New pedagogical approaches: Tools and methods

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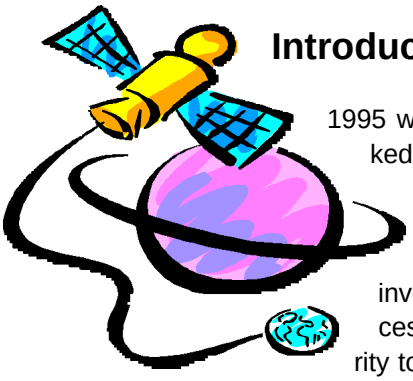


Introduction

1995 will doubtless be identified by future historians as a turning-point marked by one of the greatest breaks in the history of our societies. This transition, identified by Marshall McLuhan as the passage from the Gutenberg galaxy to the Marconi galaxy (McLuhan, Marshall et Quantin, 1970) took place 100 years almost to the day after the invention of cinema by the Lumière brothers. It is the fruit of a long process of scientific and industrial developments. These are reaching maturity today and are suddenly leading to awareness that new information and communication technology (NICT) are going to change the world in their own way.

However, while man demonstrates ever-increasing mastery of advanced technology by going into space, by dotting the sky with satellites and by developing fantastic communication machines, in spite of the continued considerable progress in agricultural science since the beginnings of farming, more than 800 million people today do not yet have sufficient food to be able to live a productive, healthy life and nearly 180 million under-nourished children will never attain a normal weight at adulthood.

The Mediterranean does not escape this situation and many people are wondering about our capacity for ensuring sustainable agricultural production in particular in regions subjected to the strongest population pressure, which are usually those whose ecosystems are the most fragile.

The idea of this conference was doubtless born of this observation. But it also comes from the increasingly clear certitude that the Mediterranean agrofood world, which is also seriously affected by a very unequal sharing of the resources from which food is produced, must face at the beginning of the twenty-first century new distortions resulting from the unequal access to new technology, to strategic information and to new knowledge.

In this context, we have to know to what extent the inequality in opportunity for access to 'learning' and knowledge may still widen the gap between rich and poor. However, it is just as important to carefully study how we could use and promote this new technology to help us to win the famous unfinished battle mentioned by Louis Malassis (Malassis, 1997), that is to say the battle against hunger, malnutrition and poverty in the world.

This talk is devoted to these questions. Three main points are addressed:

- The first concerns the importance of the management of 'knowledge' in economic development and its incorporation as a fundamental component in what we already refer to as the 'new economics'.
- The second is devoted to analysis of the change in technology and its impact on the forecastable development of teaching and research. We shall try to show the great inequality in access to this 'knowledge' by the peoples of the world and hence the inequality in development opportunities.

❏ Finally, we shall consider the action to be taken to try to reverse these trends and to make new technology a true instrument in aid for development.

I – The importance of knowledge for growth and development . Do we all have the same chances?

Never has knowledge occupied such a strategic position in the history of mankind. The rich countries have understood that they should invest in the management of knowledge and in human capital. They have also become aware of the importance that should be awarded to incorporating knowledge in production processes and the importance of the role that mass communication facilities (NICT) could play in these 'transfer dynamics'.

However, as is noted by UNESCO's world report on communication, "history shows that the countries that do not take advantage of the opportunities provided by new technology in information, informatics and telecommunications will experience a slowing of development and a shortage of 'negotiating' power in the new global communication landscape. However, history also teaches that those who obey only the mechanisms of the global market risk losing their identity and culture. The issue is therefore primordial. It consists of combining fertile tensions between the identities and expression of each country, the centrifugal forces of the globalisation of markets and the common membership of mankind in its diversity" (UNESCO, 1997).

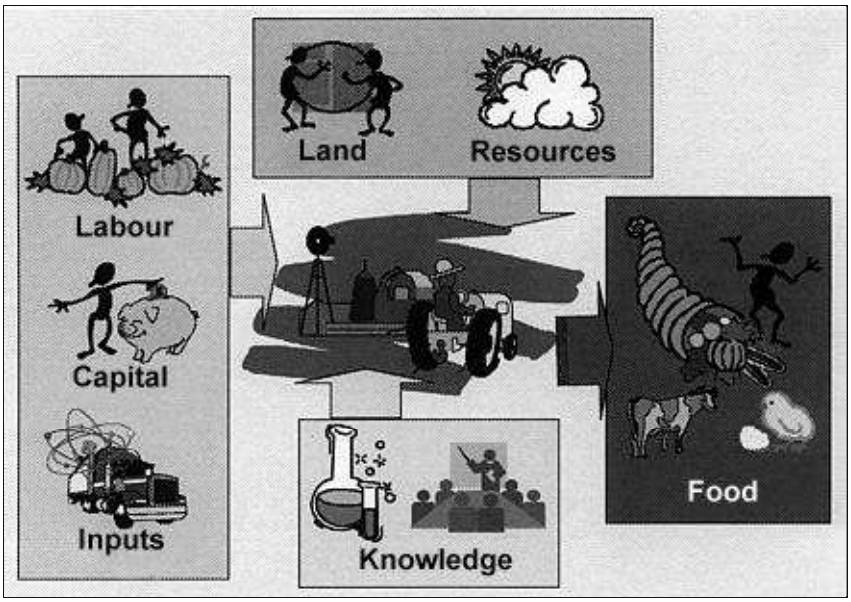
"The emergence of a knowledge-based society cannot be envisaged without the establishment of conditions enabling universal access to cultural or commercial products and services disseminated on the networks" (UNESCO, 1997). In the face of this speeding up of history, a gap is forming between people, that is to say between those who have the good fortune to have access to these tools and those who are irremediably deprived of them.

1. The 'new science economy'

The term 'knowledge economy' results from the importance acquired by the dissemination of new knowledge and the role played by NICT in economic growth. This analysis is based on understanding of the dynamics of the knowledge economy in relation to classic economic theory. The increasing codification of knowledge and the systematic development of its transmission by communications networks have gradually given birth to a society in which information plays an increasingly important role, whether such information is economic intelligence or technology.

The idea that knowledge plays an important role in the economy is not new. In his time, Adam Smith referred to the functions exercised by the new generations of specialists and thinking men in the economy. Friedrich List (the German historical school) laid stress on infrastructure and training and knowledge diffusion institutions that he considered made a contribution to the growth of the economy. The Schumpeterian concept of innovation perceived as one of the mainsprings of economic dynamics has been eminently successful. It was taken up by economists like Galbraith, Goodwin and Hirschman. Today, other economists such as Romer and Grossman are developing new growth theories to explain the forces underlying economic growth in the long term.

Figure 1. The position of knowledge in the production process



In the new theory of growth, knowledge can increase the profitability of investment which in turn can contribute to the accumulation of knowledge as it encourages the adoption of more effective methods of organisation of production and the improvement of products and services. Tools for the economics of organisation and the public economy are also used for the analysis of science.

We can likewise see the use of econometric tools in the research sector and the externalities generated. Econometric studies on the yields of science abound. The results expressed generally converge. Recent economic literature also contains studies of the role of firms in research & development and economic evaluations of new processes. These include, for example, the studies by Giliches (1986) concerning 100 firms and which showed that those that allocated larger investments to R&D displayed higher productivity, and the more recent work of Bach (1992).

2. Inequality of opportunity

There are substantial variations between countries and major regions in the world with regard to the various fields that we have grouped as 'management of knowledge' and which each at their level contribute to growth and development.

