CENTRE OF PLANNING AND ECONOMIC RESEARCH

Reports 22

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The European Observatory for Small and Medium-Sized Enterprises: Research Environment and Innovation in Greek Manufacturing

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The European Observatory for Small and Medium-Sized Enterprises: Research Environment and Innovation in Greek Manufacturing

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CENTRE OF PLANNING AND ECONOMIC RESEARCH

The Centre of Planning and Economic Research (KEPE) was established as a research unit, under the title "Centre of Economic Research", in 1959. Its primary aims were the scientific study of the problems of the Greek economy, encouragement of economic research and cooperation with other scientific institutions.

In 1964, the Centre acquired its present name and organizational structure, with the following additional objectives: (a) The preparation of short, medium and long-term development plans, including plans for regional and territorial development and also public investment plans, in accordance with guidelines laid down by the Government. (b) The analysis of current developments in the Greek economy along with appropriate short-term and medium-term forecasts; also, the formulation of proposals for appropriate stabilization and development measures. (c) The further education of young economists, particularly in the fields of planning and economic development.

The Centre has been and is very active in all of the above fields, and carries out systematic basic research in the problems of the Greek economy, formulates draft development plans, analyses and forecasts short-term and medium-term developments, grants scholarships for post-graduate studies in economics and planning and organizes lectures and seminars.

In the context of these activities KEPE produces series of publications under the title of "Studies" and "Statistical Series" which are the result of research by its staff as well as "Reports" which in the majority of cases are the outcome of collective work by working parties set up for the elaboration of development programmes. "Discussion Papers" by invited speakers or by KEPE staff are also published.

The Centre is in continuous contact with similar scientific institutions abroad and exchanges publications, views and information on current economic topics and methods of economic research, thus further contributing to the advancement of the science of economics in the country.

PREFACE

The advancement of innovative activities of SMEs in the Common European Market results in intensive competition among companies in member countries. As a result, the competitiveness of these companies is improved against similar companies in non-member countries (mainly the USA and Japan).

The European Union each year through its member states takes the initiative to prepare reports concerning the existing problems and future prospects of SMEs in each member country. This effort supports the creation of common rules and opportunities for innovative and more generally entrepreneurial activities for European SMEs.

This study, which is the result of cooperation between EOMMEH and KEPE, concerns research and development problems for Greek SMEs and belongs to the framework of annual reports which are submitted to the European Union.

Professor VASSILIS DROUCOPOULOS
Scientific Director

Center of Planning
and Economic Research
October, 1995

The ongoing integration of the European Market and the elimination of the protective mechanisms that had been created in each country have led to an intensification of the competition among small and medium enterprises (SMEs) of the different member countries of the European Union.

This intensification of competition has particularly affected Greek SMEs which produce tradable goods and which used to operate under an elaborate system of incentives, subsidies and foreign protection created by all post-war governments.

It is obvious that the ability of the Greek SMEs to invent and apply the appropriate mechanisms for the creation and/or integration of technical change will prove to be crucial for the gradual improvement of their competitiveness and therefore their viability in the long run. This study first tries to compare the advantages and drawbacks of the national system of Research and Development (R & D) in Greece after 1985, with those of the other member countries of the EU. We then present and discuss some primary data regarding the innovative activity of Greek manufacturing SMEs, the structure and sectoral distribution of the finances available to Greek manufacturing SMEs and the extent to which they are absorbed by them.

I would like here to thank F. Panaretou and L. Megir for their work on the English text and Mrs. P.C. Harbouri for her work on the final version of the study. I would also like to thank the Publications Department for their excellent job in publishing this study.

DIMITRIOS A. SAKKAS

October 1995

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INTRODUCTION

The object of this study is to verify and present the factors which affect the processes of innovation and diffusion of the new technical progress in the framework of the small and medium-sized enterprises of the domestic manufacturing industry.

At this point, it is important to define some of the terms and concepts used in this study.

Small and Medium-Sized Enterprises (SMEs): According to the practice followed in Greece[1] and the employment criterion,firms which employ 1-99 persons are considered as SMEs. They are further classified in three (3) sub-categories, namely:

(i) micro-enterprises (0-9 employees),
(ii) small enterprises (10-19 employees), and
(iii) medium ones (20-99 employees).

Finally, firms which employ more than 100 persons (100+) are considered as large enterprises.

In order to ensure that the Greek data are comparable to those of the European Economic Community, this study adopted, wherever possible, the relevant Community criterion (up to 500 employees) as its calculation basis.

Given the fact that, as a rule and specifically as regards R&D, data are not used analytically by size-groups but aggregately at the 2-digit level, an effort was made to pin-point the branches with a high employment percentage in the existing SMEs. Table 1.0, giving the results of this effort is, in most cases, the best possible approximation (on the basis of size-groups) to the composition of the relevant manufacturing units.

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[1]. See KEPE, Final Report for SMEs in Greece, Athens, March 1993.

TABLE 1.0

Percentage of Industrial Employment in Small-Medium Enterprises (0-499) and the Large-Scale Firms (500+), 1988

	NACE code	STAKOD	Percentage of Employment in Firms	
			0-499	500+
	11-12-14	32	59.9	40.1
	22	34	45.2	54.8
*	24	33	91.3	8.7
	25-26	31	78.8	21.2
*	31	35	90.6	9.4
**	32-33	36	100.0	0.0
*	34	37	92.9	7.1
	35-36	38	78.5	21.5
	41-42	20-21-22	41.9	58.1
	43-44-45	23-24-29	79.6	20.4
*	46	25-26	94.0	6.0
	47	27-28	69.9	30.1
*	48	30	97.3	2.7
**	49-37	39	100.0	0.0
Total		20-39	89.7	10.3

Source: NSSG, GSRT (unpublished statistical data).

*, ** Show sectors with a high employment participation in small-medium enterprises. In particular: * > 90%, ** = 100%.

Innovation: The term innovation[1] means a new product or techonological application, presenting possibilities of commercial exploitation and business potential, the realization of which will have positive results in the economy of the Country.[2]

Technology Diffusion: In this study the term means either the adoption of a new technology by users other than the original innovator, or its extensive and improved use by this innovator.

New Product or New Technological Application:[3] Concerning the issues of R&D in Greece, it is necessary to note, at the very start, the very limited extent - on a comparative basis - not only of the initial data collection but also of the rudimentary processing of statistical information. This situation, which shows the generally low level of the Country's technological development, is gradually improving, due to the distinct amelioration - during recent years - of the human and material resources related to the domestic system of research and technological development.

Besides the complete absence of data, there are instances where the available data (royalty payments for example) are found interspersed among different departments of e.g. the Ministry of National Economy and the Bank of Greece, in such a state that a lot of primary and time-consuming processing is needed in order to make them usable.

We would also like to point out that the content and even the form of the present study were mainly determined by specific questions, put to the authors by the European Community authorities on whose behalf this paper was carried out.

Therefore, its primary purpose was to present the required data, regarding the potentialities and weaknesses of the existing national

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[1]. See EOMMEH: Rules of Innovation Promotion.

[2]. Chapter 3 of this study presents (in the corresponding remarks) the various categories of innovation.

[3]. See Page 55.

infrastructure in the various fields of research and of the practical application of its results to the domestic production process.

Furthermore, given that the main objective of this study was its use (through a comparative evaluation of its results with those of the EEC scientific-research systems) as a basis for the formation of the European "Research and Development Policy for SMEs", its structure is -to a large extent - descriptive rather than analytical.

Chapter 1 presents some general points which are indicative of the extent and recent development of the Country's innovation activity, in the light of the gradually intensifying competition within the Unified European Market.

Chapter 2 briefly shows the main agencies-institutions of the domestic scientific research system as well as the basic financial magnitudes, which reflect their activity level during the period under examination.

Chapter 3 contains specific statistical information on the current state of research and innovation activity, in the framework of the domestic manufacturing industry in general, and the small and medium sized enterprises in particular.

Chapter 4 probes deep into the factors, which affect - either positively or negatively - the advancement of the innovation activity in the field of SMEs and shows the relevant empirical evidence.

Finally, Chapter 5 briefly presents the basic conclusions of this study.

Here it should be pointed out that a large part of the information needed derives from a research study on innovation, carried out by the General Secretariat of Research and Technology (GSRT).

1. CHALLENGES DERIVING FROM THE COMPLETION OF THE EUROPEAN INTERNAL MARKET

1.1. Innovation and Acquisition of Technology as Main Competition Components for SMEs

The integration procedure of the European Internal Market and the creation of a single legislative-organizational framework of business activity have already influenced the small - medium productive units of the Country and are expected to increase their effect substantially in the future.

From a general business point of view, the full integration of the Community Market provides, as a start, great development possibilities, mainly because of its size, to the competitive enterprises located within its boundaries which produce worldwide marketable products. Such manufacturing units will be able, without administrative interference, obstacles or discrimination deriving from any individual Member-State, to develop their business activity within a much larger market than the domestic one.

However, it is obvious that the gradual lifting of the barriers among the various countries, as well as the setting-aside of national peculiarities with regard to the type of organization and operation of each specific market, will intensify competition among the Community enterprises which produce internationally marketable goods.

The application of innovations to SMEs and their acquisition of new technical progress will, it is expected, be of increasing importance, until they finally become the factors determining enterprise competitiveness.

In the framework of the manufacturing industry, the Greek SMEs, which already confront Community competition, are expected to face more vigorous problems in this field, because of their less developed technological and economic productive structure and their so far very limited business experience within the relatively free and competitive international markets.

Competition pressure is anticipated to come not only from Community enterprises but also from the corresponding firms of the third countries, where the composition of production and the level of development are similar to those of Greece.

Given the fact that the division of labour between Greece and the other member-states started a long time ago and has now been established to a large extent, it is perceptible that the anticipated competition pressure coming from third countries will be equal to, if not greater than, the above mentioned.

However, it is expected that the geographic distance (creating high transport costs) between Greece and the majority of the other Community Countries as well as the imperfect structure and operation, even today, of the Greek Market, will to some degree impede and delay the complete harmonization of the entrepreneurs' behaviour with the European norms. Apart from the accomplishment of innovation and the acquisition of new technology, it is certain that Greek small-medium businessmen will continue to maintain, for a period of time, their comparatively low labour costs and prices of domestic raw materials during the manufacturing of certain internationally marketable and intermediate products, as two other, equally effective, competition components.

