



## **RIP-WATCH**

# **ANALYSIS OF THE REGIONAL DIMENSIONS OF INVESTMENT IN RESEARCH**

## **CASE STUDY REGIONAL REPORT: CRETE (GREECE)**

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# Case Study Regional Report on the Regional Dimensions of Investment in Research

## OBJECTIVE

The main objective of this regional case study report is to provide a better understanding of the structural techno-economic characteristics of the analysed European region, to present the key factors conducive to increased investment in R&D and to identify key R&D policy challenges the region is facing.

## BACKGROUND

In partnership with DG Research, the Institute of Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) has been implementing a watching brief on policy developments aimed at promoting both private and public investment in R&D (RIP-WATCH). A stated aim of this policy watch activity is to take stock of developments aimed at increasing investments in R&D in the European regions.

In the design phase of the activity, a typology of the European regions was produced. A balanced mix of twenty regions was selected from each of the nine identified regional types representing fifteen member states of the European Union.

## COVERED REGIONS

Phase 1		Phase 2	
1. Andalusia (ES)	2. Catalonia (ES)	11. Bavaria (DE)	12. Corsica (FR)
3. Carinthia (AT)	4. Crete (EL)	13. Emilia-Romagna (IT)	14. Etelä-Suomi (FI)
5. Dél-Dunántúl (HU)	6. Jihozápad (CZ)	15. Balearic Islands (ES)	16. Lorraine (FR)
7. Norte (PT)	8. Sicily (IT)	17. Midi-Pyrénées (FR)	18. Saxony (DE)
9. Styria (AT)	10. Wielkopolskie (PL)	19. Scotland (UK)	20. Västsverige (SE)

## THE REPORTS

The regional reports are structured according to the following two interrelated dimensions of regional techno-economic systems:

- **Regional knowledge base**, including the research, technological development and innovation (RTDI) infrastructure, human resources, RTDI efforts and outcomes and knowledge transmission mechanisms in the region
- **Regional economic structure**, including the productive structure, regional clusters and networks, international position and financial capacities and instruments

Each report examines these dimensions from two points of view: their current state as reflected in a selected set of regional indicators and their policy context (i.e. policy framework, actors, objectives and instruments).

In addition to the regional case study reports, a **synthesis report** will be produced that combines and interprets the information contained in the case study reports, presents the strengths and weaknesses of the regions covered and the factors that determined the trajectories of development of their R&D and innovation capacities, and discusses the main R&D and innovation challenges identified.

JRC-IPTS launched the first phase of the activity in June 2006 with the contribution of the ERAWATCH Network. The work has been undertaken between June and December 2006 by a project team led by LOGOTECH S.A. (EL) with the participation of iDeTra (ES), IKU Innovation Research Centre (HU), Institute of Fundamental Technological Sciences of the Polish Academy of Sciences (PL); Instituto de Estudos Sociais e Economicos (PT), Joanneum Research InTeReg (AT), Nomisma (IT), Poznan University of Economics (PL), Technology Centre of the

Czech Academy of Sciences (CZ), The Bigger Splash (ES) and Transdanubian Institute of Centre of Regional Studies of Hungarian Academy of Sciences (HU).

A first set of ten regional case study reports is now available on the ERAWATCH web-site at <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=intService.home>

The second phase of the activity was launched in December 2006. A second set of ten regional case study reports and a synthesis report are expected to be available on the ERAWATCH web-site by October 2007.

## Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>7</b>
<b>2</b>	<b>Regional Knowledge Base .....</b>	<b>8</b>
<b>2.1</b>	<b>Description of the regional knowledge base .....</b>	<b>8</b>
2.1.1	Knowledge creation capacity .....	8
2.1.2	Knowledge diffusion capacity of the region .....	11
2.1.3	Knowledge absorption capacity of the region .....	13
<b>2.2</b>	<b>Policy context .....</b>	<b>13</b>
2.2.1	Policy framework and actors .....	13
2.2.2	Policy objectives and instruments .....	14
2.2.3	Assessment of the policy mix .....	18
<b>2.3</b>	<b>Conclusions .....</b>	<b>18</b>
<b>3</b>	<b>Regional economic structure .....</b>	<b>20</b>
<b>3.1</b>	<b>Description of the economic structure .....</b>	<b>20</b>
3.1.1	The characteristics of the productive structure of the region's economy .....	20
3.1.2	Systemic characteristics of the region .....	22
3.1.3	The regional economy in the international context .....	22
3.1.4	The local financial market .....	23
<b>3.2</b>	<b>Policy context .....</b>	<b>23</b>
3.2.1	Governance structure and actors .....	23
3.2.2	Policy objectives and instruments .....	23
<b>3.3</b>	<b>Conclusions .....</b>	<b>25</b>
<b>4</b>	<b>Conclusions .....</b>	<b>27</b>
<b>4.1</b>	<b>Assessment of the RIS .....</b>	<b>27</b>
4.1.1	Strengths and weaknesses .....	27
<b>4.2</b>	<b>Assessment of policies .....</b>	<b>29</b>
<b>4.3</b>	<b>Challenges and trends of the knowledge economy .....</b>	<b>30</b>
<b>5</b>	<b>References .....</b>	<b>33</b>
<b>Annexes</b>	<b>.....</b>	<b>34</b>
<b>Annex 1: Definition of policy mix typology .....</b>		<b>34</b>
<b>Annex 2: Description of key indicators used in the summary graphs .....</b>		<b>36</b>
<b>Annex 3: Tables and Figures .....</b>		<b>37</b>

## Exhibits

Exhibit 1: RTDI policy mix affecting the region	17
Exhibit 2: Effects of policies complementary to RTDI instruments on R&D and innovation capacity of the region	25
Exhibit 3: Matching of knowledge and economic specialisation	28
Exhibit 4: Strengths and Weaknesses of the regional innovation system	29
Exhibit 5: Identification of policy challenges	32

## List of Tables

Table 1: List of public sector research establishments in Crete	37
Table 2: Number of students enrolled in Greek HEIs and students registered in 2002 per region	38
Table 3: Number of teaching staff (all levels)	38
Table 4: Expenditure on R&D in Crete Region by type of performer (EUR million)	38
Table 5: R&D expenditure per GDP and by type of performer – 2003	39
Table 6: R&D personnel in Greek regions by type of performer – head count 2003	40
Table 7: Distribution of R&D expenditure among Greek regions in 2003	40
Table 8: Distribution of GERD among Greek regions	41
Table 9: Contribution of regions to Greek HERD	41
Table 10: Contribution of regions to Greek GOVERD	42
Table 11: Funding of RTDI measures by Regional Operational Programmes of Structural Funds according to initial planning of CSF 2000-2006 – EUR	42
Table 12: Final allocated budget for funding RTDI measures by Regional Operational Programmes for programming period 2000-2006. Amounts in EUR thousand	43
Table 13: Patent applications at Industrial Property Organisation of Greece	43
Table 14: Number and proportion of employees with tertiary education	43
Table 15: Human resources in science & technology as % of total labour per region. Total HSRT*. 1994-2005	44
Table 16: Human resources in science & technology as % of total labour per region and Greece. HSRT in Core*. 1994-2005	45
Table 17: Participation in lifelong learning (population aged 25-64)	45
Table 18: Main R&D programmes in OP "Competitiveness and their budget	46
Table 19: Shares of RDP in country's GDP – and Average Annual Growth Rate – 1995-2003	46
Table 20: Population of Greek regions (thousands)	47
Table 21: Comparison of regions' GDP per capita with Greece and EU25 - Greece 100. Average annual growth of GDP per capita for 1995-2003	48
Table 22: Long-term (over 12 months) unemployment as percentage of total unemployment	49
Table 23: Gross fixed capital formation by sector of activity in Crete EUR million and average annual growth of GFCF	50
Table 24: Sectors' shares in total value added of Crete and Greece 1995-2003	51

Table 25: Number of companies and their revenue – Crete 2003	52
Table 26: Turnover and number of firms in Crete based on technological intensity – 2002	53
Table 27: Imports/exports from Crete customs offices (EUR million)	53

## List of Figures

Figure 1: Map of Greece	7
Figure 2: Key indicators of Crete's knowledge-base development in comparison with Greece	19
Figure 3: Key indicators of Crete's economic structure and development – comparison with Greece	26

## Abbreviations

ANBERD	Analytical Business Enterprise Research and Development Database
BERD	Expenditure on R&D in Business Enterprise Sector
CAP	Common Agricultural Policy
EPO	European Patent Office
GBAORD	Government Budget Appropriations or Outlays for R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GFCF	Gross Fixed Capital Formation
GSRT	General Secretariat of Research and Technology
GUF	General University Funds
HERD	Expenditure on R&D in Higher Education Sector
ISIC	International Standard Industrial Classification
IPTS	Institute of Prospective Studies, Seville, Spain
MC	Management Committee
NACE	Statistical Classification of Economic Activities in the European Community
N.E.C	Not Elsewhere Classified
NSSG	National Statistical Service of Greece
PM	Project Management
PPP	Purchasing Power Parity or Private-Public Partnerships
ToR	Terms of Reference

# 1 Introduction

Crete is the largest island in Greece, with 5.5% of the country's total population<sup>1</sup>, 5.3% of GDP<sup>2</sup>, and 80.1% of EU25 average GDP per capita in 2003<sup>3</sup>. Service activities, such as tourism, transportation services and education dominate the regional economy, accounting for over 62% of total employment and producing 78.2% of the regional value-added<sup>4</sup>. The manufacturing sector mainly revolves around activities connected to processing of primary sector output, such as food and beverages, plastics and construction. The processing industry suffers from deficiencies in organisation, planning and standardisation. Agriculture is the second largest activity, but is dominated by small landholdings, inefficient organisation and poorly skilled personnel.

Figure 1: Map of Greece



The degree of networking and interlinkage between the private and public research sectors is low. Most enterprises are SMEs with relatively low turnover. Furthermore, there are large sub-regional imbalances between north and south. Urban concentrations and mass tourism activities dominate in the north of the island, in contrast to the south which has a rural population and is dominated by agriculture. Agriculture, despite its significance for the regional economy, is marked by small and dispersed landholdings focused mainly on olive trees and wine production. Efforts are currently being made to shift to higher value-added production (such as flowers and organic farming) and develop a multifunctional agricultural setting (e.g. agro-tourism) as an alternative to mass tourism. Renewable energy sources account for 10% of the island's energy consumption, with a strong upward trend<sup>5</sup>.

The unemployment rate in Crete (7.7% in 2004)<sup>6</sup> is the lowest among the country's 13 regions. However, unemployment figures can be misleading since occupations such as tourism and agriculture, which employ a large share of the region's workforce, are seasonal.

During 2003 R&D expenditure accounted for 0.86% of GRP<sup>7</sup>, a considerably larger share than the national average of 0.63% and second only to Attica's 0.93%, with universities and PROs (public research organisations) accounting for 97.2% of total regional expenditure. Crete receives 18% of the expenditure allocated to public research centres and 8% of that allocated to higher education institutes HEIs) in Greece. However, even this R&D performance is significantly below the European average, and much lower than the Barcelona targets, particularly in regard to the private sector. Moreover, interaction between the knowledge-

<sup>1</sup> National Statistical Service of Greece, Census 2001.

<sup>2</sup> National Statistical Service of Greece.

<sup>3</sup> Eurostat.

<sup>4</sup> OECD.

<sup>5</sup> G. Lyviakis, 'Elevtherotypia' newspaper – 04.09.2006.

<sup>6</sup> National Statistical Service of Greece.

<sup>7</sup> General Secretariat of Research and Technology.

creation infrastructure and the local economic actors is very limited, due *inter alia* to a profound mismatching of orientation and specialisation.

## 2 Regional Knowledge Base

Thanks to public investment, Crete has since the 1980s developed significant R&D infrastructures that produced major results – as indicated by their participation in European RTD programmes and evaluations implemented by GSRT. However, this success was not harnessed by the regional production base due to inefficiencies in the regional innovation system, with enterprises being weakest in terms of R&D performance.

### 2.1 Description of the regional knowledge base

#### 2.1.1 Knowledge creation capacity

##### 2.1.1.1 Knowledge infrastructure

Over the last 20 years Crete has developed a significant public academic and research infrastructure, through the foundation of two universities, one non-university higher education institute (TEI) and five research centres (in Annex, Table 1).

Taken together the three HEIs had 25 300 students in 2002, accounting for 7.7% of the entire student population (Table 2). In terms of student concentration, Crete occupies fifth place among the country's 13 regions. The students enrolled in 2002 (the latest available data) numbered 5 970, i.e. 7.6% of the students enrolled in HEIs in 2002.

It is estimated that the three HEIs (Table 3) employ approximately 2 000 teaching staff (of all levels) and over 1 350 research staff members.

In terms of size, the *University of Crete* is the largest institution, with 633 teaching staff and over 14 000 students in 2005 (2 040 enrolled in 2002). It has five departments, two of which focus on science, engineering and medicine while the rest are devoted to the humanities and arts.

In contrast, the *Technical University of Crete (TUC)* focuses exclusively on technology disciplines. The university is based in Chania, with 2 500 students in 2005 (309 students enrolled in 2002) and 180 teaching staff. Its five departments focus mainly on industrial automation, ICT applications, materials, energy, biochemical and environmental engineering.

The *Technical Education Institute of Crete* acquired the status of a higher educational institute in 2003<sup>8</sup>. Its central campus is located in Heraklion, while five branches are located in Crete's other three prefectures. The TEI has over 15 000 students and 1 143 teaching staff. It is more active in research fields related to the agricultural sector and renewable energy sources, a fast growing field on the island, which has a large untapped potential (wind, solar, etc.).

In addition, Crete hosts one of the country's largest research centres – the *Foundation for Research and Technology Hellas (FORTH)* established in the 1980s. Its main activities are based in Heraklion but it has branches in other cities on Crete and in other regions. The four institutes based in Heraklion work on molecular biology and biotechnology, computational mathematics, materials structure, lasers and computer science (software development). One institute in Rethymno focuses on "Mediterranean studies". Another two of the Foundation's institutes are based outside Crete.

During 2003 FORTH's budget amounted to €31.1m, which is the largest budget for public research institutes in Greece, thereby highlighting the institute's significance not only for Crete

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<sup>8</sup> In 2003 all TEIs acquired the status of HEIs. They are not regarded as universities, however.



region but for the country as a whole. Approximately 13% of its 2003 budget came from enterprises (for R&D projects) and from sales of services and products<sup>9</sup>.

The *Mediterranean Agronomic Institute of Chania (MAICH)*, established in 1985, conducts scientific and technological research in the fields of food quality, sustainable agriculture, horticulture genetics, natural products and biotechnology. The institute runs a Master's degree, with 625 graduates, of whom 95 came from Crete<sup>10</sup>.

The agricultural research facilities of *NAGREF* are based mainly in Chania and Heraklion, with outstations in many places on the island. Heraklion also houses two institutes of marine biology, the Hellenic Centre for Marine Research established in 2003, and a new aquarium. The Centre manages major aquaculture research facilities in Heraklion.

### 2.1.1.2 Investments in R&D

#### *Investments in infrastructures*

The investments to build up the aforementioned infrastructures were completed before 2000. No major investments have been undertaken since then apart from improvements and updates to the existing infrastructure. A total of €6.2m was planned to be spent on research infrastructures and €15.6m on educational infrastructures in 2000-2006. Of these, only €6.9m and €3.3m respectively had been invested by 31.12.2004<sup>11</sup>. On top of that, two small investments amounting together to approximately €1m were co-funded by two companies and Crete's Regional Operational Programme. The first investment was for upgrading a molecular biotechnology laboratory and the second for a laboratory for advanced materials.

#### *R&D expenditures and R&D personnel*

The overall R&D spending of the **HEIs and research institutes** amounted to €72.02m in 2003, i.e. 97.2% of the region's GERD and 0.87% of its GDP (Tables 4 and 5). The government and HEI sectors together employ 4 147 R&D personnel (50% of whom are researchers), i.e. 98% of total R&D personnel in the region (Table 6).

