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Science and Technology Policy in Greece. Policy Initiatives for R&D Cooperation

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SCIENCE AND TECHNOLOGY POLICY IN GREECE. Policy Initiatives for R&D cooperation.[1]

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Technical Abstract

The introduction of new elements in the Greek Science and Technology policy has not been followed to the same extent by an explicit concern for the promotion of R&D cooperation. National policy in that respect has been shaped to a large extent by the European Commission's policy initiatives. The EU Framework Programmes and the European Support Framework I&II, although they played an important role in setting favourable conditions for the development of R&D cooperation, it would be unrealistic to expect that they could alone influence the attitude of the Greek industrial system towards this type of cooperation. National initiatives in the field of S&T policy have followed the general orientations of the EU policy but until now have failed to establish an authentic set of coherent actions aiming at strengthening interactive processes and establishing intense linkages among economic actors. It is argued that there is no independent growing interest for the promotion of R&D cooperation, neither from the policy makers side nor from the side of the private economic actors. No significant changes in competition and IPR rules have been introduced to promote R&D cooperation.

Non-Technical Abstract

R&D collaboration has been widely promoted during the last 15 years as a mean for improving industrial competitiveness, reducing technological gaps among countries and regions, strengthening the science base of the system through the establishment of dense relationships among economic actors and influencing technical change.

Other policies as well, namely competition, trade, IPR and other regulation forms may strongly influence corporate decisions regarding technological development. Technology policy makers have a number of means of influencing economic agents' behaviour regarding the establishment of links and interactive processes, including subsidies, modifications of competition policy to allow for cooperation, laws protecting intellectual property and institutions for the diffusion of new knowledge.

This paper studies the science and technology policy in Greece, with special concern on regulations promoting or interfering with the phenomenon of cooperative R&D. In addition the paper discusses the extent to which competition and IPR policies influence the formation of cooperative R&D agreements.

The experience of the last 20 years in the Greek science and technology policy points out the growing concern regarding the technological development and the introduction of new elements in the Greek institutional set-up that may encourage economic actors to improve their technological and organisational capabilities. Policy initiatives during this period have been shaped to a large extent by the orientation of the European Union's S&T policy. In this context, inter-firm cooperations have been viewed as a mechanism for establishing interactive processes among actors during the 90's and all initiatives undertaken for promoting R&D cooperative agreements were inspired mainly by European policy on research.

The major steps of S&T policy in Greece over the last 20 years show an evolution towards a more European consistent framework of policy tools. Policy makers in this context seem gradually to recognise the importance of linkages and knowledge flows in strengthening the innovative performance of the Greek industrial system. In this respect promotion of R&D collaboration has been introduced recently as a mean for developing interaction among different types of organisations (Universities, firms, research institutes etc.), aiming to underpin innovative processes. However, although policy initiatives for supporting R&D collaboration show a certain interest for this type of research activities, it doesn't appear that public and private actors have integrated the involvement in R&D collaborations in their

technology strategy. On the contrary, they do not seem to disassociate their R&D activity from public support.

Regarding competition and IPR policy, for which in Greece there is no strong tradition, no dramatic change has occurred concerning cooperative agreements. Greek legislative framework has introduced new elements consistent with the Treaty of Rome and the European Patent Convention.

The paper is structured as follows. The first section provides a picture of the key characteristics of the development of Greek industry and the main characteristics of the Greek Science and Technology System. The second section presents the evolution of the Greek technology policy, trying to reveal the main points, which relate to the formation of cooperative R&D. The third section focuses on competition and IPR regulation and their interference with the establishment of a context promoting or inhibiting the formation of cooperative R&D agreements. The last section summarises the main points and presents some conclusions.

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1. THE GREEK INDUSTRIAL SYSTEM: TRENDS AND TECHNOLOGICAL CHARACTERISTICS [3]

During the '50s and '60s, a spectacular rate of growth was observed in the Greek economy (table A.1 of the annex), based on the development of an important range of heavy industrial activities as well as on the flourishing of a spectrum of industries that composed the traditional basis of the Greek industry (textile, food and beverage). After this period of high performance, the Greek economy entered a phase of crisis, falling behind European member states in terms of productivity and competitiveness. Labour productivity growth in the business sector deteriorated in the '80s and '90s and growth rate in manufacturing was more sluggish than at the economy-wide level (table A.2 of the annex).

The main concern of Greek industrial policy during the last 20 years has been to face these problems and establish a new framework of policy intervention in the context of the European Union.

The discussion on the industrial development in Greece relates to a great extent the inadequacies of the Greek industrial system to technological issues.

Some general observations regarding the Greek industrial development and technological transformation for the period after the second oil shock may shape the context in which Greek Science and Technology Policy was formed. These constitute specific features that differentiate the Greek industrial system from other countries that could be considered of a similar development stage (Giannitsis and Mavri, 1993).

Greek industrial system specialises in low tech areas, where it confronts the competition from countries whose competitiveness lies in low wages, whereas it stands behind in what concerns high tech activities (table A.3 of the annex). Regarding services that represent a high share of the added value in Greece, available evidence points to low productivity levels in Greece, compared with other OECD countries (OECD, 1998).

The basic element of the transformation of the Greek industry has been technology transfer via import of capital equipment, foreign direct investment and licensing. Technology transfer was considered one of the main tools to improve competitiveness of Greek firms, especially during a period of globalisation of competition, of integration into the European Community and trade liberalisation.

However, low export intensity of recipient firms, the weak performance of Greek manufacturing and the increasing deterioration of the competitive position of Greece in technologically advanced activities, raise serious questions about the extent to which Greek firms succeeded to exploit technology transfer in order to upgrade their technological and organisational capabilities (Giannitsis, 1991).

