

University of Rome "Tor Vergata"
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Master of Science in Business Administration

Course:
Innovation and Cognitive Economics

Prof. Riccardo Cappellin

LECTURE 11

The model of industrial clusters and regional innovation systems and the territorial factors of knowledge creation

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2. A geographical perspective of national growth

The process of national growth has different characteristics in the various areas. Italian territory is organized in 20 Regions, 110 Provinces and 8.012 Municipalities. For research purposes the National Statistical Office (http://www3.istat.it/salastampa/comunicati/non_calendario/20051216_00/) subdivides the national territory in 686 labour market areas. As indicated in figures 2.2 most of areas, especially in North and Central Italy, have a clear industrial specialization, while the major urban areas have a high sectoral diversification and other areas, especially in South Italy do not have a clear sectoral specialization. Figure 11 indicates that many areas have a tourist specialization and among them there are not only mountain or coastal areas but also urban areas.

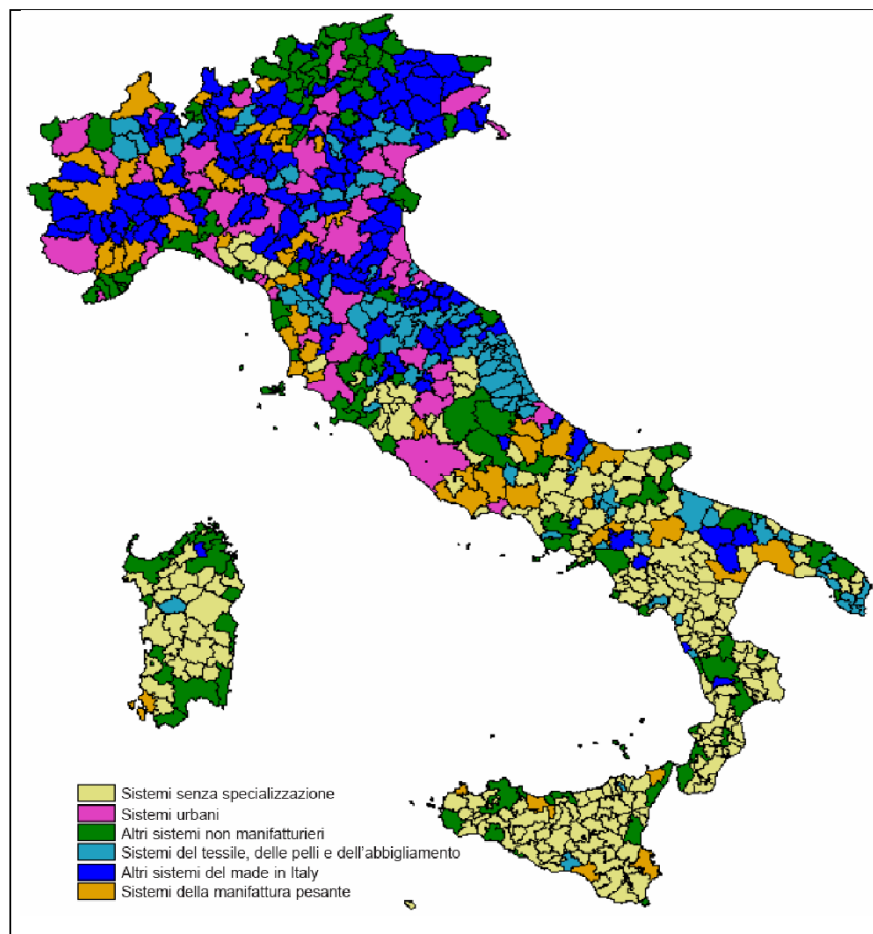
Urban areas define corridors along the major transport routes, as indicated in figure 1, and the spatial concentration of population is very uneven in the various areas. However, almost 46% of the national population is concentrated in small municipalities with less than 10.000 inhabitants and cities with more than 250.00 inhabitants represent only 15% of population. The spatial diffusion of industrial activities is even greater than that of population and the largest municipalities represent only 11% of industrial employment.

The patterns of development in the industrial, urban and rural areas of Italy and of the Arab countries: Egypt, Tunisia and Morocco, illustrates the changes in the structure of the territory during the various development phases of the national economy.

In Italy, the industrial areas or so called "industrial districts" are characterized by clusters of SMEs. Italian SMEs have evolved in the last three decades and now have decentralized productions in distant countries, are increasingly organized in financial groups and sectoral supply chains led by medium or large firms, have integrated advanced services with material manufacturing activities and have developed extensive technological cooperations with universities and also with foreign firms. Many studies on the industrial and technological transformation of these areas are published in the books of the AISRe series by Franco Angeli Editor.

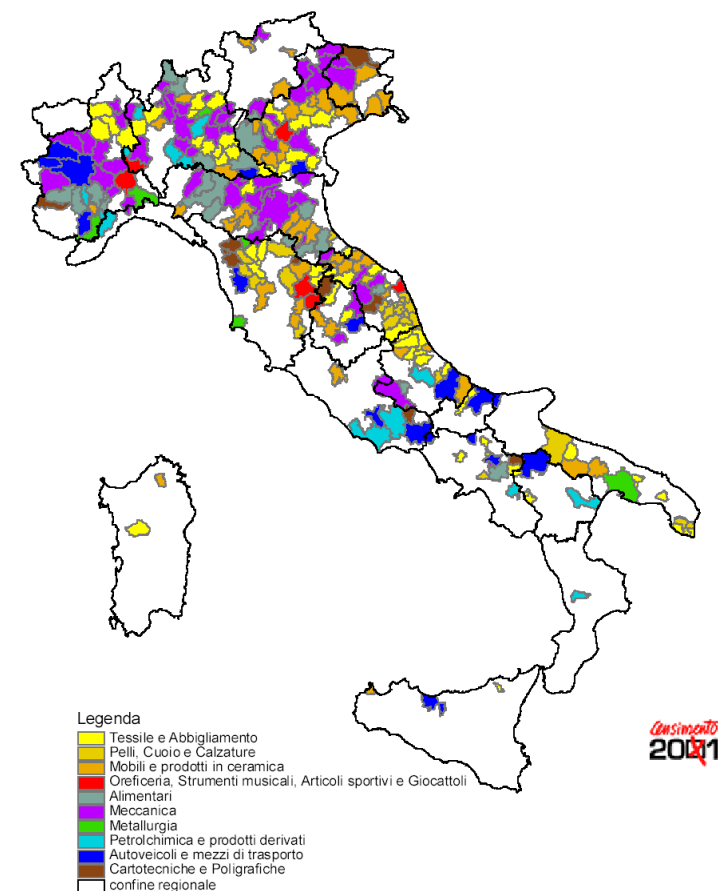
The urban and metropolitan areas in Italy are characterized by a post-industrial transformation. The quality of life in Italian cities is indicated by their capability to attract a great share of the tourist flows. Italy (165.2) is second only to Spain (213.3) for the total nights spent (million nights) by non residents and France (120.4) is third (source: Regional Yearbook 2102, Eurostat http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-HA-12-001). The economy of the largest cities is increasingly specializing into the knowledge economy or in post-industrial activities. They are characterized by an increasing decentralization of industrial activities, by a decrease of population and also by increasing social problems, as indicated in a recent book of the Torino 2011 AISRe congress published in the AISRe series by Franco Angeli Editor. On the contrary, many cities especially in the regions of Center and South Italy are not characterized by an industrial heritage and have many similarities with other Mediterranean cities in Arab speaking cities. In all cities a crucial problem is to create new jobs for the workers dismissed by the old large industrial plants which are closing and to promote a specialization in the more modern knowledge intensive private and public services and a reconversion from the traditional activities of the retail trade sector.

Fig. 2.2 –Sistemi locali del lavoro per sotto-classe di specializzazione



Fonte: elaborazioni su dati Istat, 8° Censimento generale dell'industria e dei servizi

cartogramma 10: SLL 2001 – Manifatturieri per tipologia produttiva



Censimento
2001

cartogramma 11: SLL 2001 – Turistici

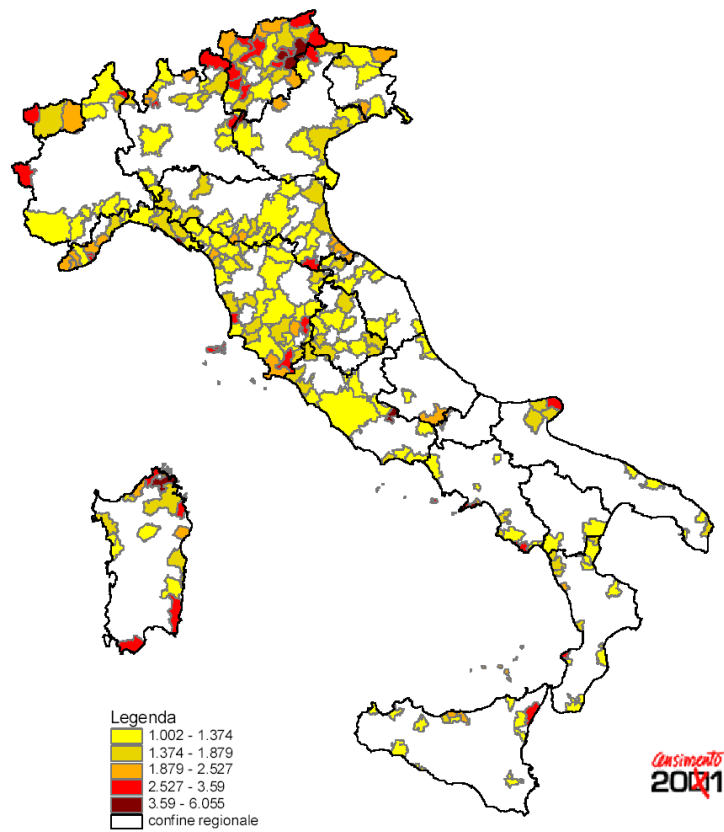


Tabella 2 La densità territoriale dei comuni italiani, per classe di ampiezza demografica, 2008

Classe di ampiezza dei Comuni	Superficie territoriale Km ²	Popolazione residente 2008		Densità territoriale (Ab./Km ²)
		Valore assoluto	Percentuale	
0 - 1.999	83.882	3.394.918	6%	40
2.000 - 4.999	78.944	6.977.613	12%	88
5.000 - 9.999	50.451	8.468.283	14%	168
10.000 - 19.999	35.809	9.476.722	16%	265
20.000 - 59.999	32.923	13.419.578	22%	408
60.000 - 249.999	16.024	9.251.597	15%	577
> 250.000	3.303	9.056.357	15%	2.742
ITALIA	301.336	60.045.068	100%	199

Fonte: elaborazione Cittalia su dati Istat (2008)

Tabella 57 Il numero degli addetti nelle unità locali nei comuni italiani, per classe demografica, 2006

Classi di ampiezza dei Comuni	Numero di Addetti alle Unità Locali					Totale
	Industria in senso stretto	Costruzioni	Commercio	Alberghi e ristoranti	Altri servizi	
0 - 1.999	-	-	-	-	-	-
2.000 - 4.999	-	-	-	-	-	-
5.000 - 9.999	788.965	262.729	386.129	130.880	457.409	2.026.113
10.000 - 19.999	934.985	304.131	534.779	166.789	683.633	2.624.316
20.000 - 59.999	984.233	384.516	818.123	212.937	1.221.567	3.621.376
60.000 - 249.999	601.085	278.955	640.679	172.300	1.306.434	2.999.454
> 250.000	408.746	233.566	628.217	219.681	1.835.074	3.325.283
ITALIA	3.718.015	1.463.897	3.007.928	902.587	5.504.116	14.596.543

Fonte: elaborazione Cittalia su dati Istat-ASIA (2006)

Source: http://www.cittalia.it/images/file/COMUNI_ITALIANI10_1.pdf

The rural and mountain areas of the Alps and the Apennines have been characterized by depopulation and emigration toward the urban areas during the 50'ties and 60'ties. Instead, they are rediscovering an autonomous economic and social development related to tourism and other modern activities during the at least the last two decades. The development in these areas and especially of the rural areas and mountain areas in Apennines and in South Italy can be rather similar to those of the interior areas in Arab countries. The transformation of the rural areas close to the urban centers and the conflicts between agricultural and residential/tourist or industrial use may also be similar. Various Italian studies on these issues are published in a recent book of the AISRe series by Franco Angeli Editor (in print).

3. A network approach in the analysis of regional growth

Differently from a traditional geographic perspective, the literature on Regional Science indicates that the spatial structure is not the result of the impact or the localization of the national economic growth on the territory, but rather that spatial or regional factors are important factors in determining the size and patterns of national economic growth.

Thus regional and urban policies and strategies have a great importance in promoting national economic growth and the regions and cities should have a greater role in determining the national development strategy.

From a methodological perspective it is clearly a challenge to illustrate that the theories and the policy strategies which have been developed in Europe during the last fifty years are relevant not only for explaining and stimulating growth in a wide variety of European regions, from large metropolis such as London or Paris to rural areas in Portugal or Greece, but also as a reference guide for designing the development policies in the urban, industrial and rural areas of South Mediterranean countries, such as Egypt, Tunisia and Morocco.

Moreover, the analysis of new types of regions and countries and the comparison with the most similar cases in Europe lead to adapt previous theoretical approaches and to extend them into new specific fields.

According to a traditional demand model (Keynesian and planning approach), the economic growth is driven by the competitiveness and the expansion of the production capacity in the export sectors, the attraction of foreign investments or by the increase of the internal demand driven by an increase of public services and public investments. To this purpose the government should expand public expenditure and increase the money supply and decrease interest rates.

According to a supply model (neoliberal approach), the economic growth proceeds spontaneously according to the increase of productivity and government should only remove the constraints which may be represented by excessive public deficit, public debt and expenditure on interest on public debt, imbalance in the external trade and amount of foreign reserves, and contain the inflation rate and adjust the exchange rate.

A regional and industrial model (local networks approach) is based on a local endogenous approach, which differs from the previous aggregated approaches because it considers the economy and society as a complex system made by many actors linked by network relations.

In fact according to many contributions in Regional Science research, local development has an endogenous character or it is not only determined by the exports of local productions, the

immigration of people with advanced competences or the capability to attract investments and firms from the other regions, but also by the capability to promote the full use of the local, human and productive, resources and the synergic relationships between the various sectors and the various local actors, institutions and development factors existing within a given "local production system".

According to this "model of territorial networks" (Cappellin and Wink, 2009) a local production system is made by actors, firms and institutions which interact between themselves, reciprocally adapt and learn from each other. Economic growth is linked to change and innovation. Thus it is linked to the shift of employment from the less productive sectors to the more modern sectors, to the birth of more competitive firms and to the closure of old and inefficient firms within each sector and also from the reallocation of the internal material and immaterial resources within the firms from the less efficient processes and from the less profitable products to the more innovative processes and products.

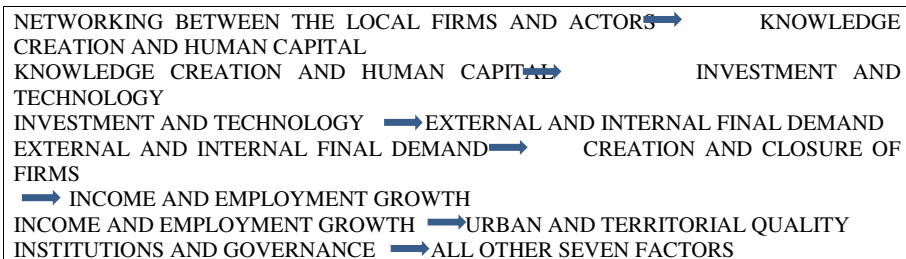
Three related conceptual tools are crucial in this "**system or local network approach**" to economic development:

- a) cognitive and institutional proximity between the actors;
- b) territory and infrastructures, as the physical support space of the economic and social system;
- c) institutions, social capital and governance of the relationships between the actors.

In particular, regional income and employment growth is determined by seven factors:

- 1) the stimulus coming from the external openness and the foreign demand as also from the changes in the internal final demand,
- 2) the growth of the production capacity linked to the use of new technologies, the innovation and the investment,
- 3) the process of knowledge creation and learning which improve the human and organizational capital in the local firms,
- 4) the process of firm turnover of the firms or the creation of new firms and the closure of old firms,
- 5) the network relations between the local firms and actors, due to flows of technological and organizational information, capital and people,
- 6) the characteristics of the regional territory and of the regional urban system, the structure of the transport networks and the urban and territorial quality,
- 7) the institutions, the social capital and the forms of governance of the relationships between the various local private and public actors.

The analysis of regional development in Europe indicate that these seven factors interact between them and lead to a continuous increase of employment, production and also of the quality of life in the area.



In fact, an increase of the network relations between the local firms leads to the development of learning processes by the workers and entrepreneurs and to the creation of new knowledge. That promotes innovation, the change of technologies and new investments in the firms.

That increases and attractiveness of the local economy and the growth of exports and the attraction of foreign capitals as also of external entrepreneurial capabilities.

Networking between the local firms and actors stimulates the growth of new firms in new productions and these firms substitute the firms which naturally close being specialized in obsolete productions.

Table 1

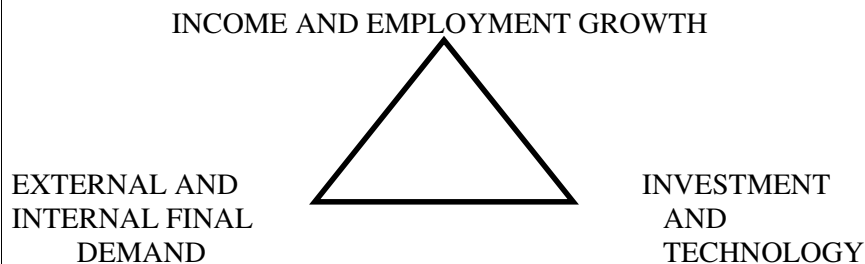
THREE MODELS OF DEVELOPMENT

DEMAND DRIVEN MODEL: Keynesian and planning approach

Income growth is determined by the growth in exports, imports, private and public consumption and private and public investments and economies of scale insure greater productivity and international competitiveness

SUPPLY DRIVEN MODEL: neoliberal approach

Per capita income growth is determined by productivity, employment and population growth and by external and internal financial constraints (external deficit and public deficit and "competition-flexibility and structural reforms").



REGIONAL-INDUSTRIAL MODEL: local networks approach

Income and employment growth is determined by 7 factors:

- external and internal final demand,
- investment and technology,
- knowledge creation and human capital,
- creation and closure of firms,
- networking between the local firms and actors,
- urban and territorial quality,
- institutions and governance.

The economic development of the region modifies the structure of the territory, determines the sprawl of the urban centers and stimulates the improvement of the transport infrastructures, but it may also have negative effects on the natural environment and on the quality of life in the urban areas.

Finally, local policies and the governance of the relations between the local actors should not only positively intervene on the individual factors indicated above, but they should also adjust the relationships between these factors in order to activate a virtuous cycle of development.

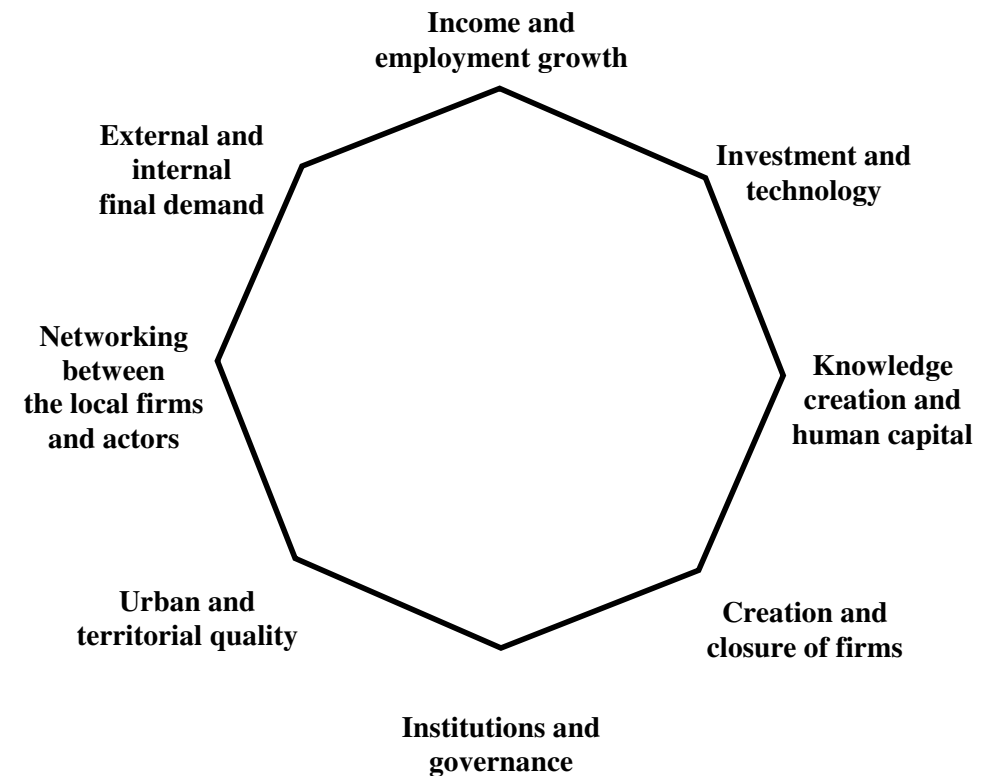


Figure 1
The local network model of regional development
Source: Cappellin and Wink, 2009

In particular, the first three variables in this local network model of regional development:

- a) income and employment growth,
- b) external and internal final demand,
- c) investment and technology.

are considered also in the more traditional demand model and in the supply model, which usually highlights the following relationships.

First, according to a demand perspective, investment and innovation determine international competitiveness and exports and these latter determine income and employment growth, which on their turn stimulate investments and innovation.

On the other hand, according to a supply perspective, investment and innovation increase production capacity and employment and that leads to an increase of exports in perfectly competitive markets and to the increase of foreign reserves and flows of international capitals which lead to greater investments and innovation.

While traditional theories have focused on the role of exports as the driver of regional growth, the internal demand, such as investment in housing and infrastructure or personal consumption, can also be a crucial autonomous factor of employment and GDP growth especially in large urban areas (Cappellin 2012b).

In fact, the analysis of economic growth in the Arab countries clearly indicates the importance of external and internal demand. The flows coming from outside, such as the increase of international tourism or the income remittances of emigrants in European countries have a clear importance as factors leading to local development. The exports of agricultural goods and of manufacturing products are also a driver of regional economic growth. Moreover, it is important to promote the development of many modern small and medium size firms (SMEs) capable to compete in the international markets.

However, also the importance of internal demand is increasing, as the growth of population and the growth of the average percapita income lead to an increasingly greater local market, especially in the largest cities, and to a greater demand for an wide variety of consumer goods, from soap to air conditioning, and also of modern personal services, such as entertainment, beauty, sports or health. That leads to the creation of new firms and of new jobs. In this perspective, also an increase of the demand and supply of public services, such as transport, education and health, may represent a driver of national growth, although it has to be financed by an appropriate increase of government taxes. Thus, the individual and social needs for a better quality of life may be a stimulus for the development of new productions and employment.

However, what makes the regional/industrial model different from the two aggregated model of demand driven or supply driven growth are the other five variables indicated in the figure 1: knowledge creation and human capital, creation and closure of firms, networking between the local firms and actors, urban and territorial quality, governance and institutions. These variables are especially important in the growth of the urban, industrial and rural areas in the European countries and also in the Arab countries.

KNOWLEDGE CREATION AND HUMAN CAPITAL

- ➡ CREATION AND CLOSURE OF FIRMS
- ➡ INVESTMENT AND TECHNOLOGY
- ➡ NETWORKING BETWEEN THE LOCAL FIRMS AND ACTORS
- ➡ EXTERNAL AND INTERNAL FINAL DEMAND
- ➡ URBAN AND TERRITORIAL QUALITY

First, the knowledge creation and the human capital is the key factor in determining the birth of new firms and the growth of the existing firms, as also in hindering the closure of old firms.

Often the growth of firms is not limited by the constraints of financial funds for investment but by the lack of knowledge of the entrepreneurs and the workers, as that hinders the adoption of modern technology, which would insure the profitability of investments.

In that perspective, knowledge creation and the human capital play a crucial role in the transformation of the firms in the informal economy which may be considered as the incubator of modern activities. That requires a gradual learning processes and the complex combination of tacit with codified knowledge and of artistic, organizational, engineering and scientific knowledge.

Knowledge and learning are the result and also stimulate the networking between the local firms and actors in the framework of "innovation networks", as the increase of the capabilities of the external suppliers leads firms to increase the outsourcing of the non strategic activities to the former. That leads to a continuous diversification and growth of the local economy, as in the Marshall's districts (Cappellin, 2012).

Knowledge creation and learning are also important in the continuous changes of the preferences and needs of the final users and citizens and that may stimulate the growth of new firms new public services, such as health, culture, leisure services.

Finally, knowledge creation and learning are important in the management of many public services and in the design of public policies and that has a positive impact on urban and territorial quality.

CREATION AND CLOSURE OF FIRMS

- ➡ INCOME AND EMPLOYMENT GROWTH
- ➡ INVESTMENT AND TECHNOLOGY
- ➡ NETWORKING BETWEEN THE LOCAL FIRMS AND ACTORS

Second, the creation and closure or turnover of firms, is crucial in order to allow an increase of employment and a decrease of unemployment rates between the youths. The creation of new firms is occurring first of all in the informal economy and then these firms gradually move into the formal economy, as they become more efficient and adopt technological and organizational innovation.

