

Organizing the Offices for Technology Transfer

Chiara Franzoni

(University of Bergamo and Ceris-Cnr)

e-mail: c.franzoni@ceris.cnr.it

Abstract. Research Institutions (RIs) in last decades have been involved in both production of technological applications and commercialization of research results for the sake of technology transfer. These tasks are frequently taken as overlapping both in theory and practice, whereas they should be ideally separated. The present paper focuses on the latter, by questioning why RIs have to be involved into commercialization of research. Drawing on the identification of coordination needs among demand and supply of technological opportunities, evidence of five extensive case studies of Technology Transfer Organizations (TTOs) belonging to RIs is analyzed, with regard to the efficiency of the process of opportunity recognition. The claim for superior efficiency of RIs in technology transfer depends, in a static perspective, on an expected superior capacity of TTOs to manage existing knowledge. However, in practice, TTOs do not always exploit available sources of efficiency gains. Implications for management of knowledge and technology transfer are discussed.

Keywords: technology transfer, OTT, spinoffs, academic patenting

JEL: O3; L2

WORKING PAPER CERIS-CNR

Working paper N. 15/2004

Anno 6, N° 15 – 2004

Autorizzazione del Tribunale di Torino

N. 2681 del 28 marzo 1977

Direttore Responsabile

Secondo Rolfo

Direzione e Redazione

Ceris-Cnr

Istituto di Ricerca sull'Impresa e lo Sviluppo

Sede di Torino

Via Avogadro, 8

10121 Torino, Italy

Tel. +39 011 5601.111

Fax +39 011 562.6058

segreteria@ceris.cnr.it

<http://www.ceris.cnr.it>

Sezione di Ricerca di Roma

Istituzioni e Politiche per la Scienza e la Tecnologia

Via dei Taurini, 19

00185 Roma, Italy

Tel. 06 49937810

Fax 06 49937884

Sezione di Ricerca di Milano

Dinamica dei Sistemi Economici

Via Bassini, 15

20121 Milano, Italy

tel. 02 23699501

Fax 02 23699530

Segreteria di redazione

Maria Zittino e Silvana Zelli

m.zittino@ceris.cnr.it

Distribuzione

Spedizione gratuita

Fotocomposizione e impaginazione

In proprio

Stampa

In proprio

Finito di stampare nel mese di January 2005

Copyright © 2004 by Ceris-Cnr

All rights reserved. Parts of this paper may be reproduced with the permission of the author(s) and quoting the source.

Tutti i diritti riservati. Parti di questo articolo possono essere riprodotte previa autorizzazione citando la fonte.

Contents

1. Theoretical framework.....	5
2. Case studies analysis.....	7
<i>UMIST Ventures Ltd. (UVL).....</i>	<i>8</i>
<i>Cambridge Enterprise (CE).....</i>	<i>9</i>
<i>Manchester Innovation Ltd. (MIL)</i>	<i>10</i>
<i>Rete Ventures SCrl (RV)</i>	<i>11</i>
<i>Office of Biotechnology Transfer (OBT) of Science Park Raf spa (SPR)</i>	<i>12</i>
3. Results and Conclusions.....	13
Acknowledgements.....	14
References	15
Working Paper Series (2004-1993)	I-V

The present work aims at contributing to the understanding of the mechanisms of technology diffusion from science to market by looking at the intermediate actors that are in charge for making knowledge transfer effective. These actors are Industrial Liaison Offices, Campus Ventures, Offices for Technology Transfer, and so on, that in the following will be addressed as “Technology Transfer Organizations” (TTOs). Their jobs typically include prior-art screening, patent filing services, marketing of technological assets, licensing agreements, industry partnership procurement, IPR management, as well as creation of spin-offs and early growth of high technology ventures, the latter role having become more and more important in the last decade (Feldman *et al.*, 2002; Bray and Lee, 2000; Lockett *et al.*, 2003).

A critical task of TTOs is to provide coordination in the market for technological opportunities. As literature on market failures in technology transfer has widely pointed out, coordination in this market does not arise spontaneously, since it is made ineffective by the existence of a set of stickinesses that ultimately depends on the nature of knowledge to be transmitted. In recent years an impressive body of literature has been published that took into account the enlargement of RIs’ mission to technology transfer issues (Thursby and Thursby, 2002; Etzkowitz *et al.*, 2000) and the effect of this shift over long term technological change. The present work aims at contributing to the understanding of the efficiency of current model of TTOs as market coordinators, i.e. of the efficiency of a solution that assigns ownership and control of operations to an upstream integrated research actor, vs. a non-integrated one. In order to do this, I analyze the process of technology transfer in five TTOs belonging to a parent RI, with special focus on their capacity to perform efficient opportunity recognition (Shane, 2000). The contribution of this paper is firstly to identify some of the organizational variables that are capable to explain efficiency of opportunity recognition in technology transfer operations (Siegel *et al.*, 2003a); and secondly to shed light on the benefits that can be reasonably expected by a

model in which this activities are performed by RIs, in term of efficiency gains in the treatment of information and exploitation of existing competencies in a static comparative efficiency framework.

The article is organized as follows: section 2 briefly addresses TTO as the targeted unit of analysis of field research. In section 3, I build up the theoretical framework that will lead the empirical search. Case studies are presented in section 4. Section 5 discusses the results and the implications for both technology transfer policy and management of TTOs.

1. Theoretical framework

Given that TTOs seek to provide organizational solutions to coordination failures in market for technology transfer, in the following, I will address the issue of the efficiency gains that can be enabled by a model where scientific institutions (i.e. an upstream integrated actor) perform this task. In order to guide the search within case studies, in this section I identify a set of organizational variables and practices that have impact over technology transfer potential and suggest a direction of causality over capacity to overcome market failures in technology transfer and to enable better exploitation of new knowledge.

A first problem in coordination is related to the transaction costs associated with asymmetric information between the supplier of new knowledge – the scientist - and the potential buyers – firms and industrial players - which raises expectation of opportunistic behavior. As literature on venture capitals and finance of high-technology ventures have explained, the problem of asymmetric information is particularly hard to tackle in this kind of market, given the specificity and knowledge-intensity of goods traded, which requires a highly sophisticated knowledge to process technology due-diligence and forecast market potential (Cable and Shane, 1997; Murray and Lott, 1995; Roberts, 1991b). The closer the technological good to the state-of-art, the harder to find the

knowledge endowment required for the evaluation. Moreover, the more sophisticated the technological good, the lower the probability that the same knowledge will be re-saleable in successive transactions. Therefore, high specific fix costs associated with the evaluation process result in an inability of market players to provide effective opportunity recognition, particularly with regard to initiatives that require a small amount of capital invested (seed capital finance). Note that the market failure argument here is rooted in the supposed separation between supplier and adopters of an innovation (Martin and Scott, 2000), which raises the argument of private information and inadequate absorptive capacity enhancing transaction costs. From this point of view, we can expect a vertical-integrated actor sharing knowledge with research departments to be facilitated in the process of opportunity recognition, to the extent that it can apply a set of knowledge and information already available within the parent organization, thus exploiting economies of scope in knowledge treatment.

Valuable knowledge for technology transfer operations is at least of two kinds: 1) private information on the characteristics and value of the piece of knowledge; and 2) scientific and technological competencies needed to evaluate/recognize technological opportunities. Private information relates mainly to the characteristics and skills of the researcher, to his/her commitment to the project and to the value of technology that has to be traded, especially with regard to its potential future development (Shane and Cable, 2002; Shane and Stuart, 2002). Yet, expectation of long-term relationship with RI reduces the incentives for the researcher to retain private information and engage in opportunistic behavior with internal TTO. However, in many cases, the researcher itself is not a reliable judge of the value of his/her technology; hence, the previous information, which cannot be directly observable nor credibly signaled in advance, can be efficiently inferred from previous relationship with parent, performance record, eminence of scientists and of research team. Therefore, I expect that a share of information with parent enable lower asymmetric information between the parties and reduced

expectation of opportunistic behavior. Similarly to the previous, parent organization may also be a supplier of competencies to apply in the evaluation of technological assets for identification and exploitation of valuable opportunities. Evaluation of a technological good that is presumably close to the state-of-art requires to the evaluator a portfolio of scientific and technological competencies. In this respect internal flow of people or consulting services, may be particularly valuable to the extent that it ensures access to sophisticated knowledge at a transfer price, which is lower than the equilibrium price on the market of resources.