The business sector failed to make systematic efforts in R&D and innovation activities, whereas the linkages of the productive and scientific system proved to be very weak. Taking into account the increased exposure of the Greek industry to foreign competition, especially from the early '80s, this problem hastened the deterioration of the Greek position to international trade (increased import penetration and low export market shares).

[3] The "STEP to RJVs" project was co-ordinated by Yannis Caloghirou, National Technical University of Athens/Laboratory of Industrial and Energy Economics. Project participants are: NTUA/LIEE (Greece), SIRN (UK), FEEM (Italy), IDATE (France), Stockholm School of Economics (Sweden), Universidad III de Madrid (Spain), PREST (UK).

For a long time high level of protectionism ensured high levels of profits to Greek firms preserving their monopolistic position (Vaitsos and Giannitsis, 1987). Policy initiatives included development laws, trade policy for the goals of industrial policy (tariff protectionism), export subsidies, exchange rate (drachma depreciation and speedy slide), direct intervention for saving ailing firms, government procurements. Most policy tools aiming to improve productive patterns and competitiveness maintained the productive and corporate status quo and economic agents relied comfortably on practices that played the role of amortisation of the effects from liberalisation of markets. However, it is worth mentioning that in the light of the European Integration, public authorities have lost most of these policy tools that used to offer protection to the Greek firms.

Trends in research and innovative activity of the Greek industrial system influence today industrial and technology policy decisions.

As indicated in the following table, gross domestic expenditure on R&D (GERD) as a percentage of GDP is one of the lowest among EU countries.

Table 1: Gross domestic expenditure on R&D (% of GDP)

country	1985	1990	1991	1993	1995	1997
Greece	0,3	0,4	0,4	0,49	0,48	0,49
Ireland	0,8	0,9	1,0	1,2	1,4	
Portugal*	0,4	0,5	0,7	..	0,6	
Spain	0,6	0,9	0,9	0,9	0,9	
Italy	1,1	1,3	1,3	1,3	1,1	
France	2,3	2,4	2,4	2,5	2,3	
Germany	2,7	2,8	2,6	2,4	2,3	
Sweden	2,9	2,9	2,9	3,4	3,6	
UK	2,2	2,2	2,1	2,2	2,1	
USA	2,9	2,8	2,8	2,6	2,6	
*: 1992 instead of 1991. Source: a) OECD, Science, Technology and Industry Outlook, 1998. b) GSRT, Research in Greece", 1999.						

The evolution of business expenditure on R&D (BERD) as a percentage of GDP, as it appears in table 2, shows the weak level of Greek firms expenditure on R&D compared with other EU countries. Although this percentage increased during the period 1988-1993, it presented a slight decrease in 1996 and 1997.

Table 2: Business Expenditure on R&D as a percentage of GDP

country	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1995**	**1996**	**1997**
Greece	0,09	0,08	0,10*	0,10	0,12*	0,13	0,13	0,11	0,11
Ireland	0,47	0,49	0,52	0,62	0,66	..			
Portugal	0,12	..	0,16	..	015	..			
Spain	0,41	0,42	0,49	0,49	0,46	0,43			
Italy	0,70	0,73	0,76	0,77	0,77	0,75			
France	1,35	1,41	1,46	1,48	1,51	1,50			
Germany	2,07	2,07	1,98	1,81	1,70	1,66			
Sweden	..	1,93	..	1,95	..	2,15			
UK	1,47	1,49	1,51	1,42	1,43	1,44			
USA	2,00	1,96	2,00	2,07	2,04	1,95			
*:estimations Source: GSRT, "Research in Greece in 1993", 1997 & 1999.									

The breakdown of R&D expenditures by source of financing and performing sector, as appears in table 3, reveals that by the mid-'90s, firms financed half of EU R&D and performed more than two-thirds. However, in Greece the breakdown shows the relative small contribution of the business sector in funding R&D. At the same time table 3 reveals the significant contribution of government in R&D funding as well as of sources from abroad,

which mainly consist of EU Framework Programmes, Structural Funds and other foreign sources. According to the figures below the business sector performed 26,8% of the R&D in Greece, which is well below the European respective average. The Government and the Higher Education sector performed the rest, which is high when compared with other European countries.

Table 3: R&D expenditure by source of financing and performing sector in 1996 in % of national total

country	source of financing				performing sector		
	Firms	Govern ment	Other national sources	Abroad	Firms	Govern ment	Higher Education
Greece*	20,2	46,9	2,6	30,3	26,8	32,0	40,7
Ireland**	67,4	22,6	1,8	8,2	70,5	9,7	19,2
Portugal**	18,9	65,2	4,0	11,9	19,8	26,7	33,7
Spain	44,5**	43,6**	5,2**	6,7**	48,6	31,8	18,5
France	48,3**	42,3**	1,3**	8,0**	61,5	20,4	16,8
Germany	60,8	37,0	0,3	1,9	66,3	18,1	15,6
EU**	52,7	39,1	1,7	6,5	62,0	16,1	21,0
*:1993 instead of 1996, **:1995 instead of 1996. Source: OECD, Science, Technology and Industry Outlook, 1998.							

However, low R&D expenditure is not an indicator that alone could evaluate innovative efforts in Greece. As empirical evidence from OECD countries indicates, only 30-50% of all innovation costs relate to R&D expenditure (OECD, 1998). The rest is expenditure on product design, market analysis, outsourcing and expenditure on patents and licenses. The breakdown of innovation expenditures, as occurred from CIS I data shows however that in Greece, the major sum spent by Greek firms is on R&D and very low amounts are spent for patents, licenses and market analysis (ibid, p.58).

