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Skills, innovation and local development

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by

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1. Prologue

January 1st, 1975. After nearly ninety years in the field of mechanical production, Hylten, a small firm in the region of Småland in southern Sweden, ceased to produce engineering parts. Since then it has become a place where the memory abides of a tradition of skills in mechanical working: the machines, well oiled – and sufficiently worn for them to be appreciated as objects that really have been used – start working trying to revive, in an appeal to all the senses, the experience of an activity that required skill and creativity. Today, Småland's development plan exploits that tradition as a leading element among the local factors important for global competition in the electronics and telecommunications sectors that are not technologically linked with metal working, but which aspire – as has happened in the case of Hylten – to have competences rooted in the community that lives and works in Småland.

Summer 1946. On returning to their country, the American armed forces left behind in Italy the majority of the devices employed during the war: weapons, vehicles, but also machinery. Traces of this can be found in the ERP aid lists, enabling one to document some important stages in Italy's economic recovery. Some of those items remained for a long time in the schools. Suffice it to think of the small hand lathe used by the American armies for all kinds of mechanical working: its great versatility gave it special value as a teaching instrument. For decades it was used by the students at the Corni Institute in Modena; well greased and polished, it made a fine show in the Corni workshops: a piece of historic evidence of inestimable value, when one recalls its contribution over the years to instruction in lathe technique, one of the mechanical tasks that have enabled the firms in the province of Modena to dominate important segments of engineering production in Italy and abroad. Other gems like that lathe can still be admired today, by visiting the mechanical firms that give them pride of place in their new premises. Enter, for instance, the firm of Righi Viliam srl., pass the modern façade – where innovation in mechanical production is mirrored in the style of building – and you will find the latest numerically controlled machines being used by one of the leading suppliers of New Holland, but also, centrally positioned, there stands the lathe on which young Viliam learnt his job in the 1950s in a mechanical firm in the province of Modena. When the activity he had set up by himself was well established, he bought the lathe: not merely for its sentimental value, but because it bore witness to the learning and change that machines had made possible and around which a great part of the economic and social wealth of this area has been produced.

Summer 1999. The entrance hall of the school has an unusual look: there's a great concourse of porters moving machinery and dismantling equipment; in one corner buckets of distemper,

rollers and brushers can be seen, and further off there are piles of packaged new desks, computers, and pipings for the electric cables. The school is making room for the new teaching equipment, and in the workshops, too, new machines are being installed: away with the old benches where files and callipers were used! away with that stench of grease and dust that had hung about for half a century and more! Modernity is breathing down our necks and we have to accommodate it, but space has its cost and perhaps there won't be enough space for memory. Anyway, what's the use of memory? Put the American lathe up for auction then: what is its starting price? The value of its weight in iron to melt down. A jewel is, of course, a thing of great value, but especially because a certain community has assigned it a high price. In the summer of 1999 the value of the versatile American lathe is that of its weight in iron: the memory it encloses disappears when it is melted into any old bit of iron, ready for use in some other production. In any case, the space to preserve and catalogue it, and a lot of other equipment, has its cost, resources are already insufficient to render the spaces in current use decent – so why seek resources for preserving a historical memory of the engineering traditions?

In what follows we shall try to give an answer to these questions. To give some idea of the extent of our reflection on this theme, we should like to take a trip across the ocean, to the America from where that lathe came.

After ten years of dismal forecasts, the economy of the United States appears to be running at full steam: in the same measure as their previous predictions were gloomy, observers now compete to paint a rosy picture. The challenge from the Japanese in the 1980s seemed to have set the American economy and society at sixes and sevens, but the response to that challenge has produced the great economic and financial *élan* linked with the opportunities of information technology. Taken as a whole, the data would seem to indicate a path boding great changes, but analysts wonder how it is possible to exploit these potentials to the best advantage in the organization of economic activities. And in this context a new production factor is emerging whose importance for economic growth has swept aside material resources: it has to do with intangible resources, and especially intellectual capital. In the American business schools, this is what the analysts are intent on. What is it? How is it measured? How can it be exploited? A little book tries to explain these things, giving, not recipes, but guidelines. Its author is Thomas A. Stewart, a brilliant journalist on *Fortune* magazine, who tells us, with an astonishing wealth of examples, where intellectual capital breeds and in what conditions it gives of its best. The book is extremely readable and takes us through a variety of sectors, from agriculture to commerce, recounting the stories of many firms.

What links the cases narrated by Stewart to the stories of many mechanical firms in this region (and to the firms of Småland and many other regions of Europe) is the same ability to innovate by relying on the capacities of the persons who work in the firm, making use of the tissue of relationships and skills possessed by those persons, increasing the education level of the population and, in general, enhancing the rootedness – in the territory where they live – of the people who work in the firms. And all these elements contribute to characterize one of the competitive advantages – in global competition – possessed by certain territories as against others, advantages that need to be carefully kept active, with ongoing “maintenance” initiatives to ensure their effectiveness over time.

The intermesh of global competition and “maintenance process” of the skills that have taken root in a community will be one of the keys to interpreting our reflection. But let us now trace the backcloth against which to decode the nexus between historical memory of mechanical skills and global competition.