The creation of new more productive firms and the closure of less productive firms is stimulating the adoption of innovation and of new technologies.

The creation of new firms is also related to the increasing outsourcing of specific production phases from existing firms, to the diversification of the production systems, and to the creation of network relationships between the firms.

NETWORKING BETWEEN THE LOCAL FIRMS AND ACTORS

- ➡ KNOWLEDGE CREATION AND HUMAN CAPITAL
- ➡ EXTERNAL AND INTERNAL FINAL DEMAND
- ➡ URBAN AND TERRITORIAL QUALITY
- ➡ CREATION AND CLOSURE OF FIRMS

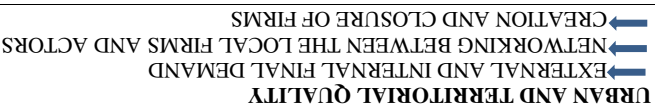
Third, the networking between the local firms and actors is leading to various forms of interactive learning and creation of new knowledge, which is the prerequisite for innovation and adoption of new technologies within the firms.

The networking between the local firms and actors is related to the development of the "social capital" or the "relational capital", such as various forms of associations, and it increases the social integration and it decreases social disparities. These associations are crucial for the management of "common goods", such as water and green areas, and also for the production of specific "club goods", such as private health and education services. That is especially important as there is a continuous evolution of the social needs of the citizens and these types of goods are important in order to tackle the problems of urban poverty and unemployment.

The networking between people is also leading to changes in the final demand by the citizens and by the firms. In fact, major factors of economic and also political changes are the changes of customs by the people and especially those of young people. The changes of the way of life and the request of a greater political freedom are the result of the impact by international tourism, the emigration to European countries and the diffusion of international TV, movies, music and Internet, as also by the increasing university education among the youths and the woman.

The process of networking and the combination of market and non-market relationships allow the gradual development of new services and soft infrastructures, which were initially produced within the family or the communities and then evolve into specialized market activities.

The networking between the actors requires and stimulates the development of public services and of modern bank and credit institutions, which perform the role of soft or immaterial infrastructures in the relationships between the local actors.



Fourth, an increase of urban and territorial infrastructures, such as: energy production, ports and highways, and also housing, hospitals and schools, is leading to a greater public expenditures and this latter stimulates production and employment in the public sector and in the economy.

An increase of urban and territorial infrastructures facilitates the cohesion among actors, increases the networking between the local actors and it decreases social inequalities and improves the quality of life.

An increase of urban and territorial infrastructures decreases the agglomeration diseconomies, allows the availability of industrial areas and it facilitates the formation of new firms.

An increase of urban and territorial infrastructures can be financed by greater taxes on income and employment growth but it should also be complemented by the design of more effective taxes on the huge and increasing land rents which are accruing to the real estate sector and determine huge wealth and income disparities, but may also become a key source of infrastructure financing.

Il modello endogeno di sviluppo

L'analisi del processo di sviluppo economico nei sistemi produttivi locali caratterizzati dalla presenza di piccole e medie imprese nella cosiddetta "Terza Italia" ha stimolato a partire dagli anni '70 l'elaborazione di **molteplici contributi teorici sia in Italia che all'estero**, che possono essere inquadrati nell'ambito di un approccio "endogeno", nell'accezione corrente nell'ambito delle teorie dello sviluppo regionale (Antonelli et al. 1994, Cappellin 1983, 1992 e 1996, Cappellin e Tosi 1993, Latella 1995).

A differenza dalla teoria della crescita, il termine **endogeno** nelle teorie dello sviluppo regionale non si riferisce alla dipendenza del progresso tecnologico dalle altre variabili del modello stesso, ma all'**origine locale, contrapposta a quella esterna, dei fattori strategici del processo di sviluppo economico** nella regione considerata.

Il modello di sviluppo "endogeno" si basa sull'assunzione che i più importanti fattori di sviluppo regionale sono quasi **immobili**, come le infrastrutture fisiche, la forza lavoro specializzata, le strutture settoriali locali, il know-how tecnico ed organizzativo, le capacità imprenditoriali, le economie di urbanizzazione, le strutture sociali ed istituzionali locali, le capacità amministrative, ecc. e quindi sottolinea che deve essere sviluppata la produttività di tali fattori.

Infatti, la forza di attrazione di una regione nei confronti delle risorse produttive "**esogene**" o mobili (capitale, lavoro e informazioni) dipende in prima istanza dalla **produttività e dalla remunerazione** di tali risorse relativa a quella in altre regioni.

Tuttavia, come indicato dal modello neoclassico del commercio internazionale ed interregionale, in ultima istanza **la produttività, il valore e l'attrazione delle risorse mobili dipende dalla disponibilità e dalla capacità o dalla produttività delle risorse produttive immobili o "endogene"** (know-how produttivo, qualità del territorio e meccanismi di governance collettiva) con cui le risorse esogene devono essere integrate (Cappellin 1983 e 1983b).

Pertanto, **il vero fattore cruciale dello sviluppo non sono tanto le risorse "esogene"**, sulle quali spesso in passato si è cercato di intervenire con la spesa pubblica o con politiche dirigistiche, **ma le risorse "endogene"**.

Ne deriva che invece di mirare ad attirare risorse produttive dall'esterno, come è tipico dei modelli di "sviluppo esogeno", è cruciale che le politiche regionali mirino a **sviluppare le risorse locali**. Questo implica da un lato la loro **piena occupazione** e dall'altro il loro **uso efficiente** e il loro **sviluppo quantitativo e qualitativo**.

L'approccio "endogeno" allo sviluppo regionale indica la necessità di promuovere le **capacità imprenditoriali locali, le capacità di innovazione e i vantaggi comparati specifici** di ogni regione in un quadro di competizione ed integrazione internazionale.

Nel modello di sviluppo "endogeno" risulta cruciale superare le **barriere all'entrata**, che ostacolano la creazione di nuove imprese o la riconversione delle imprese locali verso nuove produzioni. In questa prospettiva, risulta utile attrarre **conoscenze e competenze esterne**, che permettano di superare eventuali **strozzature interne**.

Pertanto le **misure di politica regionale** indicate da questo modello sono molto più articolate e complesse di quelle tipiche del modello "esogeno". Esse mirano in termini generali a creare un ambiente locale più favorevole alla **competitività e allo sviluppo delle imprese locali** e soprattutto implicano una valorizzazione delle autonomie locali nel disegno ed attuazione delle politiche regionali.

L'evoluzione della struttura industriale in Italia

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La distribuzione degli occupati per dimensioni delle imprese industriali dimostra l'importanza delle piccole e medie imprese.

In Italia gli addetti nelle **imprese industriali con più di 250 addetti** sono solo il 28,6%, contro il 62,5% in Germania, il 53,0% in Francia, il 55,5% in UK, il 63,4% in USA. Peraltro, tale percentuale è il 25,9% in Giappone e il 32,2% in Spagna. In particolare, le **imprese fino a 9 addetti** rappresentano il 23,3%: una percentuale largamente superiore a quella degli altri paesi (3-8%).

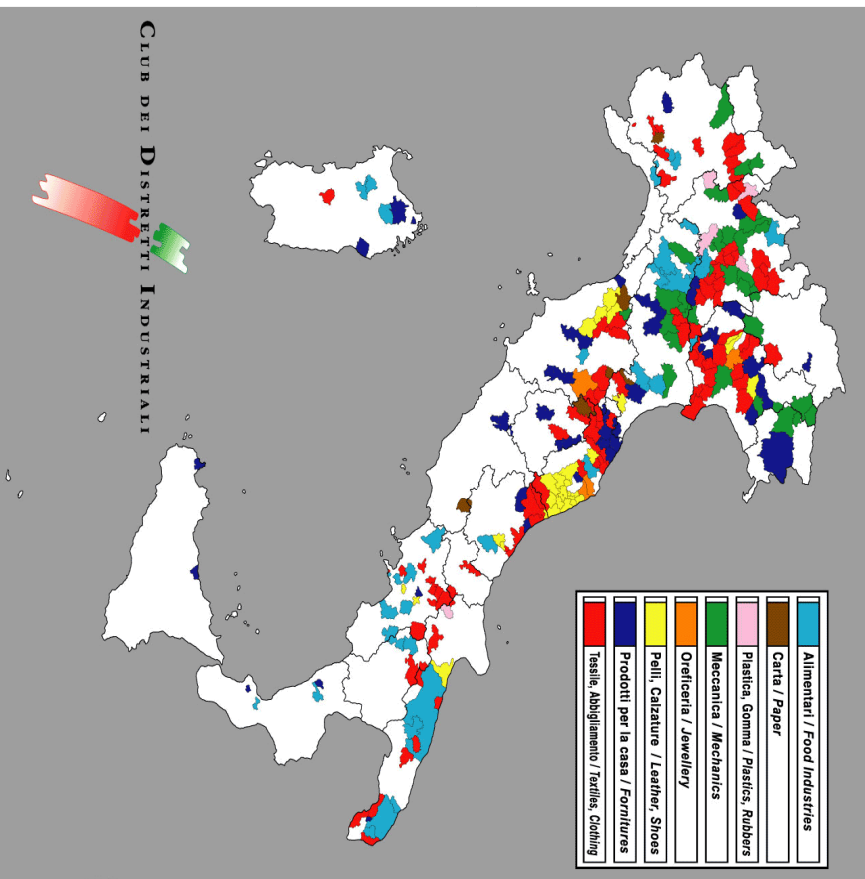
L'evoluzione degli occupati per dimensione delle imprese industriali dimostra la **continua diminuzione dell'occupazione nella grande impresa**. Infatti, in Italia gli addetti nelle imprese industriali con più di 500 addetti sono diminuiti dal 24,0% nel 1971 al 13,0% nel 1991.

La **percentuale delle micro-imprese** (<9 addetti) è prima diminuita dal 32,3% nel 1951 al 20,2 % nel 1971 e quindi è aumentata al 26,2% nel 1991. Comunque nel periodo 1951-1991 anche essa è **diminuita**.

E' **invece aumentata la quota sull'occupazione delle piccole imprese** (10-49 addetti) dal 14,1% nel 1951 al 31,6% nel 1991.

Pertanto, nel lungo periodo si è assistito alla scomparsa delle **imprese artigianali** e allo sviluppo della **piccola impresa subfornitrice**.

I DISTRETTI INDUSTRIALI IN ITALIA INDUSTRIAL DISTRICTS IN ITALY



18

Ricardo Cappelletti, Course: Innovation and Cognitive Economics, Università di Roma "Tor Vergata"

Il peso dei distretti è decisamente crescente nel tempo ed in particolare negli anni settanta e ottanta. Se si definisce la soglia dimensionale della piccola impresa in 100 addetti (cfr. Brusco e Paba 1997), la quota dell'occupazione industriale nei distretti è triplicata passando dal 10% nel 1951 al 32% nel 1991.

Questo fenomeno è dovuto a **tre componenti**: 1) la crescita del numero delle aree che possono essere definite come distretti, 2) la crescita/diminuzione dell'occupazione nei distretti sopravvissuti e infine 3) la scomparsa di taluni distretti.

Tra i distretti attivi nel 1991, la percentuale dei più antichi, quelli che risultavano già nel 1951, è del 16%, pari a 37 distretti. **Molti distretti esistenti negli anni '50 sono successivamente scomparsi**, rappresentando probabilmente delle mere aggregazioni di piccole imprese non efficienti, la gran parte delle localizzate nelle regioni meridionali del paese.

Mentre gli addetti di tutta l'industria manifatturiera italiana dal 1981 al 1991 sono diminuiti del 10,36%, nello stesso periodo, **l'occupazione manifatturiera nei distretti è aumentata**.

Inoltre **il peso della grande impresa nei distretti è diminuito**, dato che alcuni settori (meccanica), dove la grande impresa era prevalente nei primi decenni del dopoguerra, sono diventati via via dominati dalle piccole imprese.

Oltre ai "distretti industriali" in senso stretto possono essere individuate anche i cosiddetti **"sistemi locali di industrializzazione leggera"** (secondo la definizione di F. Sforzi), che rappresentano una quota molto elevata dell'occupazione manifatturiera e comprendono una superficie molto più vasta, in aree esterne ai grandi centri urbani, sia rurali che di montagna.

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Il modello dei “distretti industriali”

Sebbene non esista una definizione univoca di “distretto industriale” nei moltissimi studi sia empirici che teorici, italiani ed esteri, dedicati a questa forma moderna di organizzazione territoriale delle imprese, sembra esistere un consenso ampio sulle seguenti **caratteristiche di un “distretto industriale”** (Garofoli 1991, Brusco e Paba 1997):

- un’alta specializzazione in uno **specifico settore** o comparto produttivo manifatturiero,
- un’elevata popolazione di **piccole e medie imprese**,
- una scomposizione dei processi produttivi in **fasi differenti** caratterizzate da dimensioni ottimali ridotte,
- presenza di **economie esterne** rispetto alla impresa singola ma interne rispetto al territorio locale,
- sviluppo di contratti di sub-fornitura e di **comportamenti cooperativi** tra le imprese locali,
- elevata mobilità tra la situazione di lavoratore dipendente e di lavoratore indipendente ed elevati tassi di **nascita e mortalità delle imprese**,
- sviluppo di un **know-how produttivo e organizzativo** comune incorporato nelle competenze della forza lavoro locale.

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Le caratteristiche di un distretto secondo Becattini:

La definizione di distretto secondo Becattini presenta le seguenti caratteristiche fondamentali.

- L’unità di analisi deve cambiare: non può essere l’impresa piccola individuale, ma l’insieme dell’occupazione di un distretto, composto da molte piccole imprese. Esiste pertanto una **differenza sostanziale tra le piccole e medie imprese nei distretti e le piccole imprese al di fuori dei distretti**.
- “Il distretto è il risultato dell’incontro di certi **tratti socio-culturali di una comunità**, di **caratteristiche storico-naturalistiche di un’area geografica** e di caratteristiche tecniche del **processo produttivo** e il risultato di un processo di integrazione dinamica (un circolo virtuoso) fra la divisione del lavoro nel distretto e l’allargamento del mercato dei suoi prodotti”.
- “Il distretto industriale marshalliano è costituito da una **popolazione di piccole e medie imprese indipendenti**, tendenzialmente coincidenti con le **singole unità produttive di fase**, appoggiatisi ad una **miriade di unità fornitrici di servizi** alla produzione e di **lavoratori a domicilio** e a tempo parziale, orientate attraverso il **mercato delle commesse** da un gruppo aperto di **imprenditori puri**”
- Il distretto è una popolazione di **imprese specializzate** e appartenenti ad **uno stesso settore industriale definito in un senso particolarmente ampio** (filiera o settore verticalmente integrato).
- Il distretto non è solo un **sistema produttivo**, ma anche una **comunità locale** e un **sistema dei valori** (“l’etica del lavoro”).

La tecnologia e la specializzazione settoriale nei distretti presentano le seguenti caratteristiche fondamentali:

- i processi produttivi sono scomponibili in **fasi spazialmente e temporalmente separabili**;
- le **dimensioni tecniche ottime** sono basse;
- esistono diversi **distretti plurisetoriali**;
- nel distretto si assiste allo sviluppo di **specifici intermediari commerciali specializzati**.

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Il rapporto dei distretti con i mercati esterni è caratterizzato dai seguenti fattori:

- esiste una **domanda finale differenziata e variabile** nel tempo e nello spazio;
- lo sviluppo dei distretti è strettamente collegato con l'**espansione delle vendite a scala internazionale**;
- si assiste allo sviluppo di un **'immagine del distretto sul mercato finale**;
- sono forti i legami con i **mercati internazionali delle materie prime**;
- l'importanza del mercato è dimostrata dall'integrazione stretta tra la fase della **commercializzazione del prodotto finale e la attività di trasformazione industriale**;
- il distretto non è chiuso in sé stesso ma forte è l'**interscambio di individui tra il distretto e il mondo circostante** e la capacità di assimilazione.

La divisione del lavoro o l'integrazione produttiva tra imprese è caratterizzata dai rapporti di collaborazione.

- La collaborazione produttiva tra imprese non è il risultato di un mero processo di esternalizzazione di alcune fasi produttive e viene sottolineata la **distinzione tra il "fare" (make), il "far fare" (buy) e il "fare insieme"** (che è quindi diverso dal mero acquistare).
- Nel distretto esiste un **rapporto stretto tra concorrenza e cooperazione**.
- La lotta per la **sopravvivenza** è temperata dalla **solidarietà** nell'ambito della comunità locale
- Piuttosto che una logica commerciale e speculativa prevale una **relativa stabilità delle relazioni e dei prezzi** dei servizi e prodotti intermedi.

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Il mercato del lavoro e le risorse umane nei distretti presentano le seguenti caratteristiche.

- Nel distretto si crea una **"atmosfera industriale"** e si sviluppa la specializzazione delle **competenze tecniche** dei lavoratori.
- Nel distretto la figura chiave è quella dell'**"imprenditore puro"** (**impanatore pratese**), che organizza il lavoro di varie imprese con capacità diverse tra loro legate nel processo produttivo.
- E' sviluppato il **lavoro a domicilio e part-time**, che integra il reddito familiare e rappresenta uno strumento per l'addestramento professionale dei giovani.
- Possono esistere **legami personali e relazioni di parentela** tra i titolari delle imprese, che operano nelle diverse fasi e sono diffusi comportamenti cooperativi.
- Lo sviluppo delle risorse umane è guidato da un **meccanismo di penalizzazioni e incentivi**, che spinge verso una convergenza tra il lavoro desiderato e quello per cui si è oggettivamente più adatti.
- Prevalga una logica di **solidarietà a scala locale** piuttosto che logica di **conflitto di classe**.
- Il distretto si caratterizza per la capacità di **attrazione dei lavoratori più qualificati** provenienti da altre aree.

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Le caratteristiche di un distretto secondo Garofoli:

- a) l'esistenza di una molteplicità di imprese piccole e medie e assenza di un'impresa dominante;
 - b) una rilevante quota del mercato nazionale rispettivo;
 - c) una consistente specializzazione produttiva a scala locale;
 - d) lo sviluppo di interdipendenze produttive di tipo intra ed inter-settoriale;
 - e) una spinta alla specializzazione produttiva crescente;
 - f) la diffusione di rapporti "faccia a faccia" tra produttori ed utilizzatori di prodotti intermedi e di servizi alle imprese;
 - g) la progressiva formazione di un sistema informativo a livello d'area;
 - h) l'esistenza di una diffusa professionalità dei lavoratori;
 - i) gli elevati tassi di turnover dei lavoratori e di tassi di ricambio delle imprese;
 - j) la flessibilità del mercato del lavoro e presenza di una diffusa "etica del lavoro";
 - k) la presenza di un elevato consenso sociale e di forme di regolazione sociale.
- I punti a) d) g) i) rappresentano un contributo aggiuntivo rispetto alla definizione di **Becattini**.

Le tendenze in atto sembrano essere caratterizzate da:

- tendenza alla **crescente integrazione intersettoriale**;
- tendenza all'aumento della **capacità di controllo del mercato finale**;
- evoluzione della specializzazione settoriale dalla forma "area di specializzazione produttiva" a quella di "sistema produttivo locale" e infine a quella di "area-sistema".

La crisi dei distretti industriali classici in altri paesi europei è in gran parte dovuta agli **errori della politica industriale nazionale** che ha privilegiato lo sviluppo della grande impresa

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Le analisi di Fabio Sforzi e dell'Istat

L'analisi viene compiuta sulla base del **censimento 1981** e porta ai seguenti risultati:

1. aree del mercato del lavoro locale : n. 955
2. aree di industrializzazione leggera : n. 161, 19,5% degli addetti dell'industria manifatturiera
3. i distretti industriali marshalliani : n. 61, 8,6% degli addetti dell'industria manifatturiera

In sintesi, l'**algoritmo per l'individuazione dei distretti** utilizzato nell'analisi Sforzi-Istat sui dati del censimento 1981 si basa sull'individuazione delle aree che rispettano le seguenti 4 condizioni:

- a) la quota degli addetti nell'industria manifatturiera maggiore della media nazionale
- b) la quota degli addetti dell'industria manifatturiera in imprese con meno di 250 addetti maggiore della media nazionale,
- c) una forte specializzazione settoriale,
- d) l'esistenza in almeno uno di questi settori di una quota degli addetti dell'industria manifatturiera in imprese con meno di 250 addetti superiore alla media nazionale dello stesso settore

La stessa analisi viene ripetuta a distanza di alcuni anni sulla base del **censimento 1991**.

L'analisi di Sforzi è poco coerente con le indicazioni del modello del distretto marshalliano di Becattini. Manca un'**analisi dei flussi** di prodotti intermedi o di lavoratori tra le imprese in modo da dimostrare la forte **integrazione interna del sistema produttivo locale**. Manca la considerazione del **ruolo delle istituzioni intermedie e del capitale sociale**, senza i quali il sistema produttivo locale non ha una propria **identità e coesione interna**.

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Fonze: L. Cammari e L. Federico Signorini, Nuovi strumenti per la classificazione dei sistemi locali, in Signorini, L.F. (a cura di), Lo sviluppo locale: un'indagine della Banca d'Italia sui distretti industriali, Roma, Meridiana Libri 2000

Secondo le definizioni che si trovano in letteratura, l'elemento costitutivo fondamentale del distretto industriale consiste nell'interazione localizzata fra una **comunità di persone** (dotata di una identità storicamente definita e di particolari valori, regole, istituzioni), e una **popolazione di (piccole) imprese manifatturiere**, specializzate in un certo settore e organizzate in modo da realizzare, secondo regole in parte idiosincratiche, uno schema di divisione del lavoro per fasi che si traduce in una maggiore efficienza e flessibilità del processo produttivo. La **metodologia Sforzi-Istat** per la definizione dei distretti industriali **tenta di approssimare questo intreccio di fattori socioeconomici** distillandone l'essenza per mezzo di un limitato gruppo di variabili censuarie.

La metodologia Sforzi-Istat per la definizione dei distretti industriali consta di due passaggi distinti. Nel primo passaggio, il territorio italiano viene diviso in un certo numero di **sistemi locali del lavoro (SL)**, definiti sulla base dei movimenti pendolari giornalieri. Nel secondo passaggio, un sottoinsieme di SL viene classificato come distretto industriale sulla base di un insieme di **caratteristiche della sua struttura economica**. Tutta la procedura è basata su dati dei censimenti della popolazione e dell'industria. Una prima versione fu sperimentata sui dati dei **censimenti del 1981**; la versione più recente, a cui si fa riferimento di regola nei saggi compresi in questa raccolta, è basata sui dati dei **censimenti del 1991**.

Un SL, idealmente, è un'area **autocontenuta dal punto di vista dei tragitti giornalieri da casa al lavoro**. In pratica, l'algoritmo Sforzi/Istat individua i SL prendendo come unità di base i confini amministrativi dei comuni, e aggregando i comuni in modo tale che una quota sufficientemente piccola dei residenti nei comuni appartenenti a un certo SL si spostino quotidianamente per motivi di lavoro in comuni appartenenti a un altro SL. L'algoritmo si basa sui dati riferiti agli spostamenti giornalieri rilevati con il **censimento della popolazione**.

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Secondo le parole di Sforzi (1990), il SL "identifica lo schema tempo-spazio della **vita quotidiana per la popolazione residente**, ove si innesta la gran parte delle relazioni sociali ed economiche". Nella versione riferita al censimento del 1991, l'algoritmo Sforzi-Istat identifica 784 SL. Nella versione precedente i SL erano in numero maggiore (955); la **riduzione del numero di aree** (cioè l'incremento della loro dimensione media) riflette un **ampliamento del raggio degli spostamenti giornalieri** dovuto alla crescente mobilità della popolazione.

Il secondo passaggio si basa sull'idea che un distretto industriale marshalliano sia semplicemente un SL che possiede determinate caratteristiche strutturali. Più specificamente, tra i 784 SL del 1991 vengono classificati distretti industriali quei sistemi locali che soddisfano le seguenti condizioni:

1. la **quota degli addetti all'industria manifatturiera** sul totale degli occupati non agricoli deve essere maggiore di quella media nazionale;
2. la quota degli occupati nell'industria manifatturiera in **imprese con meno di 250 addetti** deve essere maggiore di quella media nazionale;
3. supponendo che in **una o più branche dell'industria** manifatturiera la quota degli occupati sul totale degli occupati manifatturieri sia **maggiore della media nazionale** (condizione sempre verificata al di fuori di casi limite), almeno in una di tali branche la quota di occupati in **imprese con meno di 250 addetti** deve essere maggiore di quella media nazionale.

Sulla base di questi criteri vengono individuati, con riferimento al 1991, **199 distretti industriali**, con un'occupazione manifatturiera complessiva pari al 42,5% del totale italiano.

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Come si è detto, e come è inevitabile, la classificazione di Sforzi e Istat contiene **elementi di arbitrarietà** nella selezione degli indicatori e dei relativi valori soglia (Brusco-Paba, 1997). Per esempio, il limite dei 250 addetti - fondato su definizioni statistiche comunitarie - non ha una particolare giustificazione a priori; potrebbe anzi apparire troppo alto rispetto alla realtà dei sistemi produttivi locali italiani. Per fare un altro esempio, **la misura della specializzazione settoriale** dipende dallo schema di classificazione settoriale adottato: perciò, a seconda che si scelga di operare all'uno o all'altro livello di disaggregazione, la tassonomia dei sistemi locali risulterà in generale diversa. I criteri adottati implicano inoltre che un distretto industriale Sforzi-Istat possa avere **più di una specializzazione**, e che la/le specializzazioni individuate **possano non coincidere con il settore industriale** più importante del distretto in termini quantitativi.

