Changing Patterns of University/Industry Relations in Italy[1]

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A major process of change is affecting the Italian University. Starting from the second half of the 1990s, a reform process triggered changes at three different levels of the higher education system: the governance structure, the funding mechanisms, and the curricular organisation. In the same period a similar and parallel process of change affected the National science and technology system. Both processes are having a strong impact on University/Industry (U/I) relations and fostering an unprecedented situation in the country.

This work provides an initial account of the Italian case: sections 1-2 describe the structure and culture of both the higher education and the industrial systems, sections 3-4 the institutional changes in the last decade; sections 5-8 report some initial evidence of the ongoing changes in U/I relations, and finally section 9 provides an interpretation of these changes as a case of organisational field structuration process.

1 Although this work is the result of a joint effort, sections 1, 3, and 4 were written by M. Vaira, while sections 2, 5, 6, 7, and 8 were written by M. Rostan. The Introduction and the Conclusions were written by both authors.

1. Structure and Culture of the Italian University

Since the 1859 University reform act, Italian higher education has coincided and still coincides, with the University giving the system a low degree of structural differentiation. The university system has been and to a large extent still is, almost exclusively constituted of public universities sided by few private institutions. Curricula, study courses, and subjects have largely been the same across the Nation with very little room for differentiation. Only in the 1990s did the system start to change, reducing centralisation but preserving its public nature. As a consequence, structural differentiation is still lagging both in the creation of new private universities and in the institution of a tertiary vocational education track.

A second structural feature of the Italian University is its organisational articulation based on Faculties. Faculties play a major role in governing and managing the University at the local level and base their logic of functioning and their decision-making process on collegiality and alliances among disciplines. Although the reform project aimed at weakening the central role of Faculties, its normative implementation reaffirmed their centrality and to some extent strengthened their governance role (Boffo et al. 2003; Vaira 2003a, b, c). As a consequence, the University does not deal with or relate to the external environment as a unitary entity, but as a fragmented organisation where some parts are keener to enact certain relations than others depending mainly on the kind of disciplinary culture characterising each Faculty.

A third structural feature is related to academics' recruitment dynamics and the age structure. Recruitment in Italian Universities has followed and to some extent still follows an endogenous pattern with financial resources spent by Faculties more on career advancement than in recruitment of new and younger personnel. As a consequence, the Italian University is a frozen and aging organisation (Boffo et al. 2003; Vaira 2003c).

The centralisation, the lack of structural differentiation, and the very limited number of private universities has created a sort of state-protected monopoly that allows academics to reproduce the traditional model of university – the one that Gibbons et al. (1994) call Mode 1 – in spite of the structural changes in society at large.

The Faculty structure has played a major role in preserving the traditional model or at least in resisting the ongoing change process although with differences among disciplines, Faculties, and institutions.

These structural and cultural features have three main consequences for the possibility of building U/I linkages and collaborations.

First, the Italian academy is still rather cautious about pursuing these linkages and collaborations in a systematic and organic way. The public nature and monopolistic position of the University have not facilitated the creation of a different attitude towards the opportunity of creating and exploiting the collaboration with the industrial system. Second, the pursuance of U/I cooperation depends more on Faculties' initiatives than on universities'. This means that quite often the involvement of universities in such collaborations is an indirect effect of one or more Faculties' actions, oriented to support Faculties' initiatives. Furthermore, since these collaborations are mostly pursued by Faculties, starting and realising them very likely depends on two related factors: the disciplinary fields and the structure of disciplines' power relations within each Faculty. This entails that collaborations with industries are more likely to concern applied knowledge, hard sciences, and Faculties where applied disciplines are gaining prominence.

Finally, it is plausible to expect that the more entrepreneurial Faculties are those where the academics' age structure displays average and modal age values lower than the entire University's which is again more likely to be in hard sciences than in other fields.

2. Structure and Culture of the Italian Industrial System

The Italian industrial system is characterised by very few large companies, a limited but growing number of medium size industrial groups, and a very consistent number of small and micro firms often gathered in spatially delimited clusters. These peculiar features are quite different from those characterising other advanced capitalist economies. The Italian distinctiveness is clearly evident if we consider the higher contribution SMEs give to the production of wealth and employment compared to other OECD countries (Eurostat-European Communities 2001; OECD 2002a; Onida, 1999, 2004).

These peculiarities result from several factors. Within the international division of labour, the Italian industrial system is specialised into two broad groups of economic sectors where Italian industries enjoy a competitive advantage. The first includes sectors producing traditional consumption goods related to persons and houses. The second includes firms producing mechanical equipment and specialised machinery and components mostly supplying firms operating in the first group. Both

areas of industrial activity – known as 'The Made in Italy' – are especially suited for small and medium size firms producing highly differentiated goods for highly specialised or niche markets.

Italy – with some relevant exceptions (e.g., STMicroelectronics, FIAT) – is underrepresented in two other broad areas of industrial activity: high-tech and highly innovative economic sectors based on intensive R&D activities, and sectors with strong economies of scale producing consumption or intermediate goods led by a few big oligopolistic companies.

In past decades, national industrial groups and big firms – either private or state owned – have been active in these two broad industrial areas accumulating an important wealth of technical expertise and market positions. Both private and public strategic errors, company crisis, sell-off of Italian companies or divisions to foreign multinationals, a perverted link between the political system and state owned companies, all dissipated these important assets. In recent times, a massive program of privatisation did not promote the formation of new private big companies equipped to compete globally. In 2003, the 'Fortune 500' list included only nine Italian groups; only three of them were industrial groups – FIAT, ENI, and Olivetti-Telecom – 34 British groups were listed, 35 German groups, and 40 French groups.