A. Production of 'knowledge' takes place mainly in the north

In the OECD countries, advance in knowledge production is much faster in leading-edge industries such as informatics, electronics, biotechnology and aeronautics. It is thus estimated that over 50 percent of the GDP of OECD economies is now based on knowledge[1]. As a result, investment moves towards high technology goods and services and especially information and communication technology. Expenditure on research & development attains approximately 2.5 percent of the GDP in the OECD zone and education accounts for 12 percent of public expenditure. In a knowledge-based economy, employment is also characterised by a demand for qualified workers[2].

However, the production of knowledge remains the prerogative of northern countries. Statistics show that a third of world scientific production takes place in the United States, another third in Western Europe and the remainder in Japan and other southern countries (Latin American countries, India, Israel, Pakistan, etc.). The USA and the EU, with respectively 36 percent and 30 percent of world publications,

are today the two dominant centres of the international geography of science. Japan, representing over 8 percent of the world's scientific weight, is more or less equal to a large zone that could be formed by the Asian countries (NICs, ASEAN and other Asian countries) and Australia/New Zealand (8.1 percent in all).

Total European scientific production in all disciplines is 6 percent smaller than that of the USA. The difference is greater in biology, mathematics, science of the universe, engineering sciences and biomedicine (La Lettre de l'OST, 1994). Within the European Union, the United Kingdom has a dominant position with 8.7 per cent of world publications, followed far behind by Germany (6.3 percent) and France (5.1 percent). The world geography of science displays a very contrasted landscape when examined by discipline. Over 30 percent of research in physics and chemistry is monopolised by the USA and the EU.

B. The South finds access to 'knowledge' and strategic information very difficult

NICT infrastructure has developed at an extremely fast rate in recent years. A few figures reveal progress which is far from finished. It is estimated that total expenditure on equipment for NICT reached $186 thousand million in the OECD zone alone (L'Observateur de l'OCDE, 1995). In addition, the number of personal computers world-wide fitted with CD-ROM drives increased from 2.5 million to 10.3 million from 1990 to 1994, and 6.9 million of these were in the USA alone. In networks, the Internet already had more than 30 million users in 1995 and over 50 million in 1997. The first data for 1998 indicate extremely rapid growth in this basic equipment in northern countries[3].

However, this increase has not affected all regions, countries and individuals evenly, and we should wonder about the serious distorsions that will result in the coming years from the uneven distribution of communication tools and new technology. Discussions at UNESCO in the 1980s doubtless contributed to rousing public awareness of this serious problem. These imbalances are particularly clear when one makes a comparison between the main regions of the world, as is shown in Table 1. The imbalances are most marked in the most economically backward regions, such as Africa, which has access to only 1 percent of the telephone lines available in the world whereas its population is 12% of the world population (UNESCO, 1997).

There are considerable differences between rich and poor countries in the field of the media providing access to written, spoken or filmed information. The ratio is often more than 1:10. Radio and television have made extraordinary progress in reaching the poorest households almost everywhere in the world. However, the differences are much greater in the press and books and are strongly aggravated by illiteracy.

What can one say about the situation in communications, telephone, networks and especially the Internet and computers? The levels of public and household spending do not allow public and private equipment and result in irreversible long-term slowing of access to NICT, especially in the poorest populations.

Table 1. Indicators of access to NICT

	Developing countries	Industrialised countries	World
Radios (per 1000 people)	178	1010	361
Television sets (per 100 people)	14	50	22
Published works (per 100,000 people)	7	52	18
Writing and printing paper (tonnes per 1000 people)	5.8	74	20.6
Subscriber telephone lines (per 100 people)	3.3	40.1	11.5
International telephone calls (minutes per person)	2.5	35.1	9.4
Telefax machines (per 100 people)	0.1	2.8	0.7
Cell phone subscribers (per 100 people)	0.3	4.1	1.4
Internet access subscribers (per 100,000 people)	1.5	223.2	60.9
Number of microcomputers (per 100 people)	-	14.2	-

Source: UNESCO

C. The educational dimension of knowledge management: a broadening gap

Globalisation has not yet had much effect in developing countries in terms of qualitative changes in national educational systems. In contrast, a lag is observed in numerous industrialised countries between the upheavals in national research systems and the reform that should be applied to the educational system (McGinn, 1997). Thus, new technology is already revolutionising higher education. Students enter their work on computer, teachers publish their research results, teaching assistants use teaching software and computer simulation facilities, libraries are continuing to acquire equipment and specialised journals are beginning to appear on electronic support[4].

The use of human resources plays an essential role in economic growth and development. Even if it is difficult to measure the contribution of the educational system, econometric studies show that the human capital created thanks to investment in education and the improvement of skills is one of the most determinant factors in economic growth. A high level of teaching is the most important component in the use of human resources and leads to high productivity since it facilitates the adoption of complex technology and efficient organisational structures.

The brain drain in developing countries is related to weak industrialisation. Investment in the educational system is only put to use when the NICs have acquired industrial strategies and have developed their production capacity. In addition, when there are no international level firms, even countries like India where scientific knowledge is advanced do not obey Say's law. In such countries, the supply of trained personnel has not created the demand required to employ them.

D. Knowledge and power: a relationship in need of renovation

The impact of science and technology on economic sectors is leading today to increased state intervention. Through the development of their educational systems, the creation of solid research infrastructure, the accumulation of technical skills by their personnel and the importing of patents suited to their requirements, these countries have won a non-negligible position in the world geography of science and have as a result strengthened their positions in power geopolitics. In this context, scientific research and technological progress often appear to be a power breeder capable of increasing the power of the most powerful[5].

This situation has contributed to the emergence of new questions and has led society to wondering about and/or intervening in the multiple repercussions and finalities of ongoing developments and policies in science and technology. The challenge faced by humanity is that of developing today science that founds new relations between scientists and citizens. Finally, this affirmation leads us to turn towards the old concept of Kantian ethics in which man is considered as an end rather than a means and which requires judgement of the morality of an act or a theory if the principles inspiring it can be applied without contradiction to the universe as a whole.

II – Future shock

In the communications world, as in many others that affect our daily life, history is speeding up at the end of the twentieth century. The teaching world as a whole is far from being aware of the coming earthquake. In a decade, nothing will be the same either in the way in which teaching is dispensed or in the way in which teaching institutions are managed. Will we know how to grasp these changes to promote knowledge and make it accessible to the largest number, or will we be absent for a long time from the great social debates and irreversibly marginalised in our operations in the field?

1. We are changing galaxies

Most of the specialists who analyse the evolution of our world agree that we are in a period in which there is a break with the past. These transition periods may be interesting with regard to the innovations

that they can bring us, but they are delicate and difficult times since we lack landmarks. We cannot make a mistake. Naivety and short-sightedness are quite out of the question[16]. I shall note here several of these breaks that will affect the world of education most directly.

A. Information technology revolution and 'infoenergy'

Several authors agree on the identification of three major stages in the lives of our western civilisations. Each describes them in his own terms and in the light of his own preoccupations.

