European agriculture – its economic significance, its social status, its political weight, its technological level – has undergone considerable changes over the past decades. Indeed also in the coming years these changes will continue. Accordingly, the knowledge, expertise and education base underpinning agriculture as an industrial and societal activity has to follow these changes by adapting its science base, its priorities, its organization and its way of operation. This contribution will seek to present with a bird’s eye view the developments in the European agricultural research and education structure, and will try to formulate the paradigms of a new concept of the notion ‘agricultural knowledge and expertise base’: As from the end of World War II the European industry and society developed gradually from a more or less regulated situation into a virtually completely open industrial market and civil society. And within that context the agri-food industry developed from a mainstay of European economy into just one stakeholder in a whole complex of rural economy. Accordingly the agricultural research and education and knowledge system is developing from a homogeneous, oligo-disciplinary, institutional and monopolistic system into a heterogeneous, poly-disciplinary and virtual system.

Keywords: knowledge systems; education; knowledge transfer.

I A bit of recent history.

In the first decades after the Second World War the member states of the then European Economic Community (EEC) shared a very strong ambition to free themselves from dependency of third countries for food and feed. Concomitantly, poverty and income-insecurity of farmers should be alleviated. So as to achieve this, the EEC members developed and engaged in a strong common agricultural policy aiming at maximisation of the agricultural productivity, securing an adequate and affordable (actually: cheap) food supply for the European population and providing the producers (farmers) with an income that allows for a living up to European standards. All possible technical, economic and political means were employed to attain these goals and especially the ensemble of research and development, education and extension appeared to be an effective and powerful instrument. In each of the member states ‘agricultural knowledge systems’ were established and they flourished thrivingly. Farmers’ income was based on price support of their products so they were strongly motivated to increase their productivity by adopting new technologies and innovative production systems. The price support system was ‘bridging’ between a decent farmers’ income and cheap food for the citizens.
The policy was successful to the extent that already after few decades Europe could feed its population abundantly and was turned from a net food importer into a food exporter. In fact it started to ‘dump’ its surplus of agricultural produce on the world market at prices that disturbed the balance of international trade of agricultural commodities. The result of this was an increasing incidence of frictions with its international and global trade partners. Moreover: no longer being hungry, the Europeans started to realise that the Common Agricultural Policy was not only very costly as a result of the price support system, it was also noticed that a high agricultural productivity very often takes a heavy toll on environment, ecosystems, nature and animal welfare. So in addition to the economic frictions, an important body of social and cultural frictions was gradually built up against the Common Agricultural Policy.

At the political level this was tried to counteract with a number of economical and environmental regulations: gradually cutting down the price support system to nearly the level of world market prices, schemes to set aside agricultural land, limitation of the use of chemical fertilisers and pesticides, regulations to protect nature and landscape and many more. Effectively this resulted in a significant exit of farmers and a desertification of ‘marginal’ rural areas. At the same time the remaining farming operations tended to increase their scale and efficiency and thus counteracting the political goal to reduce the productivity. Both developments: the scaling up of farming and the desertification of some rural areas are basic to the development of a new societal concern: how to keep the rural areas vital and an attractive place for people to live and recreate in, and to safeguard an authentic and generic landscape and nature. A new concept was developed, the European Model of Agriculture, which accentuates a multifunctional role of agriculture: agricultural production, protecting nature and environment, safeguarding biodiversity and landscape, contribution to cultural heritage; but still with the agricultural enterprise as the initiator and main stakeholder. The agricultural knowledge and education systems responded rather ambiguously to these developments. The momentum of the production oriented research, development and education programs appeared to be very steady and a re-orientation towards the underpinning and support of agriculture as a multifunctional driver of general rural economy occurred only hesitantly. As a consequence governmental bodies turned to other knowledge systems for support and assessment of their rural policies and in the eyes of the general public the once highly respected and undisputed agricultural knowledge and education systems became rather associated with the adverse aspects of the image of agricultural production: costly, polluting, unhealthy, technocratic and animal-unfriendly.

