

SMEs AND INNOVATION: THE ROLE OF THE INDUSTRIAL POLICY IN ITALY

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May 2001

Abstract

The aim of this paper is to match the Italian small-medium firms' (SMEs) need for technological innovation and the state and regional aid programs aimed at supporting innovation and technology. The purpose is to highlight existing capabilities and new opportunities in support of Italian SMEs requirements in innovation. The paper reports the results of two empirical research projects recently carried out at Ceris-Cnr (Institute of Economic Research on Firms and Growth – Italian National Research Council). After a framework of the most important innovation policies the Italian aid programmes for innovation and technology are described. In particular the role of the Italian Regions is analysed in depth. The empirical research confirmed that the approach to innovation of Italian SMEs tends to satisfy the demand of existing market in the best possible way compared with competitors. Product improvement follows incremental processes. The most common way of introducing new technology is the purchase of new machines and equipment to reduce costs and improve quality. All the industrialised countries tend to favour the linking of the SMEs with external sources of knowledge. The research shows that such a policy clashes with the SMEs' capacity for absorbing innovation. Most of them lack the technical structures (technical office, design department, R&D laboratory, prototype department, etc.) and graduate staff capable of interfacing with the research world.

Keywords: Innovation, Italian SMEs; Diffusion and technology transfer policies; Infrastructural policies.

Jel Classification: O33, O38

WORKING PAPER CERIS-CNR
Anno 3, N° 6 – 2001
Autorizzazione del tribunale di Torino
N. 2681 del 28 marzo 1977

Direttore Responsabile
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Maria Zittino

Distribuzione
Spedizione gratuita

Fotocomposizione e impaginazione
In proprio

Stampa
In proprio

Finito di stampare nel mese di ottobre 2001

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Private edition

CONTENTS

1. Policies for innovation and technology	7
2. Innovation policies in Italy for SMEs	10
2.1. <i>National policies</i>	11
2.2. <i>Regional policies</i>	12
2.2.1. Regional measures for innovation and quality	13
2.2.2. The lack of infrastructural policies	15
2.2.3. Innovation policies for industrial districts	17
3. Innovation and Italian SME's	19
3.1. <i>Obstacles to innovation</i>	22
3.2. <i>Human resources and the labour market</i>	24
4. Next steps	26
4.1. <i>The absolute necessity of infrastructural policies</i>	27
References	29

1. Policies for innovation and technology

Since the 1980s all the governments of industrialised countries and of those undergoing industrialisation have adopted a vast range of instruments which can be considered policies for innovation. However this concept has not yet been clearly defined and the theoretical literature available is still insufficient, while empirical information is fragmented and in any case very recent.

Generally speaking it is possible to identify two aspects within the innovation policies, one is scientific and the other is technological, and they are substantially based on the linear model of innovative process which was criticised by Kline and Rosemberg (1986) inasmuch as the relationship between science and technology is extremely complex and leads to widely varying situations. However, for some time after the second world war many governments considered the technological policy an appendix to the scientific policy and they therefore privileged financing of research activities and the growth of connected structures (teaching and research).

Since the more recent situation, in particular that of US, has shown the weakness of this system, the technological part has become increasingly more important and has been translated into a true technological policy, by which we mean the overall policies that influence company decisions regarding the development, the sale or the adoption of new technologies (Mowery, 1994).

The intervention of the European governments is nowadays almost exclusively aimed at the small and medium businesses and attempts, through various measures, to increase the link between the world of the companies and that of public research, positioning research or otherwise highly qualified personnel in small firms in order to encourage the creation of high technology businesses. This tendency has its origins in the beliefs held by the political class of these countries following numerous studies into factors concerning technology: the growing importance of innovation in international competition, the increased weight of scientific research in the innovative process, the creation of occupation by the sectors with a high technological content.

Since the 1980s all these elements have led the European governments to rethink their industrial and scientific policies and they are increasingly abandoning the direct aids for investments and creating a number of more versatile and specifically directed ways of supporting of innovative projects. This approach has been followed by regional authorities which have, almost everywhere, assumed an active role in support of innovation, substantially complementary to that of the state.

Actually innovation policies embrace three main support typologies: mission policies, diffusion and technology transfer policies, infrastructural policies.

Mission policies consist of financial support for research into cutting edge technologies, whether carried out by research institutes or businesses. The principal objective of these initiatives is to concentrate public financial resources on both basic research with particular attention to the more promising technologies and on applied research at a pre-competitive level.

Support for general technologies through co-operation between businesses appears more interesting. Examples of this are the Sematech programmes in the United States and Esprit, Brite, Race and Eureka in Europe. This second and more recent approach is influenced by the conviction that it is possible to reduce research costs and distribute the risks through co-operation. However, some empirical research has shown that economies of scale are not always present and that, in order to take advantage of the results of joint research the companies must, in any case, create within their own in-company structures of knowledge and expertise, without which it is impossible to use the newly gained knowledge.

The internationalisation which has occurred in the scientific and industrial context of advanced technologies also poses the problem of coherence between the objectives of the governments and the beneficiaries of the financing when the latter are foreign. In fact while at a European Union level co-operation between companies and research institutes from different countries is an important objective, the relationship with American or Japanese companies still poses some problems.

In any case it is important to note that this type of policy for innovation increasingly tends to elude any rigid national formulation to assume international or sovranational connotations with all the positive and negative implications which have already been encountered, for example within the EEC programmes and Eureka.

A second general area of public intervention is represented by the *diffusion and technology transfer policies*.

The most traditional initiatives were based on aids (through subsidies or tax credits) to purchase new machinery or equipment incorporating innovations. However as the characteristics of the innovative process have changed, throughout the 1980s the emphasis has been placed on measures aimed at favouring the transfer of knowledge from the places where the research is carried out to the companies, with particular attention for those of small and medium dimensions. It has been pointed out (Dodgson and Bassant, 1996) that these policies may be of little use if the capability gap which often prevents the smaller companies from making use of new knowledge produced outside the company is bridged. For this reason the most recent objectives of these

policies have become: the encouragement of research within the companies, of collaboration between companies and between companies and universities and the creation of new companies in the high technology sectors.