Ultimately, the parent research organization may be a source of technological opportunities capable of commercial exploitation, as well as a supplier of competencies to apply in the technology transfer process. Therefore, a RI that integrates vertically to provide technology transfer services and creates a TTO to market its research may obtain efficiency gains by enabling effective share of information and knowledge between the research departments and the technology transfer unit. Therefore, I expect that:

- 1) In a research-integrated TTO, private information available in parent RI is used to lower the expectation of opportunistic behavior;
- 2) In research-integrated TTO, competencies of parent RI are used to lower evaluation costs and to enhance capacity to recognize opportunities.

I will interpret share of knowledge in the form described by previous statements as supporting the hypothesis that a research-integrated design of technology transfer activities, *ceteris paribus*, provides a more efficient coordination of the market of technological goods, by making more efficient use of existing knowledge.

TTOs may also have a second source of organizational advantage to tackle asymmetric information. As a recent stream of literature has highlighted, supply of technological opportunities is self-constrained by the behavior of researchers that generate new knowledge. Firstly, retention of disclosures may arise because researcher may lack the capacity to

foresee market potential for the results of his/her own work (Thursby *et al.*, 2001; Owen-Smith and Powell, 2001). Secondly, given that researcher is subject to a multi-task optimization function, disclosure do not occur unless it is incentive-compatible, hence an unbalanced incentive system generates self-retention of potentially valuable opportunities. Now, because research career depends on the number and quality of scientific publications and because there is at least a short-term trade-off among scientific publication and market exploitation of results (Thursby and Thursby, 2002), it is reasonable to expect the probability for a researcher to quit disclosure and to go for open publication to be higher among young and untenured people, i.e. those that face a higher marginal benefit of publication (Siegel *et al.*, 2003b). In other words, if we assume a non-linear return of effort on career, researchers will be more reluctant to disclose and delay publication in strongly upward-sloped portions of their career path, which normally occur quite early in working age. As a result, because the probability of finding both higher productivity of research (Levin and Stephan, 1991; Morgan *et al.*, 2001) and superior entrepreneurial attitude is also higher among young researchers (Roberts, 1991a), the subset of opportunities spontaneously submitted to internal TTO may be adversely selected. This is true even when researcher has a contractual due to retain from dissemination because we normally observe no enforcement to the right of university to hamper early free circulation of knowledge (Siegel *et al.*, 2003b). Access to results of research is not ensured even to internal players and, given the complex framework of agent-principal relationships within the RI (Jensen *et al.*, 2003), the population of disclosed results may not only be self-constrained, but also adversely selected. In the following I want to inquire if hierarchical control may effectively substitute for failure in providing an alignment of incentives. If this is verified, a direct access to research units should result in enhanced disclosures and lower adversely selected population of input technological assets; hence, ultimately, in superior technology transfer performances.

The previous argument suggests focusing field research upon the mechanisms of

disclosure from scientists to TTO in order to understand how organizational design of technology transfer activities may tackle the sources of ex-ante adverse selection. As a starting point, I expect that:

- 3) In a research-integrated TTO, direct observability of research results lower self-retention and adverse selection of input technological goods.

2. Case studies analysis

In the following I present results of an empirical analysis conducted during spring-summer 2003 on five European (British and Italian) TTOs fully owned by a parent RI. Collection of information was conducted in the form of semi-structured extensive interviews with members of staff. After first contact with the target TTO, preliminary information collection was made through web-search and a draft of questions was sent to prepare for face to face meetings. Depending on the size of organization, a number of interviews were scheduled with operative members - basically function/unit managers - to have a good representation of all non-administrative activities carried on at the institutional level. Overall, 2.2 interviews on average for each organization were conducted, lasting from 15 to 105 minutes.

TTOs selected represent a convenience sample of Italian and UK institutions (some general information on activities of 5 TTOs is provided in table 1). Search for cases was done among the most relevant and successful organizations in both countries. Some degree of excellence in selection of cases was needed because current population of TTOs is highly skewed with regard to all indicators of performances and activities. Clearly, for the sake of analyzing internal design of TTOs, there was the need to select case studies showing a substantial organization of activities, the case of poor results being –trivially– one of almost no activities performed. Nevertheless, the sample of cases was selected so to ensure a good degree of variance in the IPR policy adopted by the parent and of organizational structure, governance and principal-agent relationship.

Table 1: Case studies. General characteristic

Case study	Ownership	Activities	% revenues share to researcher	Established	Patent licensed	Spin-off created
UVL Ltd.	UMIST	IP/patent services; licensing; spin-off creation; research agreements	75% up to 5,000£ 60% up to 20,000£ 50% over 20,000£	1988	75	38
Cambridge Enterprise	University of Cambridge	IP/patent services; licensing; spin-off creation; investment in high-tec ventures; entrepreneurship education	90% up to 20,000£ 70% up to 60,000£ 50% up to 100,000£ 33.3% over 100,000£	2003	n.a.	n.a.
Manchester Innovation Ltd.	University of Manchester	IP/patent services; licensing; spin-off creation; incubation facilities	negotiated case by case	2000	27	25
Reinventures	INFM (51%) INSTM (35%) CSGI (16%)	IP/patent services; licensing; spin-off creation; research agreements	to be negotiated (in any case > 85%);	2000	1	4
OBT of Science Park Raf spa	Science Park Raf spa	IP/patent services; licensing; spin-off creation; research agreements	50% up to 500,000€ 25% up to 600,000€ 10% over 600,000€	1995	45	2

UMIST Ventures Ltd. (UVL)

UVL is located in Fairbairn Building, standing in the middle of UMIST Area of Manchester Campus, few hundred meters far from the university main building. The campus area is just south of Manchester city center and includes the majority of buildings of three of the four local universities. Contrary to the great majority of British universities, UMIST does not claim IPRs on the results of employees' work, so that researcher has no due to disclose to internal legal office and to keep the secrecy over exploitable technological innovations. At present, UVL non-administrative staff is grouped into three functional units: 'Intellectual Property and Licensing', 'Venturing and Spin-off', and 'Collaborative Research and Contract Management'.

Disclosure mechanism. To encourage disclosure and submission of technological innovations, UVL schedules every year a plan of research auditing at the department level to have an overview of the projects going on within the campus and to meet research staff. Traditional cultural resistance was signaled by the staff in approaching departments and scheduling meetings, although willingness of scientists to deal with commercialization activities is perceived to be increasing over time and among younger members. Interviewed staff claimed that research auditing has a strong impact over

disclosures, with on average one/two contacts immediately following each meeting. This supports the hypotheses that activities of TTO can have some effect in reducing self-retention of opportunities, when caused by low awareness of scientists on potential value of applications. Still, nothing can be said about the quality of disclosures and overall there seems to be no mechanism preventing adverse selection of technologies submitted.