Il problema dell'arbitrarietà della procedura di classificazione assume particolare rilievo perché la tassonomia Sforzi-Istat è rigorosamente dicotomica: **un'area, o è un distretto, o non lo è**. Queste considerazioni hanno indotto a ricercare **proposte alternative** non tanto in un ripensamento radicale dei criteri, quanto in una attenuazione del carattere dicotomico della classificazione, che vi introducesse qualche **elemento di gradualità e di multidimensionalità**.

Fine: citazione

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Fasi del ciclo di vita dei distretti industriali:

lo sviluppo dei distretti in Italia è strettamente collegato con le fasi congiunturali dell'economia complessiva e al processo di evoluzione di lungo termine della industria italiana.

Anni 60

- Fase di crescita della economia complessiva,
- Nascita di nuove imprese operanti nello stesso settore,
- Crescita estensiva dei distretti industriali.

Anni 70

- Forte inflazione e necessità di riduzioni dei costi di produzione e di ristrutturazioni,
- Diffusa adozione di innovazioni di processo,
- Processi di selezione e di sviluppo di tipo "intensivo" (sviluppo senza creazione di nuova occupazione).

Anni 80

- Ripresa economica e recupero della grande impresa,
- Processi di concentrazione finanziaria,
- Crescente integrazione con i servizi interni ed esterni.

Anni 90

- Processi di decentramento produttivo a scala internazionale,
- Riqualificazione, focalizzazione delle produzioni e crescente divisione del lavoro tra le imprese,
- Creazione di gruppi e di reti di imprese a scala interregionale,
- Sviluppo di sistemi di logistica integrata.

Anni 2000

- Ruolo della innovazione come fattore competitivo
- Diversificazione delle produzioni in settori nuovi
- Maggiore contenuto di attività immateriali nelle attività industriali: flussi di conoscenza e strutture distributive
- Investimenti di imprese internazionali e del settore del private equity nei distretti industriali
- Crescita delle esportazioni sui mercati extraeuropei

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Anni 2010: Effetti a lungo termine della crisi finanziaria 2008-2009

- Accorciamento delle supply chain e maggiore affidabilità e prossimità geografica
- Consumi meno opulenti o più austeri e attenzione ai costi
- Diversificazione produttiva nei settori dei servizi collettivi e privati
- Investimenti dei BRIC in Europa
- Rischio finanziario più elevato e alta propensione alla liquidità delle imprese
- Investimenti italiani in società estere
- Aiuto pubblico / libero mercato / governance: nuove politiche industriali
- Politiche pubbliche restrittive nei paesi più piccoli

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L'evoluzione dei distretti industriali nelle regioni più sviluppate

L'evoluzione recente dei sistemi produttivi locali più sviluppati mostra **la transizione dal modello del “distretto industriale” a quello della rete o del “network territoriale”**.

Il modello tradizionale dei “distretti industriali” sembra di fatto corrispondere all'esperienza dello sviluppo dei sistemi produttivi locali nelle regioni di maggiore industrializzazione durante gli **anni '60**, ma si rivela del tutto inadeguato a interpretare **la struttura industriale attuale** di queste regioni.

Nei sistemi produttivi locali di PMI delle regioni con maggiori tradizioni industriali (Lombardia, Emilia Romagna, Veneto) **emergono meccanismi che sono diversi da quelli tipici dei “distretti industriali” tradizionali**. Infatti, da un lato sono chiaramente individuabili anche in queste regioni diversi “sistemi produttivi” a scala locale o provinciale, caratterizzati da strutture e specializzazioni produttive sostanzialmente differenti tra loro e fortemente radicati nel loro rispettivo territorio.

Mentre il modello dei distretti industriali si caratterizza per l'essere fondato sui concetti di **specializzazione settoriale** e di **concentrazione geografica**, il modello dei network territoriali si caratterizza per l'essere fondato sul **concetto di “integrazione” di tipo sia settoriale che geografico**.

Un sistema produttivo locale moderno non si caratterizza tanto per la **concentrazione territoriale** di molte imprese **specializzate nello stesso settore**, quanto per la **specializzazione diversa** e la **complementarietà** delle diverse imprese anche con **imprese esterne**.

Aumentano i settori di specializzazione dei singoli sistemi produttivi locali e quindi aumenta la loro diversificazione settoriale. Il “**distretto industriale**” monosettoriale tradizionale si è trasformato in un “**sistema produttivo locale**” integrato a scala intersettoriale (Cappellin, 1998).

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I sistemi produttivi territoriali in molti paesi sono evoluti dallo stadio nel quale essi erano semplici **concentrazioni di imprese simili**, che lavoravano nello stesso settore produttivo ma tra loro concorrenti, allo stadio di **reti di imprese specializzate e complementari**.

La creazione di **forme di integrazione verticale**, come le filiere, permette al sistema produttivo locale di alimentare l'evoluzione continua del know-how produttivo, dal cui controllo dipende la possibilità di mantenere un vantaggio competitivo sostenuto nel tempo, come anche di assicurarsi un accesso sempre più immediato al mercato finale, che determina il valore aggiunto totale del ciclo produttivo complessivo.

Si sviluppano le relazioni a scala regionale e interregionale con la creazione di "network territoriali" o di "**reti di sistemi produttivi locali**" a scala regionale o anche interregionale.

Dall'altro, i sistemi produttivi territoriali moderni differiscono dal **modello tradizionale del "distretto industriale"**, basato su un modello di sviluppo "endogeno" e fortemente specializzato in un settore specifico, almeno per le seguenti caratteristiche (Cappellin 1998):

- a) un'elevata e crescente apertura internazionale non solo in termini di esportazioni, ma anche di investimenti, sia dall'estero che anche sempre più verso l'estero, e di accordi di cooperazione commerciale, produttiva e tecnologica a scala internazionale,
- b) un'elevata e crescente diversificazione delle produzioni locali,
- c) un allargamento del know-how produttivo locale e un'elevata diversità e complementarietà delle tecnologie adottate nelle singole imprese dei sistemi produttivi locali considerati.

Tre dimensioni del modello dei network territoriali

Il modello dei network territoriali consente di stabilire un legame diretto tra **tre diverse dimensioni dello sviluppo locale**, quali (Cappellin 1998, 1999, 2000):

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Ricardo Cappellin, Course: Innovation and Cognitive Economics, Università di Roma "Tor Vergata"

- 1) la **dimensione industriale/economica** delle relazioni economiche tra le imprese e gli attori locali,
- 2) la **dimensione fisica** della organizzazione del territorio e
- 3) la **dimensione istituzionale** delle relazioni tra i diversi livelli di governo locale e nazionale.

La dimensione industriale

- **Immanzitutto**, in una prospettiva industriale, il modello dei network territoriali implica immanzitutto una **maggior formalizzazione delle relazioni tra le imprese**, un tempo basate prevalentemente sulla fiducia e la conoscenza personale nei distretti industriali. Da esso deriva l'uso di accordi più vincolanti tra le imprese locali, come è tipico dei processi "just in time" e della "qualità totale".

- **In secondo luogo**, un network territoriale si caratterizza, rispetto al distretto industriale tradizionale, per una **maggior diversificazione settoriale** dell'economia locale e una relazione stretta di integrazione tra settori diversi.

Infatti, un sistema di produzione locale moderno è caratterizzato dalla **specializzazione** e dalla **complementarietà** delle imprese e porta a **forme di quasi-integrazione verticale** come le filiere, che permettono al sistema produttivo locale sia di combinare il know-how in continua evoluzione specifico delle singole fasi produttive che di assicurare un accesso sempre più diretto con il mercato finale ove si determina il valore aggiunto creato.

- **In terzo luogo**, il modello delle reti territoriali permette un'estensione del **quadro geografico**, nel quale le imprese sviluppano le relazioni di sub-fornitura e di altro tipo, a scala interregionale e internazionale, rispetto al mero ambito locale tipico nel modello dei distretti industriali. Infatti, le forme delle relazioni tra

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le imprese ed in particolare i rapporti di sub-fornitura e di integrazione finanziaria evolvono **continuamente e si estendono a scala geografica sempre più ampia**. Un'organizzazione a rete a scala interregionale permette **un accesso più facile alle informazioni sui diversi mercati di sbocco** e sull'evoluzione dei bisogni dei consumatori in regioni e paesi distanti.

La caratteristica del **radicamento territoriale** ("embeddedness") non appare in contraddizione con un'apertura esterna crescente a scala sia interregionale che internazionale. E' invece necessaria **una relazione stretta tra capacità "endogene" e apertura esterna**. In particolare, il concetto di "network territoriale" si caratterizza rispetto a quello tradizionale di "distretto industriale" o di "cluster" produttivo per il passaggio da un approccio di **relativa chiusura localistica** ("selective closure") **basata sulla omogeneità territoriale** ad un approccio basato sul **concetto di integrazione territoriale, che prevede reti fortemente radicate** ("embedded") **nel territorio** e a geometria variabile tra i diversi attori locali e tra questi e le regioni e i paesi esterni (Cappellin 1997, 1999, 2000).

- **In quarto luogo**, l'apertura interregionale e il processo di networking a scala locale consentono di promuovere **uno sviluppo e un cambiamento continuo delle conoscenze e competenze** nei singoli sistemi produttivi locali, tramite la sinergia tra le risorse tecnologiche specializzate interne alle imprese locali e quelle esterne in altre regioni e paesi. Questo consente di arricchire e sviluppare il know-how produttivo locale, mantenendo il controllo sulla tecnologia che assicura un vantaggio competitivo stabile nel tempo.

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La dimensione geografica

Con riferimento alla dimensione fisica, il modello dei network territoriali, ha il vantaggio di sottolineare la stretta relazione tra l'organizzazione delle relazioni economiche tra le imprese e l'**organizzazione del territorio regionale**, che è caratterizzata da un **reticolo fitto di insediamenti industriali o "sistemi produttivi locali"**, di **centri urbani di medie e piccole dimensioni** e da complesse relazioni di questi ultimi con le **grandi aree metropolitane** (Cappellin 1988, 1997b e 2000). In particolare, lo sviluppo dei sistemi produttivi di piccola e media impresa è sempre più strettamente legato alla valorizzazione del ruolo dei centri urbani, che forniscono moderni servizi alle imprese, e allo sviluppo delle **reti di trasporto e dei servizi logistici**.

La dimensione istituzionale

Infine, un'ulteriore caratteristica del modello dei network territoriali è il fatto che esso evidenzia **la dimensione istituzionale** del processo di sviluppo locale (Cappellin 1997a, 1997d). Infatti, in una società della conoscenza o in una "learning economy" **l'intervento degli enti pubblici appare necessario ove esistono asimmetrie informative**. Il crescente decentramento della economia e la complessità crescente di una moderna economia industriale creano **l'esigenza di una funzione di integrazione**, che deve essere svolta dalle istituzioni pubbliche e da nuove organizzazioni collettive.

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Pertanto, **il ruolo del governo locale e regionale diventa quello di catalizzare nuove soluzioni, come un “integratore di sistema”**, promuovendo l’integrazione di risorse complementari dei diversi attori, stimolando la capacità progettuale degli attori locali tramite la **proposta di programmi strategici (“action plans”)** e eventualmente tramite l’offerta di assistenza tecnica nella realizzazione di progetti specifici. Lo sviluppo di **reti tra gli attori locali (“policy network”)** indica l’importanza di **ruoli nuovi come quello del negoziatore, del leader**, del facilitatore, del catalizzatore, del broker, del gestore della rete e del promotore di forme nuove sistemiche di organizzazione tra imprese, organizzazioni e istituzioni.

In un nuovo approccio alla politica locale e regionale un ruolo cruciale viene assegnato non ai **“governi”** nazionali e neanche a quelli regionali e locali, ma agli **“attori”** e alle **“reti”** o ai **“network”** che organizzano le interazioni tra tali attori.

Il concetto di **interdipendenza ed integrazione** tra le diverse attività produttive non è sufficiente e i sistemi produttivi locali devono essere in grado di promuovere la creazione di **forme esplicite di cooperazione (“partnership”)** tra i **diversi attori locali**, che devono essere unite da una strategia comune e mirare esplicitamente a realizzare programmi d’azione (“action programmes”) comuni.

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Cappellin R., Marelli E., Rullani E. e Sterlacchini A. (2014), a cura di, **Crescita, investimenti e territorio: il ruolo delle politiche industriali e regionali** (contributi di: Leonardo Becchetti, Marco Bellandi, Patrizio Bianchi, Andrea Bollino, Roberto Camagni, Roberta Capello, Riccardo Cappellin, Stefano Casini Benvenuti, Enrico Ciciotti, Romeo Danielis, Alfredo Del Monte, Sergio Destefanis, Marco Frey, Sandrine Labory, Enrico Marelli, Marco Mutinelli, Alessandro Petretto, Francesco Prota, Enzo Rullani, Alessandro Sterlacchini, Gianfranco Viesti), **Website “Scienze Regionali”** (www.rivistasr.it), eBook 2014.1

Strategie di crescita e reti di innovazione nel territorio

Riccardo Cappellin¹

3. Le teorie dei policy-makers sono l’ostacolo al rilancio dell’economia

E’ difficile attribuire alla crisi internazionale la recessione dell’economia italiana quando quest’ultima si sviluppa meno di quelle di tutti gli altri grandi paesi europei. Le ragioni della cronica stagnazione dell’economia italiana sono in gran parte interne e sono rappresentate innanzitutto dagli ostacoli che impediscono di sfruttare le opportunità di medio e lungo periodo dell’economia italiana.

Una coraggiosa politica di investimenti in una prospettiva di medio termine è ostacolata in Italia più che dalla mancanza di capacità tecnologiche o dalla carenza di risorse finanziarie dall’incapacità di governance sia del settore privato che è vincolato da una logica meramente finanziaria e dall’immobilismo del “capitalismo di relazione” delle grandi imprese, che del settore pubblico che è vincolato dalla debolezza organizzativa dell’amministrazione pubblica e dalla frammentazione dei partiti politici.

Il principale di tali ostacoli sono le scelte economiche della “classe dirigente” (i manager delle grandi imprese private, i tecnocrati dei governi e del mondo della finanza e gli opinionisti nei media) nelle organizzazioni private e pubbliche, che sono vincolate (“effetto di lock-in” o “trappola delle competenze”) dalle teorie seguite da venti anni e che apparentemente hanno portato al successo. Infatti, esiste una relazione diretta tra le conoscenze degli attori, i comportamenti degli stessi e i risultati delle singole organizzazioni e dell’economia. Ad un’analisi basata su teorie datate o valide in un sistema industriale ormai scomparso non poteva che seguire una terapia sbagliata, inutile se non dannosa, per la perdita di produzione cumulata che ha determinato durante gli ultimi cinque anni di crisi.

Secondo un modello macroeconomico di offerta o di tipo neo-liberista, la crescita del PIL è determinata semplicemente dall’occupazione e dalla produttività. Infatti, nel modello neoclassico e liberista, si suppone che l’economia sia sempre in una situazione di piena occupazione assicurata dalla flessibilità di salari e prezzi. Il prodotto procapite è quindi determinato dalla produttività, dall’occupazione e dalla crescita della popolazione. Gli investimenti aumentano l’offerta o la capacità produttiva delle imprese e quindi la produzione per il mercato internazionale in cui si suppone che la domanda abbia un’elasticità infinita. Infine, l’aumento dei ricavi delle imprese aumenta il risparmio e quindi gli investimenti stessi. La produttività dipende dalla R&S e dalla formazione, secondo un modello che viene definito “lineare” o “top-down”. Non c’è spazio per il cambiamento strutturale in questo modello aggregato e quindi non c’è spazio per l’innovazione. Dato che si suppone una situazione di piena occupazione, un aumento della spesa pubblica non fa aumentare il PIL come indicato dal moltiplicatore keynesiano, ma determina solo uno “spiazzamento” (“crowding out”) o un aumento del tasso di interesse e una riduzione della domanda privata ed in particolare degli investimenti privati e un aumento del debito pubblico determina una riduzione dei consumi dato che i privati si aspettano maggiori tasse per ripagare il debito stesso (equivalenza Ricardiana).

La tesi prevalente nel dibattito politico e nei media e quella che si esce dalla crisi con il “fiscal compact”, l’aumento delle imposte e la riduzione della spesa pubblica, l’aumento dei prezzi dei servizi collettivi, la riduzione del debito, la ricapitalizzazione delle banche e la pulizia dei loro bilanci dai prestiti in sofferenza e

¹ Università di Roma “Tor Vergata”, Dipartimento di Economia, Diritto e Istituzioni, e-mail: cappellin@economia.uniroma2.it.

con le “riforme di struttura” e una “svalutazione reale” dei paesi con alto debito pubblico e quindi con la riduzione dei salari, la ristrutturazione e la chiusura delle produzioni meno efficienti. Questa strategia è quanto meno parziale e non tiene conto dell’interdipendenza generale tra i settori dell’economia, per cui la diminuzione del PIL determina un aggravamento degli squilibri finanziari iniziali. Comunque non è l’unica strategia possibile e senza un cambiamento nell’approccio alla politica economica e l’adozione di una diversa strategia e visione di lungo periodo sia delle imprese che del governo, la situazione di stagnazione è inevitabile che continui per molti altri anni.

Conforme al modello neoclassico e liberista è quanto afferma il Presidente della BCE, Mario Draghi: “Le riforme mirano a sciogliere i nodi che imbrigliano la capacità competitiva e soffocano la crescita. Un’efficace promozione e tutela della concorrenza, un adeguato grado di flessibilità del mercato del lavoro che sia ben distribuito tra generazioni, una burocrazia pubblica che non sia di ostacolo alla crescita, un capitale umano adatto alle sfide poste dalla competizione globale, un ambiente migliore sono fronti su cui, malgrado progressi recenti, non poco resta ancora da fare, sia pure in misura diversa nei singoli paesi” (cfr. Draghi, 2013).

Invece, la causa della crisi economica è stato il crollo della domanda interna e non la diminuzione della competitività internazionale, dato che l’effetto netto sul PIL del commercio estero è stato complessivamente positivo (50 mld), nel periodo 2008-2013 si è assistito ad un aumento, anche se non enorme (4,7 mld), delle esportazioni e si è assistito ad una grande diminuzione delle importazioni (45,2 mld). Inoltre, non è neanche efficace economicamente cercare di aumentare la domanda di fattori da parte delle imprese riducendone il costo, quando il vincolo non è l’offerta dei fattori ma la loro domanda e siamo in presenza di un eccesso di capacità produttiva. Infine, la competizione globale si gioca sulle innovazioni di prodotto e gli investimenti necessari per introdurre nuove produzioni e non sui costi produttivi delle produzioni in crisi.

Il secondo elemento della dottrina liberista, dopo le “riforme strutturali”, è il “fiscal compact” o la riduzione del deficit e del debito pubblico. In particolare, secondo il cancelliere tedesco Angela Merkel: “Senza solidità finanziaria non possiamo avere crescita e consolidamento e crescita sono due lati della stessa medaglia”, e Jens Weidmann, Presidente della *Deutsche Bundesbank* che in una intervista al Financial Times, 7 maggio 2012, sosteneva che: “Macroeconomic imbalances and unsustainable public and private debt in some member states lie at the heart of the sovereign debt crisis”. Infatti, la Germania teme una “*Transfer Union*”. ove i cittadini tedeschi diventerebbero responsabili dell’intero peso delle garanzie sul debito di altri paesi.

La dottrina del “fiscal compact” non considera l’inevitabile interdipendenza tra il riequilibrio dei saldi finanziari del bilancio pubblico e il peggioramento dei saldi finanziari dei bilanci delle famiglie in termini di maggiori tasse e minori trasferimenti, che riducono la domanda interna e quindi la crescita dell’economia. Pertanto, delle politiche di fiscal compact e delle politiche di riforma strutturali si può dire quello che si dice della politica monetaria, che “è come una corda che stringe ma non spinge”.

Il fallimento delle politiche monetarie e fiscali di stabilizzazione finanziaria è di fatto indicato non solo dalla recessione ma anche dalla crescita del rapporto debito/PIL (per l’aumento del numeratore e la riduzione del denominatore), del tasso di disoccupazione, delle disparità di reddito procapite tra Germania e Italia e tra regioni del Nord e del Sud Italia, dalla frammentazione dei mercati finanziari in tanti mercati nazionali con tassi di interesse diversi, dal gap tra l’enorme liquidità presente nelle grandi banche e nelle grandi imprese e i minori investimenti produttivi (non finanziari) delle grandi imprese, dalle disparità di reddito tra i membri della classe dirigente e il restante 99% dei cittadini, dal fatto che la capacità produttiva dell’economia nel lungo periodo è diminuita come indicato dagli scarsi investimenti in innovazione e ricerca e dal fatto che molte imprese e molti stabilimenti produttivi sono stati chiusi.

Le politiche macroeconomiche finora seguite o la mancata adozione di politiche diverse, che sono state avversate in quanto troppo interventiste, hanno determinato l’aspettativa di una stagnazione di lungo periodo dell’economia, un’inflazione eccessivamente bassa che scoraggia l’indebitamento, gli investimenti e i consumi, alti tassi di interesse e stretta del credito, alta variabilità dei mercati azionari e incertezza sul tasso di cambio euro/dollaro e quindi dei prezzi sui mercati internazionali. Questo ha generato una situazione di tale incertezza, di ansietà o di bassa fiducia dei consumatori e delle imprese, che non consente la previsione e il calcolo della convenienza economica dei progetti di investimento e ha portato a rinviare le decisioni sia di investimento che di consumo e ad aumentare i risparmi e la liquidità.

È necessario un allargamento della prospettiva temporale e territoriale. E’ compito del mondo della ricerca e delle associazioni scientifiche indicare alle istituzioni nazionali ed agli operatori economici analisi obiettive e linee generali di intervento efficaci sulla base dei risultati degli studi e delle teorie più recenti. In particolare,

l’economia regionale e l’economia industriale indicano un modello della crescita economica completamente diverso da quello della macroeconomia tradizionale e dell’approccio neo-liberista.

4. La crescita economica e le reti di innovazione territoriali

Il contributo originale dell’economia industriale, regionale, del lavoro e del management sviluppato negli ultimi decenni innova radicalmente le analisi dell’economia rispetto agli strumenti teorici della macroeconomia tradizionale basata su un approccio neoclassico e neoliberista. La dottrina “neoclassica”, che insiste sulla flessibilità e la concorrenza dei diversi mercati del lavoro, finanziari, dei prodotti e dei servizi, non considera le economie e diseconomie esterne delle singole imprese nè i rapporti tra le diverse imprese nell’ambito di un sistema d’innovazione nazionale, regionale o settoriale. Pertanto, si rivela inadeguata a promuovere la crescita in una società moderna sempre più complessa, ove una sempre maggiore velocità del cambiamento è il requisito fondamentale. Invece, la letteratura economica sull’economia della conoscenza e il modello dei network territoriali, che è alla base di molti studi di Scienze Regionali (Lundvall, Johnson, 1994; Antonelli, 1998; Egidi, Rizzello, 2003; Fagerberg, 2005; Tidd, Bessant, Pavitt, 2005; Metcalfe, Ramlogan, 2005; Cappellin, Wink, 2009) spiegano che la conoscenza e l’innovazione sono il risultato di un processo di apprendimento interattivo all’interno di un network o di un sistema di innovazione composto da diversi attori, come ad esempio le grandi e piccole imprese industriali, le società di servizi tecnologici alle imprese, le istituzioni di ricerca, le banche e le istituzioni locali e nazionali.

Il cambiamento e l’innovazione sono due processi che non si vedono nei modelli di tipo aggregato come quelli neo-liberisti di offerta aggregata. Infatti, la crescita è collegata allo spostamento dell’occupazione dai settori meno produttivi a quelli più moderni, alla nascita di imprese più competitive ed alla chiusura delle imprese più vecchie ed inefficienti all’interno di ogni settore ed allo spostamento delle risorse materiali ed immateriali all’interno delle imprese dai prodotti meno profittevoli ai prodotti e processi più innovativi.

L’innovazione implica, come dice Joseph Schumpeter, un processo di “distruzione creatrice” e cambiamenti nell’allocazione delle risorse, crea conflitti tra vincitori e vinti, richiede tempi di concertazione tra attori con interessi diversi. La crisi e la chiusura delle imprese meno efficienti liberano le risorse produttive che possono essere utilizzate da produttori nuovi e più efficienti e aprono nuovi mercati alle loro produzioni innovative. Tale cambiamento nell’allocazione delle risorse è ostacolato dai costi di transazione nelle relazioni tra gli attori e dai costi di transizione nel cambiamento da vecchie a nuove soluzioni tecnologiche. Questi ostacoli possono determinare situazioni di “lock in” o di trappola delle competenze, in cui non si è capaci o non si vuole uscire da soluzioni superate. Chiaramente l’innovazione è ostacolata dall’esistenza di interessi collusivi tra i diversi attori oligopolisti tipici del “capitalismo di relazione” italiano, che perderebbero le loro rendite di potere ed economiche se si introducessero dei cambiamenti.

