The effect of regionalisation on the agricultural research system of Greece

Tsogas M., Vizantinopoulos S., Panagou E.

in

Plaza P. (ed.).
Regionalisation of agricultural research in the Mediterranean and Near-East countries

Montpellier : CIHEAM
Cahiers Options Méditerranéennes; n. 32

1998
pages 109-123

The effect of regionalisation on the agricultural research system of Greece

Miltiadis Tsogas, Spyros Vizantinopoulos, Efstathios Panagou
National Agricultural Research Foundation, Maroussi (Greece)

Abstract. This report gives a brief description of the effects of regionalisation on the national agricultural research system in Greece and presents its characteristics and particularities. It starts with a brief historical background explaining how the "necessity" of regionalisation appeared in Greece. The national agricultural research system and its regional setting are then discussed with emphasis on the effects of regionalisation on human and material resource allocation and management, research priority setting as well as the involvement of the private sector in the system. Finally, future perspectives and new political orientations are mentioned with regard to to an increase in regional and inter-regional development.

Key words. Regionalisation – Agricultural research – Priority setting – Regional cohesion

Résumé. *Ce rapport donne une courte description des effets de régionalisation sur le système national de la recherche agronomique en Grèce et présente ses characteristiques et particularités. Au début, des données de base expliquent la nécessité de régionalisation en Grèce. Ensuite, une discussion a eté entreprise sur le système national de la recherche agronomique et son lancement régional, en insistant sur les effets de la régionalisation à la contribution et au management des ressources humaines et matérielles et sur les priorités de la recherche et la participation du secteur privé au système. Finalement, de futures perspectives et de nouvelles orientations politiques se dessinent en vue d'intensifier la cohésion régionale et inter-régionale.*

Mots-clés. *Régionalisation – Recherche agronomique – Priorités de la recherche – Cohésion régionale*

I – Historical background

Agricultural research was the first form of research funded officially in Greece as early as 1925-1930. During this period, regional research institutes were established in Greece for the first time, since it was governmental policy to invest in agricultural research. The main goal was primarily to cover the food requirements of the Greek population. At that time, the problem of hunger was critical especially in developing countries like Greece, so the main target of the public policy was to focus on the issue of increasing production and improving the quality of the annual crops used for food, e.g. cereals and maize.

On the other hand, Greece was a low income developing country with about 60% of its population employed in agriculture, which contributed to about 50% of the national domestic product. Considering that agriculture can serve as the driving force for growth in both low and middle income countries, thus helping to alleviate rural and urban poverty and ensure food security, the Greek policy was aimed at the development of the agricultural sector through agricultural research in order to achieve rapid rates of growth.

The first institutes established were located in agricultural areas and regions favouring the development of annual crops which were important at that time e.g. cereals. The main target of these institutes was to cover the food requirements of the Greek population, as only 50% of food needs was produced in Greece and the rest was imported. All these research units belonged administratively to a small department in the Ministry of Agriculture and there was no scientific and research cooperation among them. Initially the sectors of research in each institute covered only the stages of primary production (cultivation, fertilization, crop protection) of the indigenous varieties of annual crops. However, the improvement of the varieties using breeding techniques combined with the import of new cultivars consisted the main goal of research interest.

The results of this activity were very impressive. The Greek researchers with their talent, good background of research knowledge combined with hard work succeeded in producing new varieties of cereals, maize and often annual crops such as cotton and by 1960 Greece became self-sufficient in basic food needs.

The breakthrough in agricultural research started in 1961. At that time it was well recognised that agricultural research is the cornerstone and the driving force for the increase of the productivity in agriculture. It was then considered on the one hand, that all stages of agricultural production (primary and secondary) are equally important while on the other hand the amount and quality of agricultural knowledge of the farmers and relative scientists, mainly agricultural engineers, should be improved. Better educated farmers and modern scientists in agriculture form the decisive tool for the "green evolution" in Greek agriculture. A special service on a central basis (Ministry of Agriculture) was established with relative regional services all over the country. The research units contributed much to this effort. In addition, a large number of fellowships for post-graduate studies abroad gave the chance to the Greek scientists to obtain the appropriate knowledge in the field of plant protection, soil management and breeding.

It is worth mentioning that during the same period issues related to sustainable production in agriculture were first set for discussion and consideration. This resulted in the gradual creation of research laboratories in the institutes dealing with subjects related to the pollution of agrosystems due to the application of pesticides and fertilisers. In he 1960s, the Ministry of Agriculture also established a special service dealing with agricultural research named "Directorate of Agricultural and Technological Research" (DATR), to which all the research units (Agricultural Research Centres, Institutes and Research Stations) referred. Very soon, due to the complexity of the problems in agricultural production, the mutual co-operation of the research units appeared as a necessity. This led the DATR service, for the first time, to co-ordinate the research units and research programmes on a national basis covering different stages of agricultural production.

