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Technological transfer: the RIDITT Programme

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The paper describes the preliminary outcomes of the Italian technology transfer (TT) policy instrument named RIDITT: Italian network for innovation and technology transfer to enterprises. As a first step some of the key and most recent theoretical and empirical works on TT policy are presented, in the wider framework of R&D public support, as well as a brief review of the trends in TT policies at national level. The paper then focuses on the results of two surveys, respectively on the innovation & TT centres operating in Italy, and on the most effective technologies available from public research for SME innovation. Both the analyses showed a populated and fast evolving system, even if affected by some weaknesses mainly related to the players' under-sizing and to the lack of a general awareness on TT potential, on the research as well as on the industrial side. The surveys results were finally used to design a tailored scheme to promote research-industry cooperation. The early evidence from its application shows that a specific TT policy can afford those weaknesses, in the Italian case, but a deeper insight on the actual TT mechanism and the availability of tested impact evaluation methodologies and metrics, are needed.

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1. Introduction

In order to understand the interest that the technological transfer (TT) process has raised for some years in Italy and in order to locate it within the research area of technological evolution and public policies, it is necessary to initially recall that: important changes in technological quality and in human capital in an organisational and sectoral restructuring process would be required in order to alter the worrying trend in the Italian potential GDP since the 1990s (Silva, 2006); the Italian productive process is characterised by too small firms, specialisation too much focused on sectors with little future prospects and low R&D investments; the supply of TT services is fragmented and realised by entities of small dimension and little interconnection and therefore it is necessary to increase firms' endowment in human, technological and financial capital both in high tech and in traditional sectors (Boffa et al., 2006); the creation of a vicious circle between innovation and productive internationalisation is widely difficult (Cantwell, 1989); a strong national innovation system requires on the one hand, that the division of labour between its main actors (public research centres, large firms, small Schumpeterian firms) be maintained, but on the other hand that their relationships get denser, thereby feeding multi-directional knowledge flows; in order to ease such relationships it is necessary to strengthen and select a network of bridging institutions dedicated to TT (Colombo et al., 2006).

In this perspective policies for TT have a significant role, as shown by the US theoretical literature aiming. Other theoretical contributions have followed in Europe, numerous

universities, in Italy in particular, have started TT promotion activities, but most importantly some European countries, including Italy, have undertaken intervention policies in this regard, creating public or mixed (public and private) bridging institutions.

The aim of this paper is twofold. First, it aims at presenting first evidence on TT policy in Italy (the RIDITT programme, meaning Italian network for the diffusion of innovation and TT) promoted by the Ministry for Economic Development and implemented by the IPI (Istituto per la Promozione Industriale, Institute for Industrial Promotion) from 2003. The second is to interpret such evidence in the light of the prevailing theoretical background.

2. TT policies

2.1. Theoretical background

In this paper we define TT as the transfer of ideas, know-how and technologies from a public research organisation (public lab, university, non-profit research centre) to another organisation dedicated to the production of goods and services (Roessner, 2000). This transfer can arise through various means, including: collaborative research contracts between firms and universities; consulting; patent licensing; publications; spin-off creation; researchers' mobility, etc. (European Commission, 2007).

Thanks to TT, small firms, even those not endowed with the technostructure necessary to realise original R&D, can benefit from public institutions' research and improve their competitiveness by realising technological evolution.

For this reason, TT policies are particularly adequate to Italy, which is characterised, as already mentioned, by small firms.

The taxonomy of Bozeman (2000) is useful in order to locate TT policies within R&D and innovation policy. Bozeman indicates three alternative paradigms: the market failure, mission technology and cooperative technology paradigms¹. Given the nature of TT processes, of strong interaction between knowledge producers and firms, the policies aimed at their promotion are comprised within the third paradigm, in turn partly related to the diffusion oriented model. The latter is based on incentives and externalities of existing firms' innovation activities with a view to stimulating them to continuously realise product and