In contrast to the public research sector, the **private sector** has only limited R&D activity, as the average BERD for 1995-2003 was 3.7% of the region's GERD (falling to 2.8% in 2003 and amounting to only 0.02% of GRP (Tables 4 and 5). This very low expenditure reflects the fact that only a few firms have an organised R&D department, while none of them has more than 10-15 persons<sup>12</sup>. Overall, there were only 84 R&D personnel in the business sector, of which just 34 were researchers (Table 6). Possible explanations for this are (i) the small size of the companies on the island, and (ii) the fact that most of them operate in low-tech segments of their respective markets (particularly for manufacturing). Exceptions to the general trend are the few firms in the plastics and food industry<sup>13</sup> which initiated R&D efforts from the mid-1990s in order to develop the competitive position needed to penetrate the European market.

It can be seen from Table 4 that absolute values of R&D investment increased more than 107% in 1995-2003<sup>14</sup>, with the highest increase of 195% being experienced in the HEI sector. Even the business sector doubled its expenditure during those eight years. Research institutes also increased their expenditure, but only by 58%. The fact that similar trends can be seen at national level (see Table 4) indicates that some of the growth should be attributed to causes applying across the country, such as the 226% growth in government funding and the 93%

<sup>9</sup> Statistics and Indicators of Supervised Research Organisations. Ministry of Development, GSRT, June 2004.

<sup>10</sup> OECD, 2005, *Place-Based Policies for Rural Development Crete, Greece (Case Study)*, Working Party on Territorial Policy in Rural Areas.

<sup>11</sup> Annual Report for Crete Regional Operational Programme for 2004.

<sup>12</sup> No official data exist on the number of R&D departments and their size.

<sup>13</sup> Plastics of Crete, Mega Plastics and Creta Farm.

<sup>14</sup> Data are available only for 1995-2003.

growth in funding of Framework Programmes and the Structural Funds from 1993 to 2003 (see Table 4a). Local specificities were also responsible for the growth, though. An example is the expansion of the Technical University of Crete with two department in areas with fast growing research activities, namely electronics and computer engineering (established in 1990) and environmental engineering (established in 1995) and the efforts of few local firms to boost their competitive position on the European market.

**Comparing Crete with the entire country**, it ranks third in terms of its share of R&D investment and R&D personnel, accounting for 7.6% and 7.5% of the country's GERD and R&D personnel respectively in 2003 (Tables 6 and 7). Crete ranks second, ahead of the region of Central Macedonia, in terms of expenditure by public research centres (17.75% of the country's GOVERD). However, it still ranks third in terms of R&D personnel. Regarding expenditure by HEIs, the region comes behind Attica and Central Macedonia. What is striking, however, is the negligible investment by the private sector, constituting only 0.66% of business R&D expenditures in the country. This figure ranks the region seventh among the 13 regions.

Viewed over a lengthy period Crete's **R&D intensity** has been one of the highest in the country, peaking at 1% of GDP in 1999. However, R&D intensity has fallen slightly since then, mainly due to the lower rate of growth in public expenditure on R&D (GOVERD and HERD) in relation to GDP growth. The same trend is apparent when comparing the shares in regional GERD and national GERD (Table 8). Comparing the contribution of the public research actors based in Crete to the country's GERD during 1995-2003 reveals a shift in the relevant weight of the different types of public research organisations, with the HEIs' importance increasing at the expense of research institutes. The contribution of HERD increased from 6.4% to 8.1% while GOVERD went down from 20.0% to 17.8% respectively (Tables 9 and 10).

#### *Funding of R&D*

R&D funding came mainly from central government in the form of general university funds<sup>15</sup>, direct funding to cover a proportion of the operational cost, or funding of research projects through the competitive research programmes co-funded under the Structural Funds. However, no specific statistics exist on the regional allocation of such support.

**Crete Region** planned to allocate €7.5m from its **Structural Funds'** Regional Operational Programme (ROP) to R&D and innovation measures for 2000-2006, which is 9.1% of total ROP (Table 11). However, only €6m were finally budgeted for 2000-2006<sup>16</sup>. This amount is negligible compared with the annual R&D expenditures in the region, as for example it represents only 8.1% of Crete's GERD for 2003.

**EU Framework Programmes** are also important contributors to R&D funding in the region, although no statistics are available for their contribution to R&D funding. Research institutes and HEIs from Crete participate in 7.4% of the FP6 projects with at least one Greek participation<sup>17</sup>. This share is equivalent to the participation of R&D expenditure and R&D personnel at Crete's research centres and HEIs in the country's GERD (7.4% for 2003) and total R&D personnel (7.3% for 2003).

The Greek **business sector's** contribution is negligible, although some funding from foreign companies has been attracted, especially by FORTH.

#### *Knowledge output and quality of research infrastructure*

Based on analysis of **publications and citations** covering 1993-1999<sup>18</sup>, FORTH and the Technical University of Athens both have the second-best score in Greece (0.88), while first

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<sup>15</sup> In Greece GUFs accounts for 49% of GBAORD.

<sup>16</sup> GSRT.

<sup>17</sup> Own estimates based on Cordis database.

<sup>18</sup> European Commission (2003), *Third European Report on S&T Indicators*.

position is held by NCSR Demokritos (score 0.9). According to the same study, over 25% of FORTH's publications are on physics and astronomy, while the impact of its research in mathematics & statistics and computer science is above the world average. Research in basic life sciences and chemistry has the highest score in the country, although it is below world average.

The same study ranks the University of Crete fourth (score 0.76) immediately after FORTH and the Technical University of Athens. The leading research areas in terms of publications are clinical medicine and physics & astronomy (each of them making up 25% of the institutions' publications). Similar to FORTH, the scores for mathematics & statistics and computer science are above the world average, while research in biological science has the highest score in the country. In addition, basic life sciences have the highest number of citations in the country.

The above data suggest that the significant agglomeration of research infrastructure in Crete makes an important contribution to knowledge production at national level in certain fields. However, as there are no other data available on citations and publications, an accurate and in-depth assessment of the system's productivity is not feasible. Furthermore, according to a recent evaluation of Greek research institutes by GSRT, the quality of the research produced at FORTH is regarded as being of the highest international standard, with impressive participation in European and international cooperative projects<sup>19</sup>.

Comparing the **applications for patents** lodged with the Greek Industrial Property Organisation, applications from Crete represented on average 6.4% of the total applications during 1997-2003 (Table 13, which is similar to Crete's contribution to the country's GERD). The trend towards a decreasing share of applications in the national total reflects the diminishing trend of R&D expenditure on the island. As is the case for R&D expenditure, patenting in the business sector is very limited, further demonstrating that sector's limited innovation capacity.

### *Scientific specialisation of the region*

Although existing assessments and output indicators are not adequate for defining the areas of scientific excellence in a well documented way, the following scientific fields appeared to be the most important in term of publications and participation in competitive research programmes:

- biology & biotechnology with some emphasis on natural products and horticulture
- health
- information & telecommunication technologies
- laser technologies & new materials
- environmental studies
- marine studies, and
- agricultural economics and management

## **2.1.2 Knowledge diffusion capacity of the region**

### **2.1.2.1 Intermediary organisation**

**Liaison offices** were established in 1996 within the two HEIs, both financed by the Operational Programme for Research and Technology (EPET II). The liaison office at the Technical University of Crete has six staff and mainly offers information services to people who are potential customers of the university. Similarly, the University of Crete liaison office mainly offers information on the university's research activities and results.

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<sup>19</sup> GSRT.

A branch of the Help-Forward Network also operates on Crete, although its headquarters are in Athens. Help-Forward was recognised as the best IRC network in Europe in 2002. Since 1991 HELP-FORWARD has offered technology transfer brokerage services to Greek companies and research institutes, and provided information, mediation and advisory services at all stages of technology transfer and exploitation of research results.

In addition, a **technology park** and **incubator** have already been established as a result of cooperation between the private and the public sector. STEP-C (EDAP SA) was established in December 1993. EDAP SA currently has participation capital of €207 190. The main shareholders are FORTH (30%) and Piraeus Bank (30%), but there are also 24 smaller shareholders, mainly private enterprises. STEP-C works with many organisations in both public and private sectors. Since the incubator was set up there have been only nine spin-offs. The most successful is FORTNET set up in 1993, which is today one of the biggest ISPs in the country. Two of the nine spin-offs also attracted foreign investors and are now operating abroad.

A second **incubator** was recently set up in Chania as a non-profit organisation. The owners are the Organisation of Small and Medium-Sized Greek Companies (90%), Chania Prefecture (5%) and Chania's Commercial and Industrial Chamber (5%). The Chania incubator owns an industrial and an office building at Chania industrial park and can host up to 15 start-ups. At the moment, eight start-ups are operating at the Chania incubator in the fields of telecommunication, software development, Internet services and manufacturing.

The establishment of an innovation pole was approved very recently, focusing on health and quality of life, culture and tourism and ICT. It will be financed by the GSRT. It is expected that the innovation pole will contribute to boosting private-sector R&D expenditure and help create cooperative networks between research organisations and firms. The innovation pole founders include research organisations, higher education institutes, companies, local chambers of commerce, financial institutions, development companies and other regional actors.

The opinion expressed here is based solely on the authors' experience and on interviews with stakeholders as no evaluations have so far been made, nor specific data on their activities published. Despite the establishment of various types of intermediary organisations, it is broadly recognised that cooperation between industry and research organisations remains at a very low level and success stories concerning the activity of intermediary organisations are very limited.

### **2.1.2.2 University–Industry links**

Analysis of the participation of Crete-based firms and research organisations in the Sixth Framework Programme shows that cooperation with Greek actors outside Crete is much more frequent than with indigenous ones. The average participation of local actors per project with at least one additional Greek partner is 1.4, while participation of actors outside Crete stands at 3.1. Cooperation with foreign firms and research organisations is strong, as 69% of the projects (44 out of 64 projects) involve participants from Crete with foreign partners only.

Data from Greek research projects indicate similar trends, although no systematic analyses have been done for Crete. An example of an organisation with significant cooperation outside Crete is the Foundation for Research and Technology (FORTH), which has developed strong links with almost all major firms in the computer services and electronics sector<sup>20</sup>. However, no firms from Crete are included, as no such firms exist on the island.

The above evidence corroborates anecdotal information that formal links and cooperation remain limited without any long-term perspective. For further improvements to be achieved, specific efforts will be necessary to change both supply and demand.

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<sup>20</sup> Ibid.

### 2.1.3 Knowledge absorption capacity of the region

Although the Crete region has one of the highest concentrations of students in Greece (88.2 per 1 000 inhabitants), far exceeding the national average (51.8) and those of the regions of Attica (29) and Thessaloniki (72)<sup>21</sup>, only a small percentage of them remain on Crete. This trend is being gradually reversed, but Cretan companies have to pay premium salaries to attract highly skilled professionals.

Based on a number of indicators, the **educational level** of employees in the region is below the national average but the gap is narrowing. In 2004 20.6% of employees in Crete had a tertiary education degree compared to 23.7% nationally (see Table 14). Human resources in science and technology show a similar trend. Comparing Crete with the other regions, it occupied fourth position in 2005 with 28.7% of the population in S&T, behind Attica (42%), Central Macedonia (33.8%) and Epirus (29.8%), while the national figure was 32.7%. Eleven years earlier Crete was in the middle of the rankings, on sixth place with just 17.5% of employees in S&T while the national figure was 25.1% (Table 15). Comparing the share of employees in core S&T, namely those with a science and technology degree employed in a science and technology position, Crete did not change its position very much, remaining sixth during 1994-2005 (see Table 16).

Furthermore, participation in **life-long learning** programmes is very low. As Table 17 shows, only 2% of adults aged between 25 and 64 are participating in such programmes. Despite the impediments created by the low levels of life-long learning, only a limited number of enterprises energetically promote upgrading of employees skills. The main source of knowledge accumulation within enterprises is suppliers<sup>22</sup>, while training is quite neglected.

## 2.2 Policy context

### 2.2.1 Policy framework and actors

#### 2.2.1.1 National level

The **RTDI governance** structure in Greece is centralised with little coordination between the various stakeholders. The General Secretariat for Research and Technology (GSRT) is responsible for designing and implementing national policy on R&D and innovation and managing most of the R&D and innovation initiatives. Funding of R&D comes mainly from the Structural Funds and the Public Investment Programme, which also co-funds the Structural Funds' Operational Programmes. The (ordinary) state budget funds the research institutes' operational costs and provides the GUFs, which account for almost 50% of public funding of R&D. The Ministry of Education, which is responsible for HEIs and whose decisions affect the size and structure of GUFs, had no specific research policy to date. Only recently, the Ministry launched three small<sup>23</sup> research programmes for academic research. The Ministry of Agriculture has a limited budget for R&D and its own network of research institutes.

The Greek Government's **regional policy** on S&T focused chiefly on decentralisation of infrastructures and spending. However, specific measures were taken only for the former through the establishment of research infrastructures in some major cities with existing Universities. Heraklion on Crete was one of those.

#### 2.2.1.2 Regional level

Regional councils are politically dependent on the national government and follow the general policy guidelines drawn up at national level. Before 1999 they were not involved in planning and implementing R&D and innovation policy. However, in 1999 the Greek Government, under European Commission pressure, encouraged regional councils to draw up, within the national policy framework, measures to support innovation and R&D in their Regional Operational

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<sup>21</sup> Ministry of Education.

<sup>22</sup> Based on interviews with industrialists from previous technology transfer projects.

<sup>23</sup> The total budget for the three programmes is €123m for eight years.

Programmes for the 2000-2006 programming period. The budgets envisaged for this period for R&D and innovation projects, excluding educational and research infrastructures, are presented in Table 11. In addition, the Crete ROP has scheduled a budget of €21.2m for educational and research infrastructures.

Despite this encouragement, none of the regional authorities were able to design their own strategy and to implement policy measures to support R&D and innovation, apart from infrastructure development projects. Despite this, central government did not take any measure to help regional authorities build up their own policy-making capacity.

In Crete, the RITTS Project implemented during 1997-2000 provided useful input for the design of R&D and innovation measures under the Regional Operational Programme. However, due to the regional authorities' lack of capacity and experience in planning and managing such intervention, the whole process was significantly delayed. Not one single measure has been implemented since 2003, and so GSRT shouldered the responsibility – on behalf of the regional authority<sup>24</sup> – of implementing specifically for Crete Region measures designed for the national level.

Despite the steps towards increasing the regional councils' autonomy in supporting R&D and innovation, the decisions on soft knowledge infrastructures such as universities and research centres remain the central government's responsibility. Regional councils are able to support those types of infrastructures with the government's agreement.

### **2.2.2 Policy objectives and instruments**

Since 2000 the main issue on the national R&D policy agenda for the regions has been the creation and upgrading of research and technology transfer infrastructures. However, the main challenge the regions faced was the small amount of interaction between research organisations and firms, and a production base that relied on low R&D intensity sectors. Thus, over a period of time the key policy issues shifted from infrastructure development to promotion of innovation, technology transfer, spin-off creation and promotion of cooperative projects between public research institutes and firms, such as<sup>25</sup>:

- commercialising research results generated at universities and public research centres;
- increasing research activities in the private sector;
- strengthening links between enterprises and public research organisations and intensifying technology transfer;
- increasing international cooperation in research;
- creating regional innovation poles.

The above strategy was set out in the 2000-2006 "Competitiveness" OP (Table 18).

Crete regional authority recognised that the activities of the universities and research institutes could become a third potential pole for future development, in addition to agriculture and tourism<sup>26</sup>, and complemented national funding with interventions aiming at "strengthening the region's role as a technological development and research centre, moving innovation forward and strengthening competitiveness"<sup>27</sup>. Out of the a total of €110.2m, €7.6m were devoted to soft measures while €21.9m went on infrastructures.

The overall policy mix which influenced the region is described below.