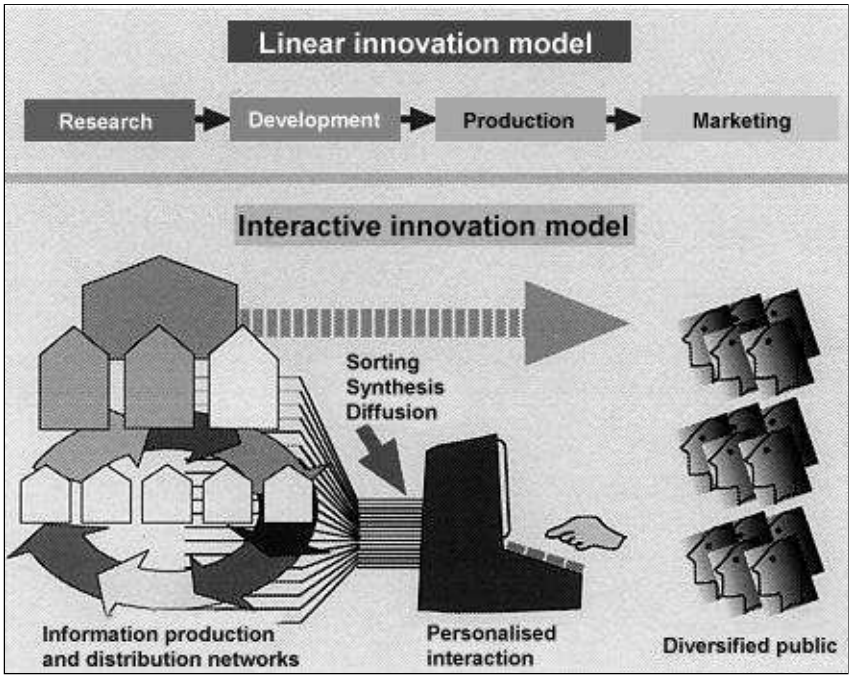
Table 2. Great periods in the history of the western world[7]

	1st civilisation	2nd civilisation	3rd civilisation
de Rosnay	Agricultural revolution *renewable energy*	Industrial revolution *concentrated energy*	Information technology revolution *'infoenergy'*
Luc de Bardandère	Aqueduct	Pipeline	Information highway
McLuhan	*Traditional* galaxy *Alphabetic* code	*Gutenberg* galaxy *Typographic* code	*Marconi* galaxy *Media* code

B. Lines of progress undergoing in-depth changes

As in research, the transfer of knowledge along *lines of progress* evolves under the combined effect of the withdrawal of the public authorities, the increased role played by the private sector in the dissemination of knowledge and the impact of NICT. Whereas until recently the lines of progress along which innovations occurred, were transferred and applied called upon individualised innovation processes that were relatively homogeneous and linear (from top to bottom), they run much more from networks today. This new situation doubtless provides those who have access to this 'knowledge' with substantial random, variable, just-in-time gains in productivity; however, it also carries a risk of excluding all those people who do, not have access to this strategic information either because they lack the financial resources or training required or because, for different reasons, they are outside these new information networks.

Figure 2. The evolution of innovation and knowledge transfer models



This evolution thus involves two fairly different models:

- From the beginning of the century, the substantial progress achieved in agrofood systems was based substantially on a linear process. This followed a fairly standardised procedure: essentially public research teams developed new technology (fairly homogenous and relatively rigid technological packages) with high potential for gains in productivity. Agricultural supply and equipment companies provided the tools and inputs required for applying them, extension services disseminated the new technology and farmers adopted the innovation to varying degrees and according to its characteristics. The linear model reached maturity with the Green Revolution.
- Much more recently, the procedure was forced to undergo rapid evolution. Firstly, the actors involved in research became strongly diversified and the number of sources of broadcasting of information increased. Following this, the traditional information dissemination channels consisting of public or mutual (associations and unions) extension services were forced to withdraw. The targets of traditional extension operations, who were used to receiving digested, filtered information, found themselves confronted with a substantial quantity of 'messages' and information that they had to go and obtain themselves and among which they had to make choices and perform arbitration.

This situation means that there has been a transition from fairly passive—even rigid—and relatively homogeneous access to innovations and dissemination of knowledge to dynamics favouring much markedly individual search for information. In this procedure, the characteristics of the receiver, his level of education and his capacity to access information networks greatly affect the level and quality of the adoption of new technology and the use made of information of the 'economic intelligence' type in decision-making.

C. Management of all the components of knowledge

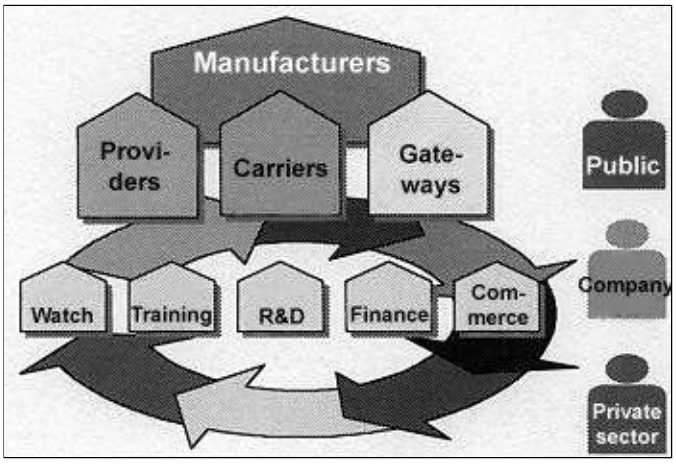
Managing knowledge means taking into account and using all the factors and variables that mean that make the best scientific and technical information available to the largest number of people. Those who need it can therefore have access to the information at the right time and can incorporate the innovations and information obtained in their production and decision-making processes.

Management of knowledge thus involves a complex set of actions that can be grouped in four main categories using an increasing number of specialists:

- production of knowledge,
- formalising it,
- making it accessible,
- training users in accessing and using it.

Each of these activities involves an increasing number of producers, disseminators and users. These are grouped below in Figure 3:

Figure 3. Actors involved in knowledge sectors



The pedagogical dimension in tomorrow's networks will soon become an essential tool for the following purposes:

- ❏ sorting pertinent information for users, putting it into perspective and highlighting it,
- ❏ training users not only in the management of this information,
- ❏ but also in using it.

This makes us draw a distinction between different forms of knowledge:

- ❏ *Knowing what*, consisting of individual items of information such as the population of a town, molecular weight, exchange rates, etc. This is essential information and is used in closer analyses. It is the case of statistical and economic databases for example.
- ❏ *Knowing why*, consisting of an analysis of a given problem. The most typical example is a scientific paper.
- ❏ *Knowing how* is more professional knowledge. It is aimed at obtaining information with a view to learning 'know-how'.
- ❏ Finally, *knowing who* is aimed at asking the two following types of question:
  – who possesses knowledge about a certain subject,
  – and who needs this information.

The right network enables—as efficiently as possible—the right person who needs information to be put in contact with the right person who can provide the right answer in the right form.

2. Increasingly powerful learning and communication tools

The transition from the atom to the bit has upset the tools we use to elaborate our teaching. The fact of being able to put written texts, fixed and animated images and sound on the same support—that is to say in bits—makes it possible to design totally integrated teaching tools that can be reproduced and disseminated infinitely in real time.

In addition, the fact of being able to use author systems to incorporate this variety of information in programmed, interactive teaching procedures enables us to adapt the information to a large number of users who can access it using a personalised à la carte method at their own speed.

How can these new possibilities upset the world of training? I will examine several major ideas for the purpose of this conference.

A. A revision of personal learning

These new training tools already exist. It is enough to see the speed of appearance of CD-ROMs and personal learning tools on the Web. Considerable progress is currently being made in 'pedagogical engineering'. A visit to certain universities providing distance training or to certain research laboratories is enough to imagine how such material and training tools will help students to access teaching that will no longer be dispensed in the classroom but that will be an integral part of a new way of learning.

