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Biotechnology In Greece

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Introduction

In Greece, the biotechnologies' debate has been trailing, rather than leading, developments in other European countries. Marouda-Chatjoulis *et al*. (1998) point out that in the 1970s there had been no Greek policy activity regarding biotechnology, contrary to the rest of Europe, where such a debate flared up in reaction to the US one following Asilomar. The emerging biotechnologies were absent from the agenda of all political parties and governments-elect in the second half of the 1970s (following the fall of the military junta in 1974). Moreover, there was no Greek firm or industry involved in biotechnology applications during the 1970s while the emerging Greek environmental NGOs were then taking their first steps (Botetzagias, 2002); that seems to hold for the majority of consumer NGOs and pressure groups.

In brief, biotechnology's applications did not constitute a prominent issue either on the public sphere or in the political arena of that era. In their investigation of the coverage of biotechnology by Greek media, Marouda-Chatjoulis *et al*. (1998) have found the related newspaper articles of the late 1970s and early 1980s to be few in number and depicting a rather reassuring image of potential health benefits through rapid medical and biological advances occurring far from Greece, although there was also a concern about 'opening Pandora's Box' in Greece.

The state showed an interest in promoting research in biotechnologies in the early 1980s (Marouda-Chatjoulis *et al.*, 1998; Caloghirou & Zambarloukos, 2000). At that same time, Greek scientists were instigating the debate over biotechnologies in Greece, although rather late if compared with other European Union (EU) countries. These first stages of the debate had taken place almost exclusively inside informal fora such as scientific meetings and conferences. The Greek public was just a distant entity that was largely uninformed about modern biotechnology applications until the mid 1990s, as the Eurobarometer surveys indicate. It was only after then, with the advent of the GMOs controversy, that we witness active protest mobilisations, originating from NGOs like Greenpeace. During the same period, public anxiety concerning biotechnology had dramatically increased, the more prominent issues in public discussions being GM food production and cloning.

Thus, biotechnology's research and development policy as well as the relevant debate can be split into two, markedly different, periods: (a) 1982-1989 and (b) 1989 to the present. The first period is characterised by lack of public awareness of biotechnology and weak efforts of the Greek state to support scientists in their research and to capitalise on biotechnological breakthroughs. The second period is marked by a negative public attitude towards biotechnology and its potential risks, as well as the emergence of debates over GM food, cloning and, more recently, over DNA decoding.

The 1982-1989 period

Policy formation and outcomes

During this period, the Socialist governments of PASOK (Panhellenic Socialist Movement), which were in office since 1981, had attempted to develop a national policy framework for biotechnology. Thus, in the early 1980s, the General Secretariat for Research and Technology (GSRT) (at that time the Ministry of Science and Technology) had announced that biotechnology was one of its three priority policy areas and had to be funded.

In charge of planning and coordinating the policy on biotechnologies had been GSRT while the Ministry for Agriculture had maintained some degree of freedom in terms of its own policy-making on agricultural biotechnologies: nevertheless, the two had been cooperating. The importance placed on biotechnology was reflected in the high priority it was assigned in the national long-term programme for the development of research and technology (Economou, 1991). Economou (*ibid.*) mentions that a survey was initially conducted in the context of that programme, aimed at all active researchers in biotechnologies. The survey covered their interests and potentialities as well as the diversity of research undertaken. The results of that survey, the national priorities, alongside information about the advances in biotechnology in other countries, have facilitated the establishment of a general master plan consisting of (*ibid.*):

- Strengthening and funding research of existing research centres.

- Foundation of new research centres in important areas of biotechnologies non-existent in Greece at the time.
- Funding research activities of Universities, research institutes of the Ministry of Agriculture, as well as industries in the public and private sector.
- Foundation of state-driven firms or funding private laboratories for making the most of the outcomes and applications of research.
- Promoting cooperation between research centres and industries.
- Participation in the programmes of the European Community concerning biotechnological research and mobility of scientists.

However, the policy initiatives undertaken had been only partially successful while there had been no explicit biotechnology programme during that period. Several regulations and laws were established in order to facilitate the alignment of Greece within the European Community: amongst others, a non-statutory regulation on gene therapy, which passed in 1984-1985 [Marouda-Chatjoulis *et al*. (1998)]. The government placed emphasis on infrastructure, which would enable biotechnology research to be carried out, mainly in (state) universities and public research institutes (Caloghirou & Zambarloukos, 2000). Thus, and in accordance with the aforementioned master plan, the Institute of Molecular Biology and Biotechnology (IMBB) in Crete was established in 1983. Since 1987, IMBB has been one of the seven institutes of the Crete-based Foundation of Research and Technology (FORTH) and has established close ties with the University of Crete. Its research, in the areas of insect molecular biology and molecular biology of unicellular organisms, has received a high degree of international reputation (Caloghirou & Zambarloukos, 2000). Another action was the establishment of a public company, BioHellas S.A., in 1984. The main investors of this venture were GSRT, the Agricultural Bank of Greece and the Greek Bank for Industrial Development (ETBA). Biohellas SA aimed at the production of [or aimed to produce] virus-free potato seed, veterinary vaccines and proteins from the exploitation of milk whey (Economou, 1991). This state venture was meant to act as an intermediary between the private industry sector and the state funded universities and research centres (Caloghirou & Zambarloukos, 2000). Unfortunately, it failed to meet expectations and finally the company was closed down in the early 1990s.

Shortly after the creation of Biohellas SA in 1984, the Greek Productivity Centre (ELKEPA) and the University of Crete joined forces to offer training courses in biotechnology as well as to conduct applied research especially in the field of agricultural biotechnology and environmental protection. In 1983-1984, five Biotech related conferences were organised, two by the government and three by scientific organisations (Marouda-Chatjoulis *et al*., 1998). The end of the 1980s offered some evidence of an institutional upgrading with respect to the increasing applicability of biotechnology. The Centre for Training and Development of the Agricultural Bank of Greece, participating in the EU project COMETT, developed an educational and training programme in English on agricultural biotechnology and organised a number of training seminars. GSRT established postgraduate studies in the field of biotechnology while the Hellenic Association of Biotechnologies was founded in 1988 (Caloghirou & Zambarloukos, 2000).

All in all, state and individual or groups of scientists' efforts bore results, although pronounced intentions and realised outcomes demonstrated quite a disparity. Thus, the programmes funded by GSRT, such as the programme for professional training which aimed to attract junior scientists for their training in biotechnological research and retain high-quality human research capital in Greece, and the grants awarded through the related research programmes of GSRT which offered the Greek Universities an opportunity to establish new curricula and scientific activities. Furthermore, fourteen state institutes and centres were reported as active in the biotechnological research in 1991 (Economou, 1991). On the other hand, despite the promising opportunities of biotechnologies, especially in the agrofood sector, and the state funded programme for the development of industrial research (PAVE) prompted no more than a handful of Greek enterprises, state or private, to extend their activities in biotechnological applications. Only a few new private companies were established, especially in the second half of the 1980s (Economou, 1991) while the linkages between industry and research were minimal, if not non-existent.

This marketing failure occurred despite the increasing allocation of state funds promoting research in biotechnology, as figure 1 indicates (Economou, 1991). It is important to note that

most of the funds that have supported biotechnological research in that period came from state resources, i.e. GSRT, the Ministry of Agriculture and state enterprises, while only 9,5% of the total funds were provided by the private sector [Economou (*ibid.*)]. Amongst the reasons behind such a poor performance one can list the high level of state protectionism at the time, favouring low-productivity firms, as well as the nature of incentives given to private firms, being purely fiscal instead of focusing on upgrades of the industries' potential.

