

**Innovation and knowledge creation in the SMEs
of an Aeronautical Industrial Cluster.**

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1. Introduction

In order to understand the role that the industrial cluster, localized in Campania, has in the aeronautical field, as well-known work on international scale, it is necessary to comprehend the dynamics that operate in such field. As it is well known, the ability to compete is strongly related to the ability to have strong relations with one's own industrial partner (Håkansson, 1987; De Bresson, Amesse, 1991; Cox and others 2000, Hughes and others 2000; Jurgens, 2000). Such phenomena produce significant changes in the industrial structure of many fields and particularly in the aeronautical field. In this sector, beginning from years '60 with the Concorde, Transall, Sepcat, Adour and Olympus programs (Jane's 1977) there are firsts experiencing in the processes of internationalization of the productive structure (Contractor and Lorange, 1988; Aoki, 1988; Thoburn and Takashima, 1992; Lengrand and Chatrie, 1999; Cabral, 2000; Dussauge and Garrette, 1999; Mowery, 2001; Mockler, 1999; Child and others 2001; Bianca and Esposito 2006). The aeronautical industry is organized as a system of international suppliers with collaboration shapes that go from the participation of minority until to the mere particular execution on plan, through several shapes of affiliation to the various programs (Hayward, 1994; Esposito 1999; Bonaccorsi, Giuri, 2001).

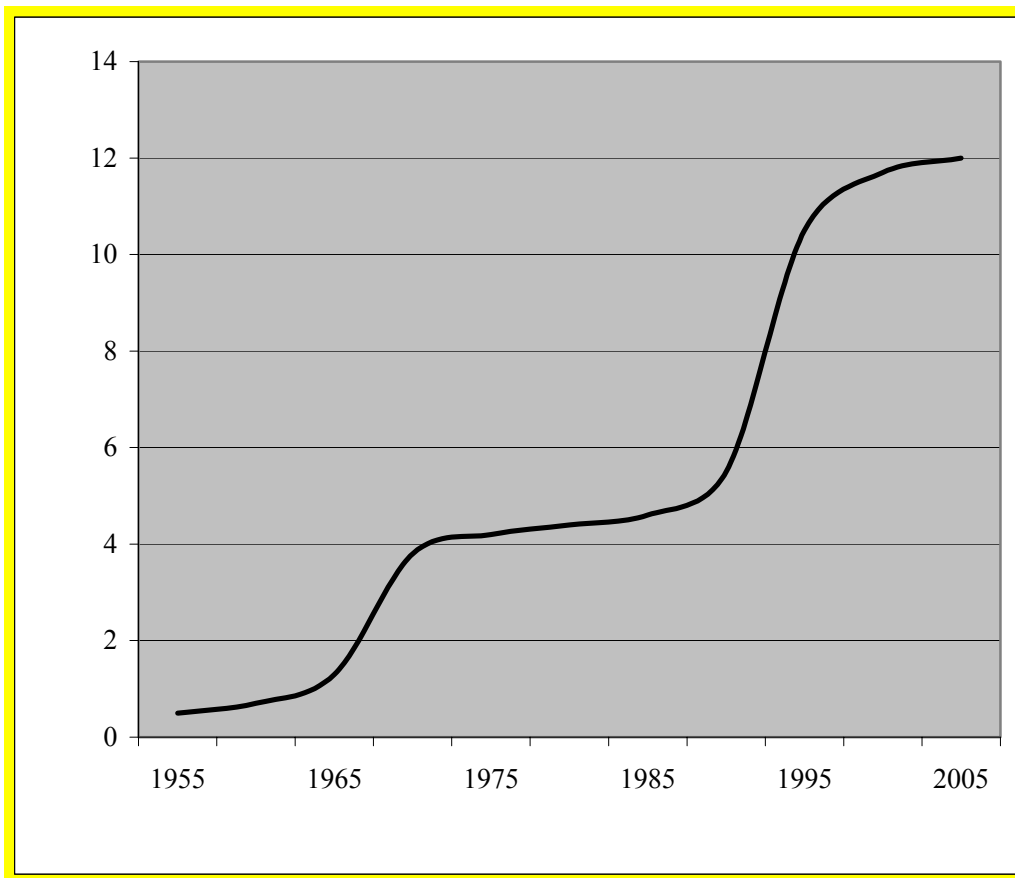
2. The barriers in action in the aeronautical field.

It is possible to schematize the forces that have determined such structure and that order the rules that put into effect the competition between companies and between groups of companies that collaborate to the same programs in the following way:

- **High technological complexity** - the production of aircrafts has a systemic characteristic that means that it is necessary to control various technical areas like Aerodynamics, Engines, Equipment and Avionics, Materials and Structures. All the foretold areas demand high specialization and ability to supply produced reliable and continuous innovations. From it derives, for a single enterprise, the impossibility to have all the necessary knowledge for the production of a single aircraft (Esposito, 1993; Hayward, 1994; Pinelli and others, 1998).
- **High development costs** – some authors, at the end of the '80s, already estimated that for the launch of a new generation of aircrafts the costs would have caught up about ten billion US\$ (Brooks, 1978; AIA, 1980; FI/DMS, 2001). Today for the launch of the A380, some esteem speaks about 15 billion US\$. To the high financial engagement is associated an extremely long period of recovery of the investment (approximately 15 years). This factors force the enterprises of the field to face strong financial exposures in conditions of relevant risk and uncertainty in the determination of the costs and in the attainment of the planned performances, like in the case of the Concorde and Olympus programs (Devriese, Young, 1972). In order to share out the financial barriers connected to the risk, the enterprises face a phase of intense pre - planning. That way, it is possible to characterize a partner with which to collaborate and to select the alternatives to carry out the development phase. It is also possible to assure an adequate market. The figure 1 shows the trend of the costs of development of the aeronautical programs from the beginning of '50s until today.
- **The Break-even point distant in the time** - From the highest costs of development it comes down immediately that no domestic market is in a position to absorb a sufficient number of aircrafts to catch up the break-even point. For example, an airplane with the characteristics of the Airbus A380 has a break-even point around the 300-400 units. Considering the cost, the operating dimension of the aircraft and its characteristics it is expectable that an airline (or a group of airlines) will satisfy their own requirements acquiring not more than ten units. It means that enterprise gets the break-even point when, at least, 40-50 airlines acquire the product. Also in the case of aircrafts that have lesser operating characteristics and so that