1.2. Norms, Standards and Quality Certification as Factors Affecting the Technological Development of SMES

It is evident that quality improvement in the production of the Greek SMEs is the expected consequence of the unified European Market.

It is necessary to provide domestic products with a national quality mark, accepted by all other member-states. This requires the gradual creation of an integrated system of norms, standards and quality certifications.

Attempts should be made, in this field, to create: (i) a network of laboratories for testing and examining products, (ii) a satisfactory assembling of national norms, which must correspond to the European or international ones and (iii) an integrated system of metrological services.

The Hellenic Organization for Standardization (ELOT) was established in 1976 and has been operating ever since under the auspices of the Ministry of Industry, Energy and Technology.

The main activity of ELOT is the elaboration and publication of the Hellenic Standards. Since its establishment, 1159 Hellenic Standards have been issued. In 1992, twenty-nine (29) drafts of Hellenic Standards were prepared.

ELOT is also the national member of the following organizations:

- the International Organization for Standardization (ISO),
- the European Committee for Standardization (CEN),
- the European Committee for Electronic Standardization (CENELEC),
- the European Organization for Quality Control (EOQC).[1]

ELOT is also responsible for the translation into Greek of their standards. Of the existing 600 European Standards (EN) of the European Committee for Standardization (CEN), 330 have been translated in Greek. Furthermore, of the 1200 Harmonization Documents (HD) of the CENELEC, 115 have been issued in Greek and 219 approved.

Certification is another significant activity of ELOT, which grants Conformity Marks and Certificates to products designed and manufactured in compliance with the official standards or other specifications.

ELOT is the authorized organization in Greece to certify the Quality Assurance Systems for industries, according to European Standards {EN 29000 (ISO 9000)}, and for the conformity of bodies/testing laboratories, also according to European Standards (EN 45000). In addition, ELOT operates laboratories for testing electrical equipment and cables.

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[1]. See Appendix, p. 89.

1.3. Patents in Greece and the Single European Market

The national organization and administration of patent rights apparently constitutes one of the barriers against the effort to create appropriate conditions, conducive to achieving the perfect model of free competition within the European Market. Consequently, it is reasonable to expect that the banning of national regulations and barriers in order to obtain the free access of all EEC firms to the patent market will lead member-countries closer to the above model. The corresponding responsible institution in Greece is the Industrial Property Organization (OBI).

OBI focuses on the protection of inventors and on matters regarding technology transfer and technical information.

Tables 1.1 and 1.2 present some relevant statistical data.

TABLE 1.1

Patent Applications

Description	1988	1989	1990	1991	1992
Patent applications of:					
Greek origin	374	377	386	312	358
Foreign origin	495	486	503	211	229
Total	869	863	889	523	587

Source: The OBI Annual Reports.

TABLE 1.2

Patents Granted by OBI

Description	1988	1989	1990	1991	1992
Patents granted	370	39	130	349	525

Source: OBI Annual Reports.

In August 1984, OBI began granting patents, according to the new provision of the Law 1733. The reports attached to the patents were drawn-up in cooperation with the European Patent Office (EPO).

Tables 1.3 and 1.4 show that the transitional period (1985-1989) lasted four (4) years according to the cooperation plan.

During the last two years, OBI underwent critical difficulties. There was, for example, the increasing domestic and international workload and the approaching deadlines in order to obtain the accommodations granted by the European Patent Office. However, the number of people employed by OBI was only 1/3 of the anticipated total, due to the government policy in force which suspended the hiring of any new employees.

TABLE 1.3

Translation of EP Patents

Description	1988	1989	1990	1991	1992
Translation of EP patents	13	325	1235	2265	3283

Source: OBI Annual Reports.

TABLE 1.4

Utility Models

Description	1988	1989	1990	1991	1992
Utility models (applications)	344	362	272	234	251
Utility models (grants)	161	252	320	207	248

Source: OBI Annual Reports.

Despite the above difficulties, OBI promoted the ratification of the International Convention on European Community Patents and the filling of relevant documents, subject to a reservation concerning the conditions of granting compulsory licenses.

2. SCIENTIFIC-TECHNOLOGICAL RESEARCH SYSTEM IN GREECE

2.1. The Principal Institutions

The Greek System of Scientific and Technological Research (ETE) was recently established. It mainly developed in accordance with the provisions of the Law 1514/1985 on "the development of scientific and technological research". The components and support institutions of this system are:

i. The Institutions of Higher Education (universities and technical colleges). There are 18 universities and polytechnic schools (AEI) and 11 institutions of technical education (TEI) in the Country.

ii. Research Centres and Institutes. The following Research Centres and Institutes operate under the auspices of the General Secretariat of Research and Technology (GSRT), which is the main institution for planning and promoting research and technology in Greece. They are:

- The National Centre for Scientific Research "Democritos" (Athens).
- The Institute of Technology and Research (ITE) (Herakleion - Crete) with branches in Rethymnon (Crete), Patras and Thessaloniki.
- The Hellenic Research Foundation (Athens).
- The National Observatory of Athens.
- The National Centre of Marine Research (Athens).
- The Institute of Marine Biology of Crete (Herakleion).
- The Greek Pasteur Institute (Athens).
- The Amalia Fleming Institute of Biology (Athens).
- The Centre for Renewable Energy Sources (Athens).
- The Technology Centre for Solid-State Fuel Applications (Macedonia).

- The Greek Centre for Social Research (Athens).
- The Institute for Speech Processing (Athens).[1]

iii. Other Institutions Rendering Technological Services. The following organizations-agencies have two purposes, namely to support technologically the domestic productive units and to inform-advise them on technical and organizational matters:

- ELOT (the Hellenic Organization for Standardization) is responsible for: (i) Hellenic and European Standards and (ii) Certification and Quality Assurance Systems (see part 1.2.).
- ELKEPA (Greek Productivity Centre) lays an emphasis on training personnel in: (i) management, (ii) labour-technical responsibilities, (iii) new technologies and (iv) scientific and technical developments.
- EOMMEH (the Hellenic Organization of Small and Medium-Sized Enterprises and Handicrafts) is the principal State organization responsible for the technical support and development of the Greek SMEs. It succeeds in its objective by improving either the organizational structure of SMEs or their socio-economic environment. For this purpose, five Innovation Centres have been established. They are located in Athens, Thessaloniki, Patras, Volos and Herakleion.

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[1]. In addition to the above 12 research centres, the Ministry of Education supervises the Institute of Computer Technology (ITY) in Patras, the two institutes of law research in Athens, the Institutes of the Academy of Athens, the Pedagogical Institute and the Institute of Technical Education. The Ministry of Agriculture administers certain institutes and organizations such as the National Institute of Agricultural Research.

- OBI (the Industrial Property Organization) is the organization responsible for protecting inventions and matters regarding Technology Transfer and Industrial Property (see part 1.3.).

iv. The Branch-Oriented Companies for Industrial Research and Development. These companies were established by the General Secretariat of Research and Technology (GSRT) and EOMMEH for a long-run purpose, i.e., to promote practically the transfer of technology from the domain of invention (scientific) to the field of application, in other words production, and primarily to small-medium enterprises.

These companies are:

- The Industrial Research and Technological Development Agency (EBETAM) in Volos.
- The Marine Technology Agency (EANT S.A.) in Piraeus.
- The Agency for Ceramics and Heat-Resistant Items (EKEPY S.A.) in Chalkida.
- The Agency for Technical Development of Weaving, Garments and Fibres (ETAKEI) in Kallithea, Attica.
- The Agency for the Development of Food Technology (ETAT S.A.) in Athens.
- The Greek Centre for Leather (ELKEDE) in Athens.
- The Hellenic Clothing S.A., in Athens.
- The Clay Industry S.A., in Athens.
- The Hellenic Goldsmith and Silversmith Centre in Athens.
- The Innovation Centres of EOMMEH in Athens, Thessaloniki, Patras, Volos and Herakleion.

v. The Technological Parks. The GSRT has promoted, through its Structural Projects, the foundation and operation of technological Parks in four (4) university campuses of Greece (Athens, Thessaloniki, Patras, Herakleion). These parks are located on sites

where certain research centres are already in operation. Their main purpose is to cover, on each particular site, either the prospective research needs of "high-tech" productive activities, aspired to be created there or the needs of those that already exist, which have to be upgraded and technically supported.

Given that technological parks constitute a relatively new institution in Greece and that their implementation is still at an initial stage of development, we use at present the experience of other countries and create "incubators" for the technical support of new enterprises with high technological demands.

2.2. Statistical Data of the Greek Scientific Research System

2.2.1. Expenditure for Scientific and Technological Research

The Gross Expenditure for Research and Development (GERD) reached 59.5 billion drachmas (1991) and, compared to the figures of the year 1989, showed an increase of barely 1%, in constant 1989 prices. The following Table 2.1 presents the ratio GERD/GDP.

TABLE 2.1

Ratios GERD/GDP, 1986-1991

1986	1988	1989	1991
0.33	0.37	0.46	0.46

Source: GSRT.

These ratios place Greece in the last position among the EEC countries. The corresponding ratios of other EEC countries for the year 1990 are: Germany 2.8, Great Britain 2.77, France 2.42, Ireland 0.81, Spain 0.80 and Portugal 0.61.

Table 2.2 shows the "inter-sectoral flows" among the sectors (rows) that finance a research project (funding sectors) and the sectors (columns) that receive this money input (executing sectors).

Table 2.4 shows that the: (i) state "sector", (ii) enterprise "sector" (both private and public) and (iii) educational "sector" (universities and polytechnic schools) are the executing sectors of a research plan, while the above three categories plus the foreign "sector" (mainly the European Community) constitute the funding sectors (Table 2.3).

The state "sector", acting as an "executor", includes all public research institutes which are under its supervision, whereas the same "sector", acting as a "financer", comprises all ministries.

The enterprise "sector" includes both the public and private firms (national or multinational), and, finally:

The higher education "sector" includes all Universities and Polytechnic Schools {the research activity of the Institutes of Technical Education (TEI) is still insignificant}.

A comparison of the state expenditure between 1989 and 1991 (in constant 1989 prices) shows a decrease of approximately 25%. Similarly, the expenditure of higher education is about the same and only the enterprise expenditure presents an approximately 14.5% increase (Table 2.5).