Inoltre, l’innovazione richiede, come dice Carlo Cattaneo, “intelligenza” e “volontà” (Loasby, 2003) o da un lato maggiori informazioni e conoscenze e dall’altro maggiori capacità di decisione, di concertazione o di coordinamento. Questo è tanto più vero in un’economia moderna ove il capitale intellettuale o la conoscenza tecnologica e organizzativa e la loro articolazione in progetti industriali validi sono indispensabili per consentire l’innovazione. Inoltre, con riferimento alla “volontà”, in un sistema moderno di “capitalismo finanziario” le decisioni sui progetti di investimento e di innovazione da parte delle imprese industriali dipendono dalle compartecipazioni azionarie e dalle alleanze tra le imprese, dall’accesso ai mercati finanziari internazionali e dal credito bancario.

Lo spazio e il territorio hanno un forte impatto sui processi cognitivi e sulla generazione della conoscenza. I processi cognitivi possiedono una dimensione localizzata e il processo dell’innovazione è caratterizzato dall’*embeddedness* che favorisce l’agglomerazione spaziale delle attività innovative (Cappellin e Wink 2009; Cappellin 2010). Infatti, una maggiore prossimità geografica e/o una maggiore prossimità cognitiva facilitano le interazioni tra diversi attori complementari e la combinazione di pezzi di conoscenza complementari e in particolare favorisce lo sviluppo della creatività che dipende dalla condivisione delle conoscenze tacite.

Pertanto, nel modello dei network territoriali, la crescita e l’innovazione risultano dalla combinazione tra tre tipi di rete e di processi, come indicato nella figura 1 (Cappellin, Wink, 2009):

1. la crescita della domanda interna che dipende dalla creazione di *reti di cittadini e associazioni*, che stimolano lo sviluppo di nuovi bisogni e la produzione di beni collettivi la cui domanda è spesso latente,

- l'aumento della propensione a investire delle imprese in produzioni complesse e innovative che dipende dalla creazione di *reti produttive e di innovazione* tra le diverse imprese,
- lo sviluppo delle capacità di governance che dipende dalle *reti delle istituzioni e degli attori locali* che permettano l'aggregazione della domanda e delle capacità di offerta a scala territoriale e regionale, data la natura collettiva e complessa dei programmi di investimento da realizzare sul territorio nazionale.
- Queste tre reti sono a loro volta collegate da un lato con le *reti di conoscenze* e dall'altro con le *reti fisiche sul territorio*. Infatti, le reti di conoscenza sono influenzate dalle reti sociali tra i consumatori e dalle reti produttive tra le imprese, in cui circolano flussi di prodotti, servizi, lavoro e capitali. Le reti di conoscenza influiscono sull'adozione delle innovazioni e quindi sulle decisioni di investimento e sulla produttività delle imprese e sul cambiamento delle preferenze e della domanda di beni e servizi da parte dei consumatori. D'altro lato, la struttura del territorio, le reti di infrastrutture e la qualità della vita influisce sulla domanda aggregata e le reti dei consumatori e sull'offerta aggregata e le reti delle imprese, oltre che sulla competitività delle esportazioni.
- In questo modello, come indicato dalla figura 1, gli investimenti sono determinati dalle innovazioni che a loro volta sono influenzate dalle reti di conoscenza, all'interno delle quali interagiscono le reti delle imprese e le reti dei consumatori, come indicato di seguito. Inoltre, gli investimenti dipendono dall'efficienza delle reti territoriali e dal bisogno di migliore qualità della vita, e dalla *governance* o dalle reti dei decisori, che determinano le politiche industriali e le politiche del credito e di finanziamento degli investimenti. Infine, la crescita del PIL è determinata non solo dall'offerta o dal potenziale produttivo ma anche dalla domanda per consumi e per investimenti e l'economia non si trova sempre in piena occupazione.
- Di fatto a differenza dei modelli keynesiano e neoclassico, ove la domanda determina l'offerta oppure l'offerta determina la domanda, nel modello dei network di innovazione la domanda ed l'offerta interagiscono in modo dinamico tra di loro non solo a livello aggregato ma anche nei singoli settori e gradualmente portano allo sviluppo di nuovi prodotti e servizi. Per ciascun prodotto o servizio la domanda e l'offerta sono in un equilibrio dinamico, in cui a volte la domanda dei consumatori o degli utilizzatori più innovativi (*lead users*) anticipa l'offerta e a volte le nuove capacità dell'offerta dei produttori più innovativi (imprese *leader*) anticipano la domanda. Questo determina un cambiamento graduale delle produzioni (Cappellin 2012). L'economia avanza come un'imbarcazione in cui i rematori di destra e quelli di sinistra spingono in direzioni opposte. Questo può essere definito un modello di crescita basato sul bilanciamento iterativo delle variazioni della domanda e dell'offerta ("*iterative balanced demand and supply changes*"). Pertanto, un elemento importante di una nuova strategia di crescita è lo sviluppo di nuovi settori moderni soprattutto nelle grandi aree urbane, trainati dalla domanda interna e che mirano a soddisfare i bisogni emergenti e particolarmente qualificati dei cittadini e dei consumatori. Sono quindi necessarie nuove politiche industriali che incentivino e aggregino tali bisogni, che sono spesso solo impliciti, tramite una regolazione appropriata, il finanziamento, lo sviluppo della progettualità e il sostegno alla sperimentazione, in modo da creare nuovi mercati (*lead markets*) per le nuove produzioni.
- Inoltre, il mercato del lavoro e il mercato dei prodotti evolvono assieme (Cappellin, 2012) come effetto dello sviluppo di nuova conoscenza. Le persone caratterizzate da maggiori livelli di conoscenza offrono servizi lavorativi sempre più qualificati. Questo aumenta la produttività delle imprese e le persone ottengono redditi da lavoro maggiori dalle imprese stesse. D'altro lato le persone con maggiori e migliori conoscenze sviluppano bisogni sempre più qualificati, che le portano a domandare beni e servizi nuovi. Le imprese, che ottengono servizi lavorativi più qualificati, possono utilizzare tecnologie più moderne e produrre beni e servizi più qualificati adeguati alla nuova domanda dei consumatori.

Figura 1 - Il modello a rete dello sviluppo regionale



Fonte: adattato da Cappellin e Wink, 2009.

5. Il ruolo delle istituzioni in una strategia di crescita

Le politiche monetarie europee di tipo espansivo, che hanno permesso il salvataggio delle banche, e le politiche fiscali europee e nazionali di austerità, che hanno permesso il salvataggio degli Stati, non sono sufficienti a promuovere la crescita. Infatti, per la gran parte dei cittadini sarebbe di grande lunga preferibile una politica industriale, regionale e del lavoro, che promuovesse l'innovazione e l'organizzazione di progetti di investimento validi economicamente sia privati che pubblici in nuovi settori moderni, che migliorasse l'accesso delle imprese all'abbondante liquidità esistente sui mercati internazionali dei capitali, che facesse crescere gli investimenti, il PIL, l'occupazione, la produttività e i salari, che riducesse le tasse e migliorasse la qualità dei servizi pubblici, che aumentasse l'efficienza e riducesse le tariffe nei servizi di interesse collettivo prodotti da imprese private in regime di monopolio o oligopolio.

Dal punto di vista macroeconomico, il rilancio della crescita non può avvenire se non con la crescita della domanda interna e in particolare degli investimenti privati e pubblici. Forti politiche regionali e industriali permetterebbero di rilanciare gli investimenti, nuove produzioni e l'occupazione, partendo in primo luogo dai bisogni insoddisfatti di "migliore qualità della vita" e di nuovi e migliori servizi dei cittadini. Ambito prioritario di una tale politica industriale sono le aree urbane, dove si concentrano gran parte della popolazione, delle imprese più innovative, della domanda aggregata come pure i più acuti problemi sociali e ambientali. Infatti, la politica industriale o è regionale e articolata in modo flessibile sul territorio nazionale o non è realizzabile ed efficace.

Di fatto, la politica industriale è indispensabile perché i progetti di investimento e di innovazione sopra illustrati sono spesso troppo complessi e grandi e richiedono tempi troppo lunghi per una sola impresa. Quindi, la loro progettazione, realizzazione e gestione richiede sia l'integrazione che la successione coordinata delle attività specifiche di imprese tra loro diverse che il libero mercato non può assicurare. Spetta inoltre alle istituzioni pubbliche e alle politiche industriali e regionali allungare l'orizzonte temporale del calcolo economico dei diversi attori privati, migliorare le loro aspettative ed indurli ad aumentare la loro propensione al rischio ed all'investimento promuovendo tramite il metodo della concertazione o della governance grandi progetti strategici di innovazione e investimento a medio e lungo termine.

Le grandi imprese devono essere indotte dalla politica industriale nazionale a riprendere i loro progetti di investimento di medio e lungo periodo² e questi investimenti faranno da volano alla produzione di molte piccole imprese fornitrici e avranno un effetto moltiplicativo sull'economia. D'altro le politiche industriali a livello regionale dovrebbero aiutare le PMI a rendersi indipendenti dalla domanda di fornitura delle grandi imprese in Italia ed a esportare su nuovi mercati. Pertanto, le politiche industriali a scala regionale dovrebbero avviare progetti di investimento di tipo strategico nelle grandi aree urbane basati sulla cooperazione pubblico-privato e sviluppare le reti di cittadini e di utilizzatori, che permettono lo sviluppo della domanda di mercato interna dei nuovi prodotti e servizi. Inoltre, dovrebbero aiutare le PMI a mettere in comune le loro conoscenze tacite di tipo tecnologico e a fare innovazione diversificando i loro prodotti e i mercati. Infine, dovrebbero sostenere con strumenti di finanziamento speciali le PMI innovative.

Un nuovo approccio alla politica economica di sviluppo richiede un nuovo ruolo dello Stato e delle istituzioni nazionali e locali. Infatti, reti di produzione e innovazione ben strutturate richiedono l'esistenza di un sistema istituzionale ben sviluppato e stabile che riduca i costi di transazione e di aggiustamento, acceleri il processo di decisione politica, diminuisca i tempi di realizzazione degli interventi e permetta una velocità maggiore del processo di cambiamento. In particolare, nuove strutture organizzative e nuove istituzioni sono necessarie per facilitare l'aggiustamento strutturale ad un'economia della conoscenza, promuovere le interazioni sociali e ridurre i tempi per adottare un'innovazione.

Come indicato dalla figura 1, le istituzioni pubbliche assieme alle istituzioni finanziarie determinano la "governance" del sistema produttivo e di innovazione locale e influiscono su tutte le variabili sopra indicate. Tramite le politiche della ricerca e della formazione³ influiscono sulle reti di conoscenza e tramite le politiche territoriali influiscono sulle reti dei trasporti e le reti degli insediamenti produttivi e residenziali sul territorio regionale. Tramite le politiche fiscali influiscono sulla domanda dei consumatori. Tramite le politiche commerciali e del tasso di cambio influiscono sulle esportazioni ed anche sugli investimenti esteri⁴ e le fusioni e acquisizioni a scala internazionale. Infine tramite le politiche industriali e dell'innovazione influiscono sulle reti di imprese, le decisioni di investimento e l'adozione delle innovazioni.

La *governance* è un approccio di politica industriale diverso dagli approcci del libero mercato e della pianificazione dirigitica ed è più adatto a "governare" un sistema capitalistico moderno e le complesse reti di conoscenza e innovazione che lo caratterizzano (Cappellin, 2009⁵ e 2009b). Il modello della *governance* o della concertazione è basato sul principio della negoziazione, dello scambio e del consenso che sono diversi dai principi dell'autorità tipico del modello della pianificazione e dal principio di competizione e della sopravvivenza del più adatto tipico del modello del libero mercato. Pertanto, una nuova politica di crescita richiede l'adozione di una logica d'interazione e cooperazione, che migliori il radicamento sul territorio di molte imprese e permetta di sviluppare una visione o una strategia di lungo termine condivisa o la capacità di "fare sistema".

La critica alle politiche fiscali e monetarie neo-liberiste non implica necessariamente una strategia keynesiana di sviluppo di tipo tradizionale. Non sono indispensabili scelte prese a livello centrale o di tipo dirigitico, come ad esempio un grande progetto di investimento pubblico nazionale o europeo. Una strategia nuova è invece quella di un approccio dal basso (bottom-up)⁵, che valorizzi le iniziative collettive e di collaborazione strategica ("Patti per la Crescita" locali e regionali) tra i diversi attori privati e pubblici nelle diverse città e regioni, e colleghi a livello nazionale ed europeo tra di loro i diversi progetti locali e regionali tramite forme flessibili o a rete di raccordo.

² cfr. i contributi di Alessandro Sterlacchini, Marco Bellandi e Enzo Rullani in questo e-book

³ cfr. il contributo di Sergio Destefanis in questo e-book

⁴ cfr. il contributo di Marco Mutinelli in questo e-book

⁵ cfr. i contributi di Enrico Ciciotti e di Roberto Camagni e Roberta Capello in questo e-book

Infine, il trasferimento a livello europeo delle politiche del tasso di cambio, della politica monetaria e della stessa politica fiscale, rende necessario che in base ad un principio di sussidiarietà verticale⁶ gli stati nazionali e le regioni possano adottare misure di politica industriale, regionale e del lavoro che stimolino l'innovazione e nuove produzioni soprattutto in una situazione cronica di altissimi livelli di disoccupazione, che rende inadeguato un approccio liberista.

⁶ cfr. i contributi di Alessandro Petretto e Roberto Camagni in questo e-book

Riccardo Cappellin, Corso di Economia della Ricerca e della Conoscenza, Università di Roma "Tor Vergata"

International Knowledge and Innovation Networks

Knowledge Creation and Innovation in Medium-technology Clusters

Riccardo Cappellin
University of Rome Tor Vergata, Italy

Rüdiger Wink
Leipzig University of Applied Sciences, Germany

NEW HORIZONS IN REGIONAL SCIENCE

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4.19 THE APPROACH OF TERRITORIAL KNOWLEDGE MANAGEMENT

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KEY POINTS

“Territorial Knowledge Management” (TKM) is an operational framework, which aims to organize the cognitive relationships between the firms in the process of innovation within a local network of cluster (Cappellin, 2003b, 2007; Harnakorpi and Melkas, 2005; Wink, 2003). TKM shall serve to facilitate the flows of tacit and codified knowledge.

Therefore, TKM represents a new approach to the local innovation policies.

More generally, TKM aims to facilitate the process of interactive learning through the governance of the cognitive relationships in a network of local actors.

The models of knowledge management are not capable to identify neither how the new knowledge is being created nor how from this knowledge value may be created. Thus, Territorial Knowledge Management follows a cognitive rather than an accounting approach and its aim is to explain the key factors leading to the creation of knowledge and how the firms may create value from knowledge through innovation.

The framework of TKM is rather general and it can be applied to different types of networks and different types of knowledge flows

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In particular, TKM aims to:

- promote the creation of the "territorial knowledge capital" (TKC);
- extract the value of territorial knowledge capital through the enhancement of innovation;
- guide the creation of new formal and informal institutions, infrastructures, norms, rules and routines;
- provide a quantitative accounting framework to measure the local strengths and weaknesses in the perspective of the knowledge economy.

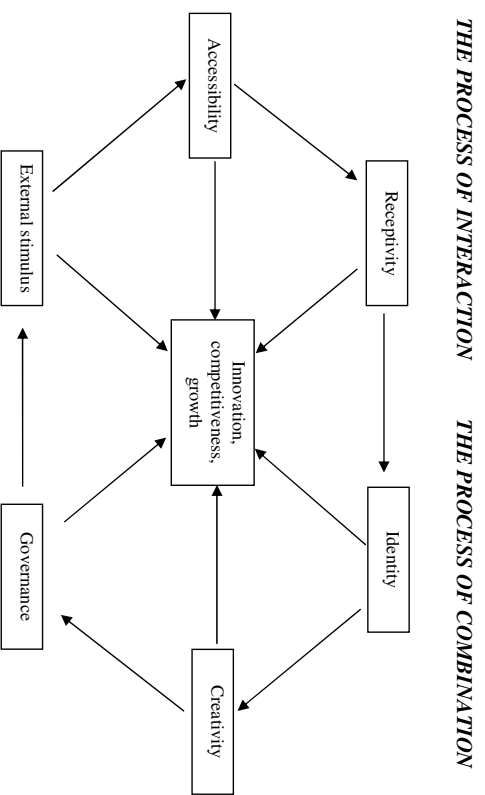


Figure 10: Territorial Knowledge Management as a framework for the governance of regional knowledge networks

The approach of Territorial Knowledge Management is based on the concepts of cognitive economics, such as the concepts of networking and integration, interactive learning and knowledge creation. This approach highlights (Cappellin, 2007) that there are six dimensions or drivers, which represent key necessary conditions for the development of interactive learning processes within a network and the creation of new tacit and codified knowledge:

- external stimulus,
- accessibility,
- receptivity,
- identity,
- creativity,
- governance.

These six factors allow to focus the various policy instruments for the governance of the learning networks in a regional innovation system on a limited number of dimensions, which are tightly related to the factors of the processes of knowledge creation according to the literature in cognitive economics.

While these three factors: external stimulus, accessibility and receptivity, are key factors in promoting interactive relationships or the connectivity between the local actors, the territorial knowledge management framework indicates three other factors, which are crucial in promoting the original re-combination of previous knowledge modules, leading to knowledge creation and innovation.

The approach of TKM represents a theoretical and operative framework based on the concepts of cognitive economics and focusing on the factors leading to knowledge creation. That allows to enlarge the factors traditionally considered in innovation policies, such as technology transfers, R&D investment and labour training, and to consider also other factors, which enhance the process of interactive learning within knowledge and innovation networks in the various regions. This approach is especially suitable in the case of networks of SMEs in intermediate technology sectors. However, it is also useful in regions specialised in high tech o in low tech sectors, where knowledge creation is still, together with others, a key factor of international competitiveness. Table 12 illustrates that the TKM approach can be flexible enough to consider the differences and specific characteristics of three different types of regions and sector specialization.

**Table 12: Policy areas according to the Territorial Knowledge Management approach
in selected knowledge and innovation networks**

Type of knowledge and innovation network			
Characteristics and factors	Ecological networks	Identity networks	Strategy networks
a) regions, sectors and firms	Peripheral regions Low tech sectors Traditional SMEs	Industrial clusters Medium-tech sectors Innovative SMEs	Urban areas High tech sectors Large enterprises
b) knowledge base	Symbolic/synthetic Knowledge	Synthetic/symbolic knowledge	Analytical/ synthetic knowledge
c) knowledge interaction	Knowledge spill-over	Interactive learning	KM and R&D Joint projects

1. Innovation stimulus	Cost competition in the global market	Customer needs and high supply chain integration	Product innovation in specialized markets and technology push
2. Accessibility	Low international accessibility - low local accessibility	Low international accessibility - high local accessibility	High international accessibility - low local accessibility
3. Receptivity	Low qualification of human resources	Specialized skilled workers	High internal sectoral diversity
4. Identity	Fragmentation and external dependence	High local embeddedness and local identity	Low cognitive proximity and common identity
5. Creativity	Technology adoption	Networking and interactive learning	High investments In R&D
6. Governance	Public infrastructures and finance and deregulation	Multi-level governance at the regional level and bridging institutions	National industrial strategies and firms alliances in specific fields

In fact, many innovations in medium-tech sectors have to integrate science-driven (analytical knowledge) or creative (symbolic knowledge) elements, which characterize either high tech or low tech activities, which may be concentrated in the same region or geographical cluster. In fact, integrated innovations not only require connections between medium and high technologies, but also the comprehension of innovation processes in high-tech and in low-tech sectors. Technologies like the development of composites as new materials are a typical example, where knowledge from high technologies have to be connected with medium-technology productions (where the new materials are used, such as aeronautics and car industry) and low-technology productions (where the new materials are integrated, such as textile).

4.20 THE INNOVATION PROCESS IN MEDIUM-TECH SECTORS

PAGES 172-174

KEY POINTS

Major factors of weakness of clusters specialized in medium tech sectors are: 1) a low international accessibility, 2) lack of creativity and product innovation instead of the hitherto focus on process innovation, 3) need for formal instruments of governance of knowledge relations to enhance the emergence of more formal cooperation between the firms. Innovation policies in the modern industrial clusters specialized in medium technology sectors should take into account the nature of their knowledge base mainly consisting of synthetic and symbolic knowledge and the form of their knowledge interaction characterized by interactive learning processes.

4.21 THE INNOVATION PROCESS IN HIGH-TECH SECTORS

PAGES 174-176

KEY POINTS

Clusters specialized in high tech sectors indicate different key problems, such as: 1) a low local embeddedness of large firms, 2) problems in combining R&D activities or analytical and symbolic knowledge, which are science and technology driven, with creativity, which is driven by the users' needs and the demand, 3) the need to avoid a too high concentration in large firms and to promote spin offs and the participation also by SMEs and other social partners in strategic decision making. These clusters can be mostly found in central and metropolitan urban areas. Innovation policies in central urban areas should take into account the nature of their knowledge base consisting of analytical and synthetic knowledge, and the form of the knowledge interaction characterized by knowledge flows coordinated by knowledge management and joint R&D projects. Knowledge networks in these areas are characterized by links between large firms and research institutions and by professional networks within knowledge intensive business services.

4.22 THE INNOVATION PROCESS IN LOW-TECH SECTORS

PAGES 176-178

KEY POINTS

Clusters specialized in low tech sectors are characterized by various weaknesses, such as: 1) too low international accessibility, 2) the lack of receptivity and qualified skills, 3) the lack of identity and fragmentation in decision-making. These clusters are typically located in less developed and peripheral areas being dependent on public subsidisation and so far exclusively on cost advantages. Innovation policies in the less developed peripheral areas specialised in low tech sectors should take into account the nature of their knowledge base, mainly consisting of symbolic or creativity based knowledge and sometimes synthetic or engineering based knowledge, and the form of knowledge interaction in these regions, characterized by automatic knowledge spill-over based on geographical proximity.

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4.19 THE APPROACH OF TERRITORIAL KNOWLEDGE MANAGEMENT

eTerritorial knowledge management f (TKM) is an operational framework that aims to organize the cognitive relationships between the firms in the process of innovation within a local network of cluster (Cappellin, 2003b,

Knowledge economy:

competitiveness through innovation, high creativity

Interactive learning and

incremental innovation

Systemic

innovation and territorial knowledge

management

Governance:

identity

networks Process innovation, technology suppliers, competitors, imitation

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and lock-in effect
Vertical
integration,
large firms and
technology transfers
to subcontractors
Governance:
strategy
networks
Industrial economy:
cost competition,
low creativity

Figure 4.17 From an industrial to a knowledge economy in mediantechology clusters

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2007; Wink, 2003; Harmakorpi and Melkas, 2005). TKM serves to facilitate the flows of tacit and codified knowledge. This approach is highly flexible and can be adapted to various European clusters. Territorial knowledge management aims to make the organization of knowledge interactions more explicit and formal. In a traditional production system, the required information and competencies are often only circulating in a too implicit, complex and slow process. Territorial knowledge management

may be defined as the policy that aims to promote the innovation potential, the competitiveness and the development of clusters and firm networks through an appropriate management of the interactive learning processes leading to the creation of new knowledge.

Therefore, TKM represents a new approach to the local innovation policies that represents an evolution of the approach of regional innovation strategies (RIS) and is different from more traditional approaches such as financial incentives to R&D, technology transfer centres, science and technological parks, incubators of innovative firms and venture capital. For medium-technology industries, TKM offers specific advantages, as it serves to overcome the barriers of knowledge interactions caused by the low formality and non-codification of tacit knowledge. These barriers have been so far the main hindrances for many European medium-tech industry firms to gain access to international knowledge networks and pipelines.

While traditional knowledge management focuses on the transformation of individual tacit knowledge into corporate codified knowledge, territorial knowledge management looks for the transformation of the internal knowledge of various firms and regional actors into localized collective knowledge to be shared between all actors of a sectoral/regional cluster. TKM also aims to facilitate the acquisition from outside the region of knowledge, which can be combined with internal knowledge and may be crucial for the competitiveness of the regional production system

considered. More generally, TKM aims to facilitate the process of interactive learning through the governance of the cognitive relationships in a network of local actors.

Traditional knowledge management aims to measure the monetary value of the various forms of knowledge existing within a firm through various, mostly quantitative indicators, but the models of knowledge management are neither capable of identifying how the new knowledge is being created nor how from this knowledge value may be created. Knowledge is not a stock or production factor, which can be bought and sold on the market, but rather it is the activity of knowing or a process of learning.

Thus, territorial knowledge management follows a cognitive rather than an accounting approach and its aim is to explain the key factors leading MI798 - CAPPELLIN TEXT.indd 162 30/3/09 15:08:34

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to the creation of knowledge and how the firms may create value from knowledge through innovation.

The framework of TKM is rather general and it can be applied to different types of networks and different types of knowledge flows, such as, for example, in the case of the governance of networks of firms in various industrial or service sectors, in clusters with low or medium or high technological level or also in the case of the professional networks made by skilled workers.

In particular, TKM aims:

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1. To 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, thus avoiding lock-in effects and managing the six levers to be described below.

Territorial knowledge capital represents a form of collective tacit knowledge and is the result of the original combination of the human capital of the individual workers and of the intellectual capital of the various firms rather than being the summation of these two components.

2. To extract the value of territorial knowledge capital through the enhancement of innovation, which is the key factor for the competitiveness and growth of a regional economy.

3. To create new innovation networks within the regional innovation system and to guide the creation of new formal and informal institutions, infrastructures, norms, rules and routines, which enable the governance of the innovation networks and the interactive learning processes.

4. To provide a quantitative accounting framework to measure the local strengths and weaknesses from the perspective of the knowledge economy.