2. *Why is it necessary to discuss mechanical skills?*

Italy’s education system is going through a stage of far-reaching institutional changes that involve school training: the autonomy of the schools together with the sweeping reform by the Ministry of Education provide the new, changed environment for the reform of the high school diploma, the raising of compulsory school age, the definition of the compulsory training up to age eighteen, and the start of integrated upper secondary education. In a short time, it is expected that the entire educational path will be redesigned, setting two educational cycles: primary, consisting of seven years, and secondary, of five years, with leaving at age eighteen (2). By transcending the centralized structure of educational organization and reforming the educational cycles, it will be possible, at local level, to define a significant proportion of curricula so as to characterize education within the social, cultural and economic environment within which it operates. The local territorial authorities are summoned, by the general process of state reform, to undertake new and more important tasks as regards *inter alia* the whole local training system.

In this framework of changes it becomes indispensable to identify which nuclei of knowledge and skills must be transmitted to the new generations in the particular cultural, economic and social context of the province of Modena. These reflections aim to open a window on this theme and to offer a contribution starting from our experience and what we know of the productive structure of the province.

To begin with, we are aware that a problem exists – above all, an ethical problem: it is necessary to qualify the meaning of primary literacy, in opposition to the tendency to restrict the possession of essential knowledge to a narrow minority of the population. As regards Italy in general, including the province of Modena, this means operating on two fronts: first and foremost, students need to be discouraged from dropping out of upper secondary education and the supply of education for adults must be potentiated, especially for those migrating from outside the EU, but at the same time one must work towards increasing the qualitative level of education offered to all. In order to achieve significant results in these areas, there must be intervention in support of the schools in pursuit of a higher overall quality in their performance.

The second point we wish to analyze takes us back to the discussion on the training of intellectual capital and the economic development in the framework of the debate on the training of social capital. The experience of growth in Emilia-Romagna provides an example of how technical and professional education in the mechanical field is an essential element for activating a virtuous circle of development which, starting from a nucleus of knowledge obtained in the education supplied by the schools, is diffused and thereafter consolidated in the tissue of technical and social relations. It is therefore necessary to fuel a social tension towards this kind of education: to contrast the reduction in enrolments in the technical and professional schools and, at the same time, to strengthen the bonds between these schools and the firms in the territory, in order to facilitate permanent education, the spread of innovations and the training of young persons, in a mesh between formal education and work paths. Over the next few years, the capacity to uphold interest in a mechanical culture could prove a decisive element for fuelling the competitive advantages of this province – not so much because “mechanical work” is the only one that can be done here, as because, starting from the skills connected with the mechanical work, other activities, too, can be developed; indeed, signs of this are already evident both in the sectors new to the province of Modena and in the traditional ones.

In the analysis that follows we put forward, in section 3, the salient points of the intermesh between professional education and economic development in Emilia-Romagna. It is essential to have a historical perspective of this analysis in order to perceive the potentials of the main changes ongoing in the secondary education system, as outlined in section 4. Section 5 draws together the points of our proposal for “historical laboratory of skills and innovation in mechanics”. Here, the term “laboratory” aims to emphasize that it must be a place to carry out processes of experimentation of the ways in which to make explicit and exploit the evolution of the mechanical culture present in this area of Emilia-Romagna. This proposal, then, identifies

the actors who must be mobilized in order for the laboratory to become an effective device in the process of change, but also the financial resources that need to be found if the project is to be implemented.

3. Professional education and economic development in Emili-Romagna

The province of Modena is characterized by a highly developed local economy and, over the last thirty years, this province, together with others in the region – and, more generally, in the North-Central Italy – has stood as a point of reference in the theoretical debate on industrial districts. It is in this context that we wish to apply certain considerations on the special features of the technical and professional education system.

Let us briefly summarize the interlink between professional education and economic and social development in Emilia-Romagna, highlighting three points: (a) the role of technical and professional education in the spread of skills that have favoured the development of small and medium enterprises as from the 1950s; (b) the transformations of the last twenty years; (c) the process of adjustment of the training system within the context of the changes, in both the productive structure and the composition of the population.

(a) The Emilia model: local productive systems and training paths

The particular productive and social structure that has come to be known as the “Emilia model” (3) is the background for the points upon which our analysis is concentrated. Let us here recall two aspects of this model: the characteristics of the local systems of small firms and the role of technical and professional education in promoting and sustaining local growth.

The first aspect characterizing the “Emilia model” concerns the productive structure which features medium- and small-sized firms and a myriad artisan firms which have operated with a highly efficient, dynamic productive system. A large part of these firms sprouted in response to the productive decentralization by the big metal-engineering firms of the region. Many were set up by ex-employees of those firms, starting their own independent activity, using machines obtained on bailment from the firms where they had worked, and relying on technical skills acquired partly from education in professional institutes and partly from their previous work experience. The technical possibility to break down the production process and the assurance of a demand initially sufficient for starting up the entrepreneurial activity were decisive elements in the birth and development of a great number of firms specializing in one or more stages in the production of automatic machines, machines for packaging, transport vehicles, tractors and agricultural machines. This mechanical production was accompanied by the development of

other, strongly localized production in certain areas of the region, such as foods at Parma, ceramic tiles in the Sassuolo-Scandiano district, and knitwear in the district of Carpi.

These systems have had high rates of growth of productivity, an intense dynamic of innovation and an increasing presence on the international markets – all elements that characterize the economic structure of Emilia Romagna (4). Case studies show that these are areas where learning processes are embedded in the network of social and economic relations that identifies the system. In such analyses, the network of social and economic relations provides the key to explaining the opportunities of transmission of knowledge that is largely tacit knowledge, transmission of which does indeed require the possibility of side-by-side working on the job (5).