The EEC financing presents a different aspect. It shows an impressive increase (77%) from 1989 to 1991, in constant 1989 prices. The participation percentages of the individual "sectors" in the relevant total budget are - during the period 1989-1991 - those shown in Table 2.5.

TABLE 2.2

Inter-Sectoral Money Flows for Scientific-Technological Research, 1991
(Million Drachmas, Current Prices)

Funding "Sectors"		Executing "Sectors" of Research Projects				
		State	Firms		Higher Education	Total GERD 1991
		(Public Research Centres)	Private	Public		
		(1)	(2)	(3)	(4)	(5)
1.	State (Ministries)	17404	742	106	1311	19563
2.	Private Firms	55	9346	22	465	9888
3.	Public Firms	183	-	2116	754	3053
4.	Higher Education	-	-	-	15187	15187
5.	EEC	6116	2101	991	2344	11552
(5.1)	Competitive Projects	1240	1429	428	1551	4648
(5.2)	Structural Projects	4876	672	563	793	6904
6.	International Organizations	126	101	4	29	260
Total		23884	12290	3239	20090	59503

Source : GSRT.

TABLE 2.3

Percent Composition of Money Flows
by Funding "Sector" in the 1991 Research Plan

Funding "Sectors"		Executing "Sectors" of Research Projects				
		State	Firms		Higher Education	Total GERD 1991
		(Public Research Centres)	Private	Public		
		(1)	(2)	(3)	(4)	(5)
1.	State (Ministries)	72.8	6.0	9.3	6.5	31.5
2.	Private Firms	0.2	76.1	0.7	2.3	16.6
3.	Public Firms	0.8	-	65.3	3.8	5.1
4.	Higher Education	-	-	-	75.6	26.9
5.	EEC	25.7	17.1	30.6	11.7	19.4
(5.1)	Competitive Projects	(5.2)	(11.6)	(13.2)	(7.7)	(7.8)
(5.2)	Structural Projects	(20.5)	(5.5)	(17.4)	(4.0)	(11.6)
6.	International Organizations	0.5	0.8	0.1	0.1	0.5
Total		100.0	100.0	100.0	100.0	100.0

Source: GSRT.

TABLE 2.4

Percent Composition of Money Flows by Executing "Sector"
in the Research Plan of the Year 1991

Funding "Sectors"		Executing "Sectors" of Research Projects				
		State	Firms		Higher Education	Total GERD 1991
		(Public Research Centres)	Private	Public		
		(1)	(2)	(3)	(4)	(5)
1.	State (Ministries)	89.0	3.7	0.6	6.7	100.0
2.	Private Firms	0.6	94.5	0.2	4.7	100.0
3.	Public Firms	6.0	-	69.3	24.7	100.0
4.	Higher Education	-	-	-	100.0	100.0
5.	EEC	52.9	18.2	8.6	20.3	100.0
(5.1)	Competitive Projects	(26.7)	(30.7)	(9.2)	(33.4)	100.0
(5.2)	Structural Projects	(70.6)	(9.7)	(8.2)	(1)1.5	100.0
6.	International Organizations	48.5	38.8	1.5	11.2	100.0
Total		40.1	20.7	5.4	33.8	100.0

Source: GSRT.

TABLE 2.5

Percentage of Financing from Greek and EEC Sources

Financing Sources		1989	1991
1.	State & Higher Education	69.0	58.4
2.	Firms:	19.4	21.7
2.1.	Private	(8.8)	(16.6)
2.2.	Public	(10.6)	(5.1)
3.	EEC	11.6	19.9
Total		100.0	100.0

Table 2.6 shows the percent participation of the executing "sectors" in the total expenditure for scientific and technological research during the years 1989 and 1991.

TABLE 2.6

Percentage of Expenditure for Scientific and Technological Research

Expenditure Sources		1989	1991
1.	State & Higher Education	77.7	73.9
2.	Firms:	22.3	26.1
2.1.	Private	(11.6)	(20.7)
2.2.	Public	(10.7)	(5.4)
Total		100.0	100.0

This table shows a slight change in the percent participation of the "sectors" in the total expenditure, namely a decrease in the percentage of the Research Centres and Institutions of Higher Education (AEI) from 77.7% (1989) to 73.9% (1991) in constant 1989 prices and a corresponding increase in the percentage of the firms, mainly private ones, which almost doubled their expenses in the period under investigation. Finally, it is impressive to observe the decrease in the participation of public enterprises during the same period.

The inter-sectoral structure of money flows between the funding "sectors" and the executing "sectors" present the degree and extent of their cooperation. We observe from the figures of Table 2.4, and specifically from the data of its diagonal part which concerns the first four (4) "sectors": (i) the very high percentage of "self-funding" of the "sectors" and (ii) the limited cooperation among them. This phenomenon is typical of the Country's low level of technological development and of the existing structural disproportions which intensify it. The level of money flow from private enterprises to the Institutions of Higher Education (4.7% of the relevant funding) and Research Centres (0.6%), and the two-way flows between public and private enterprises are very unsatisfactory. Finally, a balance is observed in the EEC flows directed to the executing "sectors" and especially in the flows which are absorbed by competitive projects. The general increase of these flows together with the participation percentages of the individual executing "sectors", explain the relatively satisfactory competition level of the Greek research personnel employed in the Institutions of Higher Education (AEI) and the Research Centres of the Country.

Recapitulating our observations concerning the structure of the research expenditure, we can conclude that the state "sector", despite its slight decline in the period 1989-1991 (most probably because of the prolonged economic stagnation) continues to be the basis of the Country's research system, both from the financers' and the executors' points of view.

In spite of all this, in Greece both indices, namely the index "r" which shows the state expenditure for R&D as a percentage of the GDP

in market prices and the index which expresses the funding of research as a percentage of the total budget, are the lowest ones among the EEC countries. More specifically, the index "r" was 0.28 in 1991 compared with 0.32 in the year 1989.

The indices "r" for the other EEC countries in 1990 were: Germany: 1.04, France: 1.40, Great Britain: 0.93, Holland: 0.93, Italy: 0.74, Spain: 0.55, Belgium: 0.54, Ireland: 0.39 and Portugal: 0.38.

Using the other index (state expenditure for R&D as a percentage of the total budget), the classification is almost the same. For the year 1988, Greece's index was 0.60%, Portugal and Ireland 0.98%, Spain 2.19%, Germany 4.11% and France 6.9%.

Finally, the structure of the state research expenditure in 1991, according to the thirteen (13) EEC targets of NABS (Nomenclature pour l'Analyse et la Comparaison des Budgets et des Programmes Scientifiques) shows that research funded by the Institutions of Higher Education (universities etc.) holds the first position (46.1%), followed by agricultural productivity and technology in agriculture (16.0%) and productivity and technology in industry (8.9%).

2.2.2. Personnel Employed in Scientific Research

In the year 1991, the number of persons employed (in full time equivalent = FTE) in the Institutions of Higher Education (AEI) and Research Centres of the Country was 8815, compared to 7776 (FTE) in 1989. Despite this increase (13.4%) in personnel during the two-year period, Greece is still significantly behind the other EEC Member-States.

In 1991, the number of persons employed in scientific-technological research of firms was 2244 (FTE); in other words 434 (FTE) more than in 1989, thus presenting an increase of 19.3% (FTE).

Table 2.7[1] shows the classification of the personnel employed (by type of occupation) in scientific research during the year 1991.

The same personnel, looked at in terms of level of education, gives the results which appear in Table 2.8.

The increase in the research personnel of the state sector between 1989-1991 is mainly due to the corresponding increase in the Institutions of Higher Education (24%) and in the Research Centres (19%), which functioned under the supervision of the GSRT. In the same table we see an increase in Ph.D. holders (53%) during the period 1989-1991, as well as a decrease in the employment of graduates with scholarships and of those who have finished elementary school. These changes are due to the engagement of teaching staff by the Institutions of Higher Education, mainly by certain regional universities, and the decrease in labourers (with primary education) who worked in research projects sponsored by the Ministry of Agriculture.

TABLE 2.7

Composition of Personnel Employed in R&D, 1991

Category of Personnel	State Sector		Firms		Total	
	Number (FTE)	%	Number (FTE)	%	Number (FTE)	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Researchers	5188	58.9	1042	46.4	6230	56.3
Technicians	1730	19.6	676	30.1	2406	21.7
Support Personnel	1897	21.5	526	23.5	2423	22.0
Total	8815	100.0	2244	100.0	11059	100.0

Source: GSRT.

[1]. Concerning the Institutions of Higher Education (AEI), the calculation of the number employed (in FTE) was made on the basis of the percentage employed in research, whereas concerning the Country's Research Centres, which were exclusively engaged in research, the computation included their total personnel.

TABLE 2.8

Research Personnel by Educational Level, 1991

Category of Personnel	State Sector		Firms		Total	
	Number (FTE)	%	Number (FTE)	%	Number (FTE)	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ph.D. holders	3672	41.7	173	7.7	3845	34.8
Post-graduate researchers with scholarships	791	9.0	-	-	791	7.1
Post-graduate students	356	4.0	483	21.5	839	7.6
AEI graduates	1227	13.9	729	32.5	1956	17.7
TEI graduates	346	3.9	375	16.7	721	6.5
High school graduates	1692	19.2	396	17.6	2088	18.9
Elementary school graduates	731	8.3	88	4.0	819	7.4
Total	8815	100.0	2244	100.0	11059	100.0

Source: GSRT.

The Institutions of Higher Education, the General Secretariat of Research and Technology and the Ministry of Agriculture employ 91% of the research staff working in the state sector and 92% of the researchers in general. In 1989, these percentages were 83.5% and 81%, respectively. In other words, we observe a gradual concentration of research staff in the above three (3) categories of institutions belonging to the state sector.

In 1991, the Institutions of Higher Education (AEI) employed 49%, the Research Centres belonging to the General Secretariat of Research and Technology (GSRT) 24%, and the Centres of the Ministry of Agriculture 18% of the research staff working in the state sector.

Therefore, the dominant role of the state sector in the Country's scientific-technological activity becomes obvious from the above figures. This sector employs: (i) 80% of the Country's total research force, (ii) 83.3% of the researchers, (iii) 72% of the technicians and (iv) 95.5% of the Ph.D.holders engaged in research.