As it is increasingly recognised, innovation relies to interactive processes and knowledge flows. One of the main problems in the Greek S&T system is the limited linkages between economic actors and the weak infrastructure for diffusion of information and knowledge. Interaction among firms as well as between firms and the scientific community are weak (Deniozos, 1996). This can be observed in the structure of GERD inflows and outflows (table A.4 of the annex), according to which private firms financed only 1,4% and 0,5% of respectively the Universities and Public Research Institutes (PRIs) expenditure on R&D. In the same time infrastructure for scientific and technological services, networks of information and databases are at an early stage of development.

The above presentation pointed out the main problems that challenge the evolution of the Greek industrial system.

The following section presents more in detail the characteristics of Science and Technology Policy in Greece and discusses specific actions that promote interaction among actors and R&D collaboration.

2. THE EVOLUTION OF TECHNOLOGY POLICY. WHERE DO POLICY OBJECTIVES CROSS THE PROMOTION OF COOPERATIVE RESEARCH AND DEVELOPMENT?

We can distinguish three stages of Science and Technology Policy in Greece[4]:

2.1. The policy before 1983.

Before 1983, relatively little attention was paid to endogenous technological development. The responsible Ministry for R&D issues was the Ministry of Culture.

As pointed out in the previous section, the main concern of industrial policy was to improve the technological base of the industrial system via technology transfer. Foreign direct investment and licensing have been the cornerstone of public intervention. Law 2687/1953 and specific agreements between the Greek State and foreign investors aimed to attract FDI, especially until 1974. Regarding licensing, although the Greek government considered it as a tool for upgrading Greek firms' performance and competitiveness, public intervention failed to turn licensing agreements into a mechanism of knowledge flows and development of technological capabilities (Giannitsis and Mavri, 1993).

At the end of this period and in light of Greece's participation in the European Union some institutions are founded in order to improve infrastructure and help the restructuring of the industrial system. The following table presents specific actions that formed the first attempts for upgrading the Greek S&T system.

However, all these efforts did not seem to have spectacular results: the public organisations had the rigidities of their originator, i.e. the Greek public sector; incentives for the development of academic research were not adequately linked to industrial needs. Universities tried to take advantage of the possibility to finance research from third parties although the private sector did not show signs of great interest into what Universities had to offer.

Table 4: Specific policy actions before 1983.

Actions	Objectives
Foundation of the National Organisation of Small and Medium Sized Enterprises and Manufacture (EOMMEX)	To support the SMEs through training, promotion of joint ventures and subcontracting, marketing assistance and technological development of SMEs
Foundation of the National Organisation of Standardisation (ELOT)	Introduction of modern standards in the Greek productive system
Creation of institutes of technical education (KATEE)	Formation of a middle management class
Specific office in the Ministry of Coordination	Responsibility for the development of science and technology and the establishment of specific ways of funding applied research
Law 706/77	Funding from third parties of basic and applied research in Universities
Special concern for scientific documentation	Diffusion of information

2.2. The policy during the period 1983-1988

During this period we witness the first attempts to set more precise objectives for technological development. Initiatives for the improvement of technological competencies of

[4] This distinction has been introduced by Deniozos, 1993.

the Greek industrial system put particular emphasis to research infrastructure and stimulation of innovation.

The following events, included in table 5, represent the growth of interest for technological development and its linkage to industrial policy:

Table 5: Specific policy actions during the period 1983-1989

Actions	Objectives
Foundation of the Ministry of Research and Technology. Integration in the Ministry of Industry, Energy and Natural Resources as General Secretariat of Research and Technology	An integrated approach of industrial and technological issues
Laws 1262/82, 1382/83, 1731/87, 1828/89	Financial incentives for R&D, innovation and exports. Support to the creation of industrial laboratories for the creation of high technology products and services
Law 1360/83	To improve the process of technology transfer with qualitative criteria to the selection and approval of the provider of technology
Foundation by GSRT and EOMMEX of intermediate organisations: Industrial Research and Technological Development Companies (EBETA)	Technological assistance to productive units in specific industrial sectors: diffusion of information and specification of firms' needs
Foundation by public enterprises of other intermediate organisations with specific technology orientations (METEK, ASPROFOS, ETEKA etc.)	Engineering assistance for reverse engineering
Foundation of research institutes (Foundation of Technology and Research-ITE, Centre of Renewable Energy Resources-KAPE etc.)	Promotion of basic research in specific areas
Creation by EOMMEX of the Direction of Innovations and Technological Development (DIKTA)	Support to SMEs through consultancy, evaluation of innovations, funding of prototypes
Foundation of Organisation for Industrial Property (OBI) along with law 1733/87	Systematic approach of property rights and rationalisation of technology transfer
Law 1775/88 for institutionalisation of venture capital	To promote investment in high technology areas and innovative activities, especially in SMEs
Technological Education Foundation (TEI), replacing KATEE	To improve linkage between education and productive system, with training and promotion of specific specialisations
Public procurements	To improve technological competencies of Greek industry
Source: Deniozos, 1993	

Regarding EBETA, assessment of their role (LOGOTECH, 1997) points out that although originally their clientele was determined to be SMEs, finally most interest for their services came from medium and large firms. It seems that SME had neither the financial resources nor the technical background that could exploit the possibilities offered by these organisations. While the most important effect from the presence of these organisations might well be their assistance in diffusing information within industry and in stimulating firms to specify their needs that could be funded from European or national programmes, their overall effectiveness has been controversial. The problems in their functioning result from[5]:

i) a fuzzy institutional status,

ii) an ill-defined context of responsibilities,

[5] "Assessment of sectoral corporations for industrial research and technological development", report to the Ministry of Development, February 1997.

iii) a weak relationship with firms of the respective sector due to difficulties in defining the needs of their clients, in finding the potential users of their services as well as difficulties due to the limp attitude of the firms regarding cooperation.

iv) a weak presence of linking mechanisms that would help to exploit the outcome of their technological activity.

v) their size, operational and organisational structure and strategic planning has not been helpful in absorbing and diffusing know-how and information.