Industrial districts are one of the more important components of the Italian industrial system. These clusters of spatially concentrated SMEs strictly linked to local communities – especially located in the so-called 'Third Italy' including the Central and North-Eastern regions – have been, and largely continue to be, the backbone of Italian economic development. Considered an alternative to the 'Fordist' model of economic development, they have built their success mobilising a wide range of social, cultural, and economical resources embedded in local societies – promoting a balanced mix of competition and cooperation, and providing firms with competitive advantages. Higher international market integration, increasing global competition, and the end of reliance on competitive devaluations are putting the industrial district system under pressure. As a consequence, new evolutionary processes are affecting the industrial district system: increasing cross-district collaboration and integration, the emergence of medium-large firms acting as districts' leaders, an organisational shift from a 'network of firms' to a 'network-firm', and the establishment of so-called Meta-districts.

Differing from traditional industrial districts, Meta-districts are not territorially but functionally identified entities connecting firms from different geographical locations. Their structure is based not only on firms but also on the Regional government, local institutions, and for the

first time and more importantly, on universities and public research centres. Furthermore, the role of SMEs is less important compared to that of big companies acting as projects' leaders in some commodity-chains.

Industrial districts and the Italian industrial system at large share a common problem widely debated in recent times: The proportion of small firms in the national economy is very high and small firms hardly ever grow to a larger dimension, weakening Italy's position in the global economy. The dimensional growth of Italian SMEs is hindered by several factors: firms' and companies' governance is strongly affected by family ownership and control (a feature not restricted to SMEs only); there is weak development of financial markets and operators (with capital venture especially lacking); there is a lack of infrastructures and market barriers at the local level; inefficiency or malfunctioning of the public administration; laws and regulations scarcely supportive of business; inefficiencies and anticompetitive practices both in services and professions etc. Despite this, in many highly industrialised areas – both within and outside industrial districts – new business groups, so called 'pocket-multinationals', are emerging. These are fast growing industrial groups including the firm leader in their market and operating at the international level, partially balancing the prevalence and difficulties of small firms and the decline of older big companies.

The dimensional peculiarities and the sector specialisation of the industrial system are strictly matched with some traditional features of the Italian entrepreneurial culture.

Familial attitudes both in big and small businesses, preference towards personal ties and interpersonal trust relations with customers and suppliers, suspicion towards non family managers, and orientation towards dynastic management are widespread. The same holds for individualistic orientations and hard work ethics especially in SMEs; praise and rewards are put upon personal creativity, craftsmanship, and incremental innovation. These traits combine with low educational levels of SME owners, a strong preference for in-house training, a weak orientation to employ university graduates, a very scarce presence and involvement of universities in the development of industrial districts, and tepid attitudes towards quotation on the stock exchange. Moreover, both entrepreneurs and managers – especially in SMEs – display very cautious attitudes towards investments in hardware, software, and related organisational changes.

These features continue to have a strong impact on U/I relations. They affect the general configuration of RandD activities, specifically the collaboration between firms and universities in this field, and the demand and the destination of graduates in the labour market.

Research, science, and technology indicators place Italy in a somehow incongruent position compared to the size of the country's GDP. Italy is falling behind its main competitors and partners and other industrialised countries. Among OECD countries, Italy ranks in eighth place by gross domestic RandD expenditure (after USA, Japan, Germany, France, United Kingdom, South Korea, and Canada) but in 22nd place by gross domestic RandD expenditure on GDP. Moreover, in Italy the percentages of RandD activities financed by industry (43%) and performed by industry (49.1%) are far behind the EU 25 average (55.4% and 64%, respectively) and the OECD countries average (62.3% and 68%, respectively). Finally, Italy can rely on 66,700 full time equivalent researchers compared to the 83,300 of Spain, the 177,300 of France, and the 264,700 of Germany (OECD 2004). It is worth noting that firms' expenditure in RandD fell from the 0.8% in 1992, to 0.5% in 2000 (OECD 2001).

As far as RandD activities in industry are concerned, three points are worth mentioning (Onida 2004; Quadrio Curzio et al. 2002). First, the peculiar specialisation pattern and the size structure of the Italian industrial system have a significant impact on the relatively low level of Italian firms' RandD investments. Yet international comparative analysis shows that in almost all sectors and in almost each dimensional category Italian firms invest less than their competitors. Structural factors partly explain the Italian situation but part must be explained taking into account other cultural and institutional factors. Second, industrial RandD expenditures are strongly dimensionally and territorially biased: 75% of total expenditures are concentrated in firms with more than 500 employees; more than 50% of total expenditures are realised in Lombardy and Piedmont. Third, figures and international comparisons on industrial RandD activities must be interpreted with caution as they refer to formal research undertaken in labs. As a matter of fact, innovation in the Italian industrial system is carried out – especially in SMEs – through technical progress incorporated in machinery purchased by firms and through tacit, informal, and incremental technological innovation fostered mainly at the shop level. This special feature of the Italian industrial innovation process largely explains why U/I relations are weaker than in other industrialised countries and why formal research appears to be mainly carried out by universities and public research agencies.