Other initiatives have involved, above all in Europe, incentives for the employment of young researchers in companies and the creation of research groups (permanent or temporary) with personnel drawn from industry, universities and research institutes.

This type of activity is linked to the conviction that a considerable part of the innovation is produced tacitly and therefore the transfer in these cases must involve the creator and possessor of this knowledge, that is the researcher.

Least, according to the most recent analyses of a structural type (Justman and Teubal, 1996) the *infrastructural policies* seem to take up a central role since it is believed that technological development will be increasingly conditioned by the presence of a public offer of technological capability useful to industry and available for a variety of applications by a number of companies or institutions. In such a situation it is obvious that many of the instruments indicated in the other two types of policy for innovation would come within the new concept of Technological Infrastructure Policy (TIP): in particular well known instruments such as scientific and technological parks created around universities and research institutes which act as catalysts of knowledge and incubators for new entrepreneurial activities. Nevertheless in various countries numerous experimental projects have been set up at local and national level focussing on the creation of centres for technological transfer and on encouraging of companies to make use of the scientific and technical services of these centres, and of the universities themselves. This has led in the most advanced countries to the creation of a vast structure of technological services and mediation which mainly involves three types of protagonist: the producers of innovation themselves (universities and research centres), the collective economic organisations (chambers of commerce, industrial associations) autonomous institutions created specifically for dealing with technological transfer (agencies, information centres, incubators).

According to this basic classification, in the next pages (par. 2) we will examine the Italian policy for innovation using the results of a survey carried out by Ceris at the national and regional level. In par. 3 a short analysis of the main results of a research concerning the innovation needs of a sample of SMEs will highlight the distance between the technology approach of SMEs and the public support in Italy. Some conclusions indicating the improvements of the Italian policy for innovation will end this paper.

2. Innovation policies in Italy for SMEs

Analysis of the Italian situation first of all shows an evident division between the various types of public schemes realised between the post-war period and the present day. For too long the education and the research systems have been managed separately without any attention for updating and modernisation. Therefore not only have the two systems remained substantially centralised, but over the years the distance between them has also increased in terms of knowledge and fulfilment of the requirements of the country. This is not merely a problem of non-communication or non-awareness between the world of research and the world of small businesses (Bower, 1992; Charles and Howells, 1992). Rather, in the midst of general disinterest, technological trajectories and learning processes have been forcibly separated as is shown by the recent research “Road Map for Italy” (Murst-Confindustria, 1999). For this reason the weak mission policy, mainly pursued through the National Research Council, has principally benefited the university-research system and to a lesser degree the bigger companies. Until the amendments made in 1995, also the most important innovation scheme (law 46/82) was essentially used by big firms (Ceris, 1997b).

A specific law (317/91) intended to become the principal direct or indirect support for innovation in SMEs, but it has been largely disregarded: chronic lack of funds, delays in issuing the necessary rulings, overlapping with other schemes. In effect this bill has become a simple law for encouraging investments without therefore leaving the traditional approach of the Italian industrial policy (Tattara, 1996). That is indiscriminate supports without a strict evaluation of the projects.

In this context it is possible to note the lack of an infrastructural policy above all in favour of technological transfer. Not only is there no national dedicated structure, but any measure aimed at encouraging and urging public and private bodies are totally missing. The recent and limited experience of scientific and technological parks clearly shows the lack of an organic and coherent plan.

As far as the important and delicate matter of technological transfer through individuals is concerned, the measures supporting the employment of young graduates and researchers has met with unequivocal success and the available funds ran out within just a few weeks. These measures are so recent that it is not yet possible to make a precise evaluation. On the other hand the transfer of public researchers was a failure for the opposition of the researches and the deep separation between SMEs and public research. Further critical elements emerge from the comparison with other countries. It is possible to note not only the lack of a strong project manager¹, but also the lack of

¹ For example ANVAR in France and the *Teaching Company Directorate* in UK.

links with the university and research system which elsewhere plays the role of supporting the introduction of young graduates in the firms.

2.1. National policies

The attention paid to SMEs within the industrial policies is slowly evolving, in particular with regard to innovation which is often considered to belong exclusively to large companies.

In the past the national and regional system of aids, and the management of community funds for innovation and quality in favour of SMEs usually suffered of planning incapacity, short-run vision, excessive bureaucracy, decision making centralisation, lack of co-ordination. Nowadays the simplification of the procedure for applied research, the increase in the use of EU funding, the co-ordination of the territorial and industrial district pacts, the new role carried out by the regions, are just a few examples of the change.

The proliferation of laws has always distinguished the Italian state aids. Approximately 550 regional and 14 national laws for support firms are in force. Obviously, not all of these refer to innovation and quality, respectively 30 regional and 10 national laws fall into this category with a plurality of support measures.

At a more general level the national system of aids has mainly favoured process innovation than product innovation (Table 1). Due to Italian SMEs generally show considerable difficulties in accessing innovation, law-makers should enlarge the approach to innovation more than the mere acquisition of technology by machinery.

The nucleus of the national activities to support innovation and R&D in small-medium firms is the law 317 of 1991 that, for instance, does not include measures for the introduction of quality systems and the certification of products and processes.

The formulation of this law was in many ways highly innovative both as far as the financial measures, participatory loans and tax credit were concerned, and with regard to the adoption of quick procedures. However, its application and the results attained were considerably less than expected.

The intent of the law was to affect contemporaneously the demand and the offer of innovation. In the first case by encouraging the companies to ask and absorb innovation. In the second side by facilitating: the setting up of consortiums for supplying real services; loan consortiums; risk capital through participatory loans and favour the setting up of financial companies for innovation and development. As a matter of fact the law 317 has been characterised by the lack of funds.

In particular the funds available for the innovative investments have been used to cover only partially the numerous applications. In fact, capital subsidies were granted only to those companies which applied the first day the law came into effect and they have received on average a contribution equal to 16.25% of the investment made. Overall a billion lire has been granted and the grants have covered only 50% of the applications. The introduction of the law 341 of 1995 for automatic aids has in effect replaced the procedure, and therefore future re-financing is unlikely.

Moreover, in recent years new measures have been developed which in some cases are a copy of the law 317. Also, while thousands of applications under the law 317 lie unanswered, the funds of other similar laws have been used to a lesser extent. These laws are destined exclusively for the depressed areas of the country, while the 317 is the only law valid for all Italian SMEs.

