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How to save clusters from dying[1]

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Abstract

The aim of this paper is to contribute to the discussion on clusters competitiveness and paths dependence. Italian clusters offer a recognized example of territorial production model. However, recent studies in the field showed that it is passing trough a crisis. Several enterprises are delocalizing their manufacture abroad loosing the shared knowledge that characterizes the cluster culture.
The paper is part of the area of studies that analyses *cluster dynamics* (Krackhardt, 1994; Ahuja, 2000; Hansen, 2002; Zaho & Aram, 1995; Nooteboom, 1992, 2004; Gulati and Gargiulo, 1999) and explores the inter-organisational relationship in a cluster situated in the Campania region and concentrated, in particular, in the urban area of Naples. This is the first part of a study that aims to analyse the evolution of a traditional industry cluster operating in a moment of maturity/crisis, analysing the impact of possible actions on the part of a leading organization or guide (Lorenzoni, 1992) and an institutional actor (Antonelli, 2005).
The focus of the empirical analysis are the companies in the railway industry, which have many elements of homogeneity: geographical and socio-cultural nearness, size, geographical trade market and end clients. The cluster has two central actors: an institution (the Campania Region, in the combined work of three assessorates) and a company (*Alfa*) linked to other companies in the cluster as their main final client.
In the first stage we analysed the strategic motivations that stimulate these actors to intervene and support processes of increasing the level of inter-organisational collaboration between the companies in the cluster. The first stage of the analysis that we present below is based upon structural indicators peculiar of the network analysis methodology. These first results over a short period allow us to

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highlight several limits of an aseptic analysis of the main structural indicators of a network. However, the qualitative analysis is a useful complement to understanding the strategic behaviour of actors that operate in a very cohesive cluster, conditioning the evolution of the life cycles of the cluster and inter-organisational relationships between its actors.
The conclusion of the first part of the paper enlightens those limits. We then try to go over them by using computer simulations and we speculate on the role that a meta-organisation has to save the cluster from dying in the long run. In the last part of this work we pose the argument upon which to construct the simulation model we will test in a further research.

1. Research questions

Within the largest category of networks and on the trail of the definitions of the concept of an industrial district (Marshall, 1920; Becattini, 1979 and Scott, 1998), Porter (1998) defined clusters as a network with a clear geographical context. More recently, Cooke ed Huggins (2003) have shown that in clusters there are relationships of competition and collaboration between the different actors, characterised by a shared vision of common objectives. In this way a cluster is a system with a high concentration of businesses and institutions that are strongly interrelated and, consequently, tend to be homogenous under a socio-institutional profile, with complex knowledge and information that can flow far more efficiently between businesses than under normal market conditions (Nohria, 1992; Saxenian, 1994; De Carolis and Deeds, 1999).
Many authors have studied Industrial Districts using a sociological approach. It stress on the geographical proximity between firms that are embedded in a specific network (Porter,1998) as a condition to guarantee cultural similarities, durable forms of interaction, interdependence among close actors and shared information (Cooke ed Huggins, 2003; Nohria, 1992; De Carolis and Deeds, 1999). Firms are embedded in their economic space (Granovetter, 1985; Lorenzoni e Lipparini 1999; Ahuja, 2000; Nooteboom, 2004) and create high levels of social capital in the network with their co-localized partners (Saxenian, 1994).
Various research on clusters has underlined the effects on the local system of the behaviour of some actors, the leading or guide companies – those companies on which the initial process of structuring the local production system and developing the network is based (Lomi and Lorenzoni, 1992; Lorenzoni and Baden-Fuller, 1995; Boari, 2001) and that exercise their influence through coordinating systems based on a hierarchy (Boari e Lipparini, 1999). This role of coordinating the network has also been recognised for another type of public or institutional actor (meta-organization) mainly in the phase of the building and birth of new clusters. These are actors who are able to become promoters, creators and sustainers of links in the network between the principal nodes of the local production system (Rulllani, 1999; Consiglio and Antonelli, 2003; Pollock et al. 2004) and can act as a social broker (Antonelli, 2004). It plays a focal role in managing connections and communication channels between different nodes and in being responsible of several activities for the cluster itself.
The first aim of the paper is to study if the introduction of an institutional actor, a meta-organiser, can change the cluster's dynamics and if it is the case, how it works.

These studies are mainly based on the perspective of embeddedness, according to which the success of single actors in the network is directly correlated to the position that each one holds in the network of social relationships (Granovetter, 1985; Saxenian, 1994; Uzzi, 1997; Lorenzoni e Lipparini 1999; Ahuja, 2000; Powell, Koput and Smith-Doerr, 1996; Walzer, Kogut and Shan, 1997).
Many authors have studied power by analysing the structural characteristics of networks and, in particular, the level of centrality (Cook and Emerson, 1978; Bonacich, 1987 and Burt, 1992). The fact

of having a high level of centrality allows the actor to have access to more resources and to exercise power on other nodes, also thanks to the possibility of controlling exchanges of information and resources.
As a consequence, the leading company that has a central position makes the most of its "structural embedding" (Nooteboom, 2004; Uzzi, 1997; Zukin e Di Maggio, 1990) to control the cluster and also support processes of innovations and investment undertaken amongst the other actors.
From the interpretation of the inter-organisational relationships derived from the intervention of an institutional actor, the first point that emerges is related to changes in the level of power of the leading business (Alfa). The entrance to the cluster of a meta-organization (Busi), has meant redefining the inter-organisational relationships between actors that alters the structural indicators of the network.
The second aim of the paper is to show that, on the contrary to what is stated in literature, the indicators of structure are not alone able to explain the variations in some competitive balance. In particular, if the indicator of centrality disappears in the guiding businesses there is no automatic corresponding loss of power. Interviews with the general managers of Alfa show the existing of a deliberate strategy in supporting the Busi creation.
According to the crisis in the cluster, the future could be characterized by two different scenarios with the some results: the district will disappeared. The feasible hypothesis are: the finished goods firms Alfa e Beta decline and, subsequently, the suppliers population declines due to a strong symbiotic interdependence, or, other ways, the suppliers loose competitiveness afterward Alfa e Beta, in a first time, turn towards suppliers out of the cluster, but in the long run will loose competitiveness themselves loosing all distinct advantage of being embedded in the cluster. The third aim of the paper is to analyze how can computer simulations can help us in supporting this hypothesis.