The continuous and rapid evolution of agricultural research in the developed countries resulted in a significant rise in agricultural productivity and encouraged the Ministry of Agriculture to organise agricultural research along modern lines. In 1977, a new organisation chart was proposed and new research institutes and stations were established. The coordination of all research units was considered important and, for the first time on a national basis, the facing of national agricultural problems with the co-operation of the research units through the central administration at the Ministry of Agriculture was promoted and applied. The research units that existed at the time, together with those newly established, now form the backbone of the National Agricultural Research Foundation (NAGREF).

In short, the main reasons for the regionalisation of the research units established all over Greece are the following:

- climatic, soil and socio-economic factors were initially the basic criteria for the establishment of research units in agriculture. Thus, the Institute of Plant Improvement was first located in Thessaly (central Greece) where the annual crops, cereals, maize etc. were the main crops and the main occupation of the population was agriculture. The Institute of Cotton was located in Central Macedonia, near Thessaloniki, as cotton was one of the most important crops. On the other hand, the research stations supporting the research institutes were all located in the countryside within the agricultural area;
- the time of establishment and the features of the research units coincided well with the evolution of human needs and the new issues in agricultural production. Thus, at first, research activities were carried out in staple food production (e.g. cereals) and later in fruit and vegetable production;
- political and other reasons. For instance, in some cases the urbanisation phenomenon influenced the features and location of the units established. Research units not associated with the rest of the scientific and technological infrastructure (Universities, Research Centres, Industry) also had significant problems of development and survival.

II – Brief description of the NARS structure and its regional setting

The Greek National Agricultural Research System (NARS) consists of Universities, Research Centres, various State Institutions, Agricultural Co-operatives and private enterprises. Among the State Institutions, the Ministry of Agriculture and the General Secretariat of Research and Technology (GSRT) of the Ministry of Development, play a leading role in the implementation of agricultural research.
More specifically, the contribution of the various legal bodies are the following:

1. Ministry of Agriculture

At the Ministry of Agriculture, the Directorate of Research is responsible for the collection, evaluation, co-ordination and monitoring of research projects funded by the Ministry of Agriculture, the European Union and other International Organisations. In addition, this Directorate is responsible for the introduction to the Co-ordination Committee of Agricultural Research on every issue concerning research policy in the agricultural sector.

Until 1989, the main volume of agricultural research was carried out by the Ministry of Agriculture through its 65 research units located all over the country. In 1989 all these units were transferred to a recently established organisation, the National Agricultural Research Foundation (NAGREF). Today, NAGREF is the national body for agricultural research and technology in Greece and functions as a private entity of the broader public sector, supervised by the Greek Ministry of Agriculture. The foundation is in charge of undertaking agricultural research for the development of technology and know-how and forwarding recommendations to the Minister of Agriculture concerning solutions to specific agricultural problems. The establishment of NAGREF was necessary for the adaptation of Greek agriculture to the rapid development of technical, economic and socio-political conditions in the international scene. NAGREF's structure consists of the Central Administration Office, located in Athens and its regional research units including 5 Research Centres, 38 Research Institutes and 19 Agricultural Research Stations. Nowadays, the foundation has focused its activities on the following areas:

- Research & Technological Activities, aiming at the integrated comparison of agricultural problems in the context of the National Agricultural Policy and in harmony with the CAP of the European Union in the fields of plant production, animal husbandry, forestry, food science, aquaculture, environment and rural development. The foundation also collaborates with foreign national organisations, signing protocols for bilateral co-operation aiming at (i) the exchange of information, data, raw material and germplasm, (ii) provision of technical and scientific expertise, and (iii) scientific exchange of researchers and experts. Until today, there have been in effect protocols of bilateral co-operation between NAGREF and the Agricultural Academy of Bulgaria, the State Science and Technology Commission of China and the Agricultural Research Institute of Cyprus.
- Development Activities, playing a decisive role in the dissemination of research results to industry, agricultural co-operatives and other enterprises. The foundation also has flexibility for providing external consultancy services in many programmes for developing countries in Central and Eastern Europe, Africa, Asia and elsewhere.
- Education and Training, contributing to the development of new research manpower with the elaboration of postgraduate thesis in co-operation with Academia. Special consideration is given to the training of the existing researchers abroad in new techniques and fields of specialisation with the provision of research grants from International Organisations such as the European Union, OECD, NATO, the Fulbright Foundation, etc.
- Consultancy work, participating in local and regional development consultancy projects in many developing countries.

