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The consequences for training

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I would like to make a few remarks in the time allowed to me concerning the work being carried out at OECD, and especially at CERI, the Centre for Educational Research and Innovation. CERI is steering a large project on the economics of knowledge, a strategic project for economies that wish to go through the next century without difficulty.

Firstly, it is necessary to be aware that what produces the wealth of nations has changed; reference is made at OECD to the *knowledge-based economy* to describe the increasing share of the intangible in the value of products. Mention is also made of weightless economies in contrast with the so-called «heavy metal» economies. In France in the 1960s, one talked in terms of heavy industries or industrialising industries, to use the expression of the development economists working under the wing of François Peroux. These were the industries that were to lead the economies of these countries where everything remained to be developed.

In fact, we are changing worlds and entering something untouchable and that cannot be grasped—the world of the intangible, that is to say, in no particular order, a commercial brand, an insurance policy, a film, a piece of software or a genetic code. These things are indeed weightless but generate much more economic value than tonnages of steel or cement. For example, a brand name is exemplary in its ability to produce value by organising a social difference. I would like to just take a figure drawn from games software. Through children, you are acquainted with the firm NINTENDO, a Japanese company whose profit per employee is much higher than that of Toyota. Another remark is that the knowledge economy is based on something strange. When you buy a bar of chocolate and give it away, you no longer have it; but this is not at all the case with knowledge. I can give you what I know but I still have it and I can even improve my knowledge by the questions that you can ask me after this talk. Systematicians refer to this dynamics as positive feedback, with knowledge enhancing knowledge.

Economists also say that knowledge is a non-rival product, a public good. A non-rival product is one that can be consumed by several people at once. For example, a bridge is built once for all those who wish to cross the river but overcrowding is always possible. This is not the case for ideas or products derived from ideas. An idea can be considered as a non-rival product with no overcrowding phenomenon. Even if a thousand million people decided to use «Windows» at the same time, there would be no overcrowding. However, this banal observation has a substantial economic effect: the larger the market in which ideas move, the more profitable it will be to invent new ones, as the same invention can be sold indefinitely. From the moment at which the marginal cost of the expansion of the same idea is zero, the cost incurred is that of the initial investment. This leads to another substantial problem in knowledge economies, that of the intellectual property of the ideas and the legal conditions for copyright. There is considerable debate today concerning the privatisation of knowledge in contrast with the polling of ideas in the name of the universalism of science. Is science a public commodity?

My final preliminary remark is that the driving force behind these economies is the information technology sector, where zeros and ones travel along high-speed highways. The IT (information technology) sector is growing strongly. I will just give a few indicators here and not go into too much detail. In the USA, corporate investment in computer equipment has increased in 30 years from 7% to 40% of all investments

today. If expenditure on software is added to that on hardware, the whole represents as much as the value of the industrial machinery installed. I shall finally give another figure interesting the present gathering: the contribution of the IT sector to the United States GNP is greater than that of American agriculture.

What are the consequences for employment and training?

This increase in the non-material in the formation of value has effects on the job structure. I shall not discuss service jobs or the 'tertiarisation' of the economy as Colin Clark's categories have become too strong for describing these new economies. For example, a vet who treats an animal is in the higher intellectual profession category but his contribution is only meaningful in relation to demand from a farmer, and this is increasingly sophisticated and particular. What is important today is the knowledge base that is required in an intervention to provide a service. Forecasting the weather by looking at clouds or by using satellite observations does not require the same knowledge base. Sociologists call this the professionalisation of production tasks.

An internal change is leading to an increasing contribution of expert trades in each economic sector—and the agricultural sector is no exception. To make a somewhat rapid summary of this point, we are entering a world which is making increasing use of knowledge and skill. This knowledge requirement aggravates inequalities. Those who know are drawn to those who know. Remaining illiterate in a world in which 80 percent of the population can read is a redhibitory defect for the other 20 percent. The result is precisely the same when you replace knowing how to read by knowing how to use basic computer programmes. The knowledge economies are extremely violent in their capacity to exclude those who do not know.