Public procurements might be a tool for improving technological competencies in the Greek industry. However, there is a strong belief that they did not contribute to indigenous technological development. It is remarkable that R&D expenditure in the Defence sector was nearly not existent. According to Caloghirou (1993) and Caloghirou, Papagiannakis (1991) it is very doubtful that public procurements helped the improvement of technological competencies in the Greek industrial system. As they were integrated in a protectionism context, in many cases they preserved the inherent problems of many sectors (e.g. shipyards, fertilisers).

During the period 1983-1989, there has been an increasing participation of Greece in European Commission's activities. This constituted a basic change for the Greek economy because of the drastic increase of the resources available for R&D funding. The participation of Greek organisations to the European Programmes was very important with the Research Laboratories taking a more active role. However, as we can see in table A.5 of the annex, private sector had the lowest participation in terms of budget even if this participation increased from 1987 to 1988. This of course varies across programmes. BRITE, ESPRIT, RACE presented an important participation of firms. In the case of EUREKA the participation was in general very low; Greece participated in 5% of the projects but only in 0,6% of the budget (Deniozos, 1993). A survey carried out during winter 1999 in Greece[6], studied the R&D collaboration funded by European or National programmes. For EUREKA projects it has been observed that in most of the cases Greek participants have not finally participated, as they didn't find the necessary funds from national sources. This can be considered as evidence that National policy didn't include the promotion of collaboration in its main policy objectives. Cooperative R&D was mainly promoted through European programmes that set the condition of partnership.

In the context of S&T policy for improvement of competitiveness and productivity of the Greek industry, two National Programmes were launched: the Programme for the Development of Industrial Research (PAVE) and the Co-financing Programme (SYN).

The main objective of PAVE was the promotion of industrial research, innovation and industrial design. More specifically the funded projects aimed at:

i) the improvement of participant's productivity and the development of new or improved products and/or processes,

ii) the development of new or improved products with high added value, the improvement of competitiveness and the entrance of the participants in new markets,

iii) the transfer and adaptation of high technology in traditional industrial sectors.

[6] In the context of the STEP TO RJVs project, a survey has been carried out in seven European countries, fielding a questionnaire to a survey sample of firms that have participated in a mixture of EU Framework Programmes, EUREKA and National Programmes. In Greece, 80 questionnaires were collected, which represented a response rate of 57,9%. The information obtained included general information on the company, information about the objectives of the company in participating in R&D cooperation(s), the obtained benefits and the problems that the company faced during the cooperation(s).

SYN aimed at the cooperation of Universities and Research Laboratories with industries/users in order to encourage the linkage of research activities with industrial applications.

Both programmes promoted cooperation especially between Universities and/or Research Laboratories and the firms. Participation in the PAVE programme didn't require partnership but it was positively taken into account during the evaluation procedure of the proposal.

An evaluation of both programmes will be presented in the following subsection.

2.3. The period from 1989 until today

During this period there was a general consensus that issues regarding technological development and modernisation of industrial structures should be approached in a systematic way.

The application of austerity policies in the preceding 10-15 year period seriously constrained the ability of the State to intervene and actively promote technological development. In addition the competition policy has reduced the possibilities for traditional direct intervention that might distort competition (e.g. support of infant industries). Thus, the proportion of R&D activities that have been publicly funded, fell from 74.4% of the total funding in 1986 to 59% in 1991 (Indicators of Research and Technology, GSRT 1995). At the same time the funding of R&D activities from European financial resources have been raised considerably (ibid). The evolution of the r indicator (government financing of R&D as a percentage of GDP) as appears in the following table, presents however a slight increase after 1992. However it should be taken into account that most of the public funds were directed to projects co-financed by EU funds, the Greek Government and private actors and could not be considered as an independent growing interest for R&D activities.

Table 6: Evolution of r indicator in Greece

1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
0.25	0.23	0.22	0.19	0.21	0.22	0.26	0.27	0,30	0,29
Notice: government financing does not include EU share of structural funds. Source: GSRT mimeo, 1999.									

As it has been pointed out in section 2, one of the main problems of the Greek industrial system is the weak presence of linkages and interactive processes. R&D collaboration is considered as a mean for establishing interactions and enhancing diffusion of knowledge and information. Until recently, policy initiatives had not been interested to this issue and did not seem to relate it to the problem of competitiveness and productivity. The main concept guiding these initiatives, derived from the linear model of innovation, where the amount of R&D spending is positively related to the innovative activity.

Signs of a sluggish change in the emphasis of S&T policy in Greece can be observed during the last five years. This turn occurred mainly in the context of the European Support Framework I and II. The Greek Government launched two Programmes promoting technological development, Business Programme for Research and Technology I & II (EPET I & II). The Programmes' objectives were in accordance with those set by the European Support Framework I & II.

The duration of the programmes was respectively 1989-1993 and 1994-1999.

The objectives of EPET I set the context for the establishment of linkages and more specifically were:

a. the linkage of productive and research activities through

- the development of units for industrial research, technology transfer and the offer of

specific services to the firms,

- the development of technological parks for the exploitation of the research output coming from the Universities and public research laboratories.

b. the transfer and diffusion of R&D information by

- creating libraries and databases,
- developing a national network of documentation and diffusion of information and linking it with international networks
- training.

c. the development of research laboratories in sectors related to the socio-economic development.

d. the human resources development.