demand less stringent technological levels, and therefore, minor costs of development, although getting the break even point with minor number of exemplary, this number it is still very far from the capacity of absorption of a single domestic market. For the ATR, the break-even point is around the 250 aircrafts, approximately 5 units for airline. It means that it is important to involve enterprises in many countries in the program.

To the technological complexity, in addition to elevate financial burdens and to the uncertainty on the effective return of the investment, many governments place direct and indirect barriers to the purchase of aircrafts not realized with the participation of the local enterprises. The enterprises manufacturers exceed these barriers of market stipulating agreements that involve the enterprises of the countries whose airlines, in the case of civil aircrafts, or whose Armed Forces, in the case of military aircrafts, will acquire the produced aircrafts.



Source – ODISSEO – OSA in Bianca, Esposito, 2006.

3. The organization of the aeronautical field.

The resulting organization of the productive cycle of the aircraft is a hierarchical structure on an international scale. At the top of the pyramid there is the final assemblage area, in which larger global firm assemble sub systems coming from four sub sectors (Aerodynamics, Engines, Equipment and Avionics, Materials and Structures). Currently, in the civil division of the aeronautical field there are few enterprises that work in the Long Range class, the class of aircrafts with greater technological content, they are the American Boeing and the European Consortium Airbus formed from EADS France (former Aerospatiale 37,9%), EADS Germany (former DASA, 37,9%), EADS Spain (former CASA the 4,2%) and British BAE that until 2005 participated in the

programs of the Airbus Consortium for a 20% of the operativities. The British BAE has decided, recently, taking advantage of the elevated value caught up from EADS shares, to realize the investment in order to invest in their own military division through the acquisition of some SMS with highly specific competences, localized in the United States. The decision to exit from the Airbus Consortium is quite surprising, particularly in a phase in which the turnover realized from the European companies, in the civil division of the aeronautical field, is, for the first time, comparable to American enterprises' turnover. However this news is not entirely unexpected. BAE System was developed from the fusion of the British Aerospace with the Marconi Electronic Systems, two companies operating in the military division mostly. BAE System, also having participated to many important civil programs, has always privileged the engagement in the military sector.

Italy, through Alenia Aeronautica Spa, has conquered, just since the '80s, the leadership in some segments of the market. This is also thanks to the politics of participation in the more important aeronautical programs undertaken from the various global operating groups. Alenia Aeronautica, in this way, acquires and develops important competences, fundamentally in the field of the materials and structures. These competences find application also in the programs with less technological content. Today, in Campania, the small and medium enterprises (SME) having a meaningful presence in the aeronautical field are approximately sixty and, realize a turnover of approximately 180 million euro with a number about of three thousand employees.

Until the end of '80s, the process of growth in the aerospace field is practically constant both in human resources and turnover. In these years, American enterprises are leaders both in the civil and in the military field. The increase of the field facilitates the development of the SME suppliers, assisted on this way by large enterprises that transmit information, processes, technology.

At the beginning of '90s, the situation radically changes and enters in a new national and international phase, that we could call *problematic growth*. This phase present fast falls and resumptions of the turnover, accompanied from a constant reduction of the number of the human resources. On a worldwide scale, the situation passes from USA monopoly to an USA-Europe oligopoly. At the national level, often the large enterprise, the SME's customer, unloads the crisis on the local suppliers, breaking off long time relationships and the related trust.

In the first years of this century, there are some other structural changes in the field:

- the international competitive context sees the strengthening of the USA-Europe oligopoly, and upgrades it into oligopoly constituted by four main countries: USA, Europe, China and Russia (which India could join in future);
- the strong sensitivity to the conjunctural events of the market pushes the large enterprises of the field towards more flexible organizations of the productive cycle;
- the ICTs (Information and communications technologies) determine a movement of core technology of the field towards the area of the systems;
- the wide use of new materials (special alloys, composites, etc), the spread of the new technologies of process, the more and more careful question to set-up buying and management costs, all move the added value towards the coordination of the program, and the interface with the final market.

In this context, the large enterprises of the world-wide oligopoly that look for flexibility, rearrange their core technology and limit their own operations to the areas of the assemblage, the program coordination and the interface with the market. These changes involve a reorganization of the supply chain and offers new opportunity but also new challenges to the SMEs.

4. The Campania's cluster

4.1 *The process of globalization and the SMEs in Campania.*

The Italian enterprises in the aeronautical field have a long and consolidated experience in the participation in the international production programs. The Italian aircraft industry, in the civil and in the military department, in the phase post WWII needs to find an international partner in order to carry out its industrial plans. In this period the internationalization doesn't come from the motivations illustrated in the previous paragraph, that will begin to influence the structure of the productive market only from early '60s, but from the impossibility to build an airplane entirely Italian, according to the peace agreements at the end of the WWII.

This is surely valid for the large national enterprise, but the SMEs only in some cases and only recently are present on the international market.

We want to emphasize, as the access to foreign market and enterprise's ability do not have high correlation, the in the field. In fact, although not always officially, internationalization is in the logic of *offset*¹

In the Campania's cluster, we can find two trends closely correlated to the business dimensions.