Share of knowledge. For what the opportunity recognition process concerns, evidence of effective share of knowledge between UVL and parent staff is very poor. No competencies for evaluation or consulting are borrowed from organizational structure of parent; evaluation are conducted by the five members of UVL "IP and Venturing" staff, that have good background in marketing and communication, sometimes coupled with Biochemistry, Electronic Engineering and Physics graduate education; check for novelty of innovation and prior-art is outsourced to an external consulting company, whereas UVL staff screens market interest by contacting a pull of industrial partners and potential buyers, normally indicated by the scientist. This practice, that seems to be widely adopted according to the empirical literature (Owen-Smith and Powell, 2003), suggests that UVL relies on knowledge of external players, rather than parent's. Additional competencies or

peered scientific opinions are occasionally outsourced to external independent consultants, but normally in later stages of development. Moreover, there seems to be some systematic constraint to knowledge share, as staff reported scientists to be often reluctant in enabling communication of results, even to colleagues and other members of scientific community, due to fear of losing control over valuable information and also to the poor status associated with commercialization of research in the scientific community. Therefore, I have found no evidence of internal management of competencies and existing knowledge: UVL is organized as a self-standing unit that is neither asked nor allowed to mobilize knowledge of parent for technology transfer purposes, both in the form of private information and exchange of competencies for opportunity recognition.

Cambridge Enterprise (CE)

Cambridge Enterprises has been recently created from the merger of four previous organizations that variously dealt with technology transfer within the University of Cambridge: Cambridge Technology Transfer Office, Cambridge Challenge Fund for early finance of technology ventures, Cambridge Entrepreneurship Centre for education on entrepreneurship and firm creation and Cambridge University Technical Services Ltd. Cambridge excellence in research and teaching needs no presentation. On the following, I will describe the set of guidelines that have been approved for the reorganization and future operation of Cambridge Enterprises, updated at the beginning of summer 2003, which however reflects the best practices developed in past experience. At the moment, university according to UK law claims only IPRs over externally funded research, whereas scientists currently own the IPRs over results created as part of their normal employment contract. However, a new IPR policy has been recently proposed (October 2002), which substantially extends university rights to all results of research.

Disclosure mechanism. As part of the institutional policy, CE does not accomplish any activity like research scouting and search for disclosures. CE staff reported that this was

perceived to be disturbing by scientists and eventually signaled to place greater interest in the pool of business ideas that comes out of university higher education programs on Entrepreneurship. Therefore, CE can only be activated by spontaneous submission of researchers, who exert substantial control over research exploitation and chooses whether to disclose or not, regardless of the IPR regime to whom the results are subjected. Therefore, I have found no support to claim for an unbiased access of CE to the research conducted within Cambridge labs and research departments. On the contrary, the role played by the scientist in deciding the destiny of research is simply made more explicit, as confirmed by the new policy assessment that includes an informal commitment of the university not to commercialize results contrary to the indication of researcher. In this respect, University of Cambridge seems to distinguish the right to decide whether the research should undergo a profit vs. no-profit diffusion path and the right to participate in the share of revenues generated. Whereas the former implies a role for institutional management of results, including control over disclosure, the latter corresponds in the right to exert an exclusive (or preferential) option over all those results that are intended to generate revenues (Sampat and Nelson, 1999).

Share of knowledge. After disclosure has been occurred and after a preliminary screening on prior-art and patentability has led to positive response, CE organization of technology transfer activities is again very peculiar and involves a strong attempt to make effective management of existing knowledge. As a first step, project is assigned to a project manager, whose commitment is to develop a feasible idea and formulate an evaluation in four weeks time. In order to complete evaluation and in the perspective of future development, CE manager is free to assemble a project team by grouping a maximum of five/six people, including the researcher, to help collection of needed information and to provide a pattern of competencies for opportunity recognition and development. Selection of members is made from a pool of candidates estimated in approximately 120 mentors that may belong to research units and university staff or to the

wider social network of Cambridge community likewise. Dimension of team and involvement of members is decided on a case-by-case basis, depending on the nature and complexity of project and on its development stage and is certainly consistent with the broadness of scientific fields of research applications. A standard-type team for a complex project, for instance one that involves creation of a new venture, has been described by staff as grouping: a member of university Technology Transfer Office, who is responsible for IPR protection and legal consulting, a person having a strong and relevant scientific background providing technological support, an expert in company creation, as a serial business angel or previous high-technology entrepreneur, and a professional for commercial, marketing, negotiation and finance activities, often coming from the Business School Faculty. The case of CE therefore provides a good example on how parent RI can enhance its technology transfer potential by managing existing knowledge. Note that skills of Project Manager are mainly those of networking among mentors, the main task being to ensure effective decision making for the development of innovation within the scheduled time. Network ties in which managers are involved also ensure a steady flow of information across the boundaries of internal units, which also gives support to the proposition made in the previous section. Note that the benefit of upstream integration is ensured by network capacities as well as research potential of parent.

Manchester Innovation Ltd. (MIL)

Manchester Innovation Ltd. is the only campus venture fully owned by University of Manchester (UoM) and is currently in charge of managing all IPRs over internal research. MIL is located in the middle of Manchester campus area, in the same building where it is also hosted the only Incubator of Manchester campus, specialized in biotechnology ventures. University of Manchester has excellent research ratings for a number of scientific fields that generate exploitable technological assets (Jensen and Thursby, 2001), mainly Biological Sciences, Pre-Clinical Studies, Pharmacies, Computer

Sciences, Pure Mathematics, Mechanical, Aeronautical and Manufacturing Engineering, Metallurgy/Materials and Physics. UoM claims all IPRs on research output and seems to be quite concerned in protecting exploitable results from dissemination. Members of staff are explicitly asked to refrain from undue publication and from all use of results that can prevent UoM from claiming rights and to collaborate with MIL for all operations required to undergo commercial exploitation.

Disclosure mechanism. Members of staff reported that MIL normally devotes time and resources to the organization of internal events and a scouting campaign to enhance the rate of disclosures and foster the collaboration climate with research units. However, MIL staff reported that the most effective results on the side of disclosures were achieved when there was a good collaboration between TTO and the Head of Departments. In those cases, disclosures had often been urged by departments, which certainly benefited direct information over research conducted internally. To the extent that this mechanism is effective, TTO may substantially delegate control over undue dissemination directly to research units, which enables a more unbiased access to exploitable results. In other words, if the described mechanism is effective, I expect control over dissemination of internal staff to be able to compensate for misalignment of incentives at least partially. In this respect, a research-integrated organization of TT may be more efficient at least in the short term than comparable independent market actors.

Share of knowledge. I expect that effective collaboration with Head of Departments, where it exists, may also involve some substantial exchange of information about technological assets and about people, which gives support to the proposition sub 2. For what the exchange of competencies concerns, similarly to some other cases, MIL seems to have a fully independent structure that does not include borrowing competencies from internal units. However, there seems to be a stronger concern on technological competencies needed in opportunity recognition, as all current five Business Development Managers, in charge of

both evaluation of technological assets and successive management of development stage, have a strong scientific background -namely a Ph.D. education in either Life Sciences, Chemistry or Physics- in some cases coupled with previous experience in business or MBA education. Note that scientific backgrounds are overall consistent with the fields of technological excellence of parent, therefore each manager is asked to follow those project where he/she had technological competencies. This may partially lower the value added of borrowing competencies from organizational structure, at least for those results of research that are not very close to the state-of-art. However, staff reported that external consulting help has been used in case of overloading, which expressively excludes use of internal competencies.

Rete Ventures SCrl (RV)

RV is a joint venture of three Italian research partners: INFM (Italian Institute for the Physics of Matter), INSTM (Consortium of Italian Universities for the Science and Technology of Materials) and CSGI (Inter-university Consortium for the Development of Big Interphase Systems). Each of the partners that jointly own RV runs a no-profit network of research units and researchers that are hosted within the research departments of national public university institutions, voluntarily joining the networks to receive research grants. Overall, the research units involved in the networks are nearly a hundred, localized across the Italian regions and specialized in the research and development within the fields of New Materials Engineering, Biophysics, Computing and Microelectronics.