The only valid option for the SMEs is to turn to the famous law 46 of 1982 which has recently been amended to facilitate the granting of funds relating to applied research for projects presented independently by SMEs. In fact, the new procedure includes: absence of specific guarantees and revision of the criteria of assignment, focussing attention on the definition of the objectives and the economic returns, simplified description of costs, prefinancing, fulfilment of the applications in 60 days.

The procedures for evaluating the economic-financial reliability are reduced to assess that the applicant does not have company debts above 50% of turnover; shareholders' equity is more than 50% of the cost of the research project (net of the grant); financial charges are less than 8% of turnover.

2.2. Regional policies

Generally speaking, the formal competencies delegated to the Italian Regions as far as industry is concerned are very limited in spite of the text of the Constitution.

The activities carried out by the Regions in identifying feasible industrial policies have encountered a lack of effective legislative power and of available financial resources. The Italian Regions are, in fact, included in a model of derived financing from the State budget with tied-up funds and without any form of direct fiscal drag.

However, this situation has not prevented some Regions from progressively proposing and deliberating a series of interesting and much appreciated laws and, at the same time maturing competence and professional skill capable of encouraging local development. While still limited to residual aspects of the industrial policy, above all in the northern regions it is now possible to note the existence of significant results and to configure a range of interventions sufficiently organic.

Since the 1980s the Italian Regions have joined the national government in actuating policies generically defined as “for innovation”. In reality the measures adopted at a local level pursue only in part the overall policies for innovation and technology, in fact the mission policies to support R&D lie within the competence of the central government. For this reason Italian Regions focused above all on the policies for the diffusion and transfer of technology and at a lesser extent on infrastructural policies.

The most traditional initiatives were based on encouraging the purchase of new machinery and new equipment incorporating innovation. In the 1990s the changes in the innovative process have emphasised the measures aimed at favouring the transfer of knowledge with particular attention towards SMEs. Other more recent objectives of the regional policies are: the encouragement of applied research; the co-operation between companies and between companies and universities or public research centres; the spin-off in high technology sectors.

The traditional aids, while remaining valid in terms of complementary support, are increasingly less efficacious if used alone. Fiscal aids depend on the level of the profit, and therefore are uncertain and in any case are postponed. In other countries soft loan and subsidies for innovation have been replaced by accelerated amortisation, tax-loss benefit or additional charge of the innovation expenses in the composition of the production costs (Airi, 1999).

In the industrial field the Italian Regions tend to pursue three objectives:

- policies to support competitiveness;
- measures aimed at promoting infrastructures and services;
- initiatives to aid territorial areas, industrial districts and areas of re-industrialisation.

As far as innovation is concerned the next three sections will examine each of these targets.

2.2.1. Regional measures for innovation and quality

All the Italian Regions have at least one law for innovation or quality although considerable differences exist for objectives and forms of facilitation.

The first difference concerns the southern Regions which generally have rather restricted areas of intervention and generally realised with structural funds. Other differences are to be found in the presence of particular requirements such as co-operation between companies, consortiums, type of sector, localisation in the objective

areas 2 and 5b, women's entrepreneurship, occupational increase, development of R&D laboratories, set-up of company incubators or new technology based firms.

The forms of facilitation fall within financial aids and could not be otherwise given the regions' inability to adopt tax or employment aids. Initially the Italian Regions adopted soft loan and strict selection procedures. In time however more traditional forms were introduced as capital and interest subsidies, above all in favour of investments made by minor or craft businesses. Recently also participatory loans have been adopted.

All the measures provide a maximum limit of subsidy and many of these percentage limits of contribution on admissible costs. Each admissible cost may include specific limits either in value or in contribution.

Regional support in favour of innovation is mainly concentrated on innovation of product and process. Generally for product innovation of all costs linked to concept, research and planning, engineering, prototype, test and reliability are financed, both the costs sustained within the company and the external technological supports.

For projects relating to process innovation, on the other hand, the costs relative to the study, the research and the design of new plant and machinery or modification of production processes are considered. The purchase of plant, machinery and equipment may also be considered. With only a few exceptions, the most of Italian Regions consider both the two innovative methods contemporaneously (Table 2).

Since the beginning of the 1990s the Italian regions have considered the development of total quality as a further area for supporting improvements in the production process, the productivity and the competitiveness of companies. The theoretical assumption is that investment in quality is the first step to invest in innovation. In this area the Italian regions have been particularly attentive and rapid in formulating forms of support. In fact Lombardy Region was the first in Europe to act in favour of quality control, but other regional legislators rapidly took up the same objectives (Table 3).

The aids in favour of quality are less complicated than those for innovation and have met with immediate acceptance from the companies. This is largely due to the relative ease of evaluating the projects and checking the results. The attainment of certification by a specific body is an undoubtedly unequivocal fact due to must be in accordance with UNI EN ISO 9000.

While the contributions are not high, on average between 10 and 20 thousand of Euro, the regional initiatives have often managed to convince companies to invest in quality. In fact while investments were initially seen as acquisition of a competitive

advantage over direct rivals, at present they are seen as necessary costs in order not to lose competitiveness.

While the regional aids shown in this paper addressed only two types of action, the analysis of the legislation has shown many differences from region to region. The differing methods make full comparison of the resources used and the results obtained difficult. The financial evaluation is also affected by two other impediments: some laws has come into effect quite recently and the results are not yet available. Moreover, regional laws often do not oblige the manager of funds to prepare technical-financial reports on the measures carried out. This leads to a widespread lack of information on the state of actuation of the regional laws and a profound difficulty in the evaluation of the results. Even in the cases where data has been gathered, they are frequently lacking in order and method and in assessment of the benefits obtained.

However, as shown in Table 4 almost 4,000 companies in the regions in which it has been possible to gather final data, have benefited from contributions and facilitation in setting up quality control systems, and more than half of these were in Lombardy alone. The average sunk fund contribution for the approved project was approximately 15 thousand Euro, while in Piedmont, where the method used was soft loan, the average value was almost 45 thousand. As far as innovation is concerned more than 1,300 companies received assistance.

