



Clustering in the Global Economy The Combinatory Systems[©] Approach

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“Today’s economic map of the world is dominated by what are called clusters” (Porter 1998)

Abstract

If economic globalization, on the one hand, stimulates growth in the scale of production processes and of firms, networking and transnational processes, on the other hand it reinforces local economies and favours the genesis of clusters of small production units in various forms: clusters, conglomerates, filière, districts, constellations and so on.

There is no contradiction in these macro and micro globalization phenomena: the development of production is either global or local, distributed or concentrated, worldwide or regional, and in general on either a macro or micro dimensional scale (Schmitz, 2000).

In this context, I aim to present a general theory – the theory of combinatory systems – which is able to describe, interpret and explain collective phenomena which derive from individual behaviours.

By Combinatory System I mean an unorganized system made up of a plurality of similar agents; the macro behaviour of the system, as a unit, derives from the combination of the analogous micro behaviours of its similar elements, according to a feedback relation between micro and macro behaviours.

I aim also to apply the theory to interpret a particular kind of collective phenomenon: the joint-location of firms in a given area and the formation of clusters.

The phenomenon we want to understand and explain is the joint-location of firms in an area that give rise to observable concentrations or clusters in every form:

1. Conglomerate clusters, typical of industrial and commercial areas;
2. Specialized clusters, typical of single-business districts or mainly-business industrial areas;
3. Vertically-integrated joint-location, typical of “filière”;
4. Vertically- and horizontally-integrated joint-location, typical of networks;
5. Hub (neck or spider-web) joint-location, arriving or departing.

These types, and others we can derive from them, are basically generated from the action of two combinatory systems:

- *systems of accumulation*, which favor the *exogenous genesis of clusters*,
- *systems of diffusion*, which instead favor the *endogenous formation and growth of clusters*.

Keywords: combinatory system, cluster, district, filière, firm behaviour

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1 - The objective and the method of the research

The main objective of this study is to explain and understand a particular *collective phenomenon*: the genesis of *clusters* deriving from the *joint-location* of firms (or of productive units) in a given area within certain boundaries¹.

The knowledge of the mechanisms which produce an observable cluster of firms is useful both for the understanding of the phenomenon itself, where it has already occurred (Piore&Sabel, 1984), and for its control and genesis, in order to allow governmental policies to support cooperative interfirm linkages (Becattini, 1989; Sabel, 1989; Pyke&Sengenberger, 1992; Schmitz, 1992).

The phenomenon of joint location, or geographic concentration (Porter (1998) can take many forms; we will consider the main ones:

1. Conglomerate clusters, typical of industrial and commercial areas,
2. Specialist clusters, or *districts*, typical of single-business or mainly-business industrial areas,
3. Vertically-integrated clusters, typical of “filière” or pipeline,
4. Vertically- and horizontally-integrated clusters, typical of networks,
5. Hub (Neck or spider-web) joint-location, arriving or departing.

Our hypothesis is that these types of clusters, and others we can derive from them, are basically generated from the action of two combinatory systems:

- *systems of accumulation*, which favor their exogenous genesis;
- *systems of diffusion*, which instead favor the endogenous genesis and growth of areas in which the firms are jointly located.

These two genetic forms are not always easy to distinguish; in fact, they often act together.

In order to avoid a simple description of this phenomenon of the accumulation of firms and to try to provide an explanation, I will present a simple general theory – the theory of Combinatory Systems – which is able to describe, interpret and explain a wide range of collective phenomena and their observable effects highlighting both their processes of development and the generative factors.

2 - The tool: the Combinatory Systems Theory (CST)

In plain words I define as (social) *combinatory systems* the *unorganized systems* made up of a collectivity of *similar agents*, each of which is capable of producing a *micro behaviour*, and a *micro effect*, analogous to that of the others. Combined together the micro behaviours produce a *macro behaviour*, and a macro effect, which, in turn, conditions the micro behaviours of the agents (figure 1)².

If, on the one hand, the macro behaviour of the System, as a whole, *derives* from the *combination* appropriately specified (sum, product, average, min, max, etc.) of the analogous behaviours of its similar agents (hence the name Combinatory System), on the other hand the macro behaviour *determines*, or *conditions*, or *directs*, by necessity, the subsequent micro behaviours.

In combinatory systems *agents, consciously or unconsciously, act (exclusively or prevalently) on*

¹ The definition of the boundaries of the joint-location is very important (Cooke&Al., 1997) even if it is often omitted in the observation of the phenomenon (Amin&Robins, 1990; Bergman&Feser, 1999; Enright, 1996). Moreover, one mustn't confuse the meaning of the term joint-location with that of other terms which indicate groups of enterprises and, above all, with the terms sector and market.

² The Theory of Combinatory Systems is at the site: www.ea2000.it/cst in which a wide bibliography is shown.

the basis of global information which they directly produce and update as the consequence of their micro behaviours. On the one hand, the global information is - or derives from - a synthetic variable whose values derive from the combination of the micro states of the agents but, on the other, these values affect the subsequent states as a result of a micro macro feedback, acting over a period, that produces self-organization in the agents' micro behaviours (Mella, 2003).

This internal *micro-macro feedback* between micro and macro behaviours – or between their micro and macro effects – guarantees the maintenance over time of the system's dynamics and produces a *self-organization* effect.

When the system starts up “by chance” or “by programme” it then maintains its behaviour “by necessity”, as if an Invisible Hand or a Supreme Authority or an Internal Organizer regulated its time path and produced the observable effects and patterns (figure 1).

There is nothing strange here: the *invisible hand* is nothing but the micro-macro feedback action that generates a synergetic effect that produces *self-organization* and *emerging macro behaviours* attributable to the collectivity.

The *macro behaviour* – or its macro effects – may be thought of as an *internal director* which modifies the micro behaviours over time.

The combinatory systems approach is *neither a macro* approach, since it also refers to local rules by considering micro behaviours, *nor a micro* approach, since it also includes the macro behaviour in the model of the *system*³.

It is rather a *micro-macro* approach, precisely in that the *operating rules*, describing the behaviour of the system, must in some way include not only *local rules* but also the *feedback* between the micro and macro behaviours⁴.

The feedback arises from *necessitating factors*, which force the agents to adapt their micro behaviour to the system's macro behaviour, and is maintained by the action of *recombining factors*, which lead the collectivity to recombine the *micro* behaviours, or the micro effects, in order to produce and maintain the *macro* behaviour, or the macro effect.

*Recognizing the existence of a micro-macro feedback and understanding the nature of both the necessitating factors and the recombining ones is indispensable for interpreting collective phenomena as deriving from a combinatory system*⁵.

In this sense the *path dependence* (Arthur, 1994; Liebowitz&Margolis, 1998), is the proof of the action of the micro-macro feedback, even if path dependence theory does not include this mechanism in the explanation of the path dependence.