RV has been founded as a private company in 2000 and is currently organized in three operative units, all located outside campus areas in Turin, Genoa and Florence, whose commitment is to offer technology transfer services to members of the networks. According to Italian 2001 regulation, researchers own all the IPRs over research results, therefore they do not have any due to disclose. In case they extract rents from research assets, they have to compensate the RI that originally provided

research grants and facilities with a percentage of profits that is always lower than 50%. Additionally, if researcher asks for technology transfer services, RV charges a fee (not representing a market price) only in case of profits.

Disclosure mechanism. Consistent with Italian regulation, RV does not have any exclusive -and in many cases not even a preferential- access to innovations of partners' members. This is because, in many cases, the universities where researchers are hosted have also some institutional organization that is in charge of technology transfer. As a result, RV may be somehow in competition with other TTOs for the supply of services. To promote contacts with researchers, RV runs communication campaigns by organizing events in partner institutions, which is claimed to enhance first contact with researcher and successive disclosure. As in previous cases, RV action seems to have some effect in reducing self-retention that is due to lack of entrepreneurship, whereas I have found no evidence of mechanisms that may prevent form adverse-selection of submitted technological opportunities.

Share of knowledge. With regard to evaluation of technological assets and opportunity recognition capacity, I have found, as in some previous cases, that RV is organized as a totally self-standing organization, with no competencies borrowed from parents. Evaluation of opportunities for development of research assets is conducted jointly by internal IP and legal staff and project managers, whereas the writing of patents is systematically outsourced to an external consultant. Among the three project managers currently working in RV, two have a strong scientific background in Physics and Chemistry, which is consistent with the scientific fields of application and one has a business and marketing education. However, members of staff have signaled that collaboration with some researchers and parent key people is sometimes particularly strong, thus involving free exchange of information following a disclosure, with a broad informal network of people being activated and apparently no strong dues to keep confidentiality of results. Therefore, I can expect that some

circulation of private information among network members is effective, which enhances the climate of trust among the parties of negotiation.

*Office of Biotechnology Transfer (OBT)
of Science Park Raf spa (SPR)*

Science Park Raf spa (SPR) is the limited company created by S. Raffaele Hospital Foundation to manage the science park hosted within S. Raffaele Hospital (SRH). The SRH area is located east of Milan town center and currently includes clinical departments, laboratories for basic research, as well as a medical school and university (hosted, but not belonging to SRH Foundation), and a small science park (SPR) that currently owns the Office for Biotechnology Transfer (OBT), a conference meeting center and ten private company labs. SRH is a private no-profit foundation with excellent research ratings in Molecular Biology and Genetics and good reputation for clinical trials and drug testing. Given the strong specialization of basic research held in parent organization, OBT is also highly focussed on Biotechnology, therefore technology transfer is strongly dependent on patent activities. According to the private nature of SRH, IPR over results of all internal research belongs to the institution, with the scientist having a contractual due for disclosure and being compensated with a share of the profit eventually generated.

Disclosure mechanism. Interviewed staff described disclosure of scientists to OBT as occurring spontaneously, the retention of information being considered negligible. This situation, that seems to be inconsistent with what reported in the previous cases, can be explained at least by two possible sets of reasons. First of all, there is certainly the effect of the scientific field of interest: because patent protection in Biotechnology tends to be ensured for basic discoveries, and because the file of a patent has been recently given increasing importance even in scientific curricula, misalignment of incentives has certainly a lower impact than in other scientific disciplines. Secondly, given the relatively small dimension of SRH and the narrow focus of its research,

especially with regard to previous cases, strong communication and direct personal relationship between members of internal research community may provide an effective mechanism of mutual control over undue dissemination of results. This seems further supported by the evidence that OBT personnel and directors of units use to have frequent meetings to discuss about progress of technology transfer projects which also involve informal communication about current research and possible future occasions of development. Overall, the small size of internal community, coupled with a co-located TTO and RI ownership of IPRs seems to create the conditions for a lower internal asymmetric information and lower occasions for opportunistic behavior of members, which gives support to hp. 3 of unbiased access to internal results (lower self-retention and lower adverse selection).

Share of knowledge. For what the process of opportunity recognition concerns, OBT organization systematically relies on competencies borrowed from research departments. After first disclosure and after prior art screening has been completed by the IP staff, researcher is asked to present the result of his/her job to an internal board that has to decide whether to patent and further support development or to quit and release IPRs. The board is composed by five permanent members: two people from the IP staff, the director of SRH, the director of clinical unit and the director of basic research department, each counting one vote in the final decision. As part of the presentation meeting, an invited member, who is selected on a case-by-case basis from research staff, is asked to provide a critical discussion to researcher's presentation, which increases information set of permanent members that have to achieve final decision. Moreover, given the small size of research community and the presence of top executives in the decision board, OBT seems to benefit a systematic share of private information on capabilities and commitment of internal staff in negotiations among the parties. The evidence supports the idea that OBT relies on effective management of existing knowledge to perform opportunity recognition task.

Table 2: Case studies. Results

Case study	Hp .1	Hp .2	Hp .3
Umist Ventures Ltd. centralised unit in the campus; UMIST does not claim IPRs over research	no informal/formal flows of information; evaluation is kept confidential to the rest of the faculty	no competences borrowed from parent structure; competences are borrowed from network of industrial partners	periodical technological auditing at the level of departments;
Cambridge Enterprise centralised unit in the campus, grouping many functional units; no IPR over research of employees IPR over external funded research	internal networking among people; private information access presumed	competences are borrowed on project basis by assembling internal and external members under direction of a project manager	absolutely no search for proposal; only voluntary disclosures
Manchester Innovation Ltd . centralised unit in the campus incubator in charge of managing all IPRs on behalf of UoM	good talk with chief of departments, some access to private information is presumed	no competences borrowed from parent structure; good scientific background of members of staff	periodical technological auditing at the level of departments; collaboration with chief of departments facilitating disclosure
Reteventures decentralised unit outside campuses providing TT services on demand to member departments; no IPRs over research	good talk with some departments, some private information access is presumed	no competences borrowed from parent structure; informal network can be activated; good scientific background of staff	random access at the departments for self-promotion; services provided on demand to members of departments
OBT of Science Park Raf spa centralised unit inside campus 9incharge of manageing all IPRs on behalf of SRH	good talk with some departments, some private information access is presumed	competences are borrowed from parent structure both systematically and on project basis	no search for proposal; mutual internal control over undue dissemination and substantial alignment of incentives

3. Results and Conclusions

I have presented evidence of five TTOs that are in charge of transferring research results into market on behalf of a parent RI (see Table 2) to inquire the capacity of research-integrated TTOs to perform the task of opportunity search and recognition by making effective management of existing knowledge, which I have separated in 1. Disclosure Mechanism and 2. Share of Knowledge.

Disclosure Mechanism. Given the agent-principal framework of relationship that stands within the RIs between Faculty and the TTO unit (Jensen *et al.*, 2003), self-retention and adverse selection of technological opportunities is likely to occur, due to the inability of scientists to recognize the potential for

technological applications and due to misalignment of scientists' incentives coupled with lack of enforcement. In this respect, I have found that some TTOs utilize their direct link with the parent to promote communication and systematic research auditing in research departments, which seems to have some effect in reducing self-retention of opportunities caused by poor awareness of scientists on commercial potential of their research. When IPRs are allocated to scientists, disclosure for commercial exploitation of research occurs only to the extent that it is incentive-compatible with researchers reward system (Lach and Schankerman, 2003). This is probably the case of OBT, where the small size of research community and the scientific field of application provide good alignment of incentives for

technology transfer purposes. In case of RI ownership of IPRs, hierarchical control of RI over undue dissemination of results may partially substitute for failure in providing alignment of incentives. In this respect, I have found that TTOs may find it hard to exert direct control over researchers' actions. However, a strong commitment to technology transfer of faculty members, and especially of Head of Department seems to work at least in the short run as a mechanism to lower adverse selection of inputs. As a result, RI Administration can indirectly enhance control over disclosure by selecting Head of Departments. This organizational variable may be of interest for future research agenda.

