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The Double Helix of Learning and Work*

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Editors' Note

The Double Helix of Learning and Work by Orio Giarini and Mircea Malitza is a report to the Club of Rome first published by UNESCO in 2003. It advances fundamental paradigm-changing ideas in the field of education. Drawing inspiration from the double helix structure of DNA, the authors seek to strengthen the relationship between education and employment in order to bring 'The Knowledge Society' within reach. This article is an abridged version of the third chapter of the report. Successive chapters will be carried in subsequent issues of *Cadmus.*

Chapter 3
"I Work, therefore I Am"

3.1. The Millenial Equation of Work

Authors find it difficult to resist the temptation of an anthropological insight when it comes to a social issue. The image of Homo antecessor, the ancestor clad in an animal skin and carrying a club in his hand, is still haunting us. Films, literature, and research keep that image alive as a memento of the long road human civilization has trodden so far.

This suggested conceptual scheme attempts to consider what is known or suspected. At the beginning, it was the need to survive that pushed humans to work for their basic living. They worked for food, shelter, and instruments to protect themselves and their groups. From the very first moment, their work differed from that of animals.

Humans were at a disadvantage compared to animals. They could not completely rely on their instincts, and they were overwhelmed with fear because they were physically weak and non-competitive. In exchange, they developed vaguely natural qualities: symbols and language that shaped their culture, group solidarity conducive to social contract, and tools

amplifying their strength and dexterity. Trial and error attempts succeeded after a number of failures and disasters.

What is striking in this picture is the artificial and original quality of the niche that humans built for themselves as their own environment. Their hesitating instincts guided them through a virtual world of symbolic links and signs, from where they returned with the schema of a hunt carved in stone. Fear induced humans to live in groups that gradually became structured and cemented owing to language. And so the bear, although stronger, fell prey to the ingenious tools and traps of humans.

In order to get their work done, humans needed to know, and in order to know, they needed to train. The labour of humans did not "get through" as raw labour but as labour backed by tools and training. Human observations leading to change came out of the laboratory of daily practice that enhanced the effectiveness of tools and the productivity of work.

There is something strange about human needs: once satisfied, humans change and develop new needs.* Inadequate work in the process of meeting these needs activates the loop of innovative learning and technology and eventually provides satisfactory solutions. This entire picture teems with loops and feedbacks. Always researchers, humans started from technology, innovation, and education applied to the individual, to their fellow-beings, and to society to build specific theories regarding them. In the Learning and Work scheme, work holds a central place. Education appears as a particular form of work, temporarily directed towards knowledge and skill acquisition to come back to the same perennial goals of producing goods and services, and acquiring wealth in the adult phase. Although the education period takes ten to twenty years, humans will spend forty years in a life of work. School is the anteroom of factories, companies, and institutions.

How does the centrality of work in the lives of humans hold up to the continuing depreciation of the idea of work in the history of humankind? To receive an answer to this question, it suffices to refer to the opinions of the philosophers of antiquity. Workers ranked lowest in the social hierarchy. Next came the merchants and the soldiers. The aristocratic élite of the wise men of the city were at the top. The dark centuries of the Middle Ages registered an increase in the dignity of labour. The guilds of craftsmen and traders commanded almost as much respect as the artists and master builders.

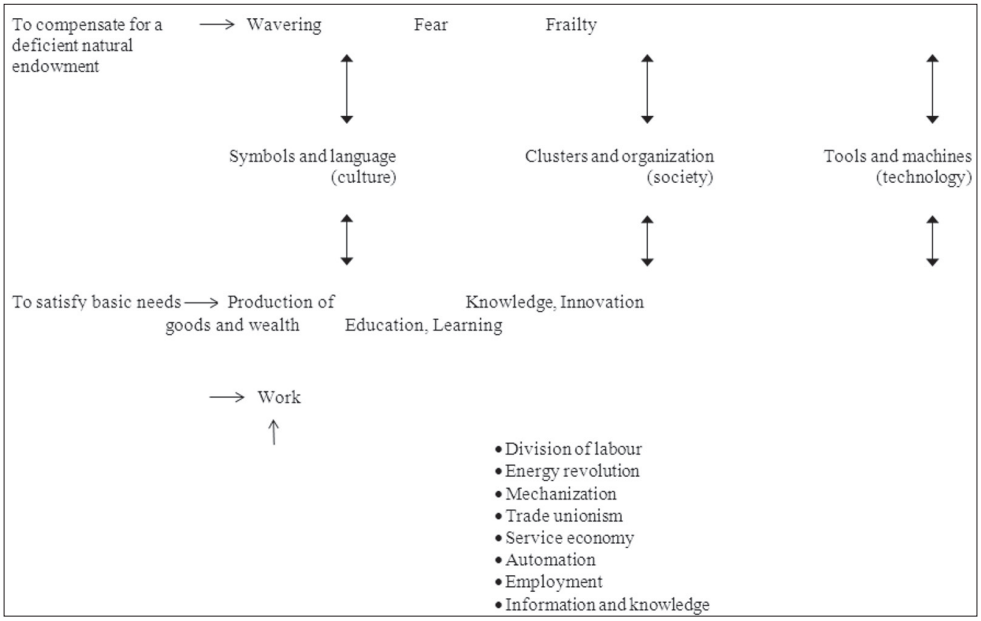
Still, the biblical curse lived on: banished from the Garden of Eden, Adam and Eve were condemned to live lives of human toil and sweat. The free gifts of the Garden were no longer within reach. Everything would have to be earned through labour. It was imposed by circumstances, and therefore it became inescapable. The division of labour increased the efficiency of human effort, but it also propelled a privileged stratum to the top of the social pyramid. It also lowered the status of raw, manual labour, based on pure muscular strength, which was even more despised as it was at least partially performed by slaves.

* An eminent logician, who was also very fond of wine, once told his students, to justify his weakness, and also to teach them a lesson in recurrent reasoning: "Every man is entitled to a glass of wine, but after he has drunk it, he becomes a new man, and is, therefore, entitled to another glass of wine, and so on".

The energy revolution came much later. For millennia, people and domesticated animals provided the energy that was necessary to produce goods. Another degrading association occurred: hard labour was used as punishment, for example on galleys or in mines. The social image of work was always negative: punishment for original sin, and alongside animals and slaves, raw and unrewarded effort.

Division into social classes followed the same pattern: the lowest stratum comprised manual workers, while the highest stratum was reserved for noble occupations such as decision-making, creative pursuits, command, and leisure.