Around the analysis of the birth and development of the industrial districts and, more generally, the local productive systems present in the region an abundant literature has grown up that has enriched both the theoretical debate on the local economic development (6) and that on the most appropriate policies for promoting and sustaining development (7). An important part has been played in that debate by the discussion on the role of technical and professional training acquired in work experience in the large and medium firms and in the formal education provided by the technical and professional schools in the region (8). This is the other aspect of the Emilia model on which we wish to focus our analysis.

A well-known reference in the international debate on local development in the “third Italy” is the history of the Aldini-Valeriani Institute (9), set up at Bologna in the last century, that has been a landmark for much of the training of entire generations of entrepreneurs, technicians and skilled workers in Bologna’s mechanical industries (10). Other professional schools in the region have played a similar role, such as the Istituto Alberghetti at Imola, founded in 1881, the Istituto Corni, founded at Modena in 1912, and the Istituto Fermi, created by the local administration of the province of Modena in 1957.

The intermesh between formal competences acquired in professional school education and those acquired on the job is obviously of importance for anyone concerned with the way in which theoretical and practical knowledge can effectively be exploited in the sphere of production. There is one point, however, that receives less attention: in order for that intermesh to be effective, it must be nourished by a social tissue that acknowledges its importance as a training path. In the experience of very many small and medium enterprises and artisan firms, the training of different members of the family nucleus has taken place along a path that, for example, linked technical and professional education with the experience of working alongside other members in the family workshop. The theoretical and practical skills acquired at school

were tried out in the workshop, in order to test one's own ability: up to the end of the 1960s, this was the main training and professional path for entrepreneurs and skilled workers in a great many of the metal-engineering firms in Emilia Romagna.

Alongside these firms, other manufacturing enterprises in the region have achieved a leading position at national level: those specializing in knitwear and ceramic tiles (11). The productive articulation of the province of Modena into specialized local productive systems in different sectors, all needing mechanical skills, has also benefited from the territorial articulation of the technical and professional institutes (12).

(b) Transformations in the last twenty years

The 1980s witnessed some changes within this model: the growing international competition spurred the firms to readjustment strategies that modified their technology and internal and external organization structure. Moreover, the regulations regarding industrial relations, taxation and environment became more restrictive and – along with other, strictly technical factors – contributed to make the size of the firm increase with respect to the average of the 1960s and 1970s.

As regards the technical change connected with the introduction of electronic and computer technologies, it should be noted that the spread of these technologies has necessitated the acquisition of new skills, but this process has involved less upheaval than was feared in the 1980s. For the widespread mechanical skills have managed to graft electronic and computer knowledge, with the help of the technical and professional education but, above all, with the training supplied by the producers of numerically controlled machinery and CAD-CAM (13). This enrichment in electronic competence has been possible precisely because a widespread and solid mechanical training was already present (14): the workers who today programme numerically controlled machine tools or work stations have, generally speaking, obtained their professional experience from working on traditional machines, which makes it easier for them to understand how production performed by the machines functions. It must be noted that the acquisition of new competences has occurred over a period of almost ten years, during which the new professional figures have taken their place beside the traditional ones: a phenomenon that quantitatively has not involved the entire workforce employed in the mechanical sector, but only the more restricted number of workers responsible for programming.

Another effect of the changes occurring in the 1980s is the shift from a situation where the organization of the firm substantially concerned production management to a situation where this organization makes it necessary to possess knowledge in other areas, such as logistics, sales

technique, the characteristics of the outlet markets (which tend to be very changeable) and the requirements or opportunities presented by the public sector (owing to the large amount of tax and regulation problems a firm must face, and the access to services and possible sources of finance). In dealing with these changes, education seems to have had a less incisive role than in the past. On the one hand, the content of the teaching has become less specific owing to the need for in-depth teaching of the basic and lateral knowledge that modern professional training must involve; on the other hand, the contact between technical and professional schools and firms has become less close.

While the schools' ability to provide skills that can immediately be applied within the firms has diminished, the family, too, has been playing a less important role. There has been a change in the strategies of families concerning the study orientation of their children. Most often, families have only one child, and an income sufficient for him/her to study up to university level, without needing to find an independent income. Enrolments at the *liceo* have increased considerably, especially for girls, who are supported in the choice of a longer study path than previously.

In the past, the family stood as a model for the professional route of young persons; in particular, it was able to ensure the ways and times of generational turnover in the management of the firm, just as it succeeded in supporting the start of numerous experiences of independent work or new entrepreneurship. All this seems to have become complicated in the face of a generation with an education higher, on average, than its predecessor, with ampler basic knowledge, but with decidedly vaguer ideas, less targeted on a precise entrepreneurial professional path. Analysts in general focus on the lesser motivation of today's youth, in comparison with their parents and grandparents who founded the firms they should take charge of. Certainly, their higher income has accustomed them to a greater ease, that gives them less encouragement to enter the factory and "soil their hands". But our intention is to discuss, not so much personal motivation, as the more difficult choices that many young persons are now summoned to make. There is the traditional difficulty of pitting oneself against one's father and mother, which is the problem of evaluating one's own capacity for independent action. But when one's parents had decided to set up on their own, they were advantaged by having to pit themselves only against their own ability to perform, to produce – one might almost say, "with their own hands". Nowadays, one must choose among a variety of fronts the one on which to test one's own capacities – not only technical ones, but capacities regarding management, organization, sales.