As from 2003 the Common Agricultural Policy took a radical change of direction. The price support system – as it is seen as the most important driver of the negative aspects of European agriculture – is abandoned and measures are taken or are being developed to make all agricultural production priced in conformity with the world market. From now on agriculture is seen as a normal industry that has to comply with the general regulations and statutory standards concerning health, environment, ecology, safety, and has to compete on the world market. At the same time a new policy is adopted aiming at the safeguarding of a healthy and vital rural area. Land owners are no longer sustained by subsidising their production; rather they are remunerated for managing the land according to well defined standards and conditions, regardless the products, if any. In the context of this Rural Policy agriculture may be just one of the actors in a general rural economy, but in many cases it will not be the most important one.

In one sentence: Over just a few decades European agriculture has developed from a most important mainstay of European economical prosperity to just one of the contributors to a healthy and sustainable rural economy.

II A new concept of agricultural knowledge and education system.
In the ensemble of activities that together constitute the rural economy agriculture still is an important actor, but more importantly: all activities in the rural area are intimately interrelated as nearly all of them rely on the availability of natural resources (soil, water, air, light etc) or are based on their exploitation. Moreover – when it comes to food and nutrition – the way this exploitation is performed has great implications on the quality of the resulting end products and their social and cultural appreciation with the general public. In view of this interrelationship we propose for the purpose of this disquisition to use the designation “agriculture” as the pars pro toto expression for the ensemble of • the exploitation of natural and biological resources • human nutrition • rural society. It is obvious that in view of the intimate coherence of the different activities in the rural society a single supporting knowledge system is indispensable to provide the expertise necessary for a prosperous development.

The agenda for such knowledge and education system is self evident and reflects the present general concerns and ambitions of modern European society:

- **Sustainability.**
  Activities – of whatever nature – should not destroy or irreversibly exhaust the natural, biological and cultural resources they are relying on.

- **Safety and Health.**
  Any products – be it food, services, non-food, (bio-)energy – should be safe for human, animal and environmental health. Where appropriate they even should contribute to improvement of human health.

- **Cost-efficiency, entrepreneurship and profitability.**
  Evidently, the entrepreneurs in the rural economy must be able to realise a decent income and adopt a modern European life style.

- **Vitality of the Rural Area.**
  Rural economy in general should be able to sustain a population living in the rural area and yet connected to the services and attainments of the urban society.

- **Ethical acceptability.**
  Any activities within the rural areas – and especially when it comes to the exploitation of the biological resources - should remain within the boundary of values and believes that modern society wishes to adhere to.

Surely this agenda is very broadly and globally formulated. For each industrial sector, for each region, for each cultural aspect, etc, this agenda needs to be articulated to their very specific needs and ambitions. And in order to be really appropriate it also needs to be articulated with the input and commitment of all concerned stakeholders.

Considering this agenda it is clear that it can only adequately be covered with the full set of academic disciplines and pedagogic competences, notably including the natural sciences, the technical sciences, the social sciences and the humanities. This requirement greatly surpasses the range of disciplines and expertises that are included in the common, current agricultural knowledge and education systems as they are presently known in most member states of the European Union.

### III Evolution of the designation ‘Agricultural Knowledge and Education system’.

Systematic development of agricultural knowledge and education is not an invention of the XX century. Learned societies, mostly dedicated to a certain crop or a certain discipline, agronomic faculties at universities, and experimental stations and professional schools were already establishes much earlier. However, only after the adoption of a powerful supranational policy (CAP) and thus driven by a well defined need and generally accepted ambition, the search for new knowledge and technologies boosted enormously. National governments invested unbridledly in existing institutions and faculties and promoted strongly the establishment of new institution whenever a new problem or a new ambition was
requesting it. In that way in most countries ‘national agricultural knowledge and education systems’ rose with schematically the following characteristics:

- The whole system was driven by a unanimous mission: to produce food as much as possible and as cheap as possible.
- There was only one sponsor: the national government. And as a rule this sponsor also was harmonising the interests and research needs of the different stakeholders in the agri-food chain.
- The knowledge base was build on a rather narrow set of scientific disciplines exclusively attuned to and selected for their possible contribution to attaining the general mission.
- In general there was no societal dispute on the ethical and cultural aspects of new technologies and the didactic approach was sound but conventional..
- The range of action hardly surpassed the dimensions of the region of the nation.