We take in exam 15 enterprises, amongst them there are seven small enterprises, seven medium enterprises and one large enterprise.

4.1.1 *Medium Enterprises*

Many of the medium enterprises have begun important processes of internationalization. Firms finalize such processes as much to increase the existing market as to establish directed relationships with the leaders of the worldwide production. Such politics concur to bypass the relationship with the large national enterprise and to obtain a variety of advantages, amongst which are a faster payment (currently Alenia Aeronautica wage with beyond 120 days) and to learn competencies, technical, organizational and managerial ones, in tight contact with the final assembler.

The achieved results appear as the product of an increase process extremely graduates in terms of competencies like dimensions. The great national enterprise has a fundamental role in such enlargement process; it is, in all the cases, the main market and the main source of knowledge for the SMEs.

Although the purposes of the internationalization process are similar for all the SME, it is possible to carry out a distinction in the modalities with which such a process is put into effect. Enterprises that produce semi-finished (as Aerosoft) choose a strategy of opening new firms and / or the acquisition of enterprises localized near the productive plants and Decision-Making Centres of the worldwide leaders. Enterprises that produce specific subsystems and finished products (landing gears, seats etc.) for which they have the total responsibility and the relative certification of airworthiness (as Oma Sud, Magnaghi, La Gatta) have chosen to internationalize the sale structure maintaining entirely national their own productive ability, with the exception of rare cases in which they have been carried out local joint ventures in agreement with the necessities of the final customer. Tecnam is a particular case, they produce little airplane for general aviation also, related to this production they implement a large series of relationships that go from the presence of consociate to the delegation in order to sell in a sure area, passing for the concession of licences for the production. They are present in more than thirty countries worldwide.

4.1.2 *Small Enterprises*

Differently from the medium enterprises, nobody in the small enterprises has a market wider than the national one. Small firms, like the medium, are greatly aware of the risks and of the opportunities deriving from the processes of internationalization in action and of the new ones

¹ With locution Off Set we intend the compensation for a country that buy aircrafts for a percentage of their value and whom, aircraft's producer, give work on that program.

entering on the global market. Small firms do not consider such events a risk for their enterprise, singularly, delivered up how much for the cluster entirely. These enterprises matured such conviction because of the strong relationship with their local customers and in the specificity of the carried out workings.

The greater limitations for such enterprises to take part to in the internationalization processes are the dimensions and the lack of organizational and managerial knowledges, apt to manage the production of complex products, which can be of interest for the large international enterprises.

Finally, we can say that generally, firms are strongly concentrated on national market and international market is only a little part of the total turnover.

4.2 The innovation strategies.

In full agreement with the literature and with how much emerged from the interview with Alenia, the customer, local or international, privileges suppliers highly focalized on the aeronautics technologies and that can invest in order to create long-term relations. In such sense the SMEs suppliers are strongly bound in the scopes which they can address the innovation processes. On the other side, SMEs are not proactive in the proposition of innovation, which is largely related to access to public financial funding.

Therefore as in the previous case, it is possible to find various trends between the small and the medium enterprises of the cluster.

4.2.1 Medium Enterprises

The medium enterprises have elaborated pursued a carefully planned strategy, based on a careful analysis of the financial needs and knowledge for the innovation.

The main strategies for innovation implemented from the medium enterprises are relative to changes in the inner organization and/or the organization of the relationships with the environment. In the manager's opinion, the improvements related to the merely technical aspects are of less importance with the aim to achieve the improvements of the prefixed performances. To trace a unitary scope for the various companies appears rather complex, in fact, the innovation answer to a perception of the risks and / or of the opportunities that is closely to the single business truth.

The organizational changes are related to opening or to the restructure of a plant, to changes in the evaluation model and in the management of the own supply chain or to participation to network of SME. We underline the specific case of a company that has had to radically change some business functions in order to manage effectively and efficiently the relationships with a foreign partner for the production of a new aircraft of general aviation.

4.2.2 Small Enterprises

The small enterprises show to comprehend the problems that plague the enterprise, but they do not have resources to elaborate a strategy that can carry them out of their troubles.

Amongst these, some enterprises do not think it is necessary to bring some type of innovation in the next few years, and others have generic objectives like the differentiation of the final market. These proposals are rather confused and lacking any planning.

Within this general trend, there are two important exceptions. In the first case, the firm introduces a system for the reproduction of art masterpiece to use of museums and private collections, based on a sophisticated system of acquisition of the three-dimensional images. Such a process has concurred to enter into the market of the artistic and cultural masterpiece that today represents an important part of the turnover.

In the second case, the enterprise has developed a new machine tool for high-speed working of great dimension pieces. Such project, that finds financial resources also with the contribution of the public financing, is fruit of a long and intense collaboration with two public research centres. The new machinery, currently at the prototype phase, has all the characteristics in order to enter in the market of the machinery suppliers, also at the international level.

4.3 The growth objectives.

From the interviews, do not emerge any differences in the judgment on the factors that mainly can influence the firms' growth, between medium firms and small ones or different kind of production. The crisis during the '90s has strongly marked the productive structure in Campania, carrying many aeronautical firms on the territory to go out of business or to change field, and all the others to drastic turnover and employee reductions. The crisis' overcoming and the conditions in which the various enterprises poured at the end of '90s is the fundamental starting point for planning the growth objectives for the single enterprises and for the cluster in its complex.

All the companies had to obtain growth in the next few years with an important difference:

- The companies that mainly suffered bad effects from the worldwide crisis in aircrafts production, have the goal to recovery the dimensions through the introduction of new operativities and a recovery of productivity. The desire to recover the human resources exited from the productive cycle induced such companies to carry out investments more for this scope than to increase the firm's competitiveness.
- The companies that have had less important repercussions in terms of turnover reduction and human resources are in aim to profit of worldwide growth.