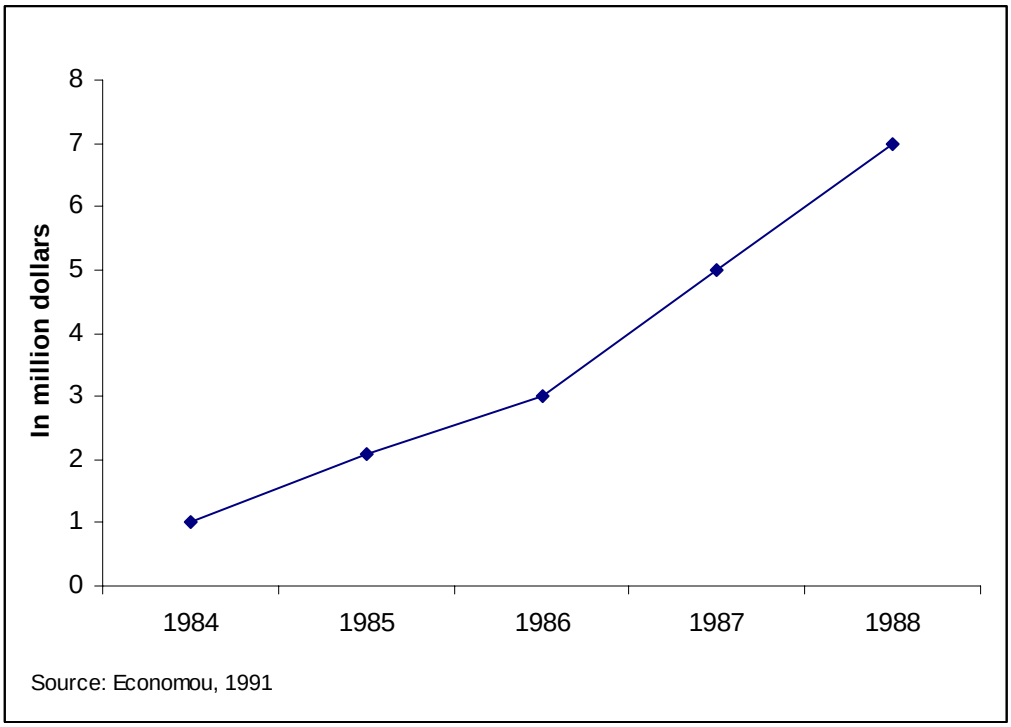

Figure 1

Framing

Setting the agenda

It is apparent from the aforementioned illustration of the policy-making spirit of the era that the main, if not the only, actor on the policy-making level was the Greek state. In the 1980s, the dominant political party (PASOK) with its socialist governmental practice had placed emphasis on the role of the state and its policy at that time was favouring research only inside (state) universities. Moreover, the negative economic environment can serve as an explanatory

factor for the lack of both biotechnology innovations in Greece and public interest in related issues.

The described lack of deliberative formats of public participation might be also attributed to the centralised character of governance at the time. Decisions were largely taken without much formal or informal input by any group outside the ruling party. Throughout the 1980s the socialist party, which was dominating in the political arena, had favoured corporatist governance in terms of strong emphasis in welfare state policy and rhetoric of historic reconciliation between the Left and the Right. Nevertheless, in science and technology policy-making, and especially on biotechnologies, the Socialists' record could be best characterised as 'discretionary': the policy-making was taking place with virtually no explicit interaction with any public, except expert scientists who were playing the role of informed consultants.

Thus, the main input to the policy process was emanating from the scientific community, inside which any controversies concerning the values and risks of biotechnology were debated. For instance, in response to the scientists' demand for a 'common body of action' on biotechnology's uses and applications, the state established Biohellas S.A in 1984, envisaged to act as the formal state policy body on biotechnology.

Framing issues

The restriction of biotechnologies within the scientific laboratories and the almost zero number of visible biotechnological products in the market had rendered the Greek public unaware of the issue. Thus, during this period there were no discussions in the public sphere concerning the applications of biotechnologies and/or the embedded moral elements. The technical issues of biotechnologies and their products remained as such, that is they had not become issues of wider public concern. Thus it is hardly surprising that in the Eurobarometer survey of 1991 more than half of the Greek respondents were unable or unwilling to answer certain questions concerning biotechnologies[1]. The survey's results also indicate that the Greek sample was the second least informed about the applications of biotechnologies, since

[1] We believe that the results of this opinion poll conducted just after the end of the period 1982-1989 could be utilised as qualifiers for our arguments concerning that period.

the ‘objective knowledge’ of biotechnology and genetic engineering mean index was 2.83 with a maximum of 7, while the EC mean was 4.09, as figure 2 indicates. Nevertheless, the Greek sample appeared as giving at the same time highly positive evaluation (+0.77) to the potential of biotechnologies to improve the life way in the next 20 years. They were less optimistic about genetic engineering (+0.62).

This mixture of optimism with relative unawareness can be explained as the result of a barren decade in terms of public debate about the applications of biotechnologies. Regulatory action had been scarce, while the ethical and moral concerns had not been integrated. In sum, biotechnologies in the 1980s did not constitute a hot issue for which stakeholders, such as scientists, activists or other informed actors would strive to capture the attention of a wider audience through mass media.

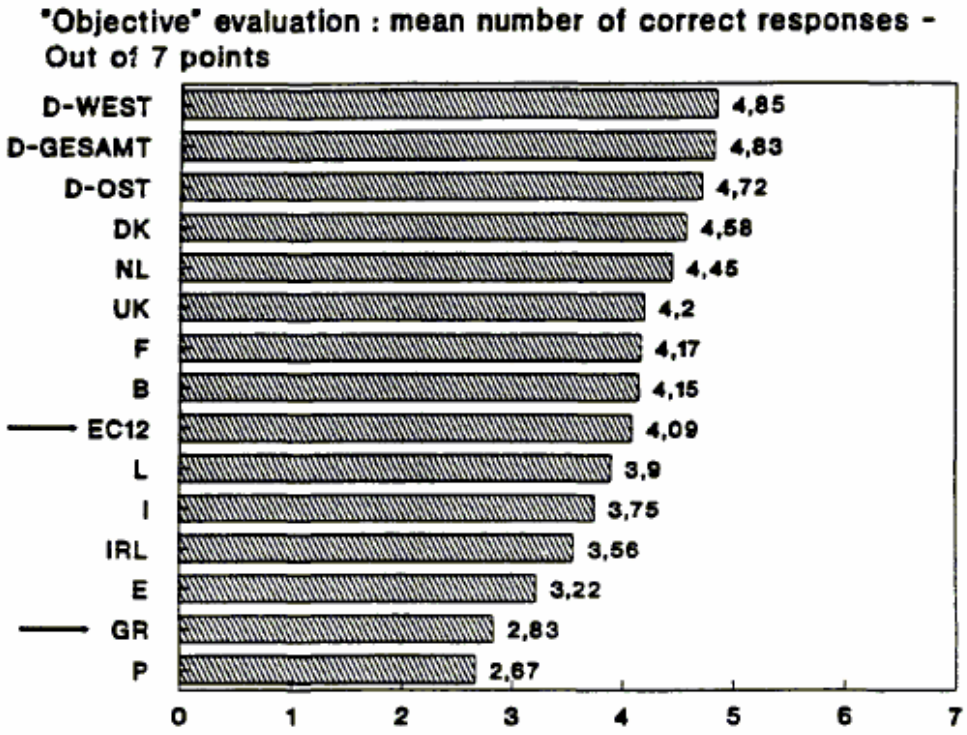

Figure 2

Framing expertise and publics

The professionals mainly involved in defining the issues regarding biotechnologies had been biologists. This is due to the fact that biotechnological applications were still in their incipient phase in Greece; thus, the discourse over the issue had remained on the home turf of the scientific expertise conducting research, a fact which established them as a separate category of actors: they were the only informed voices heard in state-organised conferences and surveys, aiming to facilitate the formation and implementation of the master-plan of biotechnologies development. In addition, the enhanced position of scientists had allowed for the top-down decision-making spirit of the period to distil down into a clear separation between experts and lay public -in terms of who had the right to talk about biotechnologies. Thus, in a 1991 Eurobarometer survey, the Greek sample appears to have strong confidence (31 per cent) on schools and universities, scientists' home ground, to tell them the truth about biotechnology or genetic engineering. Second in rank of confidence were the environmental organisations, which were to proliferate in the late 1980s and early 1990s (Botetzagias, 2001) as well the increased appearance of political ecologists and their ideas in the political and public sphere in the last years of the 1980s. Not surprisingly, Greek public authorities have received a relative high proportion of confidence (11 per cent) in comparison with other EC countries, where the degree of support for this latter source has never exceeded 9 per cent, except for Denmark with 16 per cent. Moreover, the demand of the Greek sample for government control in biotechnologies has been high in accordance with the same 'global requirement' across all of the EC countries.

The results of a survey conducted by Marouda-Chatjoulis *et al*. (1998) have shown that, in this period, the newspapers' coverage of biotechnology in Greece has been minimal compared with its counterpart in other EU countries. In fact, it was by far the lowest among all European countries. The first newspaper articles regarding biotechnology have started appearing in 1977, according to the aforementioned survey. The media were portraying an image of biotechnology-related events as occurring far from Greece, providing some feeling of security (Marouda-Chatjoulis *et al.*, 1998). The remaining three years of this period (1986-1989) were characterised by a relative silence regarding media coverage of biotechnology in Greece.

Despite the low coverage of biotechnologies by the media, it is reasonable to assume that the framing of the public during this period has been that of an entity left to be educated and enlightened about the advantages and disadvantages of the potential innovative products of science and technology research, including biotechnologies. This is apparent from the fact that the few newspaper articles concerning biotechnologies were reporting a rather reassuring image of potential health benefits through rapid medical and biological advances occurring far from Greece, while in the same time a small proportion was mentioning some concerns about the risks of opening 'Pandora's box'. Moreover, during this period there was no institutionalised nor interest representation on decision-making regarding biotechnologies that would conceive the public as an actor to be mobilised.