In some regions the potential for activation of regional financing has generated investments which were three times greater.

2.2.2. The lack of infrastructural policies

Moreover the traditional measures are insufficient to cover the increasing needs of the SMEs above all in terms of: direct and concrete support for the realisation of innovative projects; availability of information; training of technicians, appropriation of the results of external research (patents, trade marks), etc.

These defects have been widely accepted and interpreted in the development of the policies for technological innovation in other industrialised countries, in particular France, Great Britain and Germany (Ceris, 1997a). They have focussed, both at a national and a local level, above all on measures designed to improve links between firms and research which are essential to create that substrata for the growth of a culture and an entrepreneurial approach aimed at technological innovation. The local governments of these countries have therefore accentuated the infrastructural policies since the conviction that the technological and scientific infrastructures represent the skeleton of an innovative system is now widespread.

The infrastructural part of the regional policies for innovation show serious limits not only due to the delay with which these problems have been faced², but above all due to the superficiality in the planning and management of the various measures.

Lacking national and regional laws and programmes³, the decisions of local administrators have been influenced by the availability of European and, to a lesser extent, national financing rather than a correct analysis of the local situation and careful planning of the real needs of the businesses and by the institutional, legislative and financial limits on the individual measures..

The conducted by Ceris on behalf of the Cnel (Ceris, 1997b) has identified only 161 operative structures of which the centres offering services of a technological type (wholly or in part) are only 80⁴. Moreover many of the institutes examined had only a modest level of activity or were in an initial or terminal stage of their being. The same is true of the 23 Italian scientific parks: very few of them are fully operative and therefore comparable with the almost 40 French technopoles or the 51 English parks.

The Italian system of structures which offer services to innovation are currently in a delicate situation of transition with a limited nucleus of centres fully operative having reached or being about to reach a substantial form of self-financing, while there is still a vast grey area of structures which are struggling to continue or which are set up and fail squandering public money without leaving any trace of their achievements. Amongst the few successful activities are some centres for service to innovation located in industrial districts. In fact more than half the service centres studied by Ceris (42 out of 80) have their headquarters in industrial districts with a high concentration in the areas with a lengthy local tradition (Piedmont and Lombardy) and of considerable public regional aid (Emilia Romagna and Tuscany). In fact it must be said that the success of these centres is closely linked to the areas in which they are located and the more vital and expansive these are the easier it is to find structures at a high level (Cariola and Rolfo, 1999). Their job in fact is not to operate as development agencies and this explains their rarity in the weaker areas such as southern Italy, but also in those which have developed more recently in the north-centre of the country.

The results of this situation have unfortunately translated into a high rate of failure of projects proposed and delays in reaching the operative stage due to this need to overcome resistance and obstacles of various kinds.

² It must be noted that some regions such as Emilia Romagna have carried out pioneering work in this field and are even taken as models abroad.

³ The law 317/91 and the law 46/82 are the only instruments available in this field even though they have modest financing and many limits. In any case they have been activated only in the 1990s.

⁴ For comparison it must be noted that at the end of 1996 in Germany no less than 1,036 structures were operating in the field of innovation and technological transfer (Reinhard and Schmalholz, 1996)

In fact in the successful centres, that is those which have been operating for some years and with a revenue of some billions mainly deriving from the sale of services, are the structures which evolve continuously⁵ and which tend to be more similar to consulting companies rather than public agencies.

A further critical element is the substantial isolation of many centres both with respect to the training and research institutes present in the area (universities, public research centres), and to similar structures operating in other areas or other regions. This causes, for example, the lack of those common initiatives which in other countries allow a synergic relationship between the institutes and the availability of the territory and of the local industrial fabric of competencies and equipment present in the world of research⁶. The lack of synergies leads in some cases to competition at a local level in the supply of certain services, for example laboratory testing, which can be offered by both the service centres, by other public structures present locally such as research institutes (CNR and ENEA) and by industrial technical institutes. This is not a positive phenomenon for the local system which cannot globally and synergically manage the activities of the public protagonists, nor for the latter who may be led by opportunistic behaviour (funds from the sale of services) to distance themselves from institutional activities.

As far as isolation from the local district is concerned it must be emphasised that this not only causes non-circulation of experience, but it also determines a competitive situation thanks to the evolution of the more active centres towards the offer of services with a higher technological and qualitative level.

2.2.3. Innovation policies for industrial districts

In accordance with law 317/91 the industrial policy to districts is completely delegated to the Regions, but after 10 years we are still at the beginning of a true policy for the industrial districts. In fact, at the end of the year 2000 only 5 out 20 Regions had completed the legislative procedures (recognition of the districts, indications of the objectives, setting up of local committees and identification of the supports).

The delays and the hesitation of the Regions are largely attributable to the ambiguity of the delegation set out by the 317/91 law that prescribed high limitations. For instance, the Regions could support only innovative projects relating to more than

⁵ In this sense they are similar to the scientific and technological parks which according to Butera (1995) undergo a transformation from caterpillars to crysalids to finally become butterflies.

⁶ From the Ceris research only two cases of active collaboration between the service centres and the research institutes were found.

one enterprise, on the basis of a programme contract stipulated between consortia and the Regions. A part from the restriction of the beneficiaries only to the groups of enterprises (dictated by the worry of transferring to the Regions the management of incentives to individual firms), this norm, if applied to the letter, reduced the intervention margin of the Regions to a minimum. With good reason the Regions have forced the national regulations, extending the benefits to centres for innovation or bland forms of association, and substituting the programme contracts with programmes for regional development. In the majority of cases, the beneficiaries of the programmes for the districts remain collective subjects but the temptation to repeat the system of incentives in favour of the individual enterprises is ever present.

Lombardy has been the most active Region. In 1993 it had already recognised the districts, defined the procedures for predisposition of the development plans and allocated the funds. The content of the different regional laws are very similar, often the same lexical format has been used, in particular as far as the financing and the aims of the projects. In this sense the Lombardy law may be considered a true prototype. The Regional laws do not deem the district as the sum of many SMEs, but rather as a single and organic structure of firms that interact with the institutional bodies in order to analyse in depth the problems of the productive system, pursue the more efficient use of existing industrial policies, seek and activate new forms of intervention. It is the entire system that is considered a beneficiary of the support and not the individual subject. For this reason the original mechanisms of co-operation and collaboration are favoured and the SMEs are required to form consortia of not less than five to realise one or more projects.