The approach of territorial knowledge management is based on the concepts of cognitive economics such as the concepts of networking and integration, interactive learning and knowledge creation. This approach

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highlights (Cappellin, 2007) that there are six dimensions or drivers that represent key necessary conditions for the development of interactive learning processes within a network and the creation of new tacit and codified knowledge:

- α external stimulus;
- α accessibility;

- α receptivity;

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- α identity;

- α creativity;

- α governance.

These six factors allow us to focus the various policy instruments for the governance of the learning networks in a regional innovation system on a limited number of dimensions, which are closely related to the factors of the processes of knowledge creation according to the literature in cognitive economics.

The relationships between these dimensions of the knowledge creation and innovation process are indicated in Figure 4.18. In particular, the external stimulus induced by the opportunities of the demand, the pressure of competition or the change in technologies determines a tension leading to the search for a solution of the problems of the firms. This searching process is facilitated by a higher accessibility to potential complementary

partners, and it also requires an appropriate receptivity of these latter.

The creation and strengthening of a common identity, made by common values and sense of belonging, is the prerequisite for the cooperation and the search for joint solutions. These latter are the result of creative capabilities and the original combination of different and complementary pieces of knowledge through a process of interactive learning between various local actors. Finally, new ideas can be translated into economic innovations only through an appropriate organization and governance, which implies the commitment of appropriate resources and the integration of the new ideas with complementary production capabilities.

Receptivity Identity

Accessibility

Innovation,

competitiveness,
growth

Creativity

THE PROCESS OF INTERACTION THE PROCESS OF COMBINATION

External stimulus Governance

Figure 4.18 Territorial knowledge management as a framework for the governance of regional knowledge networks

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The approach of TKM indicates the cumulative nature of the process of

interactive learning, adoption of innovation and building of new competencies, as the various phases indicated above feedback on each other. The new knowledge created and the experience developed in previous periods affect the receptivity of the various actors to new ideas and also their capability to understand the emerging needs of potential users. Thus, the development of the internal capabilities of the individual actors is affecting the future evolution path of the innovation system considered.

4.19.1 Promotion of Innovation Stimulus

SMEs are characterized by close user-producer relationships. Innovation is the result of the adaptation to new needs and market demand, to changes in competition conditions and also to breakthroughs in technology. These factors represent external threats to be tackled or opportunities to be exploited and motivate action by the firms. Innovation aims to solve specific urgent problems that call for a solution and motivate investment in the iterative search for different complementary competencies. Firms are stimulated more by the risk of survival determined by the selection mechanism characterizing highly competitive markets than by the explicit aim to find a profit maximization solution on the basis of analytical reasoning. Moreover, innovation in SMEs can be stimulated more by projects aiming to respond to new needs and demands of the user side and to the creation of new lead markets rather than by the aim to commercially exploit new technological discoveries. Tacit knowledge is crucial in this phase since the capability to identify problems, recognize new needs and

business opportunities and to identify the appropriate responses to them is based on personal experience and capabilities.

4.19.2 Improvement of Accessibility

Accessibility is related first of all to geographical proximity. Adequate transportation infrastructures, logistics and modern management methods and ICT may favor the development of the relations between the various actors and firms in the local economy, by reducing both the costs of physical mobility and the transactions costs. SMEs are strongly embedded in their territory, which is characterized by the integration of cognitive, economic and social relationships. The role of tacit factors is underlined by the fact that the forms of interaction between the actors are often informal and based on social relationships, rather than on formalized procedures, as within organizations. Thus, the access to external complementary competencies requires not only transportation and communication

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infrastructures but also soft infrastructures, such as knowledge-intensive business services and bridging institutions, which may improve the eorganizational/institutional proximity.

4.19.3 Management of Receptivity

The openness of the various actors and nodes within the knowledge and innovation networks should be enhanced in order to avoid lock-in effects in traditional competencies and to alert them to the need of accessing

complementary external knowledge and assimilating it. Receptivity to external stimulus is related to the specific capabilities of the two partners in a relationship, allowing them to combine internal knowledge with external knowledge. In fact, geographical accessibility or proximity is a necessary but not sufficient condition for interaction or connectivity, and it should be integrated with receptivity or the availability of specific competencies by the two actors of the relationships, thus determining their complementarity, potential synergy and reciprocal attractiveness in terms of exchanging products, services, funds and people. Thus, interaction may be hindered not only by geographical distance or by low organization/institutional proximity, but also by high cognitive distance, which is determined by differences in the education level and cultural background, the lack of sharing of mental models, the different sectoral or technological specialization, the lack of broad diversified experiences and low learning capabilities. Receptivity depends on various forms of tacit knowledge, such as the existence of internal tacit know-how within the individual partners of a network, or their reputation, which affects attractiveness and expectation of reciprocity, or by relational capabilities, which enhance the dialogue, the reciprocal understanding and interaction between them. Previous experience, mobility, capability to attract and retain skilled labour and formal education are instruments to promote competencies of the various partners in knowledge networks and their receptivity and ability to use external tacit and codified knowledge in the process of innovation.

Receptivity is not limited to a passive, although favourable attitude. It is a process of learning or a process of adaptation to external stimulus and of re-elaboration of external information and knowledge together with available internal competencies, leading to a feedback effect, which is crucial in order to promote an interactive relationship with the external actors. Therefore, the dynamic or proactive nature of receptivity is underlined by the fact that learning and competencies are linked by a bidirectional relationship, as learning feeds into the building of new competencies, which influences the process, the direction and speed of learning.

In general, a change in the corporate culture is needed in order to promote M1798 - CAPPELLIN TEXT.indd 166 30/3/09 15:08:35

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knowledge sharing and the willingness to collaborate. Human resources should not be considered only for their absorptive capacity and resistance to the adoption of technologies, but rather as the actors who promote innovation and are endowed with specific capabilities. Formal education and lifelong learning are instruments that promote the building of competencies of the various partners in localized knowledge networks and their ability to use external tacit and codified knowledge in the process of innovation.

* * *

While these three factors: external stimulus, accessibility and receptivity, are key factors in promoting interactive relationships or the connectivity between the local actors, the territorial knowledge management framework

indicates three other factors that are crucial in promoting the original recombination of previous knowledge modules, leading to knowledge creation and innovation.

4.19.4 Building a common identity

The acknowledgement of common challenges to survive and develop creates a sense of belonging to the same community or group and is a prerequisite for collaboration in innovation. The motivation by the SMEs in a sectoral cluster to adopt a common action and to exchange their respective knowledge is determined by the sharing of common aims and mental models that induce trust and loyalty. The identity is the sharing of a common culture or a set of values and a sense of belonging to the same entity, as in the case of a company, association, cluster or region, and so on. While the concept of receptivity refers to the similarity of the individual characteristics of the actors, identity refers to their reciprocal relationships and to the explicit subjective feeling existing between them, as indicated by the concepts of trust, sympathy, emotive proximity, sense of belonging and place identity.

The concepts of social capital and relational capital are also linked to that of identity. The sense of local identity and the collaborative attitudes are enhanced by the creation of various intermediate institutions such as industry associations, professional communities or specialized services. Cooperation requires the stabilization of the relationship and defining routines, which promotes trust, avoids opportunistic behaviours and

conflicts, as is often the case with asymmetric information such as in innovation processes. These institutions, norms and routines are part of the esocial capital of the regional economy.

Collaborative attitudes, friendship relationships, the sharing of common MI798 - CAPPELLIN TEXT.indd 167 30/3/09 15:08:35

168 International knowledge and innovation networks values, reciprocal esteem, loyalty, trust and leadership in a sectoral cluster can be considered as a form of tacit knowledge and they affect the institutional/organizational proximity of indicated above.

4.19.5 Leveraging Creativity

Creativity is crucial in order to diversify the structure of the local economy into new productions. According to cognitive theories, the creation of new knowledge or creativity is related to pattern-making and to the capability to establish new contacts between different potentially complementary information and technologies, thus leading to new discoveries and inventions.

Creativity implies the recombination of subsystems of existing tacit and codified knowledge in order to generate new knowledge and processes of simplification, selection and exclusion of information and knowledge to be combined in an original way. Creativity is also the result of experience and the gradual development of a tacit architectural knowledge capable of combining in an original way different modules of information, technologies and abstract and applied knowledge, often as the result of an iterative process of experimentation, failure and success.

Clearly, creativity cannot be planned in advance, being the capability to discover original solutions, but it requires an appropriate organization. While the Fordist approach leads to the utopia of a fully automated firm without workers, a cognitive approach indicates that the generation of new ideas and innovation is not possible without the interaction of the people within the firm and with other external actors and it requires a modern internal organization by the firms. Thus, creativity is the result of the capability by the firms to leverage and combine the professional skills in their internal human resources and to attract and retain qualified workers, raise their morale, promote their empowerment, grant to the potential inventors autonomy and security and stimulate their commitment to risky exploratory analysis and lengthy process of systematic search.

Creativity in large firms or high-tech sectors may be related to explicit investments in R&D. On the other hand, within SMEs, creativity is the result of networking and informal and formal processes of interactive learning. SMEs select and combine in a flexible and original way internal competencies with external competencies of other firms, and the outcomes of this creativity process may be shared by the local actors. In particular, the socialization, sharing and combination of tacit knowledge within a network of firms and local actors are preliminary and instrumental to its codification, which facilitate its diffusion, and also to its transformation into new collective tacit knowledge. This interactive learning process leads to the creation not only of new codified knowledge, but also of new

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collective organizational and technological knowledge, which is clearly tacit and characterizes specific groups of individuals, firms and organizations. Creativity requires that SMEs devote more resources, people and time to the activity of systematic searching, exploration and exploitation. The generation of the idea is the result of close interactions between the firm and its clients and suppliers and it emerges after the explicit identification of a specific urgent problem. This idea can often only be developed further through the planning of a joint project, and sometimes even only through the creation of new start-up or spin-off firm. That requires an explicit cooperation within a network organization by clients, suppliers and other firms and organizations, such as knowledge-intensive business services or public research institutions. The flexible use of capabilities of other partners overcomes internal bottlenecks and saves the time and the R&D costs required to internally build these capabilities and thus accelerates the lead time in the elaboration of a new product or process and achieves a dynamic competitive advantage over international competitors.

Finally, within a regional cluster or innovation system the focus on the process of knowledge creation rather than on the adoption of technologies, should lead to the promotion of diversity and close interaction between different and dispersed actors and the capability to establish new connections between different pieces of information and knowledge.

Networks organize diversity and facilitate the combination of information and knowledge. Creativity may be hindered by the lack of needed competencies in the local economy and indicates the need for cooperation with international universities and major international companies.

4.19.6 Building Governance Capabilities

The implementation of innovative ideas and projects requires private and also public entrepreneurial capabilities or the capability to manage the complex relationships between many different actors and to mobilize them to transform knowledge into action. Moreover, the governance activity should promote through the creation of routines, rules and institutions the working of all other, above indicated, phases of the territorial knowledge management framework and reorient existing public investments and subsidies.

Policy-making in knowledge and innovation networks should be based on multilevel governance and intermediate institutions, rather than on the traditional planning or free market approaches. In fact, the working of knowledge and innovation networks requires organizational routines, norms and the support of intermediate or bridging institutions, which may be created by national or regional public authorities or by associations of private actors to organize these networks.

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Multilevel governance first implies the choice of the relevant nodes in the networks or the choice of how and who. The steering of relationships

between the various actors can facilitate their cooperation, mediate conflicts, create missing links between existing actors, promote the involvement of new actors, define the form and borders of the networks and promote an ex ante coordination, which keeps to adopt a forward-looking perspective. Appropriate governance can minimize the readjustment or switching costs in the transition from old to new organizational solutions and accelerate the time to change.

The governance of innovation processes requires an explicit effort in institution building and institutional learning, as the creation and maintenance of social capital or public goods depends on adequate investments by all partners belonging to a given innovation system. However, the governance of knowledge and production relationships between firms is not always facilitated by public institutions, while knowledge-intensive business services and modern financial intermediaries, such as private equity funds, are going to play an increasing role.

Thus, institutions have a clear importance in the innovation process. The creation of institutions and governance of the knowledge creation process are key factors according to the territorial knowledge management framework, as they increase the accessibility and receptivity of the actors in a cluster and develop their sense of belonging and creativity. However, the negative experience of those industrial clusters that have been artificially created in various regions is related to the fact that the creation of an institution such as a consortium of an industrial district cannot compensate

for the lack of intervention on the other various specific dimensions or drivers indicated by the TKM approach and facilitate the interactive learning processes as it spontaneously occurs in natural clusters. Some cluster initiatives have been based just on the spatial concentration of similar activities and focused only on spatial accessibility. Other initiatives have only concentrated on financing local firms and supporting their local identity. Clearly, these initiatives have overlooked the other key dimensions of a territorial process of knowledge creation and have not been capable of replicating the complexity of the factors that characterize spontaneous and successful clusters. In particular, they seem to have missed the need to promote the market orientation or identification of innovation stimulus, the creativity and governance capabilities of a new cluster.

The approach of TKM represents a theoretical and operative framework based on the concepts of cognitive economics and focusing on the factors leading to knowledge creation. This means enlarging on the factors traditionally considered in innovation policies, such as technology transfers, R&D investment and labour training, and also considering other

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factors that enhance the process of interactive learning within knowledge and innovation networks in the various regions. This approach is especially suitable in the case of networks of SMEs in intermediate technology sectors. However, it is also useful in regions specialized in high-tech or in

low-tech sectors, where knowledge creation is still, together with others, a key factor of international competitiveness. Table 4.7 illustrates that Table 4.7 Policy areas according to the territorial knowledge management approach in selected knowledge and innovation networks

Type of Knowledge and Innovation Network

Characteristics

and factors

Ecological

networks

Identity

networks

Strategy networks

Regions, sectors

and firms

Peripheral

regions Low-tech

sectors

Traditional SMEs

Industrial

clusters Medium-tech

sectors Innovative

SMEs

Urban areas Hightech

sectors Large
enterprises
Knowledge base Symbolic/
synthetic
knowledge
Synthetic/
symbolic
knowledge
Analytical/ synthetic
knowledge
Knowledge
interaction
Knowledge spill
over
Interactive
learning
KM and R&D Joint
projects
Innovation
stimulus
Cost competition
in the global
market

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Customer
needs and
high supply
chain integration
Product innovation
in specialized
markets and
technology push
Accessibility Low international
accessibility . low
local accessibility
Low
international
accessibility .
high local
accessibility
High international
accessibility . low
local accessibility
Receptivity Low qualification
of human
resources
Specialized

75

skilled
workers
High internal sectoral
diversity
Identity Fragmentation
and external
dependence
High local
embeddedness
and local
identity
Low cognitive
proximity and
common identity
Creativity Technology
adoption
Networking
and interactive
learning
High investments in
R&D
Governance Public
infrastructures

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and finance and
deregulation
Multilevel
governance at
the regional
level and
bridging
institutions
National industrial
strategies and
firm alliances in
specific fields

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the TKM approach can be flexible enough to consider the differences
and specific characteristics of three different types of regions and sector
specialization.

In fact, many innovations in medium-tech sectors have to integrate
science-driven (analytical knowledge) or creative (symbolic knowledge)
elements that characterize either high-tech or low-tech activities, which
may be concentrated in the same region or geographical cluster. In fact,
integrated innovations not only require connections between medium and
high technologies, but also the comprehension of innovation processes in

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high-tech and in low-tech sectors. Technologies like the development of composites as new materials are a typical example, where knowledge from high technologies have to be connected with medium-technology productions (where the new materials are used, such as in aeronautics and car industry) and low-technology productions (where the new materials are integrated, such as textiles).

4.20 THE INNOVATION PROCESS IN MEDIUMTECH SECTORS

Major factors of weakness of clusters specialized in medium-tech sectors are: (1) a low international accessibility, (2) lack of creativity and product innovation instead of the hitherto focus on process innovation, and (3) need for formal instruments of governance of knowledge relations to enhance the emergence of more formal cooperation between the firms. Innovation policies in the modern industrial clusters specialized in medium-technology sectors should take into account the nature of their knowledge base mainly consisting of synthetic and symbolic knowledge and the form of their knowledge interaction characterized by interactive learning processes:

1. External stimulus. Medium-tech sectors are characterized by close user, producer relationships. SMEs aim to respond to customer needs or are driven by the requirements of the client in highly integrated supply chains. Innovation is the result of the adaptation to local demand and aims to solve specific problems. In fact, the experiences of mismatch between plans and actual results push the generation

of new knowledge. Firms receive incentives for innovation by the aim to exploit new opportunities or by fearing closure as the result of a selection mechanism prevailing in highly competitive markets. Policies for these sectors and these types of firms should promote competitiveness based on product innovation rather than only on costs advantages.

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2. Accessibility. SMEs in medium-tech sectors are strongly embedded in their territory, which integrates cognitive, economic and social relationships among themselves. They participate in innovation networks, which have in most cases only a local dimension with weak international linkages. Policies should enhance the still low international accessibility of SMEs and their integration into international knowledge and innovation networks, while maintaining the high local accessibility. So far, however, the international openness in most European medium-tech networks is limited to commercial and production perspectives, while international linkages are missing for technology cooperation.

3. Receptivity. The high specialization of firms in medium-tech sectors leads to a high share of tacit knowledge within the knowledge base. Thus, the openness to external relationships is enhanced by the existence of rare internal specific capabilities suitable to be combined with

external knowledge and by relational competencies in the development of cooperation with other actors. Firms are characterized by a high flexibility in their internal organization and in their relationships with external actors. The high specialization of internal human capabilities determine a high absorptive capacity of SMEs in their specific field of specialization, but limit the capability of cooperation with other sectors using different codes of knowledge. SMEs should invest more in exploration into new fields and aim to extend their common specialized know-how for further diversification of the knowledge base.

4. Identity. SMEs in a sectoral cluster share common aims and mental models as well as trust and loyalty. Interactive learning processes lead to the development of individual and also collective knowledge. The sense of local identity and collaborative attitudes are enhanced by the creation of various intermediate institutions such as industry associations or specialized services or just common agreed routines, which are part of the social capital of the regional economy. The high common identity of the local community and regional embeddedness of firms are points of strength, but may favour conservative solutions and cause a lock-in effect if the individual actors are not allowed to have more autonomy as within the network model. The international extension of knowledge networks of SMEs calls for the identification of common objectives and projects with external partners, while

maintaining a strong local identity.

5. Creativity. Medium-tech sectors are characterized by informal processes of interactive learning instead of formal R&D. Innovation in SMEs requires better capabilities to select and combine in an original M1798 - CAPPELLIN TEXT.indd 173 30/3/09 15:08:35

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way internal competencies with external and scattered competencies through networking and interactive learning for solving new specific problems.

6. Governance. The increasing focus on knowledge creation instead of investments and public subsidies makes it necessary for innovation policy for medium-tech sectors to see the development and implementation of new instruments as a major priority. These should be designed to enhance the six drivers of TKM indicated above. The dimensions of accessibility, identity and creativity seem particularly crucial for clusters of SMEs in medium-tech sectors. SMEs need supporting infrastructures due to their scarce resources, for example intermediate institutions and linkages should be developed systematically in order to reduce the institutional distance. Policy-making should be based on multilevel governance rather than on traditional planning or the free market approach and aim for the creation and strengthening of bridging institutions like competence centres based on the agreement between various local actors on a joint long-term

development strategy.

4.21 THE INNOVATION PROCESS IN HIGH-TECH SECTORS

Clusters specialized in high-tech sectors indicate different key problems, such as: (1) a low local embeddedness of large firms, (2) problems in combining R&D activities or analytical and synthetic knowledge, which are science and technology-driven, with symbolic knowledge and creativity, which are driven by the users' needs and the demand, and (3) the need to avoid a too high concentration in large firms and to promote spin-offs and the participation also by SMEs and other social partners in strategic decision-making. These clusters can mostly be found in central and metropolitan urban areas. Innovation policies in central urban areas should take into account the nature of their knowledge base consisting of analytical and synthetic knowledge, and the form of the knowledge interaction characterized by knowledge flows coordinated by knowledge management and joint R&D projects. Knowledge networks in these areas are characterized by links between large firms and research institutions and by professional networks within knowledge-intensive business services:

1. External stimulus. The stimulus to innovation derives from new opportunities created by recent advances in science and technology at the world level, increasing international competition and the need M1798 - CAPPELLIN TEXT.indd 174 30/3/09 15:08:35
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for firms to identify very specific fields of application for these technologies.

In fact, the international enlargement of the market has created the need to look for a very narrow specialization in specific market niches, but spread at the world level. However, new markets may also emerge in large urban areas of most developed countries, as these areas serve as an incubator of innovation due to the fact that the knowledgeable citizens' expressing new needs and opportunities for new products and services are mostly located in these areas.

2. Accessibility. The international accessibility of urban areas specialized in high-tech sectors is rather favourable, as they are the nodes of international transport networks. The large dimension, increasing congestion and high diversity of citizens within these areas, however, lead to divides, exclusion and increases in social disparities and cognitive distances between the various very specialized social groups and production activities. Thus, policies should promote a greater accessibility between these groups and activities by creating soft infrastructures, performing as bridges between the different segments of the local economy and society.

3. Receptivity. On the contrary, the receptivity to innovation in urban areas specialized in high-tech sectors is relatively high, not only due to the high education level of the local labour force, related to the fact that knowledge workers concentrate in the urban areas, but also

because of the high internal diversity and specialization of the various local activities, facilitating the access to the most diversified external sources of knowledge.

4. Identity. Urban areas specialized in high-tech sectors are characterized by the existence of well-developed associations, communities and organized groups in completely different economic and professional fields. Hence, sectoral identities are strong. On the other hand, the high diversity of local actors and the high internal congestion increase the cognitive distance among them and lead to segmentation and a rather weak place identity, thus lowering the commitment by the local actors to the development of their local area. Local policies should therefore reinforce the local identity and strengthen common values and aims, for example through the organization of major international events or the building of symbolic architectures.

5. Creativity. Creativity in urban areas specialized in high-tech sectors is mainly based on high-developed formal R&D activities, both in large firms and in research institutions. However, the local market plays an increasing importance for the development of highly qualified and complex new products and services, which may later become a part MI798 - CAPELLIN TEXT.indd 175 30/3/09 15:08:35

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of the local export base. That indicates the need to better connect symbolic (creativity based) knowledge with analytical and synthetic

knowledge, which are the traditional strengths of urban areas in order to increase the brand value of new productions. Thus, policies should be capable of promoting new knowledge through interactive learning processes both within very specialized professional communities of interest and between fields that are highly diversified but may be complementary to solving these new emerging problems.

6. Governance. The international openness and role of urban areas specialized in high-tech sectors leads to the need for closer integration of local initiatives with national and European programmes. Usually, governance of knowledge networks in urban areas and high-tech sectors is characterized by the design of well-coordinated projects in rather specific fields. The various sectors and professional groups are characterized by high levels of self-government and close internal connectivity. On the other hand, the high internal diversity of urban areas

and their congestion level indicate the need to improve the connectivity between the different economic activities and professional communities through the development of bridging institutions. Universities, large research institutions and competence centres may have an increasing role in promoting these links. Moreover, the development of new productions and the fast transformation of the local economy and society within cities also leads to the importance of accompanying these changes with new projects in physical planning aiming at the renewal of specific areas.

4.22 THE INNOVATION PROCESS IN LOW-TECH SECTORS

Clusters specialized in low-tech sectors are characterized by various weaknesses, such as: (1) too low international accessibility, (2) the lack of receptivity and qualified skills, and (3) the lack of identity, and fragmentation in decision-making. These clusters are typically located in less developed and peripheral areas, being dependent on public subsidization and so far exclusively on cost advantages. Innovation policies in the less developed peripheral areas specialized in low-tech sectors should take into account the nature of their knowledge base, mainly consisting of symbolic or creativity-based knowledge and sometimes synthetic or engineering-based knowledge, and the form of knowledge interaction in these regions, characterized by automatic knowledge spillover based on geographical proximity.

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1. External stimulus. The pressure of international competition on costs is a factor that pushes the adoption of process innovation. However, the competitiveness of local productions should be less based on lower labour costs and more on product innovation and products of higher quality. This requires the improvement of the quality of human resources and productivity levels and focus on innovation. The low potential of the local market should create incentives to look for the

development of productions addressed to the international markets according to the export-led strategy, which has been followed traditionally by all successful industrial clusters. That requires more specialization of local productions and integration into interregional and international supply chains.

2. Accessibility. The development or improvement of international transport and communication infrastructures is clearly a prerequisite for an export-led growth strategy. However, less developed regions are also often internally characterized by fragmentation and isolation of individual economic activities and need to improve internal communications.

3. Receptivity. The level of general education in less developed peripheral areas is often rather high, while there is a lack of specialized workers with high professional experience. Traditional production know-how should be oriented towards more specialized fields. However, the receptivity to innovation is not only limited by the technical capabilities of the labour force, but also by a traditional organizational culture. Firms should aim explicitly for a long-term growth strategy requiring a wider vision and larger investments instead of insuring the comfort of a smaller dimension and the exploitation of rents in a local market, as often occurs in small family-owned SMEs.

4. Identity. Peripheral and less developed areas are often characterized by fragmentation, internal conflicts and low level of consensus on

common values and long-term development strategies. This weakens the potential to promote a clearer role in external relations and often leads to a situation of closure or external dependence.

5. Creativity. Innovation is often limited to product differentiation and incremental innovations, which are related to the use of symbolic knowledge. On the other hand, policies often focus on promoting technology transfers and the adoption of modern production technologies, which represent forms of synthetic knowledge, in the traditional low-tech sectors of activity. A complementary strategy could be to focus less on process and more on product innovation, to enhance creativity, to increase the effort by individual firms in the design of business plans aiming at the reconversion to new productions and MI798 - CAPPELLIN TEXT.indd 177 30/3/09 15:08:35

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at new markets, and to increase cooperation between the local and external firms aimed at the development of new and more complex production fields.