¹ The first paradigm of market failure, is based on the assumption that the free market is the most efficient in allocating goods and services and therefore leads to optimal rates not only of economic growth, but also of scientific production and technological change. The implication is that the only possible public intervention consists in eliminating possible market barriers through: intellectual property right protection, neutral taxation, limits to the regulation of business. In this vision, government policies should not influence public R&D, except for the defence sector, while the research system (university and public research organisations – EPR in Italian) should train technicians with skills adequate to the request of the production system and should realise essentially basic research, disclosing all the results. The second paradigm, that of mission technology, is based on the idea that in some fields, such as defence, security, but also energy, health, space and agriculture, in which the national interest is strong, public support to technological innovation cannot only deal with the spontaneous private activity. According to that paradigm, in these fields, the government should favour the orientation of R&D towards specific missions through the use of resources and the realisation of necessary conditions; the role of the public research system would be complementary to the private one, except for some fields in which research is realised by specialised agencies or large firms in highly risky and high critical mass programmes. This paradigm has been that of the US from the 1990s onward, although with nuances, and in Europe from 2000. According to the third paradigm, that of cooperative technology, the free market is not always the most efficient way of stimulating economic development; rather the contrary, the role of public policy is very important for technological development and innovation. In particular, universities and EPR must play a significant role in technological development at pre-competitive level, and there must be a strong collaboration between government, university and firms, and also between firms, for technological development to receive maximum impulse in the pre-competitive phase and in the so-called 'infratechnological' phase. This third model has been criticised by liberals both from an ideological point of view and from the point of view of the robustness of its proposals.

process innovations (Ergas, 1987), thereby inducing them to abandon the business model based on price competitiveness which, in a country like Italy, is now disappearing. This approach is therefore particularly adequate for the Italian case.

Such instrument must therefore use 'blind' channels, better if based on simple, quick and low-cost automatic rules from the point of view of the public administration (tax credit), as well as on vertical instruments (sectors and types of beneficiary firms), in order to avoid too fragmented financial incentives.

This reflection is also in line with the proposal made by some scholars (Colombo et al., 2006) that mission oriented policies be accompanied by diffusion oriented policies in a country like Italy. Both types of policies should be of similar importance from a financial point of view so that small and medium firms could start to demand innovation.

This framework comprises not only the RIDITT programme but also recent initiatives aimed at stimulating industrial research and public-private collaboration through the automatic mechanism of tax credit and financing of industrial innovation projects reaching a critical mass in some specific strategic areas.

2.2. TT Policies in Italy

The first case of policy aimed at promoting research-industry collaboration appeared in 1885, when the Regio Law created experimental stations for industry². These were charged of "promoting, through inquiries, studies, research, analyses, the technical progress of the special industries or groups of industries at which they are aimed, and to ensure the improvement in the technical labour force of the industries" by a similar law of 1923.

After World War Two the idea consolidated that the State could coordinate research so as to orientate it towards the support of productive activities. The Italian innovation system experienced a significant technological improvement in the 1950s and 1960s in the chemical, electronic, pharmaceutical and nuclear sectors, also through the collaboration between public research institutions and firms which were predominantly state-owned (Lissoni and Malerba, 2002). The Special Fund for Industrial Research, managed by the IMI (Istituto Mobiliare Italiano) was created in 1968 by Law n.1089, one of the aim of which was to constitute mixed public-private organisations for TT³.

Public policy was oriented towards the support of private research and of TT in the 1980s, with particular attention to SMEs. The Law n.240 of 1981 allows public research centres to collaborate with SMEs in research and TT. The Law n. 46 of 1982 created the Technological Innovation Fund which the Ministry of Industry could use to support initiatives for the transfer of national knowledge and innovation to SMEs.

Infrastructural actions were also carried out in order to improve the relationship between research and firms. Thus the first two scientific and technological parks (Area Science Park of Trieste and Tecnopolis of Bari) were created in the 1980s with financing from the Ministry of Research with the aim of promoting innovation and firm creation. In that period business innovation centres (BIC) were also created by the Society for Industrial Promotion (SPI-IRI) with the help of the European Commission. A wide structure of services and technological intermediation has been progressively created in the following years, with the involvement of universities, EPR, Chambers of Commerce and industrial associations. Such structure is characterised by some well-functioning centres together with a wide number of centres that have difficulties in surviving and rapidly disappear, without leaving any tracks (Cariola et al., 2000).