For the aims of the district programme, the state bodies (chambers of commerce, industrial development consortia) and territorial bodies (provinces, mountain communities, town councils), the consortia, the service centres, the state and private research centres, the associations of SMEs, the industry associations and the unions can prepare development projects which must refer to at least one of the following subjects: joint service centres to support innovation in SMEs; information desks to promote innovation; promotion of foreign markets and internationalisation of production; promotion of co-operation between SMEs for R&D and for technology transfer, technological structures and laboratories for quality control; renovation of abandoned industrial areas; activation of information technology networks; joint logistic structures; urbanisation.

The regional intervention consists, in all the regions, of capital subsidies to the extent of 40% of the expenses admitted (50% in Campania and Liguria), with a limit in

absolute value of 250 thousand Euro per year and 500 thousand Euro per three year period (the double in Campania), and is not cumulative with other contributions.

The aspect which most conforms the regional laws seems to be the search for self-awareness within the district, above all in the smaller ones, with the setting up of joint service centres or information desks, and in the organization of observatories on the district activities or of “economic animation”.

Technological innovation is pursued above all in the programmes of the industrial district of the most advanced regions such as Lombardy, where the law has been operative for years. In this region attention is paid to product innovation, with specific emphasis on technical information and quality control. Innovation in the field of management is also significant, aimed at responding to the numerous requirements of the individual businesses in the financial, legislative and marketing fields.

3. Innovation and Italian SME's

Since the 80's there has been a growing body of literature that focuses on the innovative behaviour of small medium enterprises. These studies while significantly fewer in number than those related to large firm, are often characterised by output measurement and the related R&D process (Link and Bozeman, 1991).

Although in many cases it has been possible to demonstrate Schumpeter's (1942) theory of a positive relationship between size and innovation, the results have shown a certain ambiguity and inconsistency (Acs and Audretsch, 1991; Toedting, 1990; Vossen, 1996). The main cause seems to be imputed to the scarcity of tools able of measuring the intensity of the firms' innovative efforts (Kleinknecht and Rejinen, 1991). The larger the size of a firm (and the more its research activity is structured) the easier it is to single out the indicators from the rest of the activities. The most innovation proxy variables used are R&D expenditures, the number of employees in R&D and patents. Besides, SMEs are an inhomogeneous set of firms over conditioned by the type of industry and the presence of big buyers and suppliers (Holmlund and Kock, 1996; Quayle, 1998).

It is important to point out that the innovative activity of SMEs is almost always carried out in a non-structured way by personnel or departments which predominantly carry out other activities (Rothwell and Dodgson, 1994). These are often innovative processes of an incremental or imitative nature where the main factor is learning by doing or learning by using (Favaretto, 1989).

The presence and the results of this informal activity emerge, therefore, from other indicators such as the product or process innovations introduced. This informal research activity is aimed towards incremental improvements rather than radical innovations (Santarelli and Sterlacchini, 1990).

In order to highlight the innovative approach of Italian SMEs, the Ministry for University and Scientific Research launched at the end of the 90s a research program (Road Map for Italy) involving about 300 SMEs operating in mature sectors: mechanical engineering, automotive, textiles-clothing, food and chemical industries. Within this project Ceris analysed 75 firms located in Piedmont, a high industrialized region of North-western Italy, through face-to-face interviews.

Literature takes for granted that technology is a crucial factor in competition is taken, on the other hand it is also true that no entrepreneurs will ever admit that their companies are characterised by a low technological level or that innovation is not a relevant aspect for their competitive edge.

The fundamental reason is due to the fact that small enterprises are created on the basis of an enterprising idea which they develop. In all the interviewed firms, the role of the entrepreneur is a stimulating factor and, to the current day, a source of innovation. The participation of the entrepreneurs in designing and innovation activities is high and the entrepreneurs preserve a greater position of control and influence in this field with respect to production activities. Often, in fact, notwithstanding the presence of technical structures devoted to innovation or functions in charge of monitoring the market on international level, the decisional responsibility lays in the entrepreneur and is often based on intuition or experience.

The prevalently technical background of the entrepreneurs is what distinguishes these small production realities with respect to the new company start-up analysis conducted, for example, in English-speaking countries, where more frequently the efforts of a group covering different, complementary skills can be found at the basis of a new enterprise. In Italy, on the other hand, entrepreneurs act essentially alone and are directly involved in all the company activities from the beginning. This full scale involvement offers few opportunities for creating and developing an internal technical group which can in time become a point of reference for the company. Only in the more evolved companies do entrepreneurs involve technical staff in researching answers to innovation stimuli.

The quality of this synergy is, however, conditioned by two factors - one technological, the other financial. The first is related to the characteristics of the required innovation. If it is inserted in the technological trajectories pursued by the enterprise (essentially mechanical), the aforesaid alliance becomes a virtuous circle. On

the hand, if the demand expressed by customers requires external skills other than those traditionally owned, the limitations of the family-owned SME appear clearly and severely as it has neither the internal technical resources nor the financial resources to make the required investments.

Given the diversity of activity sectors and company histories, we can notice how small size and the social-economical environment have strongly influenced the technological culture of the small and medium enterprise in Italy. This is, in fact, essentially based on traditional know-how acquired on the job. The innovation process generally follows the trial & error approach. Two groups can however be identified in this picture according to the internal availability of a technical office or a design organisation.