6. Governance. Less developed regions are often characterized by the weakness of the public administrative structures and by the need for a wider adoption of innovation in the public sector. Regional development policies have focused on the building of infrastructures and the provision of financial incentives to the firms, rather than on promoting innovation. The aim to create artificial clusters has often led to failure,

due to a too low effort in promoting the key factors indicated above, such as international accessibility, receptivity and local identity.

Public funds should only complement the mobilization of private investments. Successful clusters require the participation of large and often external firms and forms of interregional cooperation between the local public institutions. Intermediate institutions should promote a better connectivity and specialization of local firms, a stronger local identity and a change in local culture favouring specialization, outsourcing to other local firms and subcontracting from major external firms. In fact, the creation of local knowledge networks is highly complementary to a strengthening of other networks as subcontracting networks and labour mobility networks.

The focus by innovation policies on analytical knowledge, rather than on synthetic knowledge, has often led to the creation in less developed peripheral regions of large centres of R&D excellence supported by public funds and separated from the rest of the regional economy. Regional development agencies and other public centres could have a more strategic role than aiming at the provision of technological services to individual firms in traditional production, if they supported the design of major projects striving for the reconversion of the local economy rather than aiming to provide technological services to the individual firms in traditional production cooperation between various local firms.

Cappellin, R. and Wink, R. (2009), **International Knowledge and Innovation Networks: Knowledge Creation and Innovation in Medium Technology Clusters**. Cheltenham: Edward Elgar Publishing.

http://books.google.it/books?id=1BpeJGekx18C&printsec=frontcover&source=gbs_navlinks_s#v=onepage&q=&f=false

Cap. 4.12, pp. 127-130

12. Three types and phases of a regional innovation network

Regional production systems are evolving from the model of industrial clusters and industrial districts based on many rather homogenous firms linked by flows of knowledge spill-over to the model of territorial innovation networks made by complementary specialized firms, linked by formal forms of cooperation in production, commercial and technological field, not only locally but increasingly also at the interregional and international level. Territorial networks may be classified into three types of networks: “ecological networks”, “identity networks” and “strategic networks”, which have different characteristics, as indicated in table 7.

‘**Ecology networks**’ may be assimilated to ‘agglomeration economies’, which are also defined as “localization economies” or “urbanization economies”.

‘**Identity networks**’ are based on specialised intermediate institutions (“social capital”). They may be defined as places of collective learning.

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Riccardo Cappellin, Corso di Economia della Ricerca e della Conoscenza, Università di Roma "Tor Vergata"

Table 7: Types and phases of a regional innovation network

	Ecological networks	Identity networks	Strategy networks
Type of relationship	External economies	Exchange	Joint investment
Form of interaction	Interdependence	Cooperation	Strategic coordination
Self-consciousness	Objective homogeneity	Subjective factors, intended relationships, sense of identity	Subjective factors, intended relationships, joint aims
Formalism	Informal relationships: imitation	Informal relationships: trust relationships	Formal relationships: contracts
External support	Geographical proximity	Common infrastructures, intermediate institutions and social capital	Joint decision making and policy making
Key knowledge base	Symbolic/synthetic knowledge	Synthetic/symbolic knowledge	Analytical/ synthetic knowledge
Key knowledge phase	Exploitation	Examination/ Exploitation	Exploration/ Examination
Knowledge interaction	Knowledge spill-over	Interactive learning	TKM and R&D
Differentiation process	Homogeneity	Autonomous specialization	Division of tasks
Innovation	Process	Organizational	Product
New firms	Imitative	More specialized	Innovative
Sectors	Low tech	Medium tech	High tech

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‘Strategy networks’ are based on cooperative agreements between firms and other organisations. They are the result of negotiations, agreements on specific strategies and the creation of formal and explicit ‘joint ventures’ by the participating actors.

These three types of networks are characterized by different forms of knowledge interactions. In fact, knowledge spill-overs characterize the ecological networks, interactive learning processes are characterizing the identity networks and explicit governance of knowledge relations between the various local and non local actors is a characteristic of strategy networks.

Moreover, it is useful to distinguish three types knowledge (Asheim and Coenen, 2005, Asheim, Boschma and Cooke, 2007), such as: 1) the science based or “analytical” knowledge, which is important in high tech sectors, 2) the engineering based or “synthetic” knowledge, which is most important in medium technology sectors, and 3) the creativity based or “symbolic” knowledge, which is most important in low technology sectors.

The shift to the model of “strategy” networks implies the design and creation of specific infrastructures, institutions and procedures, which may facilitate the knowledge flows. These policy measures may be represented by the “territorial knowledge management” and the “competence centres”, in the case of synthetic or engineering based knowledge, and by international integrated projects and networks of excellence, in the case of analytic or science based knowledge.

Table 8: The knowledge flows in different types of networks

Forms of governance ----- Types of knowledge	Ecological networks	Identity networks	Strategic networks
Symbolic knowledge	Localized knowledge spillover, labour mobility, competitors imitations	Interactive learning within professional communities	Interdisciplinary integration and collaboration
Synthetic knowledge	Localized knowledge spillover, labour mobility, competitors imitations	Interactive learning between SMEs and with clients	Technological collaborations within the supply chain
Analytic knowledge	Localized knowledge spillover, university education	Technology transfers from universities and service centres to SMEs	Joint R&D projects and networks of centres of excellence

Cappellin, R. and Wink, R. (2009), **International Knowledge and Innovation Networks: Knowledge Creation and Innovation in Medium Technology Clusters**. Cheltenham: Edward Elgar Publishing.

http://books.google.it/books?id=1BpeJGekx18C&printsec=frontcover&source=gbs_navlinks_s#v=onepage&q=&f=false

Cap. 4.18, pp. 159-161

18. The evolution of industrial clusters toward the "learning region"

The factors of competitiveness of a cluster have changed.

Defining a region as a 'learning region' means that the actors of the system are committed to an interactive learning process allowing the development of knowledge, know-how and other capabilities required for creating innovation and maintaining regional competitiveness (Mailat and Kebir, 1999).

The objective of a 'learning region' is the integration of tacit or traditional production knowledge, which is bounded within the local context, with the codified knowledge available at the world level, in order to stimulate the regional endogenous potential. A 'learning region' may represent the final outcome of the evolution of an 'industrial district'.

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Riccardo Cappellin, Corso di Economia della Ricerca e della Conoscenza, Università di Roma "Tor Vergata"

The increasing complexity of technology requires a broadening of the scope of the technologies to be adopted.

Traditional boundaries between pure and basic research and applied research can no longer hold and medium and **high-technology knowledge should be connected in industrial products**. This means the need to **connect synthetic or traditional engineering and problem-solving knowledge with analytical or science-based knowledge**.

The transfer of scientific knowledge to SMEs requires **a long-term effort for strengthening the multi-dimensioned and multi-institutional regional knowledge infrastructure**.

Moreover, the increasing complexity and differentiation of needs by the users require that firms **improve their cognitive proximity with the users**.

The more radical an innovation is the more important it is to change the cognitive perspective of the customers on needs and solutions so that they will be satisfied by the innovation. Consequently, knowledge exploitation requires a perspective on potential demanders, their hidden, needs and channels to reach them. That requires to invest in the design, the perceived quality and the brand value of the product or services and to improve the relationships between the industrial firms and the modern knowledge intensive business services (KIBS) (Muller and Zenker, 2001). Thus, **symbolic or creativity-based knowledge has to be combined with technological excellence or synthetic knowledge**.

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**Table 11: From an industrial to a knowledge economy
in medium technology clusters**

	Knowledge economy: competitiveness through innovation, high creativity		
Governance: identity Networks	Interactive learning and incremental innovation	Systemic innovation and territorial knowledge management	Governance: strategic networks
	Process innovation, technology suppliers, competitors imitation and lock-in effect	Vertical integration, large firms and technology transfers to subcontractors	
	Industrial economy: cost competition, low creativity		

The linkages between SMEs in the process of interactive learning within a cluster are often informal, rather chaotic and time-consuming. That highlights the need for an explicit effort to be devoted to the organization of knowledge networks and knowledge interactions between the firms and the shift from a model of automatic free market interdependence, as in “identity” networks, to a strategic model, as in the “strategic” networks. Table 11 illustrates this shift.

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The risks of lock-in in traditional productions and technologies. In the perspective of a knowledge economy, identity networks imply, as indicated above, interactive learning and incremental innovation. However, regional production systems may evolve toward the form of ‘strategy networks’, which are based on intended relationships and formalized cooperative agreements between firms and other organisations.

Strategy networks imply **forms of central coordination**, the creation of procedures for the exchange of information, **the codification of individual tacit knowledge and the investment in the creation of collective codified knowledge**.

Instead of traditional ways of control within a strategic process, strategic governance is needed. **The model of “territorial knowledge management” aims to formulate a theoretical framework for such a governance to enhance the adoption of systemic innovations, which are based on the coordination of the investments made by various SMEs and are focused on strategic joint projects.**

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Cappellin, R. (2009), The governance of regional knowledge networks, *Scienze Regionali*, 9, 3, 5-42.

2. The process of interactive learning in knowledge and innovation networks

According to the indications of the literature on cognitive economics (Loasby, 2002 and 2003; Egidi and Rizzello, 2003; Rizzello, 1999, 2003; Metcalfe and Ramlogan, 2005), **knowledge creation is the result of a process of pattern making or of the classification and reclassification of external stimulus**. In particular, the innovation process in SMEs and in medium technology sectors has a gradual character and it is driven by **an intensive interaction between the suppliers and the customers and other actors**. This process of interactive learning (Lundvall and Johnson, 1994; Foray and Lundvall, 1996; Lawson and Lorenz, 1999) leads to the development of "tacit" knowledge which is represented by a complex set of capabilities, which are localized or idiosyncratic and can not easily be transferred (Nonaka and Kono, 1998; Howells, 2002; Wink, 2003; Cappellin, 2003b, 2004a, Cappellin and Wink, 2009). As the process of knowledge creation has an interactive and a combinative character, **a closer geographical proximity and/or a greater cognitive proximity facilitate the interactions** between various complementary actors and the combination of complementary pieces of knowledge.

Knowledge which we now have on the processes of the human mind and brain according to a scientific interdisciplinary perspective helps in explaining the relationships between economic and social actors in the processes of innovation. The mind is a process and not an organism. **We are networks in connexion with a world of networks** (Castells, 2009). **The mind proceeds by networking patterns**, which are stored in our brain, **with models of our sensorial experience**, which we derive from the contact established with our past, present and also future experience, as indicated by our **forecasts of the consequences of given signals**. (Damasio, 1999).

Knowledge sciences show that improvements in the human knowledge base are possible only when **outside stimuli reach the individual's cognitive system and they are integrated and processed within this latter**. In fact, the models of neural networks indicate that the creation of knowledge is the result of an adaptive learning or searching process, which leads to **new synaptic connections of various nodes**. First, the joint impulses or signals coming from other firms or actors **should overcome a certain threshold of intensity**: a condition facilitated by the existence of **common standards of communication and routines**.

Any new stimulus from outside of the cognitive system is then analyzed to determine whether it **fits into the already existing cognitive system, categories, experiences, and cultural values**. In the positive case, an interactive process begins, leading to **the search for consistency and compatibility**. On the other hand, if the stimulus is not compatible with the individual cognitive system, **it is rejected**.

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Riccardo Cappellin, Corso di Economia della Ricerca e della Conoscenza, Università di Roma "Tor Vergata"

In particular, **a cognitive blockade or lock-in effect may be determined by a too low accessibility or by a too low receptivity**. The accessibility is affected by the existence of infrastructures and institutions that may decrease the distance between any two nodes. On the other hand, **the receptivity is mainly related to the scope of the diversified knowledge available to the actor** or the firm considered because that allows it to identify useful forms of complementarity in the relations with other actors or firms.

Thus, **the external stimulus should be compatible with the internal integrity or "neurognosis"** (Rizzello, 2003) of the local production system and **that leads to a gradual process of adaptation**. In fact, the aim to preserve the **personal identity in the case of an individual actor** and also to ensure the **survival of the organization or the local economy** facing external competition may represent **a powerful challenge** leading to innovation.

In fact, the compatibility with other actors and the success in the adaptation leads to the creation of new connections or to **the reinforcement of existing connections through the development of appropriate routines and institutions** (Hayek, 1937; Nelson and Winter, 1982), which allows **the saving of the limited cognitive capacity of individuals** and organizations and facilitates the process of reciprocal integration (Loasby, 2003). When the same circuit is repeatedly activated, **the synapses of the neurons in the circuit become stronger, till the circuit becomes permanent**. The consciousness of oneself, which we may call **personal identity**, emerges from the need to integrate the largest number of mental patterns coming from the perception with the patterns stored in the memory. **Newly-created knowledge must be gradually consolidated into routines in order to permit further creativity** (Loasby, 2007).

On the other hand, **our brain through the mirror neurons** (Rizzolatti and Craighero, 2004) **is capable to represent the actions of other individuals**, when a person sees another person experiencing an emotion. **That activates the processes of imitation, identification or refusal, empathy and trust and it is the basic mechanism leading to cooperation between humans**. We may also say that **the identity of himself is transformed into a sense of common belonging or to a collective identity**.

Creativity is based on the integration of various abstract logical concepts and of various economic actors with different and complementary knowledge and competencies. Learning is the process whereby previous existing knowledge is selected and is viewed in a new perspective and existing knowledge may be reconverted to satisfy new emerging needs.

That also leads to a process of differentiation between the knowledge nodes, enhancing complementarity and cooperation. The differences between the various actors and firms in a knowledge economy and their interdisciplinary integration are part of an evolutionary process, as the different technical competencies are not static but rather in continuous evolution.

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This model of cognition based on interactive learning is clearly incompatible with the competitive or free market approach of standard economics. First, as **theories of rational choice equilibrium consider knowledge as exogenous**, they assume that cognition does not have opportunity costs and they do not provide an economic interpretation of its origin. Second because **the cognitive model is based on the human capability of pattern making and on the assumption of the fragmented nature of the knowledge distribution and on selected connections between a limited number of actors and that contrasts with the perfect diffusion of information**, which characterizes the hypothesis of rational expectations. Third because, in the model of interactive learning, **the relationships between the various economic actors are not based on competition and exclusion**, but on the **identification of common aims, complementarity and cooperation**.

On the other hand, **this model of cognition is also incompatible with a hierarchical planning approach**, based on top down decisions, since **knowledge is not a public good** to be produced by public research institutions, but it is the result of the interaction between various private, collective and public actors. The cognitive model does not aim to indicate "what to do" or to "pick the winners", but it rather aims to indicate "how to do" and to enhance the various factors and phases, which have been identified in the process of cognition or knowledge creation and innovation. Therefore, there is an isomorphism between the patterns of cognition and the models of regulation of the relationships between economic actors and we may state that both the process of creation of new knowledge and the relationships of cooperation, or of power or of competition between economic agents are all based on the neural networks of our brain.

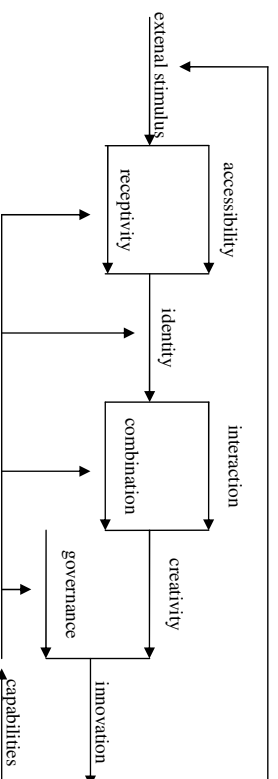


Figure 1: The process of interactive learning and innovation

On the basis of these principles, the model of "territorial knowledge management" (TKM) identifies a logical and temporal sequence between six phases and factors in the process of interactive learning and of innovation (Cappellin 2003b and 2007; Cappellin and Wink 2009): external stimulus, accessibility, receptivity, identity, creativity and governance, as indicated in figure 1. While these concepts have individually been extensively described in the economic literature, they have not been linked before between them in a coherent model, based on the

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literature on cognitive sciences. In fact, the external "stimulus" induced by the opportunities of the demand or the pressure of competition or the change in technologies (Kline and Rosenberg, 1986; Fagerberg, 2005) determines a tension leading to the search for a solution of the problems of the firms. This searching process is facilitated by a lower geographical and/or institutional distance or an higher "accessibility" to potential complementary partners (Karlsson, 1997; Howells, 2002; Boschma, 2005; Sminnie, 2005; Torre and Rallet, 2005). It also requires a low cognitive distance or an appropriate "receptivity" (Cohen and Levinthal, 1990; Antonelli, 2005) or absorption capacity of these latter.

The creation and strengthening of a common "identity", made by common values, a sense of common belonging, trust relationships and social or relational capital (Capello, 1999; Crevoisier and Camagni, 2000; Nooteboom, 2002; Capello and Faggian, 2005), is the prerequisite for the cooperation between firms and the search for joint solutions. These new solutions are the result of "creativity" (Florida, 1995; Cappellin, 2003a; Wink, 2007) or of the capability to originally combine different and complementary pieces of knowledge and to interact in the collective learning process between the various local actors (Morgan, 1997; Maillet and Kebir, 1999; Geenhuizen and Nijkamp, 2006). Then, these new ideas can be translated into economic innovations only when appropriate organizations and institutions, or the "governance" (Powell, 1990; Cooke and Morgan, 1998), promotes the commitment of appropriate real resources and of financial funds and the integration of the new ideas with complementary production capabilities.

For example, **this model indicates that the cooperation between two firms and the development of a process of interactive learning between them** require an external factor or problem, which stimulates them to the change. Second, the firms should be close each other and be capable to overcome external obstacles, such as geographic distance and also differences in the language and the institutional environment of the respective region or country. Third, each firm should be receptive and capable to understand the needs of his potential partner. Fourth, the firms should identify common medium or long terms aims and they should develop a relationship of trust and of common belonging, such as in a regional community or in ad hoc groups and joint ventures. Fifth, the firms should invest and combine the respective knowledge resources and capabilities through a tight interaction aiming to the discovery of innovative solutions of the considered problems. Finally, the firms should negotiate and agree an organizational or contractual mechanism, identify precise objectives, define policy instruments and devote financial resources in order to put ideas into practice.

Thus, the stimulus to change and innovation within firms is not only determined by the pressure of competition, the need to increase productivity and reduce costs, or the opportunity created by the supply of modern technologies and the use of modern equipments. On the contrary, especially for SMEs in medium technology sectors and also for SMEs in service sectors the most important factor is represented by the identification of new markets, the aim to adapt to changes in the demand and the opportunity to satisfy new users needs. The desired outcomes are not just the increase of productivity indicators, often interpreted as a disjoint result, but rather the speed of a continuous process of innovation, where each change is the evolution of previous changes. Entrepreneurship and governance, through public-private partnership, are required to organize the joint effort of different actors and firms. The focus shifts from stimulating competition between the local actors to governance or to promote connectivity and iterative processes of reciprocal adaptation and selection of the best productive combinations.

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3. The cumulative character of the process of knowledge creation

The innovation processes have a dynamic character, as it is indicated by the fact that the previous innovation are the base of the following innovation according to a trial and error process of learning. In particular, as indicated in figure 1, the model of TKM highlights the cumulative nature of the processes of interactive learning and adoption of innovation, as the various phases indicated above feedback on each other. In fact, innovation enhances a process of learning and it is leading to the development of the internal capabilities of the individual actors and that is affecting the future evolution path of the innovation system considered. For example, the new knowledge created and the experience accumulated in the previous periods may lead to the building of interfaces facilitating the accessibility to the other actors, to the improvement of the receptivity of the various actors to new ideas and of their capability to understand the emerging needs of potential users, to the strengthening of the sense of common belonging, to the improvement of capability in joint learning and in combining previous respective knowledge and also to the improvement of the organizational and entrepreneurial capabilities.

Moreover, the dynamic and cumulative nature of innovation and learning is demonstrated by the fact that the innovation of a firm is going to change the external selection environment for other firms and it may represent the stimulus to innovation for them, as indicated in figure 1. In fact, the last innovator may set some new initial conditions for a new round of innovation among the firms which are downhill or uphill in the innovation cycle (Cappellin, 2009). Each firm in turn uses the contributions previously elaborated by other firms and at the same time it may assume the lead of the innovation effort, performing the role of the key innovator and providing an original opportunity both for the other follower firms in the supply chain, who will continue the innovation effort, and for the competitors, who will imitate and improve his original solutions. The almost spontaneous coordination between the firms in an innovation network allows an high flexibility and to rapidly change the direction of the innovation effort, reacting to new opportunities or challenges.

In fact, like a school of fish moves in a coordinated manner and it may suddenly change its direction and also its speed, many firms and actors participate within a network to the process of innovation, performing specific tasks and introducing innovation in their respective field of activity. They procure innovative products/services from supplier firms and provide innovative products/services to client firms. Inputs sources are complementary between themselves and on the other hand clients of the products are fungible between themselves. The selection of suppliers and that of possible clients is related to their respective waiting and searching times and is affected by the scanning costs and switching costs (Cappellin, 2009).

The speed of the innovation process is determined by the speed through which the firm is capable to orient itself and to select between the possible suppliers and between the possible clients. This speed and the time lags between the innovation of a firm with respect to the innovation in the other cooperating firms, which have previously innovated or which will use the results of its innovation, depends on the adaptive and strategic behaviours of each firm and on various types of costs and factors, such as the adjustment or switching costs (Cappellin, 1983b) from one technological solution to a new solution and the transaction costs (Williamson, 1981), which affect the coordination of a firm with the other firms. In particular, these costs can be related to various factors, such as: the geographical distance and the cognitive distance between the partners, the transaction costs in the

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negotiation process, the receptivity of each partners, the memory of previous experience, the reciprocal learning costs, the trust relationships, the risk of opportunistic behaviours by the partners and by the asymmetry of information, the different preference for the future and novelty, the risk aversion and also the existence of specialized services and bridging institutions.

Thus, in a dynamic environment the creation of value and of new knowledge depends on the integration of the knowledge acquired from many firms and the speed of innovation depends on the interaction between a plurality of actors. Innovation requires flexible forms of cooperation between many different private and public, regional and international actors, such as large firms, SMEs suppliers, knowledge intensive services, higher education and research institutions, financial intermediaries, public administration and many other partners such as professional association and media. Innovation requires the combination of different competencies within a process of collective learning, as firms must cooperate to increase and diversify their knowledge base.

Networks are characterized by lower adjustment or switching costs (Cappellin, 1983b) in the choice of new possible partners and of new technological solutions and also imply less transaction costs (Williamson, 1981; Cappellin, 1988) with other actors in inter-firm relationships than a competitive market made by isolated producers and users. While competition (i.e. free market) and monopoly (i.e. hierarchy) are static models of regulation, networks allow the regulation (i.e. governance) of the dynamic processes of iterative adaptation, specialization and selection both within individual firms and at the aggregate level between the different firms.

4. The role of institutions in knowledge networks.

Due to their flexibility, networks represent the most effective form of organization to promote a fast speed of innovation. In fact, the major advantage of the network model of organization is to insure to the firms a faster access to a wide scope of complementary competencies existing in other firms and to remove the barriers, which are hindering to operate into new products, processes and markets and could lead to a lock-in situation. Through network integration, firms are capable to decrease the resources and time for adopting an innovation, with respect to the situation where they would be required to internally develop these capabilities. Weak ties or indirect links can easily be transformed into strong ties or direct links (Granovetter, 1973), when the need to respond to external opportunities and threats make that necessary. Within networks, firms can easily change the level of cooperation with previous partners, as implicit or informal contracts can more easily be adapted than explicit or formal contracts. This high flexibility is a key competitive factor in a dynamic market, where innovation has to be adopted faster than competitors.

In this respect, institutions play a key role in the process of knowledge creation. In general, rules, procedures, organizational forms, norms, routines constitute the foundation of organizational behaviour. Rules and organic institutions standardize the world and in so doing they simplify the ambit in which humans use their limited cognitive capabilities. In fact, routines facilitate the connections and create free time to be devoted to the explicit thinking on innovation (Hayek, 1952).

According to Loasby (2003), the maintenance of stable baselines within particular domains is a prime function of formal organisations, and the appropriateness of the baseline is a major determinant of organisational success or failure. The stability of the networks is insured by the existence of adequate hard and soft infrastructures representing a public good and being not only created by the individual actors themselves but also by the public authorities.

Moreover cognitive processes indicate an evolutionary sequence made by variety generation, selection, and the preservation of selected variants in the form of modified or novel routines and institutions (Loasby, 2003). The role of institutions is that to create new routines or baseline, which insure the adaptability of connections between actors (Hayek, 1952). The existence of a well-developed institutional system, made by various structures and infrastructures facilitates the relationships and decrease the transaction costs. Cognitive theories underline that the creation of new connections or the reinforcement of existing connections implies the compatibility with other actors, the success in the adaptation and the development of appropriate routines and institutions. Therefore, a central concern of policy should be the creation of institutions, which may enhance the connectivity of knowledge.

In particular, a rather diversified typology of institutions play a leading role in defining a long term strategy of innovation of medium technology sectors within the different regions (Cappellin and Wink 2009). These institutions represent the "social capital" of these regions and play the role of immaterial infrastructures, which organize the knowledge flows between various firms. Moreover, institutional solutions to overcome lack of resources by SMEs are regionally specific and influenced by long-term historical and cultural heritage within the region.