In 1994 EPET II was launched, aiming to:

a. promote the cooperation between research laboratories and productive units in projects of high economic interest such as environmental technologies, bio-sciences, information technologies, new materials, study of socio-economic and cultural issues.

b. give incentives for transfer of technology through:

- license and technical assistance,
- networks of technology transfer,
- covering business risk deriving from the adoption of new technologies.

c. promote innovative activities.

d. promote and strengthen the mechanisms for exploiting research output such as:

- technology incubators,
- technological parks,
- venture capital firms,
- centres for diffusion of information and know-how.

e. strengthen the adoption and assimilation of new technologies (e.g. Information and Communication Technologies).

f. develop Greek human resources according to the existing needs for training.

Another initiative was STRIDE HELLAS, integrated in the European initiative STRIDE (Science and Technology for Regional Innovation and Development) for the development of the less developed regions of the European Union (duration 1991-1993).

Its objectives were:

a. the linkage of productive and research activities,

b. the development of interrelations between national organisations and European and international networks,

c. the development of R&D infrastructures.

One of the main concerns of this initiative was the promotion of cooperation between

organisations.

After 1990, the programmes PAVE and SYN have been launched and funded in the context of the above initiatives. As stated before, PAVE implicitly promoted R&D cooperation whereas SYN aimed directly to the cooperation of Academic or Research Institutions with firms. After 1992, the number of PAVE projects without any type of partnership decreased significantly (LOGOTECH, 1999). On the contrary a significant increase in subcontracting agreements is observed and a steady proportion of projects with partnership (ibid). Academic Institutions represented the main proportion of sub-contractors in PAVE projects. However, the efficiency of PAVE in improving linkages among actors is contested. Many of the projects were not really adapted to firms' needs. In general, a difficulty characterised the implementation of many projects, regarding the transformation of R&D results in commercial applications. Additionally, a significant part of cooperations didn't have any continuation (ibid).

SYN appears to be a programme for Academic Institutions as they have the most active participation. Among the users of SYN projects, industrial firms represent 47% and Public Authorities 29% (ibid). However closer investigation of project deliverables has shown that many of them are studies and results that could not be exploited by the users (ibid).

The strengthening of R&D activities in strategic sectors by supporting cooperative agreements, is the main concern of the sub-programme Research Joint Ventures for Improvement of Competitiveness (EKBAN) funded by EPET II. The supported technological areas followed the choices of the EU Framework Programmes. In 1994 the contribution of firms in the accepted projects covered 48% of the total budget (GSRT, 1995). Evaluation of this programme has not been carried out yet.

The above national initiatives differ from the European Framework Programmes supporting cooperative R&D in that they do not set the condition for pre-competitive research. The outcome of the research activity may be a product or process innovation. Thus the conjunction with competition issues was not considered in the same perspective as at the level of the European policy.

2.4. Policy initiatives and actors' behaviour: some empirical evidence

It is interesting to present at this point, some empirical evidence regarding cooperative R&D funded from Greek national sources. Information on this topic has been obtained in the context of the "STEP TO RJVs" project. A Greek national database was created, including RJVs with at least one participant from the private sector, which were initiated during the period 1985-1996 and funded by national programmes[7].

In general, the technological areas that have been mostly promoted through the National Programmes (especially EPET I & II) were very similar with the areas promoted in the context of the European Framework Programmes. 35% of the subsidised projects were in information technologies, 16% in education and materials respectively, 15% in environmental protection and 12% in biotechnology. This indicates that new technologies were a high priority. However, it should be mentioned that those technological areas that were promoted in priority during the last 10 years, were selected with a bottom-up procedure, according to the technological area distribution of the proposals. Taking into consideration that expenditure on R&D is low in comparison with other countries and that the most active entities in National Programmes were Universities and Research Centers[8], it is correct to consider that

[7] The basic source of information for the construction of this database was the National Documentation Centre, where are recorded all funded projects in Greece. The database includes 154 funded RJVs with at least one firm in the consortium.

[8] "STEP TO RJVs Databank – Greek National RJV database: descriptive statistics": working paper by Aggelos Tsakanikas. The projects included to the STEP TO RJVs Databank were selected according to specific criteria and do not cover all funded RJVs.

national subsidies for cooperative R&D supported basic research in those cases where lack of financial resources is observed. An additional element is that most RJVs included in the Greek-RJV database, are a "Firm-University" and "Firm-University-Research Centre" type (52%) and only 4% are a "Firm-Firm" type of cooperation. The National Programmes presented in the above sections (PAVE, SYN, EPET, EKBAN) in addition to the European Framework Programmes, constituted for Public Institutions an important source of funding R&D activity. According to the descriptive analysis, the first twelve most frequent organizations were Universities and Research Centers and represent more than 30% of the total memberships.

Although there have been efforts from the national policy side, at least influenced by the European S&T policy, private actors have shown poor interest in cooperative R&D. Most actors that undertook cooperative R&D (about 70%) participated only once in RJVs[9], which shows poor dynamic.

The objectives of the private actors for undertaking cooperative R&D seem to be oriented towards technological development. The survey carried out in 80 Greek firms[10], showed that the most important objectives for Greek firms were to keep up with major technological development and to have access to complementary resources and skills. The benefits from undertaking R&D through cooperation showed the importance of acquisition / creation of new knowledge and the improvement of technological and organisational capabilities. Cooperative R&D in Greece seems to respond to a catching-up intention from the side of the private actors, especially when taking into consideration the weak technology base of the Greek firms. However, according to the survey results, Greek firms would not have undertaken the specific R&D projects without public funding. This finding is two-fold; it underlines the positive effect of public funding on promoting R&D activity but in the same time taking into consideration the low level of business expenditure on R&D, it reveals the strong dependency of firms' technological activities on subsidies.