- In these companies, some innovative aspects can be found, as for example the links to the final manufacturers and other suppliers with the opportunity of directly co-operating in specific designs and acquiring greater skills and know-how or setting up small R&D laboratories. These are generally annexed to the design offices where the R&D programmes are developed very often on a part time basis. The research is essentially represented by the development of new product. The temporal horizons is short-term, in principle the projects must be industrially marketable within a year. In some companies, the definition of R&D laboratories is not compliant to the usual principles. However, it is beyond doubt that in these enterprises the attempt to extend the field of investigation subsists.
- For the cases in which the need for a technical office is not taken into consideration, new products are developed on the basis of experience, i.e. on the technical skills of the entrepreneur whose sharing the innovative activities can seriously endanger the initial commercial success. This occurs for two reasons. Firstly, management is focused on solving technical tasks and not on creating a dedicated structure which can survive lacks of creativity and specific skills. Secondly, the technical solutions end up insisting on known and familiar areas finding in the very source of ideas the primary cause of the incapacity of adhering rapidly to technological leaps. This situation also reflects on investments. In order to limit the development costs for new products as far as possible, a small scale production is set-up (sometimes using old machinery), then the market results are prudently evaluated and only subsequently is production reorganised according to the new product. Consequently, the preference falls on products generating a modest impact on processes and product for which experience is scarce are usually abandoned.

3.1. Obstacles to innovation

The perception of the SME panorama in Italy is that of a production realities undergoing in-depth transformations and characterised by a considerable dynamism. Increasing complex enterprising skills are more and more required in terms of sector, market, product, etc.. However, notwithstanding the enterprise typology, the manifest sensation is that of wanting to solve all problems inside the company or with the end customer, without acquiring a wider vision of the real obstacles to development and undertaking alternative routes. Only the enterprises with a greater presence of graduated employees and positioned in the most dynamic market sectors are open to the outside.

This is the case, in fact, of sectors which innovate without research. The innovations are based on accumulated experience and know-how created by others. In other words, the matter is the appropriation of information following the spill-over channels, i.e. the flow of not coded information independent from the will of who created it, and - less frequently - via market exchanges. An example of this is co-operation with suppliers. This knowledge is then valorised by the application to the sector and the company reality.

Another reason which explains the difficulty in employing the public research organisations⁷ lays in the nature of the “know-how” which is deemed useful for the sector, i.e. very practical and application-oriented, as well as only valuable in a very restricted economical environment. When the enterprises deem the relationship with public research organisations not useful they also express the consideration that it would be excessively costly to transfer specific skills for designing to consultants with a general background. It is, in fact, basically impossible to find researchers with such specific skills in this organisations or universities. To conclude, it can be said that the obstacles to the creation of this sort of relationship can be sought mainly in the difference in interests, language and culture - even though bureaucratic problems and long waiting times are also ascribed.

Unfortunately, the rather wide band of enterprises which do not enjoy relationships with public research cannot make suggestions to improve the relationship. Those who do not have an innovative culture generally are neither aware of such know-how producers. On the contrary, the few who manage some technology are reluctant to delegate this competitive factor externally.

In this context, the approach to improving the relationship between universities (CNR, etc.) and companies can only take a top-down approach. Considering that the

⁷ The most important are the National Research Council (CNR), the Energy and Environment Agency (ENEA) and the National Institute of Nuclear Physics (INFN).

small and medium enterprises cannot provide requests and prompts to the public organisations, the public organisations will need to invent a “service” which can satisfy the not expressed technological need of the small and medium enterprise.

The SMEs consequently complain of poor undertaking and low visibility of the activities of universities and research organisations which, generally, do not have a market oriented approach - by vocation or due to institutional constraints - and consequently tend to conduct research without “advertising” it very much and without contacting the small and medium enterprises which could be interested.

The small and medium enterprises would like to be directly contacted by the centres, also in a simple and brief way, for example by receiving brochures illustrating the research activities carried out in the various centres and forms to be filled out and returned indicating the lines of research, or the single activities, on which they would like to receive more detailed information and - where relevant - organise a direct contact.

Another obstacle, which can be overcome and which is evident in the relationship between SMEs and universities and research centres, can be found in the participation to EU research schemes. This is because a specific condition states that 50% of the R&D costs related to the activity to be financed must be sustained at the promises of the universities or public research bodies. The researches proposed by small and medium enterprises in many sectors do not usually carry such a high technological content to require 50% only for basic research or strongly scientifically oriented contents, which is the support generally provided by universities. The type of research of the small and medium enterprise is often more strictly applied and cannot always be adapted to the university reality. In these cases, the small and medium enterprises believe that the scope of their innovations in terms of development and experience does not justify a volume of resources dedicated in this way and that the products - also those which need to pass type-approval tests and field tests - are not suitable to receive basic research financing. Consequently, the relationship with research institutions is considered not strategic and the component, material and machinery suppliers information channel is still privileged. In order to incentive the joint participation of enterprises and universities to externally financed research schemes, it would be useful to simplify and speed up bureaucratic proceedings and decrease the resources quota to be devoted to basic research or high scientific contents.

With respect to this general situation, the trend for quality assurance certification has provided a considerable impulse to reconsidering the process in more “scientific” terms - i.e. as an issue to be considered as a standard rather than in terms of “good” or “reject” products - than leading to reverse engineering of processes. Technical and

technological human resources were thus introduced in the companies which gradually planned to grant them increasing space. This started to highlight skill shortcomings and human resource bottlenecks. Certification has led to a cultural change which weighed considerably on the organisational structure of the company. It defined a cultural gap between the younger and the more mature workforce. The latter is more resistant to innovation and often causes management problems and slows down skill transfer times. Often the enterprise cannot do without retirement age workers which are key figures in production.

3.2. Human resources and the labour market

The capacity of the industrial system in Italy to upkeep its current competitive edge is certainly related to the quality level of the production factors employed. The quality of both human and physical capital are, however, the competitive factors which are most difficult to attain. This is because of the long time required to change the current training and innovation configuration and the large number of economical and institutional parties to be involved in such an evolution at the same time. The employees, mainly those involved in the technical tasks, form a wealth of knowledge accumulated in time and their leaving the company can be a severe loss. Many enterprises have experienced the problems deriving from the retirement of skilled technicians or worse the leaving of young, trained staff seeking new carrier opportunities. It is no chance that personnel management is in the hands of the entrepreneur who, sometimes with a rather paternalistic attitude, aims at consolidating the precious human wealth. The results are highlighted by a restricted turnover and by a general tendency to take on technical or vocational school leavers to be trained in the company.

The need to adapt training schemes to market requirements arises clearly by affirming the lack of intermediate training between the high school diploma and the university degree: companies foresee a prospective need of 9% against 1% of employees at such a level.