2.3. Scientific-Technological Research and Development of Firms

As it appears, from 1989 to 1991, the public and private firms spent 15529 million drachmas for R&D, thus presenting an 18.3% increase, in constant 1989 prices.

From the above elements we calculate the relevant ratio (firm expenditure for R&D/GDP) which is 0.12%. This percentage ranks Greece among the last EEC member-states. We observe an impressive redistribution of funding percentages between the years 1989 and 1991. The following Table 2.9 presents an increase in the percentage of enterprises and the foreign sector, which includes the three (3) categories of institutions.

The resulting decrease of state expenditure from 45.4% in 1989 to 19.1% in 1991, which derives from Table 2.9, is impressive.

This diminution is obviously due to the corresponding decrease in the number of public enterprises engaged in research (from 40 to 25), after either their privatization or the suspension of their business

activities. The private sector, on the contrary, raised its relevant percentage from 38.5% in 1989 to 60.3% in 1991, namely presenting an increase of 137.3%, in constant prices, during the same period.

TABLE 2.9

Distribution of Research Expenditure in the Firms by Funding Sector

Funding Sector	1989		1991 (1989 prices)	
	Amount	%	Amount	%
State Sector	4153	45.4	2066	19.1
Private Firms	3521	38.5	6528	60.3
Foreign Sources	1473	16.1	2228	20.6
Total	9147	100.0	10822	100.0

Source: GSRT.

Concerning the firms, the inflow of capital from the European Community for research activities is equally satisfactory. The increase of money flows from the EEC, during the period 1989-1991, reached 51.6% in constant 1989 prices.

The private enterprises absorb the largest part not only of Community money transfers (68.9%), but also of the state subsidies of the Development Plan for Industrial Research (87.5%). Table 2.10 presents the percent composition of research expenditure by executor.

Table 2.11 shows the distribution of research expenditure by geographical region and the changes between the years 1989 and 1991. The Table presents quite vividly a high expenditure concentration (approximately 71%) in the area around Athens.

TABLE 2.10

Distribution of Research Expenditure by Executor

Executor	1989		1991 (1989 prices)	
	Amount	%	Amount	%
State Sector	4389	48.0	2250	20.8
Private Firms	4758	52.0	8571	79.2
Total	9147	100.0	10822	100.0

Source: GSRT.

TABLE 2.11

Percent Distribution of Research Expenditure of Firms by Geographical Region

Region	1989	1991
Eastern Macedonia-Thrace	1.0	1.3
Central Macedonia (Thessaloniki)	7.7	8.0
Western Macedonia	0.1	0.6
Thessaly	2.8	0.9
Epirus	0.3	0.8
Ionian Islands	--	--
Western Greece	6.7	1.0
Sterea Hellas	4.8	13.5
Peloponnisos	0.8	1.6
Attica (Athens)	71.6	70.9
Northern Aegean	--	0.1
Southern Aegean	3.8	0.8
Crete	0.4	0.5
Total	100.0	100.0

Source: GSRT.

3. INNOVATION AND DIFFUSION OF TECHNOLOGY IN GREEK MANUFACTURING: NATURE AND ORIGIN

3.1. Introductory Remarks

New products, new production methods, new markets and new organization models are the main innovation elements which allow firms to preserve their efficiency through time. Science and technology, the prerequisites for the economic development of a society, are activated through innovation.

The process of innovation is better understood if placed in the analytical framework of a broad system of relevant concepts and ideas. It consists of the invention, which is followed by the realization of the innovation and terminated by the diffusion of the innovation.

An invention alternatively is: (i) an original technique, (ii) a new product, (iii) a new equipment and (iv) a manufacturing method, through which the human productive capabilities develop.

The procedure of adopting and utilizing an invention for practical productive purposes is called innovation. It consists of a multi-dimensional concept, which presents each time a different context: for example, innovation concerning a: (i) product, (ii) procedure, (iii) market, (iv) management etc. According to J. A. Schumpeter, an innovation concerns changes, effectuated in the form of the respective production functions.[1]

The third element, related to the concept and, more generally, to the process of innovation, is "its imitation or duplication; in other words, the diffusion of the innovation.

Invention, innovation and diffusion are, as a rule, the three (3) successive stages of either the innovation process or the effectuated

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[1]. J. A. Schumpeter: Capitalism, Socialism and Democracy, George Allen and Unwin Ltd., printed by The Compton Printing Works, London, 1961, p.132.

technological change. Invention is the prerequisite for innovation and innovation is the prerequisite for imitation.

The first stage, invention, is realized either by individuals or by research centres, universities, firms, etc. Invention is, logically, the output of research activity in general.

The second stage, innovation, being the result of the first, is materialized through actual investment. Investing in innovation is risky and uncertain. These two characteristics have, theoretically, the possibility to justify extra profits for the inventor-innovator.

The realization of the third stage, namely the imitation or diffusion of an innovation, depends mainly on the structure[1] of the market. If the relevant practice of using patents is inelastic, the diffusion rates of the innovation will be low. The opposite will occur if other entrepreneurs, with the same production, use this innovation more freely.

3.2. General Prerequisites for the Creation and Diffusion of New Technical Progress

We briefly presented in the previous Chapter the main institutions involved in the first stage of the innovation process, namely the domestic system of scientific and technological research, together with some of its weak points, ascertained through the calculation of certain representative indices.

The main quantitative weaknesses, such as the comparatively insufficient level and unsatisfactory composition of research expenditure, can be attributed, up to a point, to the relatively recent creation and activation of the above research system. Therefore, it is reasonable to expect a gradual improvement. However, the biggest problem which emerged from the presentation of the system of scientific and technological research is the way in which research activity is performed

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[1]. See Kamien, I. M. - Schwartz : "Market Structure and Innovation", Journal of Economic Literature, March 1975, pp.1-37.

by the particular institutions. Consequently, this is a problem of an operational nature.

In other words, we ascertained that the innovation process presents a relatively loose or even non-existent connection between its three (3) stages. This fact cannot be explained by the low level of research expenditure and the limited number of research personnel.

The primary cause, which does not seem to advance the substantial cohesion and functionality of the whole system of research and technological development in Greece, is the persistent structural disproportion which appears in the domestic productive mechanism in general and in the manufacturing in particular.

From the reproduction pattern that has prevailed ever since the post-war period, it is possible to point out both the immense delay in the formation of an elementary system of scientific and technological research in Greece and the actual development level of this system.

Domestic manufacturing has been characterized by intense structural disproportions[1] ever since the post-war period. The most impor-tant and decisive disproportion consists of the limited or even non-existent production of modern investment goods, more specifically of mechanical equipment, and of all the intermediate goods and services[2] necessary for it.

One of the main consequences of these structural disproportions has been the inability to develop integrated productive procedures with vertical organization of production (by branch), which still is a sine qua non condition for the gradual development of a corresponding system for

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[1]. D. Sakkas: Die Urspruenge des Strukturellen Ungleichgewichts und Seine Wirkung auf den Entwicklungsprozess Griechenlands, Frankfurt/M, 1984.

[2]. For more details see: (i) Dimitris Sakkas, The Construction Machinery Branch, unpublished report elaborated for the Five-Year Plan, 1983-1987, KEPE, 1982, and (ii) Hummen, W., Greek Industry in the European Community: Prospects and Problems, German Development Institut ((GDI), Berlin, 1977.

either the creation and diffusion of domestic technical progress[1] or the assimilation of an imported one.

The lack of manufacturing units producing modern investment goods results automatically in the splintering off and the operational decomposition of the domestic productive mechanism and, because of this, in its inability to form technically self-sufficient productive mechanisms for: (i) the development of new products, (ii) the decrease of the average production cost and (iii) the qualitative improvement of traditional products.

The attainment of the above three (3) objectives, which are the simple expression of any new technical progress and the actual credentials of the competitive ability of the whole research-production system, demands as a sine qua non condition either the import (partially or totally) of materials and technical prerequisites for the domestic production of the above investment goods or the direct import of the corresponding products from abroad.

From these remarks, it becomes clear that - due also to objective causes - the small-medium enterprises of the Greek manufacturing do not fulfil to a satisfactory degree the prerequisites for a long-term price and quality competition vis-a-vis the corresponding units of: (i) the technologically advanced countries in general and (ii) the Member-States of the European Community in particular.

This deficiency of the domestic manufacturing was met during the post-war period by: (i) the relatively lower level of Greek wages, (ii) the low prices of the corresponding domestic raw materials and intermediate products and (iii) the multilateral policy of incentives and customs protection, which was practised with consistency by the Greek State.[2]

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[1]. T. Giannitsis - D. Mavri, Technological Structures and Transport of Technology in the Greek Industry, Gutenberg, 1993.

[2]. See A. Mitsos, The Hellenic Industrial Production in the International Market: Protectionism and Competitiveness of Domestic Production before and after Greece's Accession into the European Community, "Themelio" Editions, 1989.

Greece's accession to the European Economic Community and the gradual integration of the domestic market on the one hand weakened the above three (3) balance-creating factors of low competitiveness, which characterizes the domestic productive units, and, on the other hand intensified competition, which obviously produced discouraging results for the Greek small-medium enterprises.[1]

Greek manufacturing today, going through a transitional stage, has to face a double main problem, consisting of: (i) its organic linkage to the integrated systems of scientific and technological research and (ii) its active participation in the processes of creating and diffusing new technical progress. The ability of Greek small-medium enterprises to survive business-wise in the increasingly intensive competition of the unified European Market depends, in the long term, on the degree of success of the Transfer-Diffusion System of the New Technical Progress, mainly from abroad. The Greek R&D System and the decrease in the structural dispropor-tions of the domestic productive mechanism could become the basis for this success.

The low level of wages and prices of the domestic raw materials, as well as the difference in transport costs between Greece and the other Member States will, in this transitional stage, continue to substitute, in part, for the competitive inabilities of some manufacturing units, in their effort to preserve, and in isolated cases to expand, their share of the domestic market and the sinlge European Market.

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[1]. T. Giannitsis: (i) Greece's Accession into the European Economic Community and Effects on Industry and Foreign Trade, the Institute of Mediterranean Studies, 1988 and (ii) Plan of Industrial Enterprise Promotion (EPB), pp.3-9 and 31-42, the Commission of the European Economic Communities, 1994.