In the above sections, it has been indicated that cooperation, and especially cooperative R&D, is explicitly promoted only in the context of the European programmes and of some national programmes whose objectives derive from the basic orientations of the European Science and Technology policy.

Policy initiatives promoting cooperation are in conjunction with other policy issues, such as competition and intellectual property rights protection.

The following section presents the framework of competition and IPR policy in Greece and discusses possible interference with policy promoting R&D collaboration.

[9] "STEP TO RJVs Databank – Greek National RJV database".
[10] See previous information about the survey in p. 9.

3. COMPETITION AND IPR POLICY IN GREECE.

3.1. Competition policy

Market competition has not been an explicit policy concern in Greece and has often been distorted through:

- state aids with sector orientation or even a specific firm orientation
- tariff protection
- preservation of monopolistic positions by specific firms.

The opening of the economy to international pressures was followed by the weakening/ loosening of the mechanisms that preserved a high profitability to Greek firms. The issue of competition gained a bigger importance within the context of European integration. Community competition rules set out in articles 37 and 85 to 94 of the Treaty of European Union appear to be the guidelines for the newly established Greek competition policy. Greek laws changed and were formed on the basis of these articles.

Responsible for preventing all anti-competitive practices and applying competition rules is the Ministry of Commerce and the Competition Commission, which is an independent authority.

There was no tradition for public policy in dealing with competition issues for a long period. The legislative framework on competition issues before 1977 was nearly non-existent. The only law regulating competition issues (unfair competition) was 146/14 with very limited possibilities.

The 703/77 law took into account the Treaty of Rome but with respect to some Greek specificities. It didn't introduce any systematic control of market concentration because this would probably have a negative impact to the efforts for increasing the size of Greek firms.

The 1934/91 law improved the role of the Competition Commission in impeding anti-competitive practices. It also introduced a sector approach to the problem by giving the authority to the Minister of Finance and the Minister of Commerce to bring under preventive control all sectors suspicious for distortion of competition conditions. Although the law clearly pointed to the need of mapping the distortions in the greek economy, this stayed unfulfilled.

In 1991, the law 2000/91 introduced the concept of "exploitation of economically dependent relationship". This was considered an extension to the outlaw of abuses of dominant position for cases where the dominant position appears in a bilateral level. It is a point that might concern also cooperative agreements and especially cases where the participants of the agreement have a user-producer relationship and one of the parties has a dominant position over the second party which does not have an alternative solution.

It is only in 1995 that the law 2296/95 introduced a systematic control over anti-competitive practices by a pre-competitive intervention. The dealing with abuses of dominant position became preventive and the Commission on competition has the power to scrutinise mergers, cooperations or concentrations in order to establish whether they lead to a dominant position. This was introduced for concentrations that control more than 25% of the market share or present a turn over more than 50 million Ecus at the national market. However even in cases where the market share of participants is over 10% or their turn over is superior to 10 million Ecus the firms are obliged to announce their cooperation at the Competition Commission. The law recognised the authority to Ministers of Finance and Commerce to exempt from anti-trust

regulations cases that are considered to lead to important positive economic implications.

Public authorities consider RJVs to lead to efficiencies that outweigh the disadvantages in competition terms. This explains the fact that almost all cases that are exempted are justified if indicted to Court[11].

All in all, the anti-monopolistic framework (legal basis and public actions) was basically non existent until the late 1970's. In the line of regulations at the EU level, there were a few changes in the 1980s and 1990s. Until very recently, however, the anti-monopolistic framework remained quite fuzzy in the sense that it lacked clear objectives about the cases that could be exempted and that the dealing with anti-competitive practices depended also from political choices[12]. Only in 1995 was introduced a more robust legal anti-monopolistic framework. Its impact is still unclear.

Regarding the national programmes PAVE and SYN it should be mentioned that pre-competitive research was not a pre-requisite[13]. On the contrary one of the main objectives being to promote innovation, the development stage was strongly emphasised, despite any possible implications on competition. The main interest from a policy perpective was to improve firm's competitiveness through research collaboration that might promote the creation of new products or services and new processes.

3.2. IPR Policy in Greece

Business culture concerning patenting in Greece is not quite developed. Following figures in table A.6. of the annex, we can observe the increasing amount of non-resident over resident applications that shows on the one hand the technological dependency from abroad as well as the loose interest of Greek firms for patenting. Figures of this table indicate the weak inventive potential in Greece in comparison with other OECD countries.

Before 1987 the system for the intellectual property rights protection was very rudimentary.

The protection of property rights was under the responsibility of the Ministry of Commerce, which didn't follow a systematic policy for these matters. The patent system was declaratory, first-to-file system and this meant that every application form was accepted without any serious considerations. Whoever had objections had to defend them in Court. This can be interpreted both ways: first a lack of a modern institutional set-up and second a context within which imitation was accepted and/or facilitated. It isn't clear whether this was happening intentionally or because of lack of experience.

In 1987 the Organisation of Industrial Property (OBI) was established and came into operation in 1988. The foundation of OBI coincides with the third phase of S&T policy in Greece (see previous section) where we have the signs of a more systematic approach regarding the issues of technological development but also with the need of the country to establish an institutional framework harmonised with European standards.

