which are also defined as **"localization economies" or "urbanization economies**" and which spread in a rather automatic and casual way between the various firms and actors living in a specific local environment. Clearly also **information and communication technologies** may favour the creation of these types of networks.

'Community networks', are based on the **sense of identity and common belonging**. These subjective element distinguishes them from ecology networks. Thus, community networks require **the sharing of an homogenous culture, common values** and are characterised by the **existence of trust relationships and of common institutions and specialised intermediate social organisations, which are defined as "social capital"** (Coleman 1988). These networks are places of **collective learning and the development of a common production know-how**. However, they lack the capability of central coordination and strategy making. Typical case of community networks are **the industrial districts or clusters and regional innovation systems**.

'Strategy networks' are based on **cooperative agreements between firms and other organisations**. These are the result of negotiations, agreements on specific strategies and the creation of formal and explicit 'joint ventures' by the participating actors. Strategy networks also imply **the reciprocal commitment of specific resources, which are invested in order to achieve common goals and future but uncertain benefits**. Strategy networks imply **forms of central coordination,** the creation of procedures for the exchange of information, **the codification of individual implicit knowledge and the investment in the creation of collective codified knowledge**. Strategy networks may be represented both by **widely geographically dispersed strategic alliances** made by pool of large and small firms or by **local clusters and regional innovation systems**, which explicitly want to **become a "learning region".**

A 'learning region' may represent the final outcome of the evolution of an 'industrial district', which undergoes an ongoing evolution thanks to the active role of the processes of learning, adaptation and innovation within the network.

The process of innovation in SMEs and in medium technology sectors		
	Linear approach	**Interactive approach**
Key word	Technology	Knowledge
Stimulus	Cost competition Supply New equipment	Market orientation Demand User needs
Process	In house R&D	Interactive learning
Outcome	Increase productivity	Continuous innovation
Policies	Public finance Public regulation	Multi-level governance Public-private partnership

4. The governance of learning network and the approach of "Territorial Knowledge Management"

Regional innovation policies should design appropriate methodologies in order to promote the creation of a "learning region" and to well organize the cognitive relations between the various local firms and actors, which represent a key advantage of agglomeration economies.

The approach of Territorial Knowledge Management (TKM) is based on the concepts of cognitive economics, and it aims to promote the innovation capabilities of a regional production system through **the growth of the "territorial knowledge capital" and the development of interactive learning processes (Cappellin, 2003).**

In particular, **TKM aims to**:

a) **promote the creation of the Territorial Knowledge Capital (TKC),** by accelerating the speed of circulation of information between local actors and between these latter and external actors, by avoiding lock-in effects and by managing the 6 levers to be described below;

b) **to extract the value of Territorial Knowledge Capital** through the enhancement of innovation which represents the key factor for the competitiveness and growth of a regional economy;

c) **to create new innovation networks within the regional innovation system and build new formal and informal institutions, infrastructures, norms, rules and routines** which may manage ("governance") the innovation networks and the interactive learning process;

d) **provide a quantitative accounting framework** to measure the local strengths and weaknesses in the perspective of the knowledge economy.