Figure 1. How humankind compensated for physical frailty with intellectual development



The successive revolutions that modified the structure and social condition of work were triggered by technical factors (energy, mechanization, automation, computerization), scientific factors (knowledge), social and legal factors. Cultural elements also made essential contributions (*e.g.,* religions). After the dissolution of the Roman Empire, the monasteries became centers of agricultural production, hard work, and order, to wit, genuine anti-entropic knots in an anarchical environment. At the time of the Reformation, Jean Calvin established the major role of work and effort in achieving spiritual salvation, with considerable economic effects. This relationship induced Max Weber to trace the origins of capitalism to the ascetic ethic of work introduced by Calvinism.

It was energy, however, that changed the nature of work, removing its association with rudimentary and tiresome human effort. A new name should be invented for the man endowed

with energy: the *enerman.* The progress of civilization was marked by the steps forward in harnessing energy: agriculture and food owing to solar energy converted through photosynthesis, transport using draft animals and the wheel, and mills driven by wind or water. In modern times, society came to depend on steam, electricity, the internal combustion engine, and atomic power. It is inaccurate to say that people work alone. Humans are always assisted by powerful "slaves" that work for them.

Let us make a simple calculation starting from the equivalence suggested by Fourastié (1972) according to which a ton of coal is equivalent to the energy consumed by ten people working over a 300-day year. Before the industrial revolution, each person had only one energy servant, one *enerman.* During the past century, a person had 100 such slaves in the United States and thirty in France. Some 4.6 billion tons of coal were added to the power of every person in the world yielding fifteen auxiliaries in 1961 and twenty-two, in 1984. In 1990, total energy consumption provided each of the 5.3 billion people of the world with twenty-four invisible auxiliaries.

The human species owes its success to billions of *enermen.* These conventional creatures also have to be fed, alongside humankind, using the resources of the planet. Without them, humankind would never have reached a life expectancy about four times larger than in the early days of the species. One should add the amenities of the habitat, improved hygiene, more time for education and leisure, transport and communications, and many other benefits that are now taken for granted by a hedonistic and wasteful generation, which hates civilization and despises science and technology. The forecasts for 2020 predict a quasi-doubling of energy for a population of up to 8 billion. The most ambitious are the continents with smaller populations of *enermen* (Asia, Africa, Latin America), while higher consumption is envisaged in the developed countries. Nevertheless, even in the happiest of cases, energy use per capita will fall behind the leading platoon of North America and Europe by 1:3 or even 1:10.

The hunger for energy, as vital to civilization as food is to humanity, puts the learning society and the promoters of knowledge to a serious test. The reserves of fossil fuels are coming close to depletion. Non-conventional sources of energy, including the sun, the ocean tides, and the wind, are expected to take up the relay in this century. For now, the rises in the price for a barrel of crude oil are not particularly alarming.

In terms of power use, the human of modern civilization has finally taken his revenge on the human of the natural state, who used to be so severely disadvantaged when the species started to fight for its life.

3.2. The Man-And-Tool Symbiosis

We have gotten so used to the writings on the "impact of technology upon work" that we have reintroduced the loop of mutual dependency with certain reservations about the ascertained one-way determinism. Machines were born of the pressures of work. They are ingenious mechanical imitations of human gestures, substitutes for manual work. Special homage is owed to the human hand, which comes next to the human brain as nature's own cre-

ation. At first, industry was manufacturing, *i.e.,* making by hand. Before the advent of industry, there was the self-sufficient household, in which food and its storage, animal breeding, building the house and the stables, and weaving the cloth were all accomplished by hand, assisted by simple manual tools.

The symbiosis between man and machine goes back quite far. It probably began with the spinning wheel, which fascinated Plato. Tools have always inspired metaphors in the minds of philosophers. After Plato's spindle and shuttle, the clock was the philosophical metaphor for cosmogony. More recently, the computer became the point of reference and inspiration for brain researchers, while computer science was assimilated to the "nerves of the governance" (Deutsch, 1963).

A genuine affective bond was established between man and his tools, and that special intimacy is quite visible at the level of a handicraft workshop or in rural households.

In the age of mechanization, the human-machine symbiosis firmly established humankind in a position of unprecedented power, a fact that should have enhanced the dignity of work. At that point, the physical force required for the accomplishment of a task was amplified, and even manual technical operations became more effective. The worker acquired more hands than Shiva, the Hindu god. But the history of the man-machine symbiosis was an agitated one, filled with controversies and disputes. At an early stage, it was marked by worker uprisings against machines. The introduction of the mechanical loom in England caused a revolt of the workers who were afraid of losing their jobs. The Luddite movement became violent; its leaders were eventually hanged. Ever since that time, that destructive reaction has been remembered whenever highly efficient technology has improved human productivity, while rendering certain of the older tools useless.

During the industrial revolution, the first generations of machines required the frequent intervention of a supervisor who had to perform a sequence of operations before handing over to the machine. Who assisted whom? The fact that the man-machine linkage, whereby human work combined with that of the machine in a series of mechanical gestures, had to keep to a certain pace diminished the claim to dignity of the machine-ennobled work.

Things became more serious once the production line was introduced. A conveyor moved a part of an assemblage in front of workers who were expected to perform certain operations on it within a short period of time. The image of Charlie Chaplin driven to exasperation and madness, as he was compelled to perform the same simple operation at an increasing speed, was a most merciless criticism of intensive mechanization as an attack on human dignity. Sociologists promptly denounced "le travail en miettes" (Friedman, 1956). The economic crisis of the 1930s and the Second World War that followed were not able to bring any remedies.

Towards the end of the Second World War, the file on the dehumanization of work was eventually re-opened. When automation enabled the machine to take over repetitive operations, the worker acquired an ability to see the whole picture of the process, to understand

the significance of various operations, and to establish a co-operative relationship with his or her colleagues. The "team" formula suggested by the so-called Scandinavian experiment began to gain acceptance. IBM was one of the first large companies that applied it. The workplace was freed of the stress of mechanical motions. It became the site of team formation and collective responsibility. The rapid pace of technological change prompted managers to introduce refresher programmes or additional training. Many of them adopted the "learning corporation" formula in response to the perceived need to consider the work process as a learning process involving the workers as conscious participants.

After 1950, the new trend of cybernetics began to identify common processes in machines and in living organisms. This development was paralleled, at a practical level, by the progress of automation and the advent of the era of robots.

While the deeper division of labour, coupled with an enhanced use of energy and mechanization, significantly altered the nature, position, and functions of work in production processes by continuously reducing the number of people required to perform a given job and increasing qualification requirements, automation also began to threaten the very existence of traditional jobs. It brought along the menace of a complete substitution of the person by enabling the machine to perform as well as him or her and even better.