Examination of the data concerning the distribution of males and females in the different orientations of upper secondary education reveals that there are still significant polarizations (15). As in the past, mechanical and engineering studies, electronics and chemistry are the almost exclusive domain of male students, whereas the courses for skilled staff in the tertiary sector are attended almost solely by females, who also make up the majority in commercial courses (16). In accordance with the way the education system is shaped, especially in its pre-university part, female students acquire the knowledge related to administration and management, as well as the skills needed for providing certain services (commerce, tourism, personal services). Males, on the other hand, mainly acquire knowledge connected with mechanics, electronics, and the new technologies. This polarization of knowledge is of little help either in the generational turnover in the management and ownership of existing firms or in setting up new ones, nor in the replacement of intermediate cadres in industry and production artisanship.

Concerning the birth of new firms, it is worth recalling that, along with the stricter regulations firms now have to face, the creation of a new firm of minimum efficient size demands a greater initial investment than previously. Take, for example, the case of mechanical stages. Twenty years ago it was possible to start up an independent activity, even on one's own, and then go on to have one or more partners and, after a few years, employ some workers. A small one-man firm, or one consisting of two or three partners working in the firm, might have only one or two traditional machine tools. Today, anyone wanting to start up in this segment must have not only traditional machine tools but also digital control machines and work stations, whose cost is ten times what it was formerly. This entry barrier restricts the birth of new firms, even in the case of highly specialized activities like mechanical production stages, and substantially modifies the picture regarding the social mobility that has appeared so important for the development of this region (17).

But, although this change is occurring in several manufacturing activities, the situation is different in services, whether oriented towards firms or towards persons. Initial investment does not yet appear to be a barrier to entry, but the relative ease of entry runs up against important problems connected with quality standards, for which appropriate knowledge for control and testing is still lacking.

The problem of the knowledge necessary for ensuring the generational turnover of the contingent of intermediate technical cadres, who represent the main factor in the success of industry in our territory, requires some additional comment. This aspect of the problem, which is no less important than what has been said about the birth of new enterprises, is more and

more frequently brought to the general attention by the entrepreneurial associations, the local authorities and individual entrepreneurs. They make use of the press to report the lack of specialized workers, or to announce agreements with the schools or local authorities in the regions of Southern Italy, in order to encourage migration of workers, or the shift of parts of their production to those areas.

The new generations are little attracted towards a career as dependent worker in industry, especially in small firms, and this is one of the most serious problems emerging from the labour market and the professions in our province. Evidently there has been a weakening in the family and social support that always esteemed work in the production departments of manufacturing industry, when the prospects for social mobility were clearer; nor have values arisen that are equally capable of sustaining training and professional paths for young persons.

(c) *Demographic trends and growth*

Generally speaking, the present articulation of the productive structure shows a fair possibility of growth in the existing firms and a moderate rate of entry of new enterprises. Over the next few years, the labour demand in this region is predicted to increase, though at growth rates lower than those of the 1970s and 1980s, and the composition of the demand will certainly change. Already for some years now, however, the region's economic development is finding an obstacle in the supply of labour rather than in the demand, in technological innovation and in investment. And in the future the situation will be made worse by a natural growth rate of population that is negative: demographic projections at regional level show that in the next ten years a gap must be bridged between labour demand and supply of around 6,000 units (18).

Long-term projections quantitatively defining the professional profiles that are predicted to characterize the future labour demand are not available. The forecasts are generally restricted to a period of 18 months, two years at most, and can therefore not be used to design the training paths of upper secondary education which last five years; at best, they may guide the planning of post-school diploma courses or the programming and realisation of training paths integrated between the schools and professional education.

It is generally agreed that the demographic trend is having a limiting effect on the supply of labour: this is a matter that needs to be addressed by educational and social policies. We wish here to recall two problems, connected with the imbalance between labour demand and supply in the region: the first regards the tasks that require a low level of professional training, while the second concerns the tasks assigned to intermediate technical cadres and needing specialist training (19).

Firstly, in spite of the high level of automation achieved in production in the province of Modena, there continues to be a demand for labour with very low skills – not only in the service and construction sectors, but also in manufacturing – which often goes hand-in-hand with working conditions in unhealthy environments. This demand is met by a work force migrating from areas of South Italy (where unemployment still stands above 20 per cent), but the prevalence is for citizens coming from countries outside the EU.

Immigration has made a crucial contribution to the development of this region, and of North Italy in general. As regards Emilia-Romagna, in the 1970s (when the demographic trend was anyway positive) immigration enabled the growing labour demand in the ceramic industry to be met, but also in the mechanical industries, especially in the case of heavy or dangerous tasks (for example, in the foundries). A great number of social and cultural interventions had the effect of raising the level of expectations, over and above income, of the migrants who, in this region, were not pushed to the margins of society but became an active part of the process of social and technological change. Suffice it to consider, in this connection, that working conditions improved because, *inter alia*, it was not felt to be socially acceptable to summon others to perform heavy, dirty work, that could be avoided with the introduction of appropriate technologies. This process of transformation increased the wealth of these places, permeating the whole of civil society. The new wave of migration poses once again the necessity for measures that shall raise the social and cultural expectations of those who come here in search of work. This is an essential condition in order for the growth of this area to become an opportunity for development, with potential feedback also for the regions from which these workers come. It requires not only social and cultural intervention, but also steps by which technical and professional education may be expanded and qualified.

As regards, on the other hand, the need for personnel with professional characteristics able to ensure the generational turnover of the intermediate technical cadres, the lesser degree of cohesion between the technical and professional institutes for industry and artisanship, on the one hand, and the local economic system, on the other, could be a determining factor. It was that cohesion that characterized other periods of expansion and, in many cases, set going the virtuous circles in which the technical competences acquired within education constituted, in the particular social and productive structure, a fundamental element for the general spread and consolidation of knowledge throughout the productive structure. We shall deal amply with this topic in the section that follows.