Robert Reich, the economist and former Labour Secretary under the Clinton administration, proposed a typology whose merit is that of being stimulating for understanding the changes in occupations and the role of training in knowledge economies. He divided the population into four quarters as follows. The first quarter consists of manipulators of symbols; they are producers of ideas for whom 'the world is a village'. The second quarter consists of all those who contribute to the functioning of welfare; in Marxist terms, one would say that they are all those who contribute to the production and reproduction of labour (health, education). The third quarter is made up of all those who provide in-person services: catering, household work and domestic help. Finally, the last quarter consists of routine production workers, that is to say all those with little professional autonomy and who are therefore strongly dependent on organisations.

This is a debatable typology but it sets the scene well for information technology. What remarks can be made today more precisely for the educational sector?

Practically all the OECD countries have laid bets on the capacity of new information technology to change educational work. Government plans have been launched—each in its own way—but they are always ambitious plans and always have impressive objectives in terms of levels of equipment to show that the future of schools involves data computers. Three themes were discussed at a recent conference held in Helsinki and attended by the ministers of education of the OECD countries: the question of software quality, the software market and the effect of software on learning. These subjects are important issues for education policies insofar as the question of the borderline between market initiatives and those that come from the public authorities is raised. A single example explains this point: as far as the quality of software is concerned, should there be a state or possibly international regulating body or quality standards emerging from the demands of the local market?

Many questions remain unanswered today and I would like to finish by proposing a moderated balance with regard to the introduction of the new information technology in the educational field.

One's view of the world always depends on the 'virtual' spectacles that one is wearing. My colleague Romain Laufer likes to say that 'you cannot see' religion unless you are wearing the spectacles of faith. I will therefore make an evaluation wearing the spectacles of doubt in technology and then those of faith in technology.

With the 'technophobic' view, it must first be said that by focusing so much on the tool and its technical characteristics we forget its purpose. When I drive a car, I do not know much about the quality of the steel used to make the drive shaft (I do not ask myself the Intel inside? question), but merely wish to travel from A to B as safely and as comfortably as possible. What is interesting is the aim, that is to say the journey. In other words, contradicting McLuhan, what is important is not the medium but the message. Several questions are raised if we now examine the logic of the construction of educational software. We see, for example, that innovations of the CD-ROM type finally hide very conventional pedagogical proposals from the nineteen-fifties, and only the perfume is different. Many programs are designed using a multiple-choice questionnaire structure which is very rigid in pre-stressed choices. The student has finally little freedom faced with an 'arborescent' type of thinking that is suitable for computer programs. These are new technologies that use fairly old pedagogical ideas. Use of the Internet is not causing a fundamental upheaval in educational methods. The scornful expression 'talk and chalk' used to describe the old schoolteachers' blackboard method still has a future for setting up a pedagogic relation. However, the lever effect of technique is impressive. For example, a version with answers provided by the teacher can be delivered instantaneously to a list of pupils all over the world. The new technology wipes out distances but does not change the teaching relationship, that one hopes can be built up around a relation between living people.

The landscape is different when one uses 'faith in technology' spectacles. The new information technologies are successive breaking waves. They gather at an extraordinary pace. For example, Internet traffic doubles every three months. It took radio at least 40 years to gain 50 million listeners. It took television less than 13 years to attain 50 million viewers. It has taken four years for the Internet to attain 50 million users, and all this starting from a limited circle of American academics. The movement is irreversible. What should be noted is its rate of spread. With regard to education, it would be a strategic error to turn one's back on this technology. At the risk of anachronism, Newton would have been the first to use the net. These new technologies have the merit of providing limitless access to information. Books and scientific journals are a dead medium that is too cumbersome to handle. If the library, schoolbook and scientific journal sector does not jump on the moving technology train it will disappear. The technologies are not just tools but also change the base, the practice of teaching. Teaching by games and by simulation can develop more easily. The job of teacher will also change fundamentally. We are seeing the end of a relation of authority between teacher and pupil in which the rostrum served as an emblem (conferring height and distance). Teachers dispensing their knowledge from the height of a dais will be replaced by teachers providing a coaching function, that is to say who provide aid and monitor the learning pathway of a student, a student who is above all a person. Once distance is no longer a constraint, these new technologies will speed up competition between programmes and the disappearance of the frontier between school time and time spent in working life. The school can enter the home throughout a person's life.

These are two visions of the world and I shall take great care not to make a conclusion.

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