The structural characteristics of the Italian industrial system also have an impact on the educational levels of the labour force, and on graduate labour market. Before the University reform, the percentage of the labour force aged 25-64 possessing a university degree or some other university qualification was 10-12%, more or less half of the EU average

(*Associazione TREELLLE* 2003; OECD 2002b; Moscati and Rostan 2000). Though it is too early to assess the impact of the new '3 + 2' higher education structure on the labour force, it is expected that it will raise the proportion of people possessing higher education qualifications and bridge the gap with other countries especially at the short programmes level. As the demand for highly qualified labour- especially in scientific and technological fields – depends on firms' size and the specialisation of the national industrial system within the international division of labour, Italian peculiarities yield a weaker demand of graduates compared to other countries, especially science and technology graduates. Finally, a weaker demand from industries combined with lower public investments in RandD also explains the 'brain drain' affecting Italy (Becker et al. 2003).

3. University and Research Reform Policies

Between 1990 and 2000, a deep process of reform changed the structural and governance features of the Italian University system as well as its way of functioning. As a consequence, more room for institutional autonomy, performance indicators as financing criteria, and curricular innovation following the Bologna scheme have been provided (Luzzatto and Moscati 2003; Vaira 2003a).

These changes entailed a shift of the University toward an entrepreneurial model (Clark 1998; Slaughter and Leslie 1997), involving both its organisational articulations, such as Faculties and Departments, and single academics.

The reform was meant to overcome the traditional gap between the university and the socio-economic environment, encouraging and pressing it to construct a wider network of relationships with external institutional and organisational actors.

The entrance of new external actors in the academic field has had two main consequences on universities: i) a process of re-hierarchisation of academic knowledge and disciplines; ii) a change in universities' autonomy status. As universities are called to collaborate with industry and the economic sector, providing them with an adequate knowledge base and the personnel to better compete under new economic conditions, and as it must drain more financial resources outside the public sector funding, it needs to concentrate more on applied knowledge or on pure knowledge capable of being transformed into applications interesting to the economic sector and generating additional funding through their economic exploitation (e.g., selling knowledge; consultancy; pat-

enting; various forms of collaboration with industry such as business incubators, start-ups, spin-offs, and scientific-technological parks). This process is reshaping the previous traditional hierarchical structure derived from the Humboldtian model and is experienced as an overturning of previous academic power relations among disciplines.

The autonomy to do things for science and knowledge's sakes, is slowly being replaced by a responsible and accountable autonomy in face of the society at large, its economic development, and of those who finance and support the university: primarily the state and private sector actors (Tapper and Salter 1995; Etzkowitz and Leyesdorff 1997). This different kind of autonomy allows universities to act more enterprisingly but simultaneously makes them more dependent on external actors other than the state and its resources (DiMaggio and Powell 1991; Pfeffer and Salancick 1978).

In addition to university reform, a stronger emphasis was also put on public policy for science and technology (S&T) and the reorganisation of the science system.

The OECD STI Outlook 2000 highlights (OECD 2000) that the structure and the organisation of the Italian S&T system changed from 1989-1998 fostering a closer relationship and cooperation between industry and public scientific research institutions, namely universities and the National Council of Researches (CNR). Yet scientific and technological policies were still limited in scope and results and too often more formalistic than effective. In particular, the funding criteria were based on an 'egalitarian' model without evaluation in terms of quality of the research project proposals and the research teams. Thus, this kind of funding allocation gave something to everybody, disadvantaging the excellent research centres and/or teams which received almost the same funds as less efficient and effective teams and centres.

A second problem concerned the creation of public institutions for technology transfer functioning as institutional buffers and linking pivot between universities, public research institutions, and industry. The bottom-up, or 'spontaneous' approach, undertaken by some universities and research centres to bridge the traditional gap was generally too limited and not always effective, even if some bottom-up realisations proved to work quite well.

Furthermore, two kind of constraints slowed and made ineffective government support to research in industry: i) the scant propensity of Italian firms to invest in innovation and RandD activities and the peculiarity of the Italian industrial structure (see section 2), and ii) the lack of a wide strategic vision of actual national priorities for investments in science and technological developments and innovations. In addition,

firms tended to use public funds not to innovate but to finance projects they would have carried out anyway.

Finally, although some steps toward an S&T policy were made in this period, its implementation was hampered by institutional and procedural factors. Some of these factors are related to the lack of collaboration and coordination between different Ministries in such policies. The Ministry of University and Research especially acted very much in isolation from other ministries; namely those responsible for economy, industry, trade, and labour, as those ministries tended not to give up some of their responsibilities. In addition, it did not enjoy additional resources to manage and to support those policies and its bureaucratic structure and way of functioning entailed further difficulties in implementation and task management. From the procedural side, the complexity and the bureaucracy of the selection processes and criteria discouraged SMEs to apply for public financing of their RandD projects.

As a result the gap between public research and industry remained pronounced. This gap became a policy issue in the period 1996-2001, entering as a part of a general institutional reform and modernisation agenda, and more specifically of the Education system reform.

The reform of the S&T system was based on the reorganisation of the public research system, its governance, and on the revision of mechanisms supporting RandD.

The government aimed at linking the S&T system to the country's general economic strategies. In the National Act for Economic Planning, a chapter was devoted to set the guidelines and the financial amount for RandD, and there was a stronger effort to connect different Ministries for RandD policy and funding, especially through a special fund for specific projects of national relevance. Furthermore, small research institutions were suppressed through merging or acquisition by larger ones in order to gain more room for autonomy, greater flexibility, a stronger evaluation of each institution, the reduction of bureaucratic constrains, more incentives for research personnel mobility, and the professional qualification of research institutions employees. Finally, some measures were intended and tailored to reduce the complexity and the bureaucratic burdens of the procedures both for application and funding allocation.