4. *What has changed in the system of secondary education and in the relation between education and territory*

In this stage of changes and transition towards a new ordering of education, we wish to take a close look at three important aspects of the working of secondary education that directly involve the relation between education and the system of local enterprises. In particular, we wish to analyze: (a) how choice is oriented after lower secondary education; (b) the effects of increasing compulsory education by one year; (c) the experience of training alternating between school and work.

(a) *Choice orientation after lower secondary school*

Over the last few years the trade associations, with the backing of the local authorities of the region, above all in the provinces of Modena and Bologna, have been conducting an all-out campaign to induce pupils to enrol in mechanical and electronic studies, not unsuccessfully but without reversing the trend.

Some remarks must be made on this point.

The increase in enrolments in schools for general studies (*liceo*) over those with technical and professional orientation is a phenomenon generally observed in the majority of European countries (20). It stems from the improvement in life conditions and the related change in families' expectations. In addition, specialist training, linked to the short-term professional prospects of young persons, is more and more frequently delegated to the tertiary sector of non-university education, as a result of the need to increase the time and energy devoted to the training in basic and transverse competences (21).

For this reason, the training of personnel with complex mechanical competences, for employment at a level of intermediate responsibility, cannot be achieved solely by increasing enrolments at technical and industrial professional institutes. Efforts must be made to structure the first university level and the post-school diploma specialization courses oriented towards training in the competences needed to sustain the innovation in local mechanical industry.

As well as this, however, overall steps must be taken throughout the education system by activating, in all the secondary schools – including the *licei* and the schools largely or exclusively attended by females – a practice of didactic work that will develop and spread a culture that exploits the knowledge of the context in which one lives, and that makes explicit the knowledge of the characteristics of the local productive systems of the region, their emerging problems and their future. And this culture must be based on knowledge of the history of the local productive systems, which is not only the history of the technologies employed but also

the life history of persons, their activities, the ensemble of their relations that have built this very special, very flourishing society. Such knowledge could reduce the element of mere chance in the information on which young people and their families project their training paths.

Lastly, all the schools should be assisted to give pride of place to the “scientific and technological knowledge” linked with mechanical innovations. Good scientific and technological teaching must be underpinned by constant interaction between elaboration of knowledge and practical, experimental activities. This explains the need to relink and consolidate the relations that enable the best local firms to become the workshop of excellence for this special training (22).

The most recent studies on technical progress have shown the importance of the spread of knowledge on “how it works” and “how it is done”. For that matter, it is precisely the interface of theoretical scientific knowledge and the possibility to acquire competences through the practice of mechanical operations that has enabled the development of a local tissue of firms with a high rate of innovation and international competitiveness.

(b) Raising of the school leaving age

In the province of Modena, the students who on completing lower secondary education do not proceed to upper secondary are few, mostly males, often with learning problems linked to social, economic and cultural factors, or having functional-type disabilities, clinically diagnosed as handicaps (23). Also relatively few are the male pupils who go on from lower secondary school to the professional training courses of the accredited bodies in the region.

Young persons who opt to discontinue education become available for low-skilled jobs in manufacturing industry, or in the service enterprises. They find work easily and their role in the family changes, assuming “adult” characteristics in line with their relative economic independence. On completion of their school career, these young persons have a very low education and lack the basic literacy necessary to profit from the ever more complex information and communication opportunity of society.

The law of January 1999 raising compulsory school age aims firstly at regaining an acceptable training level for these young people, since it is clear that, during the course of their active life, they risk finding themselves in a social marginal situation, and a precarious one on the labour market. But the upper secondary school has not proved able to *contain* (that is, “to include in its training objectives”) youths with motivation and learning problems. In the province of Modena, almost 20% quit school, mainly in the first and second years of upper secondary, above all in the professional and technical institutes.

Data on the application of the raised leaving age in the province of Modena (25) show an increase in enrolments at the professional institutes and, among these, a majority at the institutes with industrial orientation. In this way, the schools with the highest drop-out rates have to deal with the schooling of those who, prior to the passing of the law, left the training system by their own decision, after completing lower secondary school. The risk is of keeping fruitlessly in the classroom a “transitory” attendance, that needs to be motivated, convinced, rendered literate and trained, at least in pre-professional skills, by means of a supply of training that, on the one hand, will make their stay at school meaningful and, on the other, will help them progress towards work. A single year of school may not be sufficient for this purpose.

The arrival in the professional schools of groups of young persons less motivated than those who normally enrol risks making the teaching difficult and slow, unless it manages to revalue overall the school work, as something able to provide a testable contribution to the working career of the individual pupils. If the schools, especially the professional ones, are isolated and not backed up, the danger is they will lose credibility in the eyes of their young pupils, who have trouble understanding even how learning to read, write and speak correctly can be useful for their work. They know – and are daily able to verify – that a job is immediately available, not necessarily a dull or badly paid job, and one that requires no special educational qualification.

If a part of young people who have prematurely gone to work is to be brought back to education and training, this task will have to face the need to stem the drop-out from school of many others. Education can do much to reduce the factors that drive young people away from school, by innovation in methods and activities. But it cannot be left to itself, for in society there are many persuasive forces that “remove” young people from school. In particular, the need for a labour force to employ in not necessarily skilled jobs attracts the weakest and least motivated towards work at an early age. A young person with scant basic education will not manage to become a worker aware of his own duties and rights, nor will he be able to adapt swiftly to other work, when required to do so by technological conditions, and, in adult age, he will find it hard to make the effort of formal learning at the same school he abandoned when still only semi-literate.