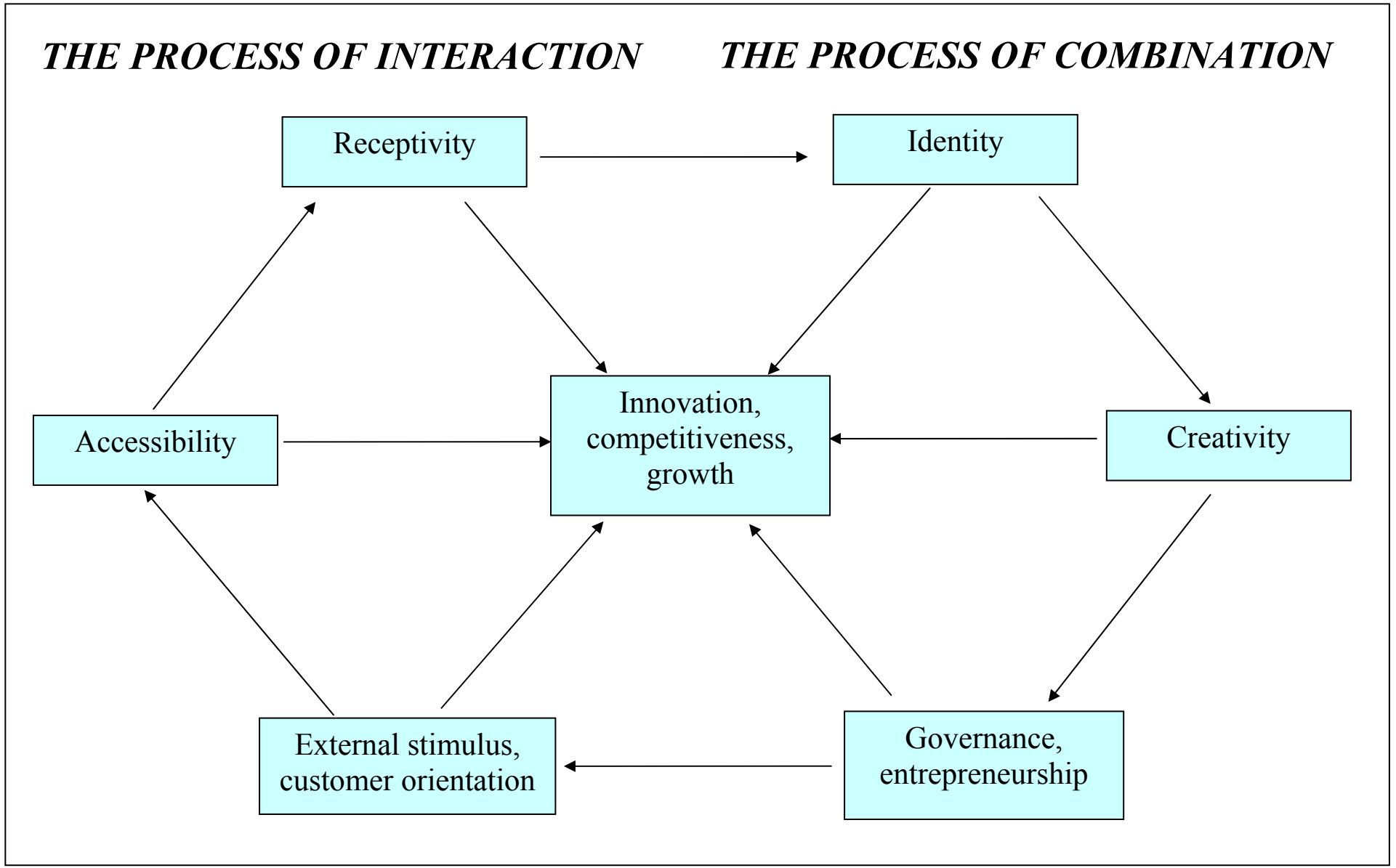

Figure 3 – The six factors of TKM - Territorial Knowledge Management

The key areas of innovation policy according to the Territorial Knowledge Management approach in selected regional innovation systems			
Policy areas in the TKM approach	**Specific types of Regional innovation systems**		
	Metropolitan areas High tech sectors Large enterprises	**Industrial clusters Medium tech sectors Innovative SMEs**	**Peripheral regions Low tech sectors Traditional SMEs**
1. Innovation stimulus	Product innovation in specialized markets	Customer needs and Supply chain integration	Cost competition in the global market
2. Accessibility	High international accessibility - low local accessibility	Low international accessibility - high local accessibility	Low international accessibility - low local accessibility
3. Receptivity	High internal diversity	High internal specialization	Low quality of human capital
4. Identity	High organizational and cognitive proximity	High local embeddedness and local identity	Fragmentation and external dependence
5. Creativity	High investments in R&D	Networking and interactive learning	Technology adoption
6. Governance	National industrial policies and companies strategic alliances	Multi-level governance	Public finance and public regulations

Conclusions

In this paper, we have stressed how **the recombinative and interactive nature of learning**, **coupled with the tacitness of knowledge**, is a key feature of technological progress in regions **specialized in medium technology industries**.

Cognitive processes for their very nature have a spatial dimension and are affected by territorial factors.

That also implies that:

- **Firms concentrate spatially due to the advantages that geographical proximity determines to knowledge creation and innovation.**

- **Territorial Knowledge Management may represent a viable approach for the governance of the learning networks.**