² Experimental station for the industry of leather and leather goods in Naples (1885).

³ The law implied the creation, among other things, of the Tecnotessile society in Prato for the support of technological development of firms in the district.

Universities were stimulated to create offices for the valorisation of research (TT offices) in the end of the 1990s, due specific measures (laws n.297 and n.388 of 2000) and to their being allowed a greater autonomy. Such technological Transfer Offices promoted patenting by academics and the creation of spin-off firms in order to commercialise innovation. The performance of such offices is positive although much less effective than similar offices in the US or in other European countries.

Particular attention has been put on the support of focalised interventions on specific strategic areas realised by firms in collaboration with the research system such as the “technological districts” and the “ industrial innovation projects” (PII in Italian). Whereas some important innovative elements were introduced in programming, some implementation problems have impeded to reach the fixed objectives. For example, in the case of technological districts, the high number of realised initiatives, aimed at many sectors, territories and technologies did not favour the aggregation of scientific, technological and industrial competencies on few and specific initiatives. While the complexity and articulation of involved partnerships in the PII projects together with a lack of adequate instruments have slowed down the administrative and managing process of initiatives with the risk of limiting success of the policy.

Last, the horizontal instrument of tax credit for R&D was launched in 2007, forecasting an increase from 10% to 40% of the allowed benefit in the case of activities conducted in collaboration with universities and research centres. In this case, the limited available resources, together with a highly competitive mechanism for their allocation are likely not to have favoured the most complex activities of collaboration between research and firms.

Overall, the lack of an organic, clear and univocal design on TT, as well as the peculiarities of the Italian productive system and the delay of universities in undertaking the so-called third mission have ended in weakening the effectiveness of the large public funding granted at national, local and European levels, aimed at promoting the collaboration for innovation between research and firms. The percentage of firms which have started collaboration for innovation with other firms, with universities and research centres is very low in Italy with respect to other countries (European Commission, *European Innovation Scoreboard*, 2009).

3. The RIDITT experience

3.1 Genesis

In the above described context the Ministry for Economic Development has started a pilot programme dedicated to TT in 2003, called RIDITT (network for the diffusion of innovation and technological transfer to firms). Such programme was initially endowed with € 5.16 million and IPI was in charge of its management. The initiative was proposed to the National Innovation System (SIN in Italian) through the supply of some information training and technical assistance services and more importantly through a specific instrument for the promotion of TT that will be examined in section 4. A prior analysis of two specific aspects of TT was realised, namely the screening of existing operators and of their intervention modes, as well as the scouting of the main technologies effectively available for transfer.

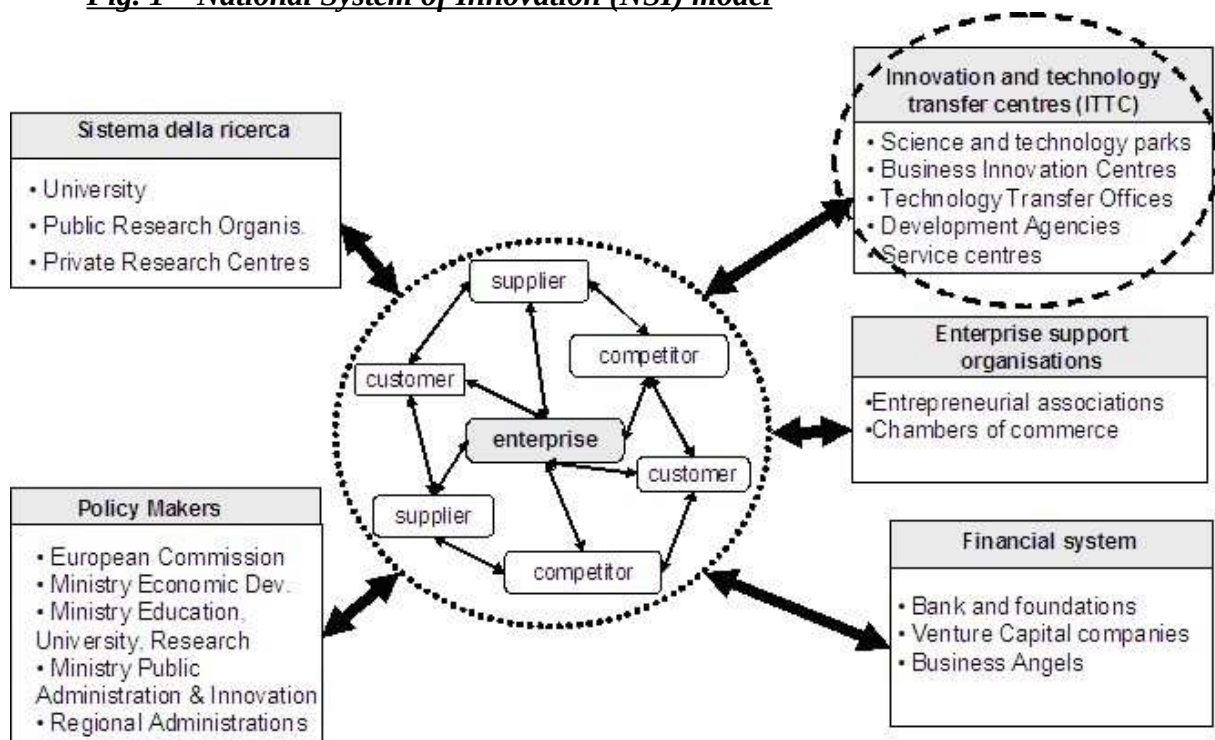
3.2. Centres for innovation and technological transfer (CITT)