2. The cluster analysed[2]

The specific empirical setting that we analyze is the rail industry district of Campania region in Italy. The railway industry cluster is an important productive reality in the Campania region. This is both in terms of occupation generated and induced, for the ability to export finished products with the made in Campania mark, and also because it supports two large international players present in this region. It is made up of 68 firms that operate in the railway industry, with just under 4000 employees3.
The railway industry is mainly characterised by:

- companies that produce rolling stock (trains, wagons, carriages, etc.);
- companies that produce systems for signalling and control of railway circulation (on board trains and on the tracks);
- companies that maintain, repair and *revamp* rolling stock.

The cluster analyzed is made up of:

- a global *player* amongst main international competitors, *Alfa*, which integrates systems and produces finished products for rolling stock (and the actor to which the research questions are referred);
- an international player, *Beta*, which has the role of producing complete products for rolling stock and supplies maintenance and repair services;

[2] For more information see: The Cesit research report, *Le capacità e le competenze dell'industria ferrotranviaria nella provincia di Napoli*, Edizioni Scientifiche, Naples, 2005.
[3] In order to determine the boarders of the study, companies have been included whose average turnover in the three year period from 2001-2003 included at least 10% generated from railway production or who had a railway turnover of at least 250,000 euro in the same period.

- small and medium size companies (in terms of employees and turnover) which produce sub-systems, components and parts for the rolling stock sector (mainly) and for communication and signalling systems.
- small and medium size companies (in terms of employees and turnover), that carry out part of the work on the production process for the production companies.
- small and medium size firms (in terms of employees and turnover), that supply spare parts for production and transport companies (end clients).
- companies involved in the maintenance, repair and revamping of rolling stock.

Without considering the two largest *players*, the companies in the cluster have the following characteristics:

- an average number of 40 employees.
- the level of specialisation in the sector (measured by the relationship between the turnover in the railway industry and turnover as a whole) is nearly 50%;
- the average turnover per employee is around 101,000 euro (2003).

In the analyzed sector, although there are many industrial companies, there is noticeable organisational isomorphism in the structural and relational mechanisms used by these companies. This strategic and organisational "similarity" is certainly due to a series of elements:

- the size of the companies, which are mainly small;
- the institutional overlapping of ownership and management in almost all cases;
- the type of technology and production used;
- their presence in the same area undertaking the same district meanings that characterise the cluster;
- the final demand characteristics (an high concentration and a few large clients that are the same for everybody).

There are different types of relationships between actors in the system within the industrial railway sector.
These relationships can be:

- contractual relationships of supply (sub-suppliers – suppliers – railway transport company)
- contractual relationships of collaboration and not of supply (mainly in the form of consortiums)
- collaborations with temporary contractual relations to take part in tenders for supply (ATI)
- inter-organisational group relationships or ownership links
- relationships of social networks of friends, acquaintances and relatives[4].

In the clusters analysed almost all of these kinds of relationships are present, even if with large differences of intensity, solidity and continuity over time.
As proof of the importance of these inter-organisational relations, it is interesting to highlight the fact that almost all the companies (around 90%) believes it is fundamental to create relationships of collaboration and partnership. In particular, a very high score (5.1 on a scale of 1 to 6)[5] is given to the importance of creating relationships of collaboration with other companies in the industrial production chain. In more detail, importance is also given to relationships with suppliers (5.6) and with clients (5.6) while a significant degree of importance is also given to links with universities and research centres in the territory (4.5).

[4] Even though these social relationships have been investigated, they are not included in this paper.
[5] Data collected are the result of interviews and questionnaires given out (see *infra* for further details).

An analysis of networking within a cluster cannot leave out an analysis of the inter-organisational relations of the international leader *Alfa* and the other large group *Beta*.
Both *Alfa* and *Beta* are two important actors in the cluster, but *Alfa* is of more central and strategic importance. *Beta* (which produces finished products for end clients and has around 1200 employees in Italy) is, as well as being *Alfa*'s important strategic part and absorbing supplies of around 37% for the companies in the group is also an important supplier for *Alfa*. However, the focal organisation is represented by *Alfa*, which plays this leading role mainly in an indirect manner, through acquisitions of orders in sub-supply.
This type of relationship is characterised by a large degree of stability over time (many relationships of sub-supply have existed for several years) and, above all, in many cases, to demonstrate the importance of this relationship, *Alfa* is the only client. Furthermore, due to the special production and technology of the final product, the supply relationship is often accompanied by *Alfa*'s constant presence for the technical management of orders.
Alfa's purchasing policy involves 87% of the companies in the sector and almost all those in the area of mechanical and electrical/electronic components. In particular, the purchase of work (e.g. building boxes for locomotives, structures and carts, electrical and electronic apparatus, work in heavy and light alloys (e.g. doors, air-conditioning systems, seats, converters and décor).
The only cases of more structured inter-organisational relationships with other companies analysed are a consortium created with *ABU* and a temporary business association stipulated with *ABB*, aimed at acquiring new orders.
Many inter-organisational relations involve companies in the cluster working independently of *Alfa*.
The most interesting form of networking in the sector is definitely the sub-compartment of repairs that involves the two consortia. The consortium that involves three companies in the rolling stock sector has similar aims and covers the segments of carpentry and repairs.
There are also many temporary associations to be found in the cluster, which involve around 30% of the businesses. Naturally, the level of stability in this relationship is far less marked and strongly linked to the opportunity to take part in tender bids, which are from time to time received by the respective participants. This is, however, an important channel of transmission for the exchange of skills and experience and, in general terms, is a mechanism of balance inside the system.