#### **Improving innovation and R&D governance**

Overall, little importance is attached to innovation policy governance issues. To date, one national foresight has been implemented, while Crete has implemented its own regional

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<sup>24</sup> This was a common approach for all RTDI measures under the 13 Regional Operational Programmes.

<sup>25</sup> Greek Regional Development Plan and OP "Competitiveness" (OPC).

<sup>26</sup> Regional Operation Programme of the Region of Crete.

<sup>27</sup> Priority Axis 1 of OP.

foresight exercise "IN.TRACK" under the European Commission's "Innovative Actions" Initiative. The public administration's commitment to the above initiatives, with the exception of GSRT, is low, as also reflected in the relatively limited funds directed towards this policy area. The few and rather fragmented initiatives lack continuity, have no follow-ups and insignificant impact, facts mirrored in the meagre number of policy suggestions from the above studies being incorporated into the public administration's policies. Moreover, particularly at regional level, the capacity for planning, monitoring and funding RTDI measures remains very weak.

### **Creating an innovation- and entrepreneurial-friendly environment**

Harnessing of research results was one of the main policy objectives in Greece after 2000, with the emphasis being placed on creation of spin-offs. In 2001 the government geared the legislation to new objectives allowing researchers to participate in spin-off companies and defining the conditions for setting up spin-offs. In addition, the PRAXE programme, launched by GSRT and aimed at creating spin-offs by researchers from public research organisations and universities, was a novelty for Greece. The programme has two phases. PRAXE A is the pre-seed capital phase, supporting the preparation of a business plan and fund-raising from private investors, while PRAXE B, the first-stage capital phase, supporting the setting-up of spin-offs based on the most promising business plans. The principal precondition is participation by private equity funds or private investors. The programme served as a training mechanism for researchers, as it gave them the opportunity to see their work for the first time from a market angle. On the other hand, it gave universities and research centres an opportunity to develop more coherent strategies on commercialising research results, particularly their IPR and royalties' strategies.

Almost 12% (27 projects) of the projects financed by Praxe A, and one of those financed by Praxe B, came from research organisations on Crete and especially from ITE. However, only one led to a company being set up.

In addition, during 2004-2006, a number of pilot activities supporting commercialisation of research results and exploitation of innovative ideas were funded by the Crete Innovative Region Programme running under the European Commission's "Innovative Actions" Initiative. The programme has not yet produced visible results as it is still in an early phase of implementation.

### **Developing human capital**

This policy area was also addressed by a number of GSRT-funded programmes focusing on employment of new research staff in enterprises (HERON), training young researchers through participation in small research projects (PENED) integrating researchers from abroad into the Greek RTD system (ENTER) and, finally, creating human networks for training on RTD issues. With the exception of PENED, where 34 out of 182 projects were from Crete (representing 22% of the total budget of €4m), only a few institutes from Crete participated.

At regional level the Crete ROP had provided for approximately €15.6m to be invested during 2000-2006 on upgrading and expanding the educational infrastructure of the island's HEIs and developing a training centre focusing on development of entrepreneurship (budget €3.9m). Of that amount, only €6m had been invested by the end of 2004.

### **Networking, co-location and clustering measures**

No clustering projects were funded in Crete after the unsuccessful effort before 2000 to build a viable cluster related to local food.

Very recently GSRT approved the financing of an innovation pole with a budget of €2m focusing on health, tourism and culture, and information society and new technologies. It is expected that the pole will bring together local companies, research organisations and industrial associations to implement research and training projects and to develop research and technology transfer infrastructures.

## **Knowledge and technology transfer to enterprises**

This policy area was addressed in the current programming period by a batch of measures, many of which were complementary. Such measures included incentives to researchers to commercialise their research results, and creation of links for research projects between public research centres (PROs) and enterprises via liaison offices, plus subsidies to enterprises for technological upgrading.

The Centre for Entrepreneurial and Technological Development in Crete (KETA) is funded under the "Competitiveness" OP.

At regional level the Crete ROP focused on technological upgrading of SMEs. The planned budget was €9m, but by the end of 2004 only €0.8m had been spent. In addition to that, €0.8m were spent on demonstration projects.

Overall, the effects of this policy area were rather limited due to low demand from firms, the weak institutional set-up of technology transfer organisations and the prevailing conception among most firms that technology transfer meant acquisition of machinery.

## **Research collaborations – PPP's**

Research cooperation between firms and public research organisations and HEIs in Crete was funded through Framework Programmes as well as by national and regional programmes.

In total, research organisations from Crete participated in 64 projects under FP6, representing 7.5% of the projects with Greek participation. Overall spending for 2003-2008 is estimated to reach €63m, while funding from the FP6 will be approximately €38m<sup>28</sup>.

At national level, cooperative research was funded by GSRT ("Competitiveness" Operational Programme) for specific research areas. In addition to national funding, the Crete ROP allocated €3.5m to a similar programme at regional level. GSRT also took on the responsibility of managing the programme.

## **Supporting public research**

Crete's public research system has been funded from the GSRT Research Excellence Programme focusing on infrastructure development, long-term research and development of human resources. ITE received €1.5m while the Institute of Marine Technology received €0.5m.

In addition, the Crete ROP funded the upgrading of the local HEIs' and research centres' research and building infrastructure to the tune of €10.3m, and this amount is expected to be doubled by the end of 2008.

From 2000 the Ministry of Education for the first time ran three small research programmes, which fund academic research inside HEIs. One of them targets female researchers while the other two have no specific focus. Regarding the thematic areas, the allocation was bottom-up, according to the demand. During 2000-2006 Crete received approximately 10.4% of the total funding of these programmes, amounting to €12.8m<sup>29</sup>.

## **Financial R&D measure for private sector**

Until recently the bulk of public support to encourage the private sector to take R&D initiatives was mainly directed through subsidies. A gradual shift in policy appears to have taken place recently through an increase in the tools available. This includes initiatives such as fiscal legislation providing for 50% of RTD expenses to be deducted from a firm's net profits on an annual basis when the year's RTD expenditures are higher than the average of the two previous years (Law 3296/2004 Article 9(8) amending Law 2992/2001 Article 10, and the Income Tax Code Article 31).

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<sup>28</sup> CORDIS database.

<sup>29</sup> Source: Ministry of Education and Religious Affairs.



The main instrument for direct funding of industrial research is PAVE-N, focusing on new firms (under five years old). The programme is running at both national and regional level and is managed by GSRT, although the programme running at regional level is funded by the Crete ROP. The Crete ROP has so far allocated €1.7m to industrial R&D projects.

In addition, the creation of TANEEO, a fund for venture capital monies, aims to fill a significant gap in the financing of innovative and high-risk ventures by bringing in a private-sector contribution. At local level, the Pancretan Cooperative Bank funded a venture capital fund in cooperation with the local chambers of industry and commerce and the University of Crete. This fund will operate until 2005, and is co-funded 50% by TANEEO, with €6m available to fund high-technology initiatives for new enterprises based in Crete. However, the fund has so far not managed to mobilise its resources towards development of new-technology-based firms.

### Exhibit 1: RTDI policy mix affecting the region

Policy Areas	Policy objectives and instruments at national level affecting the region	Policy objectives and instruments at regional level
Improving innovation and R&D governance		Innovative Actions–CRINNO: foresight project (IN.TRACK) for Crete
Creating innovation- and entrepreneurial-friendly environment	<ul style="list-style-type: none"> <li>▪ Regulation for creation of spin-offs</li> <li>▪ Programme for Exploitation of Research Results (PRAXE)</li> <li>▪ Fund of funds TANEEO</li> </ul>	Innovative Actions–CRINNO: exploit research results and innovative ideas in Crete HEIs and universities
Developing human capital	<ul style="list-style-type: none"> <li>▪ Training courses</li> <li>▪ Human networks</li> <li>▪ Young researchers (PENED)</li> <li>▪ Placement of new research staff in businesses (HERON)</li> <li>▪ Integration of researchers from abroad into Greek RTD system (ENTER)</li> </ul>	Subsidy for infrastructures for training organisations
Networking, co-location and clustering measures	<ul style="list-style-type: none"> <li>▪ Creating clusters</li> <li>▪ Regional innovation poles</li> </ul>	Crete Social Economy Network (KRHKOS)
Knowledge and technology transfer to enterprises	<ul style="list-style-type: none"> <li>▪ Setting up industry liaison offices at Greek universities</li> <li>▪ Investment law</li> <li>▪ Subsidies for demonstration of innovative technologies and products (PEPER)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Centre for Entrepreneurial and Technological Development in Crete (KETA)</li> <li>▪ Subsidies for demonstration of innovative technologies and products (PEPER) – copy of GSRT's programme</li> </ul>
Research collaboration involving public research organisations and private sector	Research consortia with participation of research organisations and private enterprises	Research consortia with participation of research organisations and private enterprises – copy of GSRT's programme
Supporting public research	Promoting excellence in research & development providing subsidies for research infrastructures Funding academic research in HEIs	Research and building infrastructures for HEIs and research centres
Financial R&D measures for private sector	<ul style="list-style-type: none"> <li>▪ Direct: subsidy for industrial research for new firms (PAVE-N)</li> <li>▪ Indirect: tax cuts for R&amp;D investment</li> <li>▪ International cooperation in industrial research, mainly bilateral agreements for research collaboration</li> </ul>	<ul style="list-style-type: none"> <li>▪ Direct: subsidy for industrial research for new firms (PAVE-N) – copy of GSRT's programme</li> </ul>

### 2.2.3 Assessment of the policy mix

The national and regional policy mix is balanced, and it focuses on a wide spectrum of issues covering most of the deficiencies in the system at national and regional level. However, the policies' degree of efficiency cannot be easily assessed because no systematic evaluation of the various policies and instruments exists. Later in Section 4 we attempt to make an overall assessment of the RTDI policies' contribution to increasing R&D investment.

Comparing the mix of regional and national instruments, it is apparent that most of the former are just copies of those launched by GSRT and there is therefore extensive overlapping. Under the Structural Fund regulations, only actors based in Crete are eligible to participate in the regional programmes. Although this is not a constraint for demonstration projects or infrastructure development, it negatively affects the quality of research projects, as the competition is limited to local firms and research centres. Furthermore, the scale of the measures funded by the Regional Operational Programme is quite limited compared to other available instruments. Comparing the funding<sup>30</sup> for local firms and research organisations under the Sixth Framework Programme with the budget for measures funded by the Crete Regional Operational Programme, the latter constitutes only 9.2% of the former.

'Innovative Action' measures were more tailored to the region's needs and specificities than was the Regional Operational Programme, because they highlighted at least three areas important for Crete, namely R&D governance, creation of an innovation-friendly environment and networking and clustering. However, no significant impact is expected due to the action's small budget and pilot character. Nevertheless, some lessons could be drawn for use when planning new measures on a larger scale.

## 2.3 Conclusions

During the last 25 years Crete has been developed as a "hot-spot" of public research with international recognition. The three HEIs and five research centres constitute a significant knowledge base which has 8% of the students and 26% of the R&D expenditure of public HEIs and research centres in Greece. Comparison of Crete's R&D intensity and concentration of R&D personnel with that of Greece clearly reveals an agglomeration of public research activities on the island. As can be seen in Figure 2, overall R&D expenditure as a percentage of regional GDP was over 40% higher than that of Greece in 2003. The difference is even more striking in the case of GOVERED where the intensity was 215% higher for the same year. In the same vein, the intensity of R&D spending in HEIs was 48% higher, with the trend going towards the gap increasing. However, since much of the increase was due to the expansion of the local universities, it is doubtful whether this trend will continue. R&D personnel in research centres and universities as a percentage of total employment were also higher in Crete, by 76% and 56% respectively. Despite the local research base's higher performance compared to that of Greece, the R&D intensity (GERD as a percentage of GDP) was only 46% of the European intensity in 2003 – and much lower than the 1.5% that is the country's Lisbon Strategy target for 2013.

European comparative studies and the high rates of participation in FP5 and FP6 indicate that high research intensity is also combined with high quality of research results.

By contrast to the public research sector's high performance level, research in the business sector is extremely low. Research intensity in the local business sector represents only 17% of the country's research intensity. The business sector's low research intensity can be only partially attributed to the region's relatively low absorption capacity compared to Greece, as

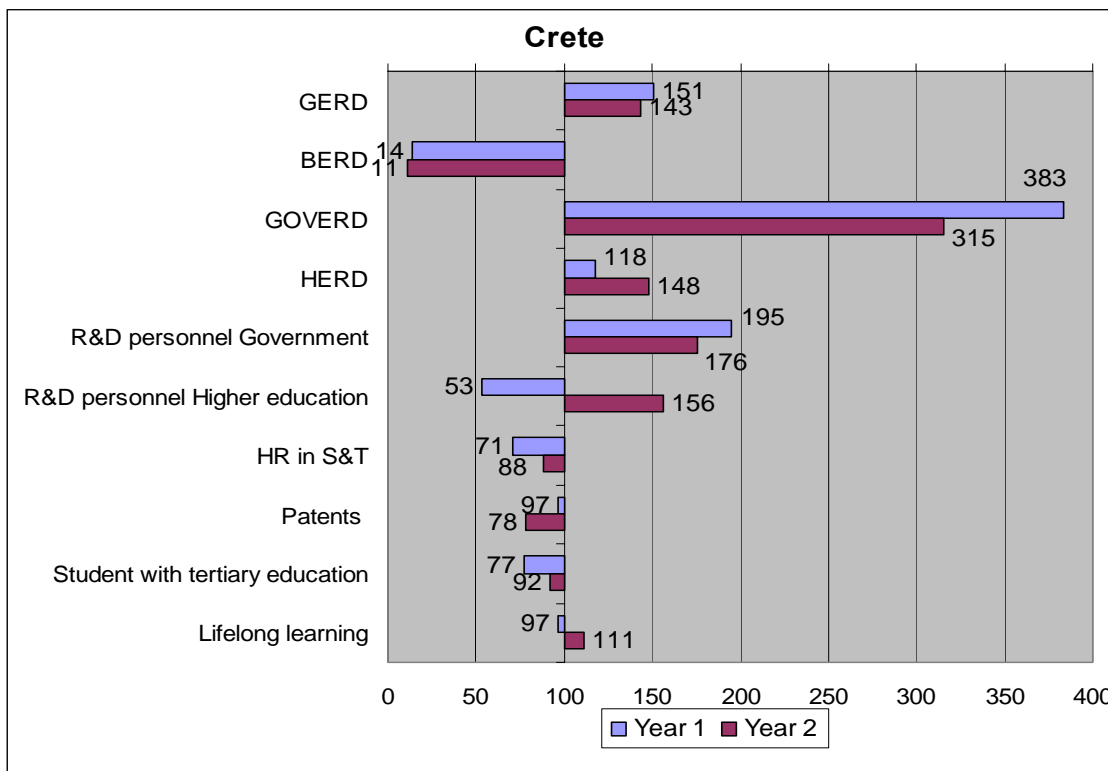
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<sup>30</sup> This is the budgeted amount, not that actually spent.

human resources in both S&T and students with tertiary education as a percentage of the population are slightly lower compared to national levels, and the trend is towards further closing the gap. Crete's current performance on lifelong learning is higher than in Greece and the trend is towards further improvement.

The relatively low performance in patenting (which is much lower when compared with EU25) is an indication of the weak R&D system (public and private) when it comes to harnessing research results.

**Figure 2: Key indicators of Crete's knowledge-base development in comparison with Greece**



Source: Eurostat.

Note: See Annex 2 for explanations of indicators.

When it comes to policy, the region has limited capacity to plan and implement R&D and innovation policies. Furthermore, the region does not have the power to influence developments in HEIs and public research centres, despite the fact that some of the funding to these organisations is channelled through the regional funding system. The creation of the research infrastructure on the island was initiated by central government, which expected (following the linear model of innovation) that investment in R&D could create a pole of dynamic economic activity.

The multiregional Operational Programmes of the Structural Funds and the Framework Programmes are the most important RTDI funding sources. The Crete Regional Operation Programme has a limited impact on R&D investment due to the small RTDI budget and the very limited progress made so far in implementing it.