³ The central idea is that we can view a collectivity as a combinatory system only if the behaviour of agents is not exclusively determined by *general rules* - as in the *cybernetic* approach (von Foerster, 1960; Haken, 1977; Prigogine, 1985; Kauffman, 1993) in *evolutionary cybernetics* (Campbell, 1960, Gould, 2000 and PRINCIPIA CYBERNETICA WEB, <http://pespmc1.vub.ac.be/BVSR.html>), in *population dynamics* (Ardeni-Gallegati, 1999), in *systems dynamics* (Forrester, 1961, Senge, 1990), in *Haken's synergetics* (Haken, 1977 and 1982; Serra&Zanarini, 1990, Corning, 1995) and in the *autopoietic approach* (Maturana&Varela, 1980; Varela, 1979, 1981) - or by *local rules* (Waldrop, 1992) - as in the traditional *complex systems* approach (Coveney&Highfield, 1995) and its related specific topics: *adaptive complex systems* (Allen, 1997, Goldspink, 2000), *cellular automata* (Bak, 1994, Schatten 1999), *Alife* approaches (<http://alife.org/index.php?page=alife&context=alife> and <http://alife.santafe.edu/>), such as *Ants*, *Swarm* and *Floys* and so on, the recursive approach, such as *fuzzy systems* (Zadeh, 1991, Negoita, 1981, Cox, 1994) and *genetic algorithms* (Goldberg, 1989) - but above all by a general micro-macro feedback rule, so that we must observe, or assume, mutual interdependence: the micro behaviours produce the macro behaviour, but this influences the micro behaviours in a micro-macro feedback which acts over many cycles.

⁴ In complex systems theory the feedback is considered between agents and not as a determining feature of the system. See: <http://pscs.physics.lsa.umich.edu/complexity.html>, <http://home.online.no/~bergar/mazega.htm>

⁵ In order to provide a technical explanation of the action of such systems, and above all for the purpose of planning them, knowledge of the energy inputs can turn out to be indispensable.

The Theory also considers reversible systems (Lustick, 2000) that have a cyclical behaviour and, under certain conditions concerning the probability function regarding the transition of state of the agents, a chaotic one as well (Gleick, 1988; Kellert, 1993).

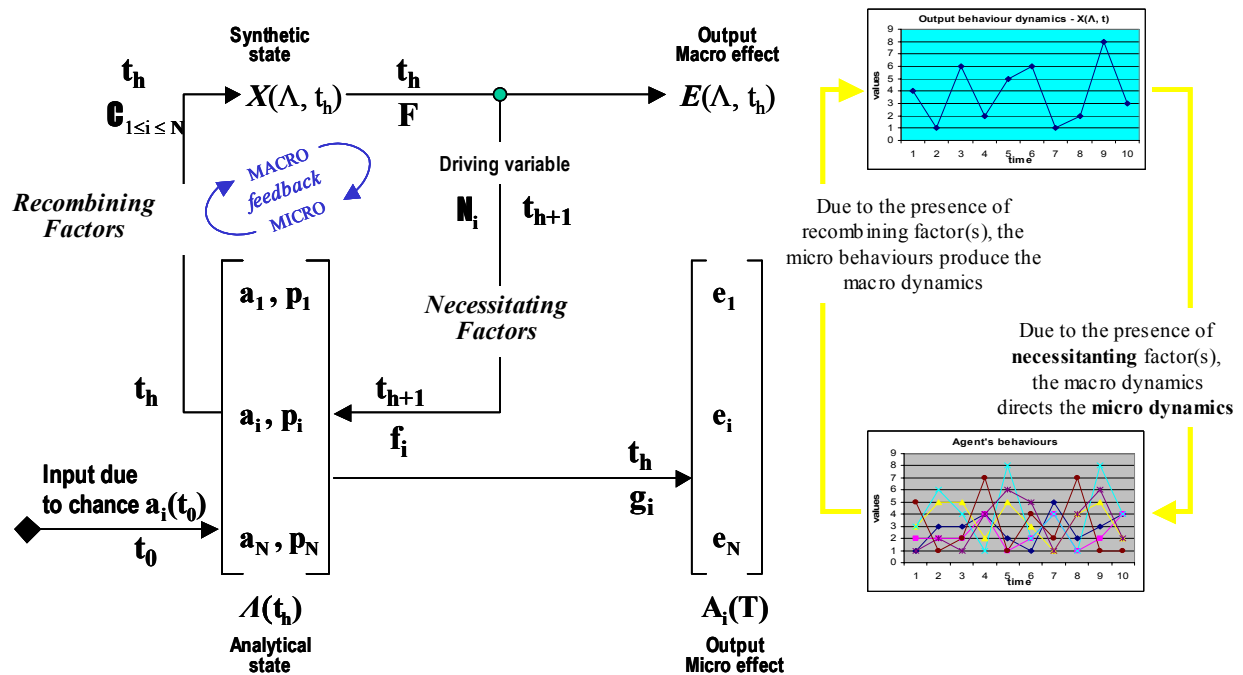


Fig. 1 – The micro macro feedback and the micro and macro behaviours

3 - Typology of combinatory systems

Combinatory systems can be ordered and classified into five classes according to the macro effect produced:

- 1 - systems of *ACCUMULATION*, whose macro behaviour leads to a macro effect which is perceived as the accumulation of objects, behaviours, or effects of some kind (figure 2);
- 2 - systems of *DIFFUSION*, whose macro effect is the diffusion of a trait or particularity, or of a "state", from a limited number to a higher number of agents of the system (figure 3);
- 3 - systems of *PURSUIT*, which produce a behaviour that consists in a gradual shifting of the system toward an objective, as if the system, as a single entity, were pursuing a goal or trying to move toward increasingly more advanced states;
- 4 - systems of *ORDER*, which produce a macro behaviour, or a macro effect, perceived as the attainment and maintenance of an ordered arrangement among the agents that form the system;
- 5 - systems of *IMPROVEMENT AND PROGRESS*, whose effect is to produce progress, understood as an improvement in the overall state of a collectivity.

The «accumulation» systems, can be described by the following heuristic model (figure 2):

MICRO RULE = NECESSITATING FACTOR: if you have to accumulate some object with others similar in nature (micro behaviour), look for already-made accumulations, since this gives you an advantage or reduces some disadvantage (necessitating factor);

MACRO RULE = RECOMBINING FACTOR: the environment preserves the accumulated objects or is not able to eliminate them, and maintains the advantages of the accumulation; everyone accumulates (macro behaviour) and an accumulation of some kind is created (macro effect);

MICRO-MACRO FEEDBACK: the larger the accumulation (macro effect) the more incentive there is to accumulate (micro behaviours) objects (micro effects); the collective accumulation (macro behaviour) leads to an ever greater accumulation.