Share of knowledge. In the theoretical framework I have highlighted that parent RI may be a source of valuable knowledge for opportunity recognition. Share of knowledge with parent may have a positive impact to technology transfer potential in two ways: because it enhances the climate of trust among parties involved into negotiation and because it enables economies of scope over competencies that already exist in the organizational structure. According to the previous, I have isolated two separate levels of share in the analysis: share of private information and share of competencies.

Valuable private information relates basically to the skills of researcher, to his/her commitment to the project and to the development potential of technological asset. I have found that this kind of share is hard to detect, as it occurs informally and staff tends to be quite sensitive in revealing this information. However, circulation of private information seems to occur normally when TTO has some good talk with research departments and when organization of activities involves share of people and of consulting services. In this respect, an integrated model of TTO seems to ensure easier communication and flow of information across the internal boundaries. Still, I have found that researcher's ownership of IPR in one case seems to systematically constrain the possibility to engage in virtuous circulation of information.

For what the internal share of competencies is concerned, I have found greatest variance of

organizational models. In the majority of cases, TTOs were found to be organized as self-standing units, performing evaluation and development of applications independently from organizational structure of parent. However, some TTOs seem to have organized their activities to make systematic use of knowledge of parent for the sake of opportunity recognition. This seems certainly to be the case of OBT, where key people from research departments are directly involved in technology transfer decision making, thus ensuring a level of economies of scale that can never be achieved by external actors. CE organization also shows a high degree of competence share in the form of consulting services provided to TTO at a non-market price. However, consistently with broadness of scientific fields, in this case competencies are borrowed not only from internal units, but also from external actors. Hence, CE structure seems to be better described as a widely networked organization, where the role of RI is certainly that of providing exploitable results, competencies for opportunity recognition as well as networking and management of environmental knowledge through long-standing reputation. This role is certainly highly-context specific and hardly replicable, but provides evidence of a socially desirable model of RI involvement in technology transfer.

Acknowledgements

I am grateful to my supervisors Mario Calderini and Secondo Rolfo for insightful indications and comments on previous drafts of the paper and to Luigi Buzzacchi for his appreciated suggestions and guidance. Rino Ferrata, Ray Oakey, and Bruce Tether provided helpful comments on early work. A preliminary version of this paper was presented at European Summer School on Industrial Dynamics (Cargese) and Doctoral Seminar Series in Entrepreneurship and Innovation (Nottingham Business School) in September 2003. I thank all discussants and participants to the workshops for their comments. Finally, I am deeply indebted to all managers, scientists and administrators that had been willing to devote their time for interviews and helped in collection of empirical evidence. All errors and views expressed herein are my own.

References

- Bray M.J., Lee J.N., 2000, "University Revenues from Technology Transfer: Licensing Fees vs. Equity Positions", *Journal of Business Venturing*, 15:385-392.
- Cable D.M., Shane S., 1997, "A Prisoner's Dilemma Approach to Entrepreneur-Venture Capitalist Relationship", *The Academy of Management Review*, 22(1):142-176.
- Etzkowitz H., Webster A., Gebhardt C., "Cantiano Terra B.R., 2000, The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm", *Research Policy*, 29:313-330.
- Feldman M., Feller I., Bercovitz J., Burton R., 2002, "Equity and the Technology Transfer Strategies of American Research Universities", *Management Science*, 48(1):105-121.
- Jensen R., Thursby J.G., Thursby, M.C., 2003, "The disclosure and licensing of university inventions", *NBER WP* n.9734.
- Jensen R., Thursby M.C., 2001, "Proofs and Prototypes for sale: the tale of university licensing", *American Economic Review*, 91:240-259
- Lach S., Shankerman M., 2003, "Incentives and invention in universities", CEPR, London, *Discussion Paper* 3916.
- Levin S.G., Stephan P.E., 1991, "Research Productivity over the Life Cycle: Evidence for Academic Scientists," *The American Economic Review*, 81(1):114-132.
- Lockett A., Wright, M., Franklin, S., 2003, "Technology Transfer and Universities' Spin-Out Strategies", *Small Business Economics*, 20(2):185-200.
- Martin S., Scott J.T., 2000, "The nature of innovation market failure and the design of public support for private innovation", *Research Policy*, 29: 437-447.
- Morgan R.P., Kannankutty N., Kruytbosch C., 2001, "Patenting and Invention Activity of U.S. Scientists and Engineers in the Academic Sector: Comparisons with Industry", *Journal of Technology Transfer*, 26:173-183.
- Murray G.C., Lott J., 1995, "Have UK venture capitalists a bias against investment in new technology-based firms?", *Research Policy*, 24:283-299.
- Owen-Smith J., Powell W.W., 2001, "To Patent or Not: Faculty Decisions and Institutional Success at Technology Transfer", *Journal of Technology Transfer*, 26:99-114.
- Owen-Smith J., Powell W.W., 2003, "The expanding role of university patenting in the life sciences: assessing the importance of experience and connectivity", *forthcoming in Research Policy*.
- Roberts E.B., 1991a, *Entrepreneurs in High Technology*, Oxford University Press.
- Roberts E.B., 1991b, "High Stakes for High-Tech Entrepreneurs: Understanding Venture Capital Decision Making", *Sloan Management Review*, winter, 9-20.
- Sampat B.N., Nelson R.R., 1999, "The Emergence and Standardization of University Technology Transfer Offices: A Case Study of Institutional Change", Prepared for 1999 *Conference of the International Society for the New Institutional Economics (ISNIE)*. September 16-18, World Bank, Washington, D.C.
- Shane S., 2000, "Prior Knowledge and the Discovery of Entrepreneurial Opportunities", *Management Science*, 11(4):448-469.
- Shane S., Cable D., 2002, "Network Ties, Reputation, and the Financing of New Ventures", *Management Science*, 48(3):364-381.
- Shane S., Stuart T., 2002, "Organizational Endowments and the performance of University Start-ups", *Management Science*, 48(1):154-170.
- Siegel D.S., Waldman D., Atwater L.E., Link A.N., 2003a, "Commercial knowledge transfers from universities to firms: improving the effectiveness of university-industry collaboration", *Journal of High Technology Management Research*, 14:111-133.
- Siegel D.S., Waldman D., Link A.N., 2003b, "Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study", *Research Policy*, 32(1):27-48.
- Thursby J.G., Jensen R., Thursby M.C., 2001, "Objectives, Characteristics and Outcomes of University Licensing: A Survey of Major U.S. Universities", *Journal of Technology Transfer*, 26:59-72.
- Thursby J.G., Thursby M.C., 2002, "Who is Selling the Ivory Tower? Sources of Growth in University Licensing", *Management Science*, 48(1):90-104.