Apart from NAGREF, the Ministry of Agriculture supervises various other state Institutions such as the Hellenic Cotton Organisation, the Hellenic Tobacco Organisation and the Benaki Phytopathological Institute.

The founding of the first two organisations was necessary because of the importance of cotton and tobacco production on the national economy, whereas the last foundation carries out research in the

fields of plant pathology, agricultural entomology and zoology, pesticide evaluation and weed control. The total funding allocated by the Ministry of Agriculture for research in 1991 was 3.847 million GDR (12.57 MECU), representing 66% of the total state funding for agricultural research.

2. General Secretariat of Research and Technology

The General Secretariat of Research and Technology supervises several research institutes, carrying out agricultural research as well. The most important of them are the National Hellenic Research Foundation, the Institute of Marine Biology of Crete, the National Centre for Marine Research, the Foundation for Research and Technology and the National Centre for Scientific Research "DEMOKRITOS".

Agricultural research is implemented mainly through the Operational Programme for Research and Technology (EPET), which comes under the Community Support Framework concerning the six-year period 1994-1999. The programme consists of the following four subprogrammes:

- Subprogramme 1, which focuses the agricultural research effort on specific, carefully selected fields of high economic interest such as environmental technology, environmental methods of production, energy saving including renewable energy resources, as well as life sciences including health and agriculture with emphasis on biotechnology applications.
- Subprogramme 2, which promotes industrial research, technology transfer and innovation.
- Subprogramme 3, which supports the promotion and reconstruction of the national scientific and technological infrastructure.
- Subprogramme 4, which supports the development of human research manpower.

The total funding allocated by the GSRT for agricultural research in 1991 amounted to 765 million GDR (2.50 MECU), representing 13% of the total state funding for agricultural research.

3. Higher Education Establishments

There are three main higher education establishments in which agricultural research is performed, namely the Agricultural University of Athens, the University of Thessaloniki and the University of Thessaly. At the Agricultural University of Athens, research is carried out in the fields of plant and animal production, food science, agricultural biology and biotechnology, soil science and land reclamation and agricultural economics.

At the University of Thessaloniki, agricultural research is carried out by the Faculty of Agriculture which consists of three departments, namely the Agronomic, Veterinarian and Forestry departments. The research fields are more or less the same as in the Agricultural University of Athens with the additional fields of forestry and veterinary research.

Finally, the University of Thessaly ,which is a relatively new educational institute established in 1983, undertakes rather limited agricultural research mainly in the fields of plant and animal production.

State funding for agricultural research activities in 1991 amounted to 1.154 million GDR (3.77 MECU), representing 20% of the total state funding for agricultural research.

In general terms, the distribution of state funding for research and technological development activities in agriculture during the period 1987-1991 is presented in Table 1 (see appendix), while the percentage regional expenditure for agricultural research in 1993 of the research establishments supervised by the Ministry of Agriculture is presented in Table 2 (see appendix).

4. Private Sector

The participation of the private sector was very small until recently, but in recent years there has been a considerable effort, mainly by the General Secretariat of Research and Technology, to increase the parti-

cipation of the private sector in agricultural R&D activities. This policy has been implemented mainly by the following programmes:

- Research Consortia for Improvement of Competitiveness (EKVAN), through which funds are made available to enterprises, universities and research centres for the development of high technology and high added-value products.
- Industrial Research Development Programme (PAVE), which encourages the co-operation of industries with research establishments, laying emphasis on the particular needs of the industrial sector (bottom-up approach).
- Joint financing Programme (SYN), which stimulates short-term co-operation initiatives on behalf of research institutions with industrial production units and also mobilises a number of enterprises to make use of research results.
- Demonstration Projects (PEPER), which aim at demonstrating the methodology and economic viability of new scientific knowledge and research results through their application on a sufficiently large scale in co-operation with industrial enterprises and other production units.

In 1993 the distribution of the private sector's total expenditure on research activities amounted to 2,459 million GDR (8 MECU) as shown in Table 3 according to sector of activity.

Table 3. Expenditure of the private sector for R&D activities in agriculture in 1993 (General Secretariat of Research and Technology, Department of Documentation and Indices. Pers. comm.)