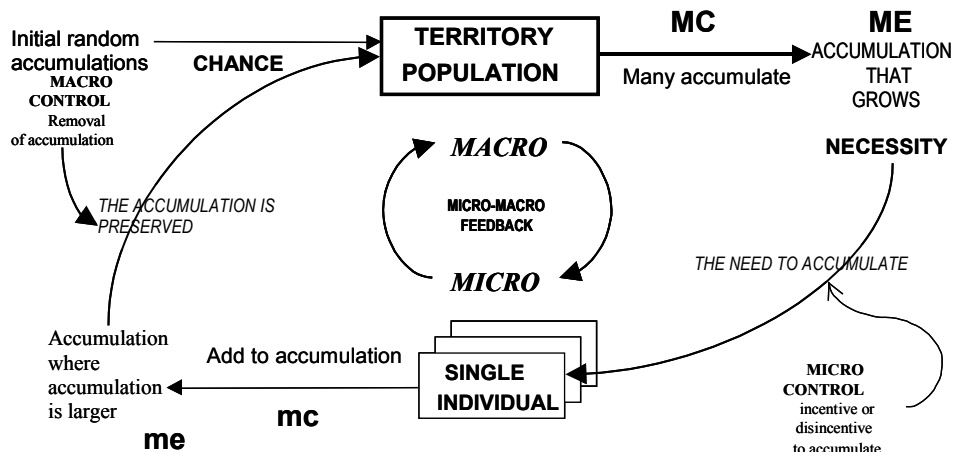


Fig. 2 – Model of accumulation systems

The heuristic system that describes *Systems «of diffusion»* contains the following rules (figure 3):

MICRO RULE = NECESSITATING FACTOR: if you see that an «object» is diffused then it is «useful» for you to possess it or harmful not to possess it (necessitating factor), and you must try to acquire it;

MACRO RULE = RECOMBINING FACTOR: the environment or the collectivity preserves the diffused objects and maintains the utility of possessing the «object»; the higher the utility or need to acquire the object for the individuals, the more the object will spread throughout the collectivity;

MICRO-MACRO FEEDBACK: a greater diffusion (macro effect) implies a greater desire to acquire the object (micro effect); the single acquisition (micro behaviour) widens the collective diffusion (macro behaviour).

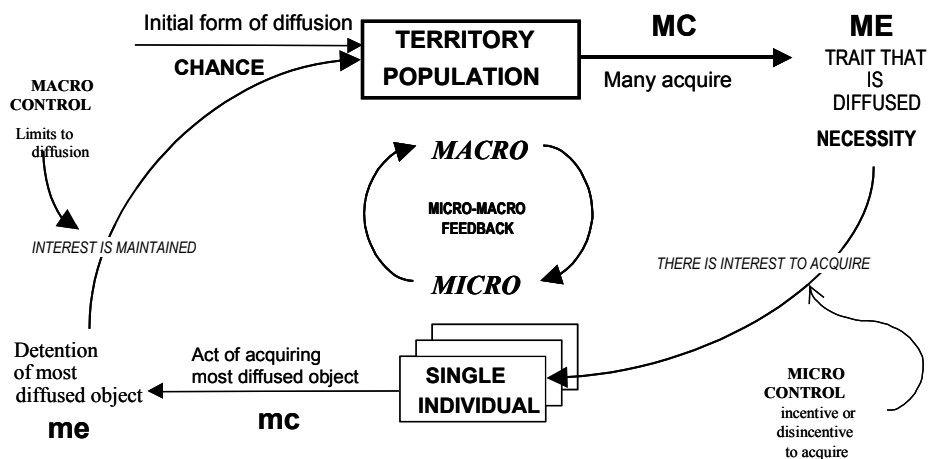


Fig. 3 – Model of diffusion systems

4 - The exogenous joint-location explained by Accumulation Systems

We define as *exogenous* the cluster deriving from the concentration in a given area of productive units which were previously located elsewhere (figure 4).

The *procedural explanation* of the phenomenon is perhaps the simplest, in that this phenomenon belongs to the typology of *combinatory systems of accumulation*.

When a given area can offer a *positive differential in economic terms* (tax reduction, infrastructures, facilities, aids and subsidies, etc.) with respect to other areas [necessitating factor], then the probability that a certain number of entrepreneurs will decide to locate in that area [micro behaviour] their productive or commercial units [micro effect] rapidly increases and the combinatory system can begin and produce the collective phenomenon of joint-location [macro behaviour], with the development of typical industrial and commercial clusters [macro effect].

If the joint location of an initial group of enterprises [chance] produces and maintains intrinsic economic advantages for the settlement [recombining factor], then the probability of new locations further rises, and this attracts new firms [necessity], which produces strengthening actions in the typical *micro-macro feedback*.

The system ceases when weakening actions intervene (for example, urban constraints, taxes, etc.) that reduce the economic convenience of the area.

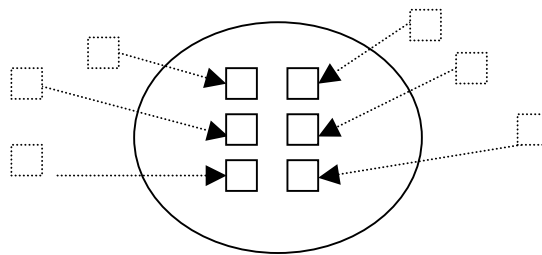


Fig. 4 – Exogenous joint-location

The heuristic model can assume the following form (figure 5):

MICRO RULE = NECESSITATING FACTOR: if you must locate a productive or commercial unit (micro behaviour), look for sites that offer positive economic differentials;

MACRO RULE = RECOMBINING FACTOR: the site maintains and increases economically-quantifiable advantages and favors the arrival of new enterprises; many locate there (macro behaviour) and an ever larger settlement is formed (macro effect);

MICRO-MACRO FEEDBACK = CHANCE AND NECESSITY: the more the area grows with enterprises (macro effect), the more advantage and incentive there is for new settlements (micro behaviours) of productive units (micro effects); first locations due to chance leads to increasingly larger settlements (macro behaviour).

In order to arrive at a *functional explanation* of the *modus operandi* of the system producing a cluster by *exogenous* joint-location, we must specify the following elements:

a. *Necessitating factors*: the convenience of *exogenous* joint-location always resides in *differences in economic advantages* with respect to the previous location, which entrepreneurs can perceive and quantify.