Two companies make exception in this general tendency. The first firm is in the aim to maintain dimensions in agreement with the strategy decided from the industrial group of which it is part. The second one, apparently, mean to reduce the own dimensions, but such attempt is correlated to the aim to subdivide the company in order to reach the creation of a small industrial group.

All the companies indicate the human resources as the key factor for the firm growth, in terms of inner competencies valorisation, development and acquisition of new technicians and manager. The greater part of the enterprises think to the development of the cluster like a simple support to the increase of the single enterprises, not in terms of system growth. There are some entrepreneurs that consider local Public Administration and the Financial Institutions deeply inadequate to the necessities of the field and a serious obstacle for the increase both of the single enterprise and of the cluster in its complex.

4.4 External relations and past firm performance.

The relations with all the industrial actors are generally good, in particular with the industrial customers but also with the companies, which are at the same level in the supply chain. In many cases, the companies come in the aircraft field thanks to current customers with which exists also a long relationship.

There are meaningful differences in terms of quality and amount of the relations, with the agencies that are part of the cluster correlated to the business dimensions. The larger are the firm's dimensions, the better are relations with agencies.

Many companies think that the operated competitive pressure from the local actors is rather low because of the existing technological diversities amongst the same ones. To such situation, contribute both the structuring of the local cluster managed from Alenia Aeronautica and the reduction of the number of enterprises operating in the aeronautical field. In such sense, many entrepreneurs and managers consider the system collaborative rather than competitive.

The great majority of the small enterprises does not have its own supply chain, rather than some firms that supply workings to low added value and lacking in great relief on the characteristics of the product. With such enterprises, there are generally optimal relationships of collaboration. There are the suppliers of special processes with which there are important asymmetries in terms of turnover and technologies, so the low importance of the turnover generated from the small enterprises makes the relationships for the small firm not always satisfactory.

The medium enterprises has an own supply chain sufficiently structured with which they entertain satisfactory relations imprinted to great opening and collaboration. There is only one company, which has recently changed property, which has not good relation with suppliers. Such company

has just inherited suppliers from the old management. Therefore firm needs of a period of transition during which it wants to change composition, organizational rules and evaluation system.

The relation between top management and human resources are positive and strongly collaborative. Sometimes such answers are related to the perception of the management rather than to the real situation. Many entrepreneurs – top manager adopt a strongly centralized directional style, so they generate confrontation with the low - middle management. The trade-union confrontation is instead rather low, because of the low number of unions' members in the SMEs of the field and because of the collaborated attitude of the representatives of the workers.

The SMEs' managers have good but not cooperative relations with local Public Administration. The same therefore happens with the industrials association, in which there are many of the examined firms.

The relationships with the institutions of local and national credit are, in the most of cases, extremely unsatisfactory and services are extremely inadequate to business requirements. In some cases, entrepreneurs speak about vexing attitudes by financial institutions' managers. Such a dissatisfaction contributes in an important measure to the fact that a larger part of the enterprises uses for the own practical workings of the *working account* that implies uses of raw materials and equipments (stamps, equipments, parts of call of assembly etc.) of property of the customer. In this way, firms' turnover practically coincides with the added value and it is relatively low respect to companies of analogous dimensions in other fields.

The relationships with research are very satisfactory beyond that continues and well structured. Only smaller dimensions firms do not take advantage of the competences present in the local, national and international research centres. The greater dimensions firms have relationships more continues and with a greater number of research centres. In all the cases entrepreneurs and managers declare themselves very satisfied of relations' results.

4.5 Key areas for the future performances.

Actual business position is the first key to valuate factors that can influence future performance.

Therefore, only medium enterprises that are already present on the foreign markets think that such markets will be able to have an important role in near future. There are also two enterprises that have as soon as begun to have contacts with the foreign country, this contact is seen like as an opportunity but not being able to affect the business development in near future. An important correlation exists also between those firms that consider the expansion on the foreign markets very important and those who think the domestic market expandable with difficulty. Similarly, the enterprises of smaller dimensions think that in future a more and more important role will be carried out from national market regarding that regional one. Such similitude leaves us to suppose that the way the geographic expansion of the destination markets is easier to pursue regarding the widening of the productive range. With such a conviction, it contributes to the fact that the first option is possible also with the possessed techniques. The widening of the productive range needs of the widening of technological wallet and of specific certifications, in both cases these processes are extremely long and expensive in the considered field.

Entrepreneurs and managers think that the local labour market is perfectly suitable to the business requirements, now like in the future, thanks to the fact that on the territory exists an ancient and consolidated culture of aeronautical production that over time produced a great number of organisms for formation and for research. The human resources are one of the factors mainly critic of the production process, many entrepreneurs and managers think that a new worker, also a simple operator of machine tool, becomes full operating in a time that goes from two to four years. Therefore, job training is important but use of human resource with university degree is low.

Alenia has adopted, from 2003, a new strategy in the management of own supply chain. Such strategy includes the verticalization of the raw materials, reduction of the number of direct suppliers through the location of strategic suppliers that they will be able to carry out the role of "coordinators" and of interfaces of the supply chain, as more in the next paragraphs.