The responsibilities of OBI were the following:

- providing patents and utility model certificates,
- registration of technology transfer agreements,
- cooperation with similar organisations from other countries,
- preparation and control of the application of international treaties regarding patents

[11] There were no data for the number of cases that asked for exemption and their application was rejected. The information came from an interview with a responsible in the Competition Committee.
[12] This might be the reason why over 150 cases are pending today waiting for decision.
[13] On the contrary, European Framework Programmes clearly focused on pre-competitive research in order to avoid negative implications in competition terms.

legislation and transfer of technology legislative framework,

- representing Greece in international organisations,
- supply and diffusion of information and advice regarding new technologies and know-how,
- registration and classification of patents, innovations and technology transfer agreements,
- with the law 2417/1996 OBI became also responsible for the protection of design or model.

In the light of harmonisation of IPR regulation in EU, OBI faces the challenge of operating in a new context in which its role will mostly be the diffusion of scientific and technological information and the assistance to firms, offering them technological services.

The legal framework regarding property rights and transfer of technology is consistent with the European Patent Convention and the Treaty of Rome as far as competition issues are concerned (article 85 about competition). However national law predominates the European Patent Convention regarding the reasons for annulment. Such reason is the ambiguity in the description of the invention.

Two main elements of the legal framework regarding the "Transfer of technology, inventions and technology innovation" (Law 1733/1987 and modifications), concern the diffusion of knowledge and technology and the creation and protection of new knowledge and technology:

1. Casual observation suggests that the typical requirements (description of the invention, summary and claims) for patent lead to a diffusion of specific and detailed information about the invention. The application is kept in confidence until the patent is issued and this can reach the maximum period of 18 months.

The extent of protection depends on claims of the inventor. In particular, as far as Greek patents are concerned, these claims cannot be contested because there is no essential examination by OBI, of the claims described in the application form. In the case of European application form the claims described define the extent of the protection but as there is essential examination of the invention there is possibility of changing the claims.

2. The reporting requirements are very different for technology transfer agreements. The transfer of technology is seen in the context of the cooperation between the provider and the receiver of the technology. The registration of these agreements requires a broad and very general presentation of the content and type (license, co-production, technical support, management, turn key) of the agreement and is kept in confidence. Many RJVs involving Greek partners might be of this kind; that is they might concern a cooperation between a foreign firm possessing a know-how and a Greek firm(s) for a special industrial application. In this context the legal framework protects the owner of the technology from disclosure and diffusion of his intellectual property to third parties.

The above are consistent with the needs of a country like Greece, which is essentially an importer of technology. It seems that the narrow protection for patents promotes diffusion of the new technology whereas broad description of transfer agreements does not discourage foreign owners of know-how to sign agreements with Greek firms.

The law 1733/1987, article 21 regarding the technology transfer agreements, refers to RJVs. These agreements, when they involve patent license, are invalid in case they constrain competition and are opposite to article 85 paragraph 3 of the Treaty of Rome.

In the case of the cooperative R&D agreements, there are three potential types of assignment of rights:

a. rights resulting from patent are shared equally,
b. if the patent involves a company and the inventor who is an employee in this

company, then 60% of the rights is assigned to the company and 40% to the inventor, except if the invention is part of the contractual obligations of the employee,

c. assignment according to the contract signed between the members of the consortium.

Protection of intellectual property rights in the case of national funded programs PAVE and SYN

In the case of the national programs PAVE and SYN the status was defined as follows:

1. In projects funded from PAVE, GGET recognises the right to the funded party to protect his/her invention in Greece or internationally. The funded party can use the invention for his own needs. However, if the funded is not using the invention, then GGET can exploit it on her own. In case that the funded party assigns the rights to a third party then GGET claims part of the revenue relative to her contribution.

2. In projects funded from SYN, GGET is the proprietor of the results of the R&D project but the other party (firm) which is also contributing with at least 30% of the budget, has the right to use the results for his own needs. If the results are protected with patent, the firm has rights and share of the revenue relative to her contribution in the budget.

This type of contractual arrangement do not ensure commercialisation of the R&D outcome, as it may be sufficient ground for industry partners to lose interest in a collaborative research.

4. CONCLUSIONS

For the last two decades, there has been a continuous introduction of new elements in the Greek institutional set-up and public policy.

Policy initiatives became more specific regarding technological development. For a long period, interest was focused on the linear relation of R&D and innovative activity that would upgrade competitiveness of the Greek industrial system. During the last five years we observe a more systematic approach for issues related to industrial and technological development. Emphasis is given through specific policy initiatives to the promotion of interaction and diffusion. It can be argued that the European Union's policy objectives shaped to a large extent the priorities of the Greek industrial and S&T policy (directly and/or indirectly).

One of the actual priorities for the EC being the formation of RJVs and generally cooperative agreements, this was also reflected to some extent to Greek public actions. However, we cannot talk about an authentic national policy forming a set of coherent instruments to realise S&T policy objectives, but mainly about actions that are inspired by the general context of the European S&T, competition and IPR policy.

Although harmonisation of Greek S&T policy with European policy is improving, and particularly in the case of promoting R&D collaboration, there is lack of coherence between different policies, as far as cooperative R&D is concerned. The balance between competition and cooperation is not clearly applied and IPR protection rules are not very well defined. A weak or fuzzy IPR protection system may reduce inventive efforts and discourage foreign firms to engage in technological agreements in Greece.

Private actors seem to recognise the benefits from participating in funded R&D cooperations and their participation in RJVs depends strongly on public support. However, the success of any policy initiatives depends on actors' intention to disassociate their R&D activities from public funding.