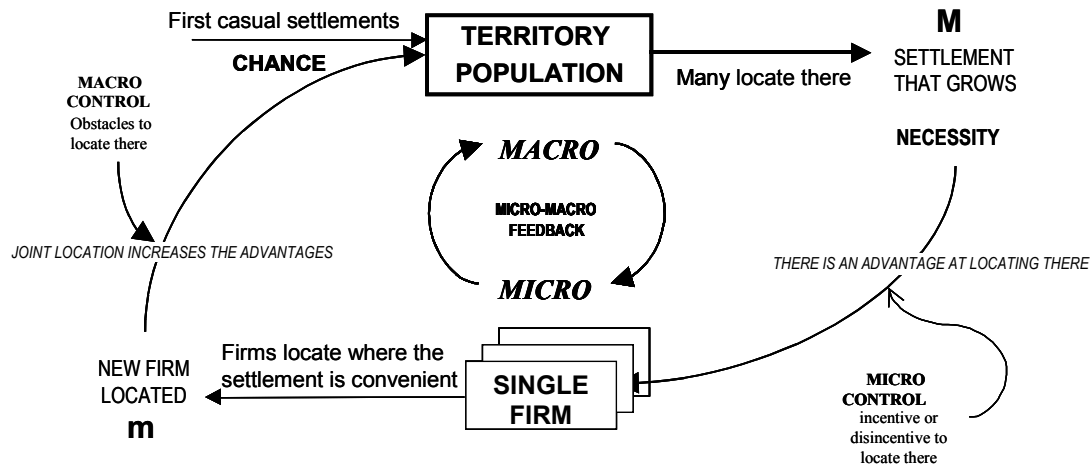


Fig. 5 – Model of the system of accumulation for exogenous joint-location

Following Marshall's view on districts (Marshall, 1891; Bellandi, 1982) and Williamson's transaction cost perspective (Williamson, 1985; Lazerson, 1988; Dyer, 1997) these economic differences can derive from *lower costs* and/or *higher revenue* and/or *knowledge exploitation* and *preservation*.

Cost savings come from *advantages of specialized processes* offered by the site, and can be connected to the presence of better production and logistical conditions; for example (Albu, 1997):

- presence of materials or the availability of work offers advantages in terms of quality/cost; the cluster is named as a resource area (Drejer et al., 1999);
- extensive functional division of labor between small and specialized firms as a source of external economies of scale and scope (Bellandi, 1996);
- a local labour market (Scott, 1992);
- ecological advantages (water, waste-disposal sites, etc.);
- presence of favorable logistical conditions (lines of communication, parking areas, the nearness of suppliers);
- tax and financial advantages (reduced tax burden, incentives, aids and subsidies to locating businesses in a given area, etc.) (Stöhr, 1990).

Revenue advantages are connected to market advantages, which are associated with the market "fertility" of the site; that is, the relative abundance of potential clients (especially for commercial areas). These advantages may also derive from prices and are connected with the quality of production or the efficiency of marketing processes.

Knowledge and learning advantages are connected to larger possibilities for information search and share aimed at the behavioural control and coordination of activities and processes, and at performance evaluation; other advantages also derive from the learning the best practices and from the ease with which innovations spread (Amin&Thrift, 1994; Asheim, 1996; Pilotti, 1998, 2000), following the cognitive approach which considers knowledge as a codifiable resource that can be managed by the individual or the firm and transferred from one individual or firm to another (Swan, Newell et al., 1999). Industrial clusters and industrial districts, in particular, become geographical examples of a *learning economy* (Lundvall & Johnson 1994). Thus in districts, "*Knowledge is the most important resource and learning the most important process*" (Lundvall, 1992) and districts can be viewed as learning regions (Asheim, 1996).

b. *Recombining factors*: due to the advantages of physical proximity of the firms in the area (Myrdal, 1957; Kaldor, 1970), which allow increasing returns in the economy of clusterized firms (Arthur, 1988); the cluster maintains the economic advantages and creates a critical mass of productive units that improves efficiency in productive, commercial and administrative practices and influences urban and territorial policies, with further improvements in economic differentials (Bellandi, 1996; Visconti, 1996); as an “invisible factor” a network of information relationships and internal commercial transactions erects barriers to entry in order to maintain the economic advantages for a maximum number of firms in the cluster; the greater the advantages the site presents and maintains, the larger will be the number of firms that seek to locate at that site by overcoming the barriers. This reinforces the advantages, generating the typical micro-macro feedback that produces path dependence (Moss, 1982; Niman, 1991; Lecoq, 1993; Belussi, 1999). When there are fewer recombining factors, then the necessitating factors are also less intense; when they are eliminated the macro behaviour ceases and the process of joint-location is interrupted; when they are negative the system shows signs of slackness (abandoning of productive units) or reversibility (processes of moving out and migration to other areas) (Dunford&Al, 1993; Harrison, 1994).

Clusters are not necessarily closed to the external environment; they can represent a system area presenting various forms of connections with other areas (Gandolfi, 1990; Garofoli, 1994).

c. *Genesis*: in general, exogenous joint-location arises as a spontaneous process, especially when the necessitating factors are in evidence, which are represented by revenue advantages (*shop rows, shopping centers*), or by cost advantages (joint-location in areas with low-cost labor) or logistical ones.

Chance moves the initial firms to locate jointly at a favorable site; the intervention of necessitating factors then pushes the system to get under way as soon as the minimum activation density (critical mass model) is reached, producing a typical path dependence (Shelling, 1978; Evans,; Antonelli, 1997; Wurster 1999).

d. *Strengthening and artificial genesis*: exogenous joint-location can be favored by certain exogenous strengthening actions that create the conditions for producing the economic differences.

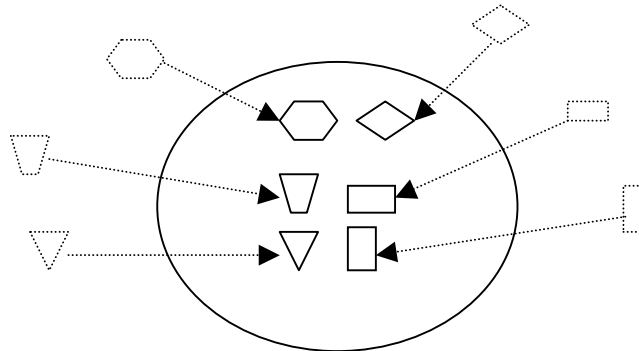
The possibility of artificial activation of clusters and, in particular, of districts, is controversial but in principle not impossible.

Particularly evident are *government policies* of incentives or constraints and actions directed at creating logistical infrastructures (highways, ports, equipped building lots, etc.) or research and educational centers (Nelson, 1993, 1995; Jaffe&Al., 1993; Stephan, 1996) and the specific recognition of cost advantages (lowering of labor costs, and tax and financial advantages).

Furthermore, policy makers might stimulate entrepreneurial activity in a local area by providing venture capital and preferential loan finance; by offering favorable tax incentives; by removing impediments to business start-up; and by providing management training and business advice (Reynolds et al. 2000). The policy of attracting inward *foreign direct investments* is another important economic development strategy of many city-regions (Gordon 1999).