B. Publishing rethought

The world of publishing and especially scientific and educational publishing will be confronted with the radical changes imposed by the passage from the atom to the bit. Many publishing houses have been aware of the change and have gone into electronic publishing.

These changes take the form today of the development of CAE (computer-aided education) facilities that combine simplicity and the quality of electronic publishing and integrate multimedia and hypertext. These developments are now attaining a certain maturity with the emergence of new, more universal forms of publishing in which any document produced by any machine can be imported and it can be read, edited and printed without difficulty. This technology materialises the virtual library mentioned in Negroponte's work. It makes it possible to access this information at any time and at any distance in a format similar to the books that we are accustomed to using. It opens the world to us thanks to the permanent links that we can establish on the Web.

Now let us imagine that these new virtual books incorporate animated pictures and sound and we shall soon understand the potential of these modern learning tools and how important it is to be present in their design and elaboration.

C. A deep-seated change in the way in which knowledge is transferred

However, the greatest revolution is that of the networks that will rapidly link these computers and enable their owners to access the world's knowledge and communicate with each other in real time. These contacts still depend to a considerable extent on traditional lines of communication (copper or optic fibre cables, radiofrequency electromagnetic waves) and should overcome the material constraints of this type of support by using the grid of geostationary satellites—almost completed today—that will enable anyone anywhere to access this source of information at all times.

This revolution is materialised from a change from homogeneous societies in which knowledge was passed on in a relatively controlled manner by speech and then in writing in a linear process—that is to say from parents to children or from teacher to pupil—to societies increasingly organised in network form. These communicate by speech, in writing and by images and increasing quantities of increasingly varied information circulates without control and in all directions.

3. The university of the twenty-first century: a blend of the virtual and the real

in which the new technology and lifelong training will play a strategic role

There is no doubt that thanks to the new technology and doubtless because of it, the world of universities and higher education, which have hardly developed since the Middle Ages and that will be increasingly confronted with international competition, will soon be obliged to change its procedures and undergo in-depth change.

New approaches are now emerging. Whether they consist of a virtual campus or a university without walls, what is involved today is the creation of training facilities that are even more universal, open, accessible and modern. Thanks to the new technology, these facilities will enable learning processes that are even more enhanced, more flexible, pedagogically more effective, economically more profitable and that enable lifelong training.

There is no doubt that many questions remain today. Thus, in a context of globalisation, many people are wondering about the risks that these changes will have for the concentration of knowledge. Some of us talk in terms of dehumanised teaching in which learners would be isolated and where the student-teacher relations would be replaced by 'man-machine' relations in an artificial universe. Others rightly point out today's technical inadequacies and wrongly consider that changes will only be possible in the distant future. It is true that these questions remain, but we have some answers that help us to have better perception today of what tomorrow might be, as long as we can accept without delay to go for this not so far off future.

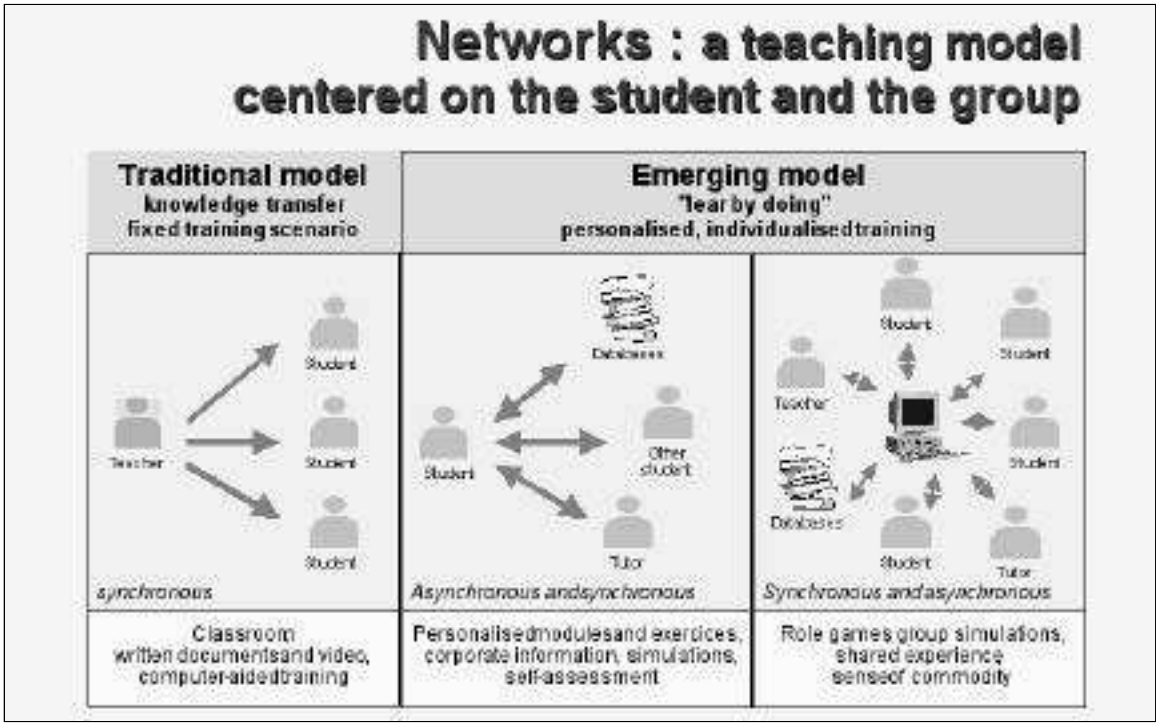
A. The virtual campus concept

A virtual campus is a learning facility which, thanks to NICT (computer hardware, software and networks) enables teachers and students to experience learning activities and to work together at a distance either directly or on a deferred basis.

We are increasingly confronted with a need for 'lifelong training' and it is more and more difficult for us to attend training sessions at fixed times, for reasons of work, family and distance. It is therefore important to imagine how training institutions can render accessible and adapt their teaching to this new public, without losing the essential teacher-student link and without forgetting the importance of the dynamics and interactions that become set up between all the participants following the same training.

The virtual campus concept was devised to meet these new needs. It consists of a strong evolution of fixed (classroom) learning systems and traditional distance learning systems, as is shown in Figure 4.

Figure 4. From the traditional system to the new virtual campus system, in which learning is centred on the student and on the group



After documents produced by the TéléUniversité of Université du Québec

In the diagrams above, each student uses a network (the Web for example) to access a body of didactic items (classes and various databases of documents, statistics, audiovisual items, etc.). The network enables him to remain in contact with his teacher, his supervisor, the other students following the same course and possibly the rest of the world.