3.3. Technological Intensity in Greek Manufacturing

3.3.1. Research Expenditure

Table 3.1 presents the total R&D expenditure of Greek manufacturing as well as its branch composition for the year 1991. This table was produced in an indirect manner, given the fact that there are no official data in the required form.

Specifically, the initial statistical data that constituted the calculation basis for the compilation of Table 3.1 originate from a GSRT survey, which deals, in general, with firms and takes place every two years. Concerning the manufacturing[1] industry, the correspondence between the 2-digit STAKOD codes and the NACE ones derives from the sector-branch composition of expenditure. Due to the fact that a further break-up (by size) of data was not possible, an attempt was made to indicate, at least, the branches which had a small percentage of large scale (500+) firms (<10% of the employed labour force).

The data of Table 3.1 (column 3) show the composition of research expenditure by manufacturing branch. According to these data, six (6) of the thirteen (13) branches absorb 86.4% of the total R&D expenditure for manufacturing. The largest percentage is concentrated in branch 37 (electrical machinery and appliances) with 47.1%, followed by plastics with 10.8%, chemical manufacturing with 9.9%, non-metallic minerals with 9.0%, food-drink-tobacco manufacturing with 5.4% and metal products with 4.2%. It should be noticed that the branches 34, 48, 24 and 31 (NACE code) comprise mainly small-medium enterprises. The ratio of the branch "R&D expenditure" over the corresponding business turnover presents the technological intensity of the particular branches (column 5). This index of course requires further specification, especially when it involves enterprises of developing countries.

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[1]. The number of 14 branches was the largest possible break-up of STAKOD branches (Greek NSSG classification).

The data in this column show that the branch of electrical machinery holds by far the first position. This is due to the intensive research activity carried out on electrical appliances and systems.[1]

The classification of the manufacturing branches (NACE code) by degree of technological intensity is the following:

TABLE 3.1

Technological Intensity in Manufacturing, 1991

	NACE Code	STAKOD	R&D Expenses in Million Drachmas	Turnover in Million Drachmas	Tech. Intensity
					3:4*100
	(1)	(2)	(3)	(4)	(5)
	11-12-14	32	277.0	472794	0.06
	22	34	31.0	297793	0.01
*	24	33	881.6	297127	0.30
	25-26	31	967.6	350615	0.28
*	31	35	409.5	194287	0.21
**	32-33	36	114.3	47568	0.24
*	34	37	4615.1	181150	2.55
	35-36	38	162.0	80420	0.20
	41-42	20-21-22	534.0	1161593	0.04
	43-44-45	23-24-29	131.0	618630	0.02
*	46	25-26	253.7	109863	0.23
	47	27-28	92.0	180523	0.05
*	48	30	1055.6	142368	0.74
**	49-37	39	280.2	24282	1.15
Total			9804.6	4159013	0.24

Source: NSSG, GSRT (unpublished statistical data).

*,** Show sectors with high participation in SMEs. In particular: * >90%, ** =100%.

[1]. The amounts concerning software development were not calculated in the research expenditure for the production of branch 34 (NACE code).

Table 3.1 a shows the classification of the manufacturing branches (NACE code) by degree of technological intensity.

TABLE 3.1a

Degree of Technological Intensity

	High Intensity (Ratio > 4%)	Medium Intensity (1% < Ratio < 4%)	Weak Intensity (Ratio < 1%)
Branches (NACE code)	-	34-(49-37)	48-24-(25-26) (32-33)-46-31 (35-36)-(11-12-14) 47-(41-42) (43-44-45)-22

3.3.2. Research Personnel by Industrial Branch

We calculated the research personnel employed in research activities which correspond to the specific branches of the manufacturing industry on the basis of the same survey undertaken by the GSRT and with the same approximation method as that used in the case of expense allocation.

The classification of the personnel into the fourteen (14) branches was based on the criterion of the research object and not of the research agency-institution.

Table 3.2 shows the number and composition of the research personnel (researchers, technicians, support staff) as well as its distribution in the corresponding fourteen (14) branches of the manufacturing industry.

TABLE 3.2

Research Personnel by Sector
of Research Activity in Manufacturing, 1991

	NACE Code	STAKOD	Total (FTE)	(Researchers-Technicians-Other)
	(1)	(2)	(3)	(4)
	11-12-14	32	47	(18-15-14)
	22	34	40	(14-12-14)
*	24	33	96	(36-29-31)
	25-26	31	170	(83-49-38)
*	31	35	76	(30-28-18)
**	32-33	36	24	(6-8-10)
*	34	37	675	(301-222-152)
	35-36	38	30	(11-11-8)
	41-42	20-21-22	95	(37-37-21)
	43-44-45	23-24-29	47	(18-15-14)
*	46	25-26	33	(13-14-6)
	47	27-28	11	(6-2-3)
*	48	30	55	(21-22-12)
**	49-37	39	58	(22-21-15)
Total			1457	(616-485-356)

Source: NSSG, GSRT.

According to the above table, the majority of Research Personnel is allocated among the following four (4) sectors: Electrical Machinery (46.3%), Chemicals (11.7%), Non Metallic Mineral Products (6.6%) and Food-Beverages-Tobacco (6.5%).

3.4. Innovation Encouragement of the Greek SMEs by EOMMEH

As regards the Greek SMEs, the Hellenic Organization of Small and Medium-Sized Enterprises (EOMMEH), as the leading institution for the encouragement of their technological modernization, created a broad system of technological support and information with the following specific purposes:

- active support of innovation;
- technology transfer;
- technological modernization of SMEs, in general.

The initial plan, which aimed at promoting innovation in Greece, was elaborated on the basis of a study undertaken in 1982 by OECD experts, in the framework of its own Technological Cooperation Program. EOMMEH, using this study, proceeded to create a national innovation network of five (5) offices in the largest cities of Greece - Athens, Thessaloniki, Patras, Volos, Herakleion - engaging the appropriate staff. Later on, the Hellenic Organization of Small and Medium-Sized Enterprises actually established these innovation centres, as its own subsidiary companies, in the following years:

Innovation Centre of Athens S.A.	1985
Innovation Centre of Herakleion S.A.	1985
Innovation Centre of Thessaloniki S.A.	1990
Innovation Centre of Volos S.A.	1990
Innovation Centre of Patras S.A.	1990

The European Economic Community financed and supported the creation and operation of the above innovation centres. Their main objective is to create an environment able to cover modern technological demands, through which the already existing Greek SMEs will be modernized and technologically developed and new ones will be established, especially by new innovators, inventors and scientists.

The main activities of these innovation centres are:

- Personnel training of the Small and Medium-Sized Enterprises in CAD/CAM/CIM technologies, management and business administration.
- Studies and consulting on the subject of CAD/CAM/CIM applications for SMEs.
- New product designing and testing with CAD/CAM support.
- Evaluation of technological projects.
- Participation in EEC Research and Development Programmes.

The services rendered by EOMMEH for the advancement of innovation are the following:

- Evaluation of innovations and inventions from the technological, economic and commercial aspects.
- Subsidization of innovation projects, in order to facilitate the creation of the prototype.
- Commercialization of innovations by means of either participating in industrial trade fairs or organizing them.
- Affiliation of innovations and patents, advanced by SMEs, with universities, technological and research institutions in the framework not only of Greece but also of Europe, in order to promote in common: research, products, laboratory tests, measurements, analyses, etc.
- Organization of advisory services on matters of technology transfer, innovation, management and technology auditing.

The specific programmes undertaken and launched by EOMMEH are the following four (4):

3.4.1. A Programme for the Encouragement and Support of Innovations in the Framework of SMEs

The assistance provided by EOMMEH,[1] within the scope of this Programme, is in the form of subsidies and aims at creating prototypes or samples of new products and systems as well as at implementing specific pilot projects of technological innovation.

The Programme also includes: (i) measurements, tests and controls of: new products, new technological applications and systems in well equipped laboratories, (ii) market research and (iii) cooperation cost, which derives from the collaboration of SMEs with technological institutions or universities.

By the terms "new product" or "new technological application" are meant:

- Technological improvement with incorporation, in general, of new technology deriving from any known product.
- Products of a high technological standard, intended for any new use or operation.
- New technological processes and scientific applications, which: (i) improve the production process, (ii) are capable of infiltrating through the market either as finished products or as contracts of technology transfer and (iii) raise the: (a) technological level, (b) productivity of the factors of production and (c) competitiveness of specific firms.
- New methods or systems which: (i) improve the quality of the product, (ii) facilitate its storage and transport, (iii) ameliorate its

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[1]. Guideline: Decision taken by the Administrative Board of the EOMMEH No.11/52B/07.09.1984.

appearance, (iv) increase its competitiveness and (v) contribute to the development of a new domestic technology.

- Products and applications of high technological and constructional quality, which are produced and marketed for the first time in our Country, with a high percentage of domestic value added and a capability of: being competitive, achieving import-substitution or even giving an impulse to Greek exports.

Furthermore, Tables 3.3a - 3.3f show the expenditure made, by region, during the period 1986-1992.

It becomes apparent from Tables 3.3a - 3.3f that during the period of 1986-1992 the average expenditure per application shows a relative stagnation or a decline (if calculated in constant prices). The 1992 expenditures are an exception that show an impressive increase in level as well as in the average expense per application. This applies especially to the area of Crete, where the increase greatly exceeds the average national level.

Regarding the regional distribution of the expenses, we observe a progressive decline in the percentage of the Attica region and an equivalent increase of the percentage in Western Greece and Crete.

TABLE 3.3a

Expenditure Plan for the Encouragement and Support of Innovation
Attica Region

	Years						
	1986	1987	1988	1989	1990	1991	1992
Applications Examined	134	108	42	91	34	54	36
Approved Cases	77	58	24	25	18	15	18
Total Grants* (Amounts in Thousand Drachmas)	70790	75055	39989	55450	35510	37843	45458
Grants per Project	919	1294	1666	2218	1973	2523	2527

Source: EOMMEH.

* Concerns 70% of the total development cost of the model.

TABLE 3.3b

Expenditure Plan for the Encouragement and Support of Innovation
Region of Northern Greece

	Years						
	1986	1987	1988	1989	1990	1991	1992
Applications Examined	43	38	18	24	7	20	5
Approved Cases	37	32	14	12	5	17	3
Total Grants* (Amounts in Thousand Drachmas)	17950	22310	10625	14204	6150	28855	9835
Grants per Project	485	679	759	1184	1230	1697	3278

Source: EOMMEH.
* Concern 70% of the total development cost of the model.