WORKING PAPER SERIES (2004-1993)

2004

- 1/04 *Le origini dell'economia dell'innovazione: il contributo di Rae*, by Mario Coccia
- 2/04 *Liberalizzazione e integrazione verticale delle utility elettriche: evidenza empirica da un campione italiano di imprese pubbliche locali*, by Massimiliano Piacenza and Elena Beccio
- 3/04 *Uno studio sull'innovazione nell'industria chimica*, by Anna Ceci, Mario De Marchi, Maurizio Rocchi
- 4/04 *Labour market rigidity and firms' R&D strategies*, by Mario De Marchi and Maurizio Rocchi
- 5/04 *Analisi della tecnologia e approcci alla sua misurazione*, by Mario Coccia
- 6/04 *Analisi delle strutture pubbliche di ricerca scientifica: tassonomia e comportamento strategico*, by Mario Coccia
- 7/04 *Ricerca teorica vs. ricerca applicata. Un'analisi relativa al Cnr*, by Mario Coccia and Secondo Rolfo
- 8/04 *Considerazioni teoriche sulla diffusione delle innovazioni nei distretti industriali: il caso delle ICT*, by Arianna Miglietta
- 9/04 *Le politiche industriali regionali nel Regno Unito*, by Elisa Salvador
- 10/04 *Going public to grow? Evidence from a panel of Italian firms*, by Robert E. Carpenter and L. Rondi
- 11/04 *What Drives Market Prices in the Wine Industry? Estimation of a Hedonic Model for Italian Premium Wine*, by Luigi Benfratello, Massimiliano Piacenza and Stefano Sacchetto
- 12/04 *Brief notes on the policies for science-based firms*, by Mario De Marchi, Maurizio Rocchi
- 13/04 *Countrymetrics e valutazione della performance economica dei paesi: un approccio sistematico*, by Mario Coccia
- 14/04 *Analisi del rischio paese e sistemazione tassonomica*, by Mario Coccia
- 15/04 *Organizing the Offices for Technology Transfer*, by Chiara Franzoni
- 16/04 *Le relazioni tra ricerca pubblica e industria in Italia*, by Secondo Rolfo
- 17/04 *Modelli di analisi e previsione del rischio di insolvenza: una prospettiva delle metodologie applicate*, by Nadia D'Annunzio e Greta Falavigna
- 18/04 *SERIE SPECIALE: Lo stato di salute del sistema industriale piemontese: analisi economico-finanziaria delle imprese piemontesi*, Terzo Rapporto 1999-2002, by Giuseppe Calabrese, Fabrizio Erbetta, Federico Bruno Rolle
- 19/04 *SERIE SPECIALE: Osservatorio sulla dinamica economico-finanziaria delle imprese della filiera del tessile e dell'abbigliamento in Piemonte*, Primo rapporto 1999-2002, by Giuseppe Calabrese, Fabrizio Erbetta, Federico Bruno Rolle
- 20/04 *SERIE SPECIALE: Osservatorio sulla dinamica economico-finanziaria delle imprese della filiera dell'auto in Piemonte*, Secondo Rapporto 1999-2002, by Giuseppe Calabrese, Fabrizio Erbetta, Federico Bruno Rolle

2003

- 1/03 *Models for Measuring the Research Performance and Management of the Public Labs*, by Mario Coccia, March
- 2/03 *An Approach to the Measurement of Technological Change Based on the Intensity of Innovation*, by Mario Coccia, April
- 3/03 *Verso una patente europea dell'informazione: il progetto EnILL*, by Carla Basili, June
- 4/03 *Scala della magnitudo innovativa per misurare l'attrazione spaziale del trasferimento tecnologico*, by Mario Coccia, June
- 5/03 *Mappe cognitive per analizzare i processi di creazione e diffusione della conoscenza negli Istituti di ricerca*, by Emanuele Cadario, July
- 6/03 *Il servizio postale: caratteristiche di mercato e possibilità di liberalizzazione*, by Daniela Boetti, July
- 7/03 *Donne-scienza-tecnologia: analisi di un caso di studio*, by Anita Calcatelli, Mario Coccia, Katia Ferraris and Ivana Tagliafico, July
- 8/03 *SERIE SPECIALE. OSSERVATORIO SULLE PICCOLE IMPRESE INNOVATIVE TRIESTE. Imprese innovative in Friuli Venezia Giulia: un esperimento di analisi congiunta*, by Lucia Rotaris, July
- 9/03 *Regional Industrial Policies in Germany*, by Helmut Karl, Antje Möller and Rüdiger Wink, July
- 10/03 *SERIE SPECIALE. OSSERVATORIO SULLE PICCOLE IMPRESE INNOVATIVE TRIESTE. L'innovazione nelle new technology-based firms in Friuli-Venezia Giulia*, by Paola Guerra, October
- 11/03 *SERIE SPECIALE. Lo stato di salute del sistema industriale piemontese: analisi economico-finanziaria delle imprese piemontesi*, Secondo Rapporto 1998-2001, December
- 12/03 *SERIE SPECIALE. Osservatorio sulla dinamica economico-finanziaria delle imprese della meccanica specializzata in Piemonte*, Primo Rapporto 1998-2001, December
- 13/03 *SERIE SPECIALE. Osservatorio sulla dinamica economico-finanziaria delle imprese delle bevande in Piemonte*, Primo Rapporto 1998-2001, December

2002

- 1/02 *La valutazione dell'intensità del cambiamento tecnologico: la scala Mercalli per le innovazioni*, by Mario Coccia, January

- 2/02 SERIE SPECIALE IN COLLABORAZIONE CON HERMES. *Regulatory constraints and cost efficiency of the Italian public transit systems: an exploratory stochastic frontier model*, by Massimiliano Piacenza, March
- 3/02 *Aspetti gestionali e analisi dell'efficienza nel settore della distribuzione del gas*, by Giovanni Fraquelli and Fabrizio Erbetta, March
- 4/02 *Dinamica e comportamento spaziale del trasferimento tecnologico*, by Mario Coccia, April
- 5/02 *Dimensione organizzativa e performance della ricerca: l'analisi del Consiglio Nazionale delle Ricerche*, by Mario Coccia and Secondo Rolfo, April
- 6/02 *Analisi di un sistema innovativo regionale e implicazioni di policy nel processo di trasferimento tecnologico*, by Monica Cariola and Mario Coccia, April
- 7/02 *Analisi psico-economica di un'organizzazione scientifica e implicazioni di management: l'Istituto Elettrotecnico Nazionale "G. Ferraris"*, by Mario Coccia and Alessandra Monticone, April
- 8/02 *Firm Diversification in the European Union. New Insights on Return to Core Business and Relatedness*, by Laura Rondi and Davide Vannoni, May
- 9/02 *Le nuove tecnologie di informazione e comunicazione nelle PMI: un'analisi sulla diffusione dei siti internet nel distretto di Biella*, by Simona Salinari, June
- 10/02 *La valutazione della soddisfazione di operatori di aziende sanitarie*, by Gian Franco Corio, November
- 11/02 *Analisi del processo innovativo nelle PMI italiane*, by Giuseppe Calabrese, Mario Coccia and Secondo Rolfo, November
- 12/02 *Metrics della Performance dei laboratori pubblici di ricerca e comportamento strategico*, by Mario Coccia, September
- 13/02 *Technometrics basata sull'impatto economico del cambiamento tecnologico*, by Mario Coccia, November

2001

- 1/01 *Competitività e divari di efficienza nell'industria italiana*, by Giovanni Fraquelli, Piercarlo Frigero and Fulvio Sugliano, January
- 2/01 *Waste water purification in Italy: costs and structure of the technology*, by Giovanni Fraquelli and Roberto Giandrone, January
- 3/01 SERIE SPECIALE IN COLLABORAZIONE CON HERMES. *Il trasporto pubblico locale in Italia: variabili esplicative dei divari di costo tra le imprese*, by Giovanni Fraquelli, Massimiliano Piacenza and Graziano Abrate, February
- 4/01 *Relatedness, Coherence, and Coherence Dynamics: Empirical Evidence from Italian Manufacturing*, by Stefano Valvano and Davide Vannoni, February
- 5/01 *Il nuovo panel Ceris su dati di impresa 1977-1997*, by Luigi Benfratello, Diego Margon, Laura Rondi, Alessandro Sembenelli, Davide Vannoni, Silvana Zelli, Maria Zittino, October
- 6/01 *SMEs and innovation: the role of the industrial policy in Italy*, by Giuseppe Calabrese and Secondo Rolfo, May
- 7/01 *Le martingale: aspetti teorici ed applicativi*, by Fabrizio Erbetta and Luca Agnello, September
- 8/01 *Prime valutazioni qualitative sulle politiche per la R&S in alcune regioni italiane*, by Elisa Salvador, October
- 9/01 *Accords technology transfer-based: théorie et méthodologie d'analyse du processus*, by Mario Coccia, October
- 10/01 *Trasferimento tecnologico: indicatori spaziali*, by Mario Coccia, November
- 11/01 *Does the run-up of privatisation work as an effective incentive mechanism? Preliminary findings from a sample of Italian firms*, by Fabrizio Erbetta, October
- 12/01 SERIE SPECIALE IN COLLABORAZIONE CON HERMES. *Costs and Technology of Public Transit Systems in Italy: Some Insights to Face Inefficiency*, by Giovanni Fraquelli, Massimiliano Piacenza and Graziano Abrate, October
- 13/01 *Le NTBFs a Sophia Antipolis, analisi di un campione di imprese*, by Alessandra Ressico, December