Sector of Activity	Amount		%
	million GDR	MECU	
Plant & animal production	262	0,85	10,65
Fisheries & aquaculture	36	0,12	1,46
Food industries	1.723	5,60	70,00
Tobacco industries	438	1,43	17,80
Total	**2.459**	**8,00**	**100**

5. Effects of the regionalisation process on human and material resources allocation and management

The regionalisation of the agricultural research system in Greece has had a great impact on the allocation and management of human and material resources. The main positive effect of regionalisation was the fact that research addressed local problems of the primary and secondary agricultural production. However, there are many negative effects such as: (i) small critical mass of researchers; (ii) difficulties in raising funds; (iii) difficulties in addressing large-scale problems of agricultural production; (iv) less possibility for promoting research manpower.

Concerning the material infrastructure, the regionalisation process has resulted in the creation of small-scale research installations without any possibility for further development, research units without sufficient durable equipment, high running costs and finally difficulties in maintenance and renewal of equipment. As a result, the agricultural research system evolved mainly towards rendering services while the possibility for producing new knowledge and technology was considerably reduced, apart from some exceptional cases such as the production of plant propagating material (e.g. new wheat varieties). Thus, the image of the agricultural research system was losing ground little by little and could not prove its value. Moreover, the large number of small research groups and units distributed all over the country did not allow a multidisciplinary approach to the problems in the primary and secondary sector, thus resulting in solutions without any future prospects.

III – Priority setting

1. Evolution of the criteria used to define the degree of priority of research programmes

The regionalisation of the system resulted in a priority setting procedure that was mainly based on the need to grow food crops. There was no central planning and all efforts were sporadic, inconsistent and uncoordinated with insufficient and often unsuccessful results, driven by the development of new agricultural products. Today, priority setting is based on the Cross Meetings procedure, an initiative undertaken by the National Agricultural Research Foundation in an effort to provide the Ministry of Agriculture with useful proposals that will form the basis for setting priorities in such way that they will be directed at the needs and potential of the real conditions of Greek agriculture as well as at the alignment of agricultural research and technology policy-making with those of the EU.

At the Cross Meetings, research priorities were determined after close collaboration of about 700 experts from the Ministry of Agriculture and other Ministries, the National Agricultural Research Foundation, Academia, the General Secretariat of Research and Technology, other research centres, the Agricultural Bank of Greece, the Greek Bank for Industrial Development, agricultural co-operatives and the private sector. In some cases, outstanding scientists from abroad and members of the permanent Greek Delegation at the EU also participated.

In all, seventeen different Cross Meetings were organised by the National Agricultural Research Foundation in various thematic areas, covering the whole spectrum of agricultural research fairly evenly, as is shown in Figure 1 (see appendix).

2. Balance between fundamental and applied research

In Greece, agricultural research is carried out at both fundamental and applied levels. The main volume of applied research (approximately 70%) is carried out by the National Agricultural Research Foundation, while fundamental research is carried out by the General Secretariat of Research and Technology and its supervising research institutes (approximately 11%) and in the academic world (approximately 19%).

3. Participation of agricultural producers, processing industries and their professional organisations

The participation of agricultural producers, processing industries and professional organisations in priority setting was limited until recently. They started to appear on the scene during the Cross Meetings organised by the National Agricultural Research Foundation to define R&D priorities in the agricultural sector; their participation amounted to 13%.

4. Contribution of the private sector to research funding at both national and regional levels

In recent years, the private sector in Greece has participated more and more actively in research activities. It is estimated that a total of 250 enterprises in different sections of the national economy in the primary and secondary production are engaged in research. In general terms, the contribution of the private sector to research funding at regional level is almost negligible, while at national level it is quite small. The total expenditure of the private sector in agricultural research activities during the period 1986-1993 is presented in Table 4 (see appendix).

IV – Structural and thematic complementarity at national level

1. Relations between the regional structures and programmes

The first attempt at regional programmes was made through the Co-ordinated Programmes of Regional Development (SPPA), funded under the First Community Support Framework during the period 1989-1993. This effort is continuing in the Second Community Support Framework with the Regional Operational Programmes (PEP) in the period 1995-1999.

2. Scientific and development efficiency

In general terms, the regionalisation of the agricultural research system had a negative effect on its scientific and development efficiency; however, there are several positive points especially in the following fields:

Production of plant propagation material

During the last thirty years, many new plant varieties have been created and adapted to the Greek environmental conditions. These plants include new durum and soft wheat varieties, maize varieties, cotton varieties, vegetable varieties etc. The main organisation for the development of new varieties and the production and distribution of certified and healthy plant propagating material is the National Agricultural Research Foundation. The foundation passes on the royalties of the new varieties to co-operatives and private enterprises for commercial exploitation. Until today the foundation has played a major role in the development of new varieties as shown in Table 5.