The province of Modena, like others in North Italy, finds itself up against particular phenomena of school drop-out and demotivation from study, linked with styles of life and consumption models that favour any sort of job; but today the young person has to make more complex, more uncertain decisions with regard to the training needed to enter, in future, a job that could be anything. We are dealing, therefore, not with a phenomenon of economic poverty,

but rather one of cultural poverty that stems from the difficulty in which young people and their families often find themselves. They are unable to interpret the economic indicators – hard to obtain and, in generally, needlessly complicated – that show, without a shadow of doubt, how difficulties at work and economic and social precariousness are connected, at least in the long run, with the individual person’s level of initial education.

To have raised the compulsory age and established obligatory training up to eighteen is not sufficient to tackle phenomena so deep-rooted as to fuel a culture unfavourable towards the education of the young generations. The law raising compulsory school age has identified in the integration between education and regional professional training the device with which to tackle the problems. It is a matter of verifying whether the collaboration set in motion has really functioned, enabling improved results, both as regards better literacy and as regards the acquisition of pre-professional and professional competences. We think that an indicator of quality in the processes activated may be the number of students who continue to drop out of education after the first year of compulsory upper secondary education.

Two problems remain unsolved. The first is how to intervene to help people to see education as an individual opportunity that is worth seizing, a collective duty towards the new generations, not merely an obligation. The second is how to help teachers to change their methods. It is widely thought that one of the obstacles to the change needed in order to bring so many young people into upper secondary education, lies in the inadequate diffusion of teaching methods linked with cognitive and meta-cognitive strategies, more suited to overcoming learning difficulties. Hitherto, as is known, the training of teachers has been constructed “on the field”: the majority of update courses centre more on subjects for teaching than on teaching methods.

Both problems recall the need for action on several fronts. Just as, from the post-war period on, the local political and social forces showed they had understood the importance of constructing and supporting an effective education system for all, so now it is necessary to sustain education in such a way as to enable it to make a qualitative leap – urgent and not too easy – towards reinforcing technological and scientific knowledge. We therefore think it indispensable for the local social, political and economic forces, and the world of culture and scientific research, to take steps in support of education, by declaring their will to invest in it.

(c) *Training paths alternating between school and work.*

During the period spent at school, the professional institutes and some technical institutes organize training stages in the firms, enabling young persons to make direct acquaintance with

a productive organization and, to a lesser extent, to acquire or consolidate specific competences. Modena's Provincial Administration has employed financial means and human resources in support of summer work by young people attending the last years of secondary education. Alongside these initiatives, it should not be forgotten that, in the region, a fairly high number of students work in manufacturing firms during the summer holidays, though the amount may be declining a little.

All these experiences have an undeniable value for training. Often they make possible the first encounter between the firms and the future school graduates. It may also happen that some young persons find their first job in the same firms where they did summer work, or where they went on a training stage. But all agree that there is a gap between the work experiences and the way the school ordinarily functions. In order for knowledge acquired inside a work environment may be organized and affect motivation, or the ability to make conscious choices, it is indispensable that young people be guided in reflecting on, re-elaborating and awarely interpreting what they have experienced. Education, through training work that involves technical, scientific and also humanities disciplines, can perform this indispensable function of "mediation". However, the contents of the subjects need to undergo vigorous, meaningful revision, with an aim to reducing their size, in order to encourage the in-depth studies necessary for constructing a training path more closely linked to the characteristics of the local community.

The recent introduction of certain areas of autonomy for the individual schools allows reduction to a minimum of the bureaucratic process for starting teaching experiments, and enables a part of the curriculum to be defined in close connection with the cultural and training requirements of the territory. The teachers have the heavy task of perceiving the external stimuli and translating them into projects and teaching praxis in the classes. To this end, apart from what we already said on the need to potentiate training in teaching methodologies, it must be recalled that few teachers are acquainted with the local productive system. Teachers with a technical-type university background (engineers, architects, economists) generally have scant knowledge of these particular systems of enterprises and their organization. Though some of them perform, or have performed, free-lance professional activity as consultants, their familiarity with the reality of the firms remains, on average, modest within the schools.

For that matter, the relationship between the individual firms, or their associations, and the schools has become less close. More and more rarely do the small entrepreneurs apply to the schools where they were trained in order to get an opinion or to utilize a particular machine. The entrepreneurs and their associations have difficulty in getting to know the contents taught in

education. Hence, it is a complex matter for the entrepreneur to know what skills can be expected of a school graduate or a person with a technical qualification.

The planning and realization of training paths alternating between school and work provide an opportunity for an exchange of information and knowledge. If the school staff, the staff of the training centres and those responsible in the firms would work together, this might enable them to construct a language and training practice shared between them. Probably, however, the present division of tasks does not allow state school teachers to increase their knowledge of work environments in order to link their knowledge of their subjects and the teaching of them with the complex knowledge that can be acquired through practical experience in the firm. An important opportunity for professional growth is thus partly wasted, and the risk is that the integration of alternating experiences in the teaching curricula and the orientation of the school will not be encouraged. In this way, a substantial part of the benefits achievable in a training path that alternates classroom or laboratory teaching with professional practice, will be thrown away.