Forms and formats of participation

Public influence on biotechnology policy-making was minimal in the 1980s while the governments in office did not try to raise public awareness, a fact attributed to the low number of Greek firms involved in biotechnology. Moreover, Greek citizens were largely uninformed of the various issues related to its innovative products. The Greek set of deliberative mechanisms promoting public involvement in biotechnology assessment was virtually empty. It did not include neither tools providing information about the public nor official instruments of information dissemination to the publics. Furthermore, there were no efforts to facilitate interaction with the publics. This lack of deliberative procedures seems to have been a recurring characteristic of the policy-making spirit in Greece during the 1980s. Moreover, there exists no evidence indicating an active role by NGOs or other civil participants on issues pertaining to biotechnologies.

Scientists appeared to be the only actors included in consultation and decision-making. This active function of scientific expertise in the promotion and regulation of biotechnologies in this period is apparent in the case of Biohellas S.A., mentioned in the previous section, which was formed following the scientists' claim for a body regulating biotechnological research and applications (Marouda-Chatjoulis *et al.*, 1998). Thus, Marouda-Chatjoulis *et al.* (*ibid.*) have identified as the key constituencies of the period mainly scientific organizations, such as the

Greek Association of Chemists, the Greek Association of Biologists, the Greek Biotechnology Society, the National Hellenic Research Foundation, etc, which have traditionally adopted a 'pro-technology' stance (*ibid.*).

From 1989 to the Present

Policy formation and outcomes

The policy-making of the 1990s in Greece developed along two axes. On the one hand, there was a gradual reorganisation of the research system as well as of knowledge provision Greece, a trend guided mainly by the EC policy directives and the research framework programmes funded by EC structural funds. In fact, the national research strategies have been subsumed under the EC policy directives since the early 1990s while emphasis was placed on the absorption of EU structural funds and the participation in EU framework programmes (as a means to enhance university-industry collaboration and activity in areas of high technology). For the period 1989 to 1999, three structural programmes targeting science and technology were implemented in Greece, all of which were mainly financed by EU structural funds (see details in the Appendix).

On the other hand, decision-making was more or less forced to follow rather than lead the domestic debate over the applications of biotechnologies. These new applications became increasingly visible through media coverage while public awareness on the risks and moral issues attached to them started to rise. In parallel, Greek governments transposed EC and EU directives on biotechnologies into the Greek legal system. Various non-statutory regulations were adopted concerning genetic screening (in 1992), novel foods (in 1992), the use of GMOs (in 1995) and their deliberate release in the environment (in 1995) (Marouda-Chatjoulis *et al*., 1998). A number of EU directives were incorporated into Greek law: the EU directive 90/220 about the purposive release of GM organisms in the environment[2] and the EU directive 90/219 regarding the limited use of GM micro-organisms (both in 1995) while a committee supervising the implementation of these directives was established in 1996, counting among

[2] Until then, there was no framework governing the use and release of GM organisms

its members representatives from the Ministry for the Environment, Planning and Public Works; the Ministry for Health; the Ministry for Agriculture; the General Chemistry Laboratory of the State; the Ministry for Development; and two scientific experts (Caloghirou & Zambarloukos, 2000).

As far as policy activities are concerned, the early 1990s (1990-1993) were overshadowed by the Conservatives' government major economic reforms, aiming to 'reduce the huge and slow-moving state'. This focus on economic issues left the development framework for biotechnology almost intact: no new regulations were introduced, no scientific conference took place while the media coverage was minimal until 1992 (Marouda-Chatjoulis *et al*., 1998).

In the following years (1993-1997), the newly available, innovative products of biotechnologies, especially in agriculture, altered the debate allowing for new actors to be heard, besides the scientists. In 1993, the Ministry for Agriculture established the Organisation for the Control and Certification of Biological Products (OCCBP) to promote biological agriculture as well as to provide the means for controlling and certifying relative products (Marouda-Chatjoulis *et al*., 1998). The GMOs issue and Dolly's cloning significantly aroused public concern during the second half of the 1990s. This increased public concern fed-back into extensive coverage by the mass media while a number of debates, both on the press and on television, concerning ethical issues and the possible risks of cloning and of biotechnologies in general, were aired. At the same time, the National Hellenic Research Foundation organised a conference on biotechnology and its relations to society and the environment, including a panel discussion on the social and ethical aspects of biotechnology (Marouda-Chatjoulis *et al*., 1998): this might well be the first official discussion outside the scientific turf.

A turning point was reached with the experimental cultivation of GM crops in certain parts of Greece. Greenpeace-Greece opened the public debate when it revealed that a large shipment of GM Soya beans was imported from the USA. In 1996, Zeneca (now Syngenta) filled a request asking for permission to develop GM tomatoes, a permission granted a year later, by OCCBP.

Yet the protest mobilisation of Greenpeace forced the state to withdraw its initial approval (Marouda-Chatjoulis *et al*., 1998). This 'tomato-saga' received high publicity, causing an informal national dialogue especially in the media. This did not deter the government from approving four more experimental cultivations, three of cotton and one of corn, in 1998 (out of twelve requests) (Caloghirou & Zambarloukos 2000). Progressively, the public attitude towards biotechnology started to become increasingly negative. Consumer and environmental groups asked for stricter application of the law and, particularly, for labelling all products containing GMOs (Caloghirou & Zambarloukos, 2000; Marouda-Chatjoulis *et al*., 1998). As a result, in 1999 the Ministry for Environment decided not only to reject all submitted applications for experimental crops in that year but also to introduce a two-year moratorium on all experimental cultivations.

It had became clear that there existed the need for a body monitoring the advances in biotechnologies and consulting the government: thus the first relevant institutional body was created in 1998, under the title of the National Commission on Bioethics. It was an independent advisory body, reporting directly to the Greek premier. Its ruling Commission has nine regular members, all high-profile academics, and two supporting scientific assistants. Almost half of its members are experts on medical or agricultural applications of biotechnology and genetics, one is a professor of sociology, one of theology, one of philosophy and two of criminal and civil law, respectively, while its chairman, Dr. George Koumantos, is an emeritus professor of civil law at the University of Athens. The mission of this commission is to explore the ethical, social and legal impact of possible applications of the evolving biological sciences. In particular, it aims to investigate the various aspects of scientific advances in biology, biotechnology, medicine and genetics; to compose along with related ministries proposals of general policy and to provide scientific recommendations on related issues; to collaborate with international organisations and to represent Greece in international fora; to inform the public on issues related to biotechnology and the impact of its applications; to orientate and coordinate related governmental advisory bodies in the field of bioethics. So far, the Commission has made three recommendations on GM plants, genetic fingerprints and stem cells. Moreover, the Commission runs an awareness website, where relevant announcements are regularly posted together with proposals, related scientific

advances in Greece and other countries, information on conferences and links to other related scientific bodies, committees, NGOs, etc.

Subsequently, three more committees have been set up, one by each of the concerned Ministries: the Ministry for the Environment, the Ministry for Health and the General Secretariat of Research and Technology (Caloghirou & Zambarloukos, 2000). Responding to intense public anxiety, the Ministry of the Environment, in April 1999, announced that the General Secretariat for the Consumer would begin investigations to ensure that products containing GMOs include information about their ingredients on their labels (*ibid.*).

In the GM crops case, the government have been obviously caught unprepared to deal with Zeneca's request for experimental cultivations. This is due to the fact that there were no national actors with whom the government had previously negotiated relevant policies, but rather local branches of multinationals were dominating in the market and setting the agenda (Moses *et al.*, 2002). Despite the worldwide interest in applications of biotechnology and the increase of research programmes for, and funds' allocation to, biotechnologies, Greece has remained the only country among all the EU members that has not any biotechnology start-up companies (*ibid.*). In fact, since the unsuccessful endeavour of Biohellas SA in the mid 1980s, no other explicit biotechnological company has been founded in Greece. Although the amount of state funds targeting to biotechnology research was increasing in the 1990s (see figure 3), it has never exceeded 9% of the total R&D state funding, which in turn has always been one of the lowest among EU member countries (0.5% of GNP). Thus, the relatively small number of businesses applying biotechnology should not come as a surprise. One should also note that most of public funds for biotechnological research were directed to the development of agricultural production (i.e. 60 per cent of total funding for biotechnology in 1996): due to agriculture's important role for the Greek economy, the government was eager to promote research in applications of biotechnology on this specific sector (Caloghirou & Zambarloukos, 2000).