The S&T system reform fostered the creation of a structure for the evaluation of research both at the macro and micro levels through the Committee for Research Evaluation and some Ministries' departments, and the creation of an Evaluation Committee in universities and research institutions. The research evaluation system was set up in 1999 though its instruments, mechanisms, and evaluation criteria still need to be

tuned and refined, since in Italy there was no tradition for evaluating research institutions and universities.

Another important novelty of this period concerns a policy package jointly produced by the Ministry of University and the Ministry of Labour introducing three main innovations concerning university spin-off companies and the possibility for academics to participate in them. The package (Decree n. 297, July 1999) promotes: 1) the temporary placement of academics and researchers within companies; 2) the creation of university spin-off companies and university incubators; 3) the participation of academics as well as public research institutions' researchers in starting up new firms and getting involved in commercial activities; 4) U/I collaborations fostering industrial research projects both at national and trans-national levels supported by public funding; 5) the creation of university consortia and research centres; and 6) R&D policies involving regions, universities, and enterprises, supported by central Government funding.

It must be stressed that Italian academics and public research institutions' personnel were legally prevented as civil servants from being involved in industrial and commercial activities, with the exception of part-time academics – in particular those belonging to the fields of law, medicine, engineering, and architecture – who were allowed to run professional activities. This kind of legal constraint lasted until the 1999 Decree, which – pivoting on the enlargement of university autonomy – deeply changed the normative framework enacting a favourable regulative environment to support R&D projects (Giacometti 2001).

4. Industrial Research and Innovation Policies

On the side of the development of research and innovation in industry, the government's commitment and efforts were devoted to tools and innovation in the existing policy framework and enforcing new specific measures.

The main policy tool was the Applied Research Fund. Instituted in 1968, administrated by the former Ministry of Education and from 1989 by the Ministry of University, Scientific Research and Technology, it is managed by the Italian Industrial Credit Institute (IMI).

In 1994 new granting procedures were introduced aiming at reducing the timing of project examinations, increasing resources addressed to SMEs through the financing of individual and cooperative research projects. In 1997 the Applied Research Fund was reformed to improve its procedural efficiency. A co-financing mechanism was introduced, re-

quiring the sharing of R&D projects' costs from the applicant firm. This was established in the light of creating a multiplying mechanism of public resources and a more direct responsibility and accountability of firms. In addition, more emphasis was placed by the Ministry of University and Research on SMEs.

Another policy measure to stimulate industrial research and innovation was the introduction of changes in the National Research Programme (NRP) launched in 1982. In 1991, NRP underwent a major change with the introduction of a new scheme to stimulate SMEs, in particular those operating in industrial districts. The scheme included the possibility to create financial intermediaries able to share not only research and innovation costs but also the economic risks of SMEs, and to promote consortia amongst firms. In 1997, the NRP was modified in its funding mechanism through the introduction of co-financing procedures to stimulate firms to be more involved in research and innovation projects.

A particular policy effort has been made since the early 1990s in the creation of science and technology parks (STPs) (OECD 2000). In particular, most of the 13 STPs created by 2000 were located in Southern Italy as an effort to boost economic development in this still less developed area. In 2000, about 50 projects dealing with scientific parks were completed, but a severe constraint to the full take-off of parks was that local firms' financial involvement was still meagre. As a consequence, the majority of financial resources came from public investments. In Northern and Central Italy, the creation of STPs followed a different pattern, fostered by private initiatives with the participation of companies, local public agencies, local governments, universities, and public research bodies. European Union funds played a role in both cases although for different reasons as Southern regions fall under one policy goal and some Central or Northern areas under another. By and large, the experience of STPs is still too recent to evaluate in the light of their research and innovation potentiality, especially because most have grown with little or no links to the market and a weak financial support by firms.

Because the employment of graduate students and PhDs in Italy in science and engineering was, and largely still is, one of the lowest in Europe (Commission of the European Communities 2002), a last policy effort was made to stimulate firms, especially SMEs and those operating in industrial districts, to employ highly educated and qualified personnel.

During 2001-2004, the public policy for S&T and R&D slowed down, as the centre-right government was in charge. This slow down

concerns both financial support and policy initiative, due to the retrenchment of government's funding and support for R&D activities, universities, public research institutions, and U/I collaborations.

On the whole, this set of policy initiatives has not been fully effective. It has proved difficult for firms to identify individual competencies and skills within university and PhD graduates. At the same time, universities found it difficult, at least up to very recent years, to set an appropriate formative supply suitable for industry needs, although university reform and bottom-up experiences like *AlmaLaurea* and *Vulcano* (see section 8) should improve the situation. Universities and public research institutions have not yet developed a policy for the temporary placement in and mobility towards, firms of their research personnel and are still reluctant to address the problem. Only a modest part of academic and public institutions' researches has a direct industrial application. The enduring culture in universities and public research institutions considers researchers' involvement in industrial and commercial activities as a sort of 'prostitution' or betrayal of the 'true' science mission. Finally, the scientific field, and in particular the so-called hard science field, is suffering a shortage of matriculating students and PhD students which means a shortage in the supply of highly qualified personnel with scientific background.

Notwithstanding difficulties and drawbacks, following the described policies changes in U/I relations are nonetheless emerging as is shown in the following.

5. University/Industry relations in Northern Italy: The Employers' View

Since 1993, *Confindustria* – the Italian association of industrial employers – annually publishes a report documenting the activity of cooperation between universities and associated members. Thanks to two general agreements signed with the Ministry of University and Research and the Italian Universities Rectors' Conference, many single initiatives born at the local level have acquired a formal status and have been recorded in an annual report called University/Industry Collaborations Inventory.