5. The innovation in the aeronautical field.

In defining innovation we have practiced an approach of the inductive type, in the sense that we have not defined such a concept in an aprioristic way rather we have been attempting to deduce a definition from the conceptualization of the carried out interviews. Therefore it appears possible to adopt for the concept of innovation the following definition: *innovation is a set of activities, initiatives, behaviors, etc. of subjects, finalized to the realization of one or more technical, organizational, managerial economical, financial, commercial changes inside the organization in which they operate, by means of the use of knowledges, technologies and financial resources, taking advantage of the necessary financial resources, with the scope to reach to a perceptible improvement of the performances of the system in its complex, and then catching up it.* From the merely technical point of view, an airplane is the fruit of the integration of numerous and various subsystems for whose realization we need four technical areas: Aerodynamics, Engines, Equipment and Avionics, Materials and Structures. We can use the concept of *technological paradigm*² in order to evidence the specificity of the four technological areas, and the contribution that these areas offer to the realization of the aircraft. Although the concept of technological paradigm has various interpretations, according to the authors who have used it, the meaning that seems acceptable has his hinge in three aspects:

- the requirements of the market that the paradigm means to satisfy;
- scientific principles which it is based upon;
- the techniques that it uses.

A technological paradigm gives origin to many technological trajectories that represent the possible activities of the technological progress inside ties and the opportunities of the same paradigm. Therefore, it is possible to recognize two typologies of innovation: specialist and systemic.

The *Specialist Innovation* has origin in the single technological areas. As an example: the introduction of new materials, the engine replacement, and the improvement of avionics of edge with a more advanced computerized system. This type of innovation usually assumes also the character of *incremental innovation* since it become part of one existing structure, already consolidated, modifying partially the performances.

We speak about *System Innovation* when the integration between the technical solutions (that they can also not be the fruit of specialist innovations) realized in the various technological areas gives life to a new product. This type of innovation corresponds to the principle of creative symbiotic (Sahal, 1981).

5.1 Kind of innovation in the cluster.

The specialist innovations like the systemic ones are attributes of the enterprises responsible of the program and even Alenia, the larger Italian enterprise in the field, can decide independently the objectives and the modalities of attainment in marginal measure and limitedly to the own area of competence (structures and materials). Therefore the, intermediate and final, customers want and drive the innovations, put generally in action from the SMEs, and they are very little autonomous in deciding objectives of the innovation. The firms that make products on which they maintain the responsibility of the airworthiness as who produces also small airplane of general aviation, in such within have, obviously, greater freedom.

5.1.1 Innovation of process and innovation of product.

Therefore, the introduction of new processes, as the improvement of the existing processes in the medium enterprises, is a kind of innovation diffused enough. In particular, recently the enterprises

² On this concept Doses (1982), Momigliano and Dosi (1983), Freeman and others (1985). The concept of "technological guidepost" derives from the concept of "scientific guidepost" sees also Kuhn (1980), Bernal (1969) and Koyré (1980).

that have changed property have been subject to a deep re-planning of the previous organization, starting from the layout of the machinery. The introduction of new processes is for the introduction of new operativities or for new products rather than for the substitution of obsolete processes. The improvement of the existing processes is like a process of "ordinary innovation" in the sense that also within of a same program the requirements of the customer and normative modifications involve an almost continues planning of the processes that ends up to become "ordinary". In the small enterprises, the product innovation is practically absent regarding the activities carried out in the field.

5.1.2 Innovation in the organization.

The medium enterprises turn out much more inclined to implement processes of organizational innovation then the small enterprises. The companies that have endured changes in the property are also those that have implemented the most important organizational innovations. However, there are also other motivations, like the evolution of the supply chain, the introduction of new products, and the necessity to adapt itself to the intentional organizational changes from the customer. This last factor determines important changes in five companies, in fact, Alenia is strongly intentioned to the passage from *working account* to the *full purchase account*, such process is still in phase of transition but it will have important repercussions on the SME.

We will analyze some repercussions in the continuation:

Acquisition of the raw materials on *working account*, such contractual typology previews that customer loads the acquisition and the management of the raw materials. The SMS has only the burden to control the relative documentation, supplied with the material from the producer of the same one.

Acquisition of the raw materials on *full purchase account*, such contractual typology previews that SME suppliers load the acquisition and the management of the raw materials, preventively characterized by the customer³.

This relevant change implies some criticism for subcontractors that requires relevant changes in the SMEs' organization. In particular, it previews that the following effects will be taken place:

- The creation and the development of complementary activities, without benefit, like an adapted warehouse, and the relative workers and procedures of management with the use of ICT. It will be necessary, moreover, to manage the new kind of contracts and new suppliers. The SME that uses suppliers of raw materials characterized by the customers does not except by carrying out same tests, this implies the acquisition of new technical acquaintances and of new procedures. If the SME decides to buy raw material from suppliers not characterized from the customers the situation could reveal still more serious. In such case, in fact, the SME must qualify suppliers and materials.
- A widening of the timesheet window. Although it is thinkable that the customers will preview larger times for the programming the production, the SMEs will extend the own scheduling, because of the raw materials time recruitment. Delivery time for same materials is also of more than 30 months.
- An increase of the management complexity. It will be necessary, in fact, to supply to an adequate complex of organizational rules that go from the emission of order for raw materials, to their connection with the timesheet and to the verification of the requirements of the customer. To understand the complexity we note that a software for the warehouse

³ For example the Alenia's "Guides lines for suppliers organized in a vertical system that mean to use the DCA" (delegation active tests) say that subcontractors can acquire raw material from Alenia's suppliers of raw material. In such case the subfornitore is exempt from the chemical and physical controls on the raw materials limiting the own responsibility to the tests of hardness, conductivity etc. and to the verification of congruence of documentation supplied from the producers and the verification of the approval of the Customer Coordinator (resident Alenia near the producers of raw material).

management that can compute correctly, does not exist to re-use the parts of raw materials turning out from a sure working and, theoretically, usable for the particular of smaller dimensions. Now such odd are like shavings and conferred in quality of refusals, but with the direct purchase of the material a recovery of efficiency is useful.