Little attention has been dedicated in Italy on the interface agents, namely agents that operate between the research world and the productive world, although the characteristics and performance of the SIN have been analysed (Lundvall, 1992), highlighting the existence of vivid evolutionary dynamics like in some studies on technological and scientific parks, on university liaison offices, on Innovation relay centres or their local subsystems, specifically regarding experiences in the North of Italy (Lombardy, Piedmont, Veneto, Emilia-Romagna:

Coccia and Rolfo, 2005; Cusmani et al., 2000). It would be useful to recognise that these organisations play a specific role even in the context of emerging paradigms such as that of the triple helix (Etzkowitz and Leydesdorff, 2000) which, in the context of TT, adds a role to the system of central and local government institutions besides the role of the research and the productive systems.

Within the RIDITT programme some elements which appeared obvious but not explicit were emphasised, such as: (i) the proliferation of organisations that are neither research centres nor productive units but generally act between them; (ii) the increasingly active role played by the collective representation of firms (association of entrepreneurs or of districts, and so on) in innovative activities and TT, by favouring the aggregation of demands for technological solutions; (iii) the increasing influence of some formal or informal investors (credit institutions, banking foundations, venture capitalists, business angels, etc.) on TT; (iv) the emerging consolidation of the extended firm model which make it difficult to provide evidence on transfer flows, both within and between firms; (v) the decreasing significance of the methodological distinction between private and public actors, which in turn depend upon: the rise in mixed shareholding; the increase in public funding in the balance sheet of private research centres; and, above all, the growing appropriability of final and intermediate research results which characterises not only public but also private research. Figure 1 represents the SIN model.

Fig. 1 – National System of Innovation (NSI) model



Source: Authors' elaboration

The research conducted by IPI within the RIDITT context aimed first at providing evidence on the number and the nature of the entities effectively comprised within the Italian CITT subsystem, rather than immediately providing detailed information on the relationships between single elements.

A number of previous studies on that topic were selected for that purpose (Nomisma, 1988; Cariola, CNR-CERIS, 1997; Farinelli, AGITEC, 2000). In particular, Nomisma identified 75 organisations able to supply real innovation services to firms (non financial services). CNR-CERIS identified 161 such organisations but of which only half were service centres and only half of which were analysed. AGITEC (Agency for technological innovation) listed (after

desk research) 691 organisations involved in TT, of which only 358 were dedicated to TT activity.

The RIDITT research allowed to count 1200 organisations, both public and private, which can be considered as TT operators from research to the firm. From these 300 organisations were selected as they corresponded to the definition of CITT. This selection was based on: (1) the main declared mission; (2) the specific set of services offered (information, training and technical assistance), which were estimated as a percentage of total activities; (3) the adopted business model.