## 3 Regional economic structure

### 3.1 Description of the economic structure

#### 3.1.1 The characteristics of the productive structure of the region's economy

During 1995-2003 the **growth** in Crete's economy followed trends similar to those of Greece, contributing to the production of 5.2% of the country's GDP in 1995 and 5.5% in 2003 (Table 19). During the same period Crete's population grew much faster than in the country as a whole (by 4.5% and 2.9% respectively), reaching approximately 600 000 inhabitants, i.e. 5.4% of the total national population (Table 20). The region's average Gross Domestic Product per capita throughout 1995-2003 was approximately 99% of the national average which grew at a slightly higher rate (Table 21). In 2003 GDP per capita reached €14 200, only 0.4% higher than that of Greece.

The **unemployment rate** remained considerably lower than the general national level, with an average of around 7.7% (with small fluctuations) during the five years from 1999 to 2004. Unemployment in the 40-plus age group is virtually nil due to the availability of jobs in agriculture. Furthermore, Crete is among the regions with the highest employment rate (52.9%) in one of the most socially sensitive groups, that of people aged between 55 and 64<sup>31</sup>. However, employment on the island is highly seasonal, particularly in agriculture and tourism, which puts pressure on the workforce from a skills aspect (multi-specialisation). There appears to be a gradual shift in employment from agricultural to tourism activities<sup>32</sup>. At the same time engineers accounted for 2.3% of employment in Crete during 2001<sup>33</sup>, while the percentage for the entire country was 2.9%. This further highlights the relative bias toward the primary and services sectors and the fact that the manufacturing sector lags behind the national average.

Over 40% of the population lives in the cities situated in the north of the island, and there is a tendency for urban migration to further increase this percentage. The north of the region has also attracted a large number of (mainly unskilled) immigrants, significantly increasing the size of the labour force. In contrast, the central part of the island is mountainous and generally underdeveloped.

Six sectors produce 82% of the island's **Gross Fixed Capital Formation** (GFCF), viz. construction, electricity and other utilities, trade, hotels and restaurants, transport, storage and communications and public administration and defence. Significant changes in the composition of gross fixed capital formation can be observed during 1995-2003 (Table 23). The highest decline in capitalisation was experienced in construction. Its share of total gross fixed capital formation dropped from 32% to 21%, being relegated from first to second place by public administration and defence. The latter experienced a steady increase in its share from 10% in 1995 to 13% in 2002, while in 2003 it jumped to 25%. Trade was the second most important sector undergoing a significant decline, from 13% to 7%. Capitalisation in hotels and restaurants, which represents one of the island's most dynamic sectors, increased slowly (despite some fluctuations) up to 2001, and then declined in 2003 from 23% of total GFCF to only 8%. As that sector's GFCF increased its share in the national figures, this decline could be attributed to a shift of investment to other regions which were to host major Olympic Games events. Finally, the share of transport, storage, and communication grew steadily, from 7.6% to 19%, and then fell back to 1998 levels.

Most companies operating in Crete are SMEs. In total, 48 223 enterprises were registered in 2002. Of those, only five firms employed more than 250 employees (mainly hotels and coastal shipping companies), while 47 691 employed 1 to 10 persons.

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<sup>31</sup> EuroNews Release 134/2006.

<sup>32</sup> OECD (2005).

<sup>33</sup> Personnel Professions by NUTS during 2001. NSSG.

Agriculture and the sectors affected by tourism – such as real estate, hotels and restaurants, trade, transport and construction – are the most important in terms of **value added**. Agriculture, suffering from long-term infrastructural weaknesses, the small size of farms<sup>34</sup> and low productivity, lost half of its share between 1995 and 2003, falling from 21.2% of total value added on the island to 9.6% (Table 24). Real estate retains a share of between 17% and 18% for the entire period and held pole position in 1997 due to the decline in agriculture. The sectors with the highest gains are (i) hotels and restaurants, with their share increasing from 12.5% to 15%, and (ii) construction, which doubled its share from 3.7% in 1995 to 7.5% in 2003 due to urbanisation trends and the growth of tourism. In the transport sector, two of the biggest Greek coastal shipping companies with an international presence have their origins on the island<sup>35</sup>.

Despite increased competition from low-cost neighbouring countries, such as Turkey, the hotel and restaurants sector is the second largest (after trade) in terms of **turnover**, accounting for 12.7% of the island's total turnover. This growth is also reflected in the astonishing increase in the number of hotel beds. In 1975 sector capacity was a mere 11 456 beds, but the number had increased to 143 480 by 2005 when the number of hotels totalled 1 506<sup>36</sup>. This increase was due mainly to the development of mass tourism in the north of the island, which increased sub-regional imbalances and had some negative knock-on effects such as environmental degradation. Tour operators largely dominate tourism in Crete, with 90% of guests preferring all-inclusive packages. At the same time, there is limited exploitation of the synergies between the tourism sector, agriculture and cultural activities. Diversification of the tourist product began in the previous decade, with the development of activities such as mountain hiking, nature tourism and agro-tourism, but the region's vast potential remains largely untapped.

During the same period, manufacturing's share of **value added** fell from 5% in 1995 to only 3% in 2003, due to its inability to adapt adequately to global competition. The manufacturing sector in Crete hinges mainly on the processing and packaging of primary products (agro-food), plus production of construction materials and furniture, with plastics remaining marginal despite the fact that one of the most country's dynamic firms in this sector operates on the island. Agro-food production accounts for 25% of manufacturing employment, 28% of manufacturing companies, and 40% of their revenue (Table 25). The firms in this sector only recently started to explore the European market, trying to increase exports and participate in international value chains.

Overall, Crete's economy is **dominated by low-tech and low-knowledge-intensive sectors**. High-tech activities in the manufacturing sector accounted for only 0.1% of the total turnover of companies in Crete in 2002, while knowledge-intensive and high-tech services accounted for only 0.3% (Table 26). In contrast, the low-tech manufacturing sectors and low-knowledge-intensive services accounted for 8.3% and 79.5% of total turnover respectively.

The abovementioned tendencies in all productive segments highlight the structural specificities of Crete's economy, and account for the limited R&D and innovation expenditure in the business sector.

The most important sectors in terms of **employment** for Crete Region are agriculture and tourism. During 2004 approximately 21.6% of the labour force was employed in agricultural activities, despite the fact that its share of regional GDP decreased to 10.7% in 2002, from 21.4% in 1995. Directly or indirectly the tourism sector employs approximately 40% of the regional workforce<sup>37</sup>, while about two thirds of the workforce are employed in the services sector in fields such as public services, health and the academic and research institutes. By contrast, employment in industry, which accounted for 8.47% in 2004, is below the national average.

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<sup>34</sup> The average size of farms in Crete is the lowest in Greece at no more than 6 000m<sup>2</sup>, while the national average is 7 300 and in Thessaly 10 780 (NSSG 2003).

<sup>35</sup> One of them still has its headquarters in Crete, while the other has moved its HQ to Piraeus.

<sup>36</sup> National Statistical Service of Greece.

<sup>37</sup> OECD (2005).

### 3.1.2 Systemic characteristics of the region

Although strengthening of **cooperation between the private and public research sectors** has been a high priority in national policy since the early 1990s, the results have remained poor across the country<sup>38</sup>. No specific studies for Crete exist on the issue of networking and interaction between local actors. However, empirical evidence (see section 2.1.2) suggests that intra-industry and industry-public research cooperation examples remain few and far between. In stark contrast, cooperative schemes with other actors from the rest of Greece or abroad are more common.

The absence of large enterprises that could create wide supplier networks also contributes to the low level of networking among local firms.

Corporatism in the agricultural sector and collective entrepreneurial ventures (e.g. in coastal shipping and the financial market) has a long tradition on Crete, but only a few cases can be regarded as successful. The one best known among enterprises is the Cooperative of Peza, Crete's biggest wine producer. During the 1980s the agricultural cooperatives tried to create alternative supplier networks bypassing the established wholesale ones, but most of their efforts failed, due to poor marketing and managerial capacity. Today agriculture cooperatives assist producers with standardisation and packaging of their products and promote them on the Greek market or abroad. Similar efforts were recently initiated to promote bio products.

The best developed **cluster**, although it is by no means institutionalised, is that of tourism, including businesses from the tourism sector (hotels, travel agencies, restaurants, etc.), transport companies (bus and coastal shipping companies) and crafts, especially activities related to pop art and production of cultural products. However, the new trend of all-inclusive tourism is seriously threatening this clustering. Agriculture was until recently only weakly related to the cluster. During the last few years there has been an increasing number of efforts to integrate agricultural activities into the tourism cluster, e.g. agro-tourism. However, these efforts are still isolated and without significant impact on the cluster's features and orientation. In parallel, a network has been created bringing together the Greek Academy of Taste and the Associations of Hotel Companies, focusing on conservation and promotion of traditional Cretan cuisine and local nutritional habits. Among its other activities this network has introduced certification for restaurants offering high-quality typical Cretan cuisine. What is striking in all these efforts is the absence of local HEI and research organisations.

Finally, an attempt to create a cluster of producers of traditional Cretan products with emphasis on the social economy was supported by the EQUAL+ programme in 2006.

The only networking effort of significant size involving the local HEIs, research centres and firms is the GSRT-financed innovation pole focusing on health, tourism and culture and ICT (see 2.2.2)

### 3.1.3 The regional economy in the international context

Internationalisation of Crete's economy is mainly based on tourism, which is also the only sector attracting direct foreign investment. Efforts to attract FDI for solar energy production during the 1980s went no further than the creation of a few sites for measurement and experimental purposes, which are no longer operating.

The region's **exports** leaving directly from Cretan customs offices are mainly agricultural products. Thus, the import/export balance is substantially negative (Table 27). However, no data exist for exports of local products leaving through Piraeus or other routes.

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<sup>38</sup> An extensive analysis was made by Kastelli Ioanna and Tsakanikas Aggelos, "Innovation Networks. Policy Initiatives in Greece", National Technical University of Athens.

### 3.1.4 The local financial market

The Cretan financial market follows the Greek market's high growth rate. All the Greek financial institutions are present on Crete, operating through local branches. Continuing the long tradition of cooperative ventures, two cooperative banks were established on the island, gaining a significant market share. Among them, the *Pancretan Cooperative Bank* is the largest cooperative bank in Greece.

The first **regional venture capital fund** was created in 2005 in cooperation with the local chambers of industry and commerce and the University of Crete. The fund was supported by TANEQ. With a capital of €6m, the fund focuses on spin-offs and local high-technology new enterprises. However, no projects have so far been funded.

During 2004-2006 the Crete Innovative Region Programme created **seed capital** to help research students at the University of Crete, the Technical University of Crete and FORTH to develop their ideas and set up spin-off companies. Additionally, an unofficial network of business angels was created, aiming to help these students to identify market opportunities.

Although in their early stages, the above efforts indicate that regional financial competencies are being strengthened by the private sector with input from the most dynamic part of the knowledge-creation sector.

## 3.2 Policy context

### 3.2.1 Governance structure and actors

Policy in Greece is centralised, and the decisions regarding, and the planning of, measures are chiefly a matter for central government and the ministries. Regional councils are appointed by the Government and are therefore politically dependent. Furthermore, they do not have their own resources. Their main instruments for funding their policies so far have been the Regional Operational Programmes co-funded by the Structural Funds and Greek Government. Within the framework of the Regional Operational Programmes and central government's general policy guidelines, regional councils can set their policy objectives and plan their measures. However, as is the case for RTDI policy, it is the relevant ministries that plan the main policy measures at national level.

So far other actors in Crete have played a rather limited role in policy-setting, mainly by contributing to the public consultation exercise organised during the preparation of Crete's Regional Operational Programmes.

### 3.2.2 Policy objectives and instruments

Specific objectives and instruments for **regional policy** were set out only in the very late 1980s and under Structural Funds pressure. Until then the major measures were limited to creation of major infrastructures for education, transportation, electricity production and distribution, and development of other utility networks. A more joined-up agenda for regional policy has been developed under the Community Support Frameworks co-funded by the Structural Funds.

Among sectoral policies, the most important for Crete were the **agriculture and tourism policies**. For many years, a major issue for the agricultural sector was efficient distribution of subsidies provided under the Common Agricultural Policy. Because there was no reliable inventory of agricultural properties, the ministry devoted significant human resources to that task at the expense of other important aspects of agricultural policy. Even agricultural experts were engaged in those tasks, to the detriment of their duties of providing farmers with advice and technical assistance. Furthermore, the subsidies became a major disincentive to adaptation of agricultural produce, improvement of cultivation processes and reorientation of agricultural production. Both trends, namely the disincentives and the weakening of the sector's knowledge and absorption capacity, resulted in low innovativeness and technology transfer. Furthermore, although Crete has a significant agricultural research infrastructure, its links with the sector remained low. Against this backdrop the policy objectives of improving efficiency in

production and distribution, developing the relevant infrastructure and creating mechanisms to increase quality<sup>39</sup> did not significantly change the main characteristics of agricultural production on the island. Apart from some fragmented measures related to the adoption of new technologies, agricultural policy was not sufficiently linked to R&D policy and did not provide sufficient incentives for research activities.

Up until 2000 emphasis in the tourism sector was on subsidies for expansion and modernisation of capacity. Only during 2000-2006 was the notion of saturation introduced, and the focus shifted from expansion to improving the quality of tourism services, differentiation of activities and development of special types of tourism. Subsidies for creating additional capacity in traditional types of tourism were eligible only in non-saturated areas. Nevertheless, as pointed out earlier, capacity continued to grow in Crete. The European Community "Leader" initiative was also an important instrument for developing agro-tourism and other alternative forms of tourism before national policy paid attention to it.

**Industrial policy at national and regional level** focused *inter alia* on developing infrastructures such as business parks and on subsidising technical change in the manufacturing sector. The "Competitiveness" Operational Programme and the Investment Law (3299/04) were the main financing instruments.

However, all efforts to modernise production capacity and increase productivity in all sectors (agriculture, tourism and manufacturing) were constrained by the employment policy, which demanded that all subsidised investments should create new jobs. Therefore, support for significant improvements in productivity was not possible without increasing production capacity as well.

Since the 1980s a significant element in **educational policy** has been the big expansion in the number and size of HEIs and TEIs through creation of new departments or new institutes in the country's peripheral areas. However, such expansion was not based on a coherent strategy for integrating them into the regions' social and economic tissue. The result was a mismatch between economic and research specialisation, which created "*cathedrals in the desert*" in several regions –Crete included. Similarly, GSRT expanded its network of research centres in Greece's peripheral areas based on short-term considerations.

The **policy aimed at mobilising private capital**, especially for funding high-risk ventures by creating a fund for funds (TANEO), yielded one of its first results in Crete with the creation of a local VC scheme. However, its impact on the regional economy remains to be seen, as no ventures have so far been funded.

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<sup>39</sup> See Operational Programme for Rural Development and Country Reconstruction 2000-2006 and Crete Regional Operational Programme 2000-2006.



## Exhibit 2: Effects of policies complementary to RTDI instruments on R&D and innovation capacity of the region

Policy Areas	Policies complementary to RTDI instruments affecting policy area	Effects on R&D and innovation capacity of the region
Improving innovation and R&D governance		
Creating an innovation- and entrepreneurial-friendly environment	Creation of KETA and intermediary organisations	Increase in awareness of available incentives and programmes
Developing human capital	Creating new universities and faculties in regions without considering local specificities.	Mismatch between economic and knowledge-creation specialisation in region. Brain drain mainly towards Athens and abroad.
	Subsidies for training mainly through national instruments.	Increase in absorption capacity
	Employment policy emphasis on achieving quick results on employment using as a criterion for subsidising investments the creation of new jobs (even short-term)	Short-sighted approach discouraging technical change focused on improving productivity.
Networking, co-location and clustering measures	Regional industrial policy placed emphasis on business and industrial parks	Created favourable conditions for creating agglomerations of manufacturing and business activities and networking among firms.
Knowledge- and technology- transfer to enterprises	Investment law providing incentives for technological modernisation.	Impact on introduction of innovations in supplier-dominated sectors.
	Only recently, tourism policy promoted differentiation of tourism product and creation of new forms of tourism	Significant delay in relation to the competition in developing new tourism products. Positive impact on innovation after 2000.
Research cooperation between public research organisations and private sector	Subsidies under Common Agricultural Policy.	Distortion of competition and disincentive for research cooperation.
Support of public research	Creating new universities and faculties in regions without concrete criteria and considering local specificities.	The size and profile of the island's research personnel and infrastructure do not match the region's economic structure and potential.
Financial R&D measures for private sector	Creating a fund for funds (TANEO) for promoting VC activities in high-risk areas	Increase in available funding for R&D and innovation.