3. The institutional regulation project

The Campania Region, with the involvement of *Alfa* (and the support of *Beta*), has created a strategic development programme with the following aims:

- to safeguard levels of employment and generate new employment in a sector that is going through a period of crisis
- to increase the level of competitiveness of companies in the cluster (increasing the capacity for innovation and for extra-regional export).

Methods of implementation identified in order to achieve these aims are:

- increasing the level of networking in the cluster through creating specialised consortia for technology and a production sub-compartment (mechanical, electronic, repair and maintenance work)
- setting up a coordinating structure known as a *business integrator* (*Busi*);
- implementing a finance programme for innovation, increasing the size of plants and creating new ones.

The *business integrator* plays a central role and coordinates financing initiatives, supplies technical and business skills to the consortium companies, supports the processes of raising the level of innovation and organises coordinating orders acquired by the consortium among the companies taking part. Its activities in greater detail are as follows:

- supporting business activity related to large industrial clients;
- selecting and segmenting consortium partners on the basis of individual technical competencies (in design and production) and cost;
- developing stable relationships between the SMF and the main companies producing rolling stock in the region and in Italy as a whole;
- transferring knowledge and skills related to the *Life Cycle* of vehicles from the companies that produce them to those that maintain them;
- developing technical skills related to maintenance activity and *revamping* of complex and innovative vehicles (locomotives, electric trains and vehicles for local transport);
- developing the managerial skills necessary to manage *performance based* contracts that include both supply and maintenance of vehicles;
- developing the financial skills related to managing contractual structures characterised by the use of innovative forms of financing for rolling stock (*leasing*, *project leasing* etc.).
- supporting the re-engineering of processes;
- managing intellectual property;
- managing technical and business contracts;
- supplying support instruments for the relationship system and for communication between partners;
- stimulating the creation of new consortiums to "guide" and help the others.

4. Methods

In order to analyse the effective importance of structural indicators in the network, two different types of methods have been used whose results are compared to support our argument.
The first is based on the use of typical *network analysis* aimed at briefly describing the characteristics of the cluster, through creating indicators of structure.
The second uses qualitative instruments in order to identify strategic behaviour and the motivations of the action of the two actors (the Campania region and *Alfa*). Both methods have been applied twice - before and after the intervention of the institutional actor - in order to obtain data for important, even if brief, periods. In more detail, we have used socio-metric questionnaires to identify the different types of relationships that link the two actors in the network: supply, relationships of supply on order with consolidated relationships and temporary associations of companies and consortiums. Relative networks have been constructed to describe the two situations, one before the intervention of the institutional actor and one after. Structural *embedding* has been analysed by processing data on inter-organisational relationships with UCINET (Borgatti S. P., M. G. Everett and L.C. Freeman 2005). In particular, some structure indexes have been used to verify the power exercised by different network actors. Focalising on the activity of governing the cluster, the presence of mechanisms of coordination has been identified using two measures that indicate norms of behaviour and shared ethical codes: the dimension of the network (*size*), i.e. the number of participants and the density of the network (Barnes,

1969), which indicates the percentage of all the direct links that potentially exist in a given network that are actually present[6].
Furthermore, if we accept the hypothesis that the central position is an index of power, three types of measurement have been used:

- the *Freeman degree*, which represents the level of direct connections that each node has compared to the total of direct connections possible.
- The *Bonacich*[7] index (1978);
- the *betweenness centrality* (Borgatti and White, 1994) that indicates the possibility for every actor to find himself at the centre of two different nodes and to be the only means of connection between the two.

In the context of the questionnaire, direct, semi-structured interviews were carried out with the managers of companies (around 90% of those selected) and with institutional officers from the Campania Region, aimed at identifying the strategic and organisational structure of businesses, the main structural indicators (turnover, employees, productive capacity, etc.) and the strategic motivations at the basis of their behaviour. Indirect sources were also examined, such as informative material, reports, end of year statements, planning documents of the Campania Region and others.

5. The structural characteristics of the cluster

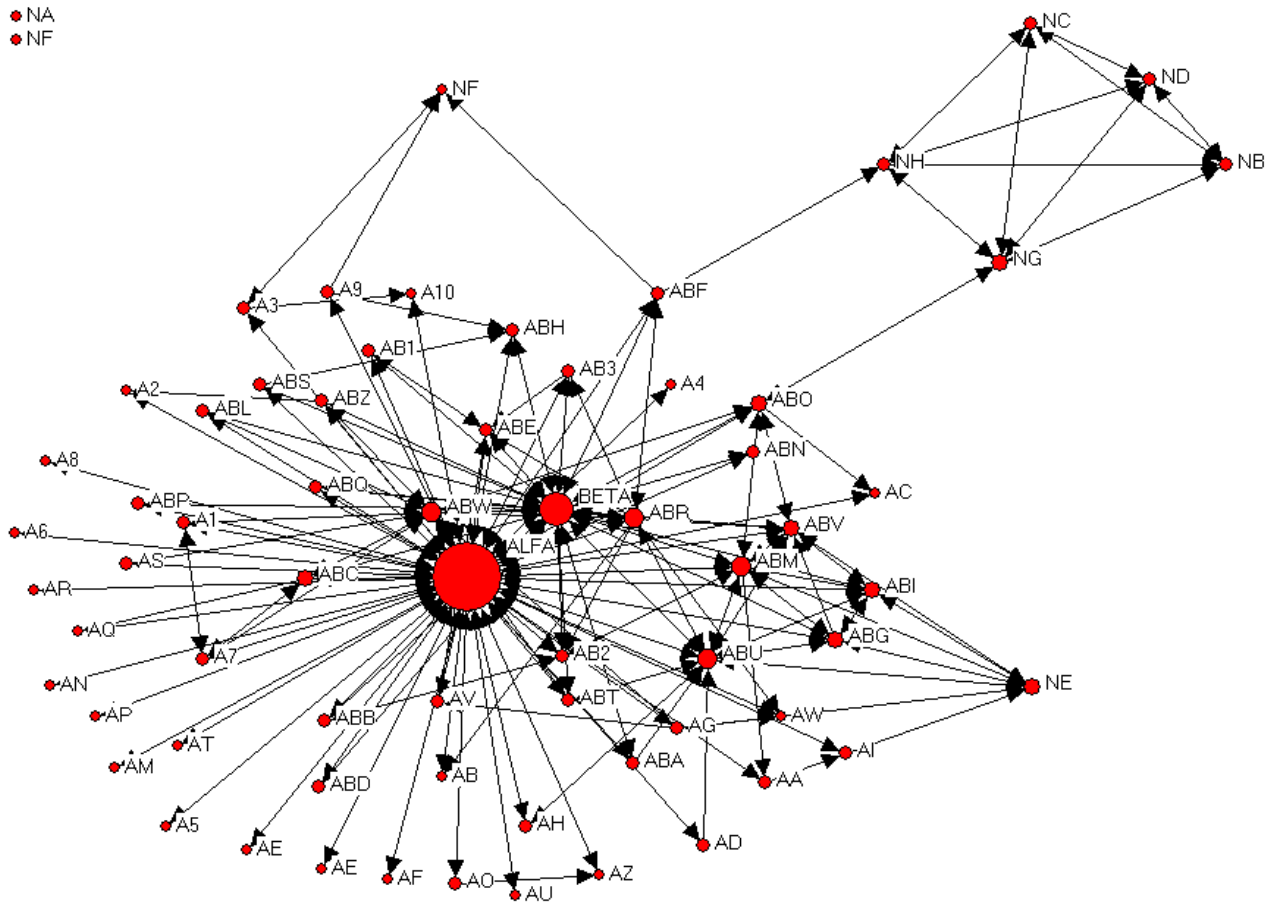
By analysing the network made up of actors in a cluster, we can see that the structure changes following the intervention of a regulator.
In this socio-metrical questionnaire, the possible relationships are assessed using a scale from zero to two. In particular, the following were attributed:

- Zero intensity if there is no relationship between the two actors.
- Intensity level 1 if the link between the two actors is a simply supply relationship.
- Intensity level 2 if:
    - There is a supply on order with a stable relationship, with technical support and presence in the management of supply on the part of the client;
    - If this is a temporary association of consortiums;
    - If this is a consortium.

The structure of the initial cluster is characterised by low density and the presence of a central actor, the leading company *Alfa*, which has the highest grade of centrality and power (*Bonacich Power*, Table 1). It is also possible to see that its direct competitor *Beta*, also has a fairly central position, even if it cannot be compared to that of *Alfa*. The cluster is therefore strongly centralised (*Freeman Degree*: 82.61%).

[6] If these two indicators are high, there is a situation in which the actors of the cluster have an advantage from the excess of information and relationships (Barnes, 1969).
[7] The *Bonacich* index, unlike other indexes that equate centrality with power, affirms that the most central actor is not the most powerful because it is connected to more nodes. The index of centrality proposed by *Freeman* (1979), for example, measures the level of variance in a network on the basis of the percentage in which it can be compared to a "star" network, in which the most central actors is connected with all the others directly and therefore determines a geodesic distance equal to one. *Bonacich*, however, believes that the actor with the highest level of power is that connected with isolated nodes that, in this way, depend exclusively on it.

Table 1 – Cluster before the intervention of regulation (size of the nodes established with the Bonacich index)



With the entrance of a new actor, *Busi*, which assumes the role of meta-organisation in the network, there is an evident loss of centrality of the two market leaders *Alfa* and *Beta*. It is interesting to note that in the network after *Busi*'s entrance:

- The businesses that are connected with *Busi* by the programme of regional development have a strong relationship (intensity level 2) with *Busi*, in that they are part of a consortium.
- All *Alfa* and *Beta*'s suppliers that have a link with *Busi* see that the intensity of their relationship with *Alfa* and *Beta* diminishes from 2 to 1, as *Busi* substitutes many functions that were previously performed directly by *Alfa* e *Beta*;
- The intensity of the relationship remains the same in all the relationships not involved in the intervention of the institutional regulator.

By calculating the indexes of centrality (Table 3) we can see that both *Freeman*'s index (which decreases in absolute value to 54,38%), and *Bonacich*'s index (Table 2 and 3) that measures the power and the *betweenness centrality* of the leading business *Alfa* decreases, as the density of the network increases. The decrease in the value of the indexes of the leading business is in the favour of the new

actor, who immediately imposes himself in a position of centrality and of force compared to the other actors in the cluster (Table 3). In the perspective of *structural embedding* the drop in these indexes should correspond to a considerable loss of strength on the part of *Alfa* in favour of *Busi* and, as a consequence, it is difficult to be coherent with a voluntary strategy of support for the entrance of a new actor.

Table 2 – A cluster after regulation intervention (size of the nodes calculated with the Bonacich index)