From that universe of 300 organisation a significant sample of 220 organisations was extracted. A survey of these 220 organisations, via normal post and via email, was subsequently conducted, submitting a questionnaire of 5 sections and 37 questions. About half the sample surveyed answered, representing about a third of the universe, namely 106 organisations. Some important elements of the CITT were therefore outlined: geographic distribution of the centres, by type; structural characteristics and main economic services; supply and capacity to meet the service demand in the market; level and type of specialisation; relational capacity and networking. Table 1 shows the number of CITT considered according the various identified types.

Table 1 – Innovation and Technology Transfer Centres (ITTC) examined, by type of organizations

ITTC type	N.
Industrial Experimental Stations	8
Science and Technology Parks	50
Technology Transfer Offices and Academic incubators	34
Business Innovation Centers	31
Chamber of Commerce' agencies and laboratories	45
Regional Development Agencies	49
Sectoral and Thematic Specialized Centres	56
Multi-sectoral Centres	27
Total	300

The data on the territorial distribution of Italian innovation centres provide evidence of a good diffusion on the whole national territory, with a certain predominance of the North and the Centre of the country, although not proportional to the higher presence of entrepreneurs in these areas.

Regarding the origin of these organisations, the majority was created following public initiative, although often in collaboration with organisations of representation of firms or with other private organisations. Only 16% of CITT result created by only private capital. This dependence on public money does not favour their market orientation; it rather raises the possibility of periodical crises related to the lack of funds or in any case in the uncertainty of activity programming.

In terms of operative age the survey shows a significant rise of the number of CITT in the 1980s. In fact, 27% of the CITT has less than five years and more than 70% has been operational for less than 15 years. The category where CITT are youngest is that of TT offices of universities, particularly the industrial liaison offices.

Concerning the volume of activities, four fifth of the examined CITT has turnover lower than € 3.5 million, and the average turnover of the centres was lower than € 500,000 in almost half the cases.

From the point of view of supply such centres tend to behave as brokers. More than half of them supply information services on the technological supply of third parties (catalogues and other repertoires of firm patents or other CITT), while only a fifth diffuses catalogues of own services or publishes studies and research, and little more than a half provides value-added technical assistance services. The specialisation level of the interviewed organisations is low on average, given that half of them declare to be specialised on more than 6 of the 10

technological areas suggested in the questionnaire, and only 66% of the labour force has received specific technical training.

The evidence is therefore that the TT system is rather young and, although distributed on the territory, it is characterised by small dimensions (two thirds of the centres have less than 30 employees and a third has less than 10 employees, with high turnover). This limits both its capacity to deal with larger projects and its specialisation, if these numerous and small organisations have to deal with a wide spectrum of technologies in a wide number of industries. This is reflected in the fact that firms tend to always go to the same centres, whatever their specific competence and specialisation and, consequently, tend to have a biased use of CITT.

3.2. Priority technologies for industrial innovation

In what follows we present the methodology and results of the IPI survey aimed at providing evidence on the technologies that are most promising for industrial innovation and, simultaneously, already available in the main research centres.

The importance of such information is particularly felt by manufacturing SMEs that are mostly exposed to international competition and have major difficulties in accessing technological developments realised by universities or other private or public research centres.

The methodology has been application-driven in order to first identify, for each sector, effective innovative industrial applications and, subsequently, identify the referring technology and technological area. This methodology has allowed to identify technologies that are appropriate to the Italian manufacturing system, as it is structured nowadays. This methodology was therefore preferred to the more diffused technology push approach which, starting from a given technology, identifies its potential impact sectors.

Eighteen manufacturing sectors were chosen adopting the classification defined by the OECD regarding the content of technology (low tech, medium low, medium high and high tech), based on R&D investment relative to turnover. Particular effort was devoted to the search for technologies for sectors of the so-called Made-in-Italy, namely low tech and medium-low tech.

The classification of technologies into given areas was deduced from the survey on the basis of the effectively used applications and technologies. For simplicity these were divided into 10 main technological areas.

Table 2 shows the examined 18 manufacturing industrial sectors and the 10 considered technological areas.