Table 5. Contribution of the National Agricultural Research Foundation in the development of new plant varieties (Agricultural Research and Technology, Quarterly Informative Bulletin of NAGREF, Third issue, October-December 1996)

Varieties	**Cultivated area (ha)**	**Quantities distributed in Greece**			**Coverage of the Greek market** (%)
		Tonnes	Million GDR	MECU	
Cotton	440.600	5.500	3.300	10,78	48
Durum Wheat	600.000	3.537	500	1,63	25
Soft Wheat	277.480	384	60	0,20	5
Rice	24.891	247	35	0,11	5
Alfalfa	135.841	298	240	0,78	65
Vegetables	85.273	8	30	0,10	7

Animal Breeding

Special animal breeding programmes have been implemented, resulting in (i) the development of artificial insemination techniques, (ii) genetic improvement of cattle, (iii) programmes for dairy product control and (iv) conservation of genetic resources of indigenous sheep and goat breeds.

Biotechnology

Biotechnology was placed among the high priority sectors of the five-year programme for the Development of Research and Technology, thus forming one of the most important components of advanced technologies. In recent years, there has been an increase in state funding for biotechnological research, as shown in Table 6 (see appendix).

As a result, new methods and techniques have been developed including:

- ❏ Micropropagation and virus elimination
- ❏ Selection via regeneration and evaluation for tolerance to environmental stresses

- ❏ Monoclonal antibody production
- ❏ Bioremediation of wastes
- ❏ Enzyme production with the use of microorganisms for refining the agricultural wastes
- ❏ Integrated control of insects and fungi
- ❏ Embryo culture for regeneration
- ❏ Molecular genetics

In addition, several research and technological organisations and private companies were established due to the scientific and development efficiency of the system such as the Institute of Marine Biology of Crete, the Aquaculture Centre of Acheloos, VIORYL S.A., VITRO HELLAS S.A., etc.

Another indicator of the efficiency of the agricultural research system in Greece is the number of Greek patents resulting from research activities, as shown in Table 7.

Table 7. Greek patents since 1988 according to sector of activity (Industrial Property Organisation, pers. comm.)

Sector of activity	Number of patents
Agriculture, forestry, animal husbandry	213
Foodstuffs, baking, edible doughs	25
Meat treatment, fish and poultry processing	2
Foodstuff treatment (not covered by the above sectors)	109
Tobacco, cigars, cigarettes	34
Preparatory treatment of grain for milling	2
Separating solids from solids	10
Performing operations; Cleaning	1
Performing operations; Grinding, polishing	11
Biochemistry; beer, spirits, wine, vinegar, microbiology, enzymology, mutation or genetic engineering	97
Sugar industry	2
Fertilisers; manufacture thereof	19
Total	**525**

V – Relations between NARS and extension and development services

With reference to the relation between the national agricultural research system and the extension and development services, it should be mentioned that initially the scheme included the research units of the Ministry of Agriculture. Nowadays, the National Agricultural Research Foundation is a producer of new know-how and technology transferred to the Ministry of Agriculture and from there to end users through the Regional Extension Services. Since 1980, this scheme has changed radically and the role of the Regional Extension Services has been downgraded. Today, these services are also provided by the National Agricultural Research Foundation through its 19 agricultural research stations located all over the country. In addition, in recent years the private sector and agricultural co-operatives are playing an important role in extension activities and in some cases they have substituted the role of the public sector. The interaction of the national research system with the extension and development services in Greece can be seen in Figure 2 (see appendix).

VI – Future prospects

1. New political orientations

The balanced development of the different regions in a country depends, undoubtedly, on the harmonious growth of all the parameters of its economy. The uneven distribution of investment in the different

regions, in the sense of providing new knowledge and technology or capital, results in unbalanced development with negative effects on employment and social cohesion, thus creating urbanisation and migration scenarios. Agricultural research and technology in rural areas and regions contribute to social cohesion, raise agricultural productivity, reduce the percentage of unemployment, help to reduce the "push" element of migration and finally prevent the degradation and depletion of natural resources. It is also accepted that accelerated growth output in any economy cannot be maintained without adequate investments in rural infrastructure, agricultural research and extension services.