Technology took a step forward in imitating and surpassing human work. In the first stage, it focused on the muscles, the arms, and on sheer strength. In the next stage, it addressed dexterities through the use of fine mechanics. Finally, technology began to replicate human senses: it was able to see, hear, feel, and even smell. Ultrasensitive sensors and ultraprecise measurements allowed control over all the thresholds between operations, no matter how minute, calling for more sophisticated technical interventions, beyond the level of discrimination of the human senses and human observation.

Automation confronted the notion of work with new problems. On the one hand, man was empowered to control, supervise, and monitor the work performed by machines. On the other hand, automation threatened to reduce the employment possibilities of humans. In terms of qualification, the requirements remained unclear. Some managers claimed that such requirements could be minimal (supervising the machines amounted to pushing buttons without necessarily understanding the complex underlying processes). In the phase of computerization, new jobs began to be created, which demanded precise qualifications (*e.g.,* programmers and system analysts) for the maintenance of complex systems that covered and unified the entire activity of a company.

When referring to technologies, it is necessary to include scientific research. Various analyses of the industrial revolution seemed to indicate that technological advances were more indebted to the experience and competencies of the practitioners than they were to scientific laboratories and universities. Today, the boundaries between science and technology have grown fuzzy. The two occur together in organizational charts (Research and Development) or in great strategy debates (Science/Technology and development (see UN Conference on Science and Technology for Development, Vienna, 20-31 August 1979)).

All the branches of science, not only the more spectacular ones such as physics and biology, made notable progress with significant practical applications. It would seem that, once the mechanics of solids and fluids had said everything that had to be said to industry, aviation, and navigation, new branches tended to emerge such as the mechanics of wheels, of dust, of sand, or of mud. All these had important applications ranging from the mechanics of derricks to the chemical and the food industries.

"Technology does not eliminate jobs; it simply moves them."

The tandem, S/T, contributed to the development of electronics, which produced the microprocessor, the basis of automation. It also ushered in the computer and the explosive development of the telecommunication industries. It all started from the observation that diodes and electrical circuits functioned according to a Boolean, linear logic. That was the case with the early computing machines and with arithmetic calculus. The advantage was decisive: enhancing computation speeds. Miniaturization, owing to the use of transistors and to program storing on microchips, brought about the most rapid and sweeping changes of which any technology could ever dream. The binary calculus of computers spanned all analogical technologies. We are now in the era of digitalization, of representing information through binary calculus (image, sound, text).

3.3. The Service Economy

The new activities and jobs follow a principle deriving from the experience of the past decades: technology does not eliminate jobs; it simply moves them. Jobs disappear from or decrease numerically in the "classical" sectors (agriculture, manufacturing, and services), and they appear in fields that did not exist before in that form. Nothing is more relevant for the transformations that occurred in the nature of work than the shifting proportions of the active population employed in the three classical sectors. At the end of the Nineteenth Century, Germany was an industrial country with a population distribution of 40/35/25 (percentages of the active population in the three sectors). At the end of the Twentieth Century, the figures were 5/45/40. In all the developed countries, mechanized, chemicalized, and irrigated agriculture employs a maximum of 5 percent of the active population. The manufacturing industries now represent 45 percent or even less in some developed countries. The greatest leap forward was taken by the service industries, which moved up to first place, employing more than 50 percent of the active population.

The progress of civilization thus appears to be a constant process pursuing precise trends: the proportion of the employed population active in agriculture and the primary resources has gone down from 90 percent to less than 10 percent today. The manufacturing industries remained in second place, employing about one-third of the active population. Services absorbed over half of the workforce. We have entered a new phase, that of the service economy. In the course of a century, we have seen how the visible hand of technology dislocated humans from one sector and moved them into another, as machines made raw or less qualified work unnecessary or useless.

Table 1. Employment trends from agriculture to services

Primary	→ Secondary	→ Tertiary
Over 90%	Less than 5% ↑	Less than 10 %
	Around 50% ↓	↑ Around 33%
Less than 5%	Around 33%	↑ Around 66%

Note: Historical trend: workforce in the three sectors.

This table provides the key to the unemployment problem, which is nothing but a bottleneck. The labour force in the primary sector is not prepared to work in either the secondary or the tertiary sectors, nor are the tertiary or the secondary sectors open to workers who do not have the necessary qualifications. The sectors that are tending to reduce their labour force (always the primary sector and, more recently, the secondary sector) have only one outlet, *i.e.,* services. Still, it is very difficult to move from cattle-breeding to programming the holidays of other people on a computer inside an office!

The key to inter-sectoral mobility lies in education. We may accept the explanation that high unemployment, in many developing countries, is linked to the fact that the educational system does not function properly. Why then does this phenomenon persist in countries with strong educational systems, such as the European countries? It is because those systems were designed as splendid instruments for a time of slow and incremental change. In our world, these are no longer adequate.

There is no distinct and clear-cut delimitation among the three sectors. A mechanized and automated farm poses the same operational problems as any industrial unit. The secondary sector itself is now quite different from the old manufacturing industry. We are talking here about production systems in which services absorb up to 80 percent of all manpower and financial resources in such fields as R&D, storage, maintenance, control of vulnerabilities, financial activities, repair systems, monitoring, distribution, customer service, and waste management.

The advance of services has highlighted another alteration in the nature of work: a vastly increased hunger for increased monetary remuneration. When money is the main form of remuneration, the system is monetarized. During the Industrial Revolution, money became the essential key for organizing the production system. Before the Industrial Revolution, most of the resources, which were mainly produced and consumed in the agricultural sector, were related to a system of self-production and self-consumption in a non-monetized system.

In the monetarized part of the economy based on exchange, the money may appear explicitly as the value of the goods exchanged (monetized) or implicitly, when there is a potential value attached to them that could be calculated in monetary terms, but is not.

In light of the distinction between monetized, non-monetized, and non-monetarized activities, the essentially agricultural society can be defined as predominantly non-monetized.

When commercial exchanges take place, we are in the realm of monetized activities. An example of non-monetized but monetarized (reference to money) was the type of exchanges performed by the ancient Greeks around the Black Sea (oil and weapons in exchange for grain and honey).

Now, the methods used in the classical industrial period, which associated productive employment with remunerated (monetized) work, have become a subject of debate. Early in the Twentieth Century, Arthur Pigou (1908) revealed the paradox according to which a bachelor employing a woman as a housekeeper caused the aggregate national income to fall when he married her. Work that previously had been remunerated would now be unremunerated.

The case of the kindergarten is also relevant. The education it provides can be supplied either through an organized (paid) system or through grandmothers, grandfathers, or other relatives who can do the equivalent job free of charge. In the first case, the work done by specialized teachers in kindergartens counts as productive work, which adds to the GNP, while in the second case, the work is not viewed as such.

