



ENEA

Programs of R&D support to SMEs

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1 Introduction

ENEA (Ente per le nuove tecnologie, l'energia e l'ambiente - Organisation for New Technologies, Energy and Environment) is a publicly-owned agency whose mission is to carry out applied research and to disseminate its findings on topics such as 'clean' energy production, environmental protection, and the use of new materials and technologies. Starting in the mid-80s, *ENEA* has pioneered at a national level the role of 'technology provider' towards the small- and medium-scale enterprises (SMEs) operating in the country, and above all those within some of the most famous industrial districts. The aim of this paper is a) to explore two such programs in the attempts to identify a set of 'best practices' in the area of technology diffusion and b) to identify the main problems that can hinder the process of technology transfer to SMEs.

Since *ENEA* was not originally established with the purpose of overseeing the diffusion of innovative technologies nor to liaison with small-scale enterprises, the paper will start with a brief introduction to the main changes this agency underwent over the 1980s. Later in the paper, the two case-studies will be presented focusing on the development of a) the *CITERA* image-database for the textile cluster of Carpi and b) the Minitel network *SPRINT* within textile cluster of Prato. A final section will explore the similarities of the two case-studies and it will attempt to explain why the two experiences differed so markedly in their outcomes.

2 The evolution of ENEA over the last two decades

ENEA was established in 1982 as an off-spring of *CNEN* (Comitato Nazionale Energia Nucleare - National Committee for Nuclear Energy) and it was made responsible for the R&D on alternative means of energy production. Initially, the overwhelming priority of *ENEA* was towards the discovery of safer versions of nuclear fusion (absorbing over 70% of the total budget), while a relatively modest importance was attached to nuclear fission (less than 10% of total budget) and to renewable energy sources (geothermal and solar energy).

As a result of 1987 referendum (which dealt the final blow to the use of nuclear fusion for the production of electricity) and later of the Chernobyl disaster, the role of *ENEA* was significantly challenged and the organisation had to drastically re-define its mission and structure. A dramatic reduction in the share of resources invested on nuclear fusion (from 58% of total budget in 1986 to 37% in 1988 and to 16% in 1990)

went along with a renewed interest towards nuclear fission (from 8% of total budget, to 14% and to 20%) and innovative technologies (from 6% of total budget, to 12% and to 24%). Over the same four years, the total budget of the agency was reduced from over 960 Lit billion in 1986 to 880 in 1988 and to under 790 in 1990, with a cut of over 33% in real terms.

In 1991 and as a result of a prolonged debate which significantly reduced its operating capacity, *ENEA* was finally re-launched and it finally acquired its present configuration. The organisation was structured around three departments (technology, environment and energy) under the supervision of a board of governors and of a director general appointed by the national government. It was only in 1995, however, that the re-organisation of *ENEA* became effective with the recruitment of young researchers. Presently *ENEA* employs just over 4,000 people scattered over 11 research centres but it maintains a relatively centralised structure (70% of its employees operate in the Rome HQ and in the two labs at the outskirts of the city). The operating budget of *ENEA* remains at a round 700 Lit. billion, less than half of what it used to be in the early 1980s.

At a first look, the rationale for the re-structuring of 1991 might appear obscure. Actually, such a transition was facilitated by the manifold attempts of the first president of *ENEA* to diversify the sphere of operation of the agency over the first half of the 1980s, as it was becoming increasingly clear that the political costs of nuclear fusion were too high to bear. The competencies acquired through the study of safer reactors (in areas such as new materials and laser technology) or through the reduction of the environmental impact of nuclear power plants were rapidly re-deployed and turned to alternative use. By the very same account, *ENEA* had attempted since 1983 to forge closer links with private entrepreneurs (initially through the Association of Industrial Producers and subsequently through SME associations). As a result two consultancy points had already been opened in Lombardy and Veneto in 1986 with the aim of a) proving up-to-date info on new technologies, b) offering discounts on quality certification tests, and c) co-funding joint research programs with individual entrepreneurs.

3 The provision of technological consultancy to the SMEs of Prato and Carpi

The two projects that will be considered in this paper both date back to early 1980s, and they therefore belong to the early experiments undertaken by *ENEA* to diversify its activities and to broaden its mission, as explained in section 2. As a result,

they should be considered as 'learning-by-doing' exercises, whereby attempts were made to address the needs and demands of a constituency of small-scale enterprises operating in mature-technology industrial sectors, and therefore alien from the traditional sphere of activity of *ENEA*. The reader should also realise that, over the years when these projects were initiated, industrial districts were not yet widely known outside the academic world, nor the subjects of industrial policies as they are becoming in the late 1990s. Consequently, both projects were looked at with a great deal of suspicion, even within *ENEA*, which further challenged the capacity of the agency to act in a coherent and well-defined way.