Regional knowledge and innovation networks lead the various actors to invest in the creation or strengthening of soft and hard infrastructures and routines linking them. That makes the relationships between firms more intense or increases the speed of the flows between the firms. The capability of the individual firm to orient itself between the various suppliers and the possible users of its own products depends on the existence of institutions and organizations, which stimulate the reciprocal trust and limit the risk of unfair behaviours, and of specialized professional services (KIBS), which perform the function of bridging institutions or of immaterial infrastructures between the various firms. In fact, the speed of decision and coordination in a network depends to a large extent on the actor who performs the function of leader and is capable to orient the other actors.

From an institutional perspective, networks are models of governance of the relationships between various actors, characterized by feedbacks in the flows of information and by incremental and cumulative processes of interactive learning and evolution. Networks are a form of learning organization, which insures a greater overall dynamic efficiency.

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5. A comparison between the cognitive model and the linear model of innovation

According to a methodological perspective, the cognitive model of innovation illustrated above is different from the linear model of innovation, which supposes a logical and temporal sequence between basic research, applied research, development, production, marketing and diffusion. In particular, this traditional model leads to overlook various important types of knowledge different from the analytical or codified knowledge (Ashstein, Boschma and Cooke, 2007), such as synthetic or engineering based knowledge and symbolic or creativity based knowledge and also managerial and institutional knowledge or capabilities. Further limits of the linear model are that it considers only the internal process of innovation within the individual firm or the in-house R&D activity rather than the case of interacting firms and that it focuses on the process of the transfer of knowledge from research to innovation rather than explaining the process of the generation of knowledge. In fact, while a linear approach aims to promote transfers of information and modern technology or to provide customized expertise to the individual firms, a systemic approach (Lundvall, 1992; Antonelli, 2005) focuses on promoting knowledge networks and cooperation between the various local and external firms and actors in the regional innovation systems and on the development of their internal capabilities. This cognitive model is also different from the "chain linked model" (Kline and Rosenberg, 1986), which envisages a tight relation or feedback within an individual firm between production activities and those of commercialization and research. On the contrary, the cognitive model highlights the interaction between different firms and actors, and it has a systemic nature.

The six driving factors of the Territorial Knowledge Management are compatible but clearly different from the four factors of the Porter's diamond of competitiveness and productivity in a cluster (Porter, 1998; Martin and Sunley, 2003): **firm strategy and rivalry (the nature and intensity of local competition); factor input conditions (the cost and quality of inputs); demand conditions (the sophistication of local customers); and related and supporting industries (the local extent and sophistication of suppliers and related industries).** In fact, these four factors are related to the concepts of identity, external stimulus, and accessibility indicated by the territorial knowledge model. But, they seem to indicate the effects of the local business environment on the geographical location of firms in a cluster, rather than to consider explicitly the internal factors affecting the behaviours of firms and other regional and external actors in the processes of knowledge creation and innovation, such as the concepts of receptivity, creativity and governance.

Finally, the cognitive model seems appropriate to explain innovation in SMEs of medium technology sectors and in service activities, but it may be useful also in highlighting some characteristics of R&D activities. Cognitive theories, which focus on the process of generation of knowledge, explain that **knowledge and innovation are the result of an interacting learning process occurring in a network made by various actors and allow to identify different phases or factors of this process.** In particular, a systemic or cognitive model underlines the importance for innovation of three general concepts: **connectivity, creativity and speed of change** (Cappellin, 2003a, 2009; Cappellin and Wink, 2009), **which apply also to the high technology sectors.** Thus, this model of innovation highlights the **tight technological interdependence existing between the medium technology industrial sectors and the high technology industrial sectors.**

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Moreover, even in the high technology sectors, **the process of knowledge creation has recently changed**. In fact, according to a cognitive perspective, **R&D activity should not be considered as a black box transforming inputs into outputs** and R&D funds into patents and publications. On the contrary, **tact knowledge of the individual researchers, interactive learning within research teams, networks of extensive and systematic international cooperative relationships** and concepts such as: **trust, identity, leadership and social capital** seem to be key characteristics also of **scientific communities and knowledge organizations**, such as scientific associations and journals, and of R&D activities within universities and firms.

In conclusion, a radical shift of perspective is needed from a traditional paradigm based on the concepts of technologies, R&D expenditure, rational process of optimization of the individual firms, market competitions between firms and resistance or receptivity of labour to the new technologies. On the contrary, innovation processes can be interpreted according to a new paradigm focused on the processes of knowledge creation, interactive learning, iterative adaptation and selection within innovation networks, and focused on the development of the internal creativity and entrepreneurial capabilities of firms and actors.

6. The spatial dimension of the learning process and territorial knowledge management

Clearly space and territory matter in the processes of cognition and generation of knowledge. Cognitive processes have a localized dimension and the innovation process have a "territorially embedded" character and that favours the spatial agglomeration of innovative activities. In this perspective it may be useful a distinction which is related to the three well known concepts of **"polarised region"**, **"homogenous region"** and **"planning region"**, which respectively focus on the concepts of tight flows, of place identity and of common institutions. First, if **interactive learning** is the key process in knowledge creation, then it is clear that **the links and the frequency of the contacts between the nodes of the network are constrained by the spatial and/or cognitive distance**.

Second, **knowledge is the result** not only of the combination of a new stimulus with the individual previous experience, which characterized the personal identity, but also of the **combination of different competencies between the various actors, who are interacting in a learning process occurring within a given geographical and sectoral cluster or network**, which has a collective identity. Thus, in a spatial perspective, the same stimulus may determine a **different pattern of response in each regional innovation system according to the different characteristics of the network of the local actors**. Regions are characterized by **different place identities and by a different homogeneity or internal diversity and complementarity between the local actors**, leading to **trust, common identity and sense of place belonging, and that may facilitate or hinder innovation**.

Finally, the success in solving previous problems is leading to strengthen particular links between some local specific actors and to create **soft infrastructures, such as routines, norms, organizations, intermediate institutions and public institutions, which will facilitate the future**

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interactions between these same actors in the region considered. Therefore, **the policy networks of regional actors and the institutional thickness of a region may enhance the speed of innovation**.

Moreover, different types of networks exist. **Territorial networks may be classified into three types of networks: "ecological networks", "identity networks" and "strategic networks", having different characteristics** (Cappellin, 2003b, 2007). 'Ecology networks', such as "Third Italy" industrial districts in the late 60'ties and early 70'ties, are characterised by **strong unintended interactions between various actors and facilitate various forms of traded and un-traded technological interdependencies or technology spill-over**, as it occurs in geographical agglomerations. 'Identity networks', such as "Third Italy" industrial districts in the late 90'ties, are based on the **sense of identity and common belonging and on the existence of trust relationships and specialised intermediate institutions ('social capital')**. 'Strategy networks', such as metropolitan areas and some industrial clusters in various European countries during the 2000'ties, are based on **intended relationships and cooperative agreements between firms** and other organisations. This typology differs in some respects from similar typologies (Gordon and MacCam, 2000; Cooke, Heidebreich and Braczyk, 2003; Asheim and Coenen, 2005; Todtling and Trippl, 2005).

Therefore, regional production systems may evolve from the form of a simple agglomeration of similar SMEs, such as in so called "ecological networks", to the form of communities characterized by intense processes of interactive learning, such as in so called "identity networks", and then they may finally evolve to the form of "strategy networks", characterized by an explicit governance of knowledge interactions between the various firms. In particular, the six phases of the process of knowledge creation and of interactive learning illustrated above in **the approach of "Territorial Knowledge Management"** allow to identify the **objectives or priorities of the innovation policies in different types of region**.

Thus, major factors of weakness of the "identity networks", such as clusters specialized in medium tech sectors seem to be: 1) a **low international accessibility**, 2) the **relative lack of creativity** and of major product innovation instead of the hitherto focus on process innovation in traditional productions, 3) the **need for formal instruments of governance of knowledge relations** to enhance the emergence of more formal cooperation between the firms. Moreover, innovation policies in the modern industrial clusters specialized in medium technology sectors should also take into account the nature of their knowledge base mainly consisting of synthetic and symbolic knowledge (Asheim, Boschma and Cooke, 2007) and the form of their knowledge interaction characterized by interactive learning processes.

On the other hand, clusters specialized in high tech sectors indicate different key problems, such as: 1) a **low local embeddedness of large firms**, 2) **problems in combining R&D activities or analytical and synthetic knowledge**, which are science and technology driven, with symbolic knowledge and creativity, which is driven by the users' needs and the demand, 3) the **need to avoid a too high concentration in large firms and to promote spin offs** and the participation also by SMEs and other social partners in strategic decision making. These clusters can be mostly found in central and metropolitan urban areas. Innovation policies in these areas should take into account the nature of their knowledge base consisting of analytical and synthetic knowledge, and the form of the knowledge interaction characterized by knowledge flows coordinated by knowledge management and joint R&D projects. Knowledge networks in these areas are characterized by links between large firms and research institutions and by professional networks and knowledge intensive business services.

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Finally, clusters specialized in low tech sectors are characterized by various weaknesses, such as: 1) too low international accessibility, 2) the lack of receptivity and qualified skills, 3) the lack of identity and fragmentation in decision-making. These clusters are typically located in less developed and peripheral areas, so far exclusively compete on cost advantages and to a large extent are dependent on public subsidisation. Innovation policies in the less developed peripheral areas specialised in low tech sectors should take into account the nature of their knowledge base, mainly consisting of symbolic or creativity based knowledge and sometimes synthetic or engineering based knowledge, and the form of knowledge interaction in these regions, characterized by automatic knowledge spill-over based on geographical proximity.

Therefore, according to the territorial knowledge management approach and a cognitive perspective, **innovation policies does not only consist in the financing with public resources the private R&D investment**, but they should **facilitate the accessibility between the actors, stimulate their internal capabilities, increase their receptivity, promote a sense of belonging to the same community and the identification of common aims, facilitate the relationships with different and complementary both regional and external actors for the creation of new firms and productions and accelerates the sequential and cumulative process of trial and error between the innovation of different firms.** For these reasons, cluster policies require new forms of regulation of the relationships between the various local actors and also the identification or creation of new organizations and institutions. The multiplication of players, the management of the knowledge relationships between them and the variety of the layers of negotiation: international, national, and local (Cappellin, 1997, 2005), **demand a different model of regulation, called "multi-level governance", based on organisational structures of interaction and partnership.**

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Porter's diamond of competitiveness and productivity in a cluster
(Porter, 1998; Martin and Sunley, 2003):

- 1. firm strategy and rivalry (the nature and intensity of local competition);**
(identity)
- 2. factor input conditions (the cost and quality of inputs);**
(receptivity)
- 3. demand conditions (the sophistication of local customers);**
(external stimulus)
- 4. related and supporting industries (the local extent and sophistication of suppliers and related industries).**
(accessibility)

Missing factors with respect to the six driving factors of the Territorial Knowledge Management:

- Local identity
- Creativity through interactive learning within the local network
- Governance and local intermediate institutions or social capital

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Synthesis

The six factors of the TKM – Territorial Knowledge Management approach and the indications of cognitive sciences

STIMULUS

Damasio e Castelli

Le immagini nel nostro cervello sono stimulate da oggetti o eventi.

La costruzione di immagini complesse a partire da diverse fonti avviene con il legame neurale che si raggiunge con **la simultanea attività neuronale svolta in diverse aree del cervello per raccogliere insieme, in un singolo intervallo di tempo**, l'attività in attivo da varie fonti.

La mente è un processo, non un organo. È un processo materiale che si svolge nel cervello che interagisce con il corpo fisico.

Il cervello e il corpo costituiscono un organismo connesso da **reti neurali attivate da segnali chimici che circolano nel flusso sanguigno e da segnali elettrochimici inviati tramite le vie nervose**.

Noi siamo retti in connessione con un mondo di reti. Ogni neurone ha **migliaia di connessioni** in entrata da altri neuroni, e migliaia di connessioni in uscita verso altri neuroni. Vi sono tra i **10 e i 100 miliardi di neuroni nel cervello umano**, per cui le connessioni sono nell'ordine delle migliaia di miliardi. **La chiusura dei circuiti crea esperienza: immediata o accumulata nel tempo**.

Le emozioni sono modelli caratteristici di reazioni chimiche e neurali risultanti dall'individuazione da parte del cervello di uno stimolo emozionalmente adeguato (ECS, Emotionally Competent Stimulus), ossia di mutamenti nel cervello e nel corpo **indotti dal contenuto di una determinata percezione** (come un'emozione di paura quando ci si trova di fronte a un'immagine della morte o che evoca la morte).

A.Smith

The motivation for generating new ideas is the first element in Smith's theory. He draws attention to **three general human passions**, arguing that people are **disturbed by the unexpected, dismayed by the inexplicable, and delighted by schemes of thought that resolve the inexplicable into plausible generalisations**, and claims that, in the absence of any assured procedure for attaining correct knowledge, these are **the motives**

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which 'lead and direct philosophical enquiries'. They are **a long way from the incentives in economists' models**, but perhaps not so far from some of the incentives that shape the behaviour of technologists, and of economists also.

Moreover, the invented principles **are liable eventually to be confronted with unexpected phenomena which they cannot be adapted to explain**. **At this point, the product of human imagination and design is rejected, and a new search for connecting principles begins**. This is the **fifth element**, which renews the evolutionary sequence.

ACCESSIBILITY

Antonelli

At each point in time knowledge is dispersed and fragmented, scattered among a myriad of learning agents.

Proximity among agents is relevant for the complementarity among external and internal knowledge, as well as among the learning efforts of each agent and the modules of knowledge possessed by each agent, to be implemented;

Technological knowledge is viewed as **the outcome of the localized interactions of a variety of learning and heterogeneous agents**, able to learn and to establish network relations, although in a limited range of activities, rooted in **a limited technical and product space** where each firm has accumulated competence by means of process of learning by doing and by using (Atkinson and Stiglitz, 1969; David, 1975; Antonelli, 1999, 2001).

The search for new knowledge takes place locally in the close surroundings of the existing activities bounded by relevant switching costs: the tacit knowledge accumulated by means of learning process is eventually valorized and articulated both internally and externally by means of network relations.

Each activity is localized by the effects of bounded rationality and proximity.

Because of bounded rationality and switching costs, proximity matters in many different ways: in regional space as well as in technical, professional and industrial space.

The amount of external technological knowledge, available in a given context, industrial, technological or regional **and its conditions of accessibility and proximity**, becomes an important endowment, as well as the conditions of access to it and the characteristics of the relational set-up.

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Hayek

Connections within the brain are selective, and so connections between human perceptions and the physical world (including the physical world of the brain) are also selective;

Hayek's account of the functioning of the human brain and neurocognitive theory both lead to the conclusion that human knowledge is necessarily dispersed and incomplete; furthermore, the particular potential and limitations of the human brain imply that knowledge can be less incomplete only if it is more dispersed. The implications for specifying the central problems of economics are not difficult to envisage.

RECEPTIVITY

Damasio e Castelli

Le reti di associazioni di immagini, idee e sentimenti che vengono connessi nel corso del tempo costituiscono modelli neurali che strutturano emozioni, sentimenti e coscienza.

La conformazione dei modelli neurali dipende dall'evoluzione della specie, dalla dotazione cerebrale originaria alla nascita e dall'esperienza appresa del soggetto.

A seconda del livello di vigilanza, attenzione e connessione con il sé, le immagini mentali che costituiscono la mente possono essere o meno consapevoli. Essere consapevoli di qualcosa vuoi dire: a) avere un certo livello di vigilanza; b) avere l'attenzione focalizzata; e) connettere l'oggetto dell'attenzione con un protagonista centrale (il sé).

Il nostro cervello elabora eventi (interiori o esteriori) in base alle proprie mappe (o reti di associazioni costituite). Tali eventi sono strutturati nel cervello. Collegando queste mappe agli eventi, il legame neurale crea esperienze emozionali con l'attivazione di due vie emozionali definite da neurotrasmettitori specifici: il circuito della dopamina veicola emozioni positive; il circuito della norepinefrina trasmette le emozioni negative.

Over time such a machine may develop a range of closely connected impressions and actions, which we might now call routines; these routines are not the result of anticipatory choice but of environmental selection among actions which, by Marshall's intentional specification of his model, cannot originate in consequential reasoning.

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Although the imprint of his mathematical training is unmistakable in the conception and structure of his 'machine', he has already moved away from the axiomatic method as the appropriate way of deciding what to do. To be precise – and this may sometimes be very important, though Marshall does not say so – selection depends on the environment as it is perceived by the machine.

In the elaboration of his model this environment contains other machines that operate on similar principles, but because of differences in initial perceptions and initial actions and the selective reinforcement of what appears to work they may develop different connections. Thus a population of machines constructed to a uniform design may generate the variety which is essential for any evolutionary process.

All this applies to organised groups of humans. Directed action within a group relies on pre-existing routines within which no choices, in the normal sense, are exercised; if directed action fails to achieve its objective, the recognition of failure leads either to a modification of existing routines or to experimentation resulting in new routines.

Marshall's treatment of organisation matches his early model of mental activity (Raffaelli 2003). Indeed, Marshall's discussion of organisation begins in Chapter 9 of the *Principles* with an account (corresponding to his early model) of the multi-level structure of the brain, in which conscious attention is reserved for problem-solving or the introduction of novelty; the application of solutions or the repetition of new actions 'develops new connections between different parts of the brain' (Marshall 1920, p. 252), which gradually take over the maintenance of these activities, leaving the conscious brain free for new initiatives, including those which utilise these now-automatic connections.

Marshall's formulation has substantial virtues as an evolutionary model which conforms to a basic economic principle: certain regularities of behaviour are selected and reinforced by their success in extracting benefit from their environment, by a procedure which operates at low cost in mental energy.

Marshall indicates this by restricting the brain to operating with 'ideas of impressions' and 'ideas of actions'; it works by linking the idea of an initial impression received by the body with the idea of an action which the body performs in response, and then linking the latter with the idea of an impression that is interpreted as a consequence of that action.

If the latter linkage produces a pleasurable sensation, then the linkage from initial impression to action is strengthened, and if the sensation is unpleasant it is weakened.

The suggested mechanism, possibly inspired by Babbage's conceptions of analytic engines and automata, to which Marshall refers, is of wheels connected by bands, which may become tighter or looser in response to the sensation experienced.

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Hayek

.....Hayek (1952, p. 40) argues that instead of direct connections between particular stimuli and particular sensory qualities, the effect that is produced by any stimulus depends, first, on how (or indeed whether) it is translated into an impulse in some nerve fibre (Hayek 1952, p. 10) and, second, on the location of this impulse in relation to other impulses within the network of connections (Hayek 1952, p. 53).

Any impulse is not a carrier of the initial stimulus but a 'representation', perhaps with some different properties; and this representation is itself interpreted in terms of the relationships which have already been established within the brain: thus 'the qualities which we attribute to the experienced objects are strictly speaking not properties of that object at all, but a set of relations by which our nervous system classifies them' (Hayek 1952, p. 143).

As Hayek (1952, p. 176) pointed out, nothing can be recognised unless it can be assigned to some existing category.

Following Hayek's insights and the more recent neurobiological and cognitive teachings (15), we can note that human brain presents a particular pre-natal structure allowing it to interpret and give significance to the external world. This neuronal structure evolves by means of exaptation in classifying new external stimuli in its preexisting nets. The actions which can solve problematic situations successfully are interpreted as satisfying (in Simon's sense) choices.

The interpretation of external stimuli generates an action. If this is successful - in satisfying terms -, it reinforces the perception mechanism that reduces the neurobiological elasticity to interpret (to exapt) in a different way the same situation when it recurs.

Or, in other words, it increases the resistance to change of our (neurognostic) brain. This mechanism of perception and feedback is coherent with the "lock-in" idea.

The fact that the evolution of the brain is path-dependent means that it certainly depends on its history, but also on its neurognostic structure, which in turn resists to continuous changes. The image of the self and the external world tends to preserve the previous one, as long as possible. In a sense, neuronal structures have a conservative nature, but they are not completely rigid.

In Hayek's conception, mind is a framework that orders perception through acts of interpretation. The human neuronal structure classifies external sensorial data by means of a process of association of classes of stimuli into classes of responses. The significance that we give to each perception depends upon the genetic characteristics of the individual and upon his/her previous activity of classifications of external stimuli (experience). The mind does not receive sensations in a passive way. On the contrary, it is an active tool that interacts with external environment. Not only. The mind continuously builds an image of itself and of the world and rebuilds them in a tacit and unconscious way.

This image of itself and of the world is the framework that allows us to give significance, by means of personal and idiosyncratic interpretation, to external information. More important, this allows us to construct knowledge, that is a fruit of an internal and subjectivist process, which we use to act. Being based on the person's genetic traits and on his/her personal experiences, every person acts after performing a process of "interpretation" of the external (objective) information, which he transforms into subjective knowledge, which is unique and original.

As is emerging, neurogenesis and exaptation are evident in Hayek's conception of the human brain.

Rizzello

When faced with a problematic new situation, individuals generally refer to previous successfully experimented schemas of action that permit to read the new phenomena accordingly (Bulos – Koppl 1997). Classification through individual association of stimuli leads to interpretative outcomes and action, which can vary greatly from an individual to another.

Path-dependence is a relevant analytical tool for economic theory. Two basic ideas are central in path-dependence: (i) history matters in determining the dynamics of social and economic processes; (ii) the passage from a state to another of an economic system depends on the previous paths.

As David and Arthur demonstrated, the path of dynamic systems depends on a stochastic and self-reinforcing mechanism that usually conducts to "lock in" the system into a trapping region, i.e. the basin of attraction that surrounds a locally (or globally) stable equilibrium (14). These kinds of equilibrium are stable but not (necessarily) optimal and they often result to be multiple ones.

(14) "When a dynamical economic system enters such a region, it cannot escape except through the intervention of some external force, or shock, that alters its configuration or transforms the underlying structural relationships among the agents" (David 1997, p. 34).

As Boulding (1992) pointed out, next to classical cybernetics, characterized by negative feedbacks, creodic processes and positive feedbacks play an important role in evolutionary processes. A creodic process is typical of a system that evolves following a blueprint or a design. As a good example of creodic processes, one can consider the construction of a building or the evolution of an egg. Positive feedbacks work in the opposite way of the negative ones. Far from re-equilibrate systems, they increase the forces of disruption. Usually they concern the drastic and catastrophic changes and in referring to economic systems they can be utilized to describe, for example, technological crisis in schumpeterian terms.

This means that the organism is able to make an action, in the opposite sense as respect to the external input.

The traditional answer that biology gives us (evolution by means of selection) is not completely satisfying. Certainly it is a good tool to explain how organisms adapt themselves to the changing environment, but it is not able to explain the functioning of the polarity between environmental adaptation and the protection of their internal integrity. Individuals do not simply "adapt" themselves to the changing environment, they resist, as long as possible, to these changes by interpreting and selecting external data in a way that results to be the most appropriate for their cognitive maps.

Let us consider neurognosis. When an organism faces new information, its capacity to give significance to this information depends on its previously stored experience and on its innate neurognostic structures (6).

(6) The notion of neurognosis is linked to the idea that knowledge is constructed in cognitive frameworks. This aspect is not new at all in the literature on organization and management of "absorptive capacity" (see Cohen and Levinthal 1990). From this perspective, firms have been theorized as "sensemaking systems", "focusing device", "systems of shared meanings" (Smircich 1983, Weick and Roberts 1993, Weick 1995, Choo 1998, Nooteboom 1999).

Human brain and mind evolve by following a path, that strongly depends on innate preexisting structures. Because of this dependence on its previous experiences and its innate structures, this can be clearly described as a path-dependent process. But it is important to stress that path-dependence emerges here more as a mechanism of resistance to change, rather than as a simple influence of the previous path on the development of organisms. Human mind tends to preserve itself, as much as possible, from change (7).

IDENTITY

Damasio e Castelli

Il cervello elabora gli stimoli ricevuti dal corpo e dal suo ambiente con il fine ultimo di assicurare la sopravvivenza e aumentare il benessere del possessore del cervello.

La coscienza probabilmente emerge dalla necessità di integrare un maggior numero di immagini mentali provenienti dalla percezione con immagini della memoria. Più grande è la capacità di integrazione di un processo mentale, maggiore sarà la capacità della mente di risolvere problemi a vantaggio del corpo.

Ma la mente conscia ha bisogno di un principio organizzativo per orientare questo livello superiore di attività. Questo principio organizzativo è il sé: l'identificazione dello specifico organismo che deve essere servito dal processo di manipolazione delle immagini mentali.

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A partire da una finalità generica di sopravvivenza e benessere, il mio cervello definisce una specifica manipolazione mentale per la sopravvivenza e il benessere di me stesso.

I sentimenti, e quindi le emozioni da cui essi nascono, svolgono un ruolo fondamentale nell'orientamento della mente nell'assicurare la destinazione dell'attività verso il giusto corpo fisico. In effetti, senza la coscienza, il corpo umano non può sopravvivere. La coscienza opera sui processi della mente. È l'integrazione delle emozioni, i sentimenti e i ragionamenti che portano alla formazione delle decisioni a determinare questi processi. Le rappresentazioni mentali diventano motori di azione significativa incorporando le emozioni, i sentimenti e i ragionamenti che definiscono il modo in cui viviamo.

Le emozioni sono impiantate profondamente nel nostro cervello (e nel cervello della maggior parte delle specie) perché sono state indotte dalla spinta a sopravvivere nel corso del processo di evoluzione.