Today, it is obvious that the policy-makers in agricultural research should introduce new orientations and new targets for maintaining inter-regional cohesion among different areas in a country. In short, the main characteristics of such policy should include:

- Common agricultural research programmes aiming at the prevention of the degradation and depletion of natural resources. The integrated approach to production should be achieved under sustainable conditions.
- The output of agricultural research should lead to livelihood systems in rural and mountainous areas. The development of agriculture in rural areas helps to reduce the "push" element in migration. Also, agricultural development in low-income regions in a country indirectly helps to reduce the pressure of migration.
- A new orientation in agricultural research should be applied in order to produce new agricultural products, to cover a broad range of new markets and to bring growth and employment. New knowledge in agricultural production can lead to a better quality of agricultural goods, while biotechnology is the basic tool for achieving the previous goals.
- An increase of investment in agricultural research to cover the elaboration, development and integration of new technologies, thus increasing the competitive potential of agricultural products.
- Reinforcement of human resource capital, resulting in better-educated farmers.

2. Role of the national and sectorial development plans in promoting fundamental and applied agricultural research

The harmonious development of the agricultural sector in comparison with other sectors in an economy e.g. industry, human services etc., is of great importance. Only the countries which have achieved rapid growth rates in the agricultural sector have been capable of achieving high rates of national domestic products. Without a doubt, a national policy should be targeting the equal development of different sectors in the economy and emphasis should be laid on the agricultural sector. Moreover, the new political balances and economic relationships point to a future world that will be increasingly interdependent. Markets are becoming more interconnected than ever before and the recently endorsed World Trade Organisation is removing many barriers to trade.

So far, in Greece, it should be noted that all the efforts made by the government to apply a national and sectorial plan for development have not been successful. On the other hand, since Greece is a member of the European Union, the national and regional plan has been included in the Second Community Support Framework Programme. In the Operational Programme for Agriculture and Fisheries only 0.05% has been allocated to agricultural research. It is obvious that the promotion of fundamental and applied agricultural research under such conditions is questionable.

The current inadequacy in the recognition of the role of agriculture in change and development in the country should be re-examined. The national and sectorial development plans can play an important role in promoting fundamental and applied agricultural research as long as the following points are satisfied:

- It is necessary to increase the funding of agricultural research to 1% of the gross domestic product. This can be achieved by implementing an associated research and production policy based on the concept of mutuality. This policy will result in sufficient funding from taxation of agricultural products and agricultural inputs.
- This increased funding for agricultural research, as a result of a new policy recognising the role of agriculture in the economy of a country, should be allocated to research activities resulting in an

increase in the competitive ability of Greek agriculture on a global basis. The existence of a certain national and sectorial policy in agricultural research for producing new, more competitive products, with high added value and quality, produced under sustainable conditions should be established by the new National Committee of Agricultural Policy (10 January 1997).

3. Consequences of the development of more powerful communication and documentation exchange technologies

Nowadays, the advances in electronic communication technology are of paramount importance as they can rapidly remove barriers and shorten distances between individuals, institutions, regions, countries and continents and speed up the pace at which a global society is emerging. The creation of an information society in a country can make a significant contribution to renewed growth and the development of new forms of jobs. The information society means fundamental agricultural, industrial, ethic and social change. Information society technology must meet the expectations and requirements of "users'" and "consumers" and the need to give them access to quality general purpose services at the lowest cost.

During the past decade, Greece has been faced with the challenge of improving the quality of its agricultural research. It is worth noting that the National Network of Information and Documentation has already been established and is expected to influence and have great impact on the increase of the productivity of agricultural research. Some of the consequences of the establishment of this National Network on agricultural research include:

- ❏ Better and more up-to-date scientific information for researchers so that the quality of the research projects submitted will be improved. The first positive output of this event appeared quite recently, since during the last five years the number of projects and amount of funds in Greece have increased.
- ❏ An increase in the number and level of scientific co-operation activities and networks, e.g. COST activities, Concerted Action initiatives etc.
- ❏ Better administrative and economic follow-up for the large research organisations e.g. NAGREF.
- ❏ Creation of electronic literature cited and digital libraries, useful tools for scientists, researchers and citizens.
- ❏ Easy access to agricultural information for the farmers, co-operatives and the private sector.
- ❏ The electronic network information systems in different agricultural areas (crop protection, fertilisers, pesticides, agricultural forecast information systems, etc.) have already contributed to agriculture and they are expected to be even more helpful in the long term.

References

• **Alexandridis C., Kazakopoulos L., Panagiotou A. and Farakou F.** (1995). *The Agricultural knowledge system in Greece*. A country report. Agricultural knowledge systems in OECD member countries. First Joint Conference of Directors and Representatives of Agricultural Research, Agricultural Advisory Services and Higher Education in Agriculture. Paris.

• **CGIAR (1995).** *Renewal of the CGIAR: Sustainable Agriculture for Food security in Developing Countries*. Summary of Proceedings and Decisions, p. 134.