Before describing the details of both projects, it is useful to reflect upon the broader methodology of *ENEA*'s intervention. In a recent paper¹, the role of *ENEA* has been described as consisting of three aspects:

“acting as a technological agency with interventions strongly connected to the socio-economic territorial aspect, and therefore not like an external technology supplier who does not know the customer’s needs but like an operator who can meet them;
supplying real services, not just financial incentives; these services will involve enterprises both in finding out the needs and in providing the facilities to supply the services;
supporting a production system as a whole (and therefore not just advising a single firm), encouraging collaboration in order to find solutions to common problems through joint efforts and common resources.”

In light of the evolution of *ENEA*'s role over the 1980s, the rationale for this methodology appears to be relatively clear. The agency has been traditionally constrained to the supply of real services (as opposed to financial resources) because they were the only ones compatible with its mission and *modus operandi*. Even before the 1987 decree which effectively broadened the mission of *ENEA* to supporting innovation at the enterprise level, it was significantly easier for the agency to finance 'in house' research projects or to re-deploy internal competencies, than to offer financial support to individual enterprises. By the same account, *ENEA* faced significant obstacles to fund the purchase of the physical infrastructures required to implement its projects targeted at enterprises, and therefore had to rely intensively on the financial

muscles of its counterparts (be it individual enterprises, groups of firms, producers associations or real service centres).

Another significant aspect of the methodology of *ENEA*, namely its preference to target enterprise groups within industrial districts rather than individual enterprises, can again be related to the peculiarities of the agency. In the early 1980s, *ENEA* was a highly centralised organisation with limited capabilities to liaison with a constituency of SMEs dispersed across a vast territory. Significantly, its earliest attempts to link up with manufacturing enterprises was through consultancy points (see previous section) located within large cities such as Milan and Venice. The choice of the industrial districts (characterised by relatively homogeneous enterprises and frequently also by the presence of 'institutional intermediaries' such as producers associations or service centres) clearly facilitated the task of an agency which had traditionally focused on large-scale, high-tech projects involving a great deal of basic research.

Within the constraints set by its internal structure and mission, *ENEA* developed a methodology which was tremendously innovative, especially for an organisation which operated at a national level and was a member of the most innovative networks at an international level. The two case studies which are going to be described in the rest of this section should in other words be looked at as attempts to realise an highly innovative methodology by an organisation with a limited background in terms of its ability to liaison with private enterprises in general, and with SMEs in particular.

3.1 The creation of CITERA

Thanks to the abundant academic literature on *CITERA*ⁱ, the case of *CITERA* is among the most quoted examples of how innovative technologies can be successfully introduced within the, otherwise largely traditional, production processes undertaken in industrial districts. In light of the availability of such studies, it is surprising that so little attention has been paid to the institutional process whereby this project came to life and it evolved over nearly a decade.

An antecedent needs to be mentioned, before the details of the *CITERA* projects are spelt out. Over the early 1980s, *ENEA* had identified the site for an experimental nuclear reactor within Emilia-Romagna at Caorso. In order to ease public resistance, the agency was advised to provide the regional economy with a range of visible support programs. The regional government actively pushed towards to the signature of a memorandum between *ENEA* and *ERVET* (the Regional Development Board of Emilia Romagna) identifying the opportunity for strengthening the technological competence of

the SMEs operating within the regional economy. Through *ERVET*, *ENEA* was led to build up a solid relationship with the real service network operating within Emilia-Romagna, and therefore also with *CITER* which had been founded in 1981 with the aim of supporting the regional textile industry in general, and the textile district of Carpi in particular.

Once approached by personnel from the *ENEA* office in Bologna, the managers of *CITER* expressed their desire to develop a computerised system to browse the growing image database they had been gathered over the previous five years and that had already raised a great deal of interest among the centre's client firms. While the request of the managers of *CITER* was a relatively simple one, the realisation of the *CITERA* database proved much harder than expected.