The low number of graduates (especially engineers) in the small enterprises is the result of social and cultural factors which lead to see graduates as potential candidates for managerial posts, which in small and medium enterprises are often concentrated in the hand of the owning family. This leads to the tendency of young graduates to leave the SME after a certain period of time, mainly to be employed in larger companies, and triggers a vicious circle making the entrepreneurs prefer high school leavers hoping that they will stay with the company longer.

The scarcity of graduated personnel perfectly matches a reality which employs the trial & error innovative mechanisms typical of the traditional technical culture. Graduates (especially engineers) should take advanced skills and methods into the enterprise but these are often in contrast with such a culture. It is no chance that many small and medium enterprises declare with satisfaction that newly employed engineers go through a training period at the drawing board or in the workshop. Rarely do entrepreneurs see the turnover of graduated personnel as an opportunity for technological updating.

Considering the figures which are required and currently labour market shortcomings more in depth, we can notice a common denominator: technically focused and diagnostic skills (retrieving, interpreting, handling information) with solid interpersonal and decision making skills. This entails reviewing the current school curricula to aim for a mixed educational process which combines a greater interaction of theory and practice obtained in in-company training schemes.

In general, enterprises acknowledge that graduates (especially engineers) has a good theoretical preparation but lack in practical knowledge. On the other hand, for technical and vocational school leavers, the attitude appears split into two. Some call the public part responsible for all the shortcomings in training and others believe that an attitude of greater co-operation between schools and industries would be useful.

The solution on how to fill this educational gap will probably be found by facilitating the meeting between school and profession/production in areas where there is currently not much harmony. On one hand, there are various not co-ordinated attempts to create new curricula aimed at better meeting the requirements of companies. On the other hand, there are short-term strategies which do not privilege new production organisations based on transverse workforce skills. The latter, in more evolved work organisations, are called to solve problems and respond to production changes in real time, also by working in groups.

The picture which generally arises from the analyses conducted on this topic shows the discrepancy between school and industry whereas the first cannot organise specialised courses to educate the most wanted technical figures and the latter cannot show their needs to the youths so that even where such courses are organised few youths take part and are attracted by the most advertised. The difficulty consists in processing the training needs of enterprises in advance with respect to future skills.

In this context, the actions undertaken by many enterprises aim at creating relationships with some schools offering the students in-company training schemes lasting a few weeks. These opportunities allow to evaluate the potential candidates not only from a school education standpoint but also as concerns their personality. Since the

need for on the job training is widely accepted, recruitment points on certain skills and attitudes, firstly flexibility, availability to learn and attitude to changes. These are, in fact, the individual response of the entrepreneur to a rigid labour market which is deemed the major reason for not taking on new personnel. It is preferred to seek new organisational solutions in the enterprises - which in some cases are very costly - rather than “facing” new recruitment which entails training and introduction costs and which, above all, stiffen the company structure which can not longer be modified in periods of slack.

4. Next steps

The evidence reported in the previous sections allows us to offer some useful suggestions about the revision of the industrial policy for innovation and technology for Italian SMEs.

The research confirms that the national system of incentives for innovation is widely well known. The high percentage of companies in the sample which have benefited from at least one aid for innovation and the complaints of those companies who for some reason did not obtain them shows how consolidated these aids are.

However a generally negative opinion of the industrial policies emerges from the interviews. Not all entrepreneurs agree with the proliferation of aids. In fact, according to some, these forms of assistance “drug” the market, the state should rather improve the country’s infrastructures and place all companies on the same level.

Those laws in favour of the south that reduce taxes for a given period or favour limited geographical areas are particularly criticised. Others recognise their theoretical validity that is however accompanied by effective uselessness, due to the need to present voluminous and complex applications.

Many of those who have applied in the past (whatever the outcome) would not do so again. The dead-weight effect is considerable. Due to the lengthy waiting times involved and the uncertain outcome, the state aid do not affect investment decision. If the outcome is positive the company would then enjoy a reduction in costs. In such a situation the efficacy of the measure is approximately nil.

Naturally a preference for automatic instruments, such as accelerated amortisation or tax deductions, can be deduced from the criticisms themselves. The majority egoistically prefers capital subsidy. Nevertheless the company’s interviewed recognise that the best results are obtained with specific projects.

On the basis of sample analysed it is possible to suggest a net division between:

- Aid focussed on process innovation which should be financed by capital subsidies and automated aids, with a high rate of security, few formalities, rapid response and ease of use. The percentage of contribution must be limited. The process innovations are linked to rapid changes in the market and the automatic aids may facilitate the adoption of new technologies.
- Incentives focussed on product innovation which should be partly financed by very soft loans. The project must be highly formalised in order to favour selection by a qualified commission. The percentage of contribution should be proportional to the difficulty of the project.

Moreover, the relationship between companies' capacity for absorption of external technological activities is closely linked to the internal organisation of the companies. In the case of SMEs this capacity for absorption is not necessarily related to R&D laboratories but more really in the technical development. This is at least true for the majority of companies in the traditional and mature sectors. The offer of technological services from an outside research body becomes useless - even when free of cost - if the SMEs are not capable of formulating a suitable request and accessing a minimum of in-company professional ability.

This confirms the importance of innovation, which is not based on formal R&D input. In these firms the sources of innovative activities are technical planning, product development and the acquisition of technology incorporated in capital assets. Amongst these technologies for product and process development (CAD/CAM/CAE/CAS) and the test laboratories, that many Italian SMEs do not own, are becoming increasingly essential. These technologies fall halfway between process and product innovation and can highly support firm growth.

4.1. The absolute necessity of infrastructural policies

If we attempt to compare the Italian situation with that of the most easily compared European countries, as well as the quantitative differences already mentioned, above all the qualitative differences become evident. In fact the numbers include a plurality of typologies, objectives and supporters which however belong specifically to each centre. These typologies such as university and research centre co-ordinating offices are practically unknown in our country, as are demonstration centres managed within the university or research structures. The European chambers are almost everywhere heavily involved in performing services, even though they are often limited to basic information and initial contacts.