• **CGIAR (1995).** *Renewal of the CGIAR: Sustainable Agriculture for Food Security in Developing Countries*. Background Documents on Major Issues, p.134.

• **Echeverria R.G.** (1990). Assessing the Impact of Agricultural Research. In R.G.Echeverria (ed). *Methods for Diagnosing Research System Constraints and Assessing the Impact of Agricultural Research*. Vol II: Assessing the Impact of Agricultural Research. The Hague.

• **Thomas F.** (1994). Environmental Scarcities and Violent Conflict. *International Security* 19 (1), Summer.

• **Tsogas M. and Tsaftaris A.** (1995). The agricultural biotechnology in Greece -Policy, activities, priorities. *Biotechnol. & Biotechnol. Eq.*, 3: 38-49.

• **World Bank** (1994). *Population and Development*. Washington D.C., p. 32

Table 1. Distribution of State funding for R&D activities in agriculture (1987-1991)

Body	1987			1988			1989			1990			1991		
	Amount		*%*	*Amount*		*%*	*Amount*		*%*	*Amount*		*%*	*Amount*		*%*
	million GDR	MECU		million GDR	MECU		million GDR	MECU		million GDR	MECU		million GDR	MECU	
Ministry of Agriculture	3.084	10	81	3.054	9,98	77	3.400	11,11	72	3.650	11,93	67	3.847	12,57	66
General Secretariat of Research & Technology	411	1,34	11	507	1,66	13	470	1,54	10	690	2,25	13	765	2,50	13
Academia	255	0,83	7	360	1.18	9	829	2,71	17	1.070	3,50	19	1.154	3,77	20
Etc.	44	0,14	1	53	0,17	1	40	0,13	1	50	0,16	1	60	0,20	1
Total	**3.794**	**12,31**		**3.974**	**12,99**		**4.739**	**15,49**		**5460**	**17,84**		**5.826**	**19,04**	

Table 2. Percentage regional distribution of expenditure for R&D agricultural activities in 1993 of the research establishments supervised by the Greek Ministry of Agriculture
(General Secretariat of Research and Technology. Department of Documentation and Indices. Pers. comm.)

Region	Research Establishment Tobacco Institute	NAGREF	Cotton Organization	Benaki Phytopathological Institute
East Macedonia - Thrace	77	4,25	5	-
Central Macedonia	9,4	29,79	38	-
West Macedonia	2,4	0,82	-	-
Thessaly	4,8	9,72	40	-
Epirus	-	3.07	2	-
Ionian Islands	-	0,09	-	-
West Greece	6,4	2,33	2,5	-
Central Greece	-	2,09	12,5	-
The Peloponnese	-	1,05	-	-
Attica	-	34,06	-	100
North Aegean	-	0,07	-	-
South Aegean	-	0,51	-	-
Crete	-	18,08	-	-

Table 4. Expenditure of the private sector for R&D activities in agriculture (1986-1993)

(General Secretariat of Research & Technology, Department of Documentation & Indices (1995). Public Expenditure for Scientific & Technological Research)

Body	1986			1988			1989			1991			1993		
	Amount		*%*	*Amount*		*%*	*Amount*		*%*	*Amount*		*%*	*Amount*		*%*
	million GDR	MECU		million GDR	MECU		million GDR	MECU		million GDR	MECU		million GDR	MECU	
Plant and Animal Production, Forestry, Fisheries	10,00	0,03	3	176,0	0,58	32	103,6	0,34	21	43,6	0,14	5	298	0,97	12
Food Industries	281,00	0,92	88	355,8	1,16	64	372,7	1,22	74	799,0	2,61	93	1.723	5,60	70
Tobacco Industries	27,68	0,09	9	26,13	0,09	5	25,0	0,08	5	18,0	0,06	2	438	1,43	18
Total	**318,80**	**1,04**		**558,10**	**1,83**		**501,3**	**1,64**		**860,5**	**2,81**		**2.459**	**8,00**	

Table 6. Distribution of State funding for R&D activities in biotechnology (1987-1991)