2000

- 1/00 *Trasferimento tecnologico: analisi spaziale*, by Mario Coccia, March
- 2/00 *Poli produttivi e sviluppo locale: una indagine sulle tecnologie alimentari nel mezzogiorno*, by Francesco G. Leone, March
- 3/00 *La mission del top management di aziende sanitarie*, by Gian Franco Corio, March
- 4/00 *La percezione dei fattori di qualità in Istituti di ricerca: una prima elaborazione del caso Piemonte*, by Gian Franco Corio, March
- 5/00 *Una metodologia per misurare la performance endogena nelle strutture di R&S*, by Mario Coccia, April
- 6/00 *Soddisfazione, coinvolgimento lavorativo e performance della ricerca*, by Mario Coccia, May
- 7/00 *Foreign Direct Investment and Trade in the EU: Are They Complementary or Substitute in Business Cycles Fluctuations?*, by Giovanna Segre, April
- 8/00 *L'attesa della privatizzazione: una minaccia credibile per il manager?*, by Giovanni Fraquelli, May

- 9/00 *Gli effetti occupazionali dell'innovazione. Verifica su un campione di imprese manifatturiere italiane*, by Marina Di Giacomo, May
- 10/00 *Investment, Cash Flow and Managerial Discretion in State-owned Firms. Evidence Across Soft and Hard Budget Constraints*, by Elisabetta Bertero and Laura Rondi, June
- 11/00 *Effetti delle fusioni e acquisizioni: una rassegna critica dell'evidenza empirica*, by Luigi Benfratello, June
- 12/00 *Identità e immagine organizzativa negli Istituti CNR del Piemonte*, by Paolo Enria, August
- 13/00 *Multinational Firms in Italy: Trends in the Manufacturing Sector*, by Giovanna Segre, September
- 14/00 *Italian Corporate Governance, Investment, and Finance*, by Robert E. Carpenter and Laura Rondi, October
- 15/00 *Multinational Strategies and Outward-Processing Trade between Italy and the CEECs: The Case of Textile-Clothing*, by Giovanni Balcet and Giampaolo Vitali, December
- 16/00 *The Public Transit Systems in Italy: A Critical Analysis of the Regulatory Framework*, by Massimiliano Piacenza, December

1999

- 1/99 *La valutazione delle politiche locali per l'innovazione: il caso dei Centri Servizi in Italia*, by Monica Cariola and Secondo Rolfo, January
- 2/99 *Trasferimento tecnologico ed autofinanziamento: il caso degli Istituti Cnr in Piemonte*, by Mario Coccia, March
- 3/99 *Empirical studies of vertical integration: the transaction cost orthodoxy*, by Davide Vannoni, March
- 4/99 *Developing innovation in small-medium suppliers: evidence from the Italian car industry*, by Giuseppe Calabrese, April
- 5/99 *Privatization in Italy: an analysis of factors productivity and technical efficiency*, by Giovanni Fraquelli and Fabrizio Erbetta, March
- 6/99 *New Technology Based-Firms in Italia: analisi di un campione di imprese triestine*, by Anna Maria Gimigliano, April
- 7/99 *Trasferimento tacito della conoscenza: gli Istituti CNR dell'Area di Ricerca di Torino*, by Mario Coccia, May
- 8/99 *Struttura ed evoluzione di un distretto industriale piemontese: la produzione di casalinghi nel Cusio*, by Alessandra Ressico, June
- 9/99 *Analisi sistemica della performance nelle strutture di ricerca*, by Mario Coccia, September
- 10/99 *The entry mode choice of EU leading companies (1987-1997)*, by Giampaolo Vitali, November
- 11/99 *Esperimenti di trasferimento tecnologico alle piccole e medie imprese nella Regione Piemonte*, by Mario Coccia, November
- 12/99 *A mathematical model for performance evaluation in the R&D laboratories: theory and application in Italy*, by Mario Coccia, November
- 13/99 *Trasferimento tecnologico: analisi dei fruitori*, by Mario Coccia, December
- 14/99 *Beyond profitability: effects of acquisitions on technical efficiency and productivity in the Italian pasta industry*, by Luigi Benfratello, December
- 15/99 *Determinanti ed effetti delle fusioni e acquisizioni: un'analisi sulla base delle notifiche alle autorità antitrust*, by Luigi Benfratello, December

1998

- 1/98 *Alcune riflessioni preliminari sul mercato degli strumenti multimediali*, by Paolo Vaglio, January
- 2/98 *Before and after privatization: a comparison between competitive firms*, by Giovanni Fraquelli and Paola Fabbri, January
- 3/98 **Not available**
- 4/98 *Le importazioni come incentivo alla concorrenza: l'evidenza empirica internazionale e il caso del mercato unico europeo*, by Anna Bottasso, May
- 5/98 *SEM and the changing structure of EU Manufacturing, 1987-1993*, by Stephen Davies, Laura Rondi and Alessandro Sembenelli, November
- 6/98 *The diversified firm: non formal theories versus formal models*, by Davide Vannoni, December
- 7/98 *Managerial discretion and investment decisions of state-owned firms: evidence from a panel of Italian companies*, by Elisabetta Bertero and Laura Rondi, December
- 8/98 *La valutazione della R&S in Italia: rassegna delle esperienze del C.N.R. e proposta di un approccio alternativo*, by Domiziano Boschi, December
- 9/98 *Multidimensional Performance in Telecommunications, Regulation and Competition: Analysing the European Major Players*, by Giovanni Fraquelli and Davide Vannoni, December

1997

- 1/97 *Multinationality, diversification and firm size. An empirical analysis of Europe's leading firms*, by Stephen Davies, Laura Rondi and Alessandro Sembenelli, January