The Service Economy has changed the manner in which this kind of work is analyzed. A growing part of the non-monetized activities is viewed as a form of productive work, which contributes to the wealth of nations. The optimum equilibrium of the monetized and non-monetized activities is still to be explored in order to arrive at new synergies and mutual integration.

There is another new trend: producers of goods and services try to pass part of the work on to the consumer. The production system includes not only distribution or disbursement, but also utilization. The consumer is actively involved in the utilization phase by putting up a non-negligible quantity of work. The introduction of self-service restaurants that transfer the ordering and serving process to the individual consumer instead of employing a waiter, or the substitution of a bank attendant by automated teller machines – expecting a higher usage knowledge at the level of clients – are just two examples. The consumer is transformed, according to Alvin Toffler (1985), into a "prosumer". It is now quite common for most citizens or families to drive cars themselves, without hiring drivers, to repair electrical or water connections without calling the electrician or the plumber, to tend the garden without a gardener, or to cut the children's hair without going to the barber. Those are all instances of non-monetized activities.

This overall picture leads to several conclusions that are pertinent for the Learning and Work analysis.

The first one of these is that all of society is working, even though one is used to thinking that such a description applies only to the active and remunerated part of the population. Beyond the established categories of paid work, beyond the low and the high age limits, beyond the legally assigned work hours, people are working and producing goods and providing services.

Second, the three identified forms of work (*i.e.,* monetized, non-monetized, non-monetarized), which broadly match the three forms of education (*i.e.,* formal, non-formal, and

informal) add up to a lifelong working system with recurrent phases that operate according to the same prerequisites that apply in the case of lifelong learning.

Third, the human-machine relationship should not be reduced to the substitution of the work of a person by the work of the machine; it should be viewed as a new type of work: a person's symbiotic work with the machine. Surrounded by the artificial environment of their tools and machines, humans work in order to use them. They train and qualify with this aim in mind; they continue to produce those special goods and to supervise them during the phase of utilization.

Fourth, the service economy introduces a new perspective on the value of a product or a service (*i.e.,* its performance value) measured in terms of its functioning over a period of time. The cost-benefit ratio is no longer estimated by comparing the production costs to the selling price. The costs comprise the design, the manufacturing, the distribution, the utilization, and the disposal or recycling. The benefits are now measured by the performance during the period of utilization. Therefore, should consumer training not be included in the cost? Should we not recognize that this argument supports the Double Helix project?

3.4. The Management and Legal Framework

In the second half of the Twentieth Century, "crisis" was the term most frequently used to describe the state of social life. This term applied to all domains, and it was followed by successive "revolutions" that opened new paths. The titles of successful books heralded the "death" or the "end" of all classical concepts, from history to man. Seldom have new trends of thought come successively into the limelight as during this period. It is worth noting that most of these trends have had a direct impact on the relationship between education and work. One of the above-mentioned "revolutions" was the one that occurred in the sphere of management. Until then, the latter had been quietly dozing inside Business Administration courses. It would soon become a doctrine, a discipline, and a universal panacea. The main idea was that the way processes were conducted and administered was the most important element in the science of organization and its capability to control and command. Resources, capital, and even work were relegated to a secondary position.

It seems paradoxical that it was a mathematical method developed to maximize the effects of bombing raids during the Second World War that inspired this new managerial school. Starting from the question, "How many bombs of each type should be launched during each operation?", the "Danzig" linear programming was born. It produced an entire mathematical theory on the optimization of non-linear programming, which preserved the name of its original military destination: operations research.

The method was successful when applied to the optimal mode of how to distribute machines in factory halls, how to organize the equipment, how to establish a production plan. Linear programming invariably called for the elimination of certain products or processes in order to enable the remaining ones to fall within an optimized goal. The euphoria caused by the first wave of calculus-based management lasted for about two decades. Game theory, queuing theory, equipment theory, stock theory, and quality theory were added to programming. At

that stage, the effect on work was the same as that of mechanization. Job loss, however, was not determined by the introduction of new machines, but rather by their disposition, which was decided by a competent manager.

In exchange, an idea supporting education gained ground. Management was turning into a science that had to be learned. Up until then, the leader had had to possess inborn qualities and acquired experience, while management had been viewed as an art and a combination of skills rather than as a package of transmissible information. Work was still generally approached under the influence of the tension between art (talent, experience, skill) and science (knowledge that could be systematized and theorized).

The favourite topics of management pertained to the production process: quality, reliability, productivity, and profitableness. A good manager was supposed to deliver growth in all those sectors. Increased competition led to the use of similar techniques in marketing as well.

Creative societies:

The other great innovation of the first decade of the new millennium was the recognition and funding of types of activity that offer an alternative to traditional work. All Europeans were given the right to devote several years of their working life to collectively useful tasks that would not find a buyer in a strict market economy: services of general interest, cultural events, work in a non-profit association, services for the poor or even rearing children. This entitlement has been set at five years full-time throughout the Union. It is left to individuals to decide how to split this time up over their lifetime, depending on their plans and commitments (some will prefer to take periods of sabbatical leave, others will continue to work but will set aside a third or a quarter of their time for non–remunerable activities). (European Commission, *Scenarios: Europe in 2020: One Europe – Five Destinies***,** 2000).

Marketing became so important that it developed into an autonomous body of knowledge and techniques. Together with price strategies and capital assets management, calculus-based methods enhanced the degree of knowledge that had to be invested in management and organization.

The effects were considerable. Suffice it to mention the role played by quality management in building the industrial power of Japan. The ability of the Japanese to use sophisticated techniques in controlling complexity was also demonstrated in the utilization of fuzzy logic in transportation planning for big cities. No matter how highly the virtues of the Japanese labour force were praised for producing the economic miracle, the rigorous and detailed application of certain mathematically based procedures and knowledge was really decisive.

The turning point in the orientation of management science was not late to come. The potential of calculus might have been exhausted after making the most of the optimization processes. Parallel to other social developments, the large numbers of people working under the orders of managers suddenly came into the limelight. They acquired a new importance

with the understanding that the success of their corporations or industries increasingly hinged on them. That accounted for the enhanced role of decentralization, communication, participation (in connection with decentralization), and innovation. Finally, management was dethroned by entrepreneurship.

A company that had made use of all the recipes of optimization to reach a maximum level of efficiency discovered that it was the prisoner of that ideal organizational solution the flaw of which lay in its fixity. Perfection and excellence thus hindered the continuing process of adaptation to the ever-changing market conditions, techniques, and demands. The traditional pyramidal organization formula proved to be exceedingly rigid and therefore vulnerable.

The savings achieved as a result of curtailing the chain of command and excessive centralization did not provide guaranteed protection against accidents: the failure of a node in a tree-like graph triggered the blockage of the entire subsumed sector. Thus, an era of decentralization began, *i.e.,* pushing responsibilities, competencies, and even initiative downward along the line. Companies became increasingly flat. Services acquired autonomous status; entire departments became quasi-independent. The pyramid became a network.