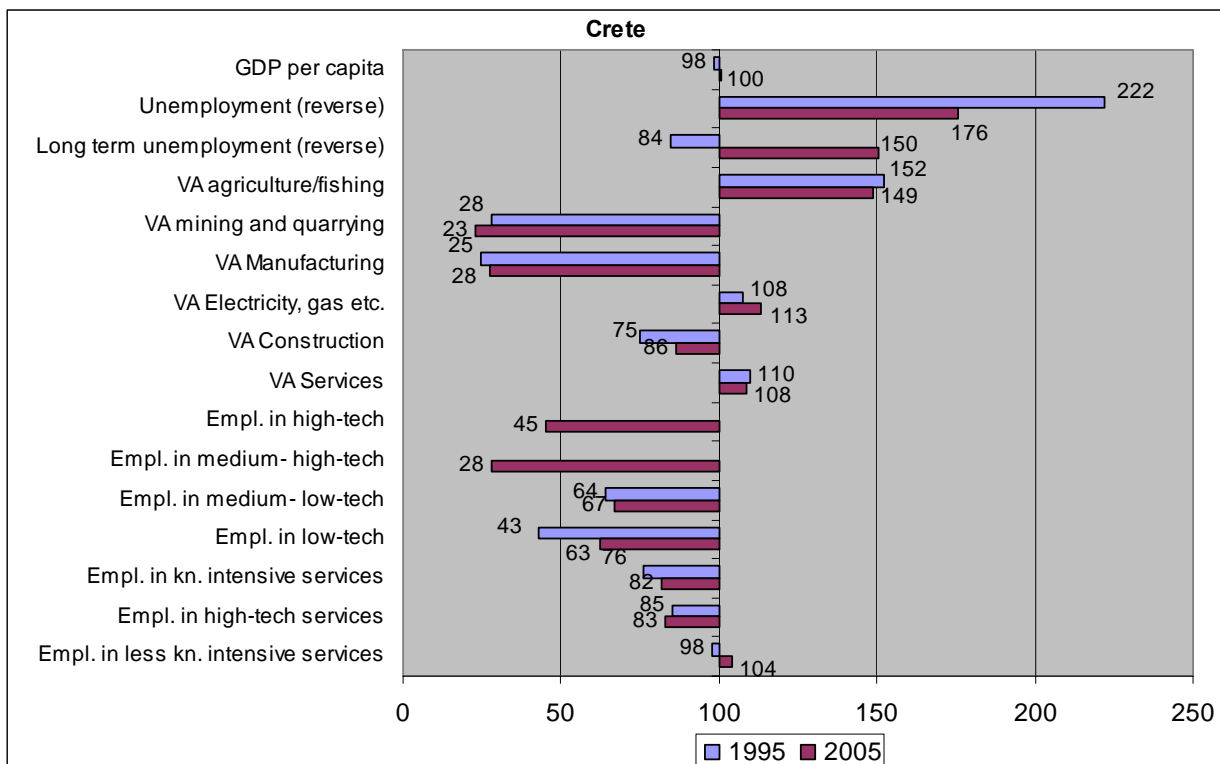
### 3.3 Conclusions

Crete is one of the wealthiest regions in Greece, with GDP per capita near the national average and with fast growing GDP and GDP per capita (higher growth rates compared to Greece and EU25) despite a fast growing population rate (see Figure 3). Unemployment levels have been lower than those of Greece and the EU ever since 1995. In 2004 Crete's unemployment rate was 7.7%, while for Greece it was 10.5%, and for EU25 8.2%. Long-term unemployment is also quite low (28.6% of total unemployment) compared to 53% for Greece and 44.5% for EU25.

The employment rate for people aged between 55 and 64 was one of the highest in Europe (53%).

However, the region is dominated by low-knowledge-intensive, low-technology sectors such as agriculture and tourism with low innovation performance, and extremely low private investment in R&D.

**Figure 3: Key indicators of Crete’s economic structure and development – comparison with Greece**



Source: Eurostat.

Note: See Annex 2 for explanations of indicators.

Education policy encouraged expansion of the island's HEIs without considering the region's socioeconomic characteristics, resulting in a mismatch between the region's scientific & knowledge specialisation on the one hand and its economic specialisation on the other.

Only very recently have agriculture and tourism policies paid serious attention to promoting innovation and value-added activities.

## 4 Conclusions

### 4.1 Assessment of the RIS

Although important components are in place for a joined-up regional innovation system, significant key organisational and institutional dimensions are either missing or ill constructed.

Since the 1980s **strong knowledge-creation capacity** has been accumulated in three HEIs (one is not a university) and five research centres. Instead of being based on an assessment of local potential and needs, the decisions to establish these on Crete were influenced by the need to decentralise research and educational activities<sup>40</sup> and by pressures from local stakeholders. They gradually built up strengths in biology & biotechnology, with some emphasis on natural products and horticulture, health, information & telecommunication technologies, laser technologies & new materials, environmental studies, marine studies, and agricultural economics and management. The public research organisations proved successful in building up cooperation with research organisations and private companies from the other Greek regions and from abroad, while cooperation with local firms is quite limited.

#### 4.1.1 Strengths and weaknesses

The private sector mainly concentrates on **supplier-dominated low-tech activities and services such** as tourism, agriculture, transport services and construction, while manufacturing is limited to low-tech sectors such as food production, non-metallic mineral products, metal products and furniture. Although major firms with international presence in the marine transport, food and plastics sectors have their origins and their operations on the island, their knowledge-creation capacity is very low – as reflected in their almost non-existent R&D expenditure.

The very **weak interaction** between public research and the private sector cannot be attributed to a lack of intermediary or bridge mechanisms, as these have been adequately developed during the last ten years. Major factors which kept the demand for research results and for cooperation with research organisations at low levels have included the domination of low-tech sectors and mismatching between research and economic specialisation, the abundance of high-quality natural resources critical for agriculture and tourism, firms' low resources due to their very small size and their **relatively low absorption capacity**.

**Regional financial competences are low.** The regional authorities have neither the jurisdiction to intervene directly in the local financial market nor the competency to design and implement measures (e.g. fund for funds, guarantee schemes) which could reduce the risk for existing private funding mechanisms. Only national instruments are available for such purposes. However, over the last few years the private sector has become quite active and taken initiatives to create local financial mechanisms. The regional council has no budget of its own for mobilising regional innovation potential. Nevertheless, it can negotiate the priorities and ways of spending the centrally allocated budget with the Government and the European Commission. However, **RTDI governance capacity is low**, and competences are missing for planning and implementing RTD policies, but there is more experience in promoting technical change and innovations.

Regional authorities have no influence on investments in soft-knowledge infrastructure other than technology parks or technology transfer centres. Universities or research centres are the responsibility of specific ministries.

As mentioned, establishment of the knowledge infrastructure largely disregarded the region's existing economic specialisation and potential. After being established, the HEIs and research

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<sup>40</sup> Until then almost all infrastructures were concentrated in the two big urban centres, viz. Athens and Thessaloniki.

centres were developed and grew in line with their own internal dynamics and as dictated by the available sources of funding, such as the national programmes and Community Framework Programmes. As can be seen in Exhibit 3, **links with the local economy** have been developed only in agriculture and food. By contrast, no strong synergies have been developed in areas where scientific excellence has been developed, i.e. biotechnology, ICT, laser, astrophysics, materials technology and life sciences. The exception is the strong cooperation with the local public health sector. However, no significant private investments have so far been attracted.

### Exhibit 3: Matching of knowledge and economic specialisation

Knowledge production in the region	Related economic sectors	Relevant specialisation of the region's economy	Conclusions
Biotechnology Biomedicine Marine biotechnology	Agro-food Pharmaceutical Aquaculture	Agro-food Aquaculture	There are biotech capabilities, agro-food and aquaculture specialisation but limited links between the two
Aquaculture	Aquaculture	Limited activity in aquaculture	Good fit but links need improving
Food quality management	Agro-food	Agro-food	Good fit but links need improving
Agricultural technologies: <ul style="list-style-type: none"> <li>▪ Olive tree and subtropical plants</li> <li>▪ Plant protection</li> <li>▪ Vegetable crops</li> </ul>	Agriculture Olive production Vegetables	Agriculture Olive production Vegetables	Perfect fit but links need improving
ICT	Cross-sector technology	Tourism Manufacturing	Exploitation of ICT capabilities in medicine but limited exploitation by tourism and other service sectors.
Laser technology	Medical instruments Instruments Machine tools	Machine tools Public Health sector	Strong cooperation with public health sector.
Life sciences	Medical services Pharmaceuticals	Public health sectors	Strong cooperation with public health sector
Materials technology	Basic metals, fabricated metal products, ceramics	Ceramics	No links
Mineral resource engineering	Mining	Limited activity in mining	No links
Electronics	Electronics	No relevant specialisation	No links
Astrophysics	Aeronautics	No relevant specialisation	No links

An overview of the **Strengths and Weaknesses** of Crete's regional innovation system is presented in Exhibit 4.

#### Exhibit 4: Strengths and Weaknesses of the regional innovation system

	Strengths	Weaknesses
Knowledge-creation capacity	<ul style="list-style-type: none"> <li>• Strong knowledge-creation capacity accumulated in 3 HEIs and 5 research centres</li> <li>• Research intensity much higher than Greece overall</li> <li>• High quality of research results</li> </ul>	<ul style="list-style-type: none"> <li>• Research intensity lower than the EU25 average and lower than country's Lisbon Strategy target</li> <li>• Knowledge-creation infrastructure does not match local economic specialisation</li> </ul>
Knowledge dissemination capacity	<ul style="list-style-type: none"> <li>• Intermediary or bridge mechanisms developed over last 10 years</li> </ul>	<ul style="list-style-type: none"> <li>• Technology-transfer mechanisms lack experienced personnel. They mainly act as information hubs.</li> </ul>
Knowledge-absorption capacity	<ul style="list-style-type: none"> <li>• Students in tertiary education: as a percentage of population this figure is above European average</li> </ul>	<ul style="list-style-type: none"> <li>• Absorption capacity is lower but close to national average.</li> <li>• Firms' absorption capacity is very low</li> <li>• Brain drain from Crete mainly to Athens or abroad.</li> </ul>
Interaction among main actors	<ul style="list-style-type: none"> <li>• HEIs and research centres have developed collaboration ventures at national and European level.</li> </ul>	<ul style="list-style-type: none"> <li>• R&amp;D and technology-transfer cooperation between local public research sector and local industry is very low and dissemination of knowledge is limited.</li> </ul>
RTDI governance capacity		<ul style="list-style-type: none"> <li>• Regional governance system does not have capacity for and experience in planning and implementing RTDI policies, nor the ability to influence investment in soft infrastructures.</li> </ul>
Economic structure	<ul style="list-style-type: none"> <li>• Tourism cluster is the engine of the economy</li> </ul>	<ul style="list-style-type: none"> <li>• Economy is dominated by low-knowledge- and low-technology-intensive agriculture and tourism SMEs.</li> </ul>

Comparing Crete's regional innovation system with the Greek national one, it appears that Crete's knowledge base outperforms but the business sector's knowledge capacity is quite low. Furthermore, it could be argued that the island's knowledge base is much more integrated within the national innovation system than within Crete's regional innovation system. Graduates from the three HEIs, as well as new knowledge and research results created in the HEIs and research centre, are more easily taken up by the national than the local economy.

Finally, the evidence suggests that **Crete's good economic performance should be attributed to factors other than R&D investment**. The exploitation of local natural resources by tourism and agriculture should instead be regarded as the driving force of the local economy. However, the question arises as to whether the current development model will be sustainable in the future.

## 4.2 Assessment of policies

Until 2000 Crete Region had no specific R&D and innovation policy. The only policy measures relevant to innovation were subsidies for technical change and raising capacity in the agricultural and tourism sectors.

Under European Commission pressure, the region tried to design its own policy for 2000-2006 by addressing the major problem of low levels of cooperation between the local economy and research organisations. However, due to not having sufficient planning and implementation

capacity, the region directly planned and implemented only funding of research infrastructure, while two research and one demonstration programme belonging to those already launched by GSRT at national level were selected and applied to Crete. In addition, GSRT took on responsibility for managing these programmes. However, the overall budget for the entire seven-year period was approximately 10% of Crete's GERD for a single year. The "Innovative Actions" Initiative proved to dovetail better with the region's needs by supporting the setting-up of spin-offs and clustering. However, their visibility was limited due to the measure's small size and pilot character.

National RTDI policy covered all policy areas except the strengthening of RTDI governance capacity, which was one of the regions' major drawbacks. Emphasis was also placed on strengthening links between public research and the private sector by avoiding funding projects which had only public research participation.

National programmes funded under the Structural Funds and Framework Programmes were the chief instrument for R&D and for harnessing the region's innovation potential, while regional measures mainly contributed to improving R&D infrastructures.

Development and expansion of the research and educational infrastructure followed the linear model of innovation, in the expectation that heavy investment in the knowledge base could generate dynamic long-term economic performance. However, after twenty years of developing the knowledge base without considering the region's specificities, interaction with the local economy remains marginal and the gap between economic and research specialisation is still wide.

The agricultural policy emphasis, over decades, on efficient allocation of Common Agricultural Policy subsidies – at the expense of promoting proactive policies to boost restructuring and upgrading of local production – created disincentives for innovation in the sector. Only recently has this trend been reversed under pressure from CAP revision and severe competition from low-cost countries.

Subsidies for upgrading production processes in manufacturing and agriculture promoted technical change and incremental innovation (mainly process innovation). However, the proviso that each investment should create new jobs in order to qualify for funding hindered the increase in productivity and thus limited their contribution to competitiveness.

In conclusion, **current national and regional R&D policy failed to attract significant business investment in R&D.** Although R&D expenditures in business have doubled since 1995, their absolute value is still too low due to the local economy's specific structural features. Investment in infrastructure and expansion of the local universities had only a significant and positive impact on increasing the R&D expenditure of public research establishments, while private funding was mainly attracted from outside the island.

Further increases in R&D expenditure in the business sector presuppose reconstructing the region's economy in favour of more knowledge-intensive activities and reorientation of the research focus towards areas where synergies with the local economy could be exploited. **Local research organisations nevertheless have the potential to contribute to strengthening the European Research Area by enhancing their links with Europe.**

### 4.3 Challenges and trends of the knowledge economy

Crete's development model, based on intensive exploitation of natural resources in agriculture and tourism, has its limits. Fierce competition from other low-cost countries and the gradual reduction of CAP subsidies increase the pressure to change the development model.

With this in mind, the main challenges for Crete can be described as follows:

- It is doubtful whether Crete, with its current economic structure dominated by low-tech sectors, could maintain current growth and employment rates in the long-term and contribute to the Lisbon objectives, especially those concerning the knowledge economy. Therefore, the challenge is to restructure the economy towards higher value-added segments of existing sectors or introducing new ones.

There are untapped opportunities for developing high value-added and high-tech services within the tourism cluster, developing new crops and improving quality in the agro-food sector by exploiting biotechnology (non-GMO applications) and new production and cultivation methods, and creating a multifunctional agricultural setting by further integrating agro-food into the tourism cluster. The island's existing knowledge capacity could support that direction.