Porter (1990), nevertheless, argues that government policy will be far more likely to succeed in reinforcing an existing or nascent industrial cluster rather than in trying to promote an entirely new one. Following Porter, the emergence of new clusters is produced by the systematic interrelationships between the following four factors: the nature of local demand conditions; the development and specialisation of factor conditions; the interactions with related and supporting industries; and the nature of cooperation and competition between firms within a cluster. Therefore, according to Porter, the role of government is to reinforce these determinants rather than to introduce them in a non-industrial area.

Fig. 6 – Exogenous conglomerate joint-location



5 - Different types of exogenous joint-location

The model of systems of accumulation explains different types of clusters of firms⁶:

- a) the *conglomerate* cluster, which arises from the transfer to a certain area of productive units (already existing elsewhere or newly created) which are usually different and not linked by inter-company trading relations (figure 6) (Storper, 1997; Porter 1998; Jonsson, 1999; Brusco, 1992); this process leads to the formation of industrial and commercial areas which we normally observe at the periphery of cities or along the main streets or near a tollboth⁷.
- b) the *spider-web*, or *constellation* cluster, which we observe when there are common facilities, or a common supplier (figure 7), or a common client (figure 8) (Lorenzoni, 1993). The location of shipping companies “near” a port or airport, or the location of production centers for iron material near a foundry that supplies the unfinished materials, or settlements near suppliers of component parts or energy are all examples of joint-location of the spider-web type in which the center is represented by the supplier. The settlements of productive units that supply components to a large car manufacturer in the same area in which the client has its main plants, or the collectors of iron materials near a foundry to which they supply the collected product, are examples of joint-location of the spider-web type in which the center is represented by the client.
- c) the *specialized joint-location*, or *districts*, which we can observe when the cluster is composed of productive units which all carry out similar activities or connected activities in the same business (Brusco, 1986). If the jointly-located firms are independent and there are no inter-company ties, we have the form of joint-location commonly known as *industrial zone* (Lorenzoni&Lazerson, 1999; Varaldo&Ferrucci, 1997).
- d) The *filière* clusters, which are composed of independent firms which carry on different phases of a single process, along the value-added chain, and are connected “up the line” and/or “down the line” with other firms in the same area (Brusco, 1982; 1992). Joint-location in a “filière” cluster can be explained:

⁶ There are various classifications of clusters (Albu, 1997). A first typology distinguishes between diversified cluster and subcontractor cluster. In the former firms have vertical specialization, while in the latter they are specified either in the horizontal way or in the vertical one and are linked to each other by contracts.

A second typology distinguishes between producer-driven clusters related to capital and technological intensive markets and buyer-driven clusters, related to labour intensive products.

⁷ For example in the Minneapolis cluster (Lawson and Lorenz, 1999) the most important factor that has contributed to the creation and development of the region was the role played by local universities.

- as the expansion of an initial nucleus of jointly-located firms of a conglomerate type, specialized according to process phase; in this case the original combinatory system of accumulation is structured and also becomes an organized system;
- as the repetition of various combinatory systems of accumulation for jointly-located firms which carry on the same process phase.

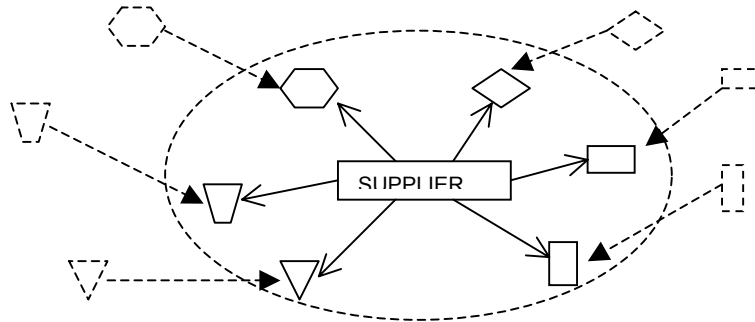


Fig. 7 – Conglomerate joint-location of the spider-web type, with the supplier at the center

- e) The *industry cluster* composed of a group of business enterprises and non-business organizations for which membership within the group is an important element of each member firm's individual competitiveness. Binding the cluster together are "buyer-supplier relationships, or common technologies, common buyers or distribution channels, or common labour pools (Bergman and Feser, 1999b).
- f) The *network cluster*, which can be observed as a network (figure 9) of firms closely linked by inter-company ties in terms of supplies, manufacturing, and process (Harrigan, 1985; Thorelli, 1986; Hakansson&Snehota, 1994, 1999; Jarillo, 1988); the network represents an organized system forming a single productive entity whose overall output - represented by the production volumes achieved by the terminal firms - depends on the activities of all the firms in the social network (Darrah, 1996).⁸; we can include many types of clusters, such as:
- *technological systems*, that is a network or networks of agents interacting in a specific technology area under a particular institutional infrastructure to generate, diffuse and utilize technology; these networks are defined in terms of knowledge or competence flows rather than flows of ordinary goods and services (Carlsson and Jacobsson, 1997);
 - *competence blocs* that represent networks of firms in which there are a number of different competences that together help to develop and commercialise a special product.

6 - Endogenous joint-location explained by Diffusion Systems

The formation of industrial, commercial and professional areas can be the result of a process endogenous to the area itself: the presence of firms creates competencies, stimulates risk acceptance and the entrepreneurial will to create new enterprises in the same area (figure 10), although many authors have doubts about these possibilities (Murray, 1987; Amin, 1993; Staber&Sharma, 1994).

⁸ The concept of a network of firms, as a unitary productive unit, is a general one and doesn't depend on joint-location; the networks can also have a spider-web form when the inter-company ties are between firm and supplier (network with a tail) or between firm and client (network with a head).

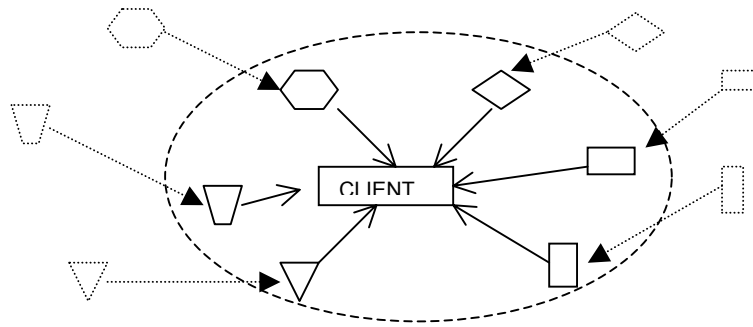


Fig. 8 – Conglomerate joint-location of the spider-web type, with the client at the center

A convenient system-procedural explanation is offered by the logic of *Diffusion Systems*.