The previous examples of businesses, just using modern biotechnology techniques and materials, can be regarded as the only biotechnology companies. These few business activities

are mostly focusing on fermentation technology, plant genetics, diagnostics, protein engineering and enzyme technology, microbial genetics and marine biotechnology (Moses *et al.*, 2002). Furthermore, the lack of demand for know-how and applied expertise has affected the indigenous scientific community: scientists sought collaborations with multinationals or foreign firms, mostly at the EU level, thus insulating themselves from the local context (Moses *et al.*, 2002).

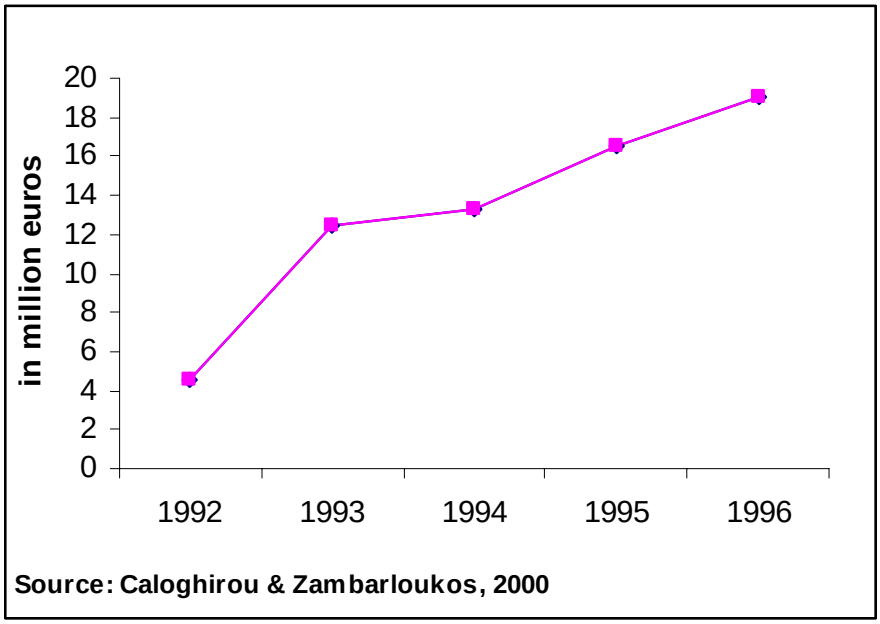

Figure 3

In the period under investigation, various ministries have been involved in policy making on biotechnology yet the most important actor has been the General Secretariat for Technology and Research (GSRT), subordinated to the Ministry for Development. GSRT has the general responsibility to design R&D policy and to set priority areas and target goals. It finances universities, research institutes, private sector research, as well as agricultural research institutes of the National Agriculture Research Foundation. In total, it supports 17 research institutes, 12 technological institutes and 4 science parks. GSRT's funding is provided mainly through competitive research programmes. Alongside GSRT, three more Ministries are indirectly involved into research policy by providing additional funding to various institutions conducting research on ministry-related issues: the Ministry for Education and Religious Affairs, the Ministry for Agriculture and the Ministry for Health.

The Ministry for Education and Religious Affairs contributes the most being the main financier (through the regular state budget) of public universities, technological institutes and specialised university-based institutes. The Ministry for Agriculture plays an important role in funding the National Foundation for Agricultural Research. It is important to mention that only GSRT and the Ministry of Agriculture support biotechnology research and development at Greek institutions through calls for programmes (Caloghirou & Zambarloukos, 2000). During 1997 and 1998, the National Agricultural Research Foundation was offering courses (typically of 150 hours duration) to farmers. Their syllabus included a description of biotechnology and its aims, basic biology and a discussion on the nature and applications of GM crops. In 1997, about 7.000 farmers have attended those courses, 40% of which focused on biotechnology (Sakellaris & Moses, 2000). Although these courses were suspended for 1999 and 2000, they were expected to restart under a new programme called 'Dimitra' in 2001. Finally, the Ministry for Health provides support for biotechnology research by funding the research centres of public hospitals.

Since 1998 Greece has been following the general directions of the European Council, as expressed at the Oviedo Convention on Human Rights and Biomedicine. The Convention explicitly forbids human cloning for reproductive or research purposes, while leaving open the cloning of other beings, yet it does not envisage any penalties for violators.[3] In September 2002, the Greek Ministry for Justice brought a new draft of law on human reproduction before the Greek Parliament and in December 2002 the bill no 3089/2002 on Human Assisted Reproduction was published. The relevant draft bill was elaborated by the *ad hoc* Committee of the Ministry for Justice, presided over by Professor George Koumantos (Chairman of the National Bioethics Commission) while the National Bioethics Commission commented positively on the regulations of the draft bill (decision of 11th October 2002). Among other issues, the law provides for: a) the possibility of post-mortem fertilization, b) the recognition of surrogate motherhood, c) the option of assisted reproduction for single women, d) the anonymity of the gamete donor, while a parallel record is kept for the benefit of the child's health. In addition, the law prohibits explicitly reproductive cloning while it allows the use of

[3] Daily Newspaper 'TA NEA', 27/11/2001

supernumerary gametes or fertilized ova for research or therapeutic purposes. Furthermore, embryo selection is prohibited, except when serious hereditary sex related disease has to be avoided. This law makes an effort to further modernise the Greek legal system on new biotechnological and medical advances, such as in vitro fertilisation (IVF), maintenance of genetic information, and the rest. According to the newspaper 'TA NEA'[4], although the issue of cloning for medical purposes stirred a controversy at the Bioethics Commission, the majority of the Commission's members did consent to exclude human tissues' cloning from the general banning of cloning.

Framing

Setting the agenda

The Socialists' (PASOK) agenda, who succeeded the conservatives' government in 1993, was markedly different from the one they pursued in the 1980s: they fully embraced the European orientation of Greece while they abandoned their previous ideas of the State's role as an entrepreneur. They stressed the need to 'modernise' the state, especially through introducing deliberative democracy. Nevertheless, their rhetoric failed to materialise: as far as biotechnology is concerned, policy-making has remained state's exclusive domain, while scientific expertise played an advisory role. As we have pointed out in the policy formation sector, although various actors were involved in policy making on biotechnology, they were mainly institutionalised (such as Ministries, GSRT) and expert advisory bodies. Pressure and interest groups, such as environmental groups and consumers' organisations, were never invited to join policy-making deliberations.

Furthermore, most policy initiatives were undertaken either within the context of EU directives' implementation or as a follow-up of foreign (i.e. EU) countries' trends and initiatives. They did not come about as response to indigenous debate or regulatory demands, save the case of GM food which was of special significance for the Greek public during the 1990s and became, accordingly, a focal campaigning issue for environmental and civil organisations. In all other issues emanating from the biotechnologies' applications, Greece simply tried to keep pace with developments at the EU level.

[4] Daily newspaper 'TA NEA', 13/09/2002. Also daily newspaper 'Eleytherotypia', 13/09/2002

Thus, the GM food was the only case when environmental NGOs and civil organisations, through their campaigning, have managed to open a public debate over a biotechnology issue. Their success seems to be highly related to their preferred way of presenting the issue to the general public (and the media). Thus, all anti-biotechnology NGOs in Greece focused their critique and reporting on GM *foods*, that is on what gets into the average Greek family's plate, while at the same time they were ignoring or understating associated environmental issues (Sakellaris & Moses, 2000).

Framing issues

In the period under investigation, scientists continued to play the central role in framing the contested issues, although ENGOs started to exhibit an increasing activity. Yet, chiefly the former were invited to television discussions and/or contributed articles in newspapers, clarifying the issues of biotechnology and related issues, like GMOs. It is through this media-induced popularisation of GM technology and cloning that citizens were informed about biotechnology's advances and potential risks. Despite the increased dissemination of information, the Eurobarometer surveys of the 1990s demonstrate that the Greek sample remained the least informed. This led to a greater anxiety experienced by the Greek public, which, in the 1999 Eurobarometer survey, appeared to be the least optimistic concerning the usefulness of and the risks emanating from most of biotechnology applications, i.e., agriculture and cloning. To the eyes of the experts this anxiety was clearly an outcome of poor understanding of the issues involved. Thus, Dr. Matsaniotis, emeritus professor of Pediatrics at the University of Athens and former President of the Academy of Athens, while addressing the Academy pointed out that 'ignorance causes fear and creates superstitions. Therefore, society needs to be familiarised with science's advances in order not to fear them. The average people are both interested in and able to understand scientific achievements, as long as they are presented to them reasonably and objectively.' [5]

In rough terms, when referring to biotechnology framing in Greece, one should keep in mind two points: first, the enduring low public awareness and, second, the absence of any focused

[5] Daily Newspaper 'TA NEA', 18/02/1998

governmental programme aiming to inform and engage the public into the debate over biotechnologies (Moses *et al.*, 2002). Despite the increased media reporting and coverage of certain biotechnological issues, such as cloning, GMOs and DNA decoding, the Greek public does not seem to have considerably improved their levels of understanding on these issues. In parallel, a biotechnological education policy in Greece was lacking, save the intrinsic, academic research. In fact, Mr. Deniozos, current head of GSRT, has affirmed this deficiency mentioning the existence of some future governmental plans on the popularisation of biotechnology (Moses *et al.*, 2002).