Communication was essential for the functioning of horizontal structures. The network could not be reduced to obeying the disposition transmitted vertically from a command node to another down to the workplace. A massive and complex communication system, which prevented possible mistakes and accidents by means of redundancy, was able to take advantage of the facilities provided "just in time" by the information revolution.

The decentralization of the structure and the multiplication of the nervous strings that ensured its unity opened the way for the involvement of workers in the management process. The newly created self-control teams began to take technical decisions and to rotate individual roles, freeing individuals form the burden of repetitive work or overspecialization and involving their understanding and support of the larger projects of the company. That was a most significant step forward for the work factor in the hierarchy of value and dignity.

What did the company gain in the participatory stage from decentralization and communication, viewed as factors that no longer belonged to the classical formula "resources-technology-capital"? It gained flexibility and readiness to adapt. Rather more than "the Adaptive Corporation" (Toffler, 1985), it became "the learning company" (Botkin, Dimăncescu, and Stata, 1982).

There remained one more bastion to conquer in order to increase competitiveness: innovative capacity. In order to win in the market it was not sufficient for the products to be the best (in point of quality, durability, functioning, safety, and price). They had to be new. Enormous investments in research and development were no longer able to quench the thirst of consumers for novelty. It was discovered that the participatory involvement of a well-trained labour force could be a precious source of ideas, suggestions, and proposals.

Innovation started to be viewed as the essential factor of modern production and the fundamental prerequisite of success. What happened to innovation had also happened to management sometime earlier. Once viewed as an art, it gradually became a science. Its source

was no longer considered as a special gift or an inexplicable illumination. "It is capable of being presented as a discipline, capable of being learned, capable of being practiced" (Drucker, 1989). The human resources of a company or institution started to be measured according to their capacity (*i*) to learn and (*ii*) to innovate.

Innovations also penetrated the school curriculum, as well as the huge number of circles, courses, foundations, institutes, and magazines seeking to enhance creativity in general and innovation in particular (especially in technology). According to Drucker (1989), the random character of external events, the incongruity between existing and desirable reality, the needs surging from ongoing processes, the changes in industry and market structures, and three other external changes involving demography, mentality and perception, and knowledge are the seven pillars of innovation. This new characteristic feature of the present or foreseeable trends in wealth creation is upgrading the role of education in its endeavour to meet the exacting new requirements for well-trained working people.

It is important to refer to Peter Drucker for an understanding of the current stage of the management science. From the end of the Second World War to the mid-1980s, his books were regarded as guiding lights in management, which he always described as "useful knowledge" or "social technology". He claimed that, after 1955, "the entire development of the world experienced a management boom". However, in 1985, he suggested that a new phase was setting in. He described it in *Innovation and Entrepreneurship* (1985), developing for it a logic that he had previously used for management: its principles, practice, and discipline. While the Americans believed excellence in management to be one of the driving forces of their economic supremacy, Drucker (1985) viewed the United States as maintaining the same role during the entrepreneurial phase. He constantly gave more credit to management and entrepreneurship than to technology in enhancing economic performance.

The transition from management to entrepreneurship also highlighted another departure from reliance on technical recipes for optimization. It was the discovery of the cultural dimension of organization arising from non-quantitative factors: values, attitudes, styles, beliefs, and mentalities. Under the title of "organization culture", it even flourished as a reaction to the technical, scientific, and measurable conception of management by emphasizing the human factor. Instead of a universally valid management, the prize went to the management that was adapted to a particular place and which became specific precisely because it differed from other cultural environments. One may say that the new school answered the needs of companies, especially the transnational ones, to expand to other countries and continents. Leaving aside its abhorrence of "universal" patterns, the cultural trend gave working individuals a new perspective compared to that of management science: their own distinct identities as people with their own language and beliefs, history, and habits that resisted the blind permutations of the global market.

At the end of the road, when we utter the word, "work", – at least in the developed countries, but also in a growing number of other situations – we have in mind an entirely different image. It is certainly not that of the industrial economy, no matter how much it has improved in the past three centuries.

The image is that of an agent possessing a high professional culture based on learning and experience, attested by diplomas and certificates, freed from the servitudes of physical effort. The working person of today lives in a symbiosis with the machine (a mutual assistance pact), shouldering responsibilities, producing innovations, and enjoying a remuneration that places him within the middle class. The hourly wages of a skilled worker are actually higher than the average earnings of clerical staff.

The position that work holds among the other social activities is not solely determined by the conscience of the public fora, the wisdom of the managerial class, or the clear-sightedness of the business community. It is also the result of long fights waged by labour unions to gain certain rights that were gradually written down and then acknowledged in national and international legislation. Since the end of the First World War, relevant legislation has started, progressively, to cover work rights and conditions, insurance, and fair remuneration.

At the International Labour Organization, this process currently takes place in a triangle involving government, employers, and employees, that is, as a recognized institution in the functional structures of certain advanced states, such as Germany or Switzerland. A large number of countries have ratified the existing international conventions banning discrimination in the workplace (*e.g.,* women's rights or the protection of certain vulnerable categories, for instance, children or the disabled).

Still, there is a dark spot in this picture. Workers who enjoy so many rights find it increasingly difficult to enjoy the security of their employment. Unemployment has become the chronic disease of underdevelopment, making emigration the only solution in sight. Work has received the mantle of nobility, but it cannot be performed. This nightmare also haunts those, who, even if they have had an opportunity to learn, cannot make use of their knowledge. This situation prompts us to take a closer look at the relationship between education and work. What is striking is the similitude not only between the deficiencies of the two twin spirals but also between the available remedies.

3.5 Learning and Work: A Parallel History

A close examination of the components that make up a pair of "inseparable antinomies" (as one author described the dichotomic and contrasting polarities that are still inextricably linked, such as education and work) reveals an unexpectedly complex picture of relationships. Even if one calls "education" one thing and "work" another, as two distinct activities that only succeed each other, they actually have many things in common.

First and foremost, they are both long and compact stages covering large portions of a person's life: education for 10-20 years and work for 30-40 years. Other than early childhood and the years of retirement and old age, the two stages stand for the entire significant life of an individual.

They both take place *intra mums,* behind closed doors, and in relative isolation. The schools, on the one hand, and the enterprises or offices, on the other, are more or less clearly delimited enclaves. A homogeneous population displaying common features inhabits each

of them: pupils for one, workers for the other. They both have strict disciplinary rules that specify precise obligations and exclude or limit liberties. Barracks and the hospitals are probably the only comparable enclaves. Until it is understood and accepted, discipline is imposed from the outside and is perceived as an encroachment on personal freedom.

