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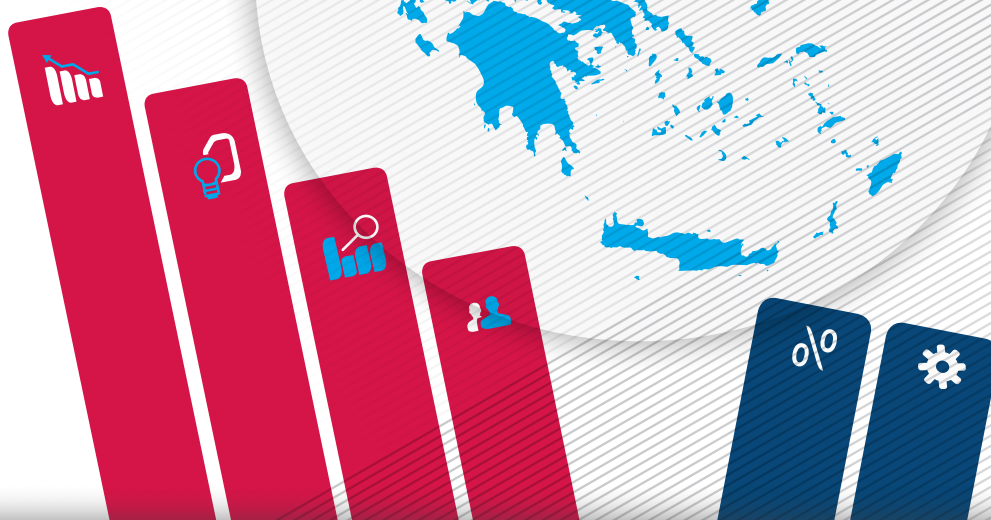
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The regional dimension of
**knowledge intensive activities
in Greece** - Overview 2015

THE REGIONAL DIMENSION OF KNOWLEDGE-INTENSIVE ACTIVITIES IN GREECE

Overview 2015

PREFACE

The need to better understand the components forming the research, development and innovation systems on a regional level has steered the appropriate national agencies into regularly measuring and publishing informed analysis on these components. In the framework of the current European 'regional innovation strategy', this sub-national analysis has become the main EU mechanism for mapping/understanding the local knowledge production systems and their contribution to growth.

This edition is the first in a series of publications being launched by the National Documentation Centre (EKT), with the aim of capturing the input and output of knowledge intensive activities across the thirteen regions of the country. So far, the lack of systematic recording and updating of data on the evolution of the regional sub-systems has resulted in a fragmentary picture of business, research and university interconnections and networking on a regional scale as well as of the regional dynamics in knowledge intensive activities.

The intention is that our publications will become a regular feature enabling interested parties to evaluate the evolution of the activities over time thus contributing to public debate and policy making.

The publication makes use of data from the official R&D and Innovation statistics which have been collected by EKT, including R&D statistics for expenditure and personnel, statistics for business innovation, bibliometric studies on scientific publications in international journals, the National Archive of PhD Theses, data on Greek participation in European research programmes, etc.

The first chapter presents data on R&D expenditure in the different sectors and the sources of funding. The second is dedicated to indicators and R&D personnel. The third explores aspects of scientific excellence and openness of the organisations in each region through their participation in the EU's 7th Framework Programme, PhD theses and scientific publications in international journals. The fourth chapter refers to the regional business

innovation scene. Finally, the fifth chapter contains notes on the methodology used to produce the indicators and the data sources.

For the full data tables, specialized documentations as well as targeted reports please refer to http://metrics.ekt.gr/.
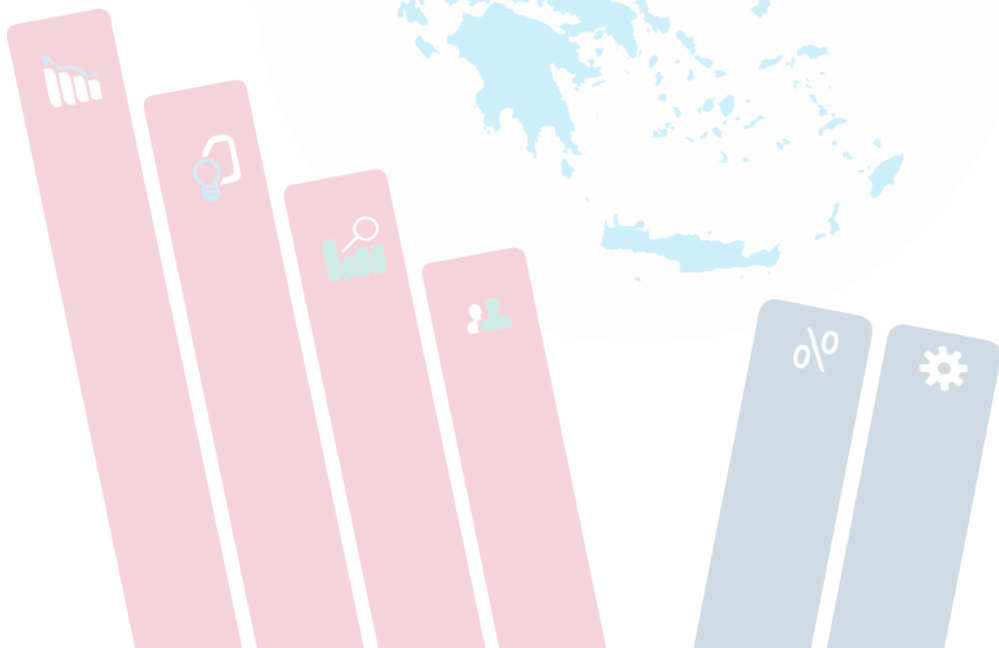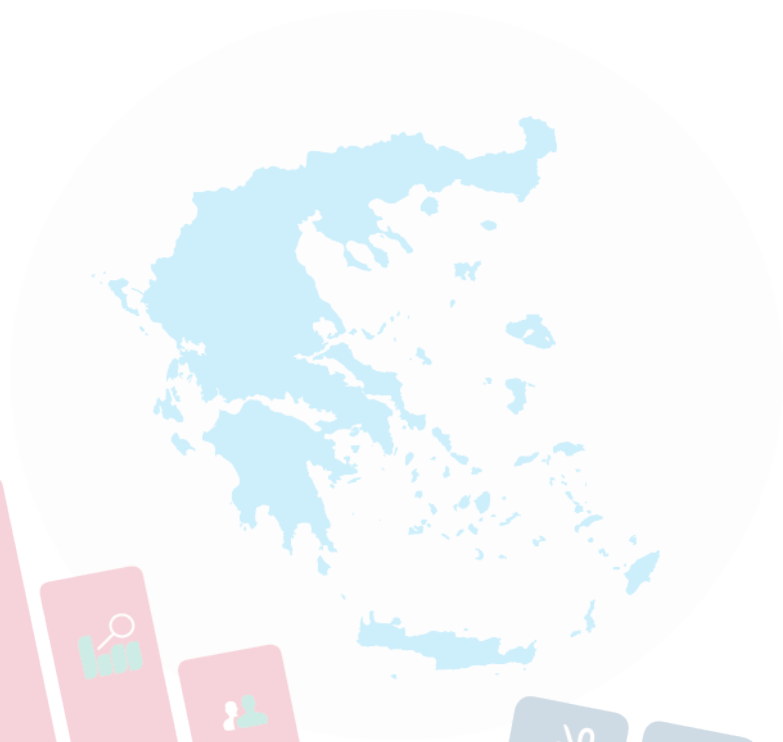
Dr Evi Sachini

Director EKT

TABLE OF CONTENTS

CHAPTER 1

R&D Expenditure and Funding

In 2013, the total R&D Expenditure in Greece amounted to 1,465.7 million Euros.

Table 1.1 presents the distribution of the national R&D Expenditure amongst the 13 Greek regions, as listed at level 2 of NUTS 2013 classification.

The largest portion of the national R&D Expenditure for the year 2013 is executed in the region of Attiki (820.27 million Euros), which is followed by, yet quite far behind, the regions of Kentriki Makedonia (183.30 million Euros), and Kriti (120.68 million Euros). Reversely, R&D expenditure is much lower in the regions of Dytiki Makedonia (17.80 million Euros), Notio Aigaio (14.98 million Euros), and Ionia Nisia (8.17 million Euros).

The distribution of R&D Expenditure by sector of performance (BES: Business Sector, GOV: Government Sector, HES: Higher Education Sector, PNP: Private Non Profit Sector) in the Greek Regions shows that only in the regions of Attiki and Sterea Ellada, the BES sector outperforms the other three sectors, whereas, in all the remaining regions, it's either the HES or the GOV sectors that rank first. Importantly, this preponderance of GOV and HES sectors is a pattern contrary to most of the EU member states as well as to global trends, indicating BES as the prime R&D performer.

Table 1.1: R&D Expenditure (in million Euros) in Greek Regions (NUTS2), 2013

Region (NUTS2)	Total R&D Expenditure (M€)	Sector of R&D Performance			
		BES	GOV	HES	PNP
ATTIKI	820.27	388.87	208.24	210.33	12.83
KENTRIKI MAKEDONIA	183.30	30.18	52.88	97.29	2.95
KRITI	120.68	5.61	59.44	54.72	0.91
DYTIKI ELLADA	79.72	12.39	16.16	51.13	0.04
THESSALIA	50.27	4.26	14.10	31.85	0.06
ANATOLIKI MAKEDONIA, THRAKI	43.21	10.06	9.68	23.42	0.05
IPEIROS	39.78	3.43	7.71	28.34	0.30
STEREA ELLADA	35.28	24.69	6.58	3.96	0.05
PELOPONNISOS	30.82	7.52	13.07	10.03	0.20
VOREIO AIGAIO	21.40	0.39	4.38	16.57	0.06
DYTIKI MAKEDONIA	17.80	0.99	6.51	10.11	0.19
NOTIO AIGAIO	14.98	0.22	7.89	6.26	0.61
IONIA NISIA	8.17	0.09	3.49	4.59	0.00
Total[1]	1,465.67	488.69	410.13	548.60	18.25

In Figure 1.1, a similar three-fold pattern is evident, where: 1) the HES sector accounts for the majority of the R&D expenditure in most regions (the highest rate is attributed in the region of Voreio Aigaio with 77.4%, followed by Ipeiros with 71.2%), 2) the GOV sector comes second, yet equally strong (highest rate in Notio Aigaio with 52.7%, followed by Kriti with 49.3%), and 3) the overall weak participation of BES. Exception to this third point is the Sterea Ellada region, where 70% of total R&D expenditure is performed by BES. This is a rate that surpasses the EU28 average (63.5%). Lastly, the contribution of the PNP sector is only minimal.

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[1] Differences between aggregates and components are due to rounding.

Figure 1.1: R&D expenditure by sector of performance in Greek regions (NUTS2), 2013
(as % of total R&D expenditure in each region)
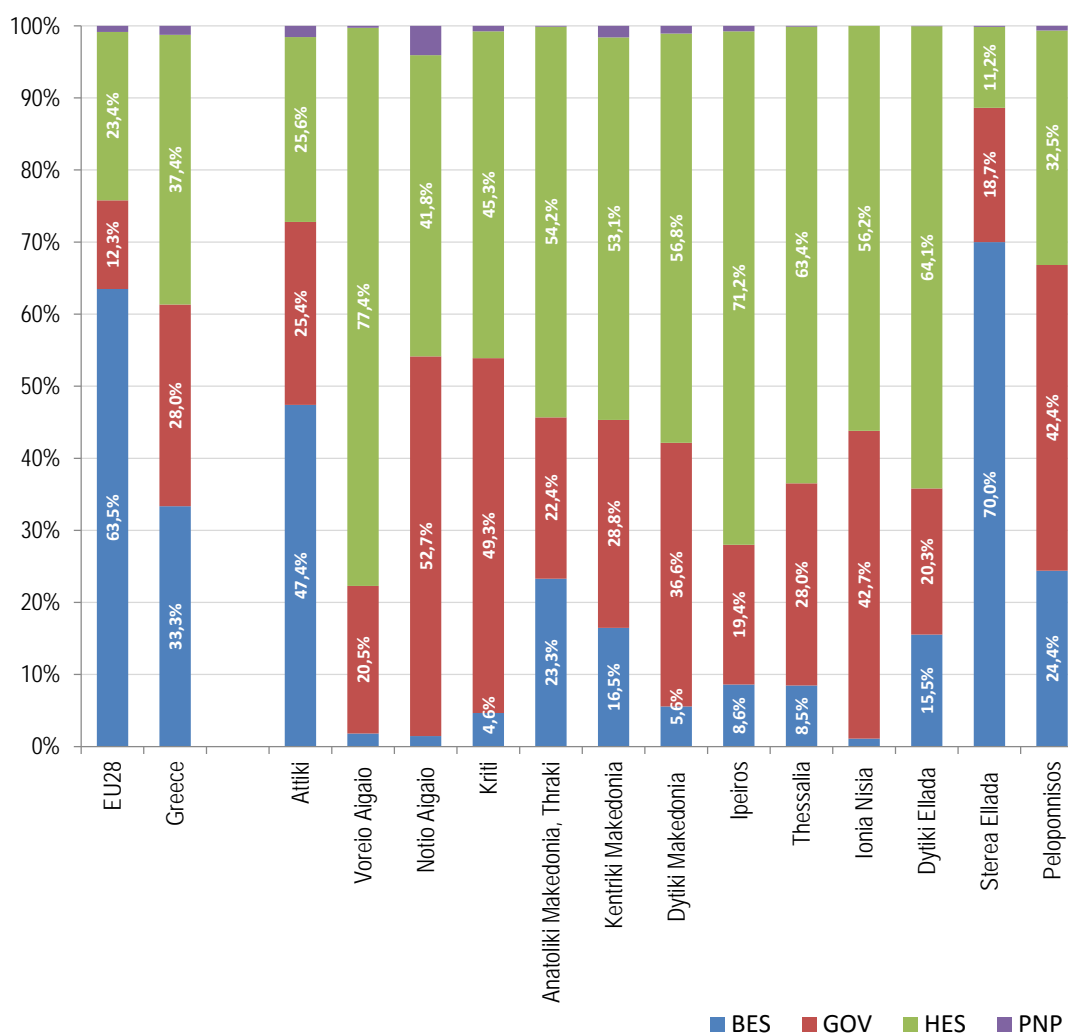
R&D intensity, that is R&D expenditure as a percentage of GDP, is a central indicator depicting the importance a country/a region attributes to such activities. According to the 2013 data, R&D intensity on a national level reached 0.80% of GDP[2]. As indicated in Figure 1.2, the four following regions: Kriti (1.35%), Attiki (0.94%), Ipeiros (0.92%) and Dytiki Ellada (0.92%) outperform the country average, yet remain significantly lower than the EU28 average (2.01%). All the remaining regions underperform national average, while the region of Voreio Aigaio only slightly so.

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[2] GDP data were drawn from Eurostat database http://ec.europa.eu/eurostat/web/national-accounts/data/database, (data code nama_10r_2gdp), last update 21.05.2015.

Figure 1.2: R&D intensity in Greek regions (NUTS2), 2013
        (R&D expenditure as % of regional GDP)
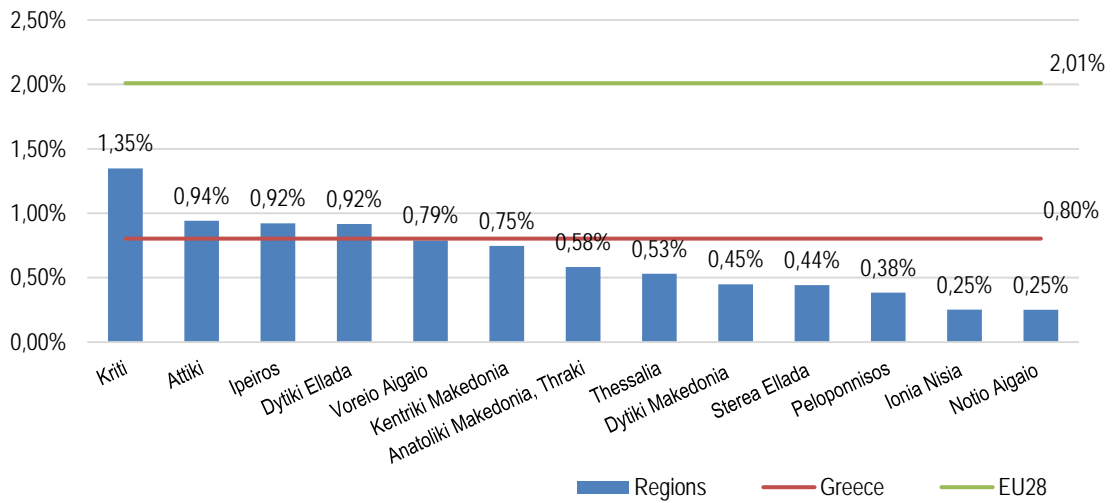
The following thematic map exhibits the performance of each region in terms of its R&D intensity. The region of Kriti achieves the highest rate of R&D expenditure as % of GDP.

Map 1.1: R&D Intensity in Greek regions (NUTS2), 2013
        (R&D expenditure as % of regional GDP)

The data classification method used was 'Jenks Natural Breaks'.
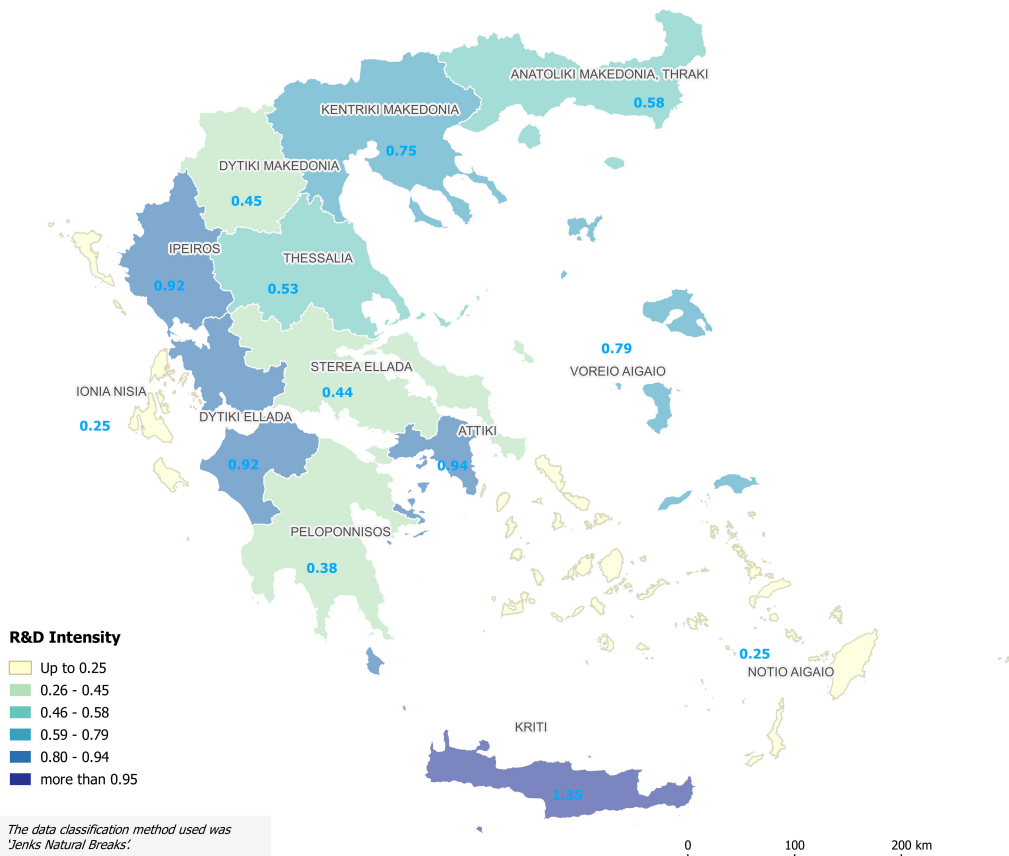
Figure 1.3 ranks the regions according to R&D expenditure per inhabitant. The region of Attiki comes first (209.2 Euros/inhabitant), followed by Kriti (191.7). Only these two regions outperform the national average (132.5). The region of Kentriki Makedonia ranks sixth (96.1), while being second in terms of R&D performance (see Table 1.1). This dimension of R&D activities equally reveals an underperformance element of all the Greek regions when compared to EU28 average (536 Euros/inhabitant).