Such innovation sees involved four medium enterprises and one small enterprise that appears the only one of the category destined to make important organizational changes. The other small enterprises have introduced small improvements in the own organization as adjustments in the Quality Management or in the administrative processes.

5.2 Motivations to the innovation.

The motivations that push a company to undertake an innovation process can be grouped in two categories: to answer to the perception of a danger or to profit for one opportunity. In such sense, there are not important differences between the various enterprises of the cluster from dimensional point of view. The enterprises that at the end of '90s poured in particularly critical conditions, have innovated in order to answer to the requirement of recovering competitiveness and market share, and also introducing new operativities. The enterprises that, on the contrary, at the end of '90s, did not pour in particularly critical conditions have been able to innovate by answering to the opportunities that were offered from the market. The main innovations do not appear directed, as it could seem obvious in relationship imprinted to partnership, to improve the own position with the customers, rather than to try new markets also through the realization of new products.

5.3 Evaluation of the innovation opportunities and obstacles to their attainment.

All companies think that they have the possibility to be useful for a greater part of innovation opportunity. Although it is true that in some situations they have had to choose between opportunity coeval so they must neglect some or postpone some other, enterprises are quite satisfied. The innovation processes are always processes with high risk also in areas where the use to make innovation is largely consolidated. The technical, organizational and managerial factors, in terms of material resources and skilled human resources, do not represent a particularly critical point, for the small like for the medium enterprises. The real criticism for the most part of SMEs is finding the financial resources for innovation. Also on this point, there are not differences between small and medium firms. Real differences are in the entrepreneur acquaintance with financial institutions. Also the role carried out from the public finance that it could constitute a useful support to the financing of the innovation processes is invalidated from the financial institutions, that assume, "an harassing and sometimes irrational attitude". As an example, we refer to the refusal to grant an increase of the bank credit to small enterprise despite of a public financing already approved and financed but materially not distributed. The episode has created remarkable problems to the firm that has risked also the declaration of bankruptcy.

Therefore, the SMEs could use facilitated finance to make innovation, but financial needs are not covered by this one totally, so they must use also financial institution. Some times low support from financial institutions make not possible the use of public finance.

5.4 The sources of the technologies for the innovation.

The firm's competencies and the productive characteristics are the key factor in the choice of technology sources and the transfer modality.

All the enterprises in the cluster use some sources of acquaintances and of competences even if the acquaintances, acquired from the same source, can have relevance really different in the process of innovation. The participation to trade fairs and extensions has an absolutely priority role that concur to be abreast in machinery and related software of management. For the same motivations, relations with the machinery producers and with the representatives are important, last ones can give contribution also in the use of new materials. The knowledge acquired in this way is not fundamental for innovation, and losing importance with the growth of the firm's dimensions.

Customers and suppliers are the most important sources of know how, also for the possibility to activate processes of technological transfer based on *making together*. In this way, acquired knowledge is entirely and immediately usable, reducing times and costs of learning and therefore the diseconomies connected to transitory. The innovation generated from the know how acquired from the customer, turns out particularly useful to the SMEs for the generation of integration processes that allow to develop tight relations of long period. The suppliers are sure important for innovations only when are "suppliers of specialties". That kind of suppliers use extremely specific techniques subsidiary to SMEs' techniques. In the case of "suppliers of capacity" that use techniques similar SMEs' ones, their role in the processes of innovation of the SME customers is low.

The specialist publications as the participation to conventions and seminaries involve transfers of nearly exclusively technical information. The great majority of the enterprises use this source. Such information is very important in implementing business processes of innovation. Relationships with the University and the Publics Research Centres are decidedly interesting; they develop technologies very near to the technological frontier and, often, move it ahead. The overwhelming majority of the enterprises uses this channel. Such phenomenon is important if we think that between SME in Italy in all fields only 2% entertain continues relationships with University and the Publics Research Centres, while 16% declare to have sporadic relationships (Tagliacarne Institute, 2003). We want to emphasize that the relationships with the PRC are true structured relations, by which SMEs develop and industrialize new techniques that, once integrated with the necessary complementary knowledge, originate important processes of business innovation. These relations are very different from the relationships present in other fields where relationship is between the single researcher and SME, quite like a consultant.

The relationships with consultant evolve in the time, ranging from consultancy closely focused on the fiscal and commercial aspects to several and articulate relations. In the small enterprises dimensions that focalize on the production process and externalize activity that generally is thought does not bring an important contribution to the know how of the enterprise, even if they understand the value of such activities cannot be underrated in order to catch up suitable standard of performance. Small firm use in smaller measure, but in increase regarding the past, technical consultant also. Firms where the planning of the product is of competences exclusive of the same one, a fundamental role in the processes of business innovation is played from the so-called the Job Stopper⁴. The contribution given from such workers is obviously in the solution of a specific trouble but their importance is also on the plan of the increase firm's knowledge. In fact, the Job Shopper working flank to flank with the technicians of the firm transmits an important part of the own knowledge to those people with which he collaborates. Therefore, by working together the enrichment of firm's knowledge is continuous, and embraces the explicit part as well as the tacit part. With the same frequency, medium firms use the organizational and managerial consultant to optimize the decisional and communication processes and to make a better choice of kind of innovation. Regarding consulting the possibility appears obvious to develop synergies between the SMS of the field. To network a series of services would allow who offers the advising to optimize resources and to offer a strongly finalized service to the specificity of the field and to the SMEs to acquire a service of greater effectiveness with lowest cost.

Many firms consider that knowledge present in the inner human resources is the main source of knowledge for innovation.