Looking at activities developed during the last decade, it is possible to distinguish two main forms of partnership between industry and university: i) the collaboration between single universities and single firms, and ii) the collaboration between universities and local employers' associations belonging to *Confindustria*.

Grassroots collaboration generally involves single departments or faculties and single firms. University units can buy highly sophisticated machines from single companies, use their industrial labs and tools, or sign teaching contracts with managers and industrial researchers. They can provide firms with studies, enquiries, researches on demand, follow-up courses and training activities for employees, lab and certification activities, scientific consultancies, and technical assistance. For their part, companies can offer targeted dissertations, stages and internships, and students' grants. Finally, universities and firms can cooperate in planning and carrying out study, training, and research activities often involving the contribution of local governments, public research agencies, and international organisations.

At a more institutional level, U/I collaboration involves not single firms but local associations of employers. Universities and local employers' associations collaborate in several ways: signing agreements for cooperation, participating together in local associations or consortia pursuing specific goals, promoting or participating in scientific and technological parks, jointly organising or participating in initiatives fostering technology transfer and the diffusion of research results, participating in national or international research projects, and acting together in the establishment of new university sites or campuses and/or in the creation of new study programs.

The year 2003 Inventory includes 87 reports from local employers' associations recording more than 500 U/I joint activities. Restricting data analysis to the five main Regions of Northern Italy – Piedmont, Liguria, Lombardy, Veneto, and Emilia-Romagna – it is possible to draw a picture of U/I relations in the economically more developed area of the country. This includes 33 local employers' associations and 23 universities. The most frequent forms of collaboration concern the field of didactics (49 cases). This form includes very different activities, from the establishment of new study programs to the organisation of stages and internships. The second most frequent activity is the approval of a general agreement of collaboration between a university or a Faculty and a local employers' association (23 cases). The third most frequent form concerns the financial support offered by industrial employers to universities (20 cases) including differentiated fields and amounts of support including financial contribution to the creation of a new university site or campus, the ongoing contribution to the ordinary functioning of a university, and the supply of grants and awards for students. The fourth most frequent form refers to the creation of special associations or consortia – generally also including other local actors (local governments,

banks, big companies, groups of interests etc.) – pursuing specific goals (18 cases).

Collaborations concerning research activities are less frequent, possibly because they are carried out at the grassroots level by single departments and firms and are not recorded in the inventory. Only six cases of research contracts or consultancies are reported; two cases of collaboration in technology transfer or diffusion of research results; a single case of joint participation in a scientific/technological park, and no case of joint participation in national research projects.

The relationship between *Confindustria*, local associated members, and some private HE institutions is very strict. *Confindustria* and *Assolombarda* – the Milan based local association – strongly support Bocconi University and its business schools; a representative of *Assolombarda* seats in the Board of the University. The local associations of Varese and Piacenza played a crucial role in the creation of the private university *Carlo Cattaneo* at Castellanza and the Catholic University at Piacenza. Local associations also played a relevant role in the creation of public higher education institutions as was the case in the establishment of the Faculty of Engineering at Bergamo University, the creation of Bologna University campus at Ravenna, and the creation of the 'twin' University of Modena and Reggio Emilia.

Publishing the inventory witnesses the extent and the growth of U/I relations during the last 10-15 years. At a more institutionalised level, employers' associations have supported the expansion of the Italian higher education system and the development of new channels of communication and cooperation between the economic and the education systems, especially at the local level.

6. The Creation of New Firms: Evidences from the University of Pavia

The state University of Pavia – founded in the 14th Century – is a medium size institution located in Lombardy with 22,000 students and 4,000 graduates (in 2003). It consists of nine faculties (Law, Political Science, Economics, Humanities, Medicine, Mathematics-Physics-Natural Sciences, Pharmacy, Engineering, and Musicology) and 51 departments. Exclusively linked to the university is *S. Matteo Policlinic*, one of the biggest and most reputed health institutions in Lombardy.

Pavia was an important industrial centre up to the 1970s; since then strong processes of de-industrialisation set in. At present, the only important industrial reality in the area is the Industrial District of Vigevano

– located some 30 km from Pavia – which is a world leader in the production of machines for shoes, footwear, and leatherwear and tannery industries. The local economy is also characterised by a rich agriculture specialised in rice fields and vineyards.

It is common sense to think that U/I relations are badly lacking because of local processes of de-industrialisation and the small sizes of the existing firms. Yet, a recent investigation (Balconi and De Carlini 2002) yields different conclusions.

During 1996-1999, eight scientific departments signed 132 contracts with industrial companies receiving €10 million of research project funding. The impact of private financing on the total research costs is higher in the Department of Electronics and the Department of Pharmaceutical Chemistry (over 10% of average annual costs). These figures underestimate the relevance of private financing because important private funds finance the activity of university researchers through external agencies – such as the Nuclear Physics National Institute – or through health institutions, and are not recorded in departments' budgets, the only source of information available to investigation.

According to ISI data from 1993-1999, 331 scientific international articles were jointly written by professors and researchers from the university and employees of big industrial companies: more than 50% were related to the chemical/pharmaceutical and biotech sector; 35% to the ITC sector, and 10% to the energy and aerospace sector.