Figure 1.3: R&D expenditure per inhabitant in the Greek regions (NUTS2), 2013
(Euros per inhabitant in each region)
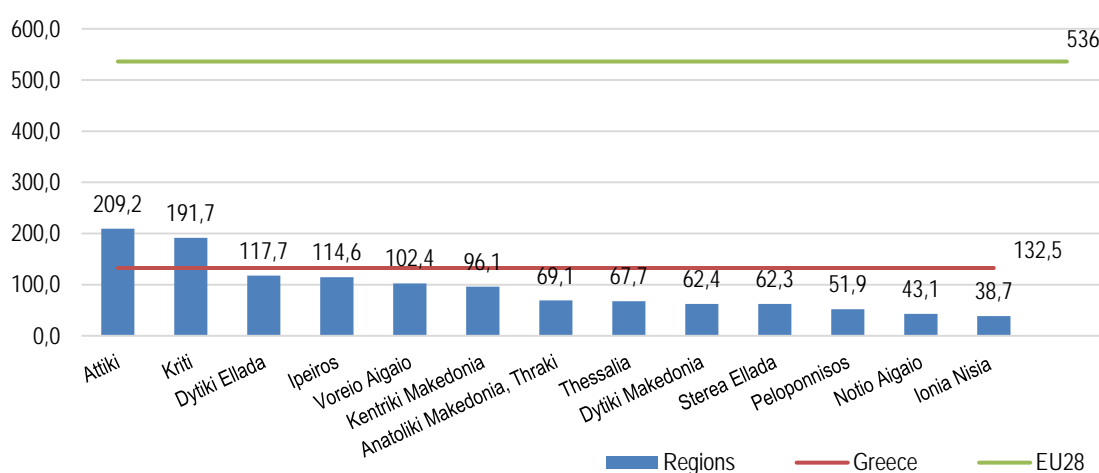
Focusing on the enterprises' R&D activities, Figure 1.4 ranks the Greek regions in terms of BES' R&D intensity. The region of Attiki ranks first (0.46%), followed by Sterea Ellada (0.31%). These two regions outperform the national average (0.28%), while all the remaining underperform. In comparison, the EU28 average stands at 1.30%.

Figure 1.4: BES' R&D intensity in Greek regions (NUTS2), 2013.
(BES R&D expenditure as % of regional GPD)
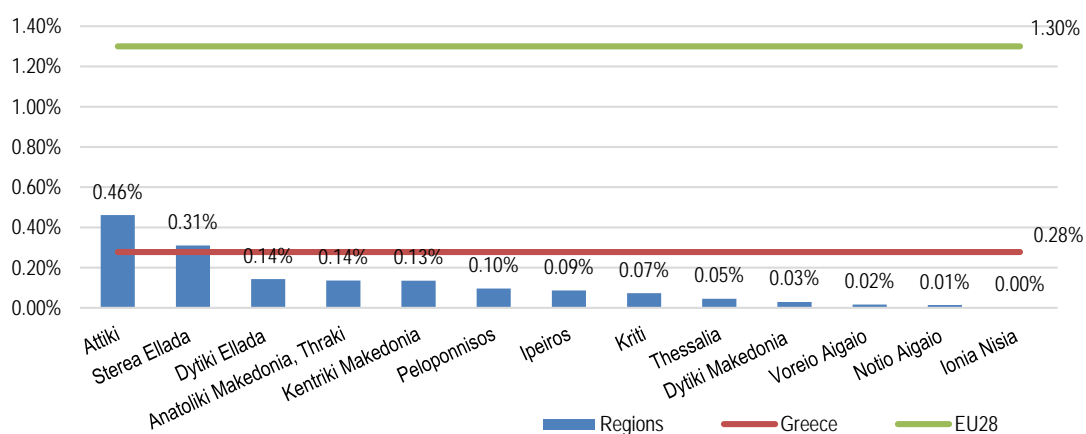
1. R&D Expenditure and Funding

2. R&D Personnel

3. Scientific excellence and international collaborations

4. Business innovation

5. Methodological notes

Figure 1.5 presents the funding sources of R&D activities. The main source of R&D funding in Greece is government (52.3%), followed by businesses (30.3%). This stands in contrast to EU averages, where government funding stands at 32.8%, and funding coming from businesses at 55.0%.

Similarly, on a regional level, government is the major source of R&D funds. This is expected since government funds are mainly directed towards the GOV and HES sectors which are the principal R&D performers across most of the Greek regions (see Figure 1.1). Exception to this, are the regions of Attiki and Sterea Ellada, where the BES sector contributes significantly to the regional R&D performance and, accordingly, is the prime source of R&D funding.

An important source of R&D funding are the resources coming from abroad. Indeed, the national average is higher than the EU average, and this stands as the case for the region of Attiki, Kriti, Kentriki Makedonia, Thessalia and Dytiki Ellada. The funds from abroad include mainly the EU financial contribution for Greek participants in EU R&D programmes (such as the 7th Framework Programme), while direct foreign investments are low.

Remaining sources of funds (other national sources) include funding coming from HES sector (mainly university revenues), and PNP sector, though this contribution is rather small across all regions.

Figure 1.5: R&D Expenditure by source of funds in Greek regions (NUTS2), 2013
(as % of total R&D expenditure in each region)
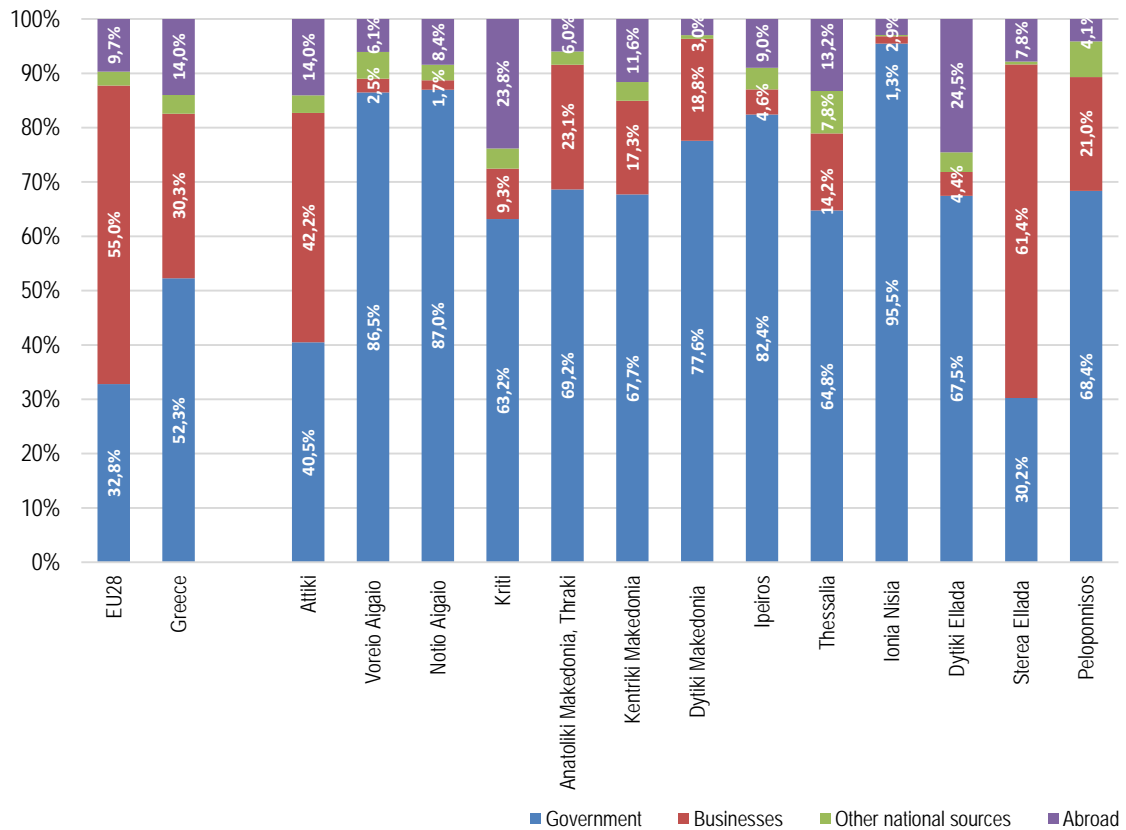
R&D funding flows between performing sectors is an important element in the analysis of the national R&D system, and receives attention in policy making (e.g. enhancing BES' R&D activities via public funding, connecting the academic and business communities, etc.)

Table 1.2 presents an analysis per region of the sectors of performance and the sources of funding. Indicatively, in the region of Attiki, the BES and the PNP sectors[3] spent more than 401.7 million Euros for executing R&D activities, of which 22.11 million Euros come from the government, 327.27 million Euros from BES, 8.05 million Euros from other national sources (HES and PNP sectors), and 44.27 million Euros from abroad.

Table 1.2: R&D expenditure by sector of performance and source of funds in Greek regions (NUTS2), 2013
(million Euros)

| REGION | Sector of performance | Total R&D Expenditure | Source of funds | | | | | |
| | | | Government | | Business sector | Other national sources[4] | Abroad | |
			Total	of which NSRF[5]			Total	of which EU
ATTIKI	BES & PNP	401.70	22.11	18.39	327.27	8.05	44.27	29.07
	GOV	208.24	174.79	63.15	4.37	0.12	28.96	26.19
	HES	210.33	135.22	44.30	14.68	18.44	41.98	38.97
	Total	820.27	332.12	125.84	346.32	26.61	115.21	94.23
VOREIO AIGAIO	BES & PNP	0.45	0.04	0.04	0.35	-	0.06	-
	GOV	4.38	4.32	3.54	0.04	-	0.02	0.01
	HES	16.57	14.15	4.91	0.15	1.05	1.22	1.21
	Total	21.40	18.51	8.49	0.54	1.05	1.30	1.22
NOTIO AIGAIO	BES & PNP	0.83	0.09	0.06	0.12	-	0.62	-
	GOV	7.89	7.71	6.02	0.04	-	0.14	0.06
	HES	6.26	5.23	1.77	0.10	0.43	0.50	0.49
	Total	14.98	13.03	7.85	0.26	0.43	1.26	0.55
KRITI	BES & PNP	6.52	0.23	0.21	4.47	0.01	1.81	0.82
	GOV	59.44	39.33	15.66	4.34	0.03	15.74	14.5
	HES	54.72	36.68	12.67	2.38	4.45	11.21	10.88
	Total	120.68	76.24	28.54	11.19	4.49	28.76	26.2
ANATOLIKI MAKEDONIA, THRAKI	BES & PNP	10.11	0.84	0.79	8.74	0.08	0.45	0.35
	GOV	9.68	8.99	3.72	0.09	0.01	0.59	0.57
	HES	23.42	19.83	3.51	1.08	0.97	1.54	1.10
	Total	43.21	29.66	8.02	9.91	1.06	2.58	2.02

[3] BES and PNP sectors are shown together, due to the small contribution of PNP sector in regional R&D Expenditure.
[4] The 'Other national sources' category comprises of the HE and PNP sectors as funding sources. The bulk of the HES component comprises of Universities' own funds.
[5] NSRF: National Strategic Reference Framework (https://2007-2013.espa.gr/en/Pages/Default. aspx)

Table 1.2 (continued)

REGION	Sector of performance	Total R&D Expenditure	Source of funds					
			Government		Business sector	Other national sources[4]	Abroad	
			Total	of which NSRF[5]			Total	of which EU
KENTRIKI MAKEDONIA	BES & PNP	33.13	7.11	6.23	22.53	0.62	2.87	2.50
	GOV	52.88	42.54	19.65	1.42	0.01	8.91	6.85
	HES	97.29	74.45	17.55	7.68	5.70	9.46	7.99
	Total	183.3	124.1	43.43	31.63	6.33	21.24	17.34
DYTIKI MAKEDONIA	BES & PNP	1.18	0.03	0.03	1.05	0.10	-	-
	GOV	6.51	3.94	1.91	2.23	-	0.34	0.26
	HES	10.11	9.84	4.13	0.06	0.02	0.19	0.19
	Total	17.8	13.81	6.07	3.34	0.12	0.53	0.45
IPEIROS	BES & PNP	3.73	0.8	0.80	0.94	0.10	1.89	1.77
	GOV	7.71	6.94	4.63	0.27	-	0.5	0.47
	HES	28.34	25.05	8.94	0.62	1.49	1.18	1.13
	Total	39.78	32.79	14.37	1.83	1.59	3.57	3.37
THESSALIA	BES & PNP	4.32	0.32	0.28	3.86	0.04	0.10	0.05
	GOV	14.1	10.27	6.07	0.41	-	3.42	2.46
	HES	31.85	21.97	7.25	2.85	3.89	3.14	2.82
	Total	50.27	32.56	13.6	7.12	3.93	6.66	5.33
IONIA NISIA	BES & PNP	0.09	0.04	0.04	0.05	-	-	-
	GOV	3.49	3.49	2.39	-	-	-	-
	HES	4.59	4.27	1.81	0.06	0.02	0.24	0.22
	Total	8.17	7.8	4.24	0.11	0.02	0.24	0.22
DYTIKI ELLADA	BES & PNP	12.43	2.64	1.78	2.54	0.04	7.21	1.63
	GOV	16.16	12.24	3.88	0.91	-	3.01	2.94
	HES	51.13	38.9	14.48	0.04	2.86	9.33	8.19
	Total	79.72	53.78	20.14	3.49	2.9	19.55	12.76
STEREA ELLADA	BES & PNP	24.74	1.41	1.41	21.19	-	2.14	2.08
	GOV	6.58	6.20	3.19	0.34	-	0.04	0.01
	HES	3.96	3.06	0.86	0.13	0.19	0.58	0.56
	Total	35.28	10.67	5.46	21.66	0.19	2.76	2.65
PELOPONNISOS	BES & PNP	7.72	1.33	1.30	6.10	0.08	0.21	0.09
	GOV	13.07	12.76	5.90	0.18	-	0.13	0.11
	HES	10.03	6.98	3.35	0.18	1.94	0.93	0.88
	Total	30.82	21.07	10.55	6.46	2.02	1.27	1.08

In the following figures (1.6 up to 1.18), the same findings on a per cent distribution per each region are presented. In the case of Figure 1.6 concerning the region of Attiki, 81.5% of the R&D activities performed by the BES sector (including PNP sector) are funded by businesses, 5.5% from government, 2.0% from other national sources, and 11.0% from abroad. Concerning the GOV sector, the major source of R&D funds is the government (83.9%), while only 2.1% is funded by businesses.

Figure 1.6: R&D Expenditure by source of funds in each sector of performance in the region of Attiki, 2013

(% of total R&D expenditure of each sector of performance)
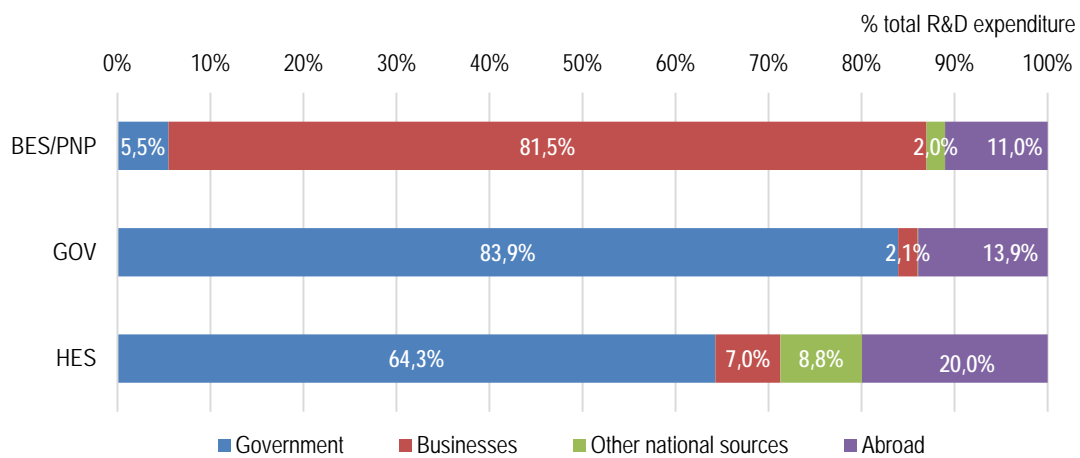
Figure 1.7 indicates the significant extent of government funding of R&D activities performed by the GOV and HES sectors in the region of Voreio Aigaio, which stand at 98.6% and 85.4% respectively.

Figure 1.7: R&D Expenditure by source of funds in each sector of performance in the region of Voreio Aigaio, 2013

(% of total R&D expenditure of each sector of performance)
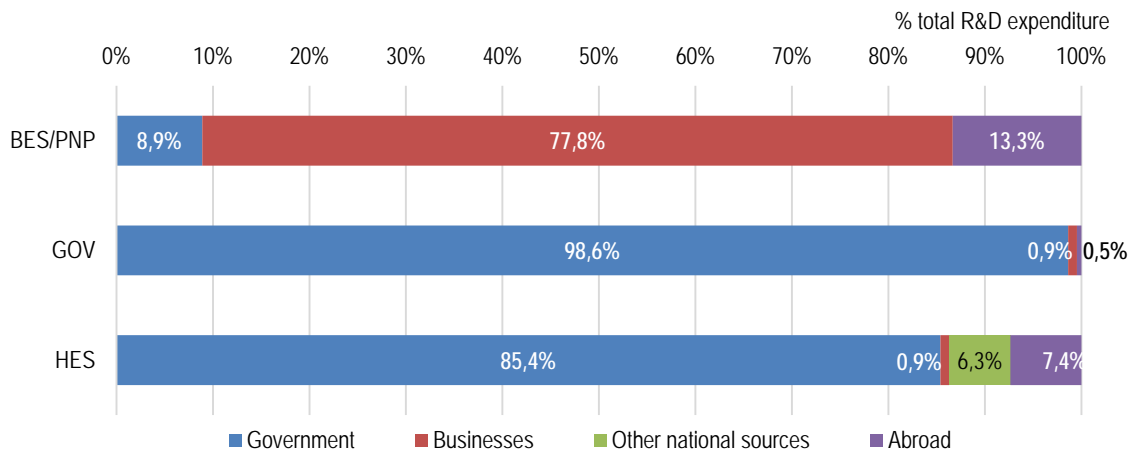
Figure 1.8 indicates the importance of funding from abroad for the BES and PNP R&D performance in the region of Notio Agaio (nearly 75%) – yet, a performance quite modest if absolute numbers are taken into consideration.

Figure 1.8: R&D Expenditure by source of funds in each sector of performance in the region of Notio Aigaio, 2013
(% of total R&D expenditure of each sector of performance)

A more balanced image is portrayed in the region of Kriti, where funds from abroad represent between 20% and 28% of R&D expenditure across all performing sectors (see Figure 1.9).

Figure 1.9: R&D Expenditure by source of funds in each sector of performance in the region of Kriti, 2013
(% of total R&D expenditure of each sector of performance)
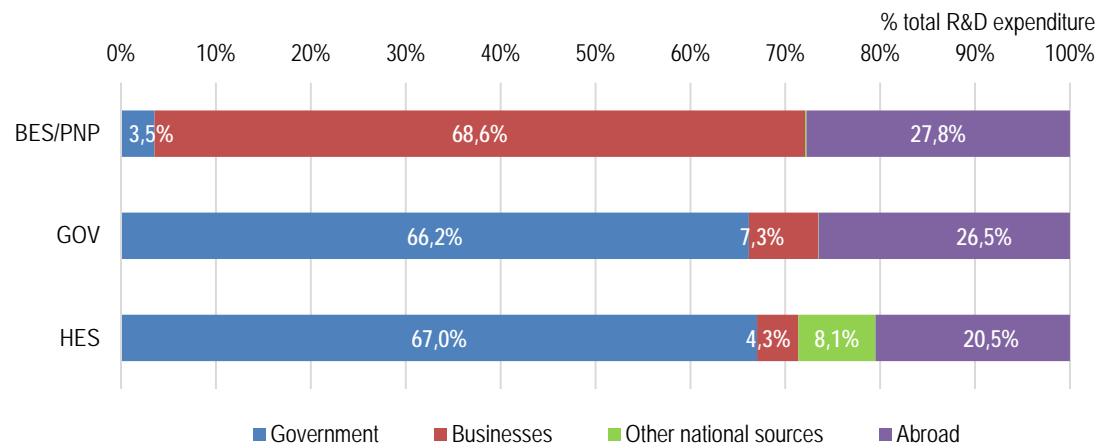
In the region of Anatoliki Makedonia and Thraki (Figure 1.10), the role of the government as an important funding source for R&D activities undertaken by both HES (84.7%) and the GOV (92.9%) is evident. In addition, BES' R&D activities are, to a great extent, financed by own funds (86.4%).