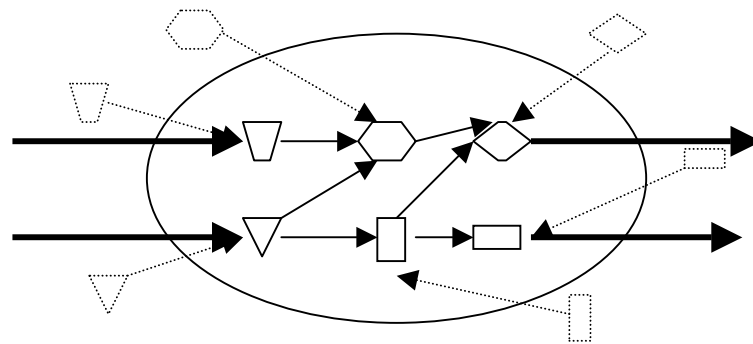


Fig. 9 – Network joint-location

When *by chance* successful firms locate in an area and are able to internally develop their personnel (employees, managers, professionals), it can happen that *by chance* some of the personnel, after having acquired the necessary competencies, decide to undertake an activity [micro behaviour] to take advantage of their acquired capacities for personal profit. New enterprises are born [micro effect]. If they are successful in their new business activities, then the combinatory system can get under way, and more firms will locate in the area [macro effect] through endogenous growth (Del Monte, 1988; Rabellotti, 1997).

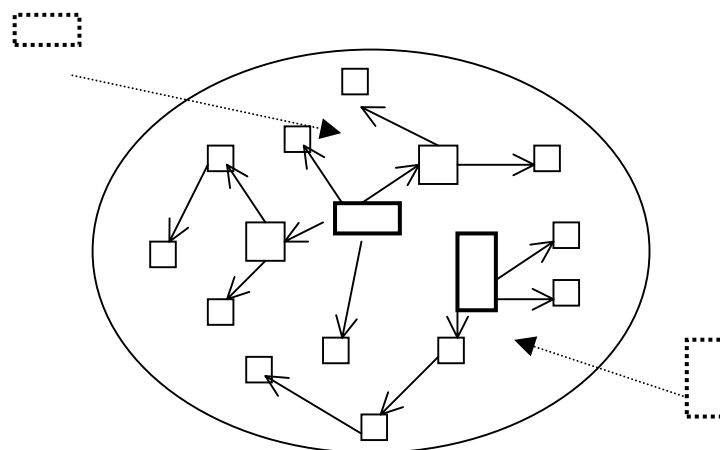


Fig. 10 – Endogenous joint-location

This represents an incentive for other workers, with similar capacities, to take a personal risk by starting new enterprises. The process spreads [macro behaviour] and the group of workers is gradually transformed into a collectivity of entrepreneurs (Antonelli, 1996). The firms become increasingly more numerous [macro effect], and this arises the probability for individuals to start new enterprises [micro behaviour], in a typical *micro-macro feedback* that characterizes systems of diffusion. An area of workers gradually becomes an area of entrepreneurs that soon will have to import subordinate workers from other areas.

The heuristic model of the combinatory system is based on the following rules (figure 11):

MICRO RULE = NECESSITATING FACTOR: if you see that many are successful in an entrepreneurial activity, and you too want to become richer and not be left behind (necessitating factor), by putting your abilities to use, then you must try to “go it on your own” by setting up “your” own enterprise;

MACRO RULE = RECOMBINING FACTOR: the environment and the collectivity have high regard for those persons who become rich by taking risks in a business activity (recombining factor); the firms are considered to be useful and the entrepreneurs successful people; many families hope their children can sooner or later open up a business; exclusive clubs for entrepreneurs are formed; personal wealth and the growth of the enterprise are variables of social success (recombining factor); the need to become an entrepreneur in order to be successful and wealthy spreads throughout the collectivity;

MICRO-MACRO FEEDBACK = CHANCE AND NECESSITY: the higher the number of successful enterprises in an area (macro effect), the more widespread the entrepreneurial desire (micro effect); the creation of a new enterprise (micro behaviour) increases the collective diffusion of the entrepreneurial activity (macro behaviour) and increases even more the density of enterprises in the observed area (macro effect).

In order to have a full understanding of the *functional explanation* we need to specify the following elements:

a) *Necessitating factor*: an enterprise is born when someone decides to risk his own capital and work in an independent activity. According to the institutionalist view (Granovetter, 1985; Camagni, 1991) the combinatory system for exogenous entrepreneurial development is set under way only if within the collectivity living in a certain area there is a spread of the entrepreneurial vision (mentality, logic, attitude, etc.), a sort of cultural isomorphism (Powell, 1990) which is the logic of investment, and thus of risking on one’s own (Kristensen, 1994; Vaccà, 1997; Becattini, 2000); this mentality is based on three *necessitating factors*:

- the entrepreneurial activity offers a high probability of success, thus of profit and personal prestige as a reward for the risk of the investment;
- the entrepreneurial activity is held to be socially useful and offers adequate forms of social recognition; this favours the formation of a social identity: the entrepreneurs feel part of a community, “*defined as a state of mind...a place based on faith in certain assumptions and values...*” (Darrah, 1996);
- the entrepreneurial activity concerns production for which it is easy to acquire the necessary skills, and there is the awareness of being able to put the acquired skills to good use.

There is no need for there to be particular economic advantages in the area which create differences in economic possibilities; the economic advantages are considered to be the result of ability rather than the consequence of location advantages.

b) *Recombining factors*: when a *critical activation mass* is reached, the endogenous joint-location system is set under way, but only under the condition that the system can recombine the micro behaviours, within an *innovative milieu* which conserves and accentuates the entrepreneurial mentality (Camagni, 1991; Maillat, 1998; Aydalot, 1986) and make possible the selection of the

best routines and procedures (Nelson&Winter,1982; Nonaka, 1994), “by imitating observed behavior of one or more “masters”, in a community of practice” (Nooteboom, 1999).

The cluster and the area create or maintain externalities concerning *knowledge spillover* between firms in this area (Jacobs,1969; Glaeser and al., 1992; Henderson&Al.,1995), following the social-constructive approach (Nightingale,1998) by which “A consequence of the embodied nature of knowledge is a return to the social.” In other words, knowledge creation takes place in a social context of firms; the cluster environment is the place in which entrepreneurs can create knowledge.