5. *A proposal: to create a “laboratory of history of competences and innovation”*

The local training system can be re-qualified through the wealth of means and competences available at local level. There are no ready-made solutions to reach our objective: thought and experiment are needed. Our proposal is that such a process might find a favourable terrain within a “laboratory of history of competences and innovation in mechanics”. The title of this proposal contains two key words that indicate, to our way of thinking, two success factors throughout the productive system: competences and innovation. Not fortuitously, these words directly call up the productive system and the training system. We do not suggest a “museum of machines”, but a “laboratory” within which to bring alive experiences, moments of encounter, construction and realization of important projects for the creation of sophisticated competences for underpinning innovation, especially in the mechanical area. The laboratory could be the focal point for initiatives involving the social, political and cultural forces in support of the complex, difficult task of educating the new generations. To this end, the laboratory must be able to contain the “weight” of the memory and history that risks being assessed as mere “old iron”.

This is a proposal: looking at the situation we have outlined in our analysis, we feel it is urgent to launch a discussion to start initiatives able to act on the delicate area of training in competences, which, as we know, require long times to permeate a social tissue.

We are aware that our analysis can be broadened and articulated in a more systematic way, but we think it provides a convincing basis to start a debate. Our proposal does not contain a detailed description of how the laboratory should be constructed. This will need to be worked on. However, there are some points from which a discussion could already set out; they concern: (a) who should be the actors who promote the laboratory ; (b) what activities should be performed in the laboratory.

(a) Who should be the actors who promote the laboratory

The laboratory must be an opportunity for working together by actors who today work separately, or fairly unconnectedly, in the field of training. A possible list of actors follows. It includes, firstly, the schools (of each cycle), the Education Authority, the Centre for Educational Documentation, but also the Centres of the regional professional training system, the university Departments of Economics, Engineering and Sciences. There are the metal-engineering firms, represented individually and through their associations. An important role must be played by the Chamber of Commerce and the service centres that work to promote innovation and local development (such as Aster, ProMo and Democenter). The local authorities and the region, through the action of the offices responsible for education, culture and economic activities, could integrate the action of the laboratory in the area of local development planning. The associations of former pupils and teachers of the professional schools can be involved. An important contribution could come directly from the metal-engineering workers and their unions. One may also find out whether the Historical Institute of Modena would be interested in taking part in this project, which might have aspects in common with the “Museum of Work” project on which they are currently engaged.

We think that it is necessary, first and foremost, to obtain the trust of the entrepreneurs’ associations, the local bodies, the universities and the schools. If a nucleus of actors deeply involved in this project can be set up, we are convinced that it will be possible to work together, also with other European partners, towards getting finance from the European Union in support of the development of local competences, and on projects of teaching experimentation on topics of scientific and technological orientation and training linked to the local productive structure. What needs to be planned is not so much a central laboratory with decentralized laboratories as, rather, a network of laboratories.

(b) Which activities could be performed in the laboratory

In what follows we have listed schematically certain laboratory activities; they are obviously open to argument and would require more precise definition within the project. The order in

which they are presented is not yet that of their respective importance. In the laboratory, generally speaking, it will be possible to:

- activate research paths to outline, also from the historical point of view, the network of competences that have contributed to the emergence of innovative processes in the mechanical field in the province of Modena;
- prepare the instruments most appropriate for representing and rendering usable, to young persons, the emergence of similar networks of competences;
- collect, catalogue and make usable the patrimony of instruments and working machines in mechanics, scattered in the schools, or abandoned in store-rooms. To this end, it might be as well to request the heads of institutes to refrain from getting rid of the machines they have inherited, currently put up for auction, and to suspend restructuring of the old premises where the machines were used (reconstruction might involve unnecessarily burdensome labour); it would also be appropriate to assess the firms' willingness to make available machines and products that would document the technical development of the mechanical firms in the province;
- contribute to the creation and testing of training paths that would enable the spread of knowledge on the technical history of mechanical industry and the history of the training of technicians;
- involve all the schools in the province (including the primary schools) in constructing teaching paths of knowledge and experimentation of technologies and mechanical work, its working instruments, and, more generally, knowledge of the "material nature" of the products;
- construct a permanent training circuit for primary and secondary school teachers on the topics of scientific, technological and professional education, as well as knowledge of the local productive structure;
- set up a source of specialized documentation on the teaching experiences in scientific, technological and professional education, with special attention to the modalities that involve alternating periods between school and work;
- enable the city, scholars, and of course not only local ones, and those visiting Modena for work or tourism, to acquire so important a part of the history of this territory.

As regards the schools, the orientation towards choice of educational path – especially where it involves very young male and female pupils – must necessarily be interlinked with the paths of knowledge of the social, economic and cultural environment to which the pupils belong. In addition, as is witnessed by the best experiences, the paths of knowledge must be able to

combine speculative experiences with practical, manual, factory activities, since it is more and more difficult to maintain a separation between “theoretical knowledge” and “know-how”. This accounts for the need to link orientation activities with scientific and technological education, on the one hand, and literary education, on the other. Secondary education is so ordered as to find room to construct an interdisciplinary activity of this type, as well as having available the appropriate disciplinary competences among its teaching staff (teachers of literary, scientific and technical subjects).