Local professors and researchers give an important contribution to the Italian System of Innovation. Matching data on the 22 years of activity of the European Patent Office and data on Pavia University staff in the year 2000, we find that 88 patents belonging to either private companies or public agencies involve professors and researchers. This data places Pavia University in fifth place among Italian universities after bigger institutions like the University of Milan (149 patents), the University of Bologna (145), Milan Polytechnic (135), and the University of Rome *La Sapienza* (126) and before other important institutions such as the University of Padova (68), the University of Pisa (63), Turin Polytechnic (50), and the University of Parma (48). Pavia's contribution is especially important in the fields of pharmaceuticals, biotech, and chemistry but the single company owning the higher number of patents involving university staff operates in the field of electronics.

In the 1990s, eight high tech micro or small independent firms and five labs belonging to electronics multinational corporations were established. Among independent firms located in Pavia and vicinities (mainly operating in the ICT sector), four were founded by professors and researchers and can be considered 'university spin-offs', three were

founded by Pavia University students or graduates, and one by professionals not linked with the University. In one case, there is a strict relationship with a university lab (Laser Sources Lab), in five cases the university is considered important as a supply of highly qualified labour force and in two cases firms and the university cooperate in student training before and after graduation. In the year 2000/2001, 142 people were working in these firms.

Among multinational corporations (two based in the USA, one in Germany, one in France, and one a joint French/Italian venture), the main reason for locating a 'design centre' in Pavia and vicinities is the excellence of the Department of Electronics in analogic microelectronics and analog circuits design. The relationship with this Department and the Faculty of Engineering is considered crucial both for the supply of highly qualified and specialised labour forces and the transfer of knowledge. In one case, a multinational corporation acquired a 'design house' started-up by graduates and professors from the university and in another case the design centre (with a research lab) is directly located within the university. In 2000/2001, 79 people worked in these centres.

Very recently a large chemical company has opened a new site specialised in systems and products for the preservation and restoration of artistic works at the Department of Earth Sciences.

Pavia shows that it is quite misleading to continue to consider Italian universities as 'Ivory Towers'. Even in a declining local industrial context – albeit within the larger context of the economically strongest region in Italy – U/I relations are not lacking. Furthermore, not only big and prestigious institutions such as Milan and Turin Polytechnics – where U/I relations are traditionally stronger – but also medium size higher education institutions such as the University of Pavia are developing networks of relations with firms and companies both at national and international levels. Local departments' scientific excellence and high qualification of graduates are appealing for foreign and domestic investments and foster the creation of new independent firms. A local knowledge and university driven economic development – albeit in a very initial phase – and the establishment of a local high tech community are indeed possible and recent institutional changes at the national level support these processes.

7. University/Industry relations in Southern Italy: Catania Consortium for Research and Etna Valley

In 1987, the University of Catania in Sicily together with the National Council of Research, a state holding (IRI), a multinational corporation (SGS Microelectronics, now STMicroelectronics) and a local economic institution (the Chamber of Commerce of Catania) promoted a non profit consortium called Catania Consortium for Research (http://www.unict.it/ccr/). Later, other national research institutions such as the Nuclear Physics National Institute (INFN) and local industrial firms operating in the fields of agro-industrial technologies and pharmaceuticals joined. The Consortium -employing some 25 people in 2004 – was created to link academic, public, and industrial research fostering technology transfer, innovation diffusion, applied research, advanced training, services for companies, and local economic development. Its key operative tools were – and still are – four organisations: two service centres and two laboratories.

The 'Innovation Centre': a) promotes, coordinates, and manages research and development projects together with universities, research institutions, and firms; b) supports firms, especially SMEs, in defining and implementing technological innovation strategies; c) develops new research and service expertise in innovative areas; and d) promotes, coordinates, and manages specialised training and cultural activities. The Centre provides local industries with an online database with updated information on some 1,500 Sicilian companies, research projects financed by EU, and technological reviews realised by experts from Catania University.

'MEDIA Innovation Relay Centre' is one of the seven Italian Relay Centres supported by the European Commission and the Ministry of University and Research to offer advanced services in the field of technological innovation, promote the transfer and the application of research results, and support SMEs' technological development. The Centre is hosted by *Apindustrie*, the local association of SMEs, and – thanks to the network connecting 68 EU Relay Centres in 30 European countries, the European Commission, and National Ministries – represents an 'international window for innovation' for companies operating in Sicily and Calabria.

The 'Laboratory of Surfaces and Interfaces' – also known as 'The Superlab' – was created in 1990 as a joint venture of the Catania Consortium, the Department of Chemical Sciences of the University of Catania, and STMicroelectronics. Superlab is located within the STMicro-

electronics plant in Catania and its research activities include all the aspects of material science dealing with the preparation, modification, and characterisation of solid surfaces and interfaces of relevant technological importance.

The 'Biotechnologies' Laboratory' – also know as 'Biolab' – operates in the fields of innovative agro-food and biomedical technologies, especially those related to molecular diagnosis and monitoring methods. The Biolab is also located within an industrial plant in Catania.

In 2004, Catania Consortium was involved in 80 research projects in 10 different fields: agriculture and agro-industry, environment, art works and cultural goods, biotechnologies, chemistry and pharmaceutical, materials and interfaces, other materials, microelectronics, management and services, and ICT and applied mathematics. Supporting and participating in these projects are 24 industrial firms and several other actors: the European Commission, the Italian Ministry of University and Research, public research agencies, and the Catania Technological Park.

The Consortium also carries out training activities and supports recent graduates in their transition from school to work. Initiatives include providing degree awards for final dissertations, scholarships, job contracts and internships, and 'ad hoc' training courses together with the University of Catania and local firms. As of 2004, the Consortium awarded about 100 Degree Awards and about 50 scholarships with the support of mostly Sicilian companies, and provided job placements and scholarships to about 100 graduates from Catania University.