B. Actors and processes on a virtual campus

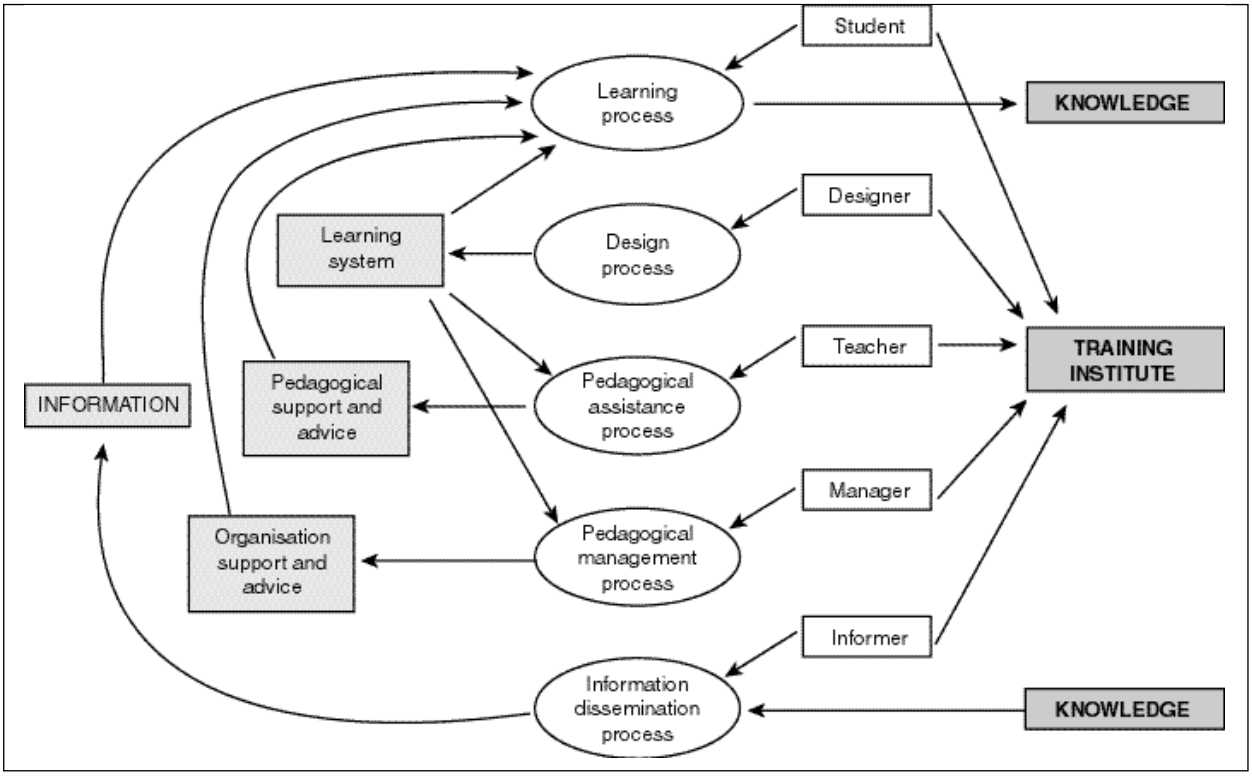
The virtual campus concept is thus a set of human, technical, organisation and financial facilities. Thanks to NICT, it enables persons scattered in space and time (direct or delayed access) to access various resources enabling them to follow training and maintain close contact with their teachers, the members of their student group and also with their professional environment.

These diversified resources (Paquette, Ricciardi-Rigault, Aubin et Paquin, 1996) group the following actors and institutions:

- ❏ teacher-conceivers who develop and update the contents of teaching and monitor the scientific quality of this teaching;
- ❏ technologists specialised in 'pedagogical engineering' who handle the form of the teaching material and ensure good management of the learning and assessment processes;
- ❏ tutors who supervise, manage, advise and assess the students and monitor learning;
- ❏ personnel handling the management, co-ordination and accreditation of this training;
- ❏ various persons and institutions who provide technical support and 'transport' facilities for these learning processes from production to dissemination (the role of disseminators is essential here).

The information of various kinds used in learning processes is voluminous and complex. It is organised in various flows as shown in Figure 5.

Figure 5. The actors and their functions in the learning process



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III – Will higher education and agrofood research succeed in evolving to become the driving forces behind development in the Mediterranean in the twenty-first century?

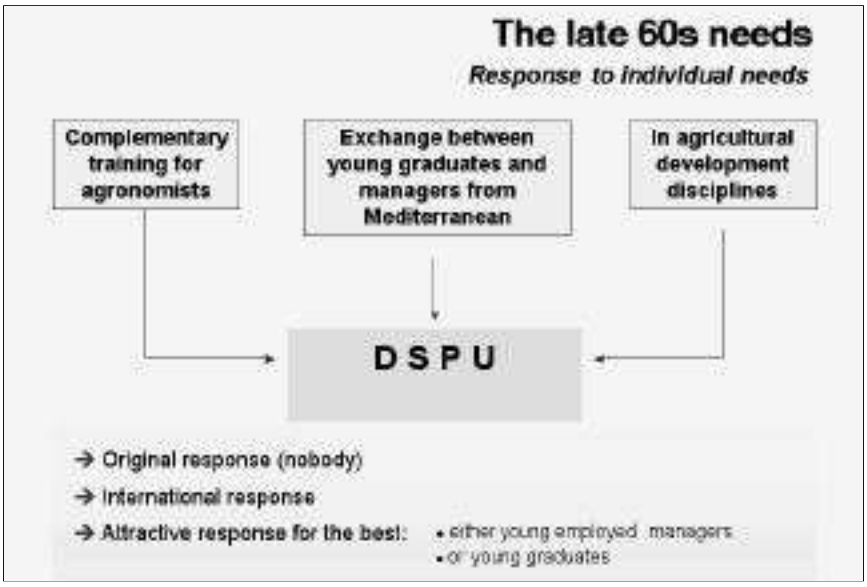
Higher education and agrofood research form a unique set of instruments for development and the bringing peoples together in the Mediterranean. It represents considerable human and scientific capital and substantial networking potential and provides original means for intervention. However, its future is closely linked to its capacity for evolution and for adaptation to a rapidly changing world. We are now in a period full of fractures, questioning and uncertainties.

The speeding up of history, the upsetting of traditional balances, the globalisation of our economies and fantastic technological progress are all new components that we must learn to incorporate in our development strategies. But these rapid changes should not make us forget the continued existence of underdevelopment, illiteracy, malnutrition and poverty that affect an increasing proportion of humanity and that market forces alone cannot remedy.

1. We must rethink our interventions according to the changes in our environment and new requirements. The case of CIHEAM

Towards the end of the 1960s, when CIHEAM received its first students, the requirements expressed were mainly individual needs.

Figure 6. Needs in the late 1960s, response to the needs of individuals



The public powers at the time had become aware of a certain similarity between agricultural problems in the northern region of the Mediterranean and wished to draw the consequence of this convergence by founding CIHEAM. The purpose was to provide a response to the complementary training requirements of individuals, usually agronomists, who already had jobs or were newly qualified. The original, international response formed by a one-year diploma course (creation of the DSPU, *Diplôme de Spécialisation Post-Universitaire*) also made it possible to respond to the exchange needs expressed by the same persons.

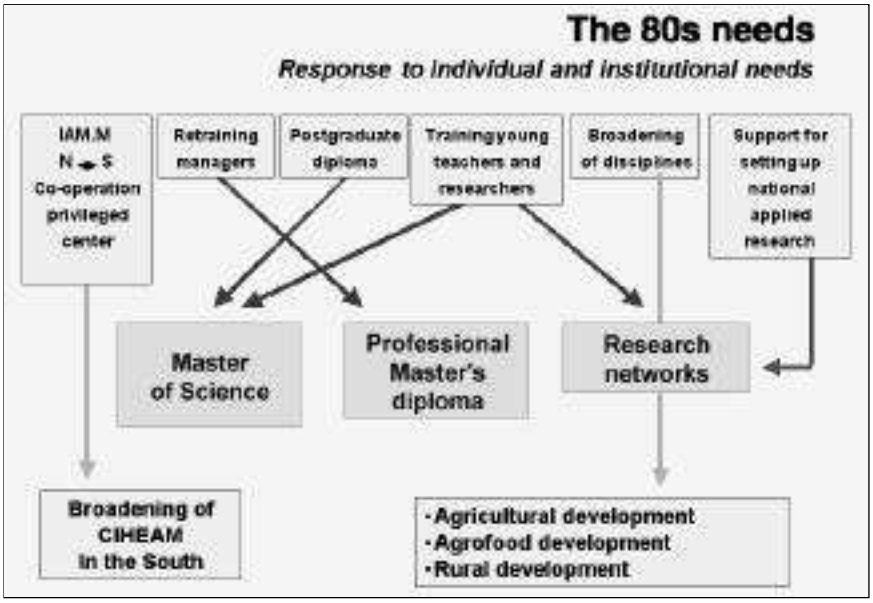
At the beginning of the 1980s, a number of new features profoundly changed the needs of Mediterranean countries in our scientific field. The first important change was the welcoming by CIHEAM of the countries on the southern shores of the Mediterranean. CIHEAM then became a special site for north-south co-operation. However, there had been deep changes in requirements, especially as they were now expressed through **institutions** and not just through **persons**.