6. The process of knowledge creation.

The firms that are in the aeronautical field use highly specific knowledge and competences. High specificity of the production process implies that the investment in knowledge has the

⁴ Draft of freelance, technicians super specializes that the company involved in the technique solution.

characteristics of a *specific investment*⁵. Unanimously with the approach of the management of the acquaintances of the territories the process of interactive learning and that one of innovation is the result of one tightened interaction of six various levels.

6.1 The focalization on customers' satisfaction.

The SMEs have continued relationships, in some cases also for many decades, with the customer. Such a circumstance has surely contributed to the creation of complex and articulated relations. These relations are often extremely structured and however very distant from the mere exchange goods – money. That typology of relationship has their origin in the necessity to develop synergies between customer and suppliers. First indication of the importance of the relation between customer and suppliers is the weight of the customer on the turnover of the supplier. An elevated weight can be indicative of a strong relation but also of a high degree of dependency of the supplier. The first customer engages on average the half of the turnover. However, it has been observed that for many enterprises this data is increased to 70%. Such a circumstance, joined to the fact that great part of the investments introduces the characteristics of specific investments (see note 5), and that the customer represents the more important technology source, they makes the adhesion to the requirements of the customer the relevant motivation to the innovation.

In such a sense, SMEs focalize on the continuity of the relationship in long period perspective rather than on the realization of high profits in the short period. The adoption of an innovation is the result of the focus on a localized framework and of the clear definition of a specific problem, which calls for a solution and motivates to a search of different complementary competencies. Nevertheless, since the final customers are international enterprise does not appear corrected to reduce the innovation processes to "local" phenomena. Moreover, although there are some examples of use of international competences, it is rare between the SME.

Now, like in the past, large enterprises localized in the regional territory drive and manage the processes of "collective innovation". We remember that Alenia, at the beginning of the '90s decided to support the start up of a centre for the treatment of metallic alloys, used in aeronautic, that can serve all the SMEs of the field. So Alenia urge the constitution of a consortium that acquires and certify with the support of Alenia, all the machinery necessary to carry out the treatments demands from the field. This is the genesis of the CTS, Center Special Treatments, in shape of society consortium. The CTS, also with optimal characteristics of efficiency and effectiveness, fails after two years because of changed market conditions, when the same associates of the consortium begin to make "elsewhere" the workings for which the CTS was born. To such failure is not stranger that from the constitution to the failure has been an alternation in to Alenia's top management that had turned out the two main supporters of the plan. The episode has deeply conditioned the vision of many entrepreneurs on the possibility to implement processes of innovation of any type in collaboration with other enterprises, customers, suppliers or companies of the same productive level.

6.2 Manage accessibility and technological capital.

Since cognitive processes and innovation in the firms often develop in the framework of a specific "local" problem and they require the in depth knowledge of clients needs and of suppliers complementary capabilities, geographical proximity and appropriate technologies, such as ICT, may help the development of the relations with various other actors and firms. The access to external complementary competencies and the access to a variety of building blocks of codified and of tacit knowledge requires the creation of those hard and soft infrastructure both in a local context and at the interregional level, which allow to organize the knowledge and innovation networks. To

⁵ Specific investment is an investment dedicated to a specific relation or a specific field, and that when realized, lost great part of the value if used in different way (Klein et al., 1978; Pitman, 1991).

such situation places, remedy partially the role-played from those enterprises that in the cluster have a greater relational skill and that carry out the role of technological gateway for the cluster.

The enterprises of greater dimensions have the necessity to carry out a constant search, on the global market, in the attempt to identify the technical and scientific acquaintances that will be able to evolve in technical acquaintances adapted to improve firm's performances.

The enterprises of smaller dimensions, with some exception for small supplier of specialized work, stretch to concentrate themselves in the valorisation of the existing technologies. In such sense, these firms need smaller complexity of relations.

6.3 Manage receptivity and human capital.

In the aeronautical field, a new human resource is really operative only after a long time of formation, generally around four years, because of the particularity of the strongly conditioned production process tightening requirement of quality of the product. This long period of formation implies high costs and the impossibility to use shapes of job to determined time in order to face the production peaks, as it happens instead in other fields but also human resources spillages from other fields. We want to underline that the recent crisis of 2002 and, above all, that one of the beginning of '90s has seen the spillage from the field of numerous human resources and it is difficult rebuild that patrimony in short times. This phenomenon emphasizes the necessity of a new approach to the management of the human resources. Approach that must hold account that this human resources are patrimony of the local community in the aim to use this skilled resource in the next growth phase of the aircraft field.

Between the technicians and the manager of the SME, we find a variety of professional shapes often tied from atypical contracts but they have a true and own directional and decisional responsibility in the enterprise. Some manager and technicians in pension, spillages from large enterprises, PRC or other agencies with large knowledge and net of personal relations can support SME competitiveness.

Independently from the dimension of the enterprises, human resources in the field have elevated instruction. Draft of a rich patrimony, in some latent way, that it can represent one great opportunity in terms of ability and creativity for the SMEs. The elevated level of education with the formation received in the firm represents a not negligible patrimony and it is an important opportunity in terms of ability and potentiality. To maintain and to develop a significant patrimony of human resources is a task, for a series of reasons, extremely arduous. In the first place, the wide presence of graduates used as labourers, if on one side it testifies the great potentiality, from the other can make to trigger demotivation that they can generate strong tensions inside of the firm.

In this context of elevated education, strong attention to the quality, remarkable weight of the investments, does not surprise an intense activity of formation. The SMEs make formation through various modalities:

- in company (through practical and with the course on specific arguments);
- nearby the suppliers of machinery and system (that it regards use and management of them,);
- nearby the customer, and in this case is just a transfer of knowledge from the customer to the supplier.