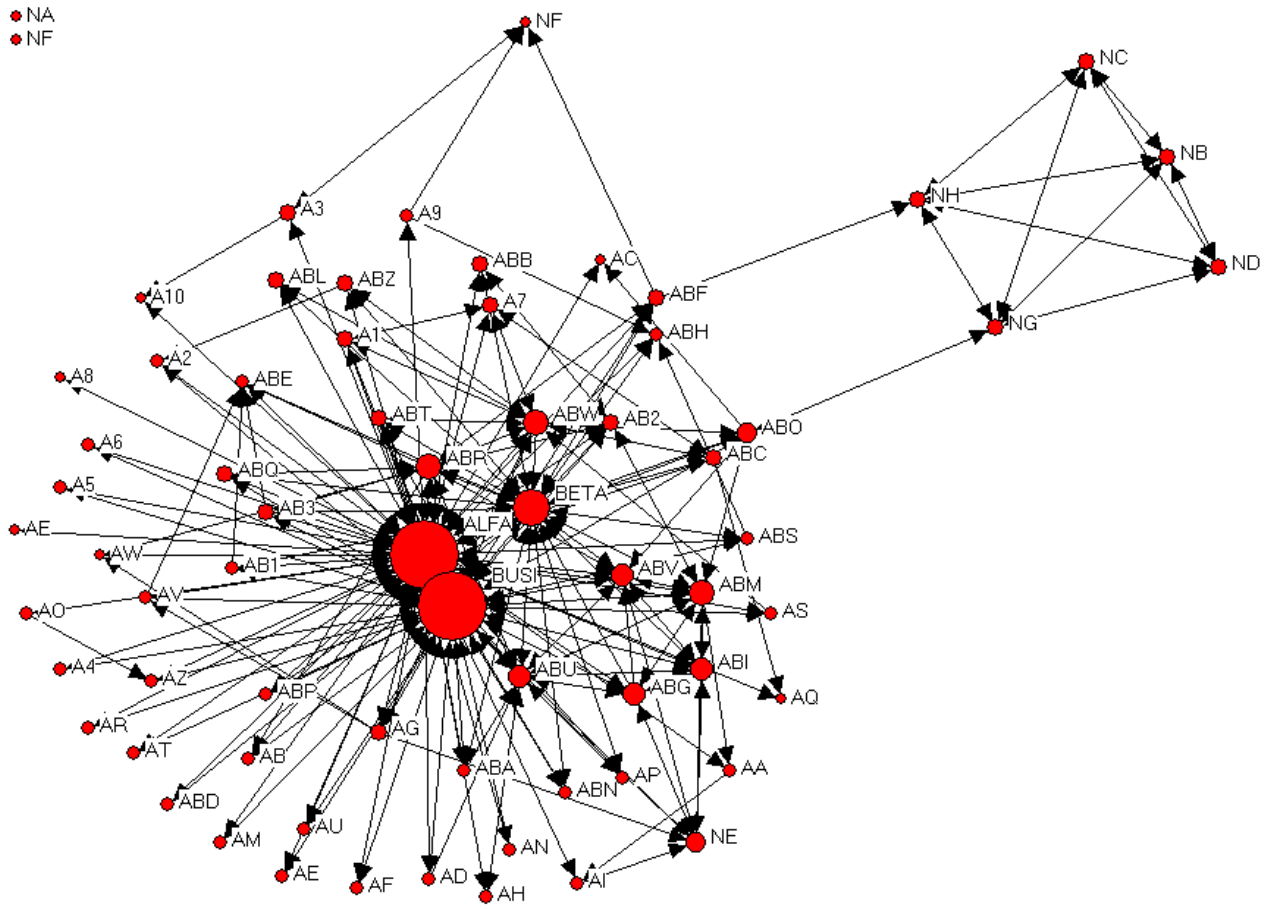


Table 3 – Structural indicators of the cluster With Busi – without Busi

	Power (Bonacich)	
	senza Busi	con Busi
BUSI	-	80
ALFA	116	79
BETA	48	35
ABW	20	20
ABM	19	19
ABR	19	19
ABU	18	18
ABG	14	14
ABI	14	14
ABV	14	14
ABO	13	13
NE	9	11
NG	10	10
ABC	9	9
A7	8	8
AB2	8	8
ABF	8	8
ABT	8	8
AG	7	8
NB	8	8
NC	8	8
ND	8	8
NH	8	8
A1	6	7
AB3	7	7
ABZ	7	7
A3	6	6
ABB	6	6
ABL	6	6
ABQ	6	6
A9	5	5
AB1	5	5
ABA	5	5
ABS	5	5
AD	4	5
ABD	4	4
ABE	4	4
ABN	4	4
ABP	4	4
AH	4	4
AS	3	4
AV	3	4
A2	2	3
A4	2	3
A5	2	3
A6	2	3
AA	3	3
AB	2	3
ABH	4	3
AE	2	3
AF	2	3
AI	3	3
AM	2	3
AN	2	3
AO	3	3
AP	2	3
AR	2	3
AT	2	3
AU	2	3
AZ	2	3
A10	2	2
A8	2	2
AC	2	2
AE	2	2
AQ	2	2
NF	2	2
AW	2	1
NA	0	0
NF	0	0

	Size	
	senza Busi	con Busi
ALFA	58.00	59.00
BUSI	-	40.00
BETA	26.00	28.00
ABR	12.00	13.00
ABU	12.00	13.00
ABW	12.00	13.00
ABM	10.00	11.00
ABV	9.00	10.00
ABG	7.00	8.00
ABI	7.00	8.00
ABO	7.00	8.00
NE	7.00	8.00
AB2	5.00	6.00
ABE	6.00	6.00
ABF	5.00	6.00
AG	5.00	6.00
AB3	4.00	5.00
ABC	5.00	5.00
ABT	4.00	5.00
NG	5.00	5.00
NH	5.00	5.00
A1	3.00	4.00
A7	4.00	4.00
AB1	3.00	4.00
ABA	3.00	4.00
ABH	4.00	4.00
ABQ	3.00	4.00
ABS	3.00	4.00
ABZ	4.00	4.00
AV	3.00	4.00
NB	4.00	4.00
NC	4.00	4.00
ND	4.00	4.00
A2	2.00	3.00
A3	3.00	3.00
A9	3.00	3.00
AA	3.00	3.00
AB	2.00	3.00
ABB	3.00	3.00
ABL	3.00	3.00
ABN	2.00	3.00
ABP	2.00	3.00
AD	2.00	3.00
AI	3.00	3.00
AP	1.00	3.00
AS	2.00	3.00
AW	3.00	3.00
AZ	2.00	3.00
NF	3.00	3.00
A10	2.00	2.00
A4	1.00	2.00
A5	1.00	2.00
A6	1.00	2.00
ABD	2.00	2.00
AC	2.00	2.00
AE	1.00	2.00
AF	1.00	2.00
AH	2.00	2.00
AM	1.00	2.00
AN	1.00	2.00
AO	2.00	2.00
AQ	2.00	2.00
AR	1.00	2.00
AT	1.00	2.00
AU	1.00	2.00
A8	1.00	1.00
AE	1.00	1.00
NA	0.00	0.00
NF	0.00	0.00