During the initial phase (1983-85), the technicians at *ENEA* had to confront two rather different problems. On the one side, the hardware required to set up an image database which would be in line with the expectations and needs of textile designers was hard to find and very expensive. Not only was the storage capacity of hard disks too low to hold over 50,000 different images, but also the graphic interfaces as well the printing devices available on the Italian market wholly unable to handle the amount of colours and the patterns required. To solve these problems, the technicians of *ENEA* had to turn to the US movie industry to find the adequate technology. While the costs to purchase such elaborate hardware were fully covered by *CITER*, *ENEA* fully funded not only the search for such hardware but also the transfer of a vast number of digitalised images on laser discs.

The second problem confronted over this period was caused by the limited spread of computer technology within the district of Carpi, and also within *CITER*. By her own admission, the Chief of the fashion branch at *CITER* had at the time no understanding of computers and little inclination to learn anything about it. This inclination could have represented a significant hindrance to the project. The contribution of Chief of the fashion branch to the definition of *CITERA* was identified as a key determinant in its overall success since the effectiveness of a computerised image database is a direct function of how easily images can be retrieved starting from a simple request by the user (i.e. a fashion designer). Unless the team of technician of *ENEA* (which held no understanding about fashion) could initiate a productive dialogue with the fashion branch at *CITER*, the collaboration between the two agencies would

run the risk of losing much of its potential. The diversity of competencies that had been accumulated within the Textile Centre over its life provided an unexpected opportunity to address this potential problem. The Head of the technology branch of *CITER* (who had been recruited to provide technical consultancy on the use of computerised looms) displayed an unsuspected understanding of computer technology. He was therefore able to act as an intermediary between the experts from *ENEA* and the head of the fashion branch, significantly speeding up the realisation of the image database.

As the image database was being completed with over 50,000 entries, the managers of *CITER* realised the opportunity to integrate it into a coherent CAD station. *ENEA* was once again contacted to adapt the *CITERA* database to the CAD software purchased by *CITER* and to write the software to bridge the two applications. In 1989, a pilot version of the *CITERA* workstation was operative within the premises of the service centre in Carpi. It included two video stations, one for the search and retrieval of the images and the other station dedicated to CAD. At this stage the use of *CITERA* was cumbersome as it relied on a text-based user interface and it did not integrate the two components within a single station. Nevertheless, *CITERA* constituted such a clear break with the past, and it cut down so drastically the time required to consult the vast archive accumulated over more than a decade, that it was received very positively by the clients of *CITER*.

The response of the designers subscribing to the *CITERA* service was so enthusiastic and immediate, that the managers of the *CITER* contacted once again *ENEA* to develop a more user-friendly version of workstation which could be sold directly to the textile enterprises. *CITERA* was consequently re-designed to operate within a Windows environment and the video-disk upgraded to store over 85,000 images. Over 50 such workstation were consequently sold to various textile SMEs operating within Emilia-Romagna. The revenues from such sales were equally split between *CITER* and *ENEA*, whereby a share of the R&D costs borne over the previous eight years were directly recovered.

Over the 1990s, because of stricter copyright regulation, the use of the larger version of the image database (with little less than 100,000 entries) was restricted to the clients of *CITER*. During the same period, pilot versions of the *CITERA* workstation were also developed for the Spanish and Portuguese market, thanks to a European Community project to support SMEs. After such effort, however, *ENEA* abandoned the

project, which had by then lost much of its innovativeness. *CITER* continued to offer access to *CITERA* to its clients, even though the video-disk technology selected in the early 1980s was proving increasingly out of touch with the evolution of computer technology. As scanning devices were becoming increasingly cheaper and as computer technology was increasingly penetrating even within the smallest enterprises operating in the Capri district, the appeal of the CAD workstation decreased dramatically. After the mid-1990s, the rapid spread of Japanese and German looms with integrated CAD-CAM facilities, dealt a final blow to *CITERA*, which was terminated in 1997. ENEA did however capitalise further upon its collaboration with CITER: not only did it manage to re-develop the database for the Spanish and Portuguese markets, but it also succeeded in designing a similar database for the tile-manufacturers of the Sassuolo district.

3.2 The SPRINT project for the Prato textile district

Very much as for *CITERA*, there is a substantial literature which focuses on the experience of *SPRINT* (Sistema Prato Innovazione Tecnologica - Prato System Technological Innovation)ⁱⁱⁱ even though the rapid demise of such project has led many researchers to consider it the archetype of the inadequate manner to introduce innovative technologies within an industrial district characterised by traditional production processes^{iv}. The reader will soon appreciate that not only the fate of the project, but also its expected outreach and degree of innovativeness make *SPRINT* something that apparently has little in common with *CITERA*. While the main features of the *SPRINT* program will be reported in this section, a comparison between the two projects will only be attempted in the next section.