Spin-offs could also generate new activities going beyond the existing economic structure. FORTHNET and ICT is such an example. The example of national pre-seed and first-stage capital provided to spin-offs can be enhanced through other activities and adapted to local conditions and needs.

New high-tech services not requiring local presence, such as telecommunication services and software development, could be further exploited. Again the FORTHNET example demonstrates the feasibility of such efforts.

- Firms' absorption capacity is relatively low compared to the national average (which is itself not sufficient). This is more apparent in agriculture and tourism, which form the island's main activities. Adequate incentives should be given to prevent brain drain and retain graduates on the island. In many cases companies pay a premium to attract employees.
- Local firms are very small and therefore cannot exploit economies of scale or devote adequate resources to innovation and learning or adequately participate in supplier networks. However, promotion of cooperatives, business and R&D networks or clustering could create agglomerations of resources. The recently established innovation pole could provide an opportunity along these lines.
- Similarly, research centres and HEIs could be reoriented to address the needs of the local economy's most advanced segments. There are untapped opportunities for exploiting ICT or biotechnology in various local economy sectors.
- However, certain areas of existing scientific excellence cannot contribute to local prosperity and growth. The challenge in those areas is further integration in the national research system and even more integration in the European Research Area.

### Exhibit 5: Identification of policy challenges

Policy challenge	Corroborating indicator	Inducement mechanisms	Effective approaches
Increase economies of scale for firms and farms by increasing size and networking	<ul style="list-style-type: none"> <li>• Percentage of firms and farms with over ten employees</li> <li>• Number of business networks and clusters</li> <li>• Participation in cooperatives</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage cooperatives</li> <li>• Development of innovation pole</li> </ul>	Development of an innovation pole has potential but it is too early to assess its contribution
Increase absorptive capacity in region, especially in the two leading sectors of tourism and agriculture	<ul style="list-style-type: none"> <li>• Share of S&amp;T workers</li> <li>• Percentage of employees with tertiary education</li> <li>• Participation in lifelong learning</li> </ul>	<ul style="list-style-type: none"> <li>• Training courses</li> </ul>	Not effectively addressed. Exploit opportunities for preventing brain drain and attracting graduates to stay on the island.
Reorientate production towards higher value-added segments	<ul style="list-style-type: none"> <li>• Increase knowledge intensity of activities</li> <li>• Increase innovative firms</li> <li>• Increase BERD</li> </ul>	<ul style="list-style-type: none"> <li>• Support high-quality agricultural products</li> <li>• Support investment in alternative forms of tourism</li> <li>• Support spin-offs</li> <li>• Create necessary legal framework for spin-offs</li> </ul>	<p>Funding of agro- and experience-based tourism. Untapped opportunities for:</p> <ul style="list-style-type: none"> <li>• developing new crops and biological products</li> <li>• harnessing biotechnology in agro-food for quality testing and preservation of varieties</li> <li>• exploiting ICT in tourism and construction technology</li> </ul> <p>National programme offering pre-seed capital and first-stage capital for spin-offs</p>
Reorientate research centres and HEIs and strengthen cooperation with local firms	<ul style="list-style-type: none"> <li>• Number of collaborative research projects</li> <li>• Technology transfer agreements</li> </ul>	<ul style="list-style-type: none"> <li>• Setting up intermediary organisation and bridging mechanism</li> </ul>	Not effectively addressed. Untapped opportunities to harness ICT in tourism, biotechnology in agro-food (non-GMOs)
Further integrate research organisations into national research system and ERA			



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## Annexes

### Annex 1: Definition of policy mix typology

- **Improving innovation and R&D governance capacity.** Technical assistance-type funding used by public authorities, regional agencies and public-private partnerships in developing and improving policies and strategies in support of R&D investments and innovation. This could include changes in the organisation of decision making, national and regional forecasting, measures for improving evaluation, etc.
- **Creating an innovation- and entrepreneur-friendly environment.** This category covers a wide range of actions which seek to improve the overall environment in which enterprises, universities and research organisations innovate. This includes the following measures:
  - Promoting an entrepreneurial and innovation culture in the private sector by undertaking awareness initiatives and changing regulations and disincentives that discourage entrepreneurship;
  - Regulations and initiatives addressing intellectual property rights either by improving legislation dealing with cases where the results of public or collaborative research are commercialised or by covering protection costs;
  - Direct or indirect support for spin-offs and new technology-based firms (NTBFs). Direct support includes public financial schemes such as pre-seed and first stage capital, while indirect measures include funding of incubators, training related to entrepreneurship, etc.
- **Developing human capital.** This category includes measures aimed at upgrading human resources in R&D and innovation-related activities, such as helping science and technology graduates to follow research and innovation-oriented careers; training researchers in enterprises or research centres; intra- and inter-national mobility of scientists; curriculum development in higher education aimed at developing science and technology; orientated under- and post-graduate courses, etc.
- **Networking, co-location and clustering measures.** Policies under this category focus on remedying deficiencies in innovation systems by promoting cooperation, networking and interaction. Measures promoting co-location of industrial and scientific organisations (e.g. innovation poles), funding for cluster infrastructure and technology- and innovation-oriented activities and support for innovation networking (e.g. information exchange clubs) are some of the possible measures in this category.
- **Knowledge and technology transfer to industry.** This category includes policies directly or indirectly supporting knowledge and technology transfer from universities and public research organisations and commercialisation of public research results. Direct support includes aid schemes for utilising technology-related services or for implementing projects transferring technology from the public or private sector to the private sector. Indirect policies include developing infrastructures facilitating technology transfer such as technology parks, innovation centres, university liaison and transfer offices.

- **Research cooperation between public research organisations and the private sector.** Measures supporting collaborative research projects and development of common research infrastructures (for use by private and public sector) are included.
- **Supporting public research.** Measures under this category include:
  - Public investments in research infrastructure and direct funding of public R&D, e.g. setting up new infrastructures or supporting centres of excellence;
  - Grants for R&D projects implemented in universities and other public research organisations;
  - Regulatory changes and incentives for universities and other public research organisations which encourage the commercialisation of research results and collaboration with industry.
- **Financial incentives for R&D in the private sector.** Two main categories of measures are included:
  - **Direct and indirect financial incentives for R&D in the private sector.** Direct measures include direct public funding of R&D in the private sector, e.g. grants, conditional loans. Indirect measures include tax incentives for firms to undertake R&D activities.
  - **Catalytic financial incentives for R&D in the private sector.** Includes instruments facilitating the access of R&D performers to external private-sector sources of finance. Typical measures of this type are measures encouraging the use of *risk capital* (e.g. venture capital funds) for both R&D and innovation-related activities and *loan and equity guarantee measures*.

## **Annex 2: Description of key indicators used in the summary graphs**

**Period of coverage:** two periods are used, i.e. 1995 and 2004, or the closest possible years

**Index:** country = 100

**Source:** Eurostat, 2006

### **Summary Graph 1: Key indicators of region's knowledge-base development in comparison to country**

1. Total intramural R&D expenditure as a percentage of GDP
  - GERD
  - BERD
  - GOVERD
  - HERD
  - PNPERD
2. R&D personnel as a percentage of total employment
  - All sectors
  - Business
  - Government
  - Higher education
  - Private non-profit
3. Human Resources in S&T as a percentage of labour force
4. Patent applications at EPO per million inhabitants
5. Students in tertiary education (ISCED 5+6) per thousand inhabitants
6. Lifelong Learning: participation of adults aged 25-64 in education and training as a percentage of population

### **Summary Graph 2: Key indicators of region's economic structure and development**

1. GDP per capita at current market prices
2. Long-term unemployment rate (on total unemployment)
3. Unemployment rate (%)
4. Value added at basic prices (EUR million): share (%) of sectors in total
  - Agriculture/fishing
  - Mining and quarrying
  - Manufacturing
  - Electricity, gas and water supply
  - Construction
  - Services (excl. extra-territorial organisations and bodies)
5. Annual data on employment in technology and knowledge-intensive sectors at regional level: percentage of total employment
  - High-technology manufacturing: NACE Rev. 1.1 codes 30, 32 and 33
  - Medium-high technology manufacturing: NACE Rev. 1.1 codes 24, 29, 31, 34 and 35
  - Medium-low technology: NACE Rev. 1.1 codes 23 and 25 to 28
  - Low-technology: NACE Rev. 1.1 codes 15 to 22 and 36 to 37
  - Total knowledge-intensive services: NACE Rev. 1.1 codes 61, 62, 64 to 67, 70 to 74, 80, 85 and 92
  - Knowledge-intensive high-technology services: NACE Rev. 1.1 codes 64, 72, 73
  - Total less-knowledge-intensive services: NACE Rev. 1.1 codes 50, 51, 52, 55, 60, 63, 75, 90, 91, 93, 95 and 99

## Annex 3: Tables and Figures

**Table 1: List of public sector research establishments in Crete**

<b>Universities</b>		
	<b>Name of the University</b>	<b>Areas</b>
1.	University of Crete	School of Science and Engineering School of Medicine School of Social Sciences School of Philosophy School of Education
2.	Technical University of Crete	Department of Electronic and Computer Engineering Department of Mineral Resources Engineering Department of Production Engineering & Management Department of Environmental Engineering Department of Sciences
3.	Technological Education Institute (TEI) of Crete	Applied Technology Management and Economics Health and Welfare Services Agricultural Technology Centre of Modern Languages and Physical Education (horizontally supports the TEI faculties in implementing foreign language courses and is responsible for the physical training sessions)
<b>Research Centres</b>		
	<b>Name of centre</b>	<b>Areas of Research</b>
1.	Foundation for Research & Technology – Hellas (FORTH)  (estimate of research employees: 800)	Information & Telecommunication Technology Molecular Biology, Biotechnology & Biomedicine Laser & Materials Technology Chemical & Environmental Engineering Applied & Computational Mathematics Mediterranean studies
2.	Hellenic Marine Research Centre  (estimate of research employees: 200)	Marine Biology & Biotechnology Marine Ecology Aquaculture
3.	Mediterranean Agronomic Institute of Chania (MAICh)  (estimate of research employees: 200)	Natural Products & Biotechnology Food Quality Management Environmental Management Horticultural Genetics & Biotechnology Management, Marketing, Agricultural Economics
4.	National Agricultural Research Foundation  (estimate of research employees: 150)	Agricultural research and technology, 3 institutes: <ul style="list-style-type: none"> <li>• Olive tree and subtropical plants</li> <li>• Plant protection</li> <li>• Viticulture, floriculture and vegetable crops</li> </ul>
5.	Institute of Geological and Mineral Research (headquarters in Athens)	Research in water, geology and minerals

Source: own survey.

**Table 2: Number of students enrolled in Greek HEIs and students registered in 2002 per region**

Region	Number of students 2002		Share of total students	
	Entrants of year 2002		Share of new entrants	
Attica	91 900	28.0%	21 345	27.3%
Stereia Ellada	13 900	4.2%	3 470	4.4%
Dytiki Ellada	32 900	10.0%	7 810	10.0%
Peloponnisos	8 000	2.4%	2 000	2.6%
Ionia Nisia	2 900	0.9%	725	0.9%
Ipeiros	22 000	6.7%	5 405	6.9%
Thessalia	21 400	6.5%	5 230	6.7%
Dytiki Makedonia	18 600	5.7%	4 620	5.9%
Central Macedonia	52 200	15.9%	12 170	15.6%
Anatoliki Makedonia, Thraki	31 000	9.4%	7 435	9.5%
Voreio Aigaio	5 400	1.6%	1 310	1.7%
Notio Aigaio	2 600	0.8%	630	0.8%
Crete	25 300	7.7%	5 970	7.6%
Total	328 100	100.0%	78 120	100.0%

Source: Ministry of Education

**Table 3: Number of teaching staff (all levels)**

HEIs	2003	2004	2005
University of Crete	655	665	633
Technical University of Crete	200	189	180
TEI of Crete	1 143	n.a.	n.a.

Source: Own survey

**Table 4: Expenditure on R&D in Crete Region by type of performer (EUR million)**

	BERD	HERD	GOVERD	Non-Profit	GERD
1995	0.99	12.47	22.220	0.01	35.70
1997	3.01	20.62	28.020	0	53.43
1999	2.77	29.30	30.97	0	64.48
2001	1.84	24.95	35.85	0	64.54
2003	2.06	36.80	35.22	0	74.08
Change 1995-2003	108.08%	195.11%	58.51%	-100.00%	107.51%
Greece: Change 1995-2003	143.33%	135.91%	78.12%	190.95%	123.76%

Source: General Secretariat for Research and Technology.

**Table 4a: R&D expenditure by sector of performance and source of funds – Greece 1993 and 2003 – EUR million. Current prices**

Sectors	GOVERD		BERD		HERD		Non-profit		Total	
	1993	2003	1993	2003	1993	2003	1993	2003	1993	2003
	Business	1.2	3.5	53.7	253.5	4.6	34.4	0.2	0.3	59.6
Government	63.3	141.7	3.7	10.5	70.9	297.3	0.5	1.1	138.3	450.6
Higher Education	0.0	0.0	0.0	0.2	7.1	24.6	0.0	0.0	7.1	24.7
Non-profit	0.0	0.5	0.0	0.2	0.0	4.0	0.4	6.7	0.4	11.4
From Abroad	29.8	52.7	21.7	21.9	37.3	96.6	0.6	1.0	89.4	172.2
Total	94.3	198.4	79.0	286.3	119.9	456.8	1.7	9.1	294.8	950.6

Source: OECD OFFBERD 2005.

**Table 5: R&D expenditure per GDP and by type of performer – 2003**

	BERD	HERD	GOVERD	Non-profit	GERD
Greece	0.18	0.29	0.13	0.01	0.61
Anatoliki Makedonia, Thraki	0.10	0.28	0.04	0.00	0.43
Central Makedonia	0.16	0.33	0.08	0.01	0.58
Dytiki Makedonia	0.07	0.10	0.04	0.00	0.20
Thessalia	0.06	0.20	0.02	0.00	0.28
Ipeiros	0.00	0.57	0.04	0.00	0.62
Ionia Nisia	0.00	0.09	0.01	0.00	0.10
Dytiki Ellada	0.03	0.68	0.07	0.00	0.79
Stereia Ellada	0.04	0.00	0.01	0.00	0.06
Peloponnisos	0.09	0.00	0.02	0.01	0.12
Attica	0.40	0.34	0.21	0.01	0.96
Voreio Aigaio	0.00	0.32	0.02	0.00	0.34
Notio Aigaio	0.01	0.08	0.01	0.00	0.11
Crete	0.02	0.43	0.41	0.00	0.87

Source: General Secretariat for Research and Technology.

**Table 6: R&D personnel in Greek regions by type of performer – head count 2003**

	Business Sector				Government Sector				HEI sector	
	PNP Sector		TOTAL		RSE	Total	RSE	Total	RSE	Total
	RSE	Total	RSE	Total						
Greece	4385	12259	3027	9148	20507	35088	139	213	28058	56708
Anatoliki Makedonia, Thraki	115	360	72	277	853	1321			1040	1958
Central Macedonia	503	1350	308	1174	4328	7172	15	26	5154	9722
Dytiki Makedonia	6	15	36	118	198	338			240	471
Thessalia	41	134	57	282	1199	2102			1297	2518
Ipeiros	5	25	37	127	996	1746			1038	1898
Ionia Nisia	0	1	21	98	146	217			167	316
Dytiki Ellada	94	231	256	457	1795	3377			2145	4065
Stereia Ellada	97	291	67	273	12	24			176	588
Peloponnisos	51	142	94	436	20	36	2	11	167	625
Attica	3414	9544	1663	4497	8639	14644	122	176	13838	28861
Voreio Aigaio			36	166	392	621			428	787
Notio Aigaio	25	82	65	321	168	265			258	668
Crete	34	84	315	922	1761	3225			2110	4231

**Table 7: Distribution of R&D expenditure among Greek regions in 2003**

	GERD	Business Non-profit organisations	Public Research Centres	Universities
Greece	100.00%	100.00%	100.00%	100.00%
Attica	58.21%	76.16%	62.39%	43.66%
Central Macedonia	14.52%	10.53%	10.98%	18.78%
Crete	7.58%	0.66%	17.75%	8.06%
Dytiki Ellada	6.94%	2.48%	2.84%	11.92%
Anatoliki Makedonia, Thraki	2.57%	1.22%	1.41%	4.04%
Ipeiros	2.47%	0.04%	0.82%	4.91%
Thessalia	2.32%	0.52%	1.05%	4.15%
Peloponnisos	1.87%	5.07%	0.74%	0.09%
Stereia Ellada	1.15%	3.15%	0.58%	0.04%
Voreio Aigaio	0.99%	0.00%	0.23%	2.01%
Dytiki Makedonia	0.58%	0.00%	0.76%	0.91%
Notio Aigaio	0.53%	0.18%	0.33%	0.87%
Ionia Nisia	0.29%	0.00%	0.11%	0.58%

Source: General Secretariat of Research and Technology.