Table 2 – Industries classified by R&D intensity examined, and technology areas taken into account

Industries	Technology areas
<i>Low-technology industries</i>	
1. Food and beverages 2. Textiles and apparel 3. Leather and shoes 4. Wood products and furniture 5. Paper products and printing 6. Gold and jewelry	1- New materials, micro and nanotechnologies 2- Chemicals and separation technologies 3- Biotechnologies 4- Mechanics and industrial production technologies
<i>Medium-low-technology industries</i>	
7. Petroleum refineries and products 8. Rubber and plastic products 9. Ceramics and glass 10. Metal products 11. Shipbuilding and repairing	5- Automation and sensors 6- Electric, electronics and optic technologies 7- Information and communication technologies
<i>Medium-high-technology industries</i>	
12. Chemicals (excl. drugs) 13. Machinery and equipment 14. Electrical machines and apparatus 15. Automotive	8- Management, organization and business engineering 9- Environmental technologies 10- Energy technologies
<i>High-technology industries</i>	
16. Pharmaceuticals 17. Electronics (communication and computing equipment) 18. Aerospace	

Contrary to the more traditional studies of technology foresight, the survey was focused on technologies located in an intermediary phase between experimental development and wider commercial diffusion, that could be, once adapted, transferred and applied to firms. This approach was preferred to the use of technologies on which R&D activities could be oriented in a medium-long temporal horizon.

The analysis presented in this paper is therefore of a technological scouting type and is complementary to other studies carried out on the Italian case, including the study by AIRI (Italian Association for Industrial Research, 2009) and that of the Rosselli Foundation (2009). Contrary to these studies, the RIDITT study is based on already available field information and not on prospective forecasts, with a shorter application horizon. The analysis was conducted using combined methodologies, namely the compilation of a list of critical and key technologies, expert panel, brainstorming (UNIDO, 2003).

IPI identified 126 key technologies (corresponding to 1,430 practical examples of industrial applications), distributed between 18 sectors and 10 technological areas.

The method used for scouting and technology selection has therefore been based on the consultation of specialised literature (by sector or disciplines), referring to information made available by the main competence centres active in the referring sector and counted in the RIDITT survey. The analysis has regarded: (i) the reports of available technological forecasts, in Italy in particular, such as the studies by AIRI and Rosselli Foundation; (ii) the publications and specific notes on research and innovation by Italian industrial associations or innovation and TT centres specialised in specific industrial fields; (iii) strategic agenda and technical documents published in the Thematic Networks and Technological Platforms of the European Commission; (iv) the technological roadmaps developed by scientific organisations or by international standardisation institutions; (v) the results of similar initiatives conducted in other countries.³ From this basis a number of lists were realised for each industrial sector, organised in three levels: technological area, technology and examples of industrial applications. This approach has allowed subsequently involved experts to provide reading of the lists according to both the technology push approach that lead to a technological

competence, typical of a research organisation, and to technology applications and industrial solutions adopted in specific industrial sectors, and the market pull approach that allows to identify given solutions, developed from technologies or products that are already available in specific disciplines. Specific sector panels or round tables were realised for the study, to which 46 experts participated, be they researchers, academics or industrial managers active in the considered sector. Experts were asked to revise and integrate the list of identified technologies per competence industrial sector, indicating other technologies and their application and, eventually, excluding some of the technologies already listed. In addition, the sector panel was asked to express qualitative and quantitative evaluations on the relative importance of each technology per industrial sector, according to the following criteria: (1) level of development of the technology; (2) potential market impact of the technology; (3) level of technical, scientific and industrial competence on the technology (that is, the level of availability, in Italy, of professional, technical, scientific and industrial competencies); (4) social and environmental impact; and, above all, (5) capacity of diffusion and technological transfer to firms, which provides indications on the available capacity, within the SIN, to diffuse and transfer the technology to firms.

From this exercise 1,430 industrial applications were identified, corresponding to 126 technologies distributed on 10 technological areas, in a rather uniform manner, from a minimum of 8 technologies in the energy area to 17 technologies in the electronic area. A (18x10) matrix could therefore be built (see figure 2), that provides qualitative evidence on the technological areas with highest impact per industrial sector (lines) and on the importance of a technological area on a manufacturing system or sector level (columns). The sector/area with more numerous technologies are outlined in the table in bold, while those with average correlation are outlined in grey.