It will not be an exaggeration to state that in the second half of the 1990s, ENGOs like Greenpeace were the prime actors inciting public awareness of biotechnology. Yet, they did so on their pre-selected sub-issues (especially on applications related to food production -GM food, Soya, experimental cultivations-) and based on their preferred policy choice (opposing the use of GMO products). To that extent, Greenpeace has been periodically issuing a leaflet with the results of its surveys concerning food products in the Greek market that may or may not contain GMOs. It was through the campaigns and protests of Greenpeace and others that public opinion was shaping and public GMO opposition was fomenting. In the absence of any sustained counter-argumentation, these organisations have managed to upgrade their role in the eyes of the public and establish themselves as actors that had to be reckoned with. Nevertheless, and despite their 'societal education' activity, these actors were never invited to participate in the formal deliberative or decision-making process.

On the other hand, state agencies never embarked on such a 'visible' public campaign. The only institutionalised body responsible to examine the ethical and social issues falling within its competence, i.e. applications of biotechnologies, the Greek Bioethics Commission, adopted a 'closed' deliberation format, without explicit interaction or engagement with the public. The only thing resembling a 'public feedback' was the incorporation, into the Committee's recommendations, of the ethical and moral concerns of the wider public as these are reported in the media and in the Eurobarometer surveys. These recommendations aim, on one hand, to contribute to the formation of a reliable thesis (from a scientific and normative view) and, on the other hand, to assist policy-making. As regards the latter, and in striking contrast with the

NGOs case, most of the propositions of the Commission are taken into account in the elaboration of specialised related legislation.

It is important to note that despite the ENGOs' attempts to 'inform' the public and the State's ones to 'educate' it, never was it 'invited' to participate in the policy process. It is not by chance that a public conference or other public engagement procedure never took place in the 1990s.

Framing expertise and the publics

The actors most involved in defining and answering the issues emanating from biotechnologies were scientists, specialised in molecular biology and genetics. In our own survey of newspaper articles of 'Eleytherotypia'[6] concerning biotechnologies for the 1996 to 2002 period, we have found that scientific expertise has been the most active subject actor during the 1990s in terms of who makes the claim(s) in the newspaper article (see figure 4). Scientists have usually acted as public educators and informed voices through their articles and appearances in the media. Although they have occasionally mentioned the risks, the moral and ethical effects of biotechnological innovations, they were not negative towards them as were the environmental groups and citizen organisations. [?? Sense not completely clear]

As we have demonstrated in the previous section, between the two groups it was the ENGOs which have managed to attract the media coverage during the second half of the 1990s. This is certainly connected to the different approaches employed by the respective groups, yet it has also a lot to do with the media's way of doing business. The Greek media were more willing to report on 'disasters' and potential risks, in order to capture public attention, rather than depict the objective image of the pros and cons of a certain issue, a somewhat dull and technical narrative. In that spirit, the Greek media's coverage of the GM food controversy aimed to capitalise upon the public's interest on such a 'hot' issue. [To the contrary.However], they were rather unwilling to host debates that could affect policy-making. Due to the predominantly negative portrayal of GM food, the Greek public was, on average, opposed to GM crops while Greece was one of the EU countries which have called for the extension of

[6] A national daily newspaper of high circulation

the de facto moratorium on the commercial exploitation of GM crops (Eurobarometer, 2002, p. 14).

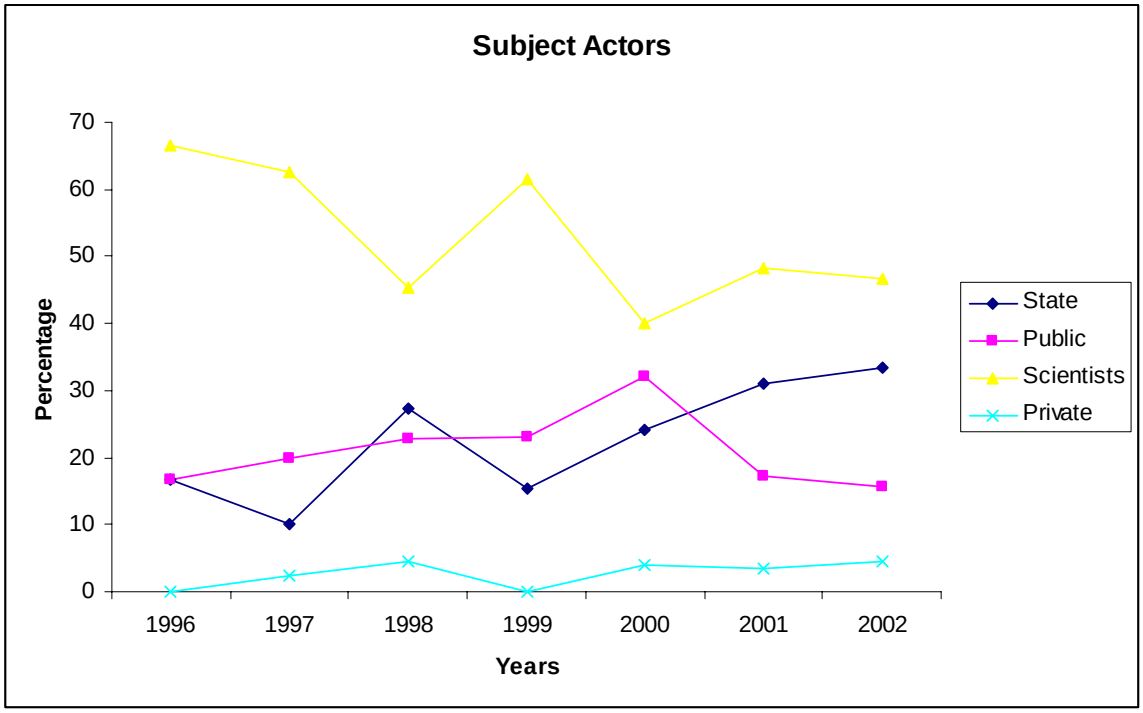

Figure 4

Contrary to the natural scientists' prominence in the GM food debate, as well as the overall policy-making process, the role played by social scientists was effectively minimal. They have remained by and large outside the public debate, not to mention policy making. Despite the issues' wider social implications, 'biotechnologies' were defined as a, primarily, technical issue. Faced with the products of cutting-edge research, worded in an unfamiliar and specialised terminology, the Greek media turned to those in a position to comprehend and popularise the issue. The qualified actors, largely perceived as being able to do so, were the natural scientists, reporting on what was going on in their labs and what the consequences might be for the lay public.

In this 'technical' debate, there was no room for 'non-experts' or the public. Their opinions entered the public sphere only through opinion poll surveys. In the early 1990s, and besides the usual rhetoric, very little was done in terms of raising the relevant issues or promoting public awareness and engagement with biotechnology. In turn, up to the mid-1990s, Greeks were the least informed amongst Europeans on issues regarding biotechnology. As the

Eurobarometer's surveys show (1991, 1993 and 1996), Greeks scored the lowest in understanding biotechnology (see figure 5). For instance, the mean percentage of Greek 'don't knows' in all Eurobarometer surveys from 1991 to 2002 was 44 per cent.