Indeed, the end of the 1970s had been marked by three phenomena (Figure 7):

- ❏ The need for a post-graduate degree common to all the Mediterranean countries. The creation of *Master of Science* met this requirement well, especially as its research-oriented training enabled those taking it to follow it by a doctorate.
- ❏ The need for specific training for young teachers and researchers. This emerged during the same period and also found a response in the MSc.

❏ However, the emergence of specific needs for refresher training for managerial level persons trained in Europe or in their own country could not find a solution in training through research. The creation of professional '*Master's'* diplomas, specific to IAM Montpellier, provided a suitable response.

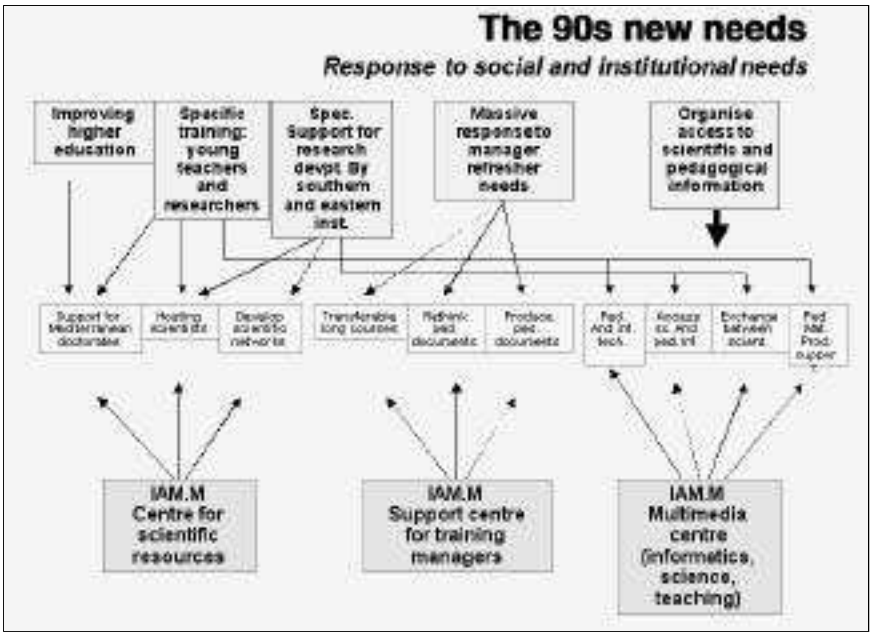
Figure 7. Needs in the 1980s, response to individuals and institutions



These new training requirements were accompanied by the emergence of new requirements in research. These were particularly substantial as there had been changes in the disciplines in our field. We now reasoned with the agricultural, agrofood and rural trilogy and no longer only in terms of agricultural development.

In the 1990s (Figure 8), new requirements have developed strongly in three directions:

Figure 8. The new requirements of the 1990s, response to institutions and to society



- The first involves scientific resources. Here, the countries south and east of the Mediterranean intend to develop their production capacities and to become in turn areas where 'knowledge' is created. Such a strategy requires specific support for the recently established doctoral training. The only available doctoral training is in fact competition. Suggesting to the best students that they should write their doctoral theses elsewhere tends to weaken the the recently established facilities. Support for the doctorates of Mediterranean partners, the development of networks for the exchange of teachers and students, the development of joint diplomas and programmes for hosting scientists for short and medium duration stays in the north are all initiatives to be developed that should provide a degree of response to these new requirements.
- The second results from the substantial requirements for training managers in the light of the deep-seated changes in the environment in which operators in agrofood development must work (withdrawal of the state, emergence of the civil society, development of the market economy and the intensification of competition as an effect of globalisation).
- The third is directly related to the marked shortage of strategic and pedagogical information suffered by most of the poor countries around the Mediterranean.

Several lines of action

In questions of teaching, these ideas can be summarised as follows, in not particular order of priority:

- Higher education, research and support for agrofood development in the Mediterranean must systematically develop leading-edge, high-level teaching meeting precise requirements of development agents working in the field.
- Whenever possible, such teaching should be designed in partnership with institutions in the south and the north. CIHEAM-IAM can play a role of support, development and concertation in this dynamics.
- Mechanisms for the continuous identification of requirements should be established (the idea of a watch, mentioned above, should acquire its full status with regard to the identification of training needs).
- It should be possible to follow this teaching as continuing education. Those who follow the course should be able to gain credits and a diploma of the professional master's type. For this, careful attention must be paid to the level and amount of studies performed (the problem of equivalence).
- This training should be funded to a considerable extent by national training systems and by international organisations (World Bank, UNDP, IFAD, etc.) or by bilateral aid (from European countries, Canada, Japan or the United States).
- Long curricula should be designed more widely and more regularly dispensed on a collaboration basis.
- For this, the teaching provided by the partners in the network should qualify more naturally and be better integrated in the other training curricula—with more involvement in doctoral schools, better integration in the network of senior agronomy colleges and universities in the north—in order to be present in the heart of various curricula and enable students to be well qualified for the subsequent part of their training.

- The network of partners set up should lay great emphasis on new technology in the development and dissemination of its teaching.
- The knock-on effects are doubtless greatest in the training of training staff and young teachers. In order to play this role to the full, it is important that the partners should initiate this type of training with play not only on the content (level, originality and coherence with requirements) but also on the transfer of modern pedagogical techniques.
- Finally, it is of strategic importance to systematically seek all the best ways of enhancing our actions: training for training staff, distance teaching, etc. On the latter point, it is important to examine the finan-

cial resources and technology that can be used in continuous or continued training to enhance the training of a large number of people who have jobs. These are the people who do not have access to traditional training (for lack of time or money, for professional or family reasons, etc.).

2. An idea that is making progress: the creation of a Mediterranean Agricultural University

Faced with the scale of the problems, only a procedure based on the principle of partnership and solidarity can be envisaged. The procedure is fairly simple: 'we should do together what we cannot do individually'. In this spirit, it is urgent that dynamics of co-operation and exchanges should be created around the Mediterranean in the fields most likely to contribute to solving major development and food security problems in the zone. For this, its is strategically important to enhance and modernise the links that we have favoured in recent years.

A number of universities and agronomy colleges are wondering today about the best way of modernising their teaching and making it accessible to a large number of people[8]. Research groups are now developing tomorrow's campuses. Suppliers of equipment and services are designing tomorrow's learning and communication machines. Architectural projects are being developed for these sites of production and dissemination of knowledge, the universities of the twenty-first century. We cannot just remain the spectators of these changes that are capital for the development of the region.