Figure 1.10: R&D Expenditure by source of funds in each sector of performance in the region of Anatoliki Makedonia, Thraki, 2013
(% of total R&D expenditure of each sector of performance)
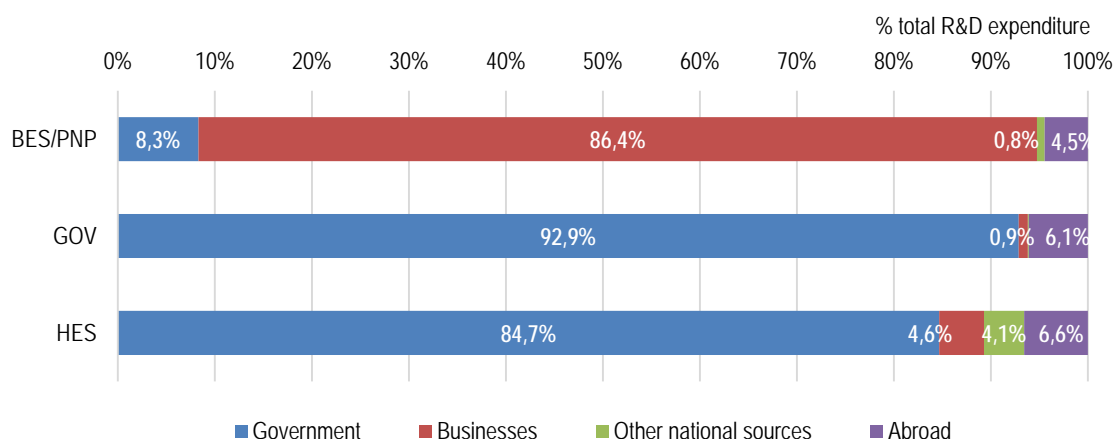
A similar image is portrayed in Figure 1.11. The government stands as a major funding source for both the HES (76.5%) and GOV (80.4%) performing actors. Yet, in this case, BES R&D expenditure receive a quite substantial funding of 21.5% from the government.

Figure 1.11: R&D Expenditure by source of funds in each sector of performance in the region of Kentriki Makedonia, 2013
(% of total R&D expenditure of each sector of performance)
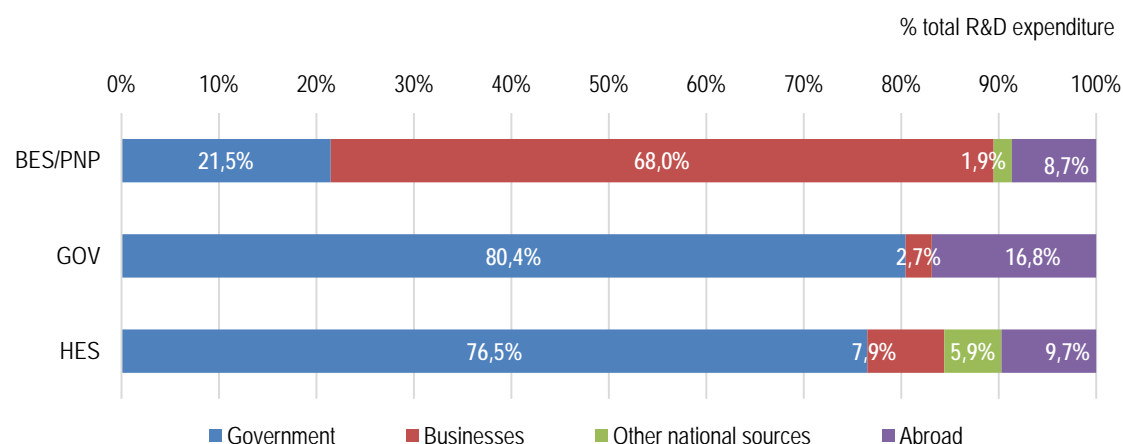
In the region of Dytiki Makedonia (Figure 1.12), the GOV sector's R&D expenditure is funded by the BES sector at a rate of 34.3%. While modest if absolute numbers are taken into consideration, this towers all other regions GOV R&D expenditure coming from the private sector.

Figure 1.12: R&D Expenditure by source of funds in each sector of performance in the region of Dytiki Makedonia, 2013
(% of total R&D expenditure of each sector of performance)

In the case of the region of Ipeiros (Figure 1.13), a funding pattern similar to that concerning the region of Notio Aigaio (Diagram 1.8) is evident, namely concerning the importance of foreign funds for the BES and the PNP sectors' R&D performance, which is slightly above 50%, – yet, a performance quite modest if absolute numbers are taken into consideration (3.7 million Euros).

Figure 1.13: R&D Expenditure by source of funds in each sector of performance in the region of Ipeiros, 2013
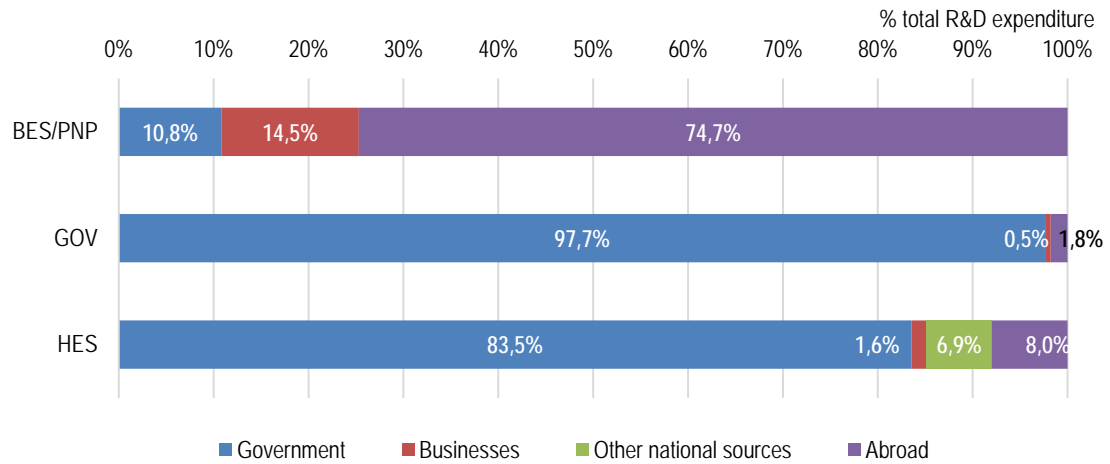(% of total R&D expenditure of each sector of performance)
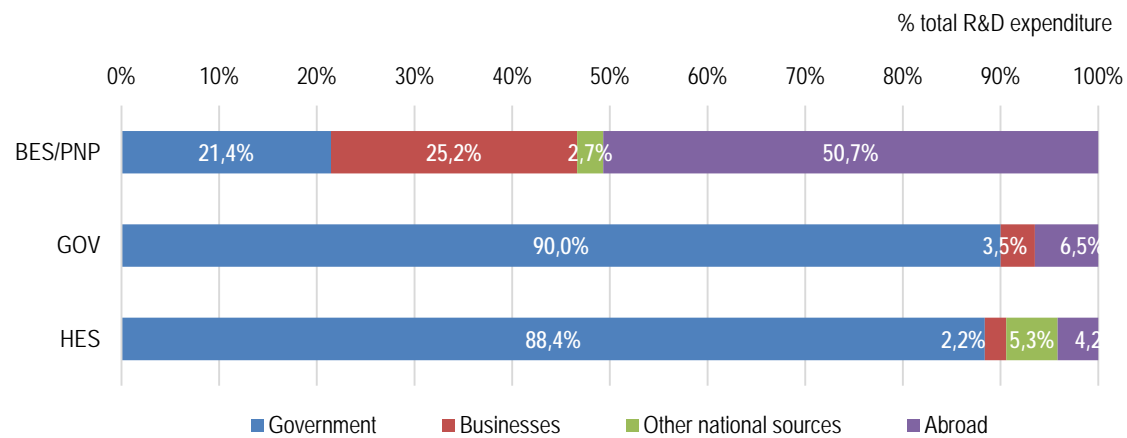
The prevailing pattern between funding sources and R&D performing sectors can be observed also in the case of the region of Thessalia (Figure 1.14). Yet, in this case, the GOV sector receives a substantial portion of funding from abroad, nearly 25%.

Figure 1.14: R&D Expenditure by source of funds in each sector of performance in the region of Thessalia, 2013
(% of total R&D expenditure of each sector of performance)

% total R&D expenditure

	Government	Businesses	Other national sources	Abroad
BES/PNP	7,4%	89,4%	0,9%	2,3%
GOV	72,8%	2,9%		24,3%
HES	69,0%	8,9%	12,2%	9,9%

Figure 1.15 indicates the state of affairs in the region of Ionia Nisia, the region with the lowest R&D performance amongst the 13 Greek regions.

Figure 1.15: R&D Expenditure by source of funds in each sector of performance in the region of Ionia Nisia, 2013
(% of total R&D expenditure of each sector of performance)

% total R&D expenditure

	Government	Businesses	Other national sources	Abroad
BES/PNP	44,4%	55,6%		
GOV	100,0%			
HES	93,0%	1,3%		5,2%

13

In the region of Dytiki Ellada (Figure 1.16) funds from abroad consist an important source of funds. Across all sectors, funding from abroad stands above 18%, a substantial portion of the overall R&D Expenditure, yet this stands as remarkably high in the case of the BES and the PNP sector reaching nearly 60%.

Figure 1.16: R&D Expenditure by source of funds in each sector of performance in the region of Dytiki Ellada, 2013
(% of total R&D expenditure of each sector of performance)
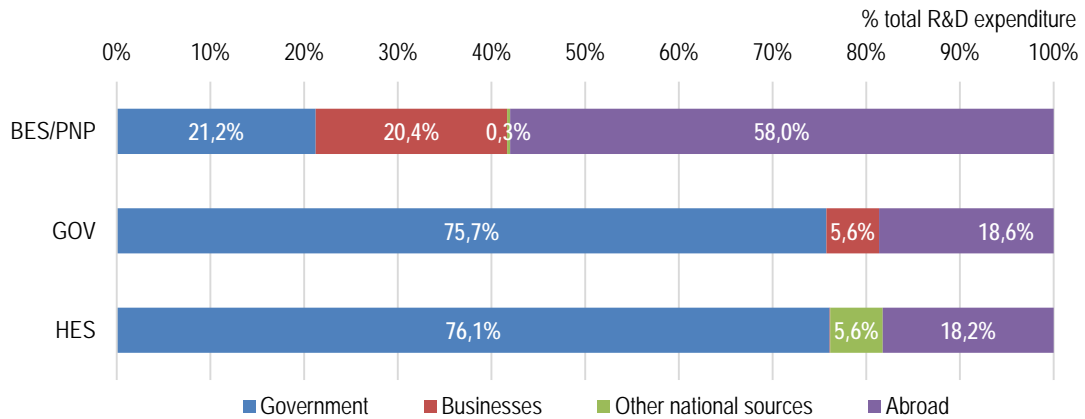
In the region Sterea Ellada (Figure 1.17) the government is the single most important contributor of R&D funds for both GOV and HES. R&D activities in BES sector are financed by own funds by 85.7%.
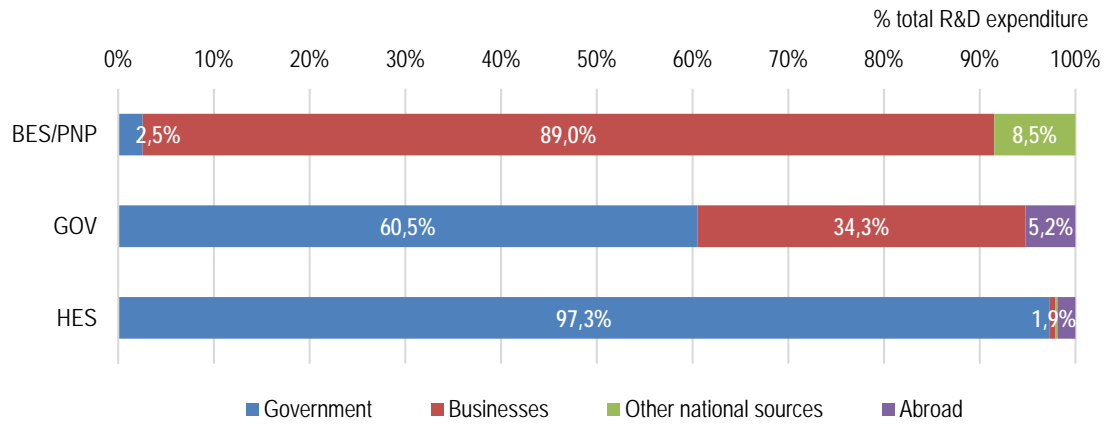
Figure 1.17: R&D Expenditure by source of funds in each sector of performance in the region of Sterea Ellada, 2013
(% of total R&D expenditure of each sector of performance)

14
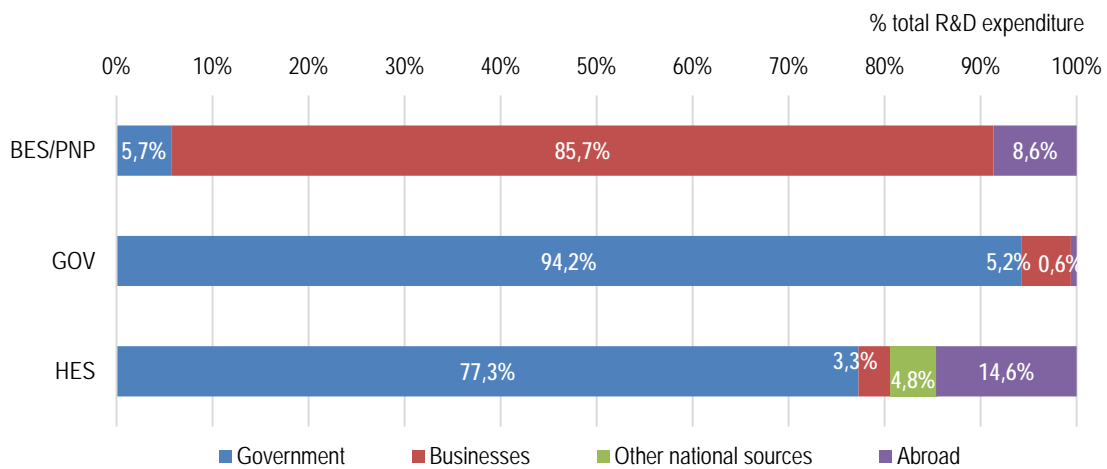
Lastly, Figure 1.18 concerns the region of Peloponnisos. The figure indicates the prevailing pattern at play. The government is the main source of funds for the GOV (97.6%) and the HES (69.6%) sectors, while the BES and the PNP sectors are being self-funded (79.0%).

Figure 1.18 R&D Expenditure by source of funds in each sector of performance in the region of Peloponnisos, 2013
(% of total R&D expenditure of each sector of performance)
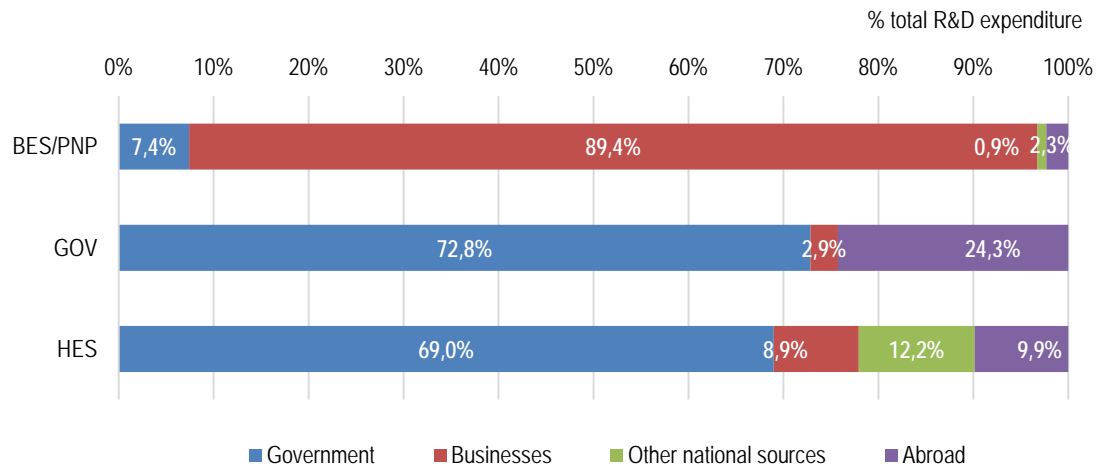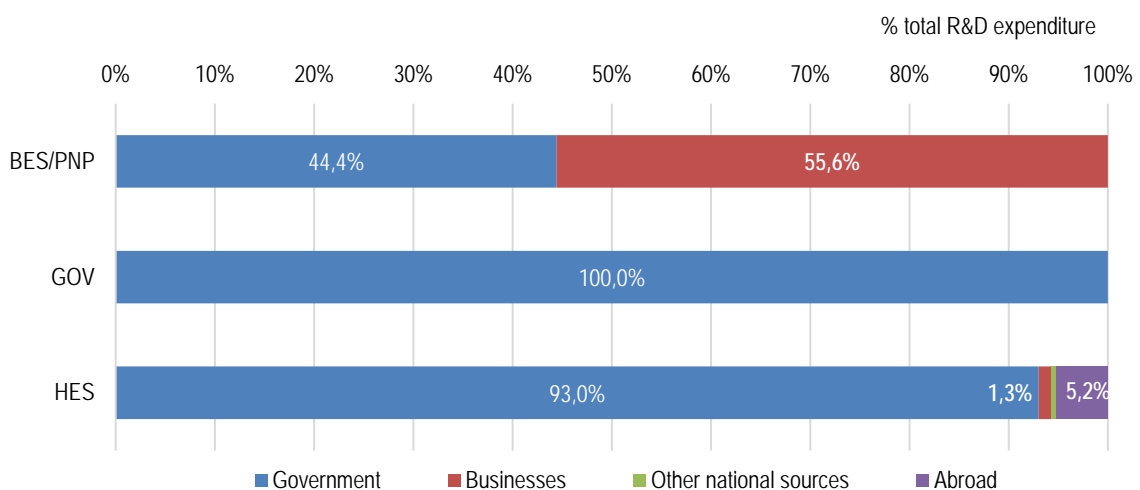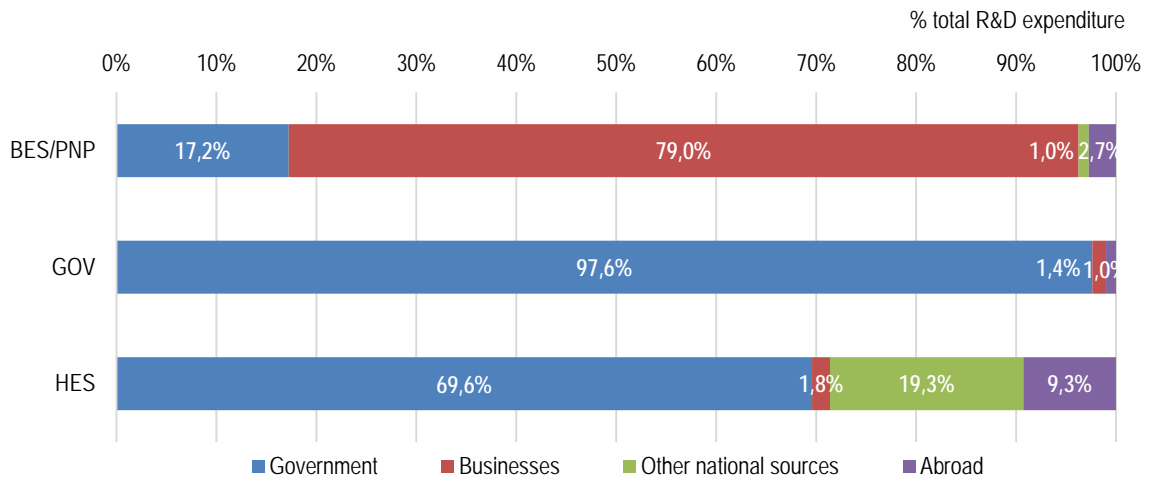
% total R&D expenditure

	Government	Businesses	Other national sources	Abroad
BES/PNP	17,2%	79,0%	1,0%	2,7%
GOV	97,6%	1,4%	1,0%	
HES	69,6%	1,8%	19,3%	9,3%

Chapter 2

R&D Personnel

In 2013, the total R&D Personnel in Greece was 82,684 people, comprising of researchers and other R&D personnel, i.e. technicians and other supporting staff.

In terms of full-time equivalents (FTE), R&D Personnel counted 42,187.6 people.

Table 2.1 provides an overview of the R&D Personnel across Greek regions, by sector of performance and by occupation, both in head counts and in full-time equivalents.

According to the table, the majority of both the R&D personnel and of the researchers is employed in the region of Attiki in numbers triple than of those employed in the region of Kentriki Makedonia (second). The region of Kriti follows third. The regions of Ionia Nisia and of Dytiki Makedonia indicate the lowest numbers of both R&D personnel and of researchers.