It is usual to suppose that, over time, schools have acquired the capacities for designing and managing complex projects. There have indeed been several occasions when, often with too scanty funding, the schools have been summoned to present a work “project”. Sometimes, not always, the schools also learnt to design *ad hoc* projects, knowing that they would not be too closely monitored and that outside assessment would not be too precise. With the “cut and sew” operation to transform the documentation on a project that the schools have been running for years, in order to present it for the different funding scales, the schools have often managed, simply by this means, to collect the minimum resources for working. But, in the absence of an effective capacity to detect and measure the results achieved, the practice of “recycling” has, in some instances, weakened the planning abilities linked with innovation or improvement in the educational practices. If this is the situation, one should avoid assuming all the schools possess an optimal ability to project innovation, to run innovative processes and to measure their results. The schools need therefore to be sustained also in the planning stage, as well as in the stages of running and evaluating a teaching project.

To sum up, while acknowledging here a great ability on the part of the teachers, without assuming it to be complete, we recall three main themes on which to articulate projects connected with the laboratory of the history of competences and innovation:

- reconstruction of the recent history of the local economy with special reference to industry, also making use of oral testimony;
- analysis of the quantitative aspects of the local economic situation and the qualitative aspects of the life and training paths of those employed in the local industry;
- analysis of the productive processes employed in obtaining commonly used products.

In order that the design of “laboratory ” activities by the schools may be effective, it should be integrated in the ordinary class plan, exploiting the opportunities (now given to the schools as part of their autonomy) to shape a portion of the curriculum according to the particular characteristics of the territory. But it will also be necessary to draw on diversified knowledge instruments – closely linked to the physical construction, creation and simulation in the

laboratory – and to build relations of collaboration that will enable integration between research activities performed within the University and the activities (didactic, research, training in service and orientation) performed in the schools.

Notes

- 1) These notes were prepared for the conference on “Competences, innovation and local development”, March 3rd, 2000, at the Faculty of Economics, University of Modena and Reggio Emilia, Italy. The text has been discussed with several persons, whom we thank for their comments that we have tried to take into account in this version. Although the ideas presented in this work are the result of an elaboration developed within a common research, sections 1, 3 and 5a are by Margherita Russo, and sections 2, 4 and 5b by Paola Mengoli.
- 2) The present situation involves a cycle of five years of primary school, followed by three years of lower secondary school (*scuola media*) and a further five years of upper secondary school (*liceo*, technical and professional institutes).
- 3) See Brusco (1982).
- 4) See Brusco and Paba (1997) and Russo (1997).
- 5) See Russo (1996a), Bellandi (1998).
- 6) For a review of the main contributions on this topic see Russo (1996a).
- 7) This is the orientation of the contributions collected in the volume edited by Cossentino, Pyke and Sengenberger (1996).
- 8) Suffice it to recall that the indications of industrial policy put forward by Sebastiano Brusco have always been distinguished by emphasis on professional training and education in general.
- 9) The Aldini-Valeriani was founded in 1839 as a municipal school for professional training, on the model of the French technical schools. The Bologna borough administration has always shown keen interest in this institution, supporting initiatives such as the setting up of a school museum and a periodical “Scuola-Officina” containing high-level contributions on the theme of professional training and technological innovation.
- 10) See Capecchi (1990).
- 11) The relevant training paths of these local productive systems are examined in various papers; see, as well as Brusco (1982) and Capecchi (1990), the more recent studies by Mengoli (1993), Cigognetti and Pezzini (1994), Solinas (1994), Mengoli and Russo (1998), Russo (2000).
- 12) Thanks to state management, the Corni Institute during the 1960s and 1970s opened branches in all the main towns of the province: Sassuolo, Carpi, Mirandola, Vignola and Pavullo. The same territorial diffusion did not, however, occur in the case of the Aldini-Valeriani, which is managed by the Administration of the borough of Bologna.
- 13) These firms, generally located outside the region, or outside Italy (in Germany and Japan), have organized specific training for the electronic programming of their machines, thus contributing to the spread of competences that, also as a result of this drive, have been widely included *inter alia* in the study curricula of the technical and professional institutes.
- 14) Insert reference to the Oecd report on Modena.
- 15) The data are elaborated in Mengoli-Russo (1998).
- 16) A similar, if less accentuated polarization can be detected in university attendance: there are more males studying engineering and many more females studying paediatrics.
- 17) See Brusco (1982), Capecchi (1990) and Solinas (1996).
- 18) See borough department for culture, sport, youth project, training systems – Emilia Romagna Region (1995). Demographic projections broken down at provincial level and for Modena’s industrial belt show even more pessimistic trends. See Fiorani (1997).
- 19) When unfulfilled requirements for work force are reported, the characteristics in terms of skill of the personnel requested are not always made clear, and this may lead to a number of misunderstandings.
- 20) See Bertocchi and Spagat (1998).

- 21) For the definition of basic, transverse and specialized competences see the work by ISFOL (1998).
- 22) Precisely in this conviction we agree with the main lines of the Basic Document recently prepared by the Coordination of the Special Project for Scientific and Technological Education of the Ministry of Education, which makes available funds for the schools of the province. The project, in a four-year perspective, aims to improve the organization of scientific-technological teaching.
- 23) Among pupils in a handicap situation, those who do not go on to upper secondary education, if they cannot avail themselves of training paths with accompaniment at work, are placed within residential rehabilitation centres or, more often, remain in their families.
- 24) In the province of Modena there are three of these courses: two specialized ones in the reception-hotel sector (which has no equivalent upper secondary school course) and one in the mechanical sector.
- 25) These are data elaborated by the Provincial Administration from not very reliable administrative sources and the data referring to handicapped subjects have not been extracted. Published in the local press following a press conference by the Province.

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