Some of our establishments are participating in this reflection and the project for the creation of a Mediterranean Agricultural University that would group existing forces is taking shape. For us, it is a possible line of evolution along which CIHEAM and its institutes have already made considerable progress with their partners and that should now be shaped and strengthened.

A. The first steps of a Mediterranean Agricultural University (MAU)

Let us imagine, for example, the project resulting from ongoing reflection at CIHEAM and being carried out experimentally in development economics at IAM Montpellier. The project, resulting from reflection performed within IAMM's Work Plan, is based on a double observation:

- Training needs have changed profoundly and the continuing training of agrofood development managers has increased considerably because of the deep-seated changes in the economic and social environment.
- In the face of these new requirements, higher education institutions providing teaching in agronomy and which master initial training fairly well are not yet equipped—either intellectually or technically—to handle advanced courses for managers.

This training can only be carried out on-site for obvious reasons of efficiency (the managers to be trained are scattered) and sovereignty (matching of continuing training operations to national development strategies and priorities). It would be advantageous to design this locally available training in a regional perspective in order to make good use of human resources, to develop the best training tools and to draw benefit from the investment devoted to it.

B. Project objectives

The objective of the project is to design, co-ordinate and support the first stages of the founding of a Mediterranean Agricultural University (MAU) that would have the following characteristics:

- The beneficiaries of the teaching provided by MAU will be students receiving initial training and professionals receiving continuing training. Special admission will be envisaged for the professional public, such as the recognition and validation of professional experience.

- ❏ MAU will group a number of training institutions that develop and dispense (in a co-ordinated manner) entirely or partially distance teaching. The aim is to use the local resources and skills of each institution.
- ❏ It should operate in a flexible manner in space (delocalised teaching) and time (teaching à la carte). This 'space-time' will be defined virtually by the organisation of the establishments as a network.
- ❏ Agronomic training is envisaged (agriculture, food environment, etc.) at 3rd to 5th year university level, hence of the master's degree type. The training will be developed using previously defined and validated common standards.
- ❏ MAU will consist of a union of universities (north-north, north-south and south-south) that have decided on the common proposing of training of the '*Master*' type. This will lead to the creation of strategic pedagogical and logistic alliances and the submitting of joint projects for programmes with a view to quality approval that could be provided by CIHEAM on behalf of MAU.

C. The different levels of co-operation and co-ordination

Three levels should be envisaged for the operation of MAU. These different functions are essential but can be handled by certain members of the consortium.

a] The first function is the ***administrative level***. It assumes the installation of a system for scientific, pedagogical and management co-ordination. Its purpose is to ensure the good running of the various components of MAU:

- ❏ Scientific management covers the accreditation and continuous assessment of the programmes (for this, MAU will call upon groups of the specialists who are most competent in the subjects assessed). It is essential to perform this to ensure the best scientific level provided for students in order to guarantee good homogeneity of the programmes and an excellent reputation for the qualifications awarded.
- ❏ The administrative management of the programmes requires the setting of a single set of pedagogical regulations for MAU as a whole, monitoring of their application and the drawing up of financial regulations.
- ❏ Finally, pedagogical management must handle those involved at the various levels of the 'design-production-dissemination-training-assessment' processes established within MAU.

b] ***A technological level*** serving two functions:

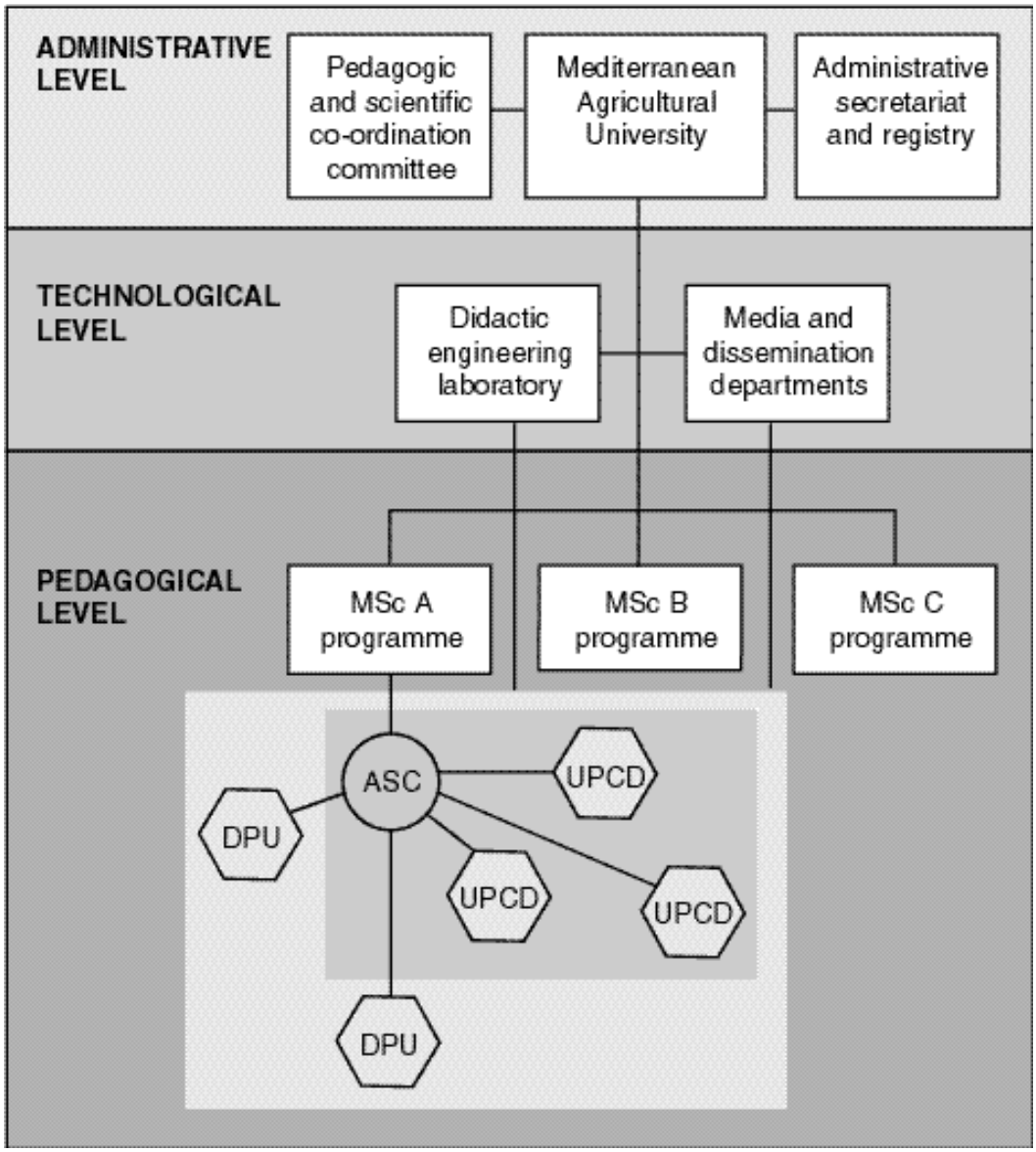
- ❏ The first concerns the 'didactic engineering' that is essential for setting up distance learning processes and that enables the production of the teaching material that is essential for setting up these processes.
- ❏ The second is media management and the dissemination of the contents of teaching. It is important that a single document dissemination source should be set up within the framework of MAU; it will also play the role of filter and information storage facility. This role can also be played for MAU by one of its partners who is better-equipped or has better experience in dissemination. It will be performed most of the time by communication companies (providers and carriers).

c] ***The pedagogical level*** is the third level. It is founded on the basic pedagogic units ('UPCD' and 'UPD'). As shown in Figure 9, the latter interested in the setting up of a programme form a group to constitute an Admission and Supervision Committee (ASC).