The reaction of the "natural" human is comparable to that of an animal subjected to domestication. The pupil is like a young horse about to be saddled, while the worker is like a horse pulling the cart. Evading the rules brings public opprobrium on the rebellious child and on the socially unadapted individual alike. Education and work are socialization and professionalization processes. What would a child or a worker have felt for centuries, when brutally awakened from sleep in the morning in order not to be late for school or work, other than the unpleasant pressure of coercion?

However, neither of the two structures is a caprice of a society bent on controlling its members by sheer terror, nor is it a gratuitous demonstration of power on the part of the controlling institutions. Individuals do need to become familiar with the symbols and tools that make up their own environment. The only serious problem is that poorer countries cannot afford to transform those imperative requirements from tough constraints into enjoyable and ludic activities.

The two structures are eminently hierarchical, vertical, pyramidal, with supreme leaders and intermediaries whose authority cannot be questioned. They give orders; they do not make recommendations. Both activities are programmed and standardized (the curriculum, on the one hand, and the production programme, job description, and operations manual, on the other). Incentives, motivations, and rewards play an important part in both of them, but there are also reprimands, punishments, and fines. The pupil is provided for by his family or by the State, while the worker earns his own living. The attitude of society is gentle (in principle) towards pupils, who are viewed as the future of the nation, but it is less affectionate towards working people (they are not told that they are the wealth of the nation).

Both activities have been increasingly regulated through legislation. They are supervised by rather bureaucratic institutions that function within a complex legal system. Road maps, performance evaluations, personal files, certificates, and permits have been devised for those two stages of an individual's life (education and work). It is not only the rigidity of the laws that makes them conservative; there is also an engrained loyalty deriving from affiliation with a certain school or company. Each of them provides the individual with its own reasons for taking pride in being "one of us": history, tradition, and recognized accomplishments. There are élite schools and "blue chip" enterprises. Both are deemed to pursue quality and excellence.

Pupils in schools have fewer means to resist inequity, exploitation, or abuse compared to workers in enterprises (*e.g.,* crippling strikes). Working people are adults with legal rights, while young people have guardians and cannot, therefore, have recourse to the law. There are other differences as well. The unforgiving laws of the market sweep away inefficient enterprises by driving them into bankruptcy, while schools are seldom closed for reasons of poor performance.

The schools are closely watched by government inspectors; their budgets are under constant scrutiny; but they do not have an acute sense of competitive pressure, which is crucial in the sphere of work. The parallel is restored, however, when reference is made to the social environment. Neither education nor work can break out of the parameters of a society's level of civilization; they cannot ignore the constraints of existing resources. General mentality, attitudes, values, and beliefs specific to a particular culture are the limits to which both teachers and managers voluntarily subscribe; so do the pupils and the labour force. When a culture is adverse to innovation and change through an addiction to traditionalism or mythology, arbitrary policies, futile constraints, and abusive suppression of fundamental human rights, the task of both education and work becomes impossible. The outcome is stagnation and paralysis.

"The information revolution – which ranks third after the agrarian and the industrial revolutions – is about to change education at least as much as it has changed industrial production or the service economy."

The parallel between education and work as described so far can be identified in the evolution of the classical economy. In the second half of the Twentieth Century, the pace of change was reflected in what we call the technological, social, and economic revolutions as well as in the value scale of mentalities and culture. The question here is not so much about historical similarities but rather about the way the two activities have responded to the great challenges of the time.

Far-reaching processes such as division of labour and specialization have an impact both on education and on work. School programmes tend to restrain generality and to encourage specialization, the same as work does. Neither the increased use of energy nor mechanization has influenced schools, even though they have transformed the nature of industry and work. One cannot claim that trade unions have only affected work, since teachers have been quite vocal in their demands concerning the organization of education. In exchange, the information revolution – which ranks third after the agrarian and the industrial revolutions – is about to change education at least as much as it has changed industrial production or the service economy. The explanation is simple: the computer is a tool of the intellect with a decisive role not only in knowledge application but also in knowledge assimilation. It is the tool that assists learning.

Here is a relevant example. What we call ICT (information technologies combined with communication technologies) has reached a level of development and accessibility that make two simultaneous processes possible: distance learning (DL) and distance work (DW). Both de-localize activities from their time-honoured sanctuaries: the school and the factory.

The Universal Declaration of Human Rights introduced the idea of dignity as a goal of the accomplishment of humankind. This goal is another common feature of education and work. The new trends in the analysis of work accuse the old schools of neglecting dignity. The behaviorists also denied the importance of dignity as a quality that gave meaning to work.

At the level of motivation, dignity plays an important part in education as well as in work; it gives a sense of satisfaction beyond material rewards or social recognition.

Currently, learning and work are two activities that are not only related, similar, comparable, and interdependent – as they used to be throughout their long and troubled history – but they have also become partners that are capable of playing interchangeable and complementary roles.

3.6. Learning and Work Programmes: The Initial Phase

The concern of education not to separate itself from work – as a final goal, an additional pedagogical instrument, or a link to real life – is old and topical at the same time. This duality is also visible in the way it has found its place in the edifice of knowledge. Let us examine the other perspective, that of work and of the way it has moved closer to learning in practical terms.

Primary and secondary education were the objects of early experiments in this respect. Up to the end of the Twentieth Century, the political map was divided into three distinct worlds: (*i*) the developed world; (*ii*) the socialist world; and (*iii*) the developing world. In the charts of international organizations, these worlds were identified either with numbers (1, 2, 3) or with letters (A, B, C). During the entire postwar period, which was dominated by the Cold War mentality, the Learning and Work idea functioned differently in each of the three worlds in terms of reasons and solutions. It was known as the EWP ("Education with Production").

Let us begin with the Third World. There was an ideological precedent here. According to Gandhi, village crafts, such as spinning, were reliable methods to build character and to cultivate self-reliance. Some Third World leaders, such as Julius Nyerere, interpreted idea as a means of shedding the colonial heritage. Then the notion of self-reliance moved into the area of economic necessities and rural transformation and acquired the status of a prerequisite for development. In 1975, all schools in Tanzania established their own production units. In Cuba, schools were allotted large crop fields to tend (especially of pineapples). The curriculum and the production plan became equal targets of school activities.

> The challenge of each individual, as subject of the learning process, is to acquire and maintain his own "employability", fully assume his responsibilities and compromises, enhance his culture and completely exercise all his rights, all pointing to a permanent or recurrent education during the entire life. Thus, each student also has the duty and the right to ask himself, according to his circumstances and possibilities, to what extent the educational offer and his own learning opportunities lead to the accomplishment of his life projects, instead of following a study program in order to obtain a degree, hoping to get a job, besides the cultural opportunities and of social involvement it can offer (Ricardo Diez Hochleitner, *Apprender para el futuro)*.