Table 2.1: R&D personnel by sector of performance and by occupation in Greek regions (NUTS2), 2013
(in Head Count and in FTE)

| Region (NUTS2) | Sector of performance | R&D Personnel | | | | | |
| | | Head count (HC) | | | Full time equivalent (FTE) | | |
		Total	Researchers	Other R&D Personnel	Total	Researchers	Other R&D Personnel
ATTIKI	BES & PNP	8,137	4,694	3,443	5,368.6	3,238.9	2,129.6
	GOV	7,683	4,579	3,104	5,509.6	3,236.9	2,272.8
	HES	20,487	13,692	6,795	9,364.4	7,155.5	2,208.9
	Total	36,307	22,965	13,342	20,242.6	13,631.3	6,611.3
VOREIO AIGAIO	BES & PNP	11	4	7	9.3	3.3	6.0
	GOV	167	65	102	101.1	38.7	62.4
	HES	1,386	1 052	334	517.0	457.8	59.2
	Total	1,564	1,121	443	627.4	499.8	127.6
NOTIO AIGAIO	BES & PNP	33	24	9	15.9	12.0	3.9
	GOV	407	180	227	246.0	108.7	137.3
	HES	784	530	254	257.7	202.7	55.0
	Total	1,224	734	490	519.6	323.4	196.3

Table 2.1 (continued)

Region (NUTS2)	Sector of performance	R&D Personnel					
		Head count (HC)			Full time equivalent (FTE)		
		Total	Researchers	Other R&D Personnel	Total	Researchers	Other R&D Personnel
KRITI	BES & PNP	304	136	168	151.2	85.2	66.0
	GOV	2,171	1,043	1,128	1,763.1	827.3	935.9
	HES	4,528	3,261	1,267	2,136.4	1,805.3	331.2
	Total	7,003	4,440	2,563	4,050.8	2,717.7	1,333.1
ANATOLIKI MAKEDONIA, THRAKI	BES & PNP	277	101	176	140.2	52.4	87.8
	GOV	383	126	257	246.3	84.7	161.7
	HES	3,470	2,379	1,091	1,538.0	1,201.2	336.8
	Total	4,130	2,606	1,524	1,924.5	1,338.2	586.3
KENTRIKI MAKEDONIA	BES & PNP	1,102	663	439	757.8	480.3	277.4
	GOV	2,383	1,131	1,252	1,346.5	615.6	730.9
	HES	10,286	7,844	2,442	4,717.8	4,093.3	624.5
	Total	13,771	9,638	4,133	6,822.1	5,189.3	1,632.9
DYTIKI MAKEDONIA	BES & PNP	77	51	26	62.5	42.8	19.7
	GOV	276	76	200	163.3	46.6	116.7
	HES	599	487	112	247.2	218.6	28.6
	Total	952	614	338	473.0	308.1	164.9
IPEIROS	BES & PNP	172	22	150	69.1	10.6	58.4
	GOV	746	116	630	456.0	77.4	378.6
	HES	3,441	2 055	1,386	991.8	768.1	223.7
	Total	4,359	2 193	2,166	1,516.8	856.1	660.7
THESSALIA	BES & PNP	98	72	26	58.9	44.8	14.1
	GOV	533	370	163	319.3	188.8	130.5
	HES	2,856	2,035	821	1,297.9	1,122.3	175.5
	Total	3,487	2,477	1 010	1,676.0	1,355.9	320.1
IONIA NISIA	BES & PNP	7	1	6	4.5	1.0	3.5
	GOV	163	47	116	97.9	28.4	69.5
	HES	701	607	94	224.5	194.2	30.2
	Total	871	655	216	326.8	223.6	103.2
DYTIKI ELLADA	BES & PNP	405	321	84	327.6	265.6	62.0
	GOV	929	434	495	582.9	288.1	294.8
	HES	4,446	3 572	874	1,441.3	1,181.3	260.0
	Total	5,780	4,327	1,453	2,351.8	1,735.0	616.9
STEREA ELLADA	BES & PNP	480	302	178	333.0	212.4	120.6
	GOV	315	149	166	179.5	84.5	95.0
	HES	762	555	207	264.6	211.0	53.6
	Total	1,557	1,006	551	777.1	507.9	269.1
PELOPONNISOS	BES & PNP	116	62	54	63.4	44.2	19.2
	GOV	707	251	456	424.0	152.4	271.6
	HES	856	655	201	391.7	345.4	46.4
	Total	1,679	968	711	879.1	541.9	337.2

The percentage of R&D personnel in total employment per region is presented in Figure 2.1. The highest performance is recorded in Kriti (1.89%), followed by Attiki (1.54%), Ipeiros (1.46%), and Kentriki Makedonia (1.23%). The percentages are higher than the national average, as well as the EU28 average (1.26%) – with the exception of Kentriki Makedonia which is, still, very close.

Figure 2.1: R&D personnel in total employment in Greek regions (NUTS2), 2013
(FTEs as % of total employment in each region)
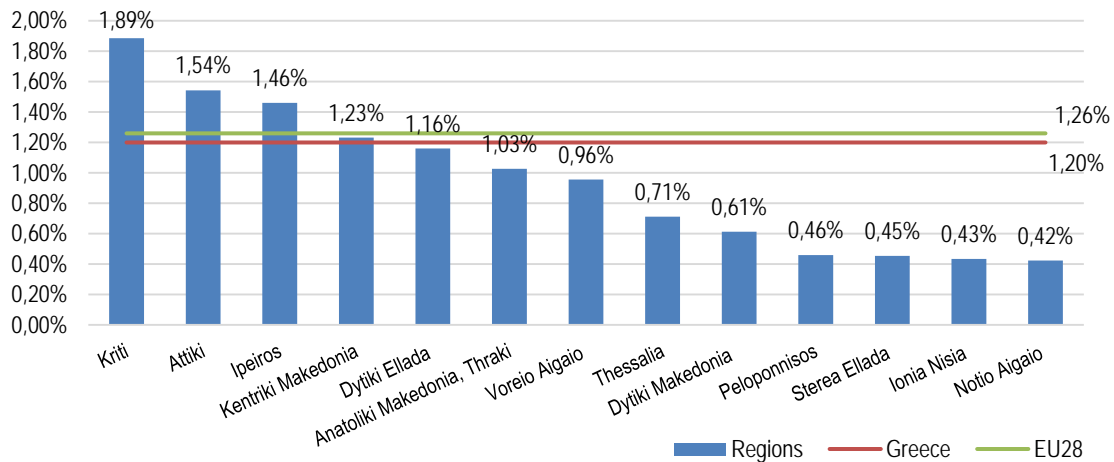
Focusing on the researchers, a similar image is portrayed. Considering the percentages of researchers (in FTE) in total employment, the region of Kriti ranks first (1.27%), followed by Attiki (1.04%), Kentriki Makedonia (0.94%), Dytiki Ellada (0.86%) and Ipeiros (0.82%). All these five regions exceed the EU28 average (0.80%) (Figure 2.2).

Figure 2.2: Researchers in total employment in Greek regions (NUTS2), 2013
(FTEs as % of total employment in each region)
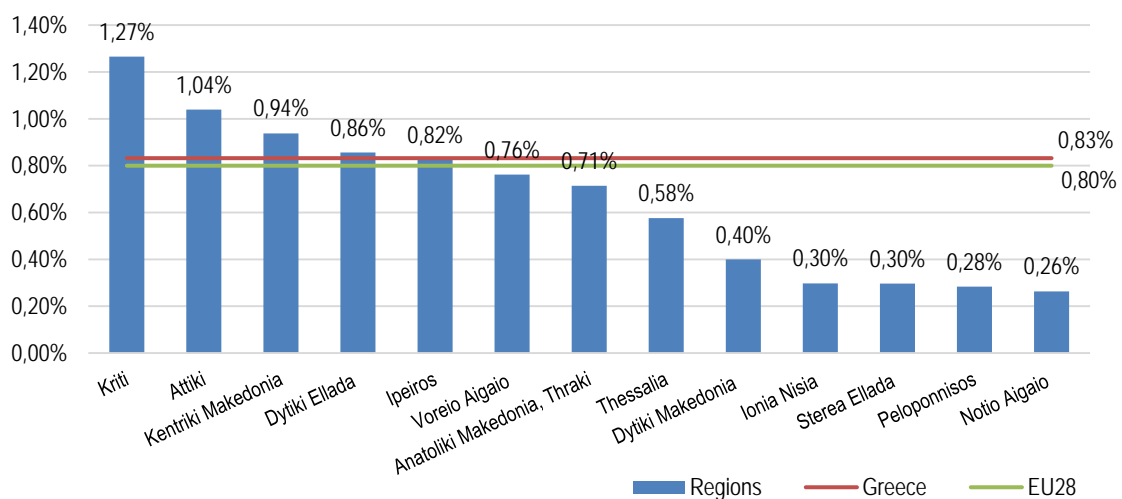
The distribution of R&D personnel and researchers across the four performing sectors (BES, GOV, HES, and PNP) is exhibited in Figures 2.3 and 2.4. Specifically, as shown in Figure 2.3, the HES sector is the foremost employer of R&D personnel across most regions (even exceeding 50% in some regions), except Sterea Ellada, where the majority of the R&D personnel is employed in BES, and Peloponnisos, where such personnel is mostly employed in GOV. The importance of HES, as a top employer, is also indicated on a national level, whereas in the EU28 the top position belongs to the BES sector.

Figure 2.3: R&D personnel by sector of performance in Greek regions (NUTS2), 2013
(FTEs as % of total R&D personnel in each region)
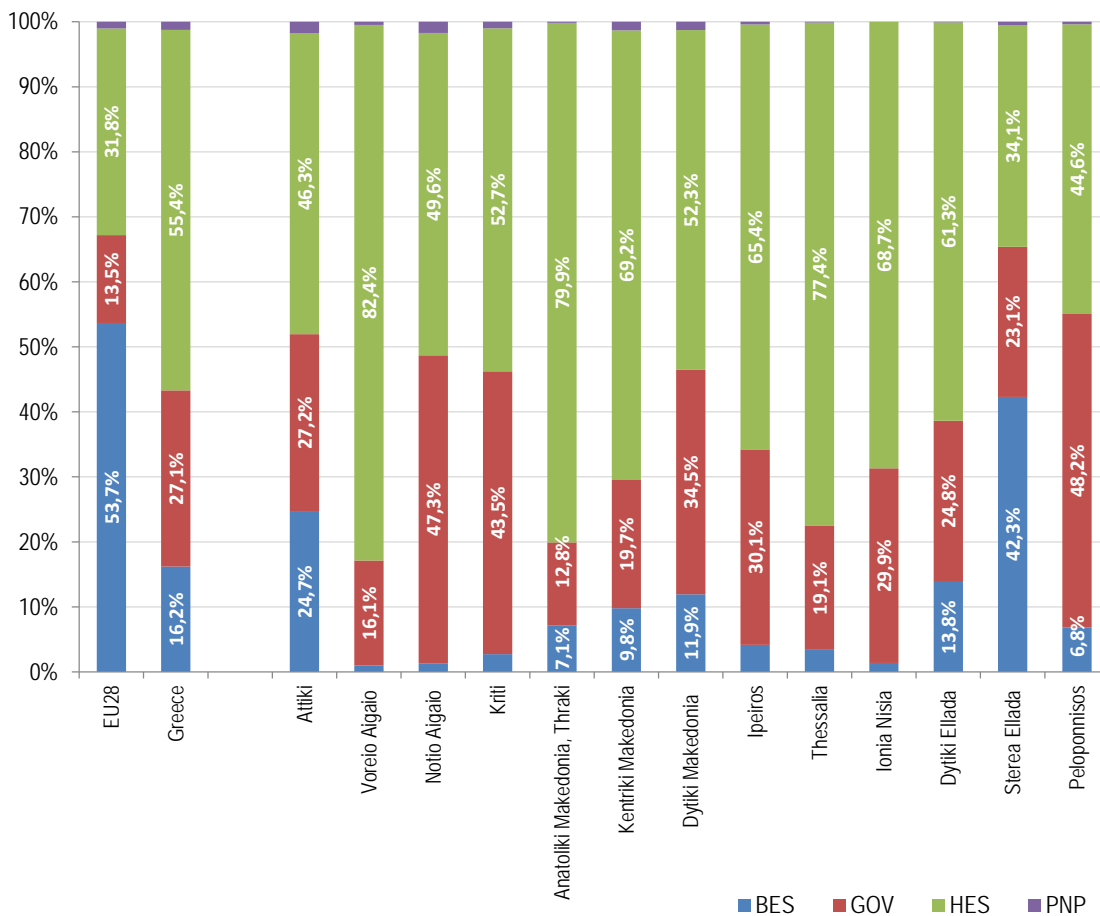
Figure 2.4 focuses on the distribution of researchers between sectors of performance across regions. The same pattern as for R&D personnel is observed. The HES sector is the top employer for researchers across all regions, followed by the government and business sector. This pattern is nation-wide, yet differentiates from the EU28 average, where the majority of the researchers are employed in BES, followed by HES and the government sector.

Figure 2.4: Researchers by sector of performance in Greek regions (NUTS2), 2013
(FTEs as % of total R&D personnel in each region)
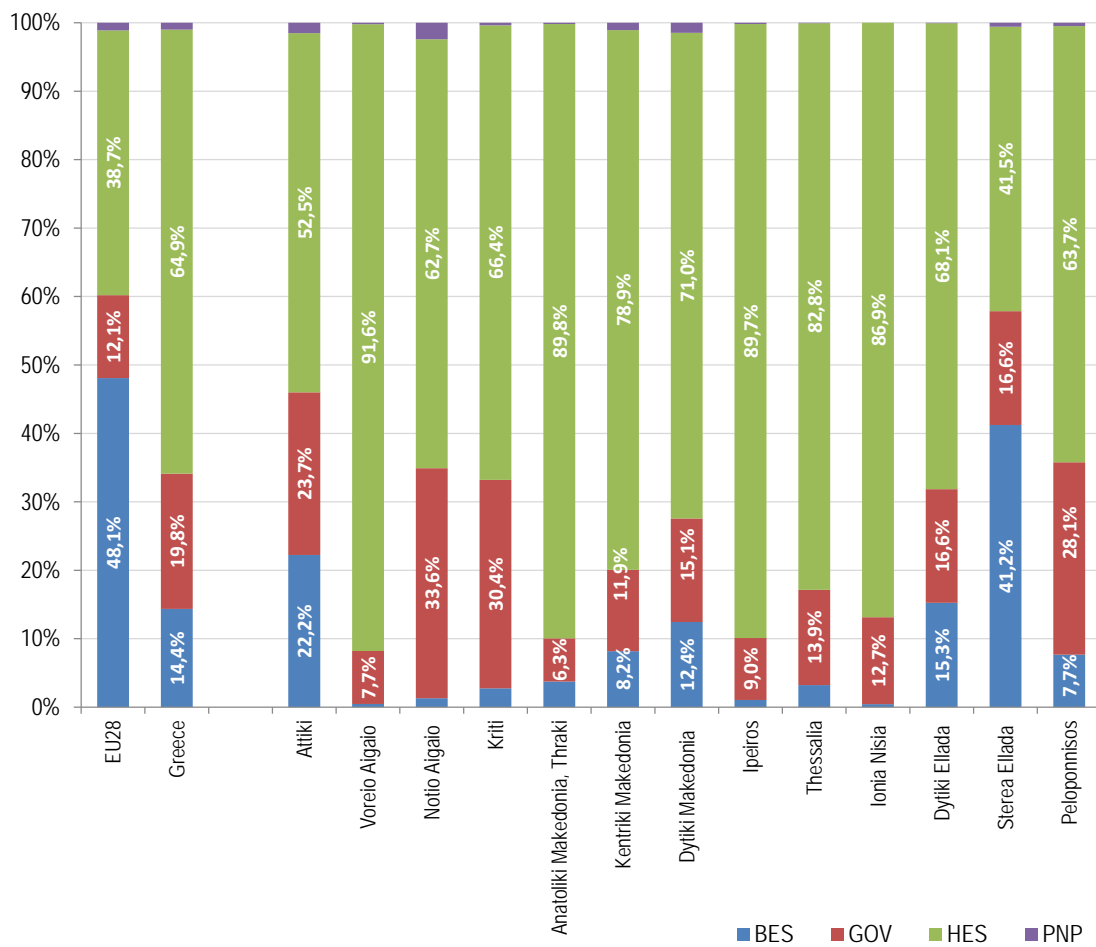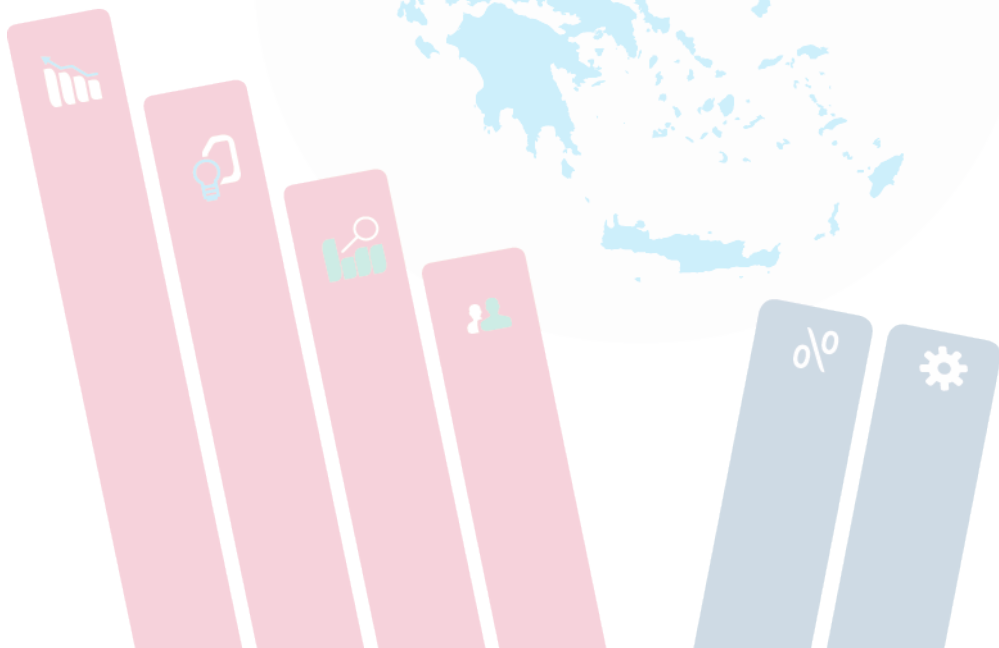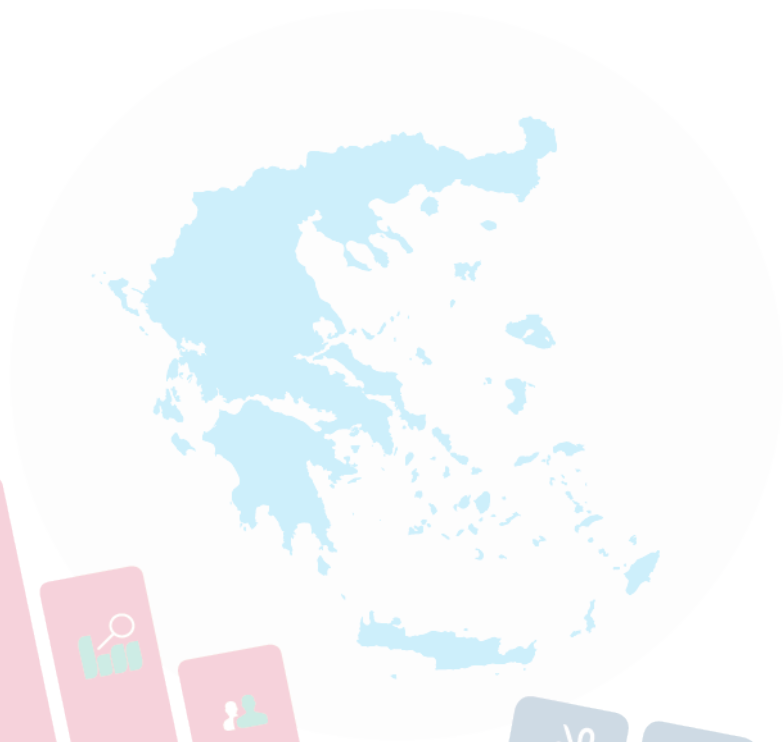
CHAPTER 3

Scientific excellence and international collaborations

The foremost tool of the European Commission to fund collaborative research projects for the period 2007-2013 has been the 7th Framework Programme (FP7), with a total budget exceeding 50 billion Euros. During FP7, Greece received funding amounting to more than 1 billion Euros (about 2.2% of total EU financial contribution) participating in 3,459 projects, and scoring 3,706 participations.

The distribution of the number of Greek participations and the corresponding EU financial contribution across the thirteen regions of the country is presented in Table 3.1.[6] The majority of the participations is attributed, as expected, to the region of Attiki, which also received the largest portion of the funding. In the second position stands the region of Kentriki Makedonia, followed by Kriti and Dytiki Ellada. The image portrayed is almost similar to the one portrayed when R&D performance across regions is taken into consideration.