- ❏ The first job of this committee is to draw up a dossier justifying the new programme developed, evaluating potential clienteles and proposing a detailed content of the teaching to be provided. This dossier will be submitted to MAU for assessment and accreditation.
- ❏ Once the programme has been approved by MAU, the pedagogical design units that also handle part of the dissemination of the teaching and are described in the diagram above as 'UPCD' (they may be faculties, colleges or departments) share the work of producing the pedagogical material. This stage is performed with the help of multidisciplinary groups centred in 'pedagogical engineering' laboratories.

- Finally, when the material is available and the supervisors have been trained, the pedagogical units that are partners in the new programme will begin to disseminate the teaching in their immediate environment.
- It is possible that a university wishes to disseminate the teaching when a programme has been tried and tested. As these units mainly handle dissemination, they are referred to as dissemination pedagogical units (DPU). The ASC then judges the ability of this university to supervise distance students in this field.

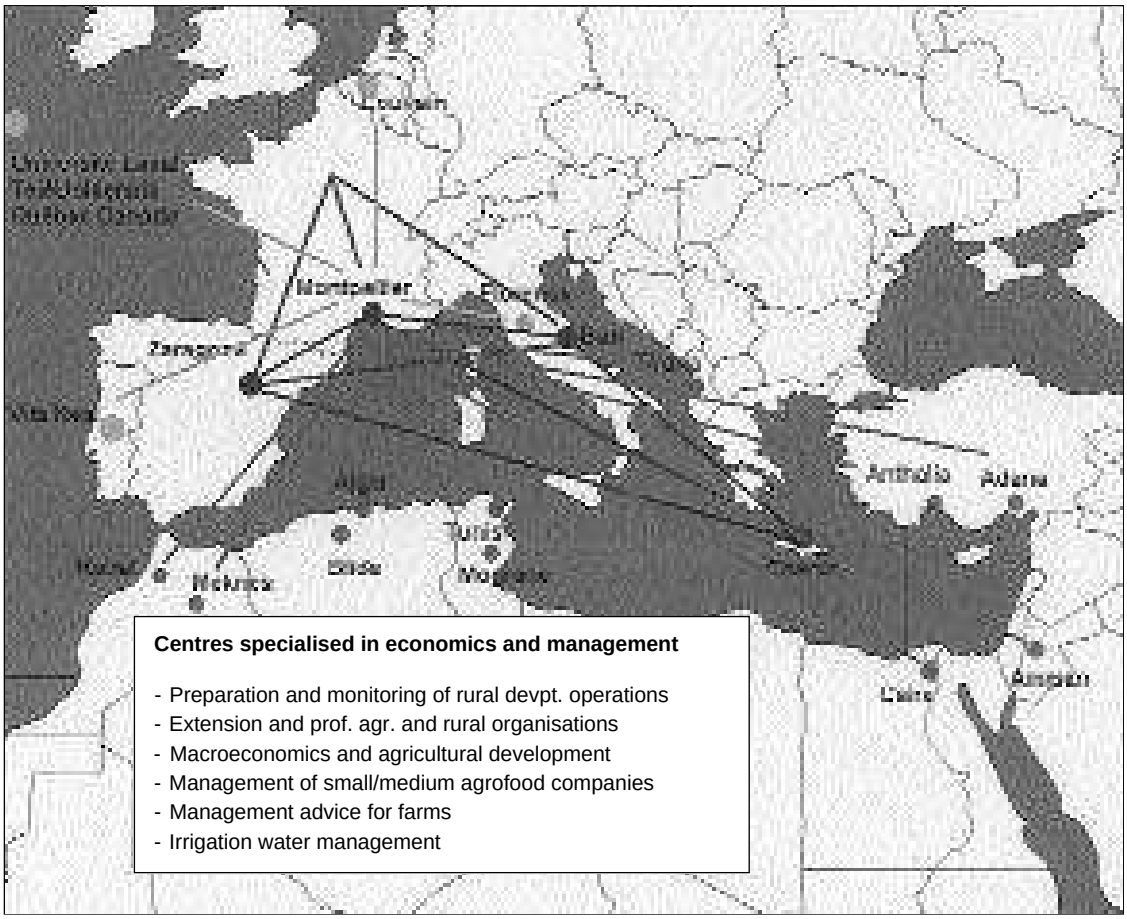
Figure 9. The three functional levels of MAU



D. A preliminary outline of MAU in economics

Profiting from the achievements in the production of teaching material in Montpellier within the framework of the Natura project with which IAM Montpellier was involved within the framework of Agropolis, it would be possible for the CIHEAM institutes to take the initiative, in collaboration with their Mediterranean and European partners, to set up several professional master's diplomas.

Figure 10. Organisation of MAU in management economics



In economics and management (as an example), ongoing discussions concern the following programmes:

- ❏ Preparation and monitoring of rural development operations
- ❏ Extension and professional farming and rural organisations
- ❏ Macro-economics and agricultural development
- ❏ Management of agrofood companies (small and medium-sized companies)
- ❏ Farm management advice
- ❏ Management of irrigation water

These proposals are synthesised in Figure 10.

Conclusions

In history, these breaks—although difficult—have enabled us to make progress in science and to extend its benefits to the largest possible number of people. Each stage has taken the form of a step forwards that is sometimes painful but always brings an improvement in quality, in which the volume and quality of information make progress, with continuously improved communication machines, providing a large number of people with easier access to information and hence to progress. The transition from one stage to the next has been allowed by the development of new media tools and their supports: writing, printing and new communication and information techniques.

We are entering the twenty-first century and we must learn to handle new technology. I feel that this determination is all the more strategic as the region has catching up to do and everything that can be

achieved in this respect will contribute to bring our teaching and research capability and our potential for action up to standard. This strategy should also enable us to increase the fruits of investments and make our services accessible to the greatest number of people.

Notes

1. OCDE, *Perspectives de la science, de la technologie et de l'industrie*, Paris, 1996.
2. OCDE, 1996, op. cit.
3. It is true that according to various estimates known, traffic on the Internet currently consists above all of company commercial connections and much less of connections by households for education or information purposes (60% for commerce, 27% for research, 9% for administrations and hardly 5% for education). These trends are tending to change gradually with the acquisition by households of computers and multi-media systems, opening up new prospects for access to communication and information.
4. According to estimates by experts, over 80 percent of students in natural science possess a personal computer. The same phenomenon is observed in the USA, where there are over 400 online specialised journals and newsletters and more than 1000 electronic forums where scientists discuss questions of medicine, philosophy or economics. One of the advantages of electronic publishing is its rapidity and distinctly lower cost than printed material. There are of course disadvantages with regard to the guarantee of the origin of messages and the mass of information received, for example.
5. King, in Pol-Droit, R., *Philosophie et démocratie*, Editions UNESCO, 1995.
6. 'Today, the forces of change in operation are difficult to manage, not only because they are new but also because they operate at a global scale and the propects of upheaveal outweight the prospects of stabilisation'. Cartier, M., *Le nouveau monde des infostructures*, Fides, Montréal, 1997
7. After Cartier M., op. cit.
8. AUPELF-UREF and NATURA in Europe and various consortia in the USA

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