**Table 8: Distribution of GERD among Greek regions**

<b>Regions</b>	<b>1995</b>	<b>1997</b>	<b>1999</b>	<b>2001</b>	<b>2003</b>
Anatoliki Makedonia, Thraki	3.5%	3.6%	3.5%	2.6%	2.9%
Central Macedonia	17.7%	17.8%	15.9%	14.5%	15.5%
Dytiki Makedonia	1.1%	2.2%	0.3%	0.6%	0.9%
Thessalia	2.3%	1.7%	2.7%	2.3%	2.7%
Ipeiros	2.3%	3.0%	3.3%	2.5%	2.5%
Ionia Nisia	0.3%	0.7%	0.3%	0.3%	0.3%
Dytiki Ellada	5.8%	6.5%	7.2%	6.9%	6.4%
Sterea Ellada	3.8%	1.9%	2.1%	1.2%	0.6%
Peloponnisos	1.2%	1.9%	3.5%	1.9%	1.0%
Attica	52.4%	49.3%	52.7%	58.2%	58.1%
Voreio Aigaio	0.9%	1.2%	0.6%	1.0%	1.0%
Notio Aigaio	0.6%	0.4%	0.3%	0.5%	0.5%
Crete	8.2%	9.9%	8.1%	7.6%	7.6%
Greece	100.0%	100.0%	100.0%	100.0%	100.0%

Source: General Secretariat of Research and Technology

**Table 9: Contribution of regions to Greek HERD**

<b>Regions</b>	<b>1995</b>	<b>1997</b>	<b>1999</b>	<b>2001</b>	<b>2003</b>
Anatoliki Makedonia, Thraki	3.9%	4.1%	4.6%	4.9%	4.0%
Central Macedonia	25.3%	24.8%	22.7%	22.3%	18.8%
Dytiki Makedonia	0.3%	0.3%	0.3%	0.2%	0.9%
Thessalia	2.0%	1.9%	3.9%	3.4%	4.1%
Ipeiros	4.4%	4.8%	6.1%	6.2%	4.9%
Ionia Nisia	0.6%	0.9%	0.6%	0.7%	0.6%
Dytiki Ellada	9.4%	11.1%	11.6%	11.2%	11.9%
Sterea Ellada	0.0%	0.0%	0.0%	0.0%	0.0%
Peloponnisos	0.1%	0.0%	0.0%	0.0%	0.1%
Attica	45.5%	42.7%	41.5%	42.3%	43.7%
Voreio Aigaio	1.2%	1.7%	1.0%	1.6%	2.0%
Notio Aigaio	0.8%	0.2%	0.2%	0.7%	0.9%
Crete	6.4%	7.5%	7.4%	6.5%	8.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: GSRT, own calculations.

**Table 10: Contribution of regions to Greek GOVERD**

Regions	1995	1997	1999	2001	2003
Anatoliki Makedonia, Thraki	3.6%	3.6%	2.9%	2.3%	1.4%
Central Macedonia	10.6%	9.6%	8.9%	7.6%	11.0%
Dytiki Makedonia	0.5%	2.6%	0.5%	0.6%	0.8%
Thessalia	1.8%	1.7%	1.4%	1.1%	1.0%
Ipeiros	0.8%	0.7%	0.6%	0.8%	0.8%
Ionia Nisia	0.1%	0.1%	0.1%	0.1%	0.1%
Dytiki Ellada	3.5%	0.8%	2.5%	2.8%	2.8%
Stereia Ellada	4.5%	0.7%	0.6%	1.8%	0.6%
Peloponnisos	0.6%	2.3%	0.9%	1.2%	0.7%
Attica	53.3%	54.9%	62.9%	62.3%	62.4%
Voreio Aigaio	0.3%	0.4%	0.3%	0.2%	0.2%
Notio Aigaio	0.5%	0.5%	0.4%	0.2%	0.3%
Crete	20.0%	22.1%	17.9%	19.1%	17.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: GSRT, own calculations

**Table 11: Funding of RTDI measures by Regional Operational Programmes of Structural Funds according to initial planning of CSF 2000-2006 – EUR**

Regional O.P.	RTDI measures	TOTAL SF Budget	Share (%) of RTDI in Total Budget	Share in Total RTDI budget
Attica	5 264 974	1 116 641 725	0.47%	6.3%
Crete	7 595 595	508 426 662	1.49%	9.1%
Voreio Aigaio	14 473 124	369 661 715	3.92%	17.3%
Notio Aigaio	0	390 121 530	0.00%	0.0%
Ipeiros	5 397 604	443 918 408	1.22%	6.5%
Stereia Ellada	6 010 770	539 284 605	1.11%	7.2%
Dytiki Ellada	4 999 290	505 940 694	0.99%	6.0%
Ionia Nisia	3 517 594	257 831 814	1.36%	4.2%
Central Macedonia	26 290 059	937 167 219	2.81%	31.5%
Dytiki Makedonia	2 439 040	390 179 449	0.63%	2.9%
Anatoliki Makedonia-Thraki	5 120 865	760 995 208	0.67%	6.1%
Peloponnisos	0	465 028 950	0.00%	0.0%
Thessalia	2 437 500	571 067 454	0.43%	2.9%
Total	83 546 415	7 256 265 433	1.15%	100.0%

Source: Ministry of National Economy.

**Table 12: Final allocated budget for funding RTDI measures by Regional Operational Programmes for programming period 2000-2006. Amounts in EUR thousand**

Regional Operational Programmes	RTD Consortia	Programme for Industrial RTD	Programme for Industrial RTD – for young firms	S&T incubators	International cooperation in industrial RTD	AKMON/MOCHLOS	Programme for Demonstration Projects	TOTAL
Attica	2 837							2 837
Central Macedonia			1 790	5 200		3 400		10 390
Anatoliki Makedonia-Thraki	3 000	2 000			1 000			6 000
Dytiki Makedonia			550					550
Dytiki Ellada	1 650		1 200					2 850
Voreio Aigaio	700		600	850				2 150
Thessalia			1 000					1 000
Ionia Nisia	1 700							1 700
Crete	3 500		1 740				800	6 040
Total of public budget	13 387	2 000	6 880	6 050	1 000	3 400	800	33 517

Source: General Secretariat for Research and Development.

**Table 13: Patent applications at Industrial Property Organisation of Greece**

Region	1997	1998	1999	2000	2001	2002	2003
Crete	42	34	29	28	40	43	16
Total in Greece	509	484	451	471	608	561	538
Crete's share	8.25%	7.02%	6.43%	5.94%	6.58%	7.66%	2.97%

Source: Industrial Property Organisation of Greece.

**Table 14: Number and proportion of employees with tertiary education**

Regions	2000		2001		2002		2003		2004	
	Employees	%	Employees	%	Employees	%	Employees	%	Employees	%
Total employees Greece	4 089		4 086.3		4 175.8		4 274.5		4 313.2	
Total employees Crete	253.9		252.2		245.7		252.4		252.8	
Tertiary education Greece	806.2	19.72	821.9	20.11	877.5	21.01	910.4	21.30	1020	23.65
Tertiary education Crete	36.9	14.53	36.7	14.55	40.6	16.52	40.9	16.20	52.1	20.61

Source: Eurostat.

**Table 15: Human resources in science & technology as % of total labour per region. Total HSRT\*. 1994-2005**

Regions	Years											
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
E. Macedonia, Thrace	14.5	14.9	15.3	16.6	19	20.4	19	19.1	19.3	21.1	22.2	22.6
Central Macedonia	25.2	25.6	26.6	26	28.3	27.9	27.8	29.9	30.9	30.2	32.8	33.8
W. Macedonia	17.4	17.5	17.7	20.3	21.5	20.5	18.3	21.1	21.7	21.4	22.5	28
Thessaly	17.9	17	18.5	19.4	21.9	22.7	21	23.7	23.2	25.1	24.5	26.6
Epirus	19.8	20.3	22.5	22.4	23.2	24.1	22.3	24.9	26.3	28.9	28.6	29.8
Ionian Islands	12.3	11.5	13.5	13.6	18.1	16.3	19.7	17.8	15.1	16.5	19.2	17.6
W. Greece	13.8	14.7	12.7	13	18.6	19.1	19.4	19.6	18.4	22.5	25.8	25.2
Central Greece	13.2	13.4	15.2	16.2	13.3	14.2	16.6	15.5	13.9	16.6	21.1	22
Peloponnesus	13.1	13.1	14.4	14.7	18	16.7	17.3	18.8	19.9	17.4	22.9	23.8
Attica	36.9	36.2	38	38.5	39.1	37.5	37.9	37.9	39.9	41.6	43.5	42
N. Aegean	19.4	18.8	19.3	21.8	24.1	20.4	23.2	22.1	22.2	23.5	29.1	27
S. Aegean	14.8	14.7	14.9	14.6	13.7	15.7	16.2	16.6	16.7	17.8	20.2	20.7
Crete	17.5	17.8	17.9	17.9	18.1	18.4	18.4	19.2	23.5	22.9	28.8	28.7
<b>Greece</b>	<b>25.1</b>	<b>25.1</b>	<b>26.1</b>	<b>26.6</b>	<b>27.6</b>	<b>27</b>	<b>27.2</b>	<b>28</b>	<b>29.1</b>	<b>30.2</b>	<b>32.8</b>	<b>32.7</b>

Source: Eurostat.

Note: HRs in Total S&T are those that have successfully completed education at tertiary level in S&T field of study, or are not formally qualified as above but are employed in S&T occupation where the above qualifications are normally required.

**Table 16: Human resources in science & technology as % of total labour per region and Greece. HSRT in Core\*. 1994-2005**

Regions	Years											
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
E. Macedonia, Thrace	6.4	6.8	6.2	7.4	8.8	9	8.6	8.4	9.4	9.5	8.8	9.7
Central Macedonia	10.6	11.3	11.7	11.6	13	12.8	12.2	13.5	14.2	13.9	15.8	15.9
W. Macedonia	8.9	8.5	7.9	9.2	10	10.3	10.2	11.7	10.7	10.1	12.3	14.1
Thessaly	9.4	8.7	9.3	9.4	11.1	11.3	10.4	12.2	11.8	13	12.2	12.4
Epirus	9.9	9.6	10.7	11	10.1	11.6	11.5	12.2	13	12.8	13.8	15.1
Ionian Islands	4.7	4.9	6.2	6.1	10.2	8	10.2	8.4	9.1	8.1	9	8.7
W. Greece	5.7	7.3	6	6.5	9.7	10.3	10.1	8.9	9.2	10.7	12.4	11.9
Central Greece	6.2	6.3	7	8	6.3	7.3	9.1	8	6.5	7.8	9.6	10.8
Peloponnesus	6.4	6.8	7.3	7.1	8.5	8.6	8.6	9.2	10.6	8.9	10.7	11
Attica	15.1	15.7	16.4	16.3	17	16	15.9	16.5	17.7	18.2	19.2	18.7
N. Aegean	7.8	8	7	9	12	8.2	9.6	9.4	10.1	10.4	14.6	13.6
S. Aegean	5.6	5.2	6.2	5.8	5.2	6.6	7.4	7	6.8	7.4	7.4	10.1
Crete	8.8	9.3	9	9.3	8.9	8.7	8.5	9.5	10.8	10.3	14.6	13.5
<b>Greece</b>	<b>10.8</b>	<b>11.3</b>	<b>11.6</b>	<b>11.8</b>	<b>12.6</b>	<b>12.2</b>	<b>12.2</b>	<b>12.7</b>	<b>13.4</b>	<b>13.7</b>	<b>15.1</b>	<b>15.1</b>

Note: HRs in Core are those that have successfully completed education at tertiary level in S&T field of study and are employed in S&T occupation.

Source: Eurostat

**Table 17: Participation in lifelong learning (population aged 25-64)**

Regions	2000		2001		2002		2003		2004	
	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%
Greece	5 627		5 679.8		5 743.3		5 799.3		5 857	5 627
Crete	290.9		294.8		298.8		303		307.6	290.9
Participants in lifelong learning										
Greece	55.5	0.99	66	1.16	62.9	1.10	171.4	2.96	104.5	1.78
Participants in lifelong learning										
Crete	3.9	1.34	3.20	1.09	n.a		7.60	2.51	6.30	2.05

Source: Eurostat.

**Table 18: Main R&D programmes in OP "Competitiveness and their budget**

Measures	Budget in EUR million
<b>Foresight Programme</b> for selecting research and technology policy directions in Greece	1.5
<b>TECHNOLOGY BROKERAGE</b> programme for supporting intermediary technology transfer	5.9
<b>PEPER</b> programme for demonstration projects	54
<b>Liaison offices</b> in research centres and higher education institutes for exploiting research results and matching researchers with potential sponsors	30
<b>ELEFTHO</b> programme for creating S&T parks and incubators	85
<b>PRAXE</b> programme for exploiting research results	76
<b>International cooperation</b> in industrial research	21.5
<b>AKMON</b> programme for developing research infrastructures with participation of users	30
<b>Bilateral and international S&amp;T collaboration programme</b> with bodies from technologically developed countries and international organisations	15
<b>Development of excellence</b> in the research centres supervised by GSRT	10.3
<b>Collaborative research programmes</b> in selected economic, scientific, cultural and environmental fields (EUR million)	164
<b>PAVET</b> programme for developing industrial research and technology	52
<b>PENED</b> programme for supporting researchers for training young researchers	60
<b>ENTER</b> programme for integration of foreign researchers for attracting notable researchers from abroad and integrating them into the national research system for a specific period	7
<b>HERON</b> programme for support of employment of research staff in enterprises	75
<b>TECHNO LEARNING</b> programme for familiarising pupils and teachers with science and technology issues	3.9

Source: Operational Programme "Competitiveness".