Table 3.1: Number of participations and EU financial contribution for participants in Greek regions (NUTS2) in FP7, (2007-2013)

Region (NUTS2)	Number of participations	EU financial contribution (M€)
ATTIKI	2,208	591.51
KENTRIKI MAKEDONIA	497	139.57
KRITI	369	124.25
DYTIKI ELLADA	276	79.71
THESSALIA	129	18.76
IPEIROS	61	14.85
ANATOLIKI MAKEDONIA & THRAKI	46	10.20
VOREIO & NOTIO AIGAIO	41	6.74
STEREA ELLADA	35	8.42
PELOPONNISOS	24	3.57
DYTIKI MAKEDONIA	17	2.71
IONIA NISIA	3	0.19
Total	3,706	1,000.47

[6] The regions of Voreio Aigaio and Notio Aigaio are presented together since the University of the Aegean, the principal R&D institution in this geographical area, operates university units, labs, etc., in both regions, thus making any further dissection difficult.

Figure 3.1 portrays the distribution of funding in FP7 across the R&D performing sectors on a national and regional level. On a national level, a full 40% of the funding is attributed to HES, while 35% to the government sector. This is followed by BES/PNP sector with 25%. Conversely, nearly 80% of the funding in the region of Sterea Ellada is attributed to BES, while in the region of Kriti the largest share is attributed to HES (60%), followed by the government sector (30%). A more balanced picture is portrayed in Attiki, the region with the highest funding, where 35% is attributed to both BES and HES, and slightly less for the government sector (30%).

Figure 3.1: EU financial contribution in FP7 by sector of performance in Greek regions (NUTS2), 2007-2013
(as % of total EU financial contribution for Greek participants in each region)
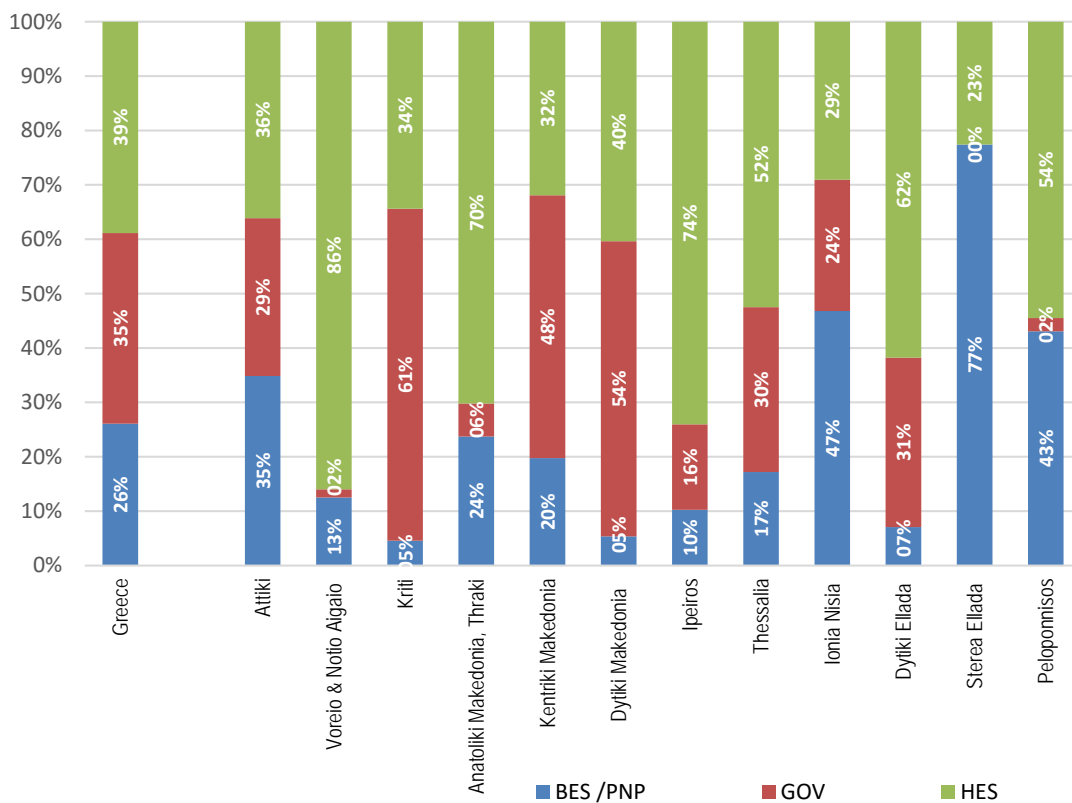
Figure 3.2 portrays the distribution of EU financial contribution across Greek regions by FP7 specific programmes (i.e., Cooperation, Capacities, People, Ideas, Euratom).

FP7 has been implemented through its five main building blocks, i.e. the specific programmes: "Cooperation", "Ideas", "People", "Capacities" and "Euratom"[7]. The Specific Programme Cooperation stands as the core of FP7, representing two thirds of the overall budget, and it supported collaborative, transnational research. The programme focused on ten key thematic areas such as health, energy, information and communication technologies, transport, etc. The Specific Programme Ideas

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[7] For more information on FP7 https://ec.europa.eu/research/fp7/index_en.cfm.

funded individuals and teams engaged in frontier research. This programme was implemented by the European Research Council (ERC). The Specific Programme People funded actions to improve the training, career development, and mobility of researchers between sectors and countries. It was implemented through the Marie Curie Actions and Specific Actions to Support ERA policies. The Specific Programme Capacities funded actions designed to improve Europe's research infrastructure and the research capacity of SMEs. It also hosted smaller programmes relating to Science in Society, Regions of Knowledge, Research Potential, International Cooperation and the Coherent Development of Research Policies. Finally, Euratom funded nuclear research and related training activities.

Across all Greek regions, most of the funding was received under the Cooperation programme, while, at the national level, this programme accounted for 70% of total funding. In most regions, this is followed by, yet with a significant gap, the Capacities and the People programmes.

Figure 3.2.: EU financial contribution in FP7 by specific programme in Greek regions (NUTS2), 2007-2013
(as % of total EU financial contribution for Greek participants in each region)

25
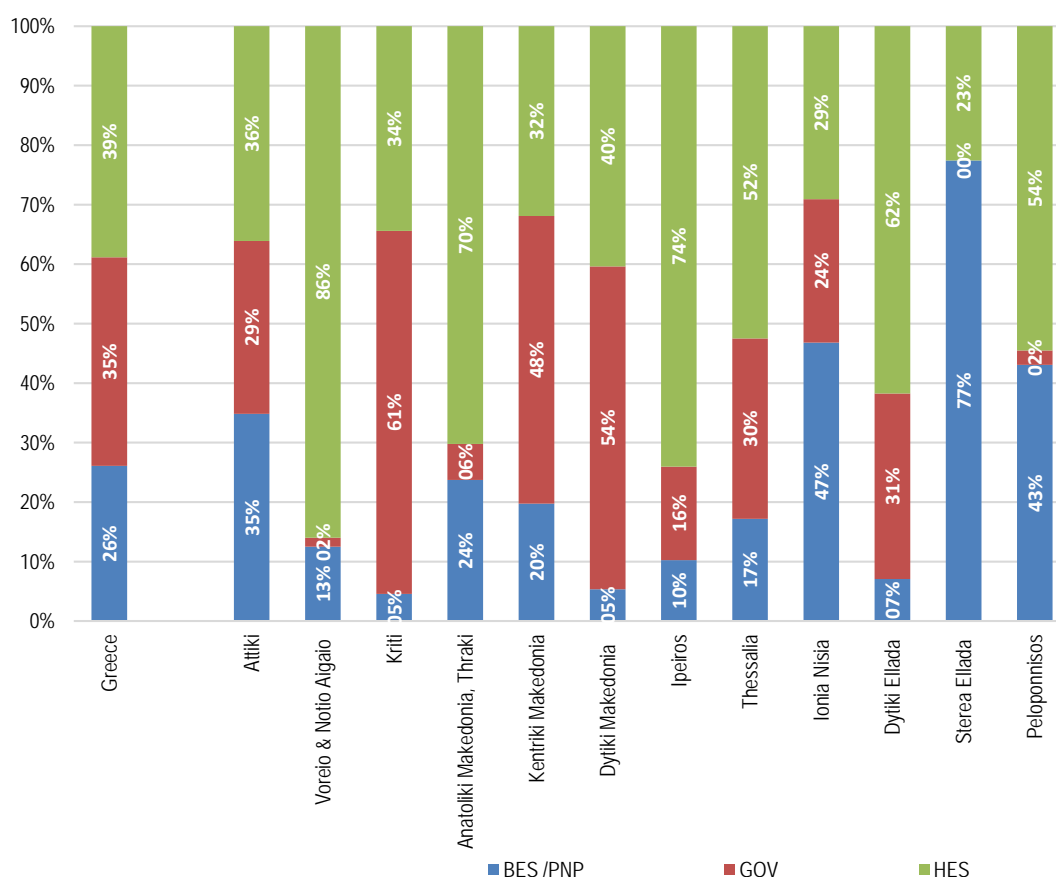
Figure 3.3. maps the thematic specialization of the Greek regions in the most populated programme (Cooperation). Accordingly, Information and communication technologies (ICT) has been the prime theme into which actors from the Greek regions have participated in and received funding for.

Figure 3.3: EU financial contribution in FP7 by thematic area of the Cooperation programme in Greek regions (NUTS2), 2007-2013
(as % of total EU financial contribution under Cooperation programme for Greek participants in each region)
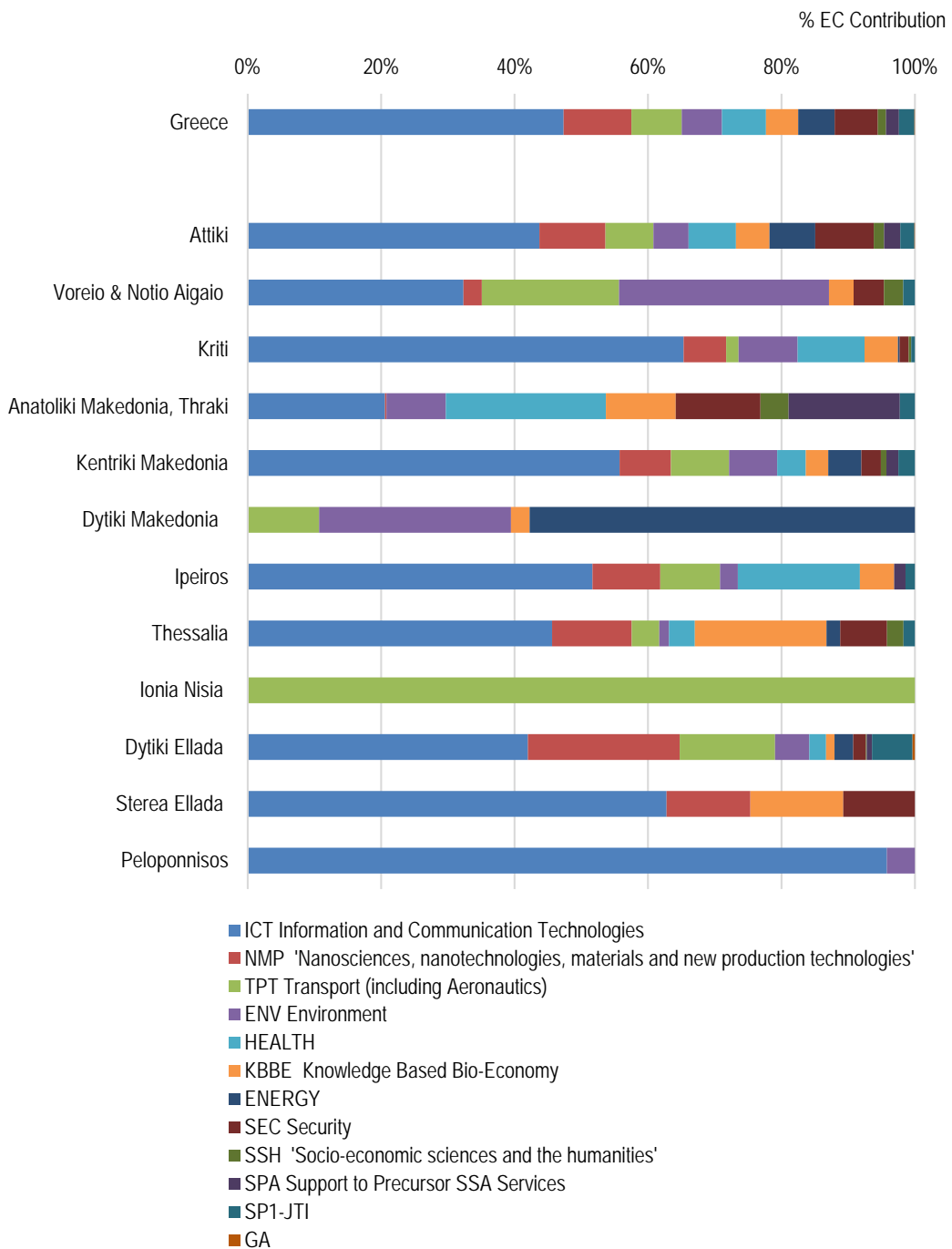
Scientific publications and PhD Theses are basic indicators of the national and subnational research output. PhD Theses refer exclusively at the HES sector, and more specifically at the Universities. Figure 3.4 displays the number of PhD Theses and their distribution per region for the period 2000-2014. The regions that perform the highest are those in which the largest Universities in the country are established in (regions of Attiki, Kentriki Makedonia, Dytiki Ellada, and Kriti).

Figure 3.4: Number of PhD Theses in Greek regions[8] (NUTS2), 2000-2014
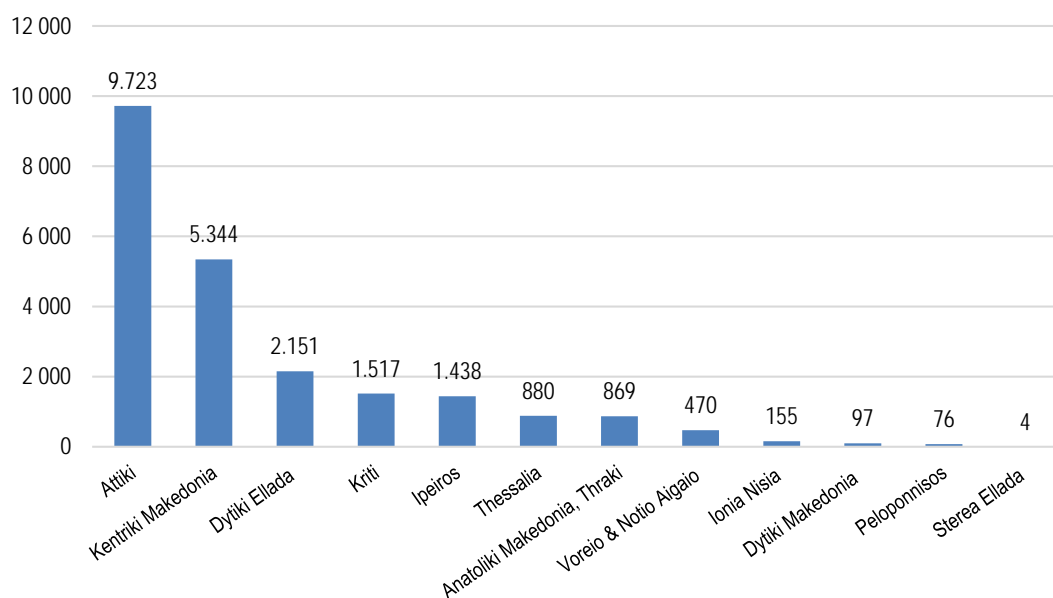
Classifying PhD Theses across different fields of science indicates the fields in which regions are mostly activated or specialized in. Figure 3.5 distributes PhD Theses per major field of science (according to the Frascati classification) per region.

According to the data presented, on the national level most PhD Theses refer to the field of 'Medical & Health Sciences' (almost 35%), followed by 'Natural Sciences' (almost 20%), 'Engineering & Technology' (less than 20%), 'Social Sciences' (15%), 'Humanities' (almost 10%), and 'Agricultural Sciences' (less than 5%). The image is only slightly differentiated on a regional level where the distribution across the region of Attiki (the region with the highest performance in the production of PhD Theses) matches that of the national level, whereas in Kentriki Makedonia the portion attributed to the 'Humanities' and 'Agricultural Sciences' are increased relative to the national ones. In Dytiki Ellada, the total production of PhD Theses concerns only three fields of science ('Natural Sciences' – 35%, 'Engineering & Technology' – almost 35%, and 'Medical & Health Sciences' – almost 30%), while in Kriti, the fields of

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[8] The regions of Voreio and Notio Aigaio are presented combined since the University of the Aegean possesses and operates university units in both regions.

'Medical & Health Sciences' and 'Natural Sciences' exhibit exceptionally high rates (almost 45% and 30%, respectively).

Figure 3.5: PhD Theses by major field of science in Greek regions (NUTS2), 2000-2013
(as % of total of PhD Theses in each region)
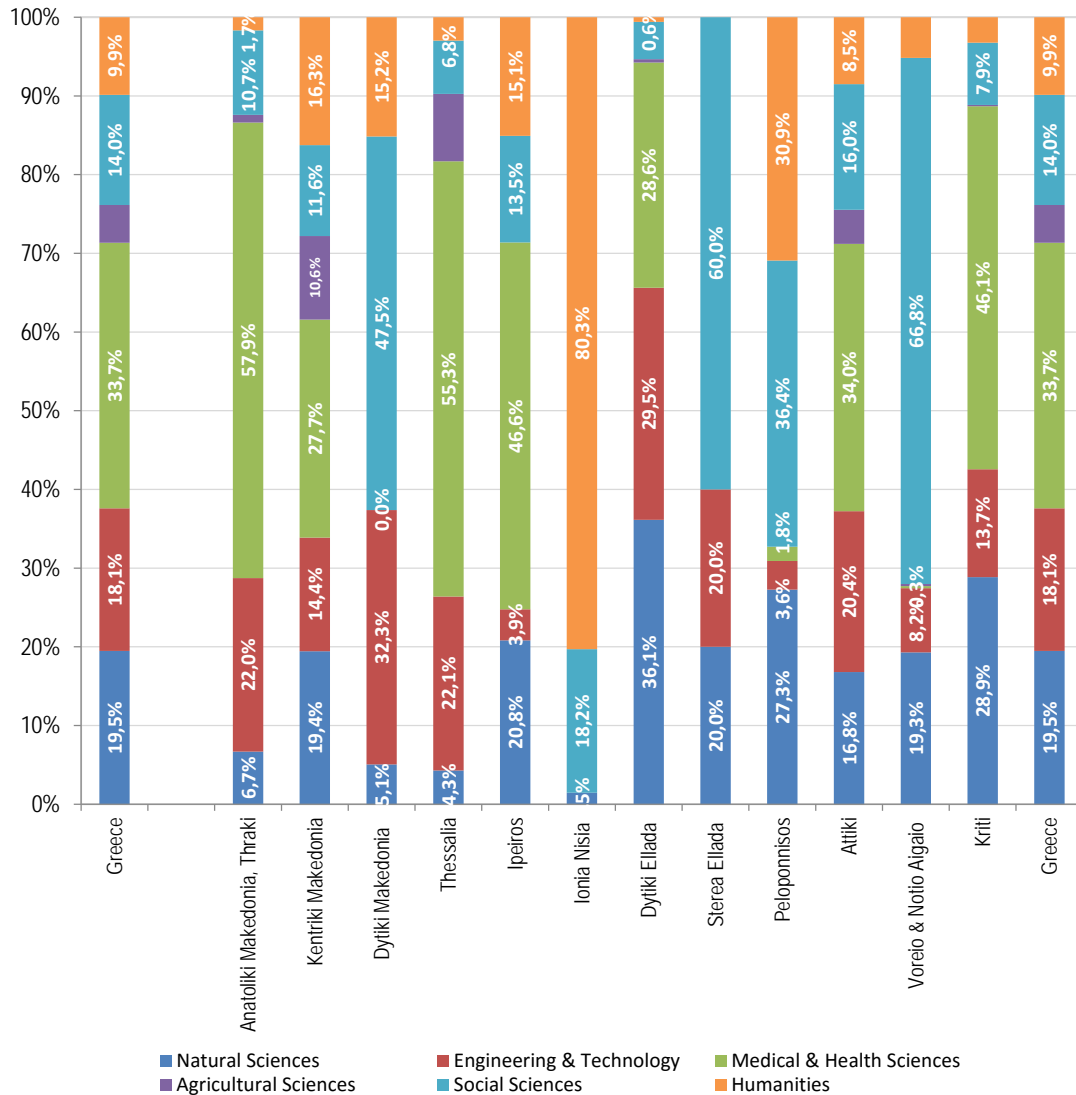
While PhD Theses concern only the Universities, scientific publications can stem from the full spectrum of actors engaged in R&D activities (Universities, Technical Education Institutions, Research Centres, Hospitals, Enterprises, etc.). In a similar spirit to that of the PhD Theses, scientific publications published in international journals and their thematic classifications stand as important indicators of the fields of science into which the research actors of each region specialize in. In addition,

under certain assumptions[9], this scientific publication data can be used as research excellence indicators on a national and regional level.