TABLE 3.3c

Expenditure Plan for the Encouragement and Support of Innovation
Region of Eastern-Central Greece

	Years						
	1986	1987	1988	1989	1990	1991	1992
Applications Examined	20	9	12	8	5	3	2
Approved Cases	13	6	6	6	4	2	1
Total Grants* (Amounts in Thousand Drachmas)	5203	4270	2103	10200	29500	6000	3000
Grants per Project	400	712	350	1700	7375	3000	3000

Source: EOMMEH.
* Concern 70% of the total development cost of the model.

TABLE 3.3d

Expenditure Plan for the Encouragement and Support of Innovation
Region of Western Greece, Peloponnese, Ionian Islands

	Years						
	1986	1987	1988	1989	1990	1991	1992
Applications Examined	34	17	22	23	15	12	17
Approved Cases	17	11	15	16	14	12	11
Total Grants* (Amounts in Thousand Drachmas)	7991	9450	9107	13495	18610	24835	22490
Grants per Project	470	859	607	843	1329	2070	2045

Source: EOMMEH.
* Concern 70% of the total development cost of the model.

TABLE 3.3e

Expenditure Plan of Encouragement and Support of Innovation
Region of Crete

	Years						
	1986	1987	1988	1989	1990	1991	1992
Applications Examined	23	16	16	14	11	16	18
Approved Cases	15	9	9	10	10	12	11
Total Grants* (Amounts in Thousand Drachmas)	5850	6240	4470	6585	20650	17035	71400
Grants per Project	390	693	497	658	2065	1420	6490

Source: EOMMEH.
* Concern 70% of the total development cost of the model.

TABLE 3.3f

Expenditure Plan for the Encouragement and Support of Innovation
Greece Total

	Years						
	1986	1987	1988	1989	1990	1991	1992
Applications Examined	254	188	110	110	72	105	78
Approved Cases	159	116	65	69	51	58	26
Total Grants* (Amounts in Thousand Drachmas)	107785	117325	66294	99934	110420	114568	152210
Grants per Project	678	1011	1020	1448	2165	1975	5854

Source: EOMMEH.

* Concerns70% of the total development cost of the model.

3.4.2. A Programme of Information Technology for SMEs

This programme concerns the introduction of information technology in the organizational-accounting domain of SMEs and includes the financing of up to 70% of the total purchase cost of computers-printers and software applications, in order to support administrative activities.

It is incorporated in the Integrated Mediterranean Programmes (EEC) and implemented through their instrumentality.

Table 3.4 shows the amounts spent for the various regions. During the period 1987-1992 there is a general increase in the subsidies provided as well as in the number of the enterprises which received these subsidies. This remark is valid for all regions except Crete, which shows a relative stagnation.

TABLE 3.4
Computerization Expenditure Programme for SMEs

Regions	1987	1988	1989	1990	1991	1992
Attica						
Number of Benefitting Firms	31	74	187	102	182	186
Total Grants*	14586	33936	87002	46160	101285	105130
Northern Greece						
Number of Benefitting Firms	28	72	188	45	249	353
Total Grants*	13197	34845	89634	20690	133997	206064
Eastern & Central Greece						
Number of Benefitting Firms	15	29	67	51	142	124
Total Grants*	6929	12337	30765	24496	76453	72563
Western Greece & Peloponnese						
Number of Benefitting Firms	15	28	39	72	61	72
Total Grants*	6523	12649	18233	34170	34113	42871
Crete						
Number of Benefitting Firms	36	20	24	22	25	42
Total Grants*	15887	9175	10674	10156	13906	23910
Aegean Greek Islands						
Number of Benefitting Firms	7	5	6	21	27	30
Total Grants*	3245	2221	2863	9876	15113	17218
Totals - Greece						
Number of Benefitting Firms Total Grants*	139 60367	228 105163	509 239172	313 146331	686 374867	807 467780

Source: EOMMEH.

3.4.3. A Programme of Advanced Telecommunication Systems for SMEs

This programme concerns the creation of an Informatics Centre, which will provide services to the SMEs located in various regions of the Country.

It is incorporated in the Project Star of the European Economic Community, comprising the following phases:

- Subsidization of SMEs for the purchase of equipment: computers/ work-stations, modem and CAD/CAM software, in order to be connected with the EOMMEH Network of Innovation Centres.
- Subsidization in order to purchase the equipment for the Informatics Centre, which will function in the EOMMEH's Innovation Centre.
- Establishment of Regional Services for Specialized Information; concerns subsidization of operational expenses of the SMEs, linked to the Computer Network of the EOMMEH Innovations Centre.
- Subsidization of SMEs for the purchase of advanced technology telecommunications equipment.
- Subsidization of SMEs for the elaboration of specific feasibility studies, with the purpose to incorporate them in the Equipment Programme of the High Tech. Communications Sector.

Table 3.5 presents the level and composition of the above subsidies. As shown in the table, the greatest amount of the subsidies has been spent for the purchase of communications equipment, the covering of the connection costs with the Athens Innovation Centre and the supply of computer equipment to the CAD - CAM sectors.

3.4.4. A Programme of Industrial Product Design for SMEs

This programme aims at encouraging the Greek SMEs in product design applications. It concerns the subsidization of up to 70% of a

TABLE 3.5

Expenditure of the Programme "Introduction of Advanced Telecommunications Systems in Small-Medium Firms", STAR/EEC

(Amounts in Thousand Drachmas)

	Description of Action		1989	1990	1991	1992	Total
3.1	Grants to SMEs for CAD/CAM, H/W & S/W (% of Firms: 70% of Total Cost)	# of SMEs Obtaining Grants	-	15	40	-	55
		Total Grants	-	74652	156616	-	231268
3.2	Grants for the Innovation Centre (% of Firms: 100%)	SMEs Number	-	1	-	-	1
		Total Grants	-	9671	-	-	9671
3.3	Grants to SMEs for the Operational Costs of Linkage with the LAN of Athens Innovation Centre	SMEs Number	-	-	10	31	41
		Total Grants	-	-	9123	29403	38526
3.4	Grants to SMEs for Advanced Telecommunications Equipment	SMEs Number	75	185	13	-	273
		Total Grants	18880	37313	2473	-	58666
3.5	Grants to SMEs for Specific Feasibility Studies Concerning the Advanced Telecommunications Systems	SMEs Number	75	47	-	-	122
		Total Grants	3750	2350	-	-	6100

Total of Benefitting Small-Medium Enterprises: 492 SMEs.
Total Grants: 344,231,000 Drachmas.
Source: EOMMEH.

project's total cost regarding its product design. It has been implemented in the framework of the Integrated Mediterranean Programmes/EEC.

The programme covers the cost of product design and prototype creation. Table 3.6 shows the level of these subsidies. The amounts that have been spent during the period 1986-1992 for the promotion of the above aims exhibit an increasing tendency.

TABLE 3.6

Grants to Small-Medium Firms for Product Design

(Amounts in Thousand Drachmas)

Activity	1986	1987	1988	1989	1990	1991	1992
Grants for Product Design	12911	35617	37739	102875	92155	107062	109002
Other Activities	18254	34408	44128	81383	57321	87774	70611
Total	31165	69925	81867	184258	149476	194836	177613

Source: EOMMEH.

3.5. Manufacturing Branches with Important Innovation Activity in SMEs

In order to examine the trends and principal characteristics of innovation development in the SMEs of the manufacturing sector, we used the interviews of the Heads of Innovation Offices, which took place not only in Athens but also in the Regions, as well as the studies elaborated on the innovation activities of SMEs.

We examined, in particular: (i) the size-groups of the innovative firms, (ii) the purpose of innovation and (iii) the specific sectors subsidized for the development of innovations.

i. Size-groups of innovative firms: 91% of the innovators come from the field of handicrafts.

ii. Purpose of innovation: In most cases of innovation, the main objects of the firms were, in order of significance, the following:

- import substitution;
- reduction of the average production cost of the product;
- quality improvement of the product;
- a more rational use, from the economic point of view, of the factors of production through the re-distribution of inputs, e.g., capital/labour;
- protection of the environment from pollution;
- use of renewable energy sources;
- development of entirely new products.

iii. Sectors subsidized for the development of innovations: From the respective files of EOMMEH for various innovation cases, it is evident that special emphasis is laid on the following sectors, in order of importance: the machinery sectors (branches 36 and 37), the manufacturing of steel products (35), and of plastic and chemical products (30, 31). These sectors are classified in the branches receiving most support (see Table3.7).

3.6. Diffusion of Technologies in SMEs

As has already been mentioned in part 3.2, the gradual integration of the internal market and its inevitable outcome, namely an increase in the intensity of competition, cannot be faced by the SMEs of the Greek manufacturing industry if these firms continue to operate within the existing system of R&D with its completely insufficient practical results (see parts 3.4 and 3.5).

The other two main sources which provide the manufacturing SMEs with new technical progress are: (i) the know-how market, which takes the form of licenses from corresponding foreign productive units and (ii) the import of technological equipment with its embodied new technology.

TABLE 3.7

Sectors Subsidized for the Development of Innovations

Sector	NACE	STAKOD *
Machinery and Appliances	32/33	36
Mainly for Agricultural Use Production of: . Foodstuffs . Wood and Metal Products . Textiles . Printing . Preservation of Energy . Environmental Protection		
Electrical Appliances	34	37
Electronics		
Informatics Technology	34	37
Miscellaneous Industries	49/37	39
Fabricated Metal Products	31	35
Rubber and Plastic Products	48	30
Chemicals	25/26	31

* STAKOD: Greek NSSG Classification.

The acquisition of know-how, through licensing, has functioned, and is still functioning, without any interference on the part of the official

state policy. With the exception of a study elaborated by D. A. Kazis and Ch. Perrakis "Licensing and Industrial Development: The Case of Greece", KEPE, 1984, neither recently estimated data nor studies on the sectoral composition of royalty payments exist.