As was stated above, this system was extremely successful. The transfer of new knowledge and technology to the users was very effective and efficient and thus the whole agri-food sector behaved dynamically and adaptive (today we would call it a ‘bio-based innovation system) and the original mission was not only attained rather soon, but surpassed it even to the extent that it became problematic.

When the success of the CAP started to cause economic, environmental and social frictions it became soon clear that – also as a consequence of the progressing unification of the European market – the underlying problems surpassed the national borders. Environmental aspects (e.g.: acid rain, water pollution) health aspects (eg: residue contamination), global trade (e.g.: WTO-vicissitudes), ethical aspects (e.g. animal welfare, biotechnology) could (and can) only tackled and solved by cross-border cooperation. In addition: those problems call for a broader palette of scientific disciplines then was and is included in the formal agricultural knowledge systems. Moreover, the stakeholders of the agricultural knowledge and education systems started to develop divergent interests and policies: governments, industry and citizens were no longer on one line. Consequently research organisations and academia were faced with the challenge to serve different ‘masters’ with different, often conflicting, interests and yet to keep up scientific excellence. And on top of that a general decrease of research funding forced the research organisations into profound reorientations of their research programmes and organisational set-up. So over the past decades the agricultural knowledge and education system had to adapt to and to cope with the following developments:

- International cooperation and coordination. First of all because the problems and challenges were of border-cross dimensions and secondly because an adequate approach and solution required an bigger and more extended scientific mass then could be supported at national level.
- A growing divergence of interests and strategies of the stakeholders. And these stakeholders also became more and more ‘international’.
- Widening of the knowledge and disciplines base. The traditional set of agricultural sciences was no longer sufficient to meaningfully address the whole range of economic, social and cultural problems and challenges. Traditionally agricultural stakeholders engaged therefore increasingly with other, non-agricultural institutions. And – seeing this market – other institutions started to offer their expertise and entered into competition with the agricultural knowledge and education systems.
- Shifting sponsorship from a unique, public sponsor to a diversified, often private sponsorship. And, in connection with this, a growing tendency to protect and valorise intellectual property where traditionally the agricultural knowledge system was completely open and public.
- Societal disputes: Citizens and consumers claimed their rights to put forward conditions and expectations about agricultural production and consequently demanded a voice in the discussions about the orientation and priorities of agricultural research.
The EU framework programmes were great propagators and facilitators of these developments by demanding multinational composition of the research consortia, by stimulating the involvement of industrial and societal stakeholders, by striving at an open European research area, and by stimulating scientific excellence. Indeed today we may witness the first signs of a completely open European research, education and knowledge market.

IV Some expectations for the near future.

In order to operate successfully in a completely open, international knowledge and research market stakeholders will need to adapt their ‘marketing’ and programming policies profoundly or even develop them completely new. Aspects to consider include:

• Variable dimensions. Ideally in an open market the initiative is in the hands of the customers. In the case of agricultural research these are political bodies, industries (or industrial consortia) and civil society. All these groups operate at three levels of aggregation: global, national, regional. This means that research organisations, academia and schools will face the challenge to operate at these three levels or to make a clear choice!

• Separate interests: The interests – and therefore also their needs for knowledge and expertise – of the different groups of stakeholders will be increasingly divergent or even conflicting. Also within these groups of stakeholders it might be the case that different elements have different problems and/or ambitions.