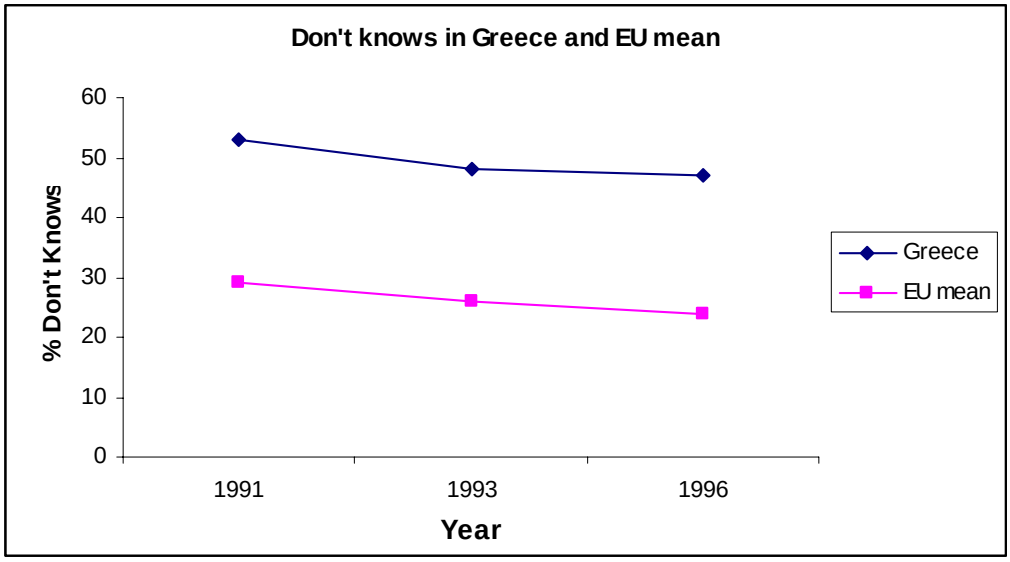

Figure 5

Nevertheless, limited and delayed awareness has not resulted in a negative stance on biotechnology in the early 1990s. Felicitous in their ignorance, Greek optimism about biotechnology was second only to Spain in 1991 (Eurobarometer, 1991). Yet it followed a downward trend, similar to the EU average, hitting rock bottom in the late 90s-early 00s (lowest in the EU both in 1999 and 2002) (see figure 6, Eurobarometer, 2002)[7].

[7] The GM tomato issue of the 1996-1997 period and Greenpeace-Greece strong reaction have certainly a lot do with the drastic drop of the Greek biotechnology optimism index in the 1996 & 1999 surveys

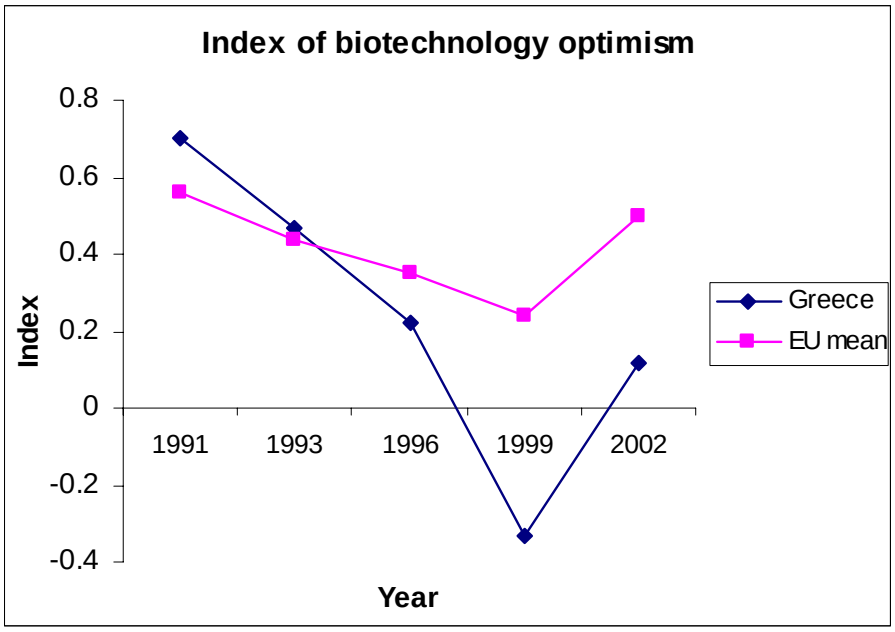

Figure 6

According to that year's Eurobarometer, in 1996 the Greek public was relatively positive on the usefulness of biotechnology in general. In particular, biotechnology was considered as having potentially positive effects in medical applications but the public was more sceptical about applications in the Agrofood and transplantation sectors. When questioned about the 'morality' of biotechnology, the positive opinions were significantly fewer, with the exception of genetic testing for inherited diseases (Eurobarometer 1996). Regarding the risk assessment of applications of modern biotechnology Greeks appeared to be highly concerned about the risks in food production and less in crops, plants or medicine use (*ibid.*). There was also a concern about the potential risk of transplantation[what does transplantation mean in this context?]. In general, Greece was just below the average of EU-15 regarding usefulness of biotechnology, while in the overall risk assessment Greece was ranked second from the bottom, superseding only Finland. On the overall moral acceptability, Greece scored 54%, when the EU-15 average was 55% (*ibid.*).

The increasing concern of the Greek public about biotechnologies is reflected in the next Eurobarometer results of 1999. The Greek sample was situated in the 'lowest limit' among Europeans on four of the seven reviewed biotechnological applications with respect to their usefulness: food production, cloning animals, human genes into bacteria and human tissue

cloning. Especially, in the first two applications, Greeks seemed to 'mostly disagree'. In the risk assessment, Greeks were especially uneasy with respect to food production but they were identifying the lowest risk (with Finland) in the detection of hereditary diseases. On the moral aspects of biotechnology, the Greek sample was the least tolerant in terms of morality associated with biotechnological applications. Greeks had the lowest moral acceptability for five out of seven biotechnology applications. The only two exceptions of this rule were in the gene transfer between plants and the detection of hereditary diseases. The Greek public had also the lowest averages in the encouragement of four out of seven biotechnology applications: food production, cloning animals, human genes introduction to bacteria and cloning human tissue for medical purposes (*ibid.*).

From 1989 onwards, the media coverage of biotechnology issues was growing, as it is demonstrated by the sustained increase of media reports. According to the survey of Marouda-Chatjoulis *et al.* (1998), up to 1993, reports on biotechnology were characterised by a focus on its medical benefits as well as on events taking place at a safe distance from Greece. The concept of 'progress' was dominant in an increasing number of related articles, while 'risks' have been rarely mentioned. Furthermore, in this period, industry has emerged as a key stakeholder (Marouda-Chatjoulis *et al.*, 1998). From 1993 to 1996, 'biotechnology' continued to appear in an ever-increasing number of reports however it was included in more generic reports on technological achievements: in other words, it was just touched-upon. Its rather positive acceptance continued while the fear of opening Pandora's box has been rarely mentioned. While in the first years of the media coverage on biotechnology the fear of doom was accompanying the context of progress, it appears that in this second phase, especially in the years 1993-1996, biotechnology articles were dealing more with pragmatic issues and the entailing questions concerning morality and ethics. Dolly, the cloned sheep, (and cloning in general) have received extensive media coverage, especially in newspapers. More recently, the Human Genome Project and the identification of human DNA have received very high publicity both in newspapers and the electronic media, where experts regularly have been debating on the pros and cons of biotechnology.

In our survey of newspaper articles in 'Eleftherotypia' during 1996-2002 we found similar evidence to Marouda-Chatjoulis *et al.* (1998) survey. The articles concerning biotechnologies

were increasing throughout the 1990s. On the other hand, the rather positive initial position of most of these articles towards the applications of biotechnologies has been altered dramatically by the end of the 1990s (see figure 7), as the steep descent of the corresponding line indicates. The turning point of this shift seems to be somewhere between 1998 and 1999, a fact consistent with our illustration of the debate over GM food, as well as the evidence of the Eurobarometer surveys. The end of the 1990s and the early 2000s suggest a rather expected trend of all three positions (positive, negative and neutral) towards convergence.