The low level of Greece's royalty payments abroad compared to those of other countries becomes evident from the study of Kazis-Perrakis, which remains highly relevant. During the period 1972-1978, royalty payments abroad amounted to a total of $95.2 million, out of which $6.6 million were paid by the non-manufacturing branches. The main results of the above study were the following:

- The branches show a different level of technological inter-connection with the other countries. The branches with the highest level of international connections are, in order of importance, the following: chemicals (35.2% of royalty payments), electrical machinery (14.5%), non-metal minerals (9.4%), rubber & plastics (8.2%) and footwear & garments (7.6%).
- Almost all the imported technology originates from three (3) sources: the EEC, the USA (40% approximately) and Switzerland.
- Tight technological relations exist at the level of the firm and not at the level of the manufacturing branch. In many cases, there are extremely few productive units which dominate, technologically, over many small ones of the same branch.
- The multi-national subsidiary enterprises play a decisive role in the transfer of technology in Greece.
- Before 1980, 34% of the royalty payments concerned rights for the use of trademarks, 22% know-how and the remaining 44% the use of both.
- Firms with 10-50 employees spent on average 35.6 thousand dollars each for royalty payments; enterprises with 51-100 employees spent 86.2 thousand dollars each and those which had more than 100 employees spent 379.3 thousand dollars.

Concerning the period after the year 1978, the available data present only the totality of the Country's royalty payments. Table 3.8 shows the absolute level of these payments.

TABLE 3.8

Royalty Payments (in Million US Dollars)

Years	1984	1986	1989	1991	1992
Amounts	12.6	10.0	15.2	13.2	19.4

Source: Bank of Greece, Monthly Statistical Bulletin.

The relatively low level of payments is also due, to some extent, to the gradual devaluation of the "drachma", since the payments are usually calculated on the basis of a certain percentage of the sales made by Greek firms. The reduction or stagnation of these sales in combination with the devaluation of the drachma parity (vis-a-vis the dollar) result in the reduction of the level of royalty payments.

What remains necessary, as regards Greek firms in general and the SMEs of the manufacturing industry in particular, is the import of capital goods from the technologically advanced foreign countries in order to acquire new technological progress.

At this point, it should be pointed out that, during the post-war period the official state policy did not consider it necessary systematically to encourage the development of branches producing investment goods in Greece. These products were de facto considered as imported ones, producing an impact only on the balance of payments of the Country[1] (and not on its technological and, more generally, productive capabilities).

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[1]. See D. Sakkas: The Development Role and the Capabilities of Producing Tools & Machinery in Greece, KEPE, 1986 (in Greek).

TABLE 3.9

Demand and Origin of Investment Goods in the Greek Industry, 1970, 1980

(In Million Drachmas)

		1970					
		Absolute Amounts			Percentages		
		Imports	Domestic Production	Total	Imports	Domestic Production	Total
		(1)	(2)	(3)	(4)	(5)	(6)
1.	Machinery	5786.6	1079.3	6865.9	84.3	15.7	100.0
2.	Transport Facilities	445.9	312.9	758.8	58.8	41.2	100.0
3.	Total	6232.5	1392.2	7624.7	81.7	18.3	100.0
		1980					
1.	Machinery	17592.6	1974.2	19566.8	89.9	10.1	100.0
2.	Transport Facilities	1183.8	89.3	1273.1	93.0	7.0	100.0
3.	Total	18776.4	2063.5	20839.9	90.1	9.9	100.0

Source: Calculations from the investment matrices by Ch. Oikonomides, Volumes of Political Economy No. 9, 1991.

A direct result of this fact is the great dependence of domestic production on the modern investment goods produced in the technologically advanced foreign countries. According to the investment matrices of the Greek Economy, compiled for the seventies and eighties,[1] 81.7% of the value of machinery and transport equipment invested in the Greek Manufacturing Industry in 1970 were imported from abroad (see Table 3.9). This percentage reached 90.1% in 1980. This development, which is expected to worsen due to the internal market, not only adversely affects the balance of payments in Greece but also intensifies the structural disproportions of the Country's productive mechanism and worsens the operational abilities of the Greek R&D System (compare to part 3.2.).

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[1]. Ch. Oikonomides: The Investment Tables of the Greek Economy for the Years 1970, 1980, Volumes of Political Economy No.9, 1991.

4. SUCCESS-FAILURE FACTORS OF INNOVATION IN SMEs

4.1. Available Statistical Data

The General Secretariat of Research and Technology (GSRT) is elaborating a survey "Study of Innovation in Greek Enterprises". Its data and conclusions have not yet been published. Consequently, official data concerning the innovative activity of Greek firms - especially of SMEs - are not available at present.[1]

EOMMEH, in the framework of its policy of encouraging and supporting: (i) innovation, (ii) diffusion and transfer of technology and (iii) dissemination of new technologies in the Greek SMEs, elaborated a study on the "Problems, Difficulties and Special Needs of the Greek SMEs for the Development of Innovations" (Innovation and Technological Development Department, 1993, unpublished).

The SMEs subsidized by EOMMEH in the framework of its Guidelines for the Encouragement and Financial Support of Innovation and Invention constitute the relevant data sources.

The above mentioned SMEs are listed in the files of EOMMEH's Innovation Department in Athens and the local Innovation Offices in Thessaloniki, Volos, Patras and Herakleion.

The exploration of the difficulties and needs of the SMEs which had advanced innovations in the previous years (from 1989 to 1992) was based on primary empirical research. Of the two hundred and four (204) organizations which received the questionnaire, only one hundred and two (102) replied, which consequently formed the sample of this survey.

The questionnaire was drawn up on the basis of the general recommendations of the OECD-OSLO Manual, 1992, "Proposed Guidelines

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[1]. The first systematic attempt to investigate this object was undertaken by S. Skoumal-D.A. Kazis, Innovation in Greek Manufacturing: Role of Advanced Technologies and New Management Outlook, KEPE, Athens, 1985.

for Collecting and Interpreting Technological Innovation Data". Tables 4.1a - 4.1c provide information referring to the innovative enterprises. According to Table 4.1a, the greatest % of these enterprises (96%) belong to the relatively small enterprises (up to 40 emloyees). The majority of the above enterprises (56%) were founded during the 5-year period 1980-1984, while 27% of these enterprises were established befor 1980 (Table 4.1b). With regard to the legal regime governing the innovative enterprises, 80% constitute legal entities, while 11% constitute personal enterprises (Table 4.1c).

TABLE 4.1a

General Information on the Innovative SMEs

Employment (Number of Employees)	Innovative SMEs
0-9	53%
10-19	29%
20-49	14%
50-99	4%
99-499	0%
Total	100%

TABLE 4.1b

General Information on the Innovative SMEs

Year of Establishment	Innovative SMEs
<1979	27%
1980-1984	56%
1985-1989	11%
1990>	6%
Total	100%

TABLE 4.1c

General Information on the Innovative SMEs

Ownership Status	Innovative SMEs
Individuals	5%
Personal Companies	11%
Legal Entities	80%
Institutes	4%
Total	100%

Source: EOMMEH.

4.2. Main Results of the Survey on the Innovation Products of SMEs

As regards the sample under study in this survey, Table 4.2 presents the categories of products examined. According to the table, 42% of innovative products are consumer durable goods, 40% are intermediate and investment products and the remaining 18% mixed production products.

TABLE 4.2

Categories of Innovation Products

Category	Products
Intermediate and Final Investment Products	40%
Consumer Durable Goods	42%
Mixed Production	18%
Total	100%

Source: EOMMEH.

Regarding the conditions and the development process of the innovation product, Table 4.3 shows the following results. 43% of the innovative products were produced following the initiative the innovator-businessman and with his own means. 41% originated from the imitation of imported products in order to provide a substitute for them, 10% after cooperation with another firm, local or foreign, and only 4% from a common effort with Research Institutes or Universities. Finally, 2% of the innovative products resulted from a know-how transfer.

TABLE 4.3

Development Conditions of the Innovation Product

	Conditions	Products
1.	The product was developed inside the enterprise:	
	- Through an initial idea of the businessman and innovator using his own means.	43%
	- Through imitation of an imported product, in order to provide a substitute for the imported one.	41%
2.	The product was developed in cooperation with another company in Greece or abroad.	10%
3.	The product was developed in cooperation with an institute or uiversity.	4%
4.	The product was developed by know-how transfer.	2%
Total		100%

Source: EOMMEH.

The main reasons for the success or failure of the innovation product, in the framework of the SMEs, are presented in Tables 4.4 and 4.5.

While the success of the innovative products is mostly due to their high quality and competitive price, failures may be attributed to many equally important reasons such as out-of-date technology (26%), delayed introduction into the market (23%), inappropriate market research (21%), intense competition (18%) and other technical organisational weaknesses (12%).

TABLE 4.4

Main Reasons for the Success of the Innovation Product in the Framework of the SMEs

	Success Reasons	SMEs
1.	High quality products by international standards	38%
2.	Competitive price of product	32%
3.	New technology incorporated in the product	18%
4.	Existence of a distribution network in Greece and the other EEC Countries as well as service support after business transaction	12%
Total		100%

Source: EOMMEH.

TABLE 4.5

Main Reasons for the Failure of the Innovation Product
in the Framework of the SMEs

	Failure Reasons	SMEs
1.	Obsolete technology and design	26%
2.	Delayed introduction into the market	23%
3.	Empirical-unsuccessful market research	21%
4.	Strong competition, high cost of product	18%
5.	Unsuccessful advertising and commercial promotion	6%
6.	Inability to finance further the construction of the model, abandonment	5%
7.	Technical difficulties/abandonment	1%
Total		100%

Source: EOMMEH.

4.3. Specific Problems Faced by the Innovative SMEs

The main problems which have to be faced by the SMEs appear during the performance of the following activities:

- development and commercialization of the innovation,
- effort of SMEs at updating obsolete technologies,
- effort of SMEs at either developing or acquiring new technologies.

The following Tables 4.6, 4.7, 4.8, 4.9 present the actual situation.

TABLE 4.6

Problems during Innovation Development and Commercialization

	Description of Problems	Innovative SMEs
1.	Insufficient financing	25%
2.	Difficulties in the markets/marketing	23%
3.	Problems in the production/raw materials	18%
4.	Difficulties in the technology development	17%
5.	Bureaucracy	7%
6.	Lack of specialized personnel in new technologies	6%
7	International Cooperations: Difficult access-participation in Community Programs etc.	
Total		

TABLE 4.7

Problems during Technological Updating

	Description of Problems	Innovative SMEs
1.	Financing	46%
2.	Bureaucracy	17%
3.	Difficulties in the rational choice of technology	13%
4.	Specifications/Total quality management	11%
5.	Training of personnel	10%
6.	Physical distribution (Land/Buildings)	3%
Total		100%

Source: EOMMEH.