While the *SPRINT* consortium was only established in May 1983, there are some antecedents that need to be described in details to understand fully the evolution of the project over a decade or so. An agency belonging to *CNEN* (Tecnotessile) was already located in the Prato area prior to the creation of *ENEA* in 1982 and it was researching on the use of energy-saving technologies for the textile industry. Since the late 1970s, Tecnotessile had tried to broaden its role within the district and, more specifically, it was interested in building upon innovative telecommunication technologies to facilitate the networking process within the area. In particular, great interest was being paid to the evolution of the French Minitel service, whereby the telephone network was being integrated with home-based terminals into what was to

prove the closest predecessor of the Internet. As *ENEA* was established in 1982, its first director built upon its personal friendship with the president of the producers' association of Prato (Unione Industriali Pratesi - henceforth UIP) to turn what had been but a dream into a fully fledged project to upgrade the telecommunication network of Prato.

The objectives of the project were introduced at a meeting with all the producers' associations representing the manufacturers of the district (including UIP but also Confartigianato and CNA representing the micro- and small-scale enterprises) held in the first half of 1982. The collaboration of the producers' associations was deemed essential for the correct identification of the services which could be delivered through the Minitel network. On that occasion the representatives of the associations were presented with an admittedly optimistic estimate of the potential benefits their associates could derive from the project based on an assessment of the French experience. Soon after the meeting, *ENEA* ordered a preliminary feasibility study to a major research institution (Reseau) with in-depth knowledge of the French Minitel. While apparently a meaningless detail, this choice testifies to the *modus operandi* of *ENEA*, which had identified the promising technology before the local producers had had a real opportunity to individually voice their needs and requirements and only against the background of its own prior involvement (through Tecnotessile) in the economy of the area.

In May 1983, a non-profit consortium was established among UIP, Confartigianato and CNA with the purpose of realising the *SPRINT* telecommunication network (what was to become known as the TELEMATICA project). *ENEA* could not be a member because of its public status. Nevertheless a range of other institutions operating locally (several banks, the chamber of Commerce of Florence, and then finally the City of Prato) expressed their interest towards the project and were therefore admitted to the consortium. Towards the end of the year, Reseau presented the results of its feasibility study, involving a detailed research of the telecommunication needs of the area and of the major bottlenecks to be addressed. On the basis of this analysis, a preliminary plan was submitted to the regional government for funding.

The choice of enlarging the consortium to the largest number of local actors was a strategy strenuously pursued by *ENEA*, which envisaged *SPRINT* as an opportunity to revolutionise the structure of the entire district at the deepest possible level. This objective required, on the one side, the need to build the broadest political consensus to

overcome the inevitable resistance and, on the other hand, the need to invest financial resources largely beyond the capacity of a public agency. The participation of many local banks (in primis the *Cassa di Risparmio di Prato*), not only as financial supporters but as potential users of the telematic network (which was initially envisaged as the right environment for innovative forms of home banking) was looked at with a great deal of optimism.

In year 1984, the first real problems started to disturb the realisation of *SPRINT*. In the attempt to draw a detailed implementation plan, significant mis-understandings and communication problems surfaced between many local entrepreneurs and the personnel of the technical consultant (Reseau). Frequently, the owners of small-scale artisan workshops complained that the researchers were behaving arrogantly and expected an excessively intensive involvement in their work. On the other hand, Reseau proved ill-equipped to confront enterprises with an incomplete understanding of their own structural problems and with limited managerial capacities. Tensions also started to surface among the members of the consortium as the feeling was spreading that *SPRINT* was over-reliant on the inputs from UIP and out of tune with the needs and expectations of the small-scale local producers. Furthermore, the three producers' associations participating to the project were displaying markedly diverging attitudes towards *SPRINT*. While UIP was calling its members to hold regular meetings to provide indications to guide the evolution of the overall project, *Confartigianato* reported a lack of interest among its associates and pursued the idea of using the Minitel network simply to renovate the range of services it traditionally provided to its members. The local branch of CNA, on the other hand, was characterised by a very sceptical approach (related to the old age of the head of its technology office) and participated only marginally to the elaboration of the project.