• General knowledge base: An open market means an open competition. As was already indicated above, customers will turn to those research organisations where they expect to receive the best performance for the lowest price. Moreover: also students will behave accordingly. Consequently obvious partnerships will no longer be normal as it was in the early days of the uniform and monopolistic national agricultural research and education systems. The present agricultural research organisations will increasingly experience the competition of the ‘general European research system.’

• Customised sponsorship: Sponsors, whether they are governmental, industrial or civic, will be inclined to sponsor only and exclusively the research that they need to attain their unique ambitions or to solve their specific problems. The concept of a general, public knowledge, expertise, training and education body, serving at the same time policy, industry and civil society in the fields of agriculture, food and rural society; and sustained by a more or less unconditioned budget will gradually fade away from the European scientific scene.

Responses and challenges to this new situation begin to appear in the different groups of stakeholders and maybe some of them might be considered to be the stepping stones for a new definition of the designation ‘agricultural knowledge system’:

• Policy bodies already tend to apply customised sponsorship. In many EU member states the policy is growing that ministries with competences for agriculture, food and rural affairs sponsor exclusively research that they expect to be helpful in implementing and assessing their policies. Only in case of border-cross policies a coordinated action may be initiated and cooperative programmes designed and implemented. As it should be in an open market the research may be done in any institute in any of the participating countries.

• For the industrial stakeholders the situation is rather complex: The big, multinational companies just continue as they are used to. They have and continue their in-house research or commit specific research projects to external research organisations. Consortia of industries at European level are beginning to make use of the instruments that the framework programmes are offering to establish technology platforms where strategic research agendas can be developed and
arrangements for (financial) implementation can be made.

SME’s will find it difficult to interact with the knowledge system as they mostly are too small (and too poor) to embark on individual research activities. It is apparently also quite difficult for them too organise themselves as their interests are in general very diverse and dependent on local or regional markets for their products and services.

The farming community is very well organised both at national and European level (e.g. COPA-COGECA), but a well structured and visionary research and knowledge strategy is not - yet? – at hand.

SME’s and farmers run a great risk to lose access to research and development in an open – and therefore highly competitive – research and knowledge market.

- In the context of this discourse, the civil society may be considered to be represented by consumer organisations and non-governmental organisations (NGO’s) and civil society organisations (CSO’s). All those are too small, too diverse and too poor to ‘buy’ access too the research and knowledge market. In principle they have the power too mobilise a great public awareness and turn this into political action, but as a rule they are too shattered, and compete for public attention in stead of cooperate. And in general they face the problem that there is a great difference between the opinion of citizens and the attitude of consumers. In an open research and knowledge market it will be very difficult for civil society to base political or societal action on sound and attuned scientific evidence.

- The science and education community itself needs to develop itself into a proactive participant in this open market. Research institutes that want to survive will need to develop marketing strategies so as to anticipate on future needs of the industrial and political ‘clients’ they have chosen to work for. If not successful, these institutes will end up re-integrated in the universities they often have originated from; or they will be closed down because of shear lack of sponsoring. A great problem and challenge is it too develop a management philosophy that provides for sufficient capacity to innovate in the science itself so as to be able - also in the future - to offer sound science and modern technology to their clients.

V Concluding remarks

As from the end of World War II the European industry and society developed gradually from a more or less regulated situation into a virtually completely open industrial market and civil society. And within that context the agri-food industry developed from a mainstay of European economy into just one stakeholder in a whole complex of rural economy. Accordingly the agricultural research, knowledge and education system developed from a homogeneous, oligo-disciplinary, institutional and monopolistic system into a heterogeneous, poly-disciplinary and virtual system.

For the big and rich stakeholders in industry and policy such system might be beneficial as it allows for perfectly attuned and effective research programmes. For the small and mostly poor stakeholders - small industries, farmers and societal organisations - it will be a great challenge to acquire access to this system.

As henceforth the general scientific community – not only the institutions that traditionally carry the name ‘agricultural’- will be approached to involve itself in the societal domain of agriculture-food- rural affairs, the question remains open: how to provide and guarantee for it a scientifically coherent knowledge base?