The Consortium made an important contribution in starting the economic and scientific experience known as 'Catania's Microelectronics Pole' or the 'Etna Valley' connecting higher education and research institutions, big companies, and hundreds of small firms (see e.g., *Financial Times*, 17/03/2000, "A High-Tech Eruption in Etna Valley: Italy's Technological Revolution"). In addition to the local university with its faculties and the School for Advanced Studies; large companies such as STMicroelectronics, Nokia, Omnitel, Alcatel, Alenia, Philips; and political and economic local actors; a key role has been played by a public research agency: the 'Institute for Microelectronics and Microsystems' (IMM). IMM is an institute of the Italian National Council of Research (CNR). Founded in 2001 during the national re-organisation process of the CNR, the Institute, whose headquarters are in Catania, is organised in five departments located in Bologna, Catania, Rome, Lecce, and Naples. IMM Catania Department inherited both the activity and staff of a former CNR local institution founded in 1993. These institutions acted as a pivotal organisation establishing links and exchanges across the whole cycle of activities required for microelectronics: higher education

and basic research (the university), oriented research (IMM-CNR), R&D activities and production (STMicroelectronics, and other smaller companies). The Department – with 25 staff – is hosted by STMicroelectronics with which six research projects were ongoing in 2004.

This Sicilian example shows that – though requiring strong support from the local political system and national policies – public/private and U/I relations fostering both scientific research and economic development are indeed possible in less developed Southern Italy. Furthermore, the Catania experience is not alone as shown by the development of the ITC sector in Sardinia centred on a big company – Tiscali – with the participation of the University of Cagliari. These examples also witnesses the positive and rather successful impact that both the higher education reform process and the re-organisation of the public research system can have – interacting with other factors – on U/I relations.

8. Graduates' Recruitment: The Case of *Alma-Laurea*

While once only a few prestigious public institutions such as Milan Polytechnic or private ones such as the Catholic University or the Bocconi Business School had a formally established job placement service, nowadays the number of institutions is growing that offer their students and graduates post-graduate internships and stages programs, career days, job placement services etc. Especially important are joint initiatives among several institutions at the regional or the national level such as *Vulcano* – a consortium among the universities of Lombardy providing on-line CVs to companies – and '*AlmaLaurea*'.

AlmaLaurea is a consortium among, in the academic year 2003/2004, 40 Italian universities out of the existing 76. Established in 1994 by the Statistical Observatory of the University of Bologna, the consortium has grown very fast and represents 63% of Italian graduates in 2003/2004. It provides graduates, companies, and universities with several services. Graduates from member institutions are offered the possibility to publish their CVs on a website just before graduation, to continuously update their CVs after graduation, to view job offers published by companies on the website, and to answer on-line to job offers. Companies and other organisations can publish their job offers on the website and can also select and purchase individual CVs of recent graduates and updated CVs of more mature graduates. Universities are provided with a common and centrally managed job placement service

offered to their students and graduates with a tool supplementing, updating, and enriching their administrative data.

The core instrument of the consortium consists of a database integrating data coming from different sources and collected in different points in time: official administrative data (field of study, type of degree earned, grades, study duration, thesis, supervisor); data provided directly by students prior to graduation (civil/military service obligations, periods of study abroad, work experience during studies, self-evaluation of foreign language proficiency and computer skills, willingness to move to get a job); and data provided directly by graduates after completion of study program (updated information on post-graduated study and training and early career).

After operating for a decade, the database contained more than 480,000 CVs in 2004. During 2003, 374,000 CVs were downloaded from the database. Since the beginning of its activity, more or less 60% of *AlmaLaurea* on-line services have been sold to companies; the rest has been supplied to associations, training agencies, and universities. Services provided to companies increased by 40% between 2003 and 2004, while less than 5% of costumers were foreign companies.

Thanks to the data collected, *AlmaLaurea* provides universities, companies, policy makers, the scientific community, and the public at large with two important reports: 'The Annual Graduate Profile Report' and 'The Annual Report on the Occupational Condition of Graduates'. The 'Profile Report' provides extended and detailed information assessing the quality of human capital produced by universities, giving also the possibility to monitor the ongoing university reform. The 'Occupational Report' provides universities and other actors – firms and companies included – with a tool for assessing the effectiveness of higher education and for monitoring local and regional graduate labour markets. In the near future, a new service will be provided as *AlmaLaurea* has been assigned by the Ministry of Education and University to set up the national register of graduates.

AlmaLaurea is an important novelty both in the higher education organisational field and U/I relations. It is an unprecedented form of inter-university cooperation strengthening communication and common action among universities both at the staff and top levels, linking the higher education system to outside actors. In fact, the Assembly ruling the consortium consists of the Rectors of member universities and the Board of Directors is comprises seven members nominated by the Assembly, one Representative from the Ministry of University, and one Representative from administrative regional bodies. *AlmaLaurea* is also a case of successful externalisation as its organisational unit and staff

operate autonomously and independently from single universities. More important, it is a bridge fostering U/I collaboration in graduate labour force recruitment contributing to a better match between demand and supply and the creation of a national (and perhaps a European) graduate labour market.