**Table 19: Shares of RDP in country's GDP – and Average Annual Growth Rate – 1995-2003**

Regions	1995	1996	1997	1998	1999	2000	2001	2002	2003	Av. Annual Growth Rate
E. Macedonia,										
Thrace	4.53%	4.48%	4.39%	4.37%	4.39%	4.32%	4.32%	4.30%	4.23%	5.91%
Central Macedonia	16.51%	17.47%	17.67%	17.48%	17.46%	17.43%	17.33%	16.96%	16.77%	7.09%
W. Macedonia	2.76%	2.73%	2.88%	2.89%	2.82%	2.77%	2.69%	2.75%	2.66%	6.40%
Thessaly	6.14%	6.14%	6.16%	6.28%	6.15%	5.80%	5.98%	6.02%	6.04%	6.63%
Epirus	2.28%	2.24%	2.40%	2.43%	2.48%	2.45%	2.46%	2.51%	2.52%	8.26%
Ionian Islands	1.61%	1.63%	1.76%	1.73%	1.73%	1.70%	1.77%	1.80%	1.81%	8.50%
W. Greece	5.58%	5.59%	5.39%	5.35%	5.14%	5.02%	5.09%	5.10%	5.11%	5.68%
Central Greece	7.84%	8.04%	7.77%	7.58%	7.15%	7.20%	7.25%	7.22%	7.25%	5.82%
Peloponnesus	4.98%	4.97%	5.22%	5.32%	5.28%	5.35%	5.20%	5.17%	5.20%	7.42%
Attica	38.07%	36.68%	36.19%	36.49%	37.06%	37.65%	37.70%	38.01%	38.07%	6.83%
N. Aegean	1.59%	1.61%	1.68%	1.68%	1.74%	1.81%	1.76%	1.80%	1.85%	8.93%
S. Aegean	2.85%	3.00%	3.15%	3.11%	3.21%	3.21%	3.18%	3.08%	3.02%	7.73%
Crete	5.25%	5.41%	5.35%	5.31%	5.38%	5.29%	5.27%	5.28%	5.46%	7.40%
<b>Greece</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>6.83%</b>

**Table 20: Population of Greek regions (thousands)**

<b>Regions</b>	<b>1991</b>	<b>Share in total (%)</b>	<b>2003</b>	<b>Share in total (%)</b>
E. Macedonia, Thrace	572.4	5.58%	605.9	5.50%
Central Macedonia	1 720.2	16.77%	1 905.6	17.29%
W. Macedonia	289	2.82%	294.7	2.67%
Thessaly	730.8	7.13%	737.8	6.69%
Epirus	327.8	3.20%	339.4	3.08%
Ionian Islands	190.6	1.86%	217.4	1.97%
W. Greece	697.2	6.80%	729.2	6.61%
Central Greece	548.9	5.35%	560.1	5.08%
Peloponnesus	575.5	5.61%	600.3	5.45%
Attica	3 606	35.16%	3 928	35.63%
N. Aegean	201.4	1.96%	203.6	1.85%
S. Aegean	257.3	2.51%	302.1	2.74%
Crete	539.2	5.26%	599.4	5.44%
Greece	10 256.3	100.00%	11 023.5	100.00%

Source: NSSG.

**Table 21: Comparison of regions' GDP per capita with Greece and EU25 - Greece 100. Average annual growth of GDP per capita for 1995-2003**

Regions	1995	1996	1997	1998	1999	2000	2001	2002	2003	Average	Av. Annual growth
European Union (25 countries)	180	174	169	174	170	174	171	165	154	170	4.3%
Greece	100	100	100	100	100	100	100	100	100	100	6.4%
E. Macedonia, Thrace	81	81	79	79	79	78	78	78	77	79	5.6%
Central Macedonia	97	103	104	102	102	102	101	98	97	101	6.4%
W. Macedonia	100	100	106	106	104	103	100	102	100	102	6.3%
Thessaly	88	89	89	92	90	86	89	90	90	89	6.7%
Epirus	73	72	77	78	80	80	80	82	82	78	8.0%
Ionian Islands	85	85	92	90	91	89	92	92	92	90	7.5%
W. Greece	83	83	81	80	78	76	77	77	77	79	5.4%
Central Greece	149	154	149	146	139	140	142	142	143	145	5.8%
Peloponnesus	90	90	95	97	96	98	95	95	95	94	7.2%
Attica	108	104	102	103	104	106	106	107	107	105	6.2%
N. Aegean	83	85	89	89	92	96	94	97	100	92	8.9%
S. Aegean	108	113	118	116	119	118	116	113	110	114	6.7%
Crete	98	101	100	98	100	98	97	97	100	99	6.7%

Source: Eurostat.



**Table 22: Long-term (over 12 months) unemployment as percentage of total unemployment**

Region	1999	2000	2001	2002	2003	2004
European Union (25 countries)				44.21	45.05	44.46
Greece	54.27	54.74	51.41	51.34	54.88	53.06
E. Macedonia, Thrace	49,42	44,96	44,47	53,79	49,56	55,74
Central Macedonia	48,86	51,57	48,32	48,78	57,54	52,97
W. Macedonia	57,5	63,7	61,74	63,89	60,73	64,4
Thessaly	59,85	65,16	57,8	58,36	58,66	66,06
Epirus	64,58	70,02	68,97	53,31	62,9	62,08
Ionian Islands	28,49	24,25	23,1	25,09	26,83	18,97
W. Greece	62,23	64,94	63,91	67,58	67,61	61,59
Central Greece	65.06	65.24	58.69	66.97	63.68	56.46
Peloponnesus	57.54	59.15	50.09	46.91	53.91	59.88
Attica	56.54	54.86	53.41	52.07	57.23	51.63
N. Aegean	52.16	56.55	47.79	51.59	61.29	54.02
S. Aegean	16.99	13.19	12.62	19.35	14.75	22.34
Crete	44.09	41.26	32.67	33.81	33.18	28.6

Source: Eurostat.

**Table 23: Gross fixed capital formation by sector of activity in Crete EUR million and average annual growth of GFCF**

<b>NACE</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agriculture	3.9%	4.4%	4.3%	3.1%	3.3%	3.2%	2.9%	3.6%	5.5%
Fishing	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%
Mining	0.3%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Manufacturing	3.4%	5.1%	4.2%	5.2%	2.2%	2.6%	2.4%	2.3%	2.5%
Electricity, gas & water	4.5%	5.8%	5.0%	3.7%	2.3%	2.3%	2.3%	2.3%	10.8%
Construction	31.5%	26.0%	32.5%	27.3%	24.4%	19.7%	19.2%	19.1%	21.4%
Trade	13.2%	10.4%	10.8%	13.0%	8.3%	4.5%	4.2%	4.2%	6.7%
Hotels and restaurants	12.8%	24.1%	13.7%	16.0%	20.8%	22.7%	23.2%	21.3%	8.0%
Transport, storage and communication	7.6%	8.0%	8.9%	10.0%	15.1%	16.1%	17.2%	19.0%	9.9%
Financial intermediation	0.6%	0.6%	0.7%	0.8%	0.5%	0.9%	0.7%	0.7%	0.8%
Real estate	0.6%	0.4%	2.2%	3.1%	3.1%	2.3%	2.2%	2.2%	2.3%
Public administration and defence	9.9%	8.2%	10.5%	9.1%	13.1%	13.2%	13.1%	12.9%	24.8%
Education	2.5%	1.4%	2.5%	4.2%	2.7%	9.4%	9.3%	9.2%	3.8%
Health and social work	1.4%	1.8%	1.5%	1.0%	1.4%	0.5%	0.5%	0.5%	0.7%
Other community service activities	7.4%	3.3%	2.7%	3.0%	2.5%	2.3%	2.3%	2.2%	2.5%

Source: Eurostat.

**Table 24: Sectors' shares in total value added of Crete and Greece 1995-2003**

Sectors	1995		1996		1997		1998		1999		2000		2001		2002		2003	
	Greece	Crete	Greece	Crete	Greece	Crete	Greece	Crete	Greece	Crete	Greece	Crete	Greece	Crete	Greece	Crete	Greece	Crete
Agriculture	9.5%	21.2%	8.7%	18.7%	8.2%	12.5%	7.9%	11.9%	7.4%	11.2%	6.8%	10.7%	6.5%	10.3%	6.5%	10.4%	6.2%	9.6%
Fishing	0.3%	0.3%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.5%	0.4%	0.5%	0.4%	0.6%	0.5%	0.6%	0.5%	0.6%	0.5%
Mining	0.6%	0.1%	0.7%	0.1%	0.6%	0.1%	0.6%	0.1%	0.5%	0.2%	0.6%	0.2%	0.6%	0.2%	0.7%	0.2%	0.6%	0.1%
Manufacturing	13.0%	5.0%	13.1%	4.9%	11.7%	2.8%	11.8%	2.9%	11.7%	3.1%	11.5%	2.8%	11.5%	2.9%	11.1%	3.0%	10.9%	3.0%
Electricity, gas and water	2.4%	2.4%	2.1%	2.1%	2.0%	2.1%	2.1%	2.3%	2.0%	2.2%	1.8%	1.9%	1.8%	2.0%	1.8%	2.0%	1.8%	2.0%
Construction	6.4%	3.7%	6.5%	3.7%	6.6%	4.7%	7.1%	5.1%	7.3%	5.6%	7.4%	5.6%	8.4%	6.4%	8.2%	6.3%	8.7%	7.5%
Trade	13.6%	11.9%	14.5%	12.4%	14.4%	13.0%	13.6%	12.1%	13.2%	11.7%	12.7%	11.6%	13.6%	12.6%	13.2%	12.4%	13.2%	12.1%
Hotels & restaurants	6.5%	12.5%	7.0%	13.0%	7.8%	15.1%	7.7%	15.0%	7.1%	14.9%	7.4%	14.3%	7.4%	14.9%	7.5%	14.8%	7.8%	15.0%
Transport, storage, communication	6.7%	5.9%	6.2%	5.3%	6.4%	6.0%	6.7%	6.3%	8.5%	8.0%	8.7%	8.4%	8.3%	7.7%	8.6%	8.0%	8.5%	7.6%
Financial intermediation	4.2%	3.0%	4.6%	3.1%	4.5%	3.6%	5.0%	4.0%	5.4%	4.2%	6.4%	5.2%	5.1%	3.8%	4.4%	3.0%	4.8%	3.4%
Real estate	17.0%	16.2%	17.3%	18.6%	17.4%	18.9%	17.3%	18.8%	16.0%	17.4%	15.9%	17.6%	15.7%	17.5%	15.7%	17.4%	15.4%	17.1%
Public administration, defence	7.2%	5.5%	6.7%	3.9%	7.0%	5.0%	6.9%	5.0%	7.1%	4.7%	7.1%	4.8%	7.1%	4.8%	7.6%	5.1%	6.9%	4.3%
Education	4.5%	2.7%	4.3%	4.3%	4.8%	5.1%	4.8%	5.0%	4.7%	5.0%	4.7%	5.1%	4.6%	5.1%	5.0%	5.9%	5.4%	6.4%
Health and social work	5.2%	4.5%	5.1%	4.3%	5.3%	5.8%	5.4%	6.0%	5.4%	5.7%	5.3%	5.6%	5.3%	5.7%	5.5%	6.1%	5.6%	6.1%
Other community services	2.6%	4.9%	2.7%	4.9%	2.5%	4.8%	2.6%	4.9%	2.8%	5.2%	2.7%	5.4%	3.0%	5.4%	3.2%	4.5%	3.2%	5.1%
Activities of households	0.2%	0.2%	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.5%	0.4%	0.5%	0.4%	0.5%	0.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Eurostat.

**Table 25: Number of companies and their revenue – Crete 2003**

<b>NACE (%)</b>	<b>Sectors</b>	<b>No of companies</b>	<b>Companies (%)</b>	<b>Turnover</b>	<b>Turnover</b>
<b>A</b>	Agriculture, hunting and forestry	968	2.12%	78.64	1.21%
<b>B</b>	Fishing	87	0.19%	3.01	0.05%
<b>C</b>	Mining and quarrying	34	0.07%	10.67	0.16%
15	Food and beverages	1 203	2.63%	288.86	4.45%
17	Textiles	94	0.21%	40.99	0.63%
18	Wearing apparel	111	0.24%	6	0.09%
19	Tanning and dressing of leather	80	0.17%	7.11	0.11%
20	Wood and of products of wood	423	0.93%	18.82	0.29%
21	Pulp, paper and paper products	13	0.03%	12.74	0.20%
22	Publishing, printing	127	0.28%	18.39	0.28%
23	Coke, refined petroleum products	9	0.02%	0.25	0.00%
24	Chemicals	32	0.07%	7.76	0.12%
25	Rubber and plastic products	24	0.05%	13.76	0.21%
26	Non-metallic mineral products	262	0.57%	107.76	1.66%
27	Basic metals	14	0.03%	0.89	0.01%
28	Fabricated metal products	774	1.69%	68.56	1.06%
29	Machinery and equipment n.e.c.	190	0.42%	17.64	0.27%
30	Office machinery and computers	4	0.01%	0.78	0.01%
31	Electrical machinery and apparatus	69	0.15%	3.27	0.05%
32	Broadcasting and communication equipment and apparatus	20	0.04%	1.87	0.03%
33	Scientific instruments	29	0.06%	1.73	0.03%
34	Motor vehicles	10	0.02%	1.08	0.02%
35	Other transport equipment	18	0.04%	0.96	0.01%
36	Furniture; manufacturing n.e.c.	661	1.45%	101.9	1.57%
37	Recycling	2	0.00%		0.00%
40	Electricity and other utilities	14	0.03%	0.52	0.01%
41	Collection and distribution of water	21	0.05%	13.3	0.20%
45	Construction	6 258	13.69%	432.94	6.67%
50	Sale, maintenance and repair of motor vehicles and motorcycles	1 724	3.77%	384.58	5.93%
51-52	Wholesale and retail trade	13 859	30.32%	2 970.95	45.79%
55	Hotels and restaurants	8 642	18.90%	825.92	12.73%
60	Land transport; transport via pipelines	1 310	2.87%	139.13	2.14%
61	Water transport	143	0.31%	187.75	2.89%
62	Air transport	4	0.01%	0.29	0.00%
63	Auxiliary transport activities	532	1.16%	135.75	2.09%
641	Post and courier activities	44	0.10%	1.94	0.03%
642	Telecommunications	45	0.10%	1.91	0.03%
65-66	Financial intermediation	46	0.10%	1.89	0.03%
67	Financial intermediation services	129	0.28%	2.74	0.04%
70	Real estate activities	307	0.67%	10.67	0.16%
71	Renting of machinery and equipment	631	1.38%	51.68	0.80%
72	Computer and related activities	95	0.21%	4.99	0.08%
73	Research and development	83	0.18%	10.49	0.16%
74	Other business activities	3 742	8.19%	188.66	2.91%
75	Public administration and defence	37	0.08%	8.38	0.13%
80	Education	282	0.62%	8.8	0.14%
85	Health and social work	135	0.30%	10.52	0.16%
90	Sewage and refuse disposal, sanitation and similar activities	47	0.10%	5.43	0.08%
91	Activities of membership organisations n.e.c.	309	0.68%	155.17	2.39%
92	Recreational, cultural and sporting activities	728	1.59%	34.88	0.54%
93	Other service activities	1 286	2.81%	85.89	1.32%
95-99	Private households with employed persons and others	4	0.01%		
	<b>Total</b>	<b>45 715</b>	<b>100.00%</b>	<b>6 488.61</b>	<b>100.00%</b>

Source: NSSG Business Registry 2002

**Table 26: Turnover and number of firms in Crete based on technological intensity – 2002**

	<b>Number of firms</b>	<b>Turnover</b>
Manufacturing high-tech	0.1%	0.1%
Manufacturing medium-high-tech	0.8%	0.5%
Manufacturing medium-low-tech	2.9%	3.2%
Manufacturing low-tech	7.1%	8.3%
Knowledge-intensive and high-tech services	0.7%	0.3%
Knowledge-intensive financial services	0.5%	0.1%
Knowledge-intensive market services	12.6%	7.4%
Knowledge-intensive other services 3.0%	0.9%	
Low-knowledge-intensive market services	68.0%	74.9%
Low-knowledge-intensive other services	4.4%	4.3%

Source: our calculations based on NSSG Business Registry, 2002.

**Table 27: Imports/exports from Crete customs offices (EUR million)<sup>27</sup>: Imports/exports from Crete customs offices (EUR million)**

Trade location	1998		1999		2000		2001		2002	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Total Greece	9 011	4 349	10 157	4 578	13 974	6 627	14 670	6 718	16 138	6 222
Heraklion	16	18	21	19	17	25	24	36	43	33
Sitia		1		0		1		1		1
Souda	11	0	11	0						
Chania	0	1	0	2	9	2	14	2	13	3
Total Crete	27	20	33	21	26	28	37	39	56	37
% of Greece	0.30	0.47	0.32	0.47	0.19	0.42	0.25	0.58	0.35	0.59

Note: 1998 to 2001 converted to euros, based on 1 euro = 340.75 drachmas.  
Source: National Statistical Service of Greece.