In the socialist countries, ideological motives took precedence because the worker was assigned the role of an ideal social prototype. His leading position was established in the

cultural superstructure that also comprised education in the organization of production and the fundamental institutions of the state. In the Soviet Union, those functions were reflected in production strategies; in the German Democratic Republic, in the polytechnic centers; and, in Romania, in the school-production-research triad. The ideological rationale also took precedence in China: production activities were sometimes performed in centers that allocated half of the time to work and half to study so as to impart the "right" attitudes.

In the West, the interest in Education with Production also had philosophical roots: pragmatism always attempted to balance a leaning towards theoretical elaboration with experiment and practice. Never before had school and production been so close to each other. But the forays of schools into productive activities rarely produced tangible benefits, other than the realization of certain social, cognitive, and moral goals (orientation, information, and familiarization).

Several reliable surveys indicated that, despite their multiplicity, the Education with Production experiments yielded negative results in all of the three worlds. The resistance of both parents and young people to manual labour, the fact that they viewed education as a means to escape the hard toil of rural life, the skepticism of teachers, the lack of enthusiasm on the part of enterprises that considered that their routines were being disturbed by this new complication, the exaggerations bordering on absurdity, that drove entire schools to harvest grapes, corn, or potatoes, seriously affected the credibility of Education with Production and slowed its application. The lack of clear guidelines, the absence of material conditions in schools and of educational conditions in enterprises, and the difficult assessment procedures contributed crucially to the decline of the Education with Production approach. The greatest obstacle was the rigid curriculum, which was unable to adapt and innovate in terms of knowledge and skills and stuck to the familiar path of teacher-based theoretical education.

The interest in Education with Production resurfaced in the last decade of the Twentieth Century. In the developing countries, now freed from the doctrines that consecrated underdevelopment rather seeking ways out of it, a new wind of realism and modernization began to blow. The trend was illustrated by the Rural Education and Agriculture Program (REAP) in Belize, the Self-Help Action Plan for Education (SHAPE) in Zambia, and the Polytechnic Education Support Programme (PESP) in Tanzania.

In those countries, where "scientific socialism" collapsed, following a period of rejection of anything that might have evoked the "cult of socialist work", schools entered the phase of computers, management, marketing, and exposure to new market economy conditions.

The most significant revival of the Education with Production idea took place in the developed countries. It happened because of a combination of reasons including the need for schools to establish contact with their social environments. The new concept was reflected, first and foremost, in integration within the community, a target of utmost importance for Western society. But schools were also interested in establishing partnerships with enterprises in order to obtain their support for additional financing of education – an increasingly difficult task. A new definition of knowledge in relation to its usefulness and applicability began to gain ground.

A vast amount of literature is available on this subject. Sociologists considered it to be an ideal angle for the study of class divisions within society, perpetuated through education and consecrated during one's working life. The new formula assigned to the school the task of reproducing the hierarchy and the power relations in society by means of a system of values, norms, and languages. The emphasis was on inequality and discrimination in the field of work, for which school is a mere rehearsal. Some American authors – free of European ideological accents – adopted a functionalist perspective and offered the vision of a society that is busy preparing young people to become competent adults, *i.e.,* training them for their future jobs: organization, control, and hierarchy, which are replicated to this end by the school.

One might well ask from where the increasing degree of nonconformity that dominates schools and the vindictive trend that troubles the harmony of life has come. The variety of opinions is huge once one considers a cultural perspective, which also includes ideology. If one seizes the more neutral ground of information, the approaches appear less controversial. The normative theories speak of a school of "social efficiency". The Learning-Work link presented is that vision of the school as training "workers in the appropriate numbers, with suitable skills and behaviors to serve the system of production". At the opposite pole, we have Dewey and the "progressive school", according to which education should not be assigned goals with a specific output. Without completely ignoring the specific professions, education should also consider the free development of the child's personality, talent, and resources, and therefore it should provide him with a variety of stimulating experiences.

The main positive input in the development of theory did not come from either philosophers or sociologists but, rather, from the economists. In 1965, the United Nations Economic and Social Council (UN/ECOSOC) adopted a resolution concerning "human development", a dimension that had been neglected during the heated debates on the new economic order initiated by the developing countries in 1964, in Geneva. The issue would subsequently rank high on the agenda of international organizations. The UNDP "Human Development" series has been issued ever since. After the Social Summit in Copenhagen (1995), a new session dealt with "humane development", thus introducing new ethical concerns. As long as the concept was not used as a counterweight to inaccessible or undesired technology, the idea of human development enhanced the efforts of developing countries in the area of education. It was eventually accepted as a policy guideline for all countries.

The opening of the "human development" chapter was the most significant contribution to economic theory, firmly establishing a bridge between education and work. It is a quite different chapter now. "Physical capital can always be repossessed and resold.... Human capital cannot be repossessed and resold" (Thurow, 1999). Ultimately, education is an investment in the development of skills leading to higher workplace productivity and to higher earnings on the labour market.

The literature on that specific subject tackled two aspects. One is the worker effect, that is, greater literacy and knowledge results in enhanced productivity (speed, quality, etc.) in the workplace. The second effect, which eventually also has an impact on productivity, refers to the improved judgment of workers regarding decisions on resource allocation and time

management. Basically, the whole question has to do with the ability of humans to obtain access to information and to process it sensibly. This new skill enables workers to take up the participatory role required by the new organization of enterprises. The question here is that of a management requirement that is understood and accepted by the investor.

At the level of principles, the Learning and Work literature is more abundant and advanced than it is at the practical level of implementation. It stresses the need to overcome the inflexibility of the curricular and diploma systems. The individual with a diploma acknowledging his or her educational accomplishments finds him- or herself in a limbo at the threshold between education and work. The debate over the "Diploma Disease" reveals how imperfect this junction is.

An entire school of thought evolved from a book, bearing that title, written by Ronald Dore (1976). It acknowledged the historical importance of educational certificates that came into being at the beginning of the modernization process. But it also pointed to the inflation of qualifications, and it questioned both the causal relation between educational qualifications and earnings and the value of credentials as indicators of the ability of people to perform productively on the job.

No one denies that literacy is a precondition for modern work and that schooling yields social and private returns. Nevertheless, the enthusiastic thesis about the value of human capital comes into question when it becomes necessary to demonstrate that additional schooling leads to productivity gains or that scholastic ability is relevant to the needs of modern sector jobs. It is, of course, a frustrating experience for those who have their experience and abilities in the workplace defied by a young graduate who, by virtue of some diploma, claims a better job, a higher salary, and rapid promotion.