In an attempt to overcome what was an increasing differentiation in the attitude of the members of the consortium, *ENEA* pressed for the creation of a technical commission which should meet regularly to oversee the evolution of the project and provide more precise guidelines. It took roughly a year before the technical commission could start to function and to address the main impediments to the realisation of *TELEMATICA*. At the end of 1986, an agreement was signed with *SIP* (the national telephone provider) for the supply of the Minitel terminals and the set-up of a dedicated telephone network. By mid-1987, 450 terminals were installed (free of charge) within the

district and 10 young people were trained to help the entrepreneurs making the best use of the service.

In 1988 the Minitel service was activated and the TELEMATICA sub-project comes to its final realisation^Y. A wide range of services was immediately provided through Minitel: UIP experimented the *Uninform* service whereby updated data were provided on customer behaviour; *Confartigianato* implemented its *VideoPaghe* service greatly enhancing the potential of its existing payroll service; the City of Prato offered a wide range of on-line civic services open to all the inhabitants of the town (through public terminals); *Cassa di Risparmio* realised a home-banking service whereby bank transfers could be dealt with from home; the Union of textile workers provided its associates with info on their rights and advertised its initiatives. Further projects were designed to become operative over 1989.

As TELEMATICA moved to its fullest implementation, new problems did rapidly surfaced. Once installed, it became immediately clear that the terminals provided by *SIP* were not at the leading edge of available technology but were on the contrary very cumbersome to use. Over the initial period, the quality of the signal left much to be desired leading to frequent and unpredictable termination of the connection. Together, these two factors significantly reduced the enthusiasm of the potential users, especially among the entrepreneurs of the district. Furthermore, the costs of the service emerged to be remarkably higher than expected, especially as end-users were not sufficiently well-trained in the use of the services provided through Minitel. As a result, an enquiry into the degree of use of the terminals which was carried out in the early 1990s displayed that only a minority of the potential users was making effective use of the services available.

A further element was rapidly emerging which further reduced the motivation of the producers' association, namely the realisation that *SIP* was rapidly dis-engaging from the project. Not only was the telephone company was failing to invest into this pilot project as it was expected to, but also to maintain the network in a decent working order. As the underlying technology was becoming rapidly out-dated, there was no sign that *SIP* had any intention to upgrade it as it would have been needed to increase the range of services offered and therefore to trigger the necessary 'network externalities'. The failure of *Cassa di Risparmio* in the early 1990s not only upset deeply the local economy, but also deprived the project of an enthusiastic supporter with had been estimated to have significant financial muscles. By 1993, the *SPRINT* consortium was

turned into a for-profit organisation, as *ENEA* attempted to broaden the range of its intervention within the district but its involvement in *TELEMATICA* was terminated.

4 A comparison of the two projects

As repeatedly emphasised over the previous two sections, it is immediately apparent that the two project undertaken by *ENEA* over the first half of the 1980s differed markedly, not only in terms of the results they achieved, but also in terms of their scope and outreach. In this section I will try to reflect on the factors which influenced the fate of the two project in the attempt to identify a set of 'best practices' concerning the characteristics of R&D support to SME clusters.

An obvious difference between the *CITERA* and the *SPRINT* projects was that the former did achieve all the objectives it was aimed to and it can therefore be broadly considered a success, whereas the second (at least for the *TELEMATICA* component discussed in the previous section) failed to do so and it has been described as a failure by independent observers^{vi}. Whereas the *CITERA* database and, later, the *CITERA* workstation were heavily used both when installed within the premises of *CITER* and after they were sold directly to the manufacturers of Carpi, remarkably little use was made of the Videotel terminals installed within the premises of the entrepreneurs of Prato, and many of the on-line services provided through the *SPRINT* network were terminated because of lack of use^{vii}.

A consideration which is commonly voiced, both within *ENEA* and by outside observers, was that *SPRINT* was too innovative for the time when it was envisaged. At a deeper scrutiny, this statement appears to shed very little light on the analysis, since the involvement of *ENEA* was based precisely on the expectation that it could act a catalyst for innovation and as a bridge between the needs of SMEs and the state-of-the-art technology outside their reach. Unless one clearly states what features of *SPRINT* were not in line with the characteristics of the Prato district and, on the contrary, what features of *CITERA* adequately responded to the requirements of the textile producers in Carpi, the above statement simply implies that *ENEA* was not up to its job.