In countries such as France and Germany the specialisation of the service centres is seen as fundamental in terms of services performed, of clients served and of supporting institutes. Clearly this causes the creation of a fairly high number of measures which could at first seem misleading with respect to the needs of the companies but which is shown to be effective thanks to the capacity to operate within a regional or national network. The activities of the local, public operator are therefore directed not at creating new structures, which is left to the single or the collective promoter, but to sustaining the national initiatives in favour of local interests and activating that network of links which will facilitate access of minor enterprises to the various services offered by different operators. This certainly does not eliminate the risks of overlapping and competition, but precisely because these services are considered institutional by many public operators (e.g. universities, chambers of commerce) the competition is effective only in those services for which there is truly a market.

In other words with respect to the Italian situation the foreign experiences show strong specialisation in one or more of the objectives which are functional to the interests of the promoters without expecting to unite diverging or merely dissimilar interests. Thus at a level of system areas or specialised productive poles it is unlikely that there is a single service centre since the various elements present locally tend to operate individually though synergically and the local administrations (municipal and provincial), while participating in individual measures for providing services, now seem to tend to create, rather than service centres, networks between the players operating in the territory or true economic development agencies capable of co-ordinating and stimulating local and external operators⁸. Moreover the industrial system can avail itself, generally at a level of sectorial structures specialised in research and in the provision of technological services, of a private nature (in Germany and Great Britain) or public (in France, but with a para-fiscal tribute on the revenue of the companies).

This group of institutional bodies does not exist in Italy and therefore determines a tendency to load service centres with supplementary duties, which are excessive in relation to their resources. This situation while it could be justified during a pioneering and spontaneous phase of creation of these structures has no reason to exist in the light of the experience matured in recent years and above all of the many failures and it is time that the regional and local policies in support of innovation in small businesses took on a more modern and adequate aspect.

⁸ Exemplary in this area is the recent experience of the new German *Laender* (Pleschak, 1995).

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Table 1: National laws for innovation and technology in Italy

CONTENTS	1329/65	46/82	67/88	346/88	317/91	488/92	598/94	104/95	140/97	449/97
Only SMEs	YES				YES		YES			YES
EU Objective 1, 2, 5b						YES		YES		
Type of incentive	Interest subsidies	Soft loan Capital subsidies	Capital subsidies	Interest subsidies Capital subsidies	Capital subsidies Tax credit	Capital subsidies	Interest subsidies	Capital subsidies Interest subsidies	Tax credit	Tax credit
Process Innovation	YES	YES			YES		YES			
Product Innovation		YES		YES		YES			YES	
R&D		External		Large project	Internal	Setting-up or up-dating R&D lab.		Internal		External
Technology transfer		YES						YES		
Services					YES			YES		
Training		YES	YES	YES		YES				
Other objectives		International co-operation			Venture capital	R&D infrastructure	Environment		Know-how purchasing	Recruitment of researchers

Source: Ceris-Cnr

Table 2: Regional aids for quality

Region	Law	Type of aid	Quality			
			Plan	Equipment	Systems	Certification
Valley of Aosta	84/93	Capit. sub.	x	x	x	x
Piedmont	56/86	Soft loan		x	x	x
Liguria	43/94	Capit. sub.		x	x	x
Lombardy	41/90	Capit. sub.				x
Veneto	9/84	Soft loan				x
	3/97	Capit. sub.				x
	3/97	Soft loan		x		
Bolzano	44/92	Capit. sub.		x	x	x
Emilia Romagna	37/92	Capit. sub.	x	x	x	x
Tuscany	11/96	Inter. sub.		x	x	x
Marche	26/92	Capit. sub.	x		x	x
Lazio	23/86	Capit. sub.			x	x
Umbria	19/91	Capit. sub.			x	x
Campania	28/94	Capit. sub.			x	x
Molise	S.F.	Capit. sub.	x			x
Basilicata	16/95	Capit. sub.		x	x	x
Calabria	S.F.	Capit. sub.				x

Source: Ceris-Cnr

S.F.= Structural funds

Table 3: Regional aids for innovation

Regions	Law	Type of aid	Innovation							
			Product	Process	Services	Environment	R & D	Technology Transfer.	Start-up	Joint Venture
Valley of Aosta	84/93	Capit. sub.	x	x						x
Piedmont	56/86	Soft loan	x	x						
Liguria	43/94	Capit. sub.	x							x
	7/93	Capit. sub.	x	x		x				
	34/85	Soft loan	x	x		x				
Veneto	9/84	Soft loan	x	x			x			
Friuli	26/95	Soft loan		x						
	30/84	Capit. sub.	x	x						
	S.F.	Capit. sub.	x	x						
Bolzano	44/92	Loan	x	x	x	x	x			
	44/92	Capit. sub.	x	x				x		
Emilia Romagna	9/94	Inter. sub.	x	x		x		x		
	9/94	Capit. sub.			x				x	
Tuscany	S.F.	Capit. sub.	x	x	x					
Marche	20/89	Inter. sub.		x						
Lazio	33/91	Soft loan	x	x					x	
	23/86	Capit. sub.	x	x						
Umbria	S.F.	Capit. sub.	x	x						
Abruzzo	55/91	Capit. sub.					x	x		x
	143/95	Inter. sub.	x	x					x	
Molise	S.F.	Capit. sub.						x		
Puglia	S.F.	Inter. sub.	x	x						
Sicily	S.F.	Capit. sub.						x		x
Sardegna	21/85	Soft loan			x					

Source: Ceris-Cnr

S.F.= Structural funds

Table 4: Some results of the regional aids (1997)

Region	Quality			Innovation			Total investment	Activation Ratio
	N. applications	N. applications granted	Regional funds (mil Euro)	N. applications	N. applications granted	Regional funds (mil Euro)		
Valley of Aosta		8	0.15		1	0.3		
Piedmont	500	397	18.1	896	584	26.8	116.8	2.6
Lombardy	2,700	2,102	34.1				157.5	4.63
				576	303	36.4	108.9	2.99
				470	337	13.5	45.4	3.35
Bolzano		43			83	4.29		
					19	10.8		
Veneto					44.9		90.2	2.01
Marche	770	646						
Umbria	608	530	5.5				10.9	1.97
Lazio	321	184	2.9				8.4	2.88
				15	12	0.3	2.6	8.5
TOTAL		3,910			1,339			

Source: *Ceris-Cnr*

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