	Degree (Freeman)	
	senza Busi	con Busi
ALFA	116.000	81.000
BUSI	-	80.000
BETA	52.000	37.000
ABW	23.000	23.000
ABU	22.000	22.000
ABM	19.000	19.000
ABR	19.000	19.000
ABV	17.000	17.000
ABG	14.000	14.000
ABI	14.000	14.000
ABO	13.000	13.000
NE	11.000	13.000
NG	10.000	10.000
AB2	9.000	9.000
ABC	9.000	9.000
NH	9.000	9.000
A7	8.000	8.000
ABE	8.000	8.000
ABF	8.000	8.000
ABT	8.000	8.000
AG	7.000	8.000
NB	8.000	8.000
NC	8.000	8.000
ND	8.000	8.000
A1	6.000	7.000
AB3	7.000	7.000
ABH	7.000	7.000
ABZ	7.000	7.000
A3	6.000	6.000
ABB	6.000	6.000
ABL	6.000	6.000
ABQ	6.000	6.000
A9	5.000	5.000
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A2	3.000	4.000
AA	4.000	4.000
AB	3.000	4.000
ABD	4.000	4.000
ABN	4.000	4.000
ABP	4.000	4.000
AH	4.000	4.000
AI	4.000	4.000
AP	2.000	4.000
AS	3.000	4.000
AW	4.000	4.000
AZ	3.000	4.000
NF	4.000	4.000
A4	2.000	3.000
A5	2.000	3.000
A6	2.000	3.000
AC	3.000	3.000
AE	2.000	3.000
AF	2.000	3.000
AM	2.000	3.000
AN	2.000	3.000
AO	3.000	3.000
AQ	3.000	3.000
AR	2.000	3.000
AT	2.000	3.000
AU	2.000	3.000
A8	2.000	2.000
AE	2.000	2.000
NA	0.000	0.000
NF	0.000	0.000

	Betweenness	
	senza Busi	con Busi
ALFA	3421.648	2717.311
BUSI		816.063
ABO	461.386	466.575
NG	346.185	349.667
BETA	340.931	298.796
ABF	165.272	176.367
NH	84.086	87.200
A3	81.371	79.567
ABW	53.517	49.922
ABM	49.742	30.331
ABU	34.800	23.086
ABR	22.387	17.455
ABV	33.201	15.945
A9	17.371	14.567
ABI	19.524	6.867
ABG	16.993	5.657
NE	5.200	4.833
AI	7.782	3.341
AG	6.782	2.786
ABC	2.476	2.458
AB2	1.391	2.130
NF	1.000	1.000
A1	0.000	0.903
ABZ	1.143	0.792
AV	0.500	0.725
A7	0.667	0.667
AA	0.667	0.643
AZ	0.000	0.625
ABT	0.837	0.575
ABH	0.500	0.500
ABS	0.000	0.410
ABE	0.500	0.333
A2	0.000	0.327
AB1	0.000	0.225
AB3	0.000	0.225
ABL	0.143	0.125
A10	0.000	0.000
A4	0.000	0.000
A5	0.000	0.000
A6	0.000	0.000
A8	0.000	0.000
AB	0.000	0.000
ABA	0.000	0.000
ABB	0.000	0.000
ABD	0.000	0.000
ABN	0.000	0.000
ABP	0.000	0.000
ABQ	0.000	0.000
AC	0.000	0.000
AD	0.000	0.000
AE	0.000	0.000
AE	0.000	0.000
AF	0.000	0.000
AH	0.000	0.000
AM	0.000	0.000
AN	0.000	0.000
AO	0.000	0.000
AP	0.000	0.000
AQ	0.000	0.000
AR	0.000	0.000
AS	0.000	0.000
AT	0.000	0.000
AU	0.000	0.000
AW	0.000	0.000
NA	0.000	0.000
NB	0.000	0.000
NC	0.000	0.000
ND	0.000	0.000
NF	0.000	0.000

Density	
Senza Busi	Con Busi
Density (matrix average) = 0.1192	Density (matrix average) = 0.1262
Standard deviation = 0.4676	Standard deviation = 0.4550

6. The actors' strategies

Some interviews were made with the heads of the two organisations to understand the strategies that have inspired the institutional actor to promote the development of a cluster through the creation of a *business integrator* and, above all, the leading company to accept and sustain a strategy that apparently determines a consistent loss of power.
The institutional actor wants to govern inter-organisational dynamics to safeguard the cluster in a crisis, to reinforce its degree of innovation and to increase its level of competitiveness.
Since the beginning, however *Alfa* has stimulated and supported the regional intervention programme, also offering technical help to the companies that are to be involved in the project. There are many objectives that have inspired it to take this strategy on board, which involves many important changes in the inter-organisational compartment. Firstly, *Alfa* is one of the main competitors at an international level in all segments of the market in which it operates. It is active in the territory of the cluster analysed, with around 1000 employees (2003 data) with 3600 spread in various Italian regions at a group level. In 2004 *Alfa* decided to carry out a series of actions that led to diminishing the percentage of supplies purchased from companies not situated in Campania. It usually relied on supplies from companies that were not part of the cluster for a value of 70% of its total purchases.
The increase in purchasing within the cluster in Campania would mean the following for *Alfa*'s strategic plan:

- a decrease in the costs of supply;
- greater control over products and components purchased;
- greater control over suppliers;
- less dependence on suppliers outside the cluster, which have greater contractual power than those of the cluster (since that for almost all the businesses of the cluster *Alfa* is the main client and, in some cases, the only client) (Pfeffer e Salancik, 1978).

The regional programme also stimulates innovation in the suppliers' base conditions to also increase the innovation potential of *Alfa* itself.
The final important result is linked to the *Business integrator*, which becomes (when the programme is running) *Alfa*'s main interlocutor in entrusting production orders and supplying the businesses of the consortium with the technical-operative assistance and skills that are in many cases carried out directly by *Alfa*.
The other businesses in the cluster are encouraged to accept the presence of *Busi* and the regional development plan for different reasons: first of all, to access funding to support enlargement, new plants and innovation projects, to raise the critical mass necessary to secure new orders and, finally, to increase the possibility of entering new sectors and new geographical markets.