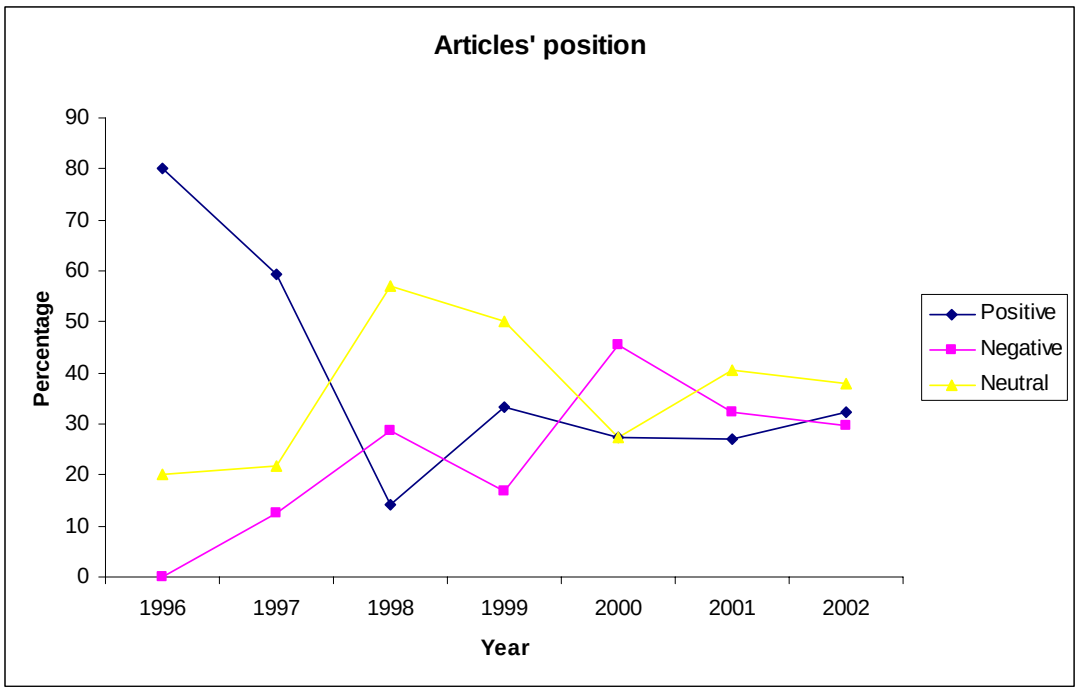

Figure 7

As we have mentioned earlier, in the early 1990s biotechnologies were considered as a primarily scientific field rather than an area where public engagement was significant or sought after. By the end of the 1990s, when GM food and cloning had entered the public discourse, public attitude started to play an important, although indirect, role in the overall management of the policy process. In the 'tomato-saga' it became clear that 'biotechnology' had became an issue capable of mobilising the public, one potentially entailing political costs to insensitive governments. As a result, the legitimising role of the state had been upgraded, in response to the public demand for state regulation of the biotechnologies in order to ensure

safety in areas of increased concern for the Greek public, such as food production, cloning and transplantation. This augmented public demand on State legitimising role is reflected in our newspaper survey. The state, i.e. government and public services, increasingly appeared as targeted actor of claims reported in the articles of 'Eleytherotypia' (see figure 8). While in 1996 the state was the last among the targeted actors (in terms of frequency of appearances), by 2000 it had overcame three-fold the percentages of the two other most prominent targeted actors, the 'scientists' and the 'public'[8]. However, the latest trend points to a decline of the 'state' and 'scientists', as targeted actors to decline while the 'public' constitutes the majority of the targeted claims.

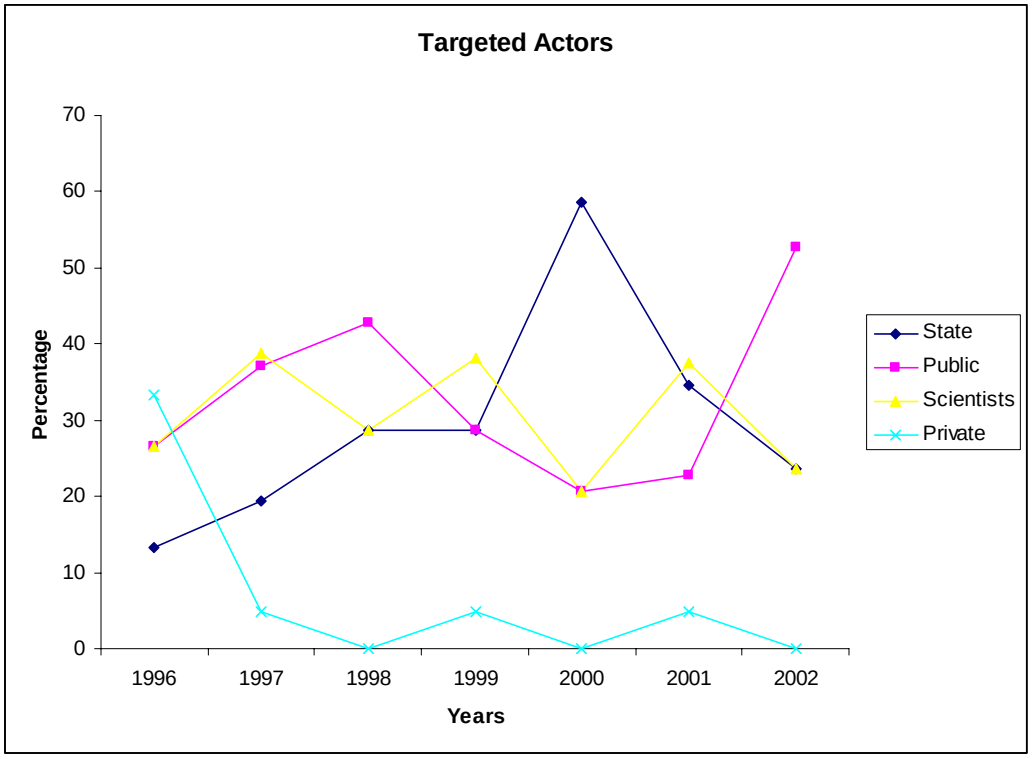

Figure 8

As we have indicated, the private sector has always been the least significant of actors engaged in biotechnologies' discourse. This could be attributed to the absence of an indigenous, developed biotechnological industry. This pattern reappears in our own survey. The private sector is the least mentioned actor in terms of 'who makes the claim' (subject

[8] The 'public' category includes individuals and/or actors not grouped under the remaining three categories

actor-see figure 4); 'at whom the claim is addressed to' (targeted actor-see figure 8); and, 'who will be affected if the claim is realised' (affected actor-see figure 9).

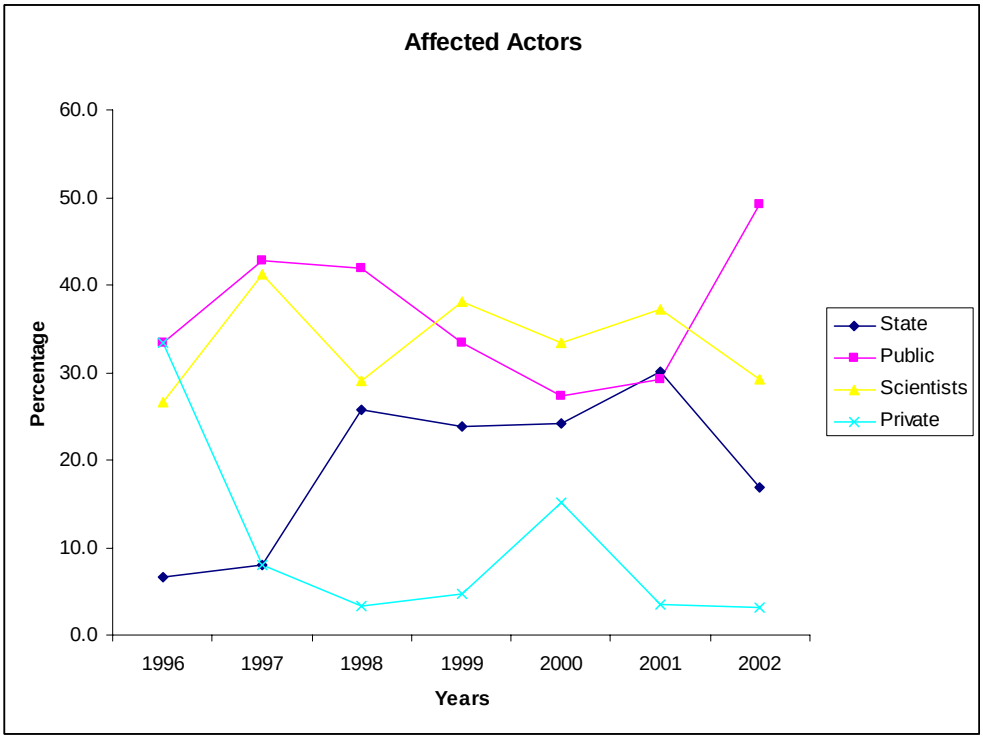

Figure 9

The latest available data on Greek attitudes on biotechnology offer us some useful insights. In the last survey of the Eurobarometer series (Eurobarometer, 2002), the Greek sample has continued to appear the least optimistic among all Europeans towards the applications of biotechnologies (see figure 5). Nevertheless, Greeks have followed the general European trend increasing their level of optimism from the nadir of the 1999 survey. As it is indicated in the survey, there is a plethora of possible explanations for this trend. One could be that the *de facto* moratorium on the commercial utilisation of GM crops might have taken 'the heat out of this controversy'. Another plausible reason is the promise of new medical breakthroughs following the completion of the sequencing of the human genome (Eurobarometer, 2002).

Concerning their support of or opposition to the various applications of biotechnologies, Greeks were supporting the so-called 'red biotechnologies' (i.e. medical uses such as genetic screening, GM enzymes and, surprisingly, cloning) while they were rather opposed to the so

called green 'biotechnologies' (i.e. applications of the agrofood sector such as GM crops and food) and xenotransplantation (*ibid.*). The Eurobarometer results point to such a persistent, low level of engagement for the Greek public, that there is a mention of a possible North-South divide on the biotechnologies' issue. Greeks have responded that they have rarely discussed these issues while their knowledge about biotechnologies continues to be the lowest together with the Portuguese sample. Nevertheless, most of them indicated they would like to take part in public discussions or hearings and that [??]they would spend time to watch a TV programme about biotechnologies (*ibid.*). This could be a sign that the Greek public desires to further engage with biotechnologies and the related processes of policy-making.