Area	1987			1988			1989			1990			1991		
	Amount		*%*	*Amount*		*%*	*Amount*		*%*	*Amount*		*%*	*Amount*		*%*
	million GDR	MECU		million GDR	MECU		million GDR	MECU		million GDR	MECU		million GDR	MECU	
Health	468	1,53	53	639	2,09	55	732	2,39	57	528	1,73	63	751	2,45	52
Agriculture	217	0,71	30	351	1,15	31	278	0,91	22	197	0,64	24	394	1,29	27
Industry	29	0,09	3	29	0,09	3	13	0,04	1	17	0,06	2	23	0,08	2
Environment	56	0,18	6	67	0,22	6	168	0,55	13	61	0,20	7	85	0,28	6
Energy	10	0,03	1	10	0,03	1	-	-	-	-	-	-	-	-	-
Etc.	63	0,21	7	50	0,16	4	84	0,27	7	34	0,11	4	157	0,51	11
Total	**889**	**2,75**		**1.149**	**3,74**		**1.277**	**4,16**		**838**	**2,74**	**1.440**	**4,61**		

Figure 1. Cross Meetings outline

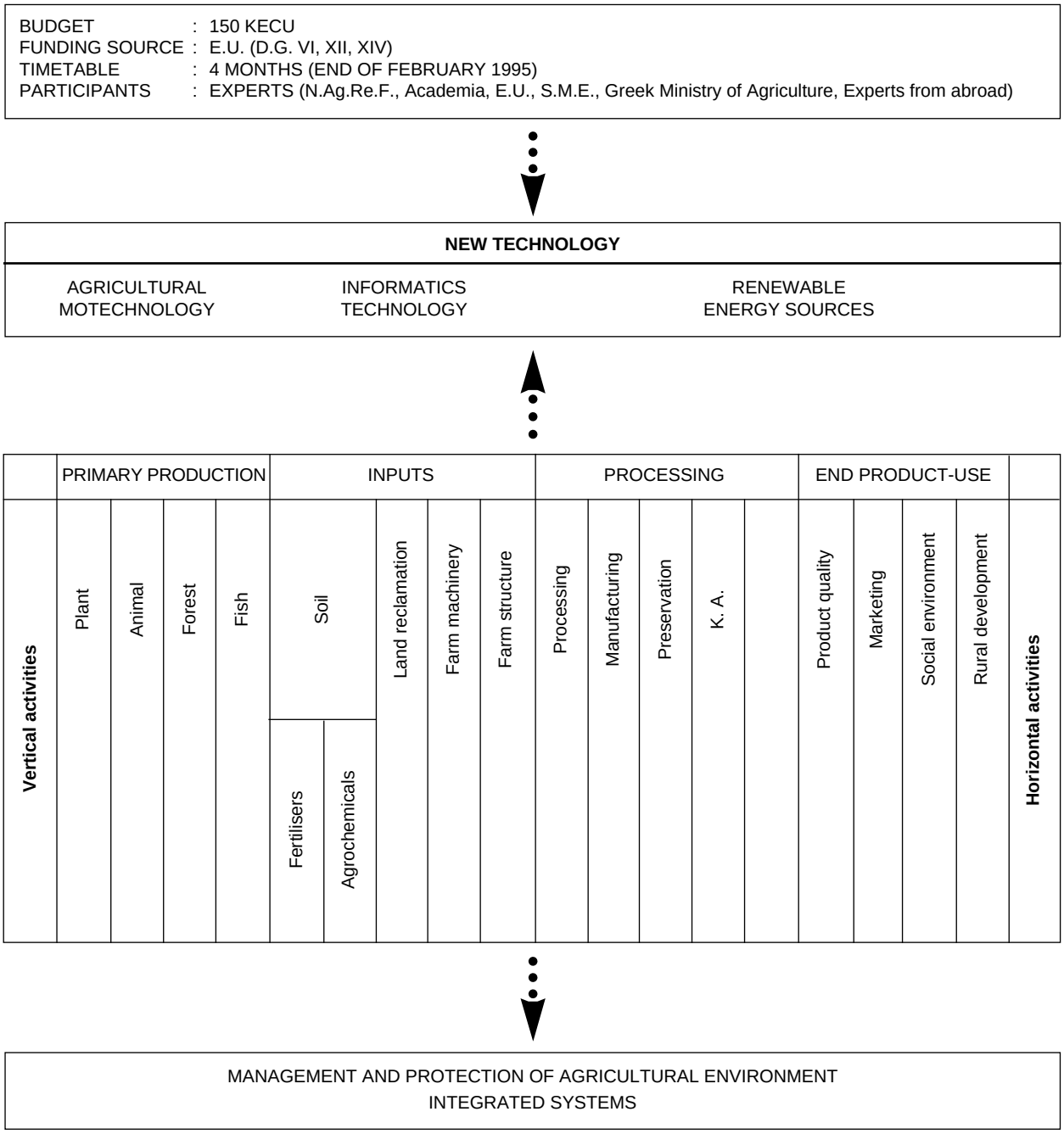

Figure 2. The relation between the national agricultural research system and extension and development services