What appears to be beyond dispute, is that *SPRINT* was envisaged, from its very first days, as an explicit attempt to initiate what Rosenberg calls a 'radically innovative process'^{viii}, namely to revolutionise the very nature of the district and the structure of the relationships within which the production process was embedded. As such, the project inevitably collided with the entrenched interests of various key players

within the district and therefore required an adequately comprehensive political consensus in order to be sustainable. More precisely, the belief that the major obstacle to a more efficient flow of information within the district was the traditional telecommunication network that mediated the interaction between the local enterprises (a vision which was implicitly enshrined in the feasibility study by Reseau) led to the definition of a project which required the entrepreneurs, and especially the small-scale sub-contractors, to re-define radically the way they conducted their businesses.

Quite on the contrary, the involvement of *ENEA* with *CITERA* was more of a problem-solving kind within what appears to have been an 'incrementally innovative' process. In other words, by 1982 *CITER* had already built up a reputation for providing its clients (entrepreneurs who had proved willing and able to pay) with a database of images using a very rudimentary and therefore excessively time-consuming technology. Through its collaboration with *ENEA*, *CITER* was simply attempting to upgrade one of its, already viable, products. *CITER* was therefore in a position to provide constant feedback to the developers of *CITERA* and, consequently, to further build upon the collaboration with *ENEA* to devise a completely innovative, stand-alone application (the *CITERA* workstation) which could eventually be sold directly to the enterprises. What resulted at the end as a highly innovative, high-tech product was not initially envisaged as such but it emerged through a continuous and incremental process of collaboration between a few researchers of *ENEA* and the personnel of *CITER*.

Another importance difference between the two projects concerns their scale. *SPRINT* was a significantly larger-scale project not only because it was more expensive than *CITERA* (which required an overall investment comparable to half of the yearly running costs of *SPRINT*) but because it required a much larger 'critical mass' of users to become fully operative. As already mentioned, the success of *SPRINT* depended critically on the number of its users: the larger the number of entrepreneurs correctly using the Videotel terminals, the lower the costs they would need to pay for the services provided on-line, the greater the incentive to broaden the range of such services. Much unlike *CITERA*, *SPRINT* was in other words characterised by significant 'network externalities'. The failure of *ENEA* to catalyse not only a sufficient political consensus around the project, but also to win over the co-operation of a sufficient number of local entrepreneurs, significantly worsened the fate of *SPRINT*.

From the point of view of the technology involved, it has been repeatedly stated that *SPRINT* was built upon an incorrect reading of the evolution of information technology, and therefore that its fate was doomed from the very beginning. As a matter of fact, the Minitel achieved a limited success in France but failed to gain the upper hand, especially if compared to the much more rapid spread of the Internet and of the World Wide Web in the late Nineties. Certainly the choice made by *ENEA* to rely upon an external consultant with great knowledge of the French experience, significantly influenced the evolution of *SPRINT*. What needs to be emphasised is that also *CITERA* was built around a technology standard (the video disc) which appeared promising in the early 1980s but that was discarded at the end of the decade because of the drastic fall in price of other storage devices. In both projects, *ENEA* displayed a limited ability to successfully forecast the main trends in the evolution of technology. Nevertheless this feature does not seem to have burdened the success of *CITERA*, at least in the medium period.

By the same account, the criticism that *ENEA* was over-dependent upon *SIP* for the realisation of *SPRINT* does not appear to be fully adequate. It is certainly true that the scepticism and lack of endorsement displayed by the telephone company around the Minitel standard constituted the most visible factor leading to the demise of the project in Prato. Personnel at *ENEA* deeply resented such behaviour and assured that it could not have been envisaged over the planning phase in 1982-83. What is equally true is that *ENEA* did not display any particular in-house expertise to design image databases and integrated CAD workstations prior to its involvement with *CITERA* but that such a feature did not hinder the project to any visible extent. After all its role as a technology consultant was correctly interpreted as to act as an intermediate between the needs of the enterprises and the knowledge available elsewhere and therefore not to require an in-depth expertise in any specific field of technology.

A feature that needs to be duly emphasised is that both projects under consideration required a great deal of after-sale customisation to be adapted to the skill and needs of its potential users. The reader should not be surprised by this realisation since much of the state-of-the-art technology available even today has been originally designed around the needs of productive systems that have very little in common with industrial districts and with the needs of SMEs. What proved to be a discriminant between the two projects considered in this paper, was the ability of *ENEA* to undertake autonomously such a 'customisation' task. The over-reliance upon *SIP* in the case of

SPRINT appears as a major weakness in the design of the project which fortunately had no counterpart in the case of *CITERA*.