Forms and formats of participation

In the 1990s, the public involvement in biotechnological issues has been rather enhanced in terms of formal mechanisms of information dissemination to the public, such as the awareness website of the Bioethics Commission. Nevertheless, interaction with concerned publics, other than experts, has remained outside the Greek set of deliberative tools.

The debates over the applications of biotechnologies have exited the scientific turf of the 1980s and entered primarily into the public sphere in the second half of the 1990s. The lack of novel deliberative tools in Greece has transformed the press and particularly television into the main carriers of the debates. Scientists, activists, clerics, members of the Greek parliament and magistrates have been the main participants in discussions on the mass media, which were covering protests or milder pressure actions driven by environmental and civic organizations. Although the government had incorporated the two central EC directives on GMOs (90/219 and 90/220) since 1995, it has appeared unprepared to anticipate the extent of the issue of GM food and the Syngenta applications. Moreover, the absence of native Greek industries specializing in genetic engineering as well as a possible initial misjudgement of the public impact of these innovative technologies by Greek scientists during the 1980s (when biotechnologies have been mainly 'another' research area), might provide some, although insufficient, explanation of the corresponding inability of scientists to initiate a wider public debate in the first place.

However, scientists have played, and still do, a central role in the debates and decision-making processes during the 1990s. They have been the informed voices both in the public sphere and the national political arena. Nevertheless, they were not anymore alone in defining the issues as it had happened in the 1980s. Issues have been raised by activities of other actors, such as multinationals and environmental and consumer organisations. New actors have emerged primarily in the public arena, especially in the GM food debate. Those were ENGOs, such as Greenpeace, which at that time were attracting a relatively high amount of public attention and press coverage through their demonstrations and protests regarding the imported GM Soya seeds and the eventually rejected cultivation of GM tomatoes from Syngenta.

Another prominent actor has been the organisation E.K.Poi.Zo (Union of Consumers for the Quality of Life). In contrast to Greenpeace, E.K.Poi.Zo was using conventional pressure measures such as press releases, conferences and interviews in the mass media, as well as educational campaigns in primary and secondary schools. It has dealt with GM crops but it has never undertaken any specific product testing, as Greenpeace systematically does. The position of the organisation on GM food has been that there is a need for testing in the case of animals for several years before the implementation of tests on human volunteers and finally on a limited portion of the public. Only if such a testing schedule were followed, would the organisation withdraw its objection, provided further that GM food carries explicit labels. Regarding gene testing, E.K.Poi.Zo has appealed to the moral aspects of the issue; it has demanded that insurance companies should not have access to personal genetic data. Furthermore, the organisation has some concerns about the value of advance warnings to individuals based on their genetic tests (Sakellaris & Moses, 2000).

Apparently, the introduction of NGOs in the debate has altered the mode of deliberations regarding biotechnology. Since these organisations commonly adopt pressure measures ranging from conventional ones (such as press releases) to protest activities (such as demonstrations) the Greek state was forced for the first time to abandon discretionary politics and (appear to) enter into deliberative governance. Nevertheless, this was not the outcome of a trend towards consensus regarding biotechnological issues, but it was rather due to persistent

characteristics of the Greek political system, such as trapping votes and minimizing political costs.

Although since the 1990s the Greek governments are much more sensitive to what is going on in the public sphere on issues concerning biotechnologies, the delimitation or exclusion of other publics from the institutionalised deliberations, except scientists, was sustained. For instance, the main authorised advisory body, which is the National Commission of Bioethics, is actually a committee of scientific and law sages. In their dual capacity as consultants to the government on biotechnology issues and informers of the public about the applications of biotechnologies and the related moral issues, members of the Commission have often participated in public discussions as well as in debates on television and the press (Sakellaris & Moses, 2000).

Discussion

The issue of biotechnologies in Greece was perceived as primarily a ‘technical’ subject. The government - at all stages - simply rode the wave of scientific innovation and EU legislation. Thus, it relied on a combination of late state-driven development of biotechnologies and discretionary governance, especially in the 1980s. In other words, the government never puzzled itself over the social acceptance of its policies: the ‘technical’ cons and pros had to be determined by ‘scientists’ while the state was to introduce a set of ‘regulative rules’.

As usually is the case, this approach proved its limitations at the first signs of ‘externally’ imposed stresses in the mid 1990s. Effectively banned from the decision making process, the emerging NGOs of the nineties did what they do best: appealed to the public, in their usual eschatological rhetoric, through the media, which were only too eager to cover a story spiced with mentions of doom. The sharply increased public anxiety had, then, forced the government to withdraw from its initial plans.

Unfortunately, this clear failure of the existing model of decision-making did not spur the government into re-thinking the underlying logic of the arrangement. Rather, it was perceived as one of these times when things simply go wrong and one is best advised to hide the debris under the carpet and move along. Greece sided with the EU-countries calling for a moratorium on GM food – thus, neutralising an obvious rallying focus for the ENGOs - while the scientists and the various state committees were left to continue their research and deliberations.

In other words, the discretionary model of governance has prevailed up to date. The Greek state, unaccustomed to deliberative processes, was equally unwilling to embark on an 'educational' approach which could (?) relax the tension surrounding the issue. The manifest ignorance of Greeks on the subject, coupled with their expressed interest in informing themselves, offers a unique opportunity-window to distil into the public the government's agenda on biotechnologies. Yet, it seems that this opportunity is being left to pass by: despite the rhetoric to the contrary, no sustained educational campaign has been undertaken, a clear sign that the government feels secure that when the next crisis comes around the usual quick-fix patches could be employed once again. Such an approach points towards an, unspoken, hegemonic feeling of security. The government feels strong enough to opt-out of any involvement with the public, confident in its appraisal that it can 'self'-manage the points of discontent down the road.

Alas, the past Greek experience testifies to the wisdom of such an approach. As it will become clear in another Greek case study – that of the environment - the societal actors had never been strong enough to force the government into a, more, deliberative form of governance. The rare instances that it happened, it was due to supra-national developments and pressure, and not to an indigenous shift towards greater public involvement into the decision-making.

Appendix

In the second period of biotechnology policy-making in Greece, the following structural programmes were undertaken (GSRT, 1994, 1994b):

- EPET 1 (1989-1993): The aim of this programme was to link science with industry through the creation of scientific infrastructure (including research laboratories) and the enhancement of skills through education. In this programme, 4.1 million euros were spent for biotechnology R&D activities and infrastructure (Zechendorf *et al*., 1996).
- STRIDE Hellas (1990-1994): Goals of the programme were to link Greek institutions of Science and Technology (S&T) with European and International Networks, to establish a native scientific network with the participation of industry, to improve the available infrastructure, to enhance technology education and mobility of scientists. In this programme, 6.4 million euros were spent on biotechnology (Zechendorf *et al*., 1996).
- EPET II (1994-1999): This programme aimed to improve S&T research in such areas as biotechnology, to enhance industrial research and technology transfer through collaboration between industry and academia, to restructure and reorient S&T infrastructure and to enhance skills through education and mobility of scientists.

Under the EPET II umbrella-programme, various programmes were funded, most of which were aiming to strengthen the collaboration between science and industry.

- EKVAN: It supported projects submitted by joint ventures of research organisations and private firms. During the first EKVAN call and EKVAN-P, 9.6 millions ecu and 12.3 million ecu, respectively, have been allocated for biotech projects. Through EKVAN second call (1998-2001), the corresponding amount was 12.3 millions ecu (Caloghirou & Zambarloukos, 2000).
- PAVE: Its target was to advance industrial research. In this programme, 1.3 millions ecu were spent for biotechnology since 1994 (Caloghirou & Zambarloukos, 2000).
- PENED: It aimed to enhance human research potential via training and mobility. In this programme, 0.9 millions ecu were spent on biotechnology (Zechendorf *et al*., 1996).

- YPER: It financed research fellowships. In this programme, 0.49 millions ecu were spent during 1996-98 for biotech doctoral research, in which 25% of the funding came from industry.
- SYN: It promoted cooperative projects between the research community and industry; 50% of each project's budget was contributed by industry. Approximately 1.83 millions ecu were spent under this programme during 1995-1996 and 1998-1999 (Caloghirou & Zambarloukos, 2000).

Under the new Operational Program for Competitiveness (EPAn) 2000-2006, which finances projects on research and technology development in domains of high importance for the Greek economy, there is a priority sector, named Biomedicine, which is expected to encompass medical applications of biotechnology (GSRT, 2002).

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