To some respect the subsidies supporting R&D cooperation have been a tool to prompt

industry to undertake R&D activities. It is quite unclear if this goal has been reached. Even if industry participation in R&D projects has increased, there is no important evidence that this trend is self sustained. Besides, any policy effort to have a permanent impact in improving Greek industry's competitiveness needs to be integrated in a set of policy actions that support economic development.

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Competition Commission,

OBI, Organisation of Industrial Property.

ANNEX

TABLE A.1

Average change in some main indicators of economic performance in EU and Greece								
	GDP	GDP	GDPp.c.	GDPp.c.	Ind. Production		GFCF-total	
	Gr	EU	Gr	EU	Gr	EU	Gr	EU
1961-1972	7.72	4.64	8.34	4.43	10.60	5.52	10.43	5.68
1973-1983	2.97	2.31	1.90	2.25	4.23	1.72	-0.50	0.08
1984-1995	1.62	2.40	1.21	1.96	0.49	1.84	0.78	2.53
Source: European Economy, Annual Economic Report 1995, no 59.								

TABLE A.2

Labour Productivity (compound annual growth rates in %)							
	Business Sector				Manufacturing		
Country	1960-73	1973-79	1979-89	1989-96	1973-79	1979-85	1985-95
USA	2,7	0,3	1,0	0,6	1,5	3,5	2,4
Japan	8,4	2,8	2,7	1,3	4,1	3,4	2,3
France	5,2	3,0	2,5	1,8	3,6	1,9	2,8
Germany	4,5	3,1	1,6	0,1	3,3	1,3	1,8
Greece	9,0	3,4	0,8	0,5	0,8	1,1	1,0
Ireland	4,8	4,4	4,3	3,5	..	..	..
Italy	6,4	2,8	2,0	2,2	4,2	4,2	3,7
Portugal	7,5	0,4	1,8	3,9	1,3	3,0	4,2
Spain	6,0	2,8	3,0	2,5	-0,8	4,8	1,8
Sweden	3,6	1,4	1,6	2,7	1,1	3,1	4,0
UK	4,1	1,6	2,2	1,2	0,6	3,8	2,4
Source: OECD, Science, Technology and Industry Outlook, 1998.							

TABLE A.3

Relative export specialisation by type of industry									
country	high			medium			low		
	1980	1992	%	1980	1992	%	1980	1992	%
Greece	17	17	0.00	31	27	-13	212	263	24
Ireland	113	157	39	58	58	0	144	115	-20
Turkey	9	23	155	36	32	-11	220	259	18
OECD average=100									
Source: OECD, Science and Technology Indicators, sept. 1995.									

Table A.4

Structure of GERD inflows and outflows (%) in 1993						
To / From	PRIs	Universities	Public Firms	Private Firms	Non-profit organisations	% on total GERD
Central government budget	63,6	15,7	5,0	4,6	27,0	28,1
Universities	-	43,4	-	-	-	17,7
Structural Funds	17,7	13,1	15,0	13,7	34,0	14,9
Own funds of Universities/PRIs	3,5	5,9	-	-	26,6	3,7
Public firms	0,8	2,4	65,7	0,1	2,5	3,5
Private firms	0,5	1,4	4,7	67,5	7,0	16,7
Non-profit organisations	-	-	-	-	-	-
EU Framework Programmes	13,0	17,7	7,6	12,4	0,4	14,5
International Organisations	0,8	-	-	-	-	0,3
Other foreign sources	0,1	0,3	2,0	1,7	2,6	0,7
Total	100,0	99,9	100,0	100,0	100,1	100,1

TABLE A.5

Distribution of European funds among Greek organisations (%)			
YEAR	RO	EDU	FIRMS
1987	50	29	21
1988	36	34	30
Source: Deniozos, 1993, p. 233			
RO: Research Organisation			
EDU: Universities			

TABLE A.6

Patent applications: dependency ration (non-resident/resident applications)														
country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Greece	1.48	1.53	1.57	1.61	1.81	3.36	7.32	35.61	37.49	47.24	..	97.19	99.77	..
France	3.27	3.39	3.37	3.65	3.50	3.67	3.74	4.24	4.65	5.19	4.96	5.20	5.16	5.53
Italy	..	..	..	..	..	..	..	..	..	..	..	7.16	7.27	7.34
Ireland	5.75	6.17	4.46	4.18	3.60	3.60	3.96	4.37	4.75	5.45	4.83	18.43	45.16	49.61
Spain	4.95	5.20	5.58	5.00	4.26	7.69	12.43	13.32	13.45	19.72	19.87	22.27	21.81	23.88
Portugal	20.48	18.85	19.34	18.29	22.42	28.45	37.02	44.63	38.50	35.06	33.85	183.58	396.94	395.82
Sweden	4.86	4.76	4.90	6.03	6.53	7.42	8.31	10.26	11.94	13.52	12.78	12.93	11.50	11.96
UK	1.98	2.04	2.16	2.43	2.41	2.47	2.62	2.85	3.25	3.67	3.53	3.73	3.77	4.03
Japan	0.15	0.13	0.13	0.12	0.11	0.11	0.11	0.12	0.13	0.13	0.13	0.14	0.14	0.16
USA	0.74	0.77	0.79	0.85	0.89	0.87	0.95	0.95	0.96	0.93	1.00	1.01	0.89	0.93
EU	1.60	1.70	1.77	1.95	1.97	2.12	2.29	2.57	2.98	3.74	3.68	3.78	4.08	4.38
OECD	1.03	1.00	0.99	1.01	1.00	1.02	1.06	1.19	1.28	1.44	1.41	1.61	1.72	1.88
Source: "Intellectual Property Rights: Patents and Innovation in the International Context", OECD 1996, p. 9.														