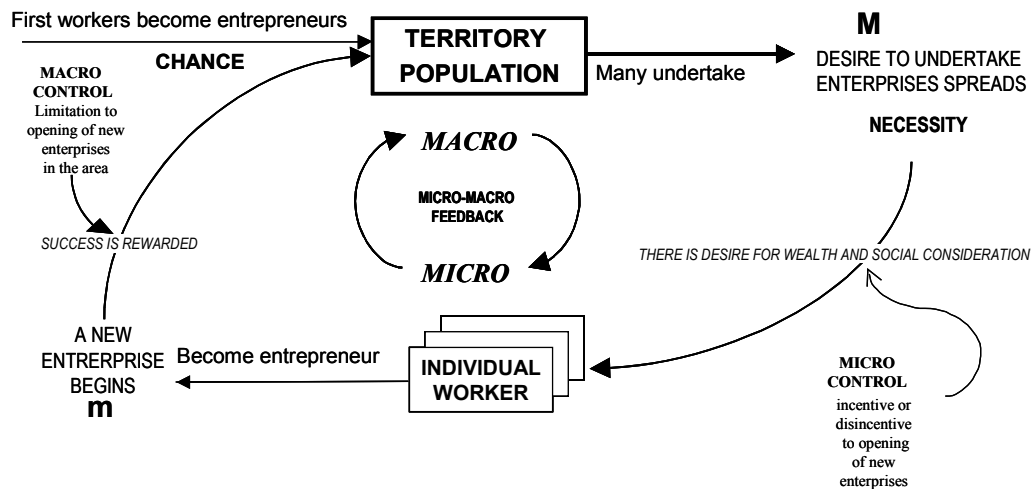


Fig. 11 – Model of a system of diffusion for endogenous joint-location

There are several fundamental recombining factors:

- 1) the system is composed of successful enterprises; the collective success spreads the *faith* in individual success and provides incentives to the taking of personal risk (Fukuyama, 1995; Uzzi, 1997); the cluster produces and reinforces networks of cooperation and trust and maintains a climate of social dialogue, with institutions which materialize those human meanings and intentions (Feldman and Francis, 2001);
- 2) the entrepreneurial activity is able to transmit competencies to all personnel (in production, finance, and marketing); the system must be composed of enterprises that use transmissible competencies (Lawson, 1999); this favors apprenticeships, learning, specialization, and thus the awareness of the acquisition of the necessary know-how for starting up an independent entrepreneurial activity that is similar or complementary to that which has provided the acquired skills and capacities (Garnsey, 1998; Florida, 2000);
- 3) the enterprises in the system carry on business activities on a reduced scale or, in any case, through activities divided up into discrete operations, which can be carried out in productive units even of a modest size; this provides faith in the possibility of putting the acquired competencies to good use (Staber, 1998);
- 4) the system must be able to sustain the new activities with adequate capital flows; in particular, it must supply equity (Aoki,1988, 1990) and financial capitals to allow the new firms to take advantage of the financial leverage effect (Dosi, 1990; Christensen, 1992);
- 5) the cluster generates some form of *governance*; internal and external stakeholders sustain the clustering processes, operate in order to maintain cluster advantages (Alberti, 2001) and create and maintain an *industrial atmosphere* (Castillo, 1994);

- 6) the cluster produces and reinforces a climate of social dialogue, with institutions which materialize those human meanings and intentions, (Polanyi, 1992, p. 251), as well as reinforce them;
- 7) in a climate of social dialogue, with institutions which materialize those human meanings and intentions, (Polanyi, 1992, p. 251).

If the enterprises are successful and the Return on Equity is adequate, then the capital is available for new investments; the propensity to undertake entrepreneurial activities sustains the propensity to form companies for the raising and investment of equity (Dei Ottati, 1994).

When the recombining factors weaken, even the necessitating ones lose their intensity; when they are eliminated the macro behaviour ceases (the settlements that already exist remain, but the process leading to the genesis of new enterprises is interrupted); when they become negative the system begins to break down (closing of enterprises) or to reverse itself (liquidation and trasferrance of capital to enterprises in other areas).

c. *Genesis*: while *exogenous* joint-location is based on differences in economic advantages that firms in the area can benefit from, *endogenous* location is based on the transmission of competencies, of faith, of rewards for risk (Nonaka, 1994).

The genesis of the combinatory systems for the diffusion of entrepreneurial activity usually requires a *chance* event (Porter and Sölvell 1998), but once the system is under way the necessitating and recombining factors make it particularly resistant. As with any cultural change, the culture of the firm, of risk, of investment is difficult to create but, once created, it is difficult to eliminate. When a class of entrepreneurs has been formed at a certain site, and the system of enterprises rewards the new business initiatives, the site is maintained and grows through endogenous genesis.

Chance can act in several ways to generate the systems of diffusion in the *entrepreneurial culture*:

- there can be an initial exogenous, chance location of firms that use local manpower, which they train by transmitting competencies; if the firms that jointly-locate through exogenous processes have the necessary recombining characteristics, then, again by chance, the first enterprises can form by means of endogenous processes;
- a firm that is already located in an area needs other forms of production to integrate its own processes both “up the line” as well as “down the line”; rather than import enterprises from outside the area, an initial spider-web of firms is endogenously formed; this sets off the system that widens the web;
- a fountain of fertility is discovered that is exploited either by firms exogenously located in the area or by those that have come about “by chance” from within; if the fertility guarantees a premium for risk, then the culture of the enterprise spreads and, when the critical mass is reached, the system is set under way.

c. *Strengthening and artificial genesis*: the combinatory system of endogenous joint-location can be favored by particular strengthening measures, among which:

- the activation of professional schools that guarantee an initial employment in a certain career;
- the availability of risk and loan capital;
- the incentive to form new enterprises through facilitating measures (e.g., young entrepreneurs);
- the creation of forms of protection against unsuccessful activity;
- the incentive for the exogenous joint-location of small enterprises;
- the creation of places for exchanging knowledge; the idea is to look at the cluster as a “ba”, “as a shared place for emerging relationships” (Nonaka and Konno, 1998). In this sense the success of the

cluster form could be found in the fact that it could represent a natural form of “ba”.

The exogenous creation (or that by public authorities) of enterprises with the appropriate features (small-scale businesses, the need for small-scale collateral production, professional training) can artificially set off the system, on the condition that the *critical mass* of new enterprises arising *in loco* is reached, so that the necessitating and recombining factors emerge which can assure the occurrence of micro-macro feedback (Freeman, 1987; Dosi, 1988)

7 - Different types of endogenous joint-location

The model of systems of diffusion helps us to improve and supplement our understanding of the joint-location of firms in the same area.

In fact, all the forms of joint-location we have considered in the exogenous processes are also present in those characterized by endogenous formation.

In addition to an exogenous joint-location, conglomerate joint-location can be explained as the result of the endogenous impetus to economic undertakings. Every enterprise can require the presence of a supplier of materials, components, or services (figure 12); if the culture of risk is rewarded, then firms can be created which produce the necessary supplies for firms that already exist. We then get a conglomerate productive settlement of firms that operate in a single business, or in a “*filière*” or in a Value chain or supply chain.

As an example we can consider the wealth and variety of productive settlements in areas where there is a large car manufacturer that relies on outside firms for components and certain production activities.

Endogenous genesis favors the creation of spider-webs with a head or a tail (figure 13).

The process of integrating the activities of enterprises with those of others that have formed in the same area can be structured and specialized, leading to the formation of networks of enterprises linked by exclusive or prevalent supply relations (Powell, 1990).