Emozioni e sentimenti sono connessi nella mente per orientare il sé verso il processo decisionale in relazione alle reti interne ed esterne del sé.

Specie o individui che non sono attrezzati con il corretto sistema di percezione emozionale hanno scarsa probabilità di sopravvivere.

Diventando noti al sé conscio, i sentimenti sono in grado di governare il comportamento sociale, e in ultima analisi di influenzare il processo decisionale collegando sentimenti del passato e del presente per anticipare il futuro, attivando le reti neurali che associano sentimenti ed eventi.

I sentimenti e la costituzione del sé emergono in stretta relazione, ma è solo quando il sé è formato che le emozioni vengono elaborate come sentimenti.

I neuroni specchio rappresentano l'azione di un altro soggetto. Attivano processi di imitazione e di empatia. Rendono possibile mettersi in relazione con lo stato emozionale di altri individui, un meccanismo che sta alla base della cooperazione negli animali e negli umani.

Le emozioni non sono cruciali soltanto per i sentimenti e il ragionamento, ma sono anche indispensabili per la comunicazione negli animali sociali.¹

L'attivazione del nostro cervello tramite modelli neuronali indotti dai neuroni specchio è alla base dell'empatia, l'identificazione o il rifiuto verso le narrazioni della televisione, del cinema o della letteratura, e verso le narrazioni politiche di partiti e candidati.

Il potere, come tutta la realtà, è costruito nelle reti neurali del nostro cervello. Il potere si genera nei mulini a vento della mente.

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A.Smith

Smith's third element, implicit in the reference to **notions of good order**, is the **link between emotion and aesthetics**. He explains the **importance of aesthetic criteria both in guiding conjectures**, for example those of Copernicus and Kepler, **and in encouraging their acceptance**, notably in discussing the rhetorical appeal of Newton's theory, which in his *Lectures on Rhetoric* exemplifies Smith's ideal method of 'giving an account of some system' (Smith, 1983, p. 146). **Aesthetic influences in the natural sciences and in economics** (signalled earlier by the **reference to the elegance of rational choice equilibria**) are occasionally recognised but rarely explored (see **Schlicht, 2000**); aesthetic influences on the design of artefacts are often of major significance. Sometimes aesthetic appeal is a major objective.

The fourth element in Smith's proto-evolutionary theory is his proposition that **connecting principles which seem to work well are widely diffused because of our readiness, when in any difficulty or discomfort, to look for guidance from others who seem to know better, and because of our desire to act, and indeed think, in ways that merit the approval of others**. These powerful motivations, **together with the underlying similarity in human mental, emotional and aesthetic processes** which underpins them, are **foundational principles of Smith's (1976a [1759]) Theory of Moral Sentiments**, which is itself an essential component of **Smith's complex account of social organisation**, and applicable both to technological evolution and any adequate understanding of organisational behaviour.

Rizzello

The self-organization approach is emerging as a new promising branch of evolutionary economics, which differs in some respects from the most traditional models of evolution, applied to economic change. By proposing a new point of view on evolution, such an approach seems able to answer some open relevant questions in evolutionary economics that invest the nature, role and dynamics of economic change. **Such an approach is typical of time-irreversibility and dissipative structures in which change is not linear, and uncertainty, creativity and novelty matter**.

Humberto Maturana coined the term "autopoiesis" about in 1960. Maturana and Varela use the term to refer to the fundamental process of living systems. Autopoiesis is essentially the mechanism by which living systems continually produce themselves as autonomous unities.

Public good, club goods, community goods, social capital, relational goods

A public good is a good which is non rivalrous and non excludable. Therefore, as in the case of external economies, the production of a public good requires a superior authority, which is capable to impose to every user a fee or a tax in order to finance the production of the public good.

Club goods (artificially-scarce goods) are a sub-type of public goods, that are **excludable but non rivalrous**, at least until reaching a point where congestion occurs. Club goods represent an intermediate case between the private and the public goods since they do not have the rivalry

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characteristic of the former and the non excludability characteristics of the second.

First, privately owned and operated clubs **must be voluntary**: members choose to belong because they anticipate a net benefit.

Second, club goods, unlike pure public goods, **involve sharing that may result in congestion or crowding**.

Third, club goods require an exclusive group whereby **non members are excluded**. In contrast, pure public goods are associated with inclusive groups, since additional users can bring down per-person fees and impose no crowding costs on others.

The European Union can be considered as a club good. Also **a nation can be seen as a club** whose members are its citizens and the government would then be the manager of this club. Also, roads and cities **may be considered as club goods** and are subject to crowding and exclusion. Thus the concept of club goods can be used in defining the jurisdictional size in regional economics.

The case of club goods is linked to **the contribution of Charles Tiebout (1956)**, who developed a theory of jurisdictions, that provide a single shared good, whereby a heterogeneous population partitioned themselves into homogeneous clubs by **choosing the jurisdiction** with the tax-public good package that best suited their tastes. Thus **club goods may lead both to spatial segregation or increasing disparities between regions** and also to forms of cooperation between regions.

An increase of the number of participants may lead to positive and also to negative effects. In the *Logic of Collective Action*, Mancur Olson (1965) indicated the need for exclusive clubs that restricted membership size owing to congestion or crowding as a greater utilization of an impure public good by one user decreases the benefits or the quality of service still available to others. Relational goods display two peculiar features. They cannot be enjoyed alone, but exists in as much as they are shared; and their production and consumption very often cannot be separated: relational goods are produces and consumed at the same time through participation in some social activity with other people.

In relational goods production, investment and consumption coincide since participating to a relationship is both an act of production (my presence contributes to the increase in the value of the good), investment (the time invested in the relationship makes it stronger) and consumption (I enjoy it while producing it).

Relational goods are a specific kind of local public goods (requiring the joint participation of at least two individuals) for which investment, production and consumption coincide (Gui, 2000; Ulianer, 1989).

Relational goods are local public goods in the sense that non-excludability and non rivalry are limited to participants. Actually, they are a special kind of public goods since they should be more properly defined as anti-rival than non rival since their very same nature is based on interpersonal sharing of them.

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This case of interactive use-production is different from the previous case of public goods, where the relationships between the various partners where indirect and yet connected by the individual and often rival consumption of a common pool of a good.

Consider that, with extremely rare exceptions, relationships do not appear directly in the *homo oeconomicus* utility function.

In some cases, the consumption of some goods and services, such as those characterizing specific fashions, is the instrument in order to participate to a given community and to allow to the consumer the possibility to socialize with other actors, characterized by a similar preferences, knowledge or culture. In this perspective, the definition of "community goods", seems more appropriate than that of "club goods".

In the case of these "community goods" the payment of the price is not the main instrument to allow a potential consumer to use the good, as the knowledge of the rules governing that community and a deep knowledge of the specific field of activity, are conditions not only in order to appreciate the product, but also in order to be personally recognized by the other specific consumers and to be allowed to enter in the considered community of the users.

Relational good imply that each partner is directly providing a service to the other partners and these latter reciprocate in providing a similar contribution. They imply an interactive relationship in the use-production of a good. Clearly also these interactions are affected by geographical proximity.

As each region is directly contributing to the wellbeing of the other regions, the concept of "empathy" is especially important in the case of relational goods.

Social capital is made by trust and civic norms and voluntary associations and horizontal organization. Social capital may be defined as the norms and social relations embedded in social structures of societies that enable people to coordinate action to achieve desired goals.

Social capital is the collection of those productive assets that are incorporated in the social structure of a group (rather than in physical goods and individual human beings, as physical and human capital) and that allow cooperation among its members to reach common goals.

The rules of the economic system are the institutions or the social capital. Thus, social capital is like an immaterial infrastructure, which as the transport infrastructures allows a decrease of the costs in the relationships or like a software allows the working of a system of production.

Social capital is accumulated through social participation in group activities. In fact, social capital may be seen as an input in the production of relational goods.

The national institutions play a major role, but the local and regional institutions are often the bridge between the actors of the various society and economy and can stimulate them to undertake specific joint projects.

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CREATIVITY

Antonelli

The generation of new technological knowledge is the result of **four specific activities**: a) **learning**, b) **socialization**, c) **recombination** and d) **research and development**, where both general the process and

No agent can possess and control all the knowledge available at each point in time; **the complementarity among modules of knowledge possessed by each agent is relevant**: its valorization provides the opportunity to generate new radical advances;

Collective knowledge is a shared activity that can be implemented only by interactive agents that belong to a community of practice and understanding.

Complex system dynamics provides an analytical framework into which our analysis can be accommodated with some qualification.

Damasio e Castelli

La mente è il processo di creazione e manipolazione di immagini mentali (visive o meno) **nel cervello**. Le idee si possono vedere come configurazioni di immagini mentali. Con ogni probabilità, **le immagini mentali corrispondono a modelli neurali**. I modelli neurali sono configurazioni di attività nelle reti neurali. **Le reti neurali connettono i neuroni, che sono cellule nervose**. I modelli neurali e le immagini corrispondenti **aiutano il cervello a regolare la sua interazione con il corpo fisico e con il suo ambiente**.

Il cervello costruisce modelli neurali dinamici mappando e immagazzinando attività e le reazioni che queste suscitano.

Le immagini corrispondono ad alterazioni nel corpo e nel suo ambiente, trasformate nel cervello grazie a un complesso processo con cui si costruisce la realtà lavorando sulla materia prima dell'esperienza sensoriale tramite l'interazione tra varie aree del cervello e le immagini immagazzinate nella sua memoria.

Noi costruiamo la realtà in reazione a eventi reali, interni o esterni, ma il nostro cervello non si limita a rispecchiare questi eventi. Piuttosto, li elabora in base ai propri modelli. Gran parte dell'attività di elaborazione è inconscia. Così, **la realtà per noi non è né oggettiva né soggettiva, ma una costruzione materiale di immagini che mescolano ciò che accade nel mondo fisico (all'interno e all'esterno di noi) con l'iscrizione**

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materiale dell'esperienza nei circuiti del nostro cervello.

Le immagini mentali, per esempio, le idee, sono generate con l'interazione tra specifiche regioni del cervello e il corpo, rispondendo a stimoli interni ed esterni.

Il legame neurale crea nuove esperienze. Possiamo istituire relazioni spaziali e temporali tra gli oggetti che percepiamo. La costruzione del tempo e dello spazio definisce in larga misura la nostra costruzione della realtà. Questo richiede un livello superiore di manipolazione delle immagini. Ossia, richiede la mente conscia: una mente che simbolizza corrispondenze tra eventi e mappe mentali; per esempio, con l'uso di metafore, molte delle quali derivate dall'esperienza del corpo fisico.

Così, la mente procede collegando in rete modelli presenti nel cervello con modelli della nostra percezione sensoriale che derivano dal contatto che stabiliamo con le reti di materia, energia e attività che costituiscono la nostra esperienza passata, presente e futura (tramite la previsione delle conseguenze di determinati segnali in base alle immagini immagazzinate nel cervello).

Questa maggiore capacità ricombinante è associata con ciò che chiamiamo creatività e innovazione.

A.Smith

The second element in Smith's theory is the sequence that is inspired by this complex motivation: a combination of imagination and ex-ante selection guides the invention of 'connecting principles' which sort phenomena into categories and link these categories by an explanation which is sufficient to 'soothe the imagination'. Smith (1980 [1795], pp. 61, 90) shows how the 'equalising circle' in Ptolemaic geometry and Kepler's rule that 'when one body revolved round another, it described equal areas in equal times' appealed to principles of motion that conformed to prevailing conceptions of good order: most economists accept the notion of 'rational expectations' because it fits their idea of a good theory; and both technology and business strategy are shaped by what people feel comfortable with. Ideas must satisfy the selection criteria of the imagination.

The sixth element in Smith's system is the evolution of the evolutionary process itself. The basic human activity of seeking psychological comfort by inventing and imposing connecting principles generates an increasingly distinct category of knowledge which comes to be called 'scientific', with its own group of practitioners; and as this category expands, we begin to observe a progressive differentiation between sciences that we might now label speculation. The consequent differences of focus and of criteria for acceptable categories and explanations lead to an increasing variety of problems that are more precisely defined, accelerating the growth of science.

It is in this scientific context that the effects of the division of labour first appear in Smith's (1980 [1795]) surviving work: it therefore seems

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Riccardo Cappelletti, Corso di Economia della Ricerca e della Conoscenza, Università di Roma "Tor Vergata"

natural that in the *Wealth of Nations* he invokes the division of labour, not as the best way to exploit differentiated skills—which was a very old idea—but as the chief instrument for improving productive knowledge (Smith, 1976b [1776]). This is the seventh element of Smith's evolutionary theory; and it is easily the most important idea in economics, since the co-ordination problem which normally receives priority among economists would be trivial without the continuous generation of new knowledge and new artefacts.

Marshall

This cumulative trial and error process, which forms associations of contiguity or similarity, is consistent with Bain's account of the physiology of mental phenomena: and Marshall shows how the process could produce complex patterns of relationships. The basic mechanism, including the importance of sensation, also corresponds quite closely with Smith's mentally-focussed account of the growth of knowledge, though it would correspond even better with an elaborated account of the process by which the division of labour fosters the development of capabilities.

Marshall continues his evolutionary sequence by postulating the emergence of a second level of control within the brain, which uses similar mechanisms for different purposes (an early example of exaptation as a postulated evolutionary mechanism). Ideas of impressions received which have not been linked to any idea of satisfactory action can now be referred to this higher level, which may generate the idea of a novel action and associate it with the idea of an impression of its effects. Expectations appear, but they appear as conjectures. A pleasurable linkage of contemplated ideas is then transferred to the lower level, where it directs bodily action; and if the action produces the anticipated impression the corresponding link between impression and action forms a new routine. This is a crucial development: it introduces imagination and the possibility of trial and error within the mind which may improve the chances of success in the environment, thus opening the path to modern practices of research and development.

Marshall's formulation has substantial virtues as an evolutionary model which conforms to a basic economic principle: certain regularities of behaviour are selected and reinforced by their success in extracting benefit from their environment, by a procedure which operates at low cost in mental energy.

These routines are not the result of anticipatory choice but of environmental selection among actions which, by Marshall's intentional specification of his model, cannot originate in consequential reasoning. Although the imprint of his mathematical training is unmistakable in the conception and structure of his 'machine', he has already moved away from the axiomatic method as the appropriate way of deciding what to do. To be precise – and this may sometimes be very important, though Marshall does not say so – selection depends on the environment as it is perceived by the machine.

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In the elaboration of his model **this environment contains other machines that operate on similar principles, but because of differences in initial perceptions and initial actions and the selective reinforcement of what appears to work they may develop different connections. Thus a population of machines constructed to a uniform design may generate the variety which is essential for any evolutionary process.**

All this applies to organised groups of humans. Directed action within a group relies on pre-existing routines within which no choices, in the normal sense, are exercised; if directed action fails to achieve its objective, the recognition of failure leads either to a modification of existing routines or to experimentation resulting in new routines. Thus knowledge that is already organized into routines facilitates the creation of new knowledge – especially that which builds on the old; and new knowledge which is corroborated by apparently successful application is consolidated into new routines. It is not then surprising that **experimentation should be at one or other of the margins of knowledge;** and these margins will differ according to the past history of the growth of knowledge within each organisation, because this history influences the development of capabilities within that organisation and also of beliefs about these capabilities and about the ways in which they might be most effectively applied. **The generation of variety across organisations is a natural consequence;** and this may be considered an effective response to the underlying and pervasive uncertainty about the likely directions of progress.

It is no accident that changes in organisation were incorporated by Marshall (1920, p. 318) in his definition of increasing return. As Quéf   (2003, p. 198) writes, ‘Increasing returns do not pre-exist. They are the result of an economic process; that is, a result of the way co-ordination problems are managed over time’. **Our clearer understanding of the relationship between Marshall’s theory of the mind and his theory of economic progress may suggest that he was thinking not only of the reordering of relationships between people but also of the subsequent reordering of relationships within minds; at both levels the increasing returns are not produced by the elements but by the connections between them.**

Marshall’s recognition of this is exemplified by his ‘principle of substitution’, which is a guide to selective experimentation against a baseline of established practices (Loasby 1990), as in scientific procedures.

Better knowledge was a primary source not only of increased productivity (as mainstream economists have rediscovered) but also of better patterns of consumption (which is still neglected); for Marshall, preference functions, like production functions, were a product of the economic system.

Marshall saw this as a particular problem with large firms, in which routines are prime supporters of organisational coherence, and especially dangerous because of the valid claims that large firms could achieve greater efficiency through more carefully-planned and larger-scale routines: the means of achieving this efficiency may repress ‘elasticity and initiative’ (Marshall 1919, p. 324), and therefore the changes in mental and formal organisation that aid knowledge. Moreover, larger firms necessarily imply fewer firms, and therefore a reduction in variety. In standard economics fewer firms may reduce welfare because they reduce allocative efficiency; that they may reduce welfare because they reduce the range of experiments is not compatible with the assumptions that are necessary to sustain the standard analyses of rational choice equilibria.

Loasby

This process of learning works through the creation and modification of connections within the brain, for selective connections are the key to human cognition. This is precisely how learning is modelled by Hayek, and also by Marshall (1994).

The switch from rationality to cognition entails, I believe, a shift of emphasis from symbol processing, on which Simon focused his attention by way of computer models of artificial intelligence, to pattern-making and pattern-using. Symbol-processing has the dual virtues of directing our thoughts to how problems are handled and reminding us that our mental processes necessarily take place in the space of representations, and not in the space of real-world phenomena.

This distinction resembles that between detailed and architectural change in contemporary writing on strategy and management, and it may be applied not only to a single firm but also to networks or clusters of firms. A similar distinction may be applied to the organisation of knowledge, and changes in the architecture of knowledge may lead to changes in the architecture of both firms and industries.

However, I suggest that the most promising approach to understanding representations is not by modelling humans as analytic engines but through the human facility for pattern-making, by which representations are created.

In sharp contrast to the standard assumption that the information available to agents is always a partition of the full information set which corresponds precisely to the configuration of the economy, **the selectivity of perception and cognition results from conjectures (rarely completely conscious) that are imposed on phenomena.**

Developed capabilities are configurations that economise on cognition by the creation of cognitive capital that is appropriate to particular fields; Marshall (1920, p. 251) explains how someone who has learnt to skate can employ that knowledge as a unit in constructing more elaborate figures.

Civilisation advances by extending the number of significant operations which we can perform without thinking about them’. The conversion of explicit innovations into routines which are no longer verbalised is an essential feature of Marshall’s theory of development, and it reappears in Nelson and Winter’s (1982) theory.

Moreover, the very process of codifying cannot dispense with tacit elements. We can go further: The actual generation of new ideas (whether good or bad, true or false) is necessarily tacit; although we may construct, as an academic exercise, a codified representation of a system in which all possible connections between its elements are clearly defined, nevertheless for anyone within an existing system, whether it be, for example, a firm, an economy, or a system of thought, the process of making a novel connection is necessarily tacit. We can, as it were, give our brains directions to help us with a particular problem, but there is no procedure by which we can control precisely what they should think. What has not yet been thought cannot yet be codified.

Hayek's account of the functioning of the human brain and neurocognitive theory both lead to the conclusion that human knowledge is necessarily dispersed and incomplete; furthermore, the particular potential and limitations of the human brain imply that knowledge can be less incomplete only if it is more dispersed. The implications for specifying the central problems of economics are not difficult to envisage.

Marshall and Hayek have much in common. Both explain the growth of knowledge by the creation of selective connections, and both are concerned with mechanisms that make this possible, though Marshall is content with what we would now call a constructive existence proof (explaining how it could be done) while Hayek seeks to explain how it is actually done. In addition, both examine two processes, which are built of similar elements but produce different results. This common source of differentiation is a feature of evolutionary thinking. However, there is an apparent difference between the pairs. Whereas Marshall's processes, though relying on similar mechanisms, necessarily operate at different levels, Hayek presents the processes of creating the sensory and physical orders as if they operate at the same level.

Rizzello

The term exaptation was coined by biologists to design the situations in which evolutionary systems discover new uses for old inventory (Varela 1979, Gould – Vrba 1982, Gould 1991). This happens when organisms become able to use, for a novel function, something which arose for some other reasons (8). Following Gould, major innovations in evolution are all fruit of an exaptation process. "The human brain is, par excellence, the chief exemplar of exaptation" (Gould 1991, 55). It continuously builds models of world and of itself and, in doing so, new neuronal structures emerge, in order to give significance to the sensorial data from old ones. Exaptation is not predictable because it is an act of co-optation for the new function of something which evolved for different reasons.

A famous example in this literature concerns penguins' wings. Usually wings arose in birds in the context of flight, but it was an exaptation process that conferred advantages to penguins in swimming (Gould – Vrba 1982).

Apparently exaptation is irreconcilable with neurogenesis. The latter, in fact, stresses the relevance of innate structures in explaining evolution. The former does not consider innate explicitly and it does not clearly underline the role of path dependence. But the point of view here proposed supports these two analytical categories as complementary, by presenting Hayek's idea of evolution, selection and change. Hayek's surprising concept of evolution has psycho-neurobiological foundations. As will emerge, this is very close to the above-mentioned biological and anthropological literature (9).

(9) This problem is linked to another well-known problem in organizational literature, that of combining "exploitation and exploration" (March 1991).

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Starting from its native structures, brain evolves by building new nervous circuitries. They result from the feedback with the relatively inelastic (but not completely rigid) nature of our a-priori mental schemes which interpret external information in a path-dependent way. This interpretation is carried out by means of exaptation.

In other words, previous neuronal structures built and developed to solve problems of interpretations of external world effectively, reveal their capacity to co-opt new configurations and functions when individual faces new problems (12). After this process, these latter result, in turn, modified and they are ready to co-opt new unfamiliar external data and so on.

Moreover, cognitive processes, involved in most relevant activity, do not take place just in one single mind but they are distributed throughout many members. Since there is still a very big open problem in neoinstitutional literature, this could be a simple suggestion to address further developments.

GOVERNANCE

Antonelli

This localized knowledge approach has made possible to grasp the relevance of path dependence and dynamic coordination within complex system dynamics.

There is an array of possible network architectures.

The understanding of the knowledge trade-off contributes the parallel development of a systemic approach to the understanding of the economics of technological change. In this approach the characteristics of the regional, industrial, professional and national systems play a major role in determining the rate and the direction of technological change. Technological knowledge is endogenous to the system into which each agent is rooted.

The focus is now more and more centered upon the analysis of the mechanisms of governance of the broad array of knowledge interactions among agents, including coordinated division of labor and market transactions, and their effects in terms of generation and dissemination of new knowledge.

An array of specific institutional arrangements emerges eventually as indispensable conditions that are necessary for the trade of such a idiosyncratic and heterogeneous good to take place in order to handle the difficulties in understanding and using the differentiated set of new knowledge modules supplied in the markets place (Menard, 2000; Gulihon, 2004).

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The issues of dynamic coordination are clearly central in this context and hence the related key notion of governance.

The role of the State in the provision of inputs for dynamic coordination can now be fully appreciated.

Hayek

Some cerebral circuitries remain stable, and the brain builds up its balance between stable and unstable circuitries.

Therefore, Hayek emphasizes the importance of the connection between the evolution of the mind and the evolution of institutions.

Stressing the role of evolution in human mind and brain and the link between mental mechanism and the emergence and nature of rules and institutions, Hayek gives us a model of evolution in which both ontogenesis and phylogenesis played a balanced role. In this light, the evolutionary cognitive approach could fill in the gap between the cognitive individual dimension and the holistic one.

Because of the neurognostic structure of their brain and their ability to exapt, humans continuously evolve by both resisting to change and by adopting changes.

The role played by human mind's nature and limits appears evident in Hayek's conception of evolution of rules and institutions. Very shortly, we can state that rules of conduct, habits and routines emerge from the human limits in interpreting the very complex external world. Following rules and codifying them in institutions is an "economic way" to act successfully. Rules and organic institutions, in fact, standardize the world and in so doing they simplify the ambt in which humans use their limited cognitive capacity.

Loasby

Smith's, Marshall's and Hayek's psychological systems rely on routines and institutions which economise on cognition, and so do the economic systems that they later considered and which are populated by human beings who are equipped with such systems. The preservation of such established structures is therefore an important economising principle.

Smith's, Marshall's and Hayek's psychological systems rely on routines and institutions which economise on cognition, and so do the economic systems that they later considered and which are populated by human beings who are equipped with such systems.

A fundamental characteristic of the cognitive theory underlying this presentation is the intimate dependence of all change on the absence of change.

Systematic development is impossible unless there is a stable baseline from which to begin and a stable environment against which options may be assessed, and which may give direction to deliberate attempts to generate conjectures.

The maintenance of stable baselines within particular domains is a prime function of formal organisations, and the appropriateness of the baseline is a major determinant of organisational success or failure.

If we think of institutions as 'the rules of the game', or slightly more precisely as indicating the premises and procedures for deciding what to do, then we can see that this definition can be applied directly to the way in which the developed brain functions according to the ideas of Smith, Marshall, Hayek and Kelly.

The routines and institutions within Smith's, Marshall's and Hayek's psychological systems have the additional merit of focussing attention on the issues for which they are inadequate at any particular time: consequently these are systems in which the evolutionary sequence of variety generation, selection, and the preservation of selected variants in the form of modified or novel routines and institutions is a natural occurrence. Indeed, one can say that there can be no evolution without routines. This evolutionary sequence may be handled, in somewhat different ways, at several levels; these may include, for example, genetic and neuropsychological structures, ideas, and organisations, formal and informal, which link together clusters of routines and institutions and provide both the framework and the problems for continuing innovation.