9. Conclusions

It is possible to advance an initial interpretation of the ongoing changes in the Italian university sector and U/I relations. The interpretative framework is provided by the concept of organisational field structuration (DiMaggio and Powell 1991). This concept highlights the process of growing interconnectedness, mutual dependence, and emerging power relations in an organisational field among heterogeneous organisations in the face of institutional changes. The structuring process of an organisational field consists of four elements (DiMaggio and Powell 1991, p. 65): i) an increase in the extent of interaction among organisations operating in the field, ii) the emergence of sharply defined inter-organisational structures of dominance and patterns of coalition, iii) an increase in the information load with which organisations in a field must contend, and iv) the development in a set of organisations of the mutual awareness among participants that they are involved in a common enterprise.

The reported evidences can be interpreted as the structuration process of the academic field; an organisational field displaying peculiar features. In Bourdieu's terms, it is a social space with a certain degree of autonomy in relation to other fields. Therefore it is structured by peculiar constitutive, generative, and definitive principles, logic of functioning, power relations and *habitus* (i.e., a system of cognitive and normative schemata embodied, deployed, and reproduced by collective and individual actors, Bourdieu 1988, 1992, 1998). These institutionalised features are the main source of academics' responses and resistances to changes.

The combination of structuration and academic field is useful to describe a contrasted process by which: first, innovations triggered by state policy reforms – introducing different constitutive and generative principles and a different logic of functioning – impact a structured and relatively autonomous field affecting both its power relations and *habitus*; second, new organisational actors with their demands, needs, and resources enter the field. This in turn entails that the field experiences a reduction of its autonomy and that it reacts to those threatening institu-

tional pressures. It can be said that we are witnessing the emergence of a new structure of resources and constraints, as well as constitutive and normative rules, affecting the Italian academic field.

The academic field (in Bourdieu's sense) is thus changing into an organisational field (as DiMaggio and Powell conceive it) where University and the State are only two among many actors: local, regional, national, and supranational public institutions and administrations, banks, industries, R&D organisations, and departments both public and private etc.

There are several clues and evidences witnessing the construction and structuration of the organisational field in which U/I relations are embedded. Four points highlight the main findings supporting the existence of an ongoing process of structuration.

- New actors are entering the academic field, new relations are set up, new rules (either formal or informal) are both implemented and emerging, and new organisational arrangements are taking form. First, universities – both as a corporate actor and a set of faculties and departments – are facing a range of new actors ranging from SMEs and big companies to employers' associations, local economic institutions (e.g., Chambers of Commerce), local governments (especially at the regional level), public research agencies, and the European Union. Second, new relations are established including exchanges of information (e.g., on job vacancies and graduates profiles), mutual supply of resources (e.g., highly qualified labour force, know-how and technology, qualified staff for spin-offs; research funds and grants), joint participation in the pursuit of common ends and mutual understanding of being involved in a common enterprise (e.g., scientific and economic development, establishment of new study programmes or university sites). Third, new rules governing these relations are operating: both top-down regulations setting a new institutional environment (e.g., public policies and reform acts) and bottom-up agreements and contracts between firms and universities. Fourth, new organisational arrangements are emerging such as consortia, pragmatic collaborations (Withford and Zeitlin 2003), and new organisational units siding and complementing the ordinary operation of university administrative offices.
- The structuring of U/I relations is still in a very initial phase, yet some trends and problems can be detected. First, these relations are disciplinary and territorially biased. The greater part of reported collaborations involves hard science faculties and departments mostly located in more economically developed areas. Factors pushing col-

laboration though, seem to be different in different areas. U/I collaboration is led by private actors' initiatives supported by local governments in economically stronger areas such as Piedmont, Lombardy, and Emilia-Romagna, while it is promoted especially by universities, public research agencies, and the central government in other areas as a policy device fostering economic development. Second, U/I relations reveal that public/private dynamics are quite complex. On the one hand, the university system isn't entirely public because it includes also private institutions; on the other, the industrial system is not entirely private because the state is still participating in or controlling important companies or groups. Furthermore, the boundaries between the two spheres have somehow become blurred: private universities receive public financing; public universities' faculties and departments receive funds and grants by private firms; state controlled companies, private companies, public and private research agencies, and universities increasingly interact; and private-based organisational arrangement – such as consortia and associations – are promoted by public actors.

- U/I relations do have a feedback effect on academic culture and practices. This can be seen in the more open attitude towards external actors' demands and needs in shaping the formative supply. Furthermore, academics are pushed to pay more attention to fundraising activities and to match extrinsic criteria based on usefulness and applicability of their research and teaching activities. Nonetheless, the institutionalised traditional academic culture and habitus, strengthened by the university's demographic inertia and the shortage of new (and younger) academic staff recruitment, are still the main break for a full-fledged cultural change in U/I relations.
- Ongoing U/I relations have an impact – albeit still to be fully assessed – on the construction of an effective and well established national graduate labour market, which is still quite underdeveloped in Italy. The operation of AlmaLaurea and other university consortia, as well as the signing of specific agreements at the local level are at least siding as institutional buffers the functioning of other matching devices between supply and demand; for example, networks of informal social relations. Furthermore, the growing interaction between pure and applied research among a plurality of actors, as in the Catania and Meta-districts, suggest the emergence of a Mode 2 type of knowledge production both within and outside universities.

On the whole, although a complete survey on U/I relations in Italy has not yet been done, these initial insights witness and confirm that a struc-

turation process is at work, with some contradictions and/or resistances typical of any process of change in its early stages. Comparing these with the definition of structuration, it is quite manifest that each of the four indicators of structuring is present with different degrees of strength. Ongoing changes make Italy a good laboratory to study the structuration of a new organisational field, and especially U/I relations in their early developments.

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