- 2/97 *Qualità totale e organizzazione del lavoro nelle aziende sanitarie*, by Gian Franco Corio, January
- 3/97 *Reorganising the product and process development in Fiat Auto*, by Giuseppe Calabrese, February
- 4/97 *Buyer-supplier best practices in product development: evidence from car industry*, by Giuseppe Calabrese, April
- 5/97 *L'innovazione nei distretti industriali. Una rassegna ragionata della letteratura*, by Elena Ragazzi, April
- 6/97 *The impact of financing constraints on markups: theory and evidence from Italian firm level data*, by Anna Bottasso, Marzio Galeotti and Alessandro Sembenelli, April
- 7/97 *Capacità competitiva e evoluzione strutturale dei settori di specializzazione: il caso delle macchine per confezionamento e imballaggio*, by Secondo Rolfo, Paolo Vaglio, April
- 8/97 *Tecnologia e produttività delle aziende elettriche municipalizzate*, by Giovanni Fraquelli and Piercarlo Frigero, April
- 9/97 *La normativa nazionale e regionale per l'innovazione e la qualità nelle piccole e medie imprese: leggi, risorse, risultati e nuovi strumenti*, by Giuseppe Calabrese, June
- 10/97 *European integration and leading firms' entry and exit strategies*, by Steve Davies, Laura Rondi and Alessandro Sembenelli, April
- 11/97 *Does debt discipline state-owned firms? Evidence from a panel of Italian firms*, by Elisabetta Bertero and Laura Rondi, July
- 12/97 *Distretti industriali e innovazione: i limiti dei sistemi tecnologici locali*, by Secondo Rolfo and Giampaolo Vitali, July
- 13/97 *Costs, technology and ownership form of natural gas distribution in Italy*, by Giovanni Fraquelli and Roberto Giandrone, July
- 14/97 *Costs and structure of technology in the Italian water industry*, by Paola Fabbri and Giovanni Fraquelli, July
- 15/97 *Aspetti e misure della customer satisfaction/dissatisfaction*, by Maria Teresa Morana, July
- 16/97 *La qualità nei servizi pubblici: limiti della normativa UNI EN 29000 nel settore sanitario*, by Efisio Ibba, July
- 17/97 *Investimenti, fattori finanziari e ciclo economico*, by Laura Rondi and Alessandro Sembenelli, rivisto sett. 1998
- 18/97 *Strategie di crescita esterna delle imprese leader in Europa: risultati preliminari dell'utilizzo del data-base Ceris "100 top EU firms' acquisition/divestment database 1987-1993"*, by Giampaolo Vitali and Marco Orecchia, December
- 19/97 *Struttura e attività dei Centri Servizi all'innovazione: vantaggi e limiti dell'esperienza italiana*, by Monica Cariola, December
- 20/97 *Il comportamento ciclico dei margini di profitto in presenza di mercati del capitale meno che perfetti: un'analisi empirica su dati di impresa in Italia*, by Anna Bottasso, December

1996

- 1/96 *Aspetti e misure della produttività. Un'analisi statistica su tre aziende elettriche europee*, by Donatella Cangialosi, February
- 2/96 *L'analisi e la valutazione della soddisfazione degli utenti interni: un'applicazione nell'ambito dei servizi sanitari*, by Maria Teresa Morana, February
- 3/96 *La funzione di costo nel servizio idrico. Un contributo al dibattito sul metodo normalizzato per la determinazione della tariffa del servizio idrico integrato*, by Giovanni Fraquelli and Paola Fabbri, February
- 4/96 *Coerenza d'impresa e diversificazione settoriale: un'applicazione alle società leaders nell'industria manifatturiera europea*, by Marco Orecchia, February
- 5/96 *Privatizzazioni: meccanismi di collocamento e assetti proprietari. Il caso STET*, by Paola Fabbri, February
- 6/96 *I nuovi scenari competitivi nell'industria delle telecomunicazioni: le principali esperienze internazionali*, by Paola Fabbri, February
- 7/96 *Accordi, joint-venture e investimenti diretti dell'industria italiana nella CSI: Un'analisi qualitativa*, by Chiara Monti and Giampaolo Vitali, February
- 8/96 *Verso la riconversione di settori utilizzatori di amianto. Risultati di un'indagine sul campo*, by Marisa Gerbi Sethi, Salvatore Marino and Maria Zittino, February
- 9/96 *Innovazione tecnologica e competitività internazionale: quale futuro per i distretti e le economie locali*, by Secondo Rolfo, March
- 10/96 *Dati disaggregati e analisi della struttura industriale: la matrice europea delle quote di mercato*, by Laura Rondi, March
- 11/96 *Le decisioni di entrata e di uscita: evidenze empiriche sui maggiori gruppi italiani*, by Alessandro Sembenelli and Davide Vannoni, April
- 12/96 *Le direttrici della diversificazione nella grande industria italiana*, by Davide Vannoni, April
- 13/96 *R&S cooperativa e non-cooperativa in un duopolio misto con spillovers*, by Marco Orecchia, May
- 14/96 *Unità di studio sulle strategie di crescita esterna delle imprese italiane*, by Giampaolo Vitali and Maria Zittino, July. **Not available**
- 15/96 *Uno strumento di politica per l'innovazione: la prospezione tecnologica*, by Secondo Rolfo, September

- 16/96 *L'introduzione della Qualità Totale in aziende ospedaliere: aspettative ed opinioni del middle management*, by Gian Franco Corio, September
- 17/96 *Shareholders' voting power and block transaction premia: an empirical analysis of Italian listed companies*, by Giovanna Nicodano and Alessandro Sembenelli, November
- 18/96 *La valutazione dell'impatto delle politiche tecnologiche: un'analisi classificatoria e una rassegna di alcune esperienze europee*, by Domiziano Boschi, November
- 19/96 *L'industria orafa italiana: lo sviluppo del settore punta sulle esportazioni*, by Anna Maria Gaibisso and Elena Ragazzi, November
- 20/96 *La centralità dell'innovazione nell'intervento pubblico nazionale e regionale in Germania*, by Secondo Rolfo, December
- 21/96 *Ricerca, innovazione e mercato: la nuova politica del Regno Unito*, by Secondo Rolfo, December
- 22/96 *Politiche per l'innovazione in Francia*, by Elena Ragazzi, December
- 23/96 *La relazione tra struttura finanziaria e decisioni reali delle imprese: una rassegna critica dell'evidenza empirica*, by Anna Bottasso, December

1995

- 1/95 *Form of ownership and financial constraints: panel data evidence on leverage and investment choices by Italian firms*, by Fabio Schiantarelli and Alessandro Sembenelli, March
- 2/95 *Regulation of the electric supply industry in Italy*, by Giovanni Fraquelli and Elena Ragazzi, March
- 3/95 *Restructuring product development and production networks: Fiat Auto*, by Giuseppe Calabrese, September
- 4/95 *Explaining corporate structure: the MD matrix, product differentiation and size of market*, by Stephen Davies, Laura Rondi and Alessandro Sembenelli, November
- 5/95 *Regulation and total productivity performance in electricity: a comparison between Italy, Germany and France*, by Giovanni Fraquelli and Davide Vannoni, December
- 6/95 *Strategie di crescita esterna nel sistema bancario italiano: un'analisi empirica 1987-1994*, by Stefano Olivero and Giampaolo Vitali, December
- 7/95 *Panel Ceris su dati di impresa: aspetti metodologici e istruzioni per l'uso*, by Diego Margon, Alessandro Sembenelli and Davide Vannoni, December

1994

- 1/94 *Una politica industriale per gli investimenti esteri in Italia: alcune riflessioni*, by Giampaolo Vitali, May
- 2/94 *Scelte cooperative in attività di ricerca e sviluppo*, by Marco Orecchia, May
- 3/94 *Perché le matrici intersettoriali per misurare l'integrazione verticale?*, by Davide Vannoni, July
- 4/94 *Fiat Auto: A simultaneous engineering experience*, by Giuseppe Calabrese, August

1993

- 1/93 *Spanish machine tool industry*, by Giuseppe Calabrese, November
- 2/93 *The machine tool industry in Japan*, by Giampaolo Vitali, November
- 3/93 *The UK machine tool industry*, by Alessandro Sembenelli and Paul Simpson, November
- 4/93 *The Italian machine tool industry*, by Secondo Rolfo, November
- 5/93 *Firms' financial and real responses to business cycle shocks and monetary tightening: evidence for large and small Italian companies*, by Laura Rondi, Brian Sack, Fabio Schiantarelli and Alessandro Sembenelli, December

Free copies are distributed on request to Universities, Research Institutes, researchers, students, etc.

Please, write to:

MARIA ZITTINO

Working Papers Coordinator

CERIS-CNR

Via Real Collegio, 30; 10024 Moncalieri (Torino), Italy

Tel. +39 011 6824.914; Fax +39 011 6824.966; m.zittino@ceris.cnr.it; <http://www.ceris.cnr.it>

Copyright © 2004 by CNR-Ceris

All rights reserved. Parts of this paper may be reproduced with the permission of the author(s) and quoting the authors and CNR-Ceris