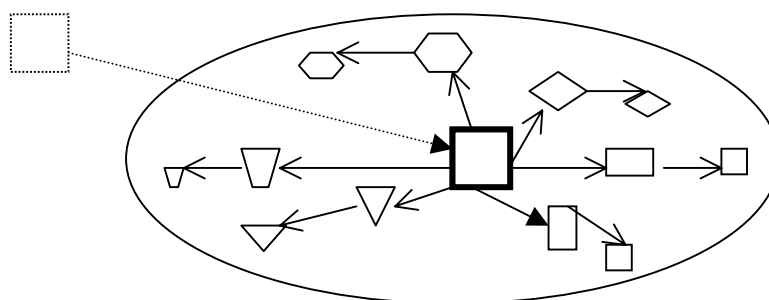


Fig. 12 – Conglomerate endogenous joint-location

The systems of diffusion offer a better explanation than systems of accumulation for the processes of *specialized joint-location* for the endogenous formation of new enterprises, all of which are engaged in similar or complementary activities. In particular, they explain the birth of simple *industrial zones*, or “*filière*”, or *districts*.

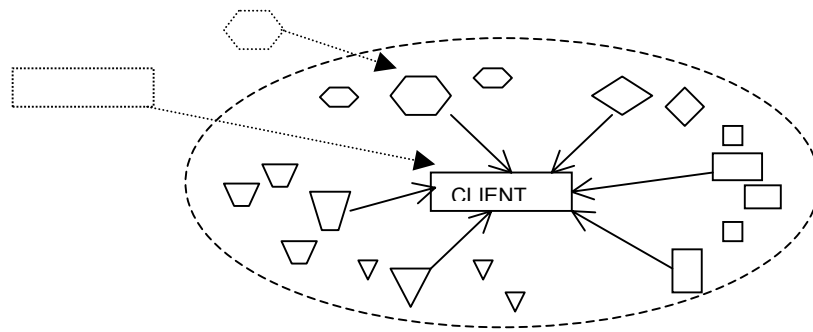


Fig. 13 –Conglomerate endogenous joint-location in the form of a spider-web with head

The formation of *industrial zones* mainly composed of single-business enterprises can be considered a form of *horizontal diffusion*; enterprises of a certain type generate others of the same type and this encourages cooperation, innovation and assistance (Lundvall, 1993).

The "filière" zones are a form of *vertical diffusion*; enterprises of a certain type generate others that complete the processes both "up the line" and "down the line".

The structure of the enterprises created through vertical diffusion can go as far as the formation of networks or spider-web patterns of enterprises.

In particular, joint-location in *industrial zones*, *city-regions*, *technopolis* (Preer 1992) and *districts* can be explained

- a) as the expansion of an initial nucleus of jointly-located enterprises that carry out similar activities which are not complex and can be broken up into sub-activities. These enterprises transmit their competencies and emulative spirit to their employees, who become entrepreneurs in the same business for which they have acquired the capacities and skills and for which new firms are more likely to cooperate even though this means a loss in their autonomy (Uzzi, 1996). In Italy we can observe many significant examples. The goldsmith in Vicenza gives rise to other goldsmiths in Vicenza; the jeweller in Valenza generates other jewellers in Valenza (some of whom move to Mede, where the same system of diffusion exists); the button manufacturer in Piacenza creates other button manufacturers in the same area; the blown-glass artisan in Murano generates other blown-glass artisans in Murano;
- b) as the break-up of a large enterprise (even because of succession) that is engaged in a business which is split up into distinct operations, or as the contracting out of phases or parts of phases of the business activity (subcontracting or contracting out supplies); in the first case the need to survive leads the employees to undertake an entrepreneurial activity in order not to waste the acquired competencies; if the number of enterprises created through the break-up is large enough, then the system of diffusion can get under way; in the latter case the genesis of the enterprises is led by the main factor until the system can sustain itself autonomously;
- c) as the development of a system of accumulation of enterprises that then is transformed into a system of diffusion, as occurs in areas where firms were originally attracted from the outside because of the presence of raw materials that were then processed. When the raw materials are gone, there remains the enterprises of transformation, which perhaps enter into another line of activity. The diffusion of the entrepreneurial spirit makes the joint-location areas stable, even when the object of their activity has changed.

8 - Conclusion

Although many authors have doubts about the possibility of clusters and districts to revitalize stagnant economies (Antonelli&Al., 1989; Amin&Robins, 1990; Amin, 1993), the process of joint-location is important for local employment and welfare. There is no growth in employment without a growth in entrepreneurial activity (Amin&Thrift, 1994).

The joint-location of enterprises in a circumscribed area can be explained, when it is not completely a casual development, as the macro effect of a combinatory system.

We can arrive at some immediate conclusions regarding exogenous joint-location:

- entrepreneurs who have made a careful economic calculation and whose production is not exclusively local set off migratory processes toward areas that offer better economic conditions (especially concerning the cost of labor and capital, and logistical infrastructures);
- exogenous joint-location is thus based mainly on the perception by entrepreneurs, who are already located elsewhere, of possible economic differences in a given area (Busch and Reinhartdt, 1998);
- it is thus necessary to favor business settlement through economic incentives which can be easily perceived and enjoyed (Rosenfeld, 1997);
- when the economic differences no longer exist, we have the reverse process of moving away; to avoid this the economic advantages must be maintained within the area;
- to provide incentives to the exogenous joint-location process it is necessary: to provide the area with infrastructures that provide clear logistical advantages; to offer subsidies for settling in the area; to make available factors of production at relatively low cost. These economic benefits can be accompanied by tax advantages.

We can come to the following conclusions regarding endogenous joint-location:

- the formation of an enterprise always requires an investment of capital and labor, and know-how in production and/or distribution;
- endogenous joint-location arises in an area when it is possible to train people in the necessary skills and there is a climate that rewards the entrepreneur who is successful;
- it is equally necessary to have a climate of faith in the possibilities of investment and in the realization of the economic results that this entails;
- in order to begin the endogenous joint-location process the presence of productive units managed with public capital could be useful, but on the condition that these units are involved in activities which are split up into discrete operations, and thus can be managed by new enterprises; or that they require the integration of processes “up the line” and “down the line” which can be managed by new enterprises and, above all, can generate the necessary know-how;
- cathedrals in the desert have never favored the creation of local entrepreneurs, precisely because they have not set in motion any combinatory system due to the lack of the requirements we have mentioned above.

A final concluding observation: the two forms for the development of enterprises in a given area are not mutually exclusive; in fact, they are usually complementary:

- a) an initial exogenous settlement can start up the system of diffusion that leads to endogenous joint-location;
- b) the endogenous formation of entrepreneurs, which occurs *by chance*, not only is able to set under way the process of endogenous joint-location, but, if the local public authorities provide

the appropriate incentives, can also set under way the system of accumulation of enterprises, which leads to the migration *in loco* of other productive units.

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