7. Conclusions, limits and further developments

From the first analysis of the structural indicators of the network it seems that *Alfa* has undertaken a "losing" competitive strategy in terms of controlling relations with other actors in the cluster. Its unchallenged central position was eroded by *Busi* and the intensity of links with suppliers involved in the development decreases. Furthermore, in the light of the approach that depends on resources (Pfeffer e Salancik, 1978) the suppliers of *Alfa* and *Beta* manage their symbolic independence with the two main clients better with *Busi*. Once again *Alfa* – which is managing a single strong relationship with *Busi*, as well as its strong, pre-existing relationships with suppliers that are not involved in the development programme – would see on one hand a decrease in transaction costs (Williamson, 1975), but on the other would have to negotiate and deal with an actor with a stronger contractual power.
In reality, what emerges from the interview with the management is that it is a deliberate strategy that has even stimulated and supported the institutional action.
Even if *Alfa* has to deal with a greater contractual power and will see its "formal" role as a leader altered, it will:

- have lower transaction costs
- manage less negotiations/contracts, with lower administrative costs.
- have lower costs for technical assistance to suppliers in the production phase
- be able in the mid-long term to better manage the symbiotic interdependence with suppliers outside the cluster, when those inside will be capable of replacing them.

Furthermore, *Alfa* would like to increase the innovative ability of the suppliers by favouring their recurrent aggregation and exchange in consortiums coordinated by a meta-organisation. In reality, experts have stated that before radical innovations are developed, companies must be structured in very dense networks of relationships, characterised by a low level of centrality and by the frequent exchange of actors who give the possibility of coming into contact with different information and knowledge (Granovetter, 1973; Hansen, 1999; Burt, 1992 and Nooteboom, 2004). Highly connected networks, on the other had, favour innovation in terms of better exploitation of skills already present between actors, but does not develop new ones.
These first results over a short period allow us to highlight several limits of an aseptic analysis of the main structural indicators of a network. However, the qualitative analysis is a useful complement to understanding the strategic behaviour of actors that operate in a very cohesive cluster, conditioning the evolution of the life cycles of the cluster and inter-organisational relationships between its actors.

7.1 Limits of the study

The first limit is linked to the time scheme. To verify the effective success of the strategy of two actors (Alfa and the Region) we must repeat the analysis carried out over the mid term. In this way we could analyse effects not only in terms of inter-organisational dynamics and structural characteristics, but also in terms of changes in the organisational demographic of the cluster (birth, death etc), collective performance and that of single actors (especially *Alfa*).
Another limit is that, in this study, social links have been identified but not considered (links of trust, friendship, kinship, etc.) that would condition a reading of the dynamics analysed. Furthermore, in this phase of the research, the object of the study was limited to the cluster in Campania and suppliers and clients of Alfa, which does not, however, coincide with the entire network of the leading company nor is it exhaustive in terms of all the relationships between the different actors involved. This is because we wanted to limit the research to the territory under the administrative control of the Campania Region.

Therefore, in the continuation of the research we will aim to enrich the theoretical *framework* with hypotheses linked to overcoming these limits by broadening the analysis to other actors involved in the network (other clients and suppliers).

The network study presented in the foregoing reveals a great deal of the structure of the analyzed cluster. Yet, the research elicits another important limit of the network approach. Indeed, in the study, the actor Alpha maintains its key role in the cluster despite the fact that it looses its centrality within the cluster's network. Another limit of the network analysis is that it is a static approach. The analysis offers the picture of the web of relationships among firms within the cluster but does not support the analysis of how the relationships will evolve over time. Indeed, traditionally, contributions on cluster dynamics have focused on advantages of co-localisation of supply-chain, in terms, for example, of entrenched reciprocal knowledge and relational capital in addition of savings of costs of logistics. Our empirical study suggests that the web of causal relationships in which various actors within a cluster are embedded may reveal long-term paradoxical situations.

7.2 Dynamic hypotheses on cluster evolution: a cause-effect diagram

In tables 4 and 5, we use a cause-effect diagram to describe dynamics emerging from the web of relationships described in the network analysis. The presented causal structure embodies a dynamic hypothesis concerning plausible interaction dynamics.
As described, we suggest that the relationship between Alpha and its suppliers crystallizes a paradoxical situation to deal with.
On the one hand, the diagram in table 4 depicts how the interaction of Alpha with its suppliers generates a virtuous cycle in which the geographical proximity of a supply-chain increases the competitive advantage of Alpha; Alpha is then able to increase its sales and to foster further growth of its supply-chain. The situation described is a win-win game in which incentives of Alpha and its supply-chain are aligned.
On the other hand, the diagram in table 5, explains how the close relationship between Alpha and its suppliers conceals a strong divergence in incentives as well. Indeed, the supply-chain of Alpha includes small and medium firms producing components with a low level of technological content. For this reason, Alpha enjoys high bargaining power since it can arbitrage among undifferentiated producers. However, the low technological knowledge that characterizes its supply-chain forces Alpha to depend on suppliers outside the cluster for the components with higher technological content. The suppliers of technology are often large firms situated in oligopolies. As a consequence, Alpha attempts to increase the level of technological know-how of its suppliers in order to decrease its dependency from these technological suppliers. A problem may emerge as the supply-chain of Alpha starts to shift towards differentiated products with higher technological content. On the one hand, Alpha enjoys the possibility to diversify supply of technology but, on the other hand, actors in the local supply-chain may increase their bargaining power and cut margins of Alpha.