However, this formation is directed, mostly, to labourers and technical workers, with essentially technical topics, or in the aim to obtain and to maintain the Quality Certification. So it is, mostly, formation with the aim to develop technical know how rather than organizational and managerial ones. SMEs' management never attempts courses of formation. This is an approach strongly oriented to the hard activities and little inclined to face the management problems.

The SMEs think that the legislation relative to the practical on the job is not adequate for effective use of who is on training. Moreover, there is a deficit of public formation courses on issue of interest for aircraft field because of lack of an institutional interlocutor in local institutions.

6.4 Building a common identity and improve institutional/organizational proximity.

Actors to be involved in innovation should share common aims, mental models, as also trust and loyalty. To promote knowledge sharing and the willingness to collaborate requires a change in the corporate culture. The identification of common challenges to survival and development creates a sense of belonging to the same community or group, and is a prerequisite for collaboration in innovation. In the aeronautical cluster, a common culture derives from the long tradition that the region has in the production of aircrafts. The situation in Campania appears showing a deficit of some fundamental characteristics for the constitution of knowledge and innovation network. In particular, the trust and loyalty between customers and suppliers was one of the key factors of the technological increase of the cluster, the events of years '90, partially, tilted such feelings. The sharing of the acquaintances and the availability to collaborate with the other actors of the cluster has the necessity to recover totally the climate of confidence and the acknowledgment of the mutual loyalty. Now in many companies a generational turnover is in action in the SMEs' entrepreneurs that could favour such recovery. This implies that large national enterprises fix innovation's objectives, for the single SME like for the cluster. In such sense, many SMEs are strangers to the decisional process concerning to the location of objectives and, therefore, little motivated to pursue them. A decisional process mainly participated from the SMEs would be favourable like the autonomous location of innovation objectives for the SME. The ability to collaborate with the other enterprises of the cluster can be considered a shape of tacit acquaintance and are tightly related to the creation and the development of several intermediate institutions, such as industry associations, specialized services, or just commonly agreed routines, which are part of the "social capital" of the regional economy.

Therefore the sharing of a common productive culture is a fundamental requirement also for being in a position to acknowledge know-how transmitted from the industrial customers. In fact the collaboration with the customer implies, in agreement with the literature on supply chain, not a mere exchange goods-money, but rather a relationship than is near to integration in which the large enterprise guides the increase of its own suppliers.

6.5 Leverage creativity and manage internal organizational capital.

According to cognitive theories, creativity is related to pattern making or the capability to establish original contacts or synapses between different potentially complementary informations, technologies, knowledge, thus leading to new discovery and inventions. Creativity is crucial in order to diversify the structure of the local economy into new productions. Obviously the creativity cannot be planned, the ability to find solutions for old problems cannot be programmed, but it is possible to create the conditions because such abilities can adequately be valued. In particular, in order to increase creativity, the enterprises aim to leverage morale and to the empowerment and commitment of people, in order to secure to potential inventors the freedom, security and willingness to invest in risky exploratory analysis and in a lengthy process of systematic search.

In the Campania's cluster, the ability to produce new acquaintance is concentrated in R&D departments, where present, or in the technical function. Frequently is the entrepreneur that carries new ideas that will be able to originate innovation in the firm.

6.6 Insure the governance and enhance entrepreneurship.

The implementation of innovative solutions in the organization of the cluster requires the capability to cope with key problems of the various organizations, to manage the complex relationships between many different actors, and to mobilize them. This requires entrepreneurship capabilities and to integrate knowledge with complementary material resources, in order to transform knowledge into action. The government of the processes demands an explicit effort in the creation of institutional references that can guarantee an independent government of the existing social capital contributing, at the same time, to its increase and valorisation. Such creation cannot prescind from investments, also huge, explicitly dedicated to it.

In particular, the development of a local system appears necessary, that has ability for-assets to the changes in action, through the institution of a Permanent Observatory in the aircraft field. In such structure must be included all the entities that are part of the sector. More specifically the Government of Campania Region, the PRC actively present in the acquaintances production relevant for field (CIRA, CNR, and Universities), the industrial associations and unions.

Beside the function of economic and managerial observatory on the aerospace field, it is possible to characterize some of the main activities that such observatory would have to carry out:

- *Auditing of the search*, which it can make available to the firms working in the aerospace field, most recent searches conducted in national and international PRC. Observatory must be focalized on researches that can be useful for the improvement of the products and the processes techniques, through the activation of the opportune processes of technological transfer. Particular attention seems to deserve the organizational and managerial component of the technology.
- *Auditing of means and the productive methodologies* that can offer scenarios of more modern means for the aircraft production, with particular reference to retrofit of local firm equipment.
- *Auditing of projects and programs*, for a continuous of the market opportunities.

7. Conclusion

The aircraft field, at the global level, is in turmoil. The traditional Core Technology is changing, from focus on techniques knowledge to organizational and managerial ones. The SMEs, localized in Campania, are adequate to make technical innovation, but smaller firms are in difficulty in the implementation of organizational and managerial ones.

The large national enterprise localized in Campania give a good support for innovation made by the single SME, but they do not have a strategy for cluster innovation.

Local Institution that should be prime actor in the cluster organization, put in act a lot of action to support SMEs' grown but really incoherent, so they can't have an important role in the cluster growth. Most of all, Local Public Administration is not a powerful link with Local Finance Institutions that are really inadequate to SMEs' needs. Particularly SMEs have proximity with local public administration and with other local organizations, but there is high cultural distance with local and national politicians, particularly about feed back time in the answer to the SMEs' instance. Definitely, the organizational and managerial model of the Campania's cluster became more and more inadequate for the challenge of global competition.

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NOTE

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The final version will be presented at the Conference and available on the project IKINET site <http://iunet.uniroma2.it/ikinet/>

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