From an institutional point of view, it clearly appears that *ENEA* worked much more effectively in a productive area characterised by a well-established governance structure. For the reasons discussed in section 2, the mission of *ENEA* required the agency to help the SMEs of an industrial district to address their collective needs, rather than to help single enterprises to solve their individual problems. The need to work under such a constraint implied that *ENEA* had to identify a counterpart within the districts which would voice the needs and reactions of the local enterprises. In the case of Carpi, *CITERA* acted as an ideal such partner since a) it provided *ENEA* with a clearly defined request for help, b) it provided the financial resources required to realise the project, c) it helped *ENEA* to customise its technological solutions to the existing capacities of the SMEs, d) it acted as a “guinea pig” for the pilot version of the *CITERA* workstation, and e) it took care of the sale of the commercial version of the workstation. In Prato, on the contrary, such partner was initially missing, and indeed its creation represented a major watershed for the district, which had up to that moment failed to spontaneously develop any experience of district-wide governance.

The problems experienced in Prato over the 1984-87 period further testify to the role that a real service centre can play for the rejuvenation of the production technology within a district. On the one hand, such a centre can act as an ‘impartial’ referee overseeing the evolution of the project and ensuring that it is not excessively biased by one or more of the local players. After the initial problems described in section 3.2, *ENEA* realised that the *SPRINT* consortium was not perceived to be sufficiently independent from the interests of the large-scale producers of the district. The agency realised the importance of playing directly such a role and invested much of its (scarce and not sufficiently well-trained) human resources in an attempt to dispel the feeling that the project would ultimately prove to be beneficial only to the large-scale producers. The continued scepticism that surrounded the project among the representatives of the smaller textile producers proves that an external actor was probably ill-suited to understand the subtleties of local politics.

On the other hand, a real service centre can act as an intermediate between *ENEA* and the local branches of the producers’ associations to insulate the evolution of the project from the disputes that inevitably characterise a diversified environment such

as the industrial district. An element that was emerged frequently during the interviews with the personnel of *ENEA* was that the technical commission created in 1985 within the *SPRINT* consortium proved for long much less effective than initially expected because the representatives of the producers organisations spent an excessive amount of time discussing issues of crucial importance for the district as a whole (wage-bargaining, business cycle, local elections, etc.), but entirely irrelevant to the evolution of the project at hand. The very same problems did not plague the evolution of *CITERA*. To be sure, the managers of *CITERA* did have to win the initial resistance of the producers' associations sitting on the board of the centre who resented the investment of significant financial resources on *CITERA*. This type of discussion was however framed within on-going relationships between the managers and the board and never influenced the collaboration with the researchers of *ENEA*.

5 Conclusion

The above analysis shows that there can be positive prospects for a large-scale research agency acting as technology provider for the SMEs of an industrial district. The case-studies presented in section 3 indicate that close links and prolonged collaboration were established between the researchers of *ENEA* and the representatives of producers association, and even with groups of entrepreneurs. In the case of *CITERA* such collaboration resulted in the development of highly innovative technological solutions fully customised to the peculiar needs of small-scale enterprises. Section 4 has attempted a comparison between *SPRINT* and *CITERA* to explain the difference in fate which characterised the two projects. From the discussion presented, three elements appears to be worth emphasising, which should constitute the core of an effective industrial policy aimed at rejuvenating the production processes undertaken within industrial districts.

The success of a process of technology transfer is directly related to its being **strongly demand-oriented**, as duly emphasised by the *ENEA* methodology explicitly quoted at the beginning of section 3. When a cluster of SMEs is involved, however, a crucial factor that needs to be considered is whose demand should the process focus on. With *SPRINT*, *ENEA* experienced a hybrid approach, a) selecting a promising technology prior to an in-depth study of the area and then b) consulting the local producers' associations when it had to define the characteristics of the services to be

provided on-line. With *CITERA*, the agency relied, on the contrary, upon the knowledge available at *CITER* concerning the needs of the district. The unfortunate fate of *SPRINT* has been at least partially related to the characteristics of the hybrid approach, and above all the reliance of *ENEA* on the *ex ante* evaluation of the collective needs of the Prato district.