Table 3.2 records the number of scientific publications in international journals based on analysis of the Web of Science database, as well as the citations the publications received per region. According to the data, the largest volume of publications and citations are attributed in the region of Attiki, followed by Kentriki Makedonia, Kriti, and Dytiki Ellada. The citation performance of the region of Kriti is almost equal to that of Kentriki Makedonia, even though its publications numbers are considerably lower, indicating research quality.

Table 3.2: Number of scientific publications in international journals and number of citations in Greek regions (NUTS2), 2008-2012

	Number of scientific publications	Number of citations[10]
ATTIKI	27,314	154,544
KENTRIKI MAKEDONIA	10,960	51,600
KRITI	6,677	48,301
DYTIKI ELLADA	5,360	25,220
IPEIROS	3,945	27,113
THESSALIA	2,757	11,635
ANATOLIKI MAKEDONIA, THRAKI	2,258	8,019
VOREIO & NOTIO AIGAIO	1,073	3,940
DYTIKI MAKEDONIA	477	1,525
PELOPONNISOS	385	1,467
STEREA ELLADA	302	1,010
IONIA NISIA	77	79

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[9] As it is mentioned in chapter 5, mapping of the scientific output based on bibliometric indicators, which themselves are based upon the number of publications in international journals, presents a number of limitations, especially in the fields of Social Sciences and Humanities. These limitations are due to the specialised characteristics of the research and the publications taking place across different scientific disciplines. For example, in the field of Humanities, the publication rates are slower, monographs are an essential means of scientific communication, publication language is not necessarily English. The above characteristics go undetected by standard international databases.
[10] Citation count is made using 5-year window i.e. citations received in the 5-year period 2008-2012 for publications edited within the same 5 year period.

Figure 3.6 presents the number of publications per region for the period 2008-2012, as well as the number of citations and the corresponding citation impact. The citation impact is the ratio of the number of citations relative to the number of publications, that is the average citations per publication.

Regions are ranked according to their citation impact. The region of Kriti tops the ranking (7.23), followed by Ipeiros (6.87), Attiki (5.66), Kentriki Makedonia (4.71) and Dytiki Ellada (4.71). The above regions are also the regions having the most of publications, but with a different ranking.

Figure 3.6: Number of publications, number of citations and citation impact in Greek regions (NUTS2), 2008-2012
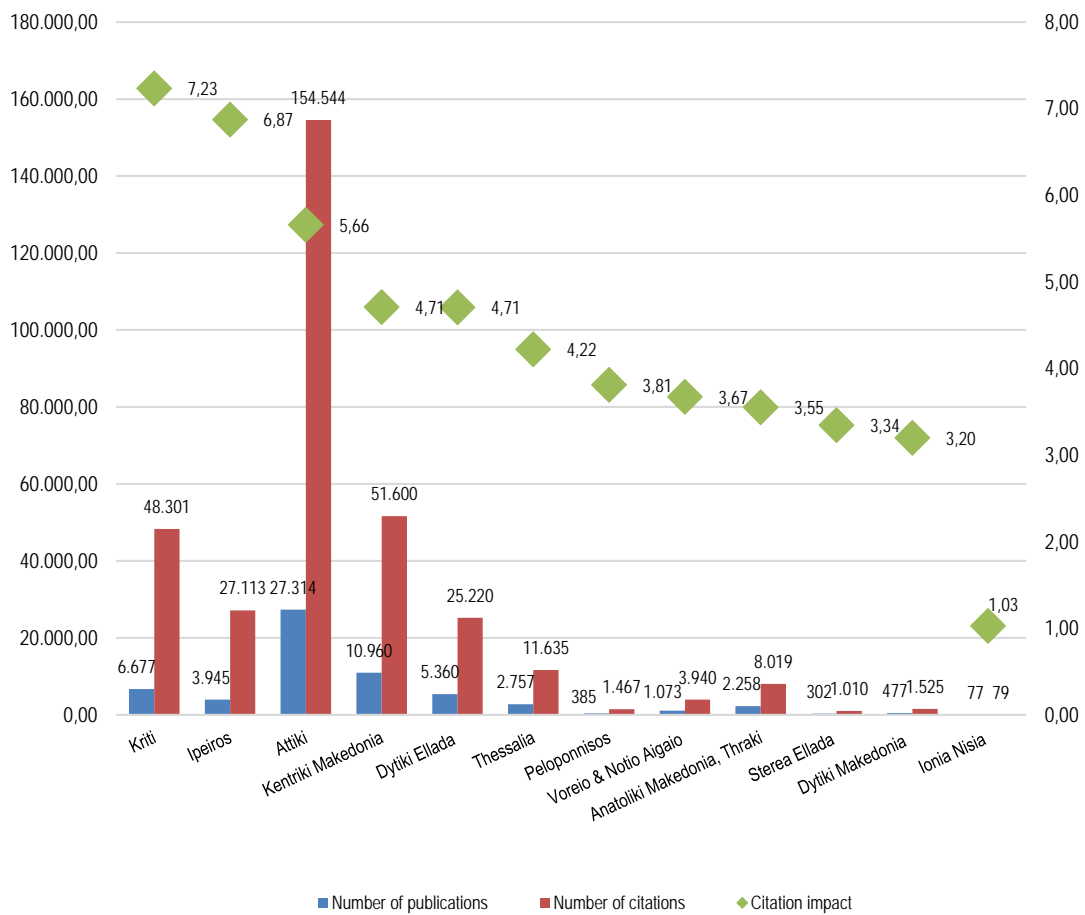
Combining the numbers of scientific publications in international journals with a) R&D expenditure, and b) R&D personnel per region, a number of interesting points can be made. Specifically, if R&D expenditure is taken into consideration (see Figure 3.7.), the region of Ipeiros tops the related index (99.2), followed by Dytiki Ellada (67.2), Kentriki Makedonia (59.8), and Kriti (55.3). Conversely, Attiki ranks in the seventh position (33.3), while a similar low overall national index (36.4) is recorded.

Figure 3.7: Number of scientific publications (2012) per million of R&D expenditure (2011) in Greek regions (NUTS2)
(no of publications per million Euros)
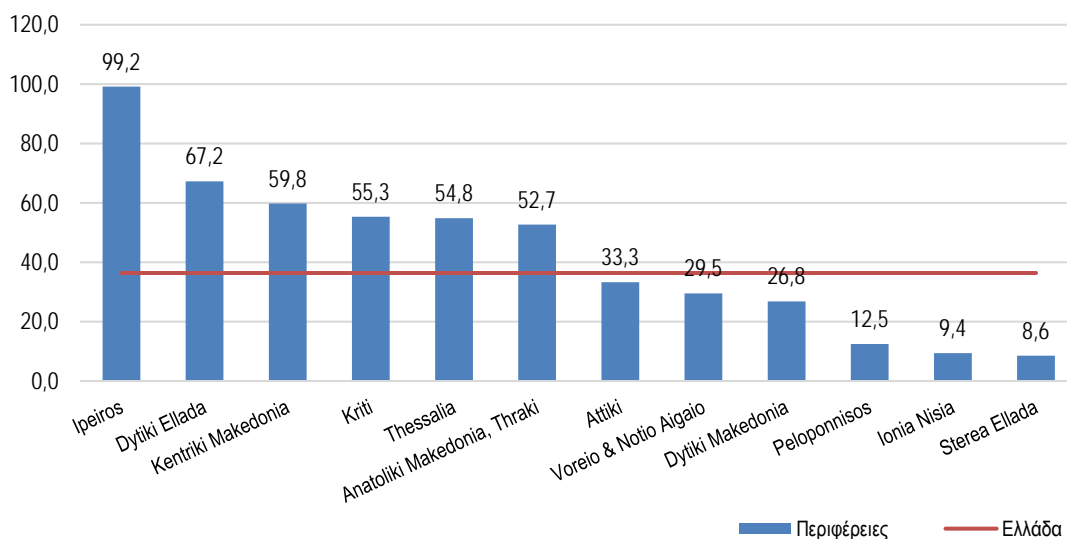
Figure 3.8 combines the number of publications in international journals with researchers (as counted in FTE). An image similar to the one found in Figure 3.7, is portrayed. The region of Ipeiros keeps abreast (4.4), followed by Dytiki Ellada (3.2), Kriti (2.7), and Thessalia (2.6). The regions of Attiki and Kentriki Makedonia fall in the 5th and 7th position, respectively, with an index score of 2.4, while the national average is located further down (2.2).

Figure 3.8: Number of scientific publications (2012) per researcher (Full Time Equivalent, 2011) in Greek regions (NUTS2)
(no or publications per researchers FTE)
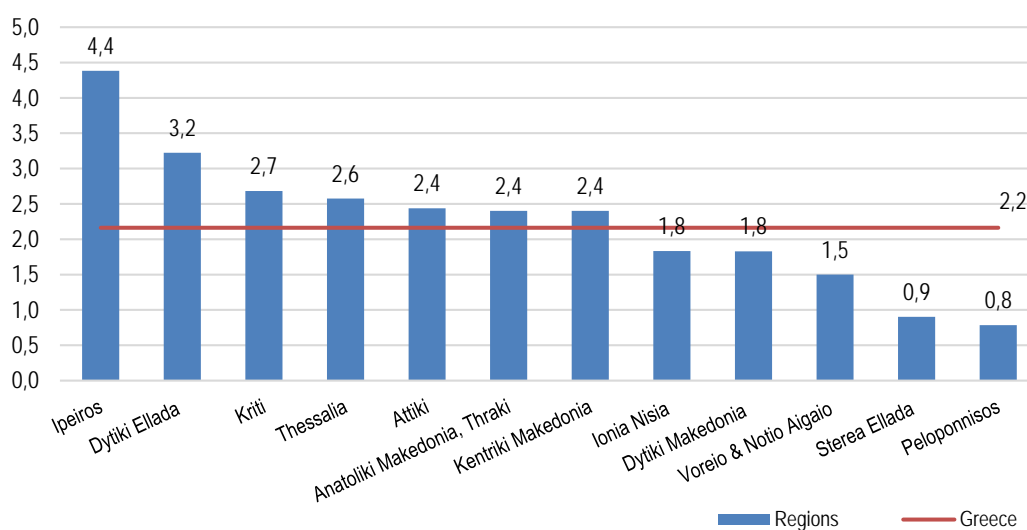
31

Figure 3.9 maps the thematic specialization of the scientific publications in international journals per region following the classification of the main fields of science, according to the Frascati Classification.

The scientific publications in the field of 'Natural Sciences' ranks first in all regions, with the exception of Thessalia and Anatoliki Makedonia-Thraki. In these two regions, it is the field of 'Medical & Health Sciences' that ranks first. Overall, the field of 'Engineering & Technology' is third, followed by the 'Social Sciences', the 'Agricultural Sciences', and the 'Humanities'.

Figure 3.9: Fields of science as % of total publications in Greek regions (NUTS2), 2008-2012
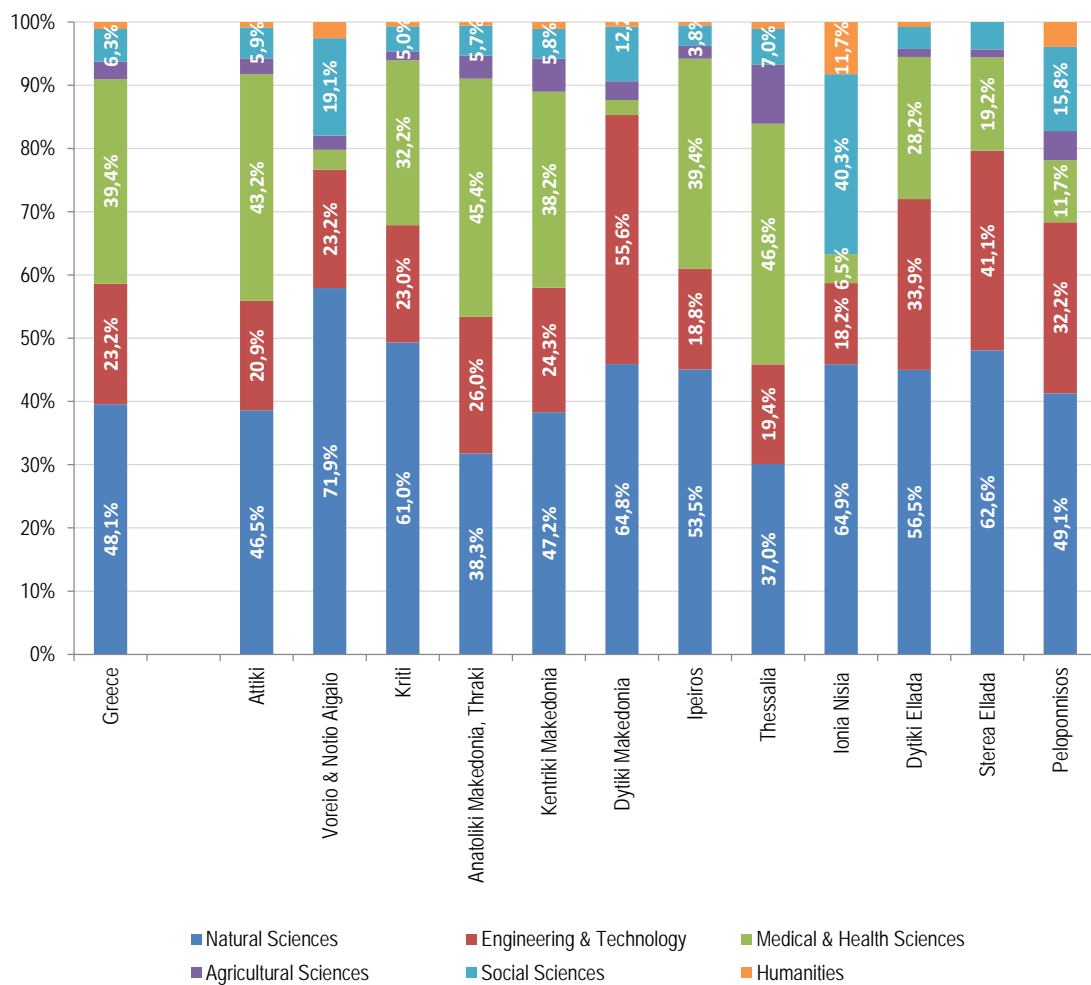
International collaborations in scientific publications stand as an indication of the scientific outwardness of the domestic science production base. Figure 3.10 indicates that, during the period 2008-2012, the highest portion of international co-publications were achieved in the regions of Kriti (53.9% of total regional publications), Ipeiros (45.6%), and Attiki (43.3%). These three regions outperform the national average (42.5%). Conversely, the regions of Anatoliki Makedonia-Thraki and Ionia Nisia are located at the bottom of the ranking (23.9% and 22.1%, respectively).

Figure 3.10: International scientific co-publications in Greek regions (NUTS2), 2008-2012
(publications with at least one international collaboration as % of total publications in each region)
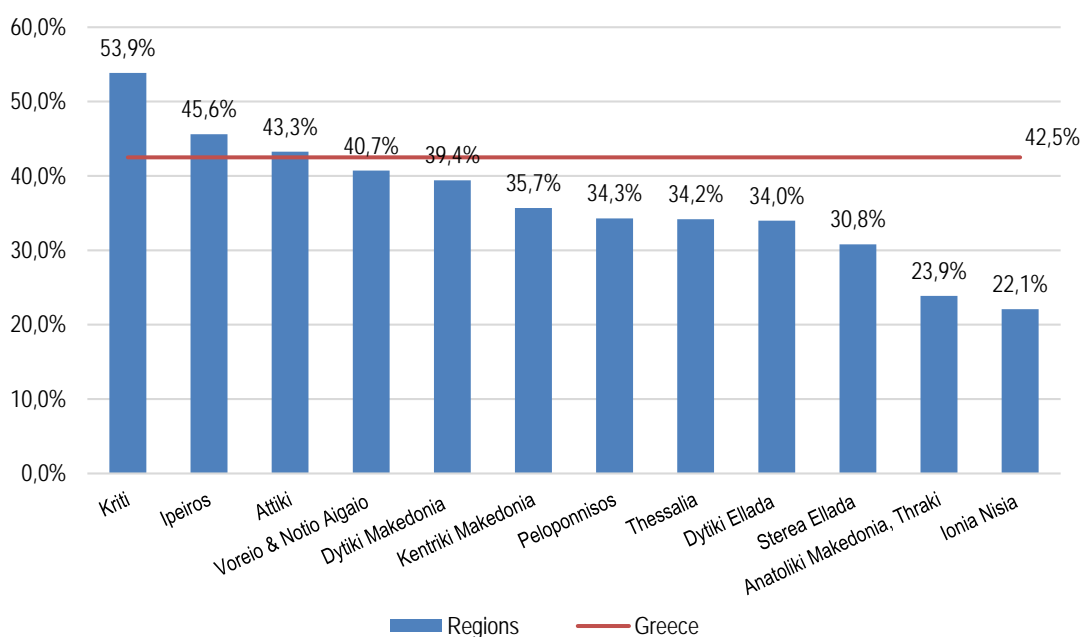
Figure 3.11 presents an indirect measure of research excellence per region based on highly cited publications, i.e. publications belonging to the top 10% most cited publications worldwide. Under this framework[11], it is the region of Peloponnisos that tops the ranks (14.5% of its scientific publications are classified amongst the top-10% cited publications), followed by Kriti (13.3%), Ipeiros (12.5%), Attiki (10.7%), and Dytiki Makedonia (10.3%). The above regions record rankings higher than the national average (10.2%).

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[11] In order to obtain a full appreciation of the presented data, the absolute publication numbers should be taken into consideration. For example, in the region of Peloponnisos 56 publications (out of 385) belong to the top-10% class of cited publications, 890 (out of 6,677) in the region of Kriti, 493 (out of 3,945) in the region of Ipeiros, 2,913 (out of 27,314) in the region of Attiki, etc.

Figure 3.11: Scientific publications among the top 10% most cited publications worldwide in Greek regions (NUTS2), 2008-2012
(as % of total publications in each region)
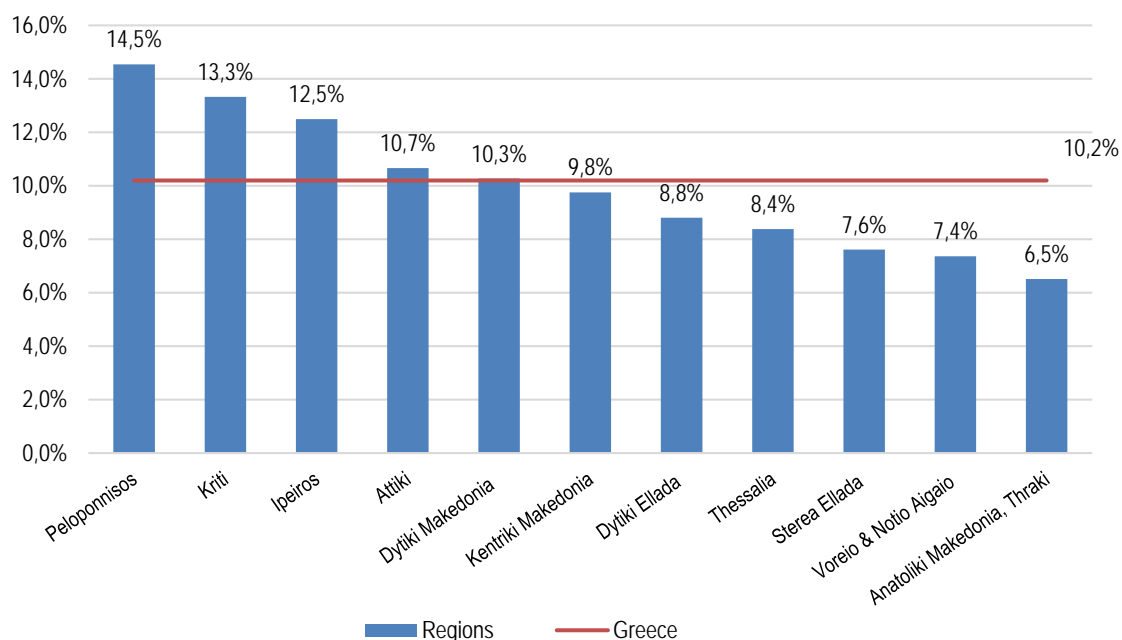
Tables 3.3-3.8 further focus on the image portrayed in Figure 3.11 presenting a per-field-of-science analysis making use of the 'Field normalized citation score'. This score normalizes the simple citation impact indicator across the different scientific subfields of the Web of Science database, and compares the impact of a publication relative to the impact in this specific subfield of science on a world scale. If the score is higher than the value 1, then the publications at hand exhibit greater impact than the world average. The benefit of the field normalized citation impact score is that it allows for comparison per and within specialized fields of science.