Fig. 2 – Industry-technology area matrix

Technologies \ Sectors	New materials, micro and nanotech	Chemicals and separation technologies	Biotech	Mechanics and industrial production technologies	Automation and sensors	Electric, electronics and optic technologies	Information and communication technologies	Management, organization and business engineering	Energy technologies	Environment technologies
Food and beverages										
Textiles and apparel										
Leather and shoes										
Wood prod. and furniture										
Paper prod. and printing										
Gold and jewelry										
Petroleum refineries										
Rubber and plastic prod.										
Ceramics and glass										
Metal products										
Shipbuilding and repairing										
Chemicals										
Machinery and equipment										
Electrical machines and apparatus										
Automotive										
Pharmaceuticals										
Electronics										
Aerospace										
	High Impact									
	Medium Impact									
	Low Impact									

*OCSE taxonomy based on average R&D expenditure

Source: Authors' elaboration based on RIDITT (IPI) survey

The matrix shows that the areas of industrial automation, of advanced materials, organisational and management technologies and energy technologies are more transversal, confirming their importance in supporting innovation in manufacturing firms. In addition, some areas are more specific, including biotechnologies that have more impact in the chemical - pharmaceutical and food sectors. From the point of view of sectors it is interesting to notice how the low and medium-low tech sectors have innovation opportunities in various technological areas (automation, ICT and organisational-management), contrary to common

sense that claims that innovation is specific to high tech sectors. The sectors with highest number of significant sector/area correspondences are the instrumental good, chemical and motor vehicles sector, showing the multidisciplinary of the firms in these sectors.

The first positive implication of this analysis regards the methodology. Technology scouting in desk mode, subsequently followed by expert panels, has resulted effective in identifying technologies. Second, the objective of the study of identifying technologies that could be readily available for TT has been a success, given that almost 1,400 such technologies have been identified in all sectors and all technological areas.

This instrument therefore appears useful although some additional details would be necessary to identify policy priority at sector or technological area level. Given these considerations, the pilot study described in this section has been focused on specific areas.

4. Pilot action for the promotion of TT

The RIDITT programme has implemented some pilot actions aimed at checking on the field the correspondence of the analysis described in the preceding sections relative to actual processes in the national innovation system. A positive signal with respect to the existence of a specific demand of TT instruments and to the capacity of operators to aggregate for this purpose has emerged during the first RIDITT round of 2005. In fact, on that occasion the opportunity to co-finance projects explicitly and exclusively aimed at the transfer of technologies already developed and available in universities and research centres was proposed, with the constraint that at least one entrepreneurial association be part of the project and that the themes be related to only four technological areas (automation and sensing, advanced material, biotechnologies, chemico-separative technologies). Other specificities of the experiences regarded: the involvement of intermediary organisations, the possibility of only developing technology marketing activities (promotion, proofs and feasibility analyses), the use of a predetermined set of evaluation criteria and premium to project dedicated to traditional sectors.

Despite the innovative character of the instrument and the numerous imposed constraints, the participation rate was much higher than expected, given in particular the limited amount of resources made available, that is, a bit more than € 2 million. The SIN replied with 42 project proposals, of a total value of more than € 40 million and the aggregation of 203 organisations, of which 50 universities, 24 research centres, 66 entrepreneurial associations and 63 CITT.

Besides this evidence, the Programme allowed to derive some indications regarding the management of TT processes, derived from the monitoring of the 4 co-financed projects⁴, the activities of which have been undertaken in 2006 and 2007. A good propensity towards strategic marketing of technologies emerges in particular, although it appears necessary to use instruments and approaches more oriented towards operative marketing. The capacity to precisely identify the range of technological supply and the segments of the potential market has for instance advantaged some projects over others. The advantaged projects have limited technological supply to non more than 2-3 technologies, associated to the realisation of a