A second element that was discussed in the paper is the importance of a careful **customisation** of the technological solutions offered to the SMEs of a district. In both projects, this stage proved significantly harder than initially expected, above all because of the wide gap between the competence of the 'users' and the knowledge required to make the best use of the novel technology introduced in the production process. Furthermore, the greater the innovativeness of the technology (both in terms of its radical impact on the structure of the district and in terms of the network externalities that characterise it), the harder it proved to motivate the SME owners to experiment with it and to provide the necessary feedback to the technology consultant.

A third feature which has been emphasised concerns the **governance** of the process whereby a new technology is introduced within the district. A key aspect to be kept in mind is that many features of the inter-actions among the district enterprises are so embedded within the local tradition to be silent and therefore unlikely to be explored and adequately understood in the preliminary planning phase. Under such settings, the introduction of new technologies is likely to prove much more conflictual than initially envisaged, as the balance of political power within the district is upset and as some district actors see their influence and/or success challenged for the benefit of other district actors. While a wide consensus is likely to initially surround a project aimed at radically upgrading the traditional production technologies, conflict is therefore likely to emerge, unless the benefits of innovation are adequately re-distributed within the district. As a result, the introduction of new technologies (and especially radically new ones) is a process which certainly involves significant *technical* problems to be addressed but which also needs to be embedded in a comprehensive *governance* framework.

For all the above reasons, it appears that the presence within an industrial district of a provider of real services with a) first-hand experience of the needs of the local producers and yet with b) sufficient political and financial autonomy to pursue a program of technological innovation on behalf of its clients/associates is a crucial factor

behind the success of a project of technological transfer. This conclusion does not imply that the introduction of new technologies in an industrial district should be made dependent uniquely on the innovativeness displayed by the real service centres located within the district (an approach enshrined in the current attempt to establish *in situ* a dedicated innovation centre or a technology park). The sheer breadth of state-of-the-art technology and the its rapid evolution most probably require large-scale agencies entrusted with the mission of helping SMEs to innovate. What appears to be of crucial importance is that these agencies should be in a position to liaison efficiently with a set of intermediaries which are strongly rooted within the district economy and that can filter the demands and reactions of the local producers and of their associations.

ⁱ De Maria, R., 1992. Case Study on Creativity and Innovation: The Approach of ENEA ad the 'Prato Case' in UNIDO, 1992. *Manual for Training in Research and Innovation Management*, Augusto Forti.

ⁱⁱ Asheim, B. 1994. 'Industrial districts, inter-firm cooperation and endogenous technological development' in ed. UNCTAD, *Technological dynamism in industrial districts: an alternative approach to industrialization in developing countries?*, New York, United Nations - Bianchi, P. & Bellini, N. 1991. 'Public Policies for local networks of innovators' in *Research Policy*, Vol. 20, No. 5, pp. 487-497 - Mazzonis, D., 1989. Small firm networking, cooperation and innovation in Italy, *Entrepreneurship and Regional Development* pp. 61-74 - Schmitz, H. & Musych, B. 1994. 'Industrial districts in Europe: Policy lessons for developing countries?' in *World Development*, Vol.22 No.6 pp.889-910.

ⁱⁱⁱ Mazzonis, D., 1989. Small firm networking, cooperation and innovation in Italy, *Entrepreneurship and Regional Development* pp. 61-74.

^{iv} Bonaccorsi, et al. 1997. 'The role of meta-organizers in industrial district networking' mimeo - Università degli Studi di Udine - Harrison, B. 1994. 'The Italian Industrial District and the crisis of the cooperative form: Part II' in *European Planning Studies*, Vol. 2, No. 2 pp. 159 - 174.

^v Overall the SPRINT program involved a number of other sub-projects focusing on production technology (INFRATECNOLOGIA) such as loom automation, CAD, colour processing, quality control and on automated inventories as well as on the use of energy (ENERGETICA). These aspects of SPRINT are not dealt with in this paper, even though they proved remarkably more successful than the TELEMATICA sub-project.

^{vi} Most notably those cited in footnote iv.

^{vii} The same conclusion cannot be reached for all the other sub-projects of SPRINT, since INFRATECNOLOGIA had a very significant impact on the research on new fibres, and opened as a consequence a new and very profitable market niche for the producers of Prato. In the longer run,

it can be certainly claimed that the experience of SPRINT facilitated the introduction of the Internet within the area, which is currently among the most advanced in the country for its civic network.

^{viii} Rosenberg, N 1982. *Inside the black box: technology and economics*, Cambridge, Cambridge University Press