Each of the following tables present the regional performance per each field of science. The presentation concerns those fields of science for which the field normalized citation impact score (lines) exceeds the value 1 per region (columns), while in brackets the absolute number of those publications are included.

Table 3.3: Overview of scientific subfields of publications with field normalised citation score ≥1 in Greek regions (NUTS2), in Natural Sciences, by region, 2008-2012; in brackets are the absolute number of such publications

Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
physics, multidisciplinary	4.82 (648)	-	1.83 (189)	-	6.50 (183)	-	6.60 (138)	-	-	1.26 (80)	-	-
physics, particles & fields	1.79 (648)	-	1.65 (97)	-	1.72 (187)	-	1.92 (168)	-	-	-	-	-
genetics & heredity	1.79 (353)	-	1.92 (95)	1.13 (33)	1.25 (109)	-	2.96 (78)	-	-	-	-	-
reproductive biology	1.63 (113)	-	-	-	2.06 (103)	-	-	-	-	-	-	-
physics, nuclear	1.47 (209)	-	-	-	-	-	1.51 (81)	-	-	-	-	-
physics, mathematical	1.45 (185)	-	1.29 (70)	-	-	1.32 (8)	-	-	-	-	-	2.31 (14)
microbiology	1.37 (519)	-	-	-	1.14 (131)	-	-	1.18 (105)	-	-	-	-
astronomy & astrophysics	1.32 (696)	-	1.07 (215)	-	1.33 (182)	-	1.28 (77)	-	-	-	-	-
physics, fluids & plasmas	1.28 (130)	-	1.36 (45)	-	-	1.57 (12)	-	1.35 (23)	-	-	-	-
acoustics	1.24 (57)	-	-	-	-	-	2.09 (12)	-	-	-	-	-
oceanography	1.22 (165)	1.32 (22)	1.32 (33)	-	-	-	-	-	-	-	-	-
entomology	1.21 (183)	-	1.91 (26)	-	-	-	1.44 (10)	1.22 (78)	-	1.43 (10)	-	1.11 (9)
chemistry, multidisciplinary	1.18 (245)	-	1.43 (211)	-	-	-	1.03 (84)	-	-	-	-	1.82 (28)
computer science, artificial intelligence	1.18 (254)	-	1.36 (118)	1.12 (70)	1.20 (169)	1.15 (21)	1.24 (42)	1.3 (17)	-	1.39 (95)	1.81 (21)	2.99 (13)
polymer science	1.17 (276)	-	1.91 (137)	-	1.03 (111)	-	-	-	-	1.41 (133)	-	-
computer science, theory & methods	1.11 (230)	1.67 (37)	1.54 (57)	1.09 (36)	1.66 (99)	1.30 (17)	1.12 (35)	1.40 (15)	-	-	-	2.90 (11)
optics	1.10 (470)	-	1.73 (253)	-	1.09 (103)	-	1.03 (45)	-	-	1.05 (129)	-	1.09 (14)
computer science, cybernetics	1.10 (32)	1.07 (10)	1.52 (15)	-	-	-	-	-	-	-	-	-
chemistry, applied	1.09 (263)	-	-	-	1.12 (176)	-	1.01 (52)	-	-	1.19 (55)	-	-
spectroscopy	1.06 (112)	-	1.44 (39)	-	1.48 (44)	-	1.23 (15)	-	-	-	-	-

Table 3.3 (continued)

Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
marine & freshwater biology	1.06 (344)	-	1.00 (75)	-	1.1 (114)	-	-	1.19 (46)	-	-	-	-
crystallography	1.05 (89)	-	1.21 (33)	-	1.11 (50)	-	-	-	-	-	-	-
geology	1.05 (29)	-	-	-	-	-	-	-	-	-	-	-
mathematics, applied	1.02 (531)	-	1.06 (137)	2.10 (34)	-	1.53 (13)	1.35 (108)	-	-	-	-	5.34 (22)
chemistry, analytical	-	2.45 (10)	1.27 (113)	-	1.03 (306)	-	-	-	-	-	-	-
biology	-	1.77 (14)	-	-	-	-	-	-	-	-	-	-
ecology	-	1.26 (56)	-	1.12 (23)	-	-	-	-	-	-	-	-
physics, applied	-	1.24 (13)	1.28 (354)	-	-	1.19 (23)	-	-	-	1.01 (224)	-	-
computer science, software engineering	-	1.19 (41)	1.03 (50)	-	1.14 (109)	2.45 (11)	-	1.05 (9)	-	-	-	1.3 (11)
meteorology & atmospheric sciences	-	1.10 (35)	2.10 (144)	-	1.25 (191)	-	-	-	-	1.56 (71)	-	-
geography, physical	-	1.04 (21)	1.59 (9)	-	1.33 (42)	-	1.03 (11)	-	-	1.38 (15)	-	-
geosciences, multidisciplinary	-	1.03 (44)	1.25 (96)	-	-	-	-	1.08 (30)	-	-	-	-
mathematical & computational biology	-	1.01 (10)	1.02 (38)	-	-	-	1.64 (23)	-	-	-	1.06 (14)	-
chemistry, inorganic & nuclear	-	-	1.55 (65)	-	1.31 (131)	-	1.08 (83)	-	-	1.34 (145)	-	-
microscopy	-	-	1.39 (12)	-	-	-	-	-	-	-	-	-
statistics & probability	-	-	1.35 (18)	-	-	-	1.29 (21)	1.07 (11)	-	-	-	-
environmental sciences	-	-	1.28 (300)	-	-	-	-	-	-	-	-	-
physics, condensed matter	-	-	1.27 (270)	-	-	-	-	-	-	-	-	-
chemistry, physical	-	-	1.27 (386)	-	-	-	-	1.51 (19)	-	1.35 (289)	-	-
biochemistry & molecular biology	-	-	1.20 (285)	-	-	-	-	-	-	-	-	-

Field												
geochemistry & geophysics	-	-	-	-	-	-	-	-	-	1.13 (51)	-	-
water resources	-	1.10 (8)	-	-	-	-	-	-	-	1.11 (111)	-	-
cell biology	-	-	-	-	-	-	-	-	-	1.10 (169)	-	-
electrochemistry	-	-	1.05 (66)	-	1.35 (15)	-	-	-	-	1.10 (68)	-	-
mathematics, interdisciplinary applications	1.93 (25)	-	-	-	-	-	-	-	-	1.05 (39)	-	-
biotechnology & applied microbiology	-	-	-	-	-	1.00 (79)	-	-	1.11 (51)	1.03 (102)	-	-
biophysics	-	-	-	-	-	-	-	-	-	1.02 (65)	-	-
chemistry, organic	-	-	-	-	-	-	-	-	-	1.00 (58)	-	-
evolutionary biology	-	-	-	-	-	-	-	-	-	1.00 (25)	-	-
mathematics	-	-	-	-	-	1.58 (81)	-	-	2.40 (9)	-	-	-
virology	-	-	-	-	-	-	-	-	1.91 (9)	-	-	-
mycology	-	-	-	-	-	-	-	1.06 (18)	-	-	-	-
computer science, information systems	1.61 (32)	-	-	-	1.32 (36)	1.31 (35)	-	-	-	-	-	-
computer science, interdisciplinary applications	2.51 (28)	1.20 (30)	-	-	1.14 (52)	1.02 (67)	-	-	-	-	-	-
biodiversity conservation	-	-	1.33 (8)	-	-	-	-	-	-	-	-	-

37

Table 3.4: Overview of scientific subfields of publications with field normalised citation score ≥1 in Greek regions (NUTS2), in **Engineering &Technology**, by region, 2008-2012; in brackets are the absolute number of such publications

Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
instruments & instrumentation	1.61 (270)	-	1.35 (48)	-	1.66 (82)	-	3.58 (59)	-	-	-	-	-
thermodynamics	1.55 (147)	-	-	-	1.12 (57)	1.08 (23)	-	1.15 (15)	-	1.20 (19)	-	-
medical laboratory technology	1.42 (124)	-	3.06 (10)	-	1.26 (18)	-	1.29 (11)	-	-	-	-	-
energy & fuels	1.37 (534)	1.12 (15)	1.27 (123)	-	1.19 (196)	-	1.47 (42)	1.15 (34)	-	1.47 (134)	-	-
transportation science & technology	1.34 (132)	-	1.87 (28)	-	1.09 (25)	-	-	-	-	1.50 (10)	-	-
materials science, composites	1.29 (40)	-	1.08 (15)	1.40 (8)	-	-	1.29 (39)	-	-	1.18 (72)	-	-
automation & control systems	1.25 (85)	-	2.40 (42)	1.29 (14)	1.38 (53)	-	-	-	-	-	-	-
computer science, hardware & architecture	1.25 (173)	-	-	1.23 (21)	1.80 (59)	1.73 (9)	-	1.07 (16)	-	1.06 (92)	-	3.19 (16)
robotics	1.23 (24)	-	2.62 (12)	2.51 (11)	2.59 (9)	-	-	-	-	-	-	-
mining & mineral processing	1.23 (41)	-	-	-	1.09 (10)	-	-	-	-	-	-	-
engineering, electrical & electronic	1.15 (1153)	-	1.34 (247)	-	1.37 (562)	1.61 (66)	1.1 (63)	-	-	1.00 (374)	1.35 (54)	2.12 (59)
mechanics	1.13 (338)	1.32 (18)	1.46 (77)	-	1.16 (114)	-	1.31 (24)	1.13 (69)	-	1.00 (100)	-	-
construction & building technology	1.12 (155)	-	1.19 (13)	1.12 (22)	-	-	1.05 (24)	-	-	-	-	-
engineering, industrial	1.09 (82)	-	1.54 (17)	1.09 (9)	-	1.13 (8)	-	-	-	1.16 (27)	-	-
engineering, chemical	1.09 (365)	-	1.16 (174)	1.09 (53)	1.15 (316)	1.02 (44)	1.09 (53)	1.12 (45)	-	1.43 (112)	1.36 (13)	-
engineering, aerospace	1.08 (23)	-	-	-	-	-	-	-	-	1.14 (14)	-	-
engineering, environmental	1.02 (233)	1.24 (17)	1.3 (130)	1.31 (62)	1.30 (144)	1.18 (20)	1.38 (35)	1.40 (18)	-	1.45 (75)	-	-

engineering, mechanical	-	-	1.23 (83)	-	-	-	-	-	-	-	-	1.01 (220)
nuclear science & technology	-	-	-	-	-	1.21 (41)	-	-	-	2.14 (8)	-	1.00 (266)
telecommunications	1.21 (39)	1.98 (37)	-	-	1.02 (46)	1.19 (12)	1.64 (43)	1.78 (208)	-	-	-	-
engineering, civil	-	-	-	-	-	1.28 (22)	1.30 (13)	1.01 (170)	-	1.28 (91)	2.17 (12)	-
materials science, multidisciplinary	-	-	1.07 (362)	-	-	-	-	-	-	1.19 (407)	1.15 (17)	-
metallurgy & metallurgical engineering	-	-	-	-	-	-	-	-	-	-	1.15 (10)	-
materials science, biomaterials	-	-	1.30 (25)	-	-	-	-	1.04 (38)	-	1.97 (16)	-	-
engineering, multidisciplinary	-	-	-	-	-	-	-	-	-	1.37 (37)	-	-
engineering, manufacturing	-	-	1.29 (53)	-	-	-	-	1.03 (27)	-	1.35 (12)	-	-
nanoscience & nanotechnology	-	-	-	-	-	1.07 (57)	-	-	-	1.33 (185)	-	-
engineering, biomedical	-	-	-	-	-	-	-	-	-	1.23 (44)	-	-
food science & technology	-	-	1.07 (46)	-	1.06 (104)	-	-	-	-	1.02 (80)	-	-
imaging science & photographic technology	-	-	-	-	-	1.67 (10)	-	-	-	1.01 (16)	-	-
neuroimaging	-	-	1.25 (8)	-	-	-	-	2.21 (8)	-	-	-	-
remote sensing	-	-	-	-	-	1.81 (12)	-	1.55 (49)	-	-	-	-
materials science, characterization & testing	-	-	-	-	-	1.78 (14)	-	-	-	-	-	-
materials science, ceramics	-	-	1.16 (29)	-	-	1.51 (21)	-	-	-	-	-	-

Table 3.5: Overview of scientific subfields of publications with field normalised citation score ≥1 in Greek regions (NUTS2), in Medical & Health Sciences, by region, 2008-2012; in brackets are the absolute number of such publications

Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
allergy	1.64 (95)	-	1.36 (14)	-	-	-	-	-	-	-	-	-
cell & tissue engineering	1.64 (17)	-	-	-	-	-	-	-	-	-	-	-
dermatology	1.52 (171)	-	-	-	1.55 (77)	2.00 (17)	-	-	-	-	-	-
infectious diseases	1.38 (488)	-	1.04 (85)	-	1.18 (111)	-	-	1.35 (69)	-	-	-	-
rheumatology	1.33 (168)	-	3.00 (56)	-	-	1.52 (62)	-	1.90 (34)	-	1.51 (18)	-	-
hematology	1.27 (388)	-	-	-	-	-	-	-	-	1.14 (46)	-	-
medicine, general & internal	1.22 (390)	-	1.11 (67)	-	-	4.01 (96)	-	-	-	-	-	-
public, environmental & occupational health	1.20 (475)	-	1.43 (136)	-	-	2.35 (69)	-	1.14 (43)	-	1.18 (27)	-	-
critical care medicine	1.19 (202)	-	1.15 (35)	1.21 (23)	1.15 (38)	-	-	1.83 (18)	-	-	-	-
toxicology	1.19 (144)	-	-	1.77 (26)	1.21 (69)	1.42 (32)	-	-	-	1.33 (25)	-	-
gastroenterology & hepatology	1.12 (438)	-	1.04 (73)	-	-	-	-	1.11 (64)	-	-	-	-
anesthesiology	1.10 (61)	-	-	-	-	-	-	-	-	-	-	-
nutrition & dietetics	1.08 (451)	-	1.31 (87)	-	-	1.03 (36)	-	1.01 (43)	-	1.09 (29)	-	-
immunology	1.03 (470)	-	-	-	-	-	-	1.06 (49)	-	-	-	-
health policy & services	1.02 (39)	-	-	-	2.14 (14)	-	-	-	-	2.23 (11)	-	-
chemistry, medicinal	1.02 (314)	-	-	-	1.05 (135)	-	-	1.29 (36)	-	-	-	-
parasitology	1.00 (54)	-	1.00 (13)	-	1.77 (26)	-	-	-	-	-	-	-
clinical neurology	1.00 (447)	-	-	1.42 (61)	-	-	-	-	-	-	-	-
medical informatics	-	1.43 (8)	1.59 (34)	-	-	1.90 (23)	-	-	-	-	-	-
sport sciences	-	-	1.99 (13)	-	-	1.70 (26)	-	-	-	-	-	-
urology & nephrology	-	-	1.35 (31)	-	1.26 (125)	-	-	-	-	-	-	-
surgery	-	-	1.28 (126)	-	-	1.03 (133)	-	-	-	1.02 (102)	-	-

Category						
cardiac & cardiovascular systems	1.24 (134)					1.12 (49)
transplantation	1.08 (9)					
health care sciences & services	1.07 (23)	1.05 (8)	1.35 (32)	1.75 (13)		
tropical medicine	1.06 (10)					
endocrinology & metabolism	1.04 (76)		1.24 (238)			
physiology		1.25 (16)				1.07 (37)
pathology		1.18 (9)				
respiratory system		1.1 (45)				1.08 (66)
pharmacology & pharmacy		1.09 (68)	1.01 (310)	1.19 (133)		1.13 (90)
orthopedics		1.00 (41)				1.18 (63)
obstetrics & gynecology			1.22 (218)	1.23 (64)		
psychiatry			1.16 (88)	1.81 (39)		1.22 (8)
medicine, legal			1.14 (13)			
geriatrics & gerontology			1.10 (45)			
medicine, research & experimental				1.33 (58)		
radiology, nuclear medicine & medical imaging				1.06 (88)		
peripheral vascular disease				1.00 (85)		1.06 (48)
pediatrics						1.07 (31)
otorhinolaryngology						1.02 (12)

Table 3.6: Overview of scientific subfields of publications with field normalised citation score ≥1 in Greek regions (NUTS2), in Agricultural Sciences, by region, 2008-2012; in brackets are the number of these publications

Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
agricultural engineering	1.36 (74)	-	1.70 (21)	1.34 (13)	1.11 (43)	1.65 (14)	-	-	-	1.59 (33)	-	-
fisheries	1.12 (144)	-	1.11 (28)	-	1.69 (34)	-	-	-	-	-	-	-
agriculture, multidisciplinary	1.07 (110)	-	-	-	-	-	-	1.09 (34)	-	-	-	-
agriculture, dairy & animal science	1.00 (89)	-	-	-	-	-	-	1.06 (59)	-	-	-	-
soil science	-	-	1.02 (9)	1.15 (8)	-	-	-	1.22 (18)	-	-	-	-
agronomy	-	-	-	1.26 (31)	-	1.41 (11)	-	-	-	-	-	-
horticulture	-	-	-	-	-	1.04 (9)	-	-	-	-	-	-

Table 3.7: Overview of scientific subfields of publications with field normalised citation score ≥1 in Greek regions (NUTS2), in Social Sciences, by region, 2008-2012; in brackets are the number of these publications

Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
psychology, social	1.56 (19)	-	-	-	-	-	-	-	-	-	-	-
psychology, biological	1.30 (8)	-	-	-	-	-	-	-	-	-	-	-
international relations	1.29 (22)	-	-	-	-	-	-	-	-	-	-	-
anthropology	1.21 (32)	-	1.74 (10)	-	1.56 (23)	-	-	-	-	-	-	-
environmental studies	1.21 (107)	-	1.16 (24)	1.08 (12)	-	-	-	-	-	-	-	-
psychology, developmental	1.18 (26)	-	-	-	-	-	-	-	-	-	-	-
operations research & management science	1.14 (235)	-	1.57 (56)	-	1.19 (84)	1.06 (14)	1.3 (26)	1.27 (16)	-	1.22 (53)	-	-
information science & library science	-	1.74 (9)	-	-	-	-	-	-	-	-	-	-
psychology, educational	-	-	1.11 (17)	-	1.01 (15)	-	-	1.06 (11)	-	-	-	-
education & educational research	-	-	1.07 (16)	-	-	1.00 (9)	-	1.44 (34)	-	-	-	-
ergonomics	-	-	1.01 (15)	-	-	-	-	-	-	-	-	-
economics	-	-	-	1.23 (13)	-	-	-	-	-	-	-	-
urban studies	-	-	-	-	1.54 (10)	-	-	-	-	-	-	-
social sciences, mathematical methods	-	-	-	-	1.15 (10)	-	-	-	-	-	-	-
management	-	-	-	-	1.04 (49)	-	-	-	-	-	-	-
business, finance	-	-	-	-	-	-	1.47 (12)	-	-	-	-	-
psychology, clinical	-	-	-	-	-	-	-	-	-	1.27 (17)	-	-

Table 3.8: Overview of scientific subfields of publications with field normalised citation score ≥1 in Greek regions (NUTS2), in Humanities, by region, 2008-2012; in brackets are the number of these publications

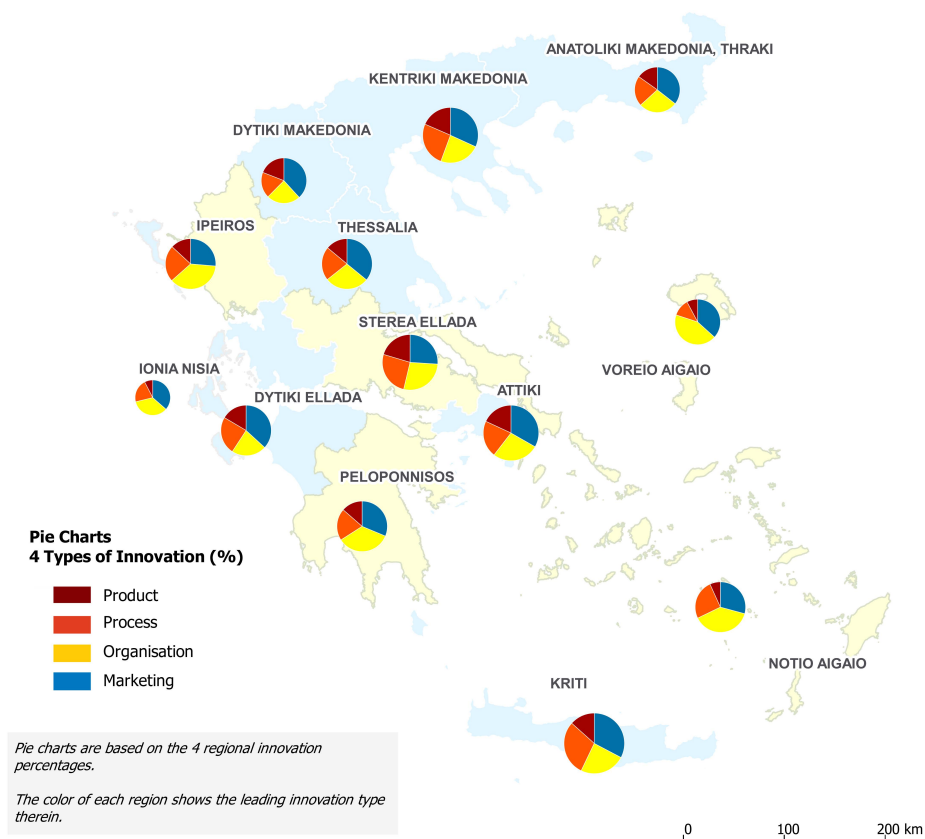| Scientific Subfield (Web of Science)	Attiki	Voreio & Notio Aigaio	Kriti	Anatoliki Makedonia, Thraki	Kentriki Makedonia	Dytiki Makedonia	Ipeiros	Thessalia	Ionia Nisia	Dytiki Ellada	Sterea Ellada	Peloponnisos
archaeology	-	-	1.93 (16)	-	1.13 (55)	-	-	1.27 (16)	-	-	-	-
art	-	-	-	-	1.83 (14)	-	-	-	-	-	-	-
humanities, multidisciplinary	-	-	-	-	1.15 (11)	-	-	-	-	-	-	-
linguistics	-	-	-	-	-	2.00 (8)	-	-	-	-	-	-

CHAPTER 4

Business innovation

Among the four types of innovation (product, process, organizational and marketing innovation), the last two types are found to be the dominant in Greek enterprises across all regions. Map 4.1 indicates the distribution of each type of innovation in each region. In 8 regions marketing innovation is the dominant type, while in 5 regions it is the marketing innovation that ranks first. It is to be noted that in every region, all four types of innovation are present yet with varying degrees.