⁴ Among the international references that have been used for the methodological definition and for the analysis of results are: “Technologies clés” (France, 2005); “Futur – the German research dialogue” (Germany, 2002); “The second foresight cycle” (UK, 2002); “Technological foresight programme” (Spain, 2001); “Delphi Austria” (Austria, 1998); “The foresighted society” (Sweden, 2000); “Czech foresight programme” (Czech Republic, 2001); “Hungarian foresight programme” (Hungary, 2000); “Technology foresight and critical technology selection” (China, 2003); “Technology foresight in Japan” (Japan, 2004); “Technology roadmapping” (Corea, 2002); “Critical technology selection” (USA, 2005). Project information has been derived from: *Ministère de l’Economie, des Finances et de l’Industrie, Secrétariat d’Etat à l’Industrie*, DIGITIP (2000); Cuhls and Georghiu (2004); Miles, Keenan (2003); von Knud BÖhle (2003); Carsten (2003); Annele, Birte Holst (2002); Klusacek (2004); PREST (2004); Yang *et al.* (2004); Michio (2000); Choi (2005); Moguee (1991).

limited number of products, rather than to the firms of a whole sector. Similarly on the demand side, entrepreneurial associations which had a strong relationship with a given territory together with a specific industrial competence resulted more effective, because they managed in this way to meet the needs of the productive processes identified on the supply side and to more intensely involve SMEs interested in the activities of the project. Hence one can identify one of the aim of a programme supporting TT in the harmonisation and diffusion of the best operative practices.

Although the provided indications cannot be much generalised because they are derived from the observation of a limited number of projects, the lack of availability of instruments and validated operative methodologies was also felt in management aspects. TT actions indeed necessarily require easier procedures relative to R&D projects, in that they are closer to the market and correspond to more immediate firm needs. This is partly shown by the higher readiness of EPR relative to universities observed during the realisation of the programme.

As a conclusion, whereas the four projects have shown, with different modes and results, that it is possible to reach the objectives of the programme through promotion, proof and study activities, the evaluation of their impact has proved difficult to measure. Neither the experiences of other European countries nor theoretical developments allow to find satisfying measures in order to assess the effects of a specific TT policy on the competitiveness of productive systems. Measures and evaluation instruments are also lacking in the USA, given that Bozeman, while recognising the capacity of public policies of the 1980s and 1990s to free the “lamp genius” and to realise some “desires” (the collaboration between research and firms), stresses that it would be better to observe not so much “desires” but rather the overall effectiveness of the “genius” (i.e. the policy) (Bozeman, 2000).

For this purpose, a more scientific and deeper reflection would be important in order to develop instruments and methodologies for the assessment of the impact of TT policies.

The availability of such instruments and methodologies would be useful in the second phase of the RIDITT programme. The Ministry of Economic Development has in fact, in 2007, decided to continue the RIDITT initiative, with a total financing of € 17,8 million. The objectives of this second phase, which will last five years, are as follows: particular attention to the actions which had positive effects in the pilot programme (aggregation of operators, focus on specific technological areas, creation of new firms dedicated to TT, etc.); a test of more efficient TT operative processes; the introduction of corrections in order to make administrative procedures simpler and quicker and to reduce the weight given to some indicators in the selection of projects; dedicated resource allocation for impact assessment.

5. Conclusions and policy implications

The empirical results of the RIDITT pilot programme implemented in Italy, together with the analysis of the literature on TT policies show how specific policies aimed at supporting the collaboration between public research and business, independently from R&D policies, have an important role to play in the promotion of the competitiveness of the productive system.

Another result is that it is important to implement these policies given a deep knowledge of the TT system (operators, technologies and interaction mechanisms), that has to be studied upstream, while the availability, downstream, of monitoring and impact assessment systems is also key. In Italy the knowledge of the TT system is still limited and monitoring and assessment are not systematically carried out.

Besides this, the instruments available for this type of policy appear obsolete and inadequate to deal with the complexity inherent in the relationships between public and private institutions regarding TT.

More generally, the ‘scientific’ interpretation of the problems to be resolved cannot be neglected, looking for most appropriate instruments to reach the fixed objectives and taking past experiences into account. For this purpose, more effort is necessary at both national and international levels to develop models, measurement methods and analytical instruments that could be applied both in the policy decision-making processes and in the adaptation of implementation measures.

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