As a reaction to the "human capital" school, which invests in education because it embraces its formative virtues, the practicist "screening" trend, based on skills and aptitudes, has developed more recently. It focuses on reducing the abundance of required reproductive ratings and on the substitution of tests for diplomas when processing applications for jobs.

To those looking for new and innovative solutions to the Learning and Work relationship, the content of that debate is just a symptom of an unsatisfactory state of affairs. Both sides of the debate are "right": (*i*) The role of the school in the formation of the labour force is justified, and educational certificates must not be banished from the selection or promotion procedures. (*ii*) Although the school does not provide sufficient input in regard to relevant training, the practical value of graduation certificates should not be questioned.

The development of a modular system of credits accumulated with a view to meeting a certain target *(e.g.,* a well-defined activity) would make the diploma debate pointless, even though the tensions between theoreticians and empiricists is likely to last forever.

3.7. Learning and Work Programmes in Full Swing

The conclusions to be drawn from the current phase of Learning and Work are well summed up in the following identified trends:

- The emphasis has shifted away from preparation for work in schools toward the concept of lifelong learning that is work-related.
- There is a realization that both technical and social and interpersonal skills are required in the workplace and that these need to be readily transferable.
- The old dichotomies between liberal education and vocational education and between education and training are breaking down.
- Preparation for a life of work has implications for curriculum content, pedagogy, and the organization of schooling.
- Rapid technical and organizational changes in the world of work have profound implications for education.

All these trends are valid and evidence-based, starting with the acceptance of the idea that the old dichotomy. Education *versus* Work has a new chance to be resolved in the framework of lifelong education. The conclusions lead to a new series of innovations that the present trends make possible.

In order to review the emerging opportunities, we shall resort to the double helix metaphor as well as to that of the zipper that brings them together. The starting point is the fact that both halves have progressed a great deal and have initiated (not necessarily corresponding) changes. The question as to whether or not the acquisitions of Education include suggestions for Work, and the other way round, may lead us to the schema of a much more daring programme as compared to the current period of research and experimentation, no matter how intense they may have been.

i. *Lifelong learning through Education still has no clearly determined equivalent in the sphere of Work.* A finite and closed segment of work seems to oppose lifelong education.

ii. *Distance learning and teleworking already exist, thanks to the same technology.* They open widows in a learning-work continuum, which allows transfers from one helix to another as well as the simultaneous performance of both activities.

iii. *Part-time learning and part-time work exist owing to the evolution of the labour market.* The growth of evening courses and distance learning systems indicate new trends in education. In France, the demand for part-time jobs is encouraged through measures such as the reduction of the social security contributions required of employers. A parallel evolution of part time activity is obvious in both Education and Work.

iv. *Alternation is a current practice in education, but it has no equivalent in Work.* It consists of the systematic inclusion, in educational programmes, of periods of work outside the institutions of learning. There are successful examples of alternation in education in Germany (the country that has kept and has modernized the apprenticeship tradition) and in the Netherlands. These are part of a series of efforts

to bring secondary and higher education into a functional relationship with the labour market. Nevertheless, the worker is refused the opportunity of a similar attachment to the formal educational system, even though on-the-job training and other forms of professional recycling inside the company have considerably increased.

v. *Modularization is a method specific to the organization of knowledge.* Its philosophy has long been applied in the production of parts and in assembly work as well as in flexible production and, more recently, in the manufacturing of tailor-made industrial goods. In education, it is used mainly in the sphere of vocational education, where its usefulness has been recognized. Vocational models are only a step away from practical training for machine handling. The technical know-how is still presented in the form of compact handbooks or operating manuals.

vi. Teamwork is much more frequently the object of experimentation by modern industrial managers than it is by educators. Nevertheless, successful projects have been tried out in elementary education (in Australia, for instance).

vii. *The most interesting and advanced initiative for Learning and Work is recurrent education.* It is the form of lifelong education which was once called "permanent education". No international debate has ever come so close to the real solution to the Learning and Work relationship. In 1968, Olaf Palme (then Swedish Minister of Education) presented the idea at an OECD meeting. In 1973, the Center for Educational Research and Innovation (CERI) of the OECD discussed a report on the implications of the new proposition. It sought mainly to promote the "complementarity between learning taking place in schools and learning occurring in other life situations. Such complementarity implies that degrees and certificates should not be looked upon as an 'end result' of an educational career but rather as steps in a process of lifelong education development across the life span" (Tuijnman, 1996). All the elements that are relevant today were foreshadowed in that study. At the end of an educational cycle, the student is provided with a curriculum giving him or her a real choice between further study and work. There is co-ordination between educational policy and public policy in general and labour market policy in particular. The system provides opportunities for adult education in universities, acknowledgment of the value of credits gained through non-traditional educational routes, abolition of terminal stages, so that all tracks lead to other programmes, alternation of education and work, possibility to pursue any career in an intermittent way, and alternative work and study.

Everything that is of concern to us today – unemployment, the social imperative of providing chances for success to the young, the aspiration for greater social equity and the fight against discrimination, the interest in the value of personal initiative – was also topical in 1968. Global conditions, however, changed in the decade of recessions. The innovative élan and the prosperity of the 1960s turned to bitter disappointment in the 1970s.

It would be interesting to review the obstacles that brought that remarkable initiative so close to utter failure. Besides the troubled and unfavourable historical environment, the following impediments can be listed:

- The institutions at which the new approach was aimed (schools and companies) were not ready to move away from a piecemeal and *ad hoc* approach to a long-term view;
- There was increasing reluctance to undertake new financial commitments out of fear of additional costs (applicable to both the state and to the private sector);
- The persistently closed nature of university programmes left them completely unprepared for continuing education and unfriendly to outsiders;
- Rigid legislation and an inertia-bound, traditionalist mentality opposed continuing education;
- There was complete institutional inability to elaborate, co-ordinate, and manage a comprehensive social project designed to redistribute educational opportunities and resources over the whole life-span of the citizen;
- A growing oppositionist trend glimpsed a conspiracy of the decision-making factors behind any new structure or technology.

Obviously, the original project cannot be taken literally and transplanted into the reality of today, given the considerable changes that have occurred in the past three decades. Still, the persistence of obstacles might provide an incentive for the development of a more effective strategy. The novelty of the more favourable global environment of today brings into play supplementary elements: a fresh emphasis on knowledge and human capital as crucial factors in the production of goods and services, falling school enrollments and declining birthrates, the advent of new technologies, increased competition in international trade, and the emergence of market models driven by private initiatives. Methodological maturity in the field of knowledge organization and teaching, also illustrated by modularization and the extensive use of ICT assistance, is a useful additional ingredient to the external factors.

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