TABLE 4.8

Problems during New Technology Development

	Description of the Problems	Innovative SMEs
1.	Financing	38%
2.	Raw materials	21%
3.	Specialized personnel	15%
4.	Sub-contractors/Machinery	13%
5.	Cooperation with R&D institutions	11%
6.	International cooperation/EEC projects	2%
Total		100%

Source: EOMMEH.

TABLE 4.9

Needs for Technological Support in the Framework of the Innovative SMEs

	Description of Needs	Innovative SMEs
1.	Product quality control/Certificates/TQM	17%
2.	Product design/CAD-CAM Systems	16%
3.	Organization-Programming of production/CIM	16%
4.	Construction of the model	12%
5.	Technical consulting	11%
6.	Training of technical staff	10%
7.	Stock organization/Control	7%
8.	Test/Measurement/Analysis	6%
9.	Various	5%
Total		100%

Source: EOMMEH.

Tables 4.6 - 4.9 show the relative importance of the role of the various obstacles in the innovation activity of the enterprises sampled. Most of these obstacles reflect on the one hand the weaknesses of the Greek scientific - research system as a whole, and on the other the low technical - organisational level of the domestic manufacturing industry in particular.

4.4. Effects on SMEs Deriving from the Community Programmes for Research and Technological Development[1]

The integration of the European Internal Market creates important competition problems for Greek manufacturing firms, and specifically for the SMEs, because of their low technological level and the existing structural weaknesses within the Greek Economy.

Given the fact that the traditional ways of facing the limited competitive capabilities of the Greek manufacturing units have lost a great deal of their effectiveness, there remains no other solution for the SMEs but innovation and acquisition-diffusion of the new technical progress.

In this case the relevant problem in Greece consists of the non-integrated (and as a result less effective) R&D System and the limited level of research funding. It is certain that research and technological development, especially when harmonized with the research and technological activities of the European Community, constitute a prerequisite not only for raising the competitive capability of the Greek SMEs but also for giving an impulse to the economic development of the Country in general.

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[1]. Certain views expressed in this Chapter are based on an unpublished study of the Working Group for R&D, elaborated for the second National Program for Research and Technology (EPET II), February 1993.

The participation of Greece in the General Guidelines of the third Framework programme of Community activities in the field of research and technological development, 1990-1994, is characterized by:

- Great adaptability of Greek Institutions to Community Programmes.
- A strong tendency for the Greek firms to internationalize their activities through additional funding sources.
- Encouragement of cooperation among universities/research centres/firms.
- Increased participation of Greek entrepreneurs in international joint-undertakings.
- A warmer response than ever of Greek enterprises to the acquisition of new technology.

The effects on Greece of Community Programmes for Research and Technological Development can be considered as positive. More specifically, these Programmes have contributed to:

- The proximity to the member-states at the research-technology level and the creation of a European conscience among scientists-entrepreneurs-executive cadres of the R&D System.
- The encouragement of basic infrastructure (creation of research centres, etc.) through Community funding.
- The upgrading of research activity through participation in advanced European Programmes.
- The access to R&D findings which have a large scale applicability.
- The attraction of young scientists and entrepreneurs specialized in issues of technological development.

Regarding the effects on Greece of certain specific structural Community and Greek Programmes {Mediterranean Integrated Programmes (MOP), Programmes for R&D - First National Programme for Research and Technology (first EPET) - Community Support Framework (KPS) 1989-1993, STRIDE and the Programmes of GSRT, Development

Programme of Industrial Research (PAVE), Programme of Co-financing and Creating Research joint-undertakings, contained in the STRIDE}, the following consequences are observed:

- Enlargement and strengthening, in general, of the Greek R&D System, not only in the public sector but also in the private one; increase in expenditure and extension-improvement of the relevant infrastructure.
- Percent increase in the Greek expenditure for R&D visibly lower than that of the less favoured regions of the European Community; low percent participation of SMEs in R&D and relatively unstable mode of operation of the whole Greek R&D System.
- Signs of inconsistency in the Greek policy on R&D.

Regarding above listed three (3) points, some additional explanatory remarks can be made, such as:

- The existence of managerial-organizational weaknesses (mainly deriving from the public sector) on several occasions, e.g. in the case of the Mediterranean Integrated Programmes, impedes the absorption of the relevant funding as planned.
- The funding of operational expenditure of many research institutions (especially the new ones) is problematic, due to their great competition in claiming research projects, on which they depend for their existence and operation.
- The participation of firms in the R&D expenditure, in spite of being unimportant, increases at a slow pace.
- The development of domestic and international mechanisms for the transfer of technology has not made satisfactory progress.
- The relevant expenditure is concentrated in the Attica region (Athens); thus, Thessaloniki, Patras and Herakleion must increase their relevant share.
- Encouragement of the effectiveness of the Greek R&D System has been effected by: (i) the creation of infrastructure, (ii) the

immigration of Greek researchers, (iii) the education of young scientists and (iv) the inducement of firms to participate in scientific-technological activities.

- The institutions of the Greek R&D System acquired a new mentality and improved, in general, their attitude towards research and development, considering it, at last, as a decisive factor of economic development.

On the basis of the above, it is obvious that the participation of Greece - as important as it can be - in the Community R&D Programmes must be combined with encouragement of the positive consequences and discouragement of the negative ones, the main objective being a perceptible improvement of the operational and practical effectiveness of the Greek R&D System.

5. CONCLUSIONS

The above analysis of the quantitative and qualitative characteristics of the Greek R&D System leads to certain basic conclusions:

The percentage of national resources provided for R&D is very low, especially that allocated to the private sector which fluctuates between 10%-15% of the total expenditure. These figures indicate the comparatively limited interest of the Greek State in R&D issues as well as the indifference of the great majority of firms towards an active participation in innovation processes. This situation results in the following:

a. The number of researchers, technicians and support personnel employed in R&D activities is very limited.
b. The existing institutions of the Greek R&D System do not suffice for the fulfilment of the workload which corresponds to a well organized system.
c. The rendering of services by the domestic R&D System is insufficient to cover existing needs and inferior to that of the Community.
d. The operational capability of the System, namely the degree of cooperation and practical effectiveness of the institutions which participate in R&D processes, is far from approaching the desired level.

Thus it is obvious that the future R&D policy must focus mainly on the following points:

1. The need to increase the national resources allocated to R&D. The ratio GERD/GDP from 0.46% must increase substantially in order to approach 0.6%.
2. The strengthening of the demand for research in selected sectors. The encouragement of cooperation and the creation of joint-undertakings among the specialized institutions (research,

scientific, productive, etc.) in order to cover the prospective demand.

3. The support of research centres - which are under the supervision of the GSRT - and of their geographical expansion in Thessaloniki and Patras. The creation of new research centres in these two cities is considered fundamental in order to encourage the Country's development effort and the perspective opening up towards the west and the north of Greece.

4. The increase in the number of the Greek research force and specifically the raising of its quality level; the relevant quality improvement can be achieved by using the possibilities offered by: (i) international cooperations (Community), (ii) intensification of the existing links between the relevant theoretical knowledge and practical applications (mobility of personnel among universities, research centres and firms) and, finally, (iii) development of an educational system of basic and applied research, which should be incorporated in the long-term R&D objectives and policies of the Country.

Gradual progress in the encouragement of the above general aspirations will by itself create a more favourable environment for the modernization and the technological development of SMEs.

Concerning this more specific issue, EOMMEH has drawn up a plan which introduces policy measures in order to give multilateral support to the Greek SMEs as regards their decisions, on the one hand, to participate actively in innovation processes and, on the other, to become familiar with the new technical progress by acquiring it. Each proposed policy measure is followed by: (i) the definition of its final objective, (ii) the description of its implementation, (iii) the scope of the benefitting firms and (iv) the anticipated ceiling of relevant expenses.

The proposed policy measures by EOMMEH are listed, in brief, below:

1. Encouragement for the development of innovations and subsidization of prototypes.
2. Partial subsidization of cost in order to secure inventions at the international level.
3. Encouragement of SMEs to introduce informatics.
4. Subsidization of SMEs (manufacturing branch) for technology transfer.
5. Encouragement of SMEs (manufacturing branch) to use CAD/CAM/CAE.
6. Creation of a data base and relevant network for the linkage of SMEs with the EOMMEH Centre.
7. Study-realization of specialized units - in the framework of the EOMMEH Innovation Centres - for rendering technological services to SMEs.

APPENDIX

GLOSSARY OF TERMS AND ABBREVIATIONS

AEI	Universities/Institutions of Higher Education
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
EN	European Standards
EOQC	European Organization for Quality Control
ELOT	Greek Organization for Standardization
ELKEPA	Greek Productivity Centre
EOMMEH	Hellenic Organization of Small and Medium-Sized Enterprises and Handicrafts
EPET	National Program for Research and Technology
EPO	European Patent Office
ETE	Scientific Technology Research
FTE	Full Time Employment
GERD	Gross Expenditure for Research and Development
GSRT	General Secretariat of Research and Technology
HD	Harmonization Documents
INVENTION	Creation of new technology. In a broad sense, invention is "the output of the research industry".
ISO	International Organization for Standardization
KEPE	Centre of Planning and Economic Research
LICENCE	Written, legal authorization or permit to have or do a specified thing; the official document granting this authorization or permit.
MOP	Mediterranean Integrated Programmes
NSSG	National Statistical Service of Greece
OBI	Industrial Property Organization
PATENT	It is a document that concerns a recognized and registered invention. It is issued by an authority which exclusively grants or secures, to a specific person or group, the right of manufacturing-selling-using this invention/Letters Patent.
PAVE	Development Programme of Industrial Research
ROYALTIES	Sum paid to the owner of a Copyright or Patent.

STAKOD Greek Standard Industrial Classification of Economic Activities

TECHNOLOGY DIFFUSION Technology adoption by other users than the original innovator/More extensive and improved use of technology by the original innovator.

TECHNOLOGY -TRANSFER All activities concerned with the transformation of new technology into innovation and the various means by which technological knowledge is disseminated.

TEI Institutions of Technical Education

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