Table 4 - The virtuous cycle of Alpha and its suppliers

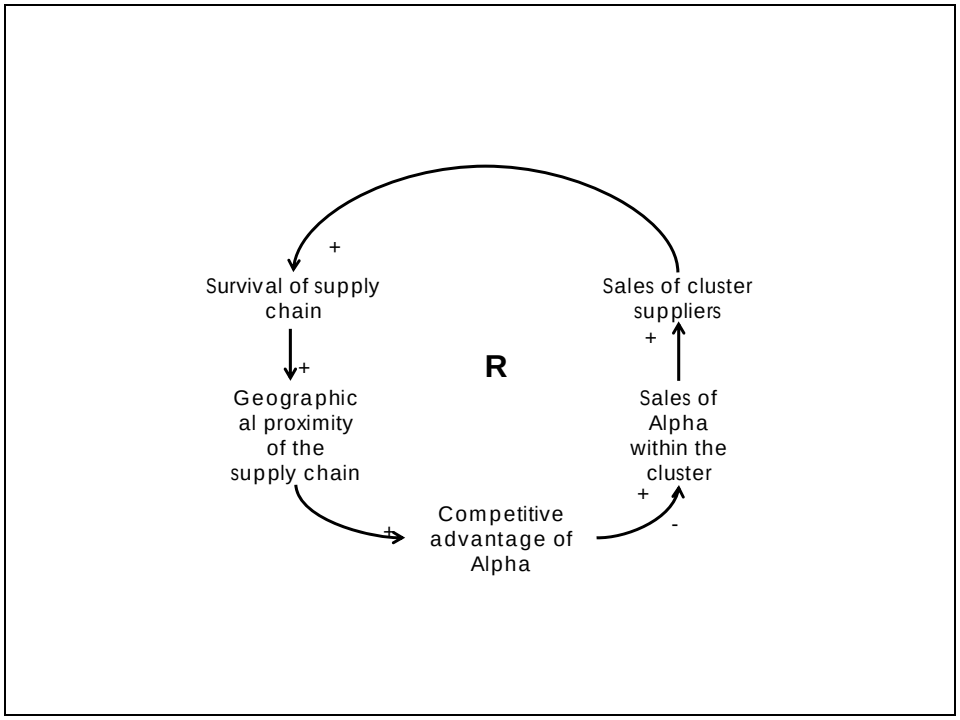
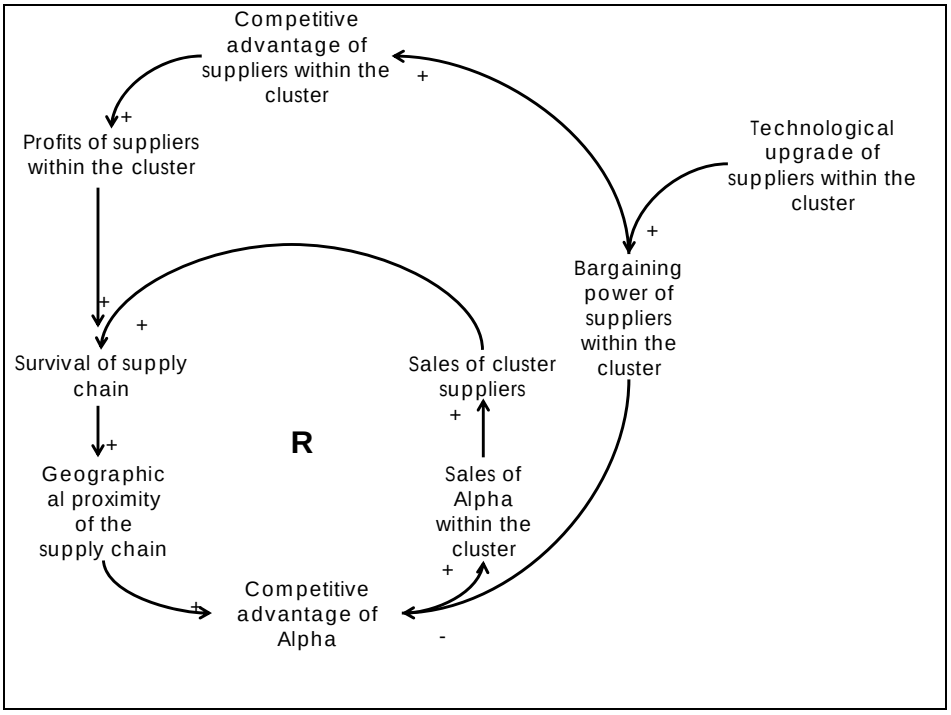


Table 5



7.3 Open questions and research approach

The described cause-effect diagrams stimulate a key question. What the long term consequences are for Alpha of supporting the development of technological know-how in its supply-chain? We want to articulate the question by exploring possible emerging behaviour generated by the cause-effect diagram presented in tables 4 and 5.
A number of possible avenues for further exploration are the following: how long does it take to create the necessary technological know-how I the supply-chain? Is there a specific governance structure of the supply-chain that better preserves the interests of Alpha along the evolution of the supply-chain? In particular, is the Business Integrator the appropriate agent to govern the transition of the cluster? Is there specific area of investments that to Alpha ought to privilege? What the long-term consequences are of deciding not to invest to upgrade the technological know-how of the supply-chain?
Using computer simulation, we would like to address the questions investigating how unexpected and non-trivial consequences of the represented causal structure unfold over time.
To pursue the analysis of the dynamics described in tables 4 and 5, we intend to use System Dynamics (SD) approach to modelling and simulation (Forrester, 1961: Sterman, 2000). SD has been previously used in social sciences; Hanneman, Collis and Mordt, for example, analyzed theories of conflict by using a SD model (1995). More specifically, we will ground our work on previous SD applications in organizational and strategy research (Sastry; 1997; Gary, 2005). As far as our purpose is concerned, SD research methodology, offers a number of advantages in modeling the described cluster dynamics. First, the methodology emphasizes a feedback perspective, and allows us to treat an organization, or a cluster of organizations, as a complex system consisting of one or more feedback loops. The dynamic interplay of these feedback loops explains emerging non-linear organizational behavior carried by multi-level actors in complex social systems, which is not necessarily intuitively understood, nor can be replicable using other conventional research methodologies. Second, SD models approximate continuous-time, rather the discrete time, processes. Such a modeling approach is appropriate since our point of view stresses the role of emergent organizational decision-making which unfolds gradually over time as the consequence of pressures, incentives and resources continuously accumulated within a cluster.

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