Map 4.1: Distribution of types of innovation of Greek enterprises in Greek regions (NUTS2), 2010-2012
**(% sum of all types of innovation in each region)**
Regions are coloured in blue in case marketing innovation is the dominant type of innovation in the region and in yellow when organisational innovation prevails.

ANATOLIKI MAKEDONIA, THRAKI

KENTRIKI MAKEDONIA

DYTIKI MAKEDONIA

IPEIROS

THESSALIA

STEREA ELLADA

VOREIO AIGAIO

IONIA NISIA

DYTIKI ELLADA

ATTIKI

PELOPONNISOS

Pie Charts
4 Types of Innovation (%)

- Product
- Process
- Organisation
- Marketing

NOTIO AIGAIO

KRITI

Pie charts are based on the 4 regional innovation percentages.

The color of each region shows the leading innovation type therein.

0   100   200 km

In most regions, the percentage of innovative enterprises is above 40%, while, their innovation performance on a national level (52.3%) outperforms the EU28 average (48.9%). More specifically, the regions of Kriti (65.2%), Sterea Ellada (56%), Attiki (54.3%), and Kentriki Makedonia (53%) outperform both the national and EU-28 averages.

Figure 4.1: Innovative enterprises in Greek regions (NUTS2), 2010-2012,
(% of all entreprises in each region)
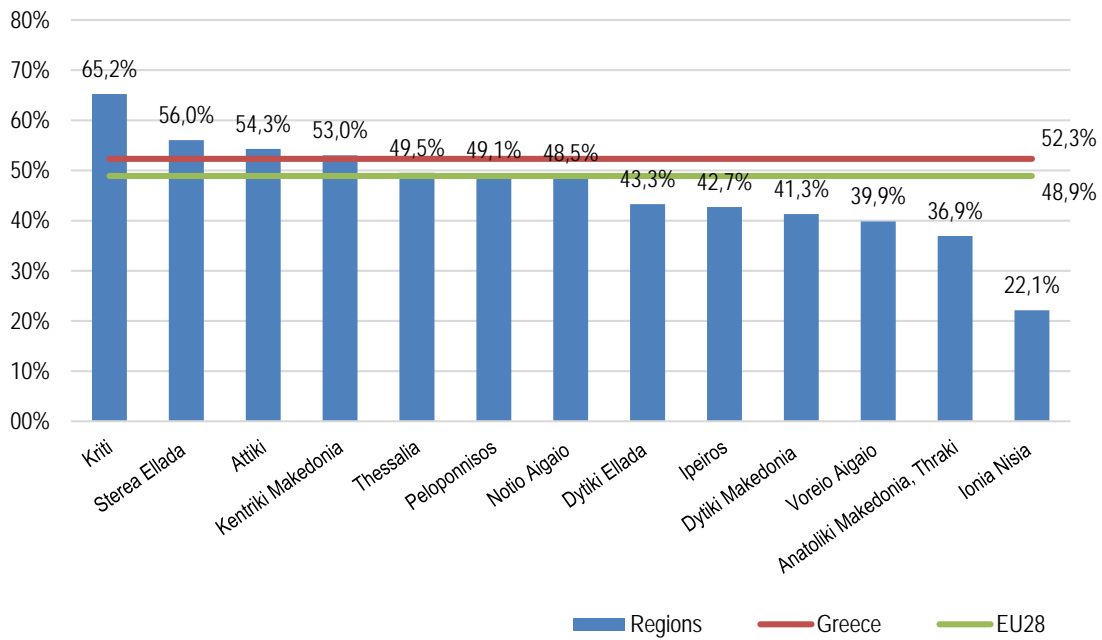
Focusing on the performance of Greek enterprises in the different types of innovation, it appears that domestic enterprises indicate high performance concerning organizational and marketing innovation, significantly outperforming the relevant EU28 average (see Figure 4.7). Conversely, their performance relative to product (goods or services) and process innovation, that is those types of innovation often referred to as technological innovation, are found to be lacking. This is especially true for the development of product innovation given that the latter are usually related with significant investments on machinery, in-house/outsourced R&D, human capital, skills acquisition, etc.

Figure 4.2 maps the product and /or process innovation types across Greek regions. The national performance is lower than the EU average (34.3% as opposed to 36%). On a regional level, only Kriti (50.6%) and Attiki (36.2%) outperform the EU average while Kentriki Makedonia (35.9%) and Sterea Ellada (35.8%) are above the national average.

Figure 4.2: Product and / or process innovative entreprises in Greek regions (NUTS2), 2010-2012
(% of all entreprises in each region)
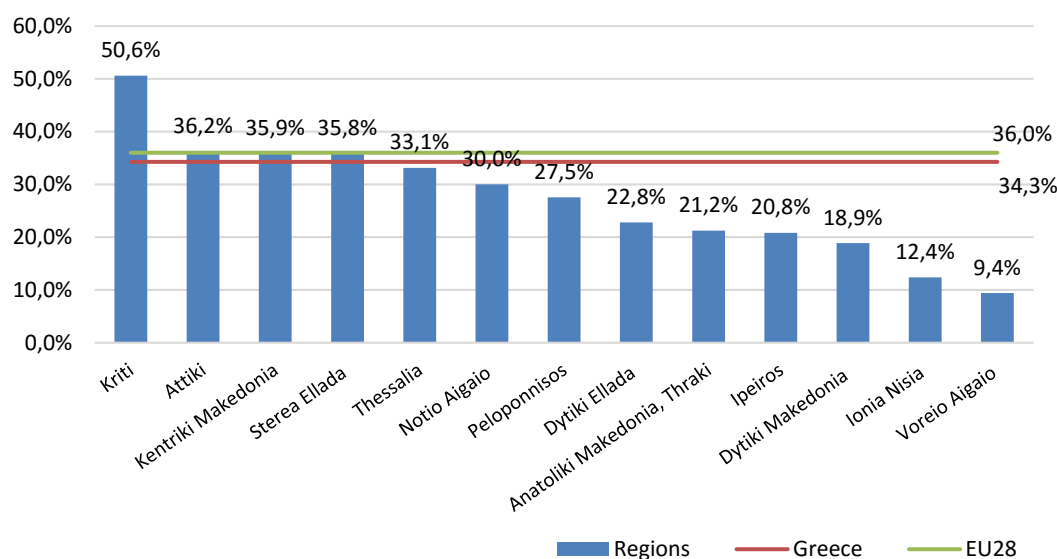
Greek enterprises, in 2012, invested 1.9 billion Euros, that is 0.98% of GDP, in product and/or process innovation activities. Examining the intensity of this expenditure, as % of each region's GDP, performances outperforming the national average (see Figure 4.3) are found in the region of Kentriki Makedonia (2.12%), Attiki (1.11%) and Sterea Ellada (0.99%). The regions with the lowest such performance are Ipeiros (0.22%), Thessalia (0.21%), Voreio Aigaio (0.05%), and Ionia Nisia (0.02%).

Figure 4.3: Expenditure for innovation activities in Greek regions (NUTS2), 2012
(as % of regional GDP)
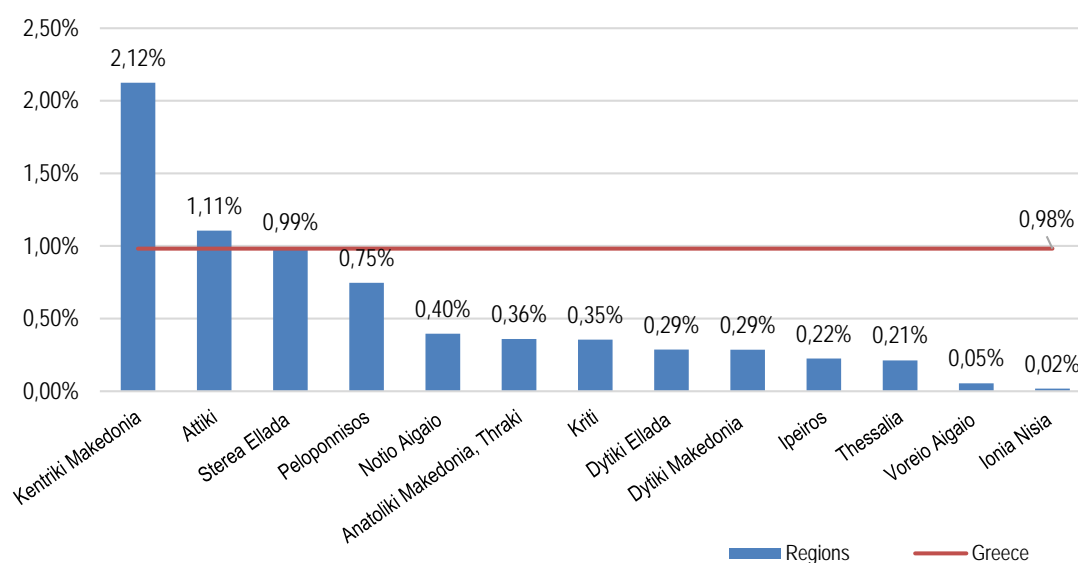
Concerning the introduction of new products into the market, enterprises located in the region of Attiki are found to be most innovative (16.8%), followed by those in Sterea Ellada (14.3%). These two regions are the sole ones outperforming the national average (14.0%), indicating their particular importance in the national productive and industrial fabric (Figure 4.4).

Figure 4.4: New to the market product innovative entreprises in Greek regions (NUTS2), 2010-2012
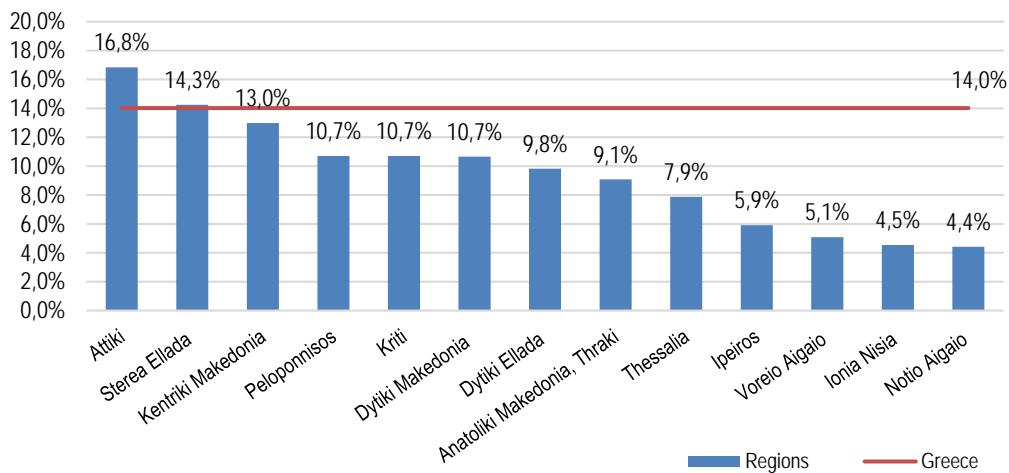**(% of all entreprises in each region)**

Figure 4.5 ranks Greek regions relative to the percentage of innovative products turnover (both new-to-firm and new-to-market) to the enterprise's total turnover. The firms located in the region of Kentriki Makedonia (17.8%) rank first, followed by those in Attiki (12.4%). Both are above the national average (11.8%).

Figure 4.5: Sales of new to market and new to firm innovations as % of total turnover in Greek regions (NUTS2), 2012
(% of total turnover of all entreprises in each region)

48
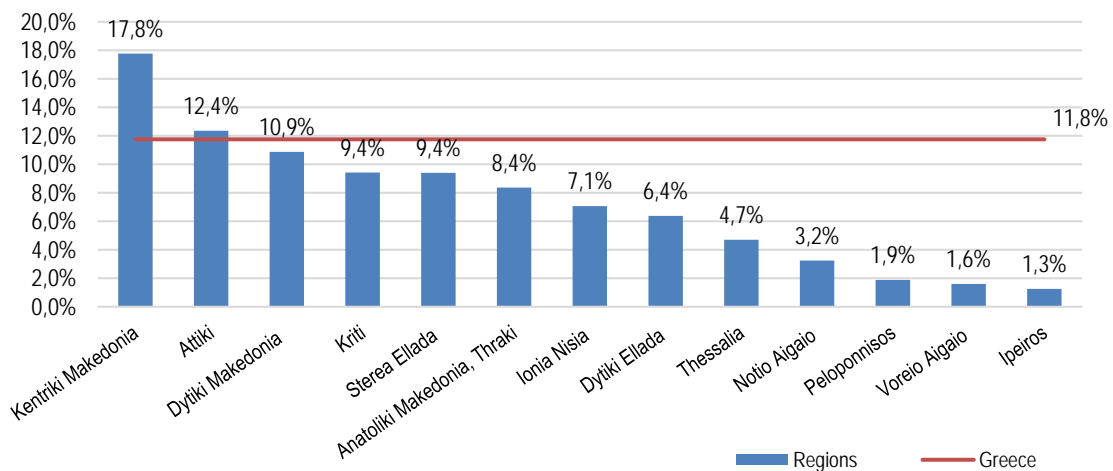
An important indicator of the international orientation of innovative enterprises is the collaborations established for carrying out product and/or process innovation activities. According to Figure 4.6, the percentage of enterprises collaborating with others is higher in the region of Thessalia (17.9%), followed by Sterea Ellada (13.6%), and Kentriki Makedonia (13.3%). The national average (13.1%) is above the EU28 average (11.3%).

Figure 4.6: Product and / or process innovative entreprises collaborating with others in Greek regions (NUTS2), 2010-2012
(% of all entreprises in each region)
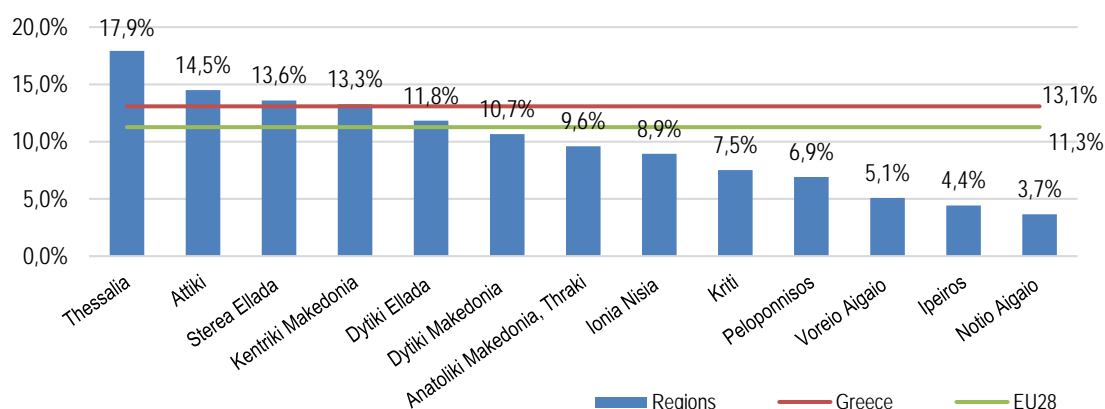
Figure 4.7 portrays the regional performance in the two (non-technological) innovation types, i.e. organisational and marketing innovation. Overall, the national performance (45.4%) outperforms the EU28 average (37.1%), while Attiki is the region with the highest percentage of such enterprises (49.3%), followed by Kriti (48.2%), Thessalia (43.8%), and Kentriki Makedonia (43.6%).

Figure 4.7: Organisation and or marketing innovative entreprises in Greek regions (NUTS2), 2010-2012
(% of all entreprises in each region)
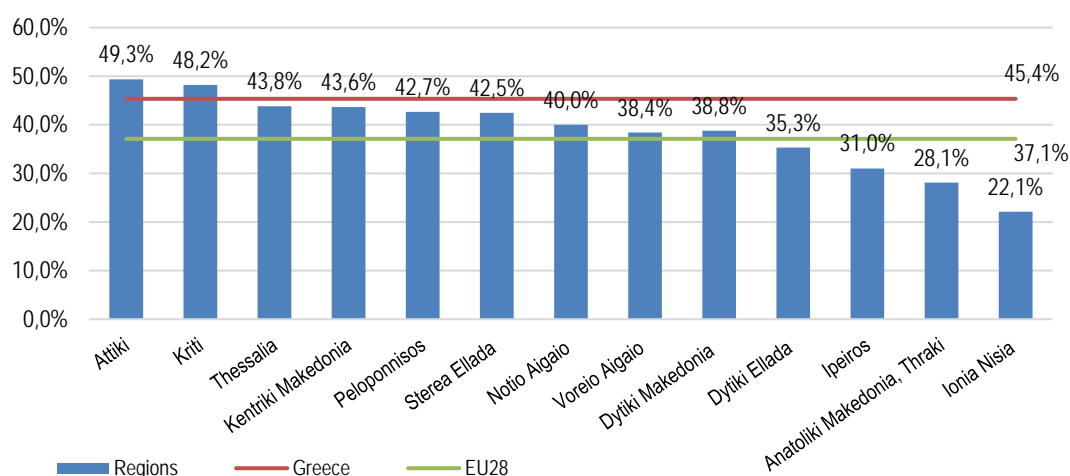
A dominant feature of the domestic innovative enterprises' strategy has been cost reduction, either in-house operational costs or costs of purchased materials, components or services. Cost reduction, among a number of alternatives, such as developing new markets, increasing flexibility, intensifying or improving marketing of products, etc., has been the strategy most frequently regarded as being highly important between 2010 and 2012 for innovative enterprises across nearly all regions (Table 4.1).

Table 4.1: Highly important strategies in innovative entreprises in Greek regions (NUTS2), 2010-2012

Region	Most important strategy in the region	% innovative entreprises considering the relevant strategy as highly important
ATTIKI	Reducing in-house costs of operation	57.6%
VOREIO AIGAIO	Reducing in-house costs of operation	63.9%
NOTIO AIGAIO	Reducing costs of purchased materials, components or services	78.5%
KRITI	Reducing costs of purchased materials, components or services	56.8%
ANATOLIKI MAKEDONIA, THRAKI	Reducing costs of purchased materials, components or services	47.4%
KENTRIKI MAKEDONIA	Reducing in-house costs of operation	53.7%
DYTIKI MAKEDONIA	Developing new markets outside Europe	54.0%
IPEIROS	Reducing in-house costs of operation	65.4%
THESSALIA	Reducing in-house costs of operation	67.2%
IONIA NISIA	Increasing flexibility / responsiveness of the entreprise	73.4%
DYTIKI ELLADA	Reducing costs of purchased materials, components or services	62.7%
STEREA ELLADA	Reducing in-house costs of operation	47.2%
PELOPONNISOS	Reducing in-house costs of operation	37.2%

Concerning the obstacles innovative enterprises are faced with towards fulfilling their objectives, a more differentiated picture is evident. According to table 4.2, i) strong price competition, ii) lack of adequate finance, iii) lack of demand, and iv) high cost of access to new markets have been the dominant obstacles for innovative enterprises across all regions, yet with alternating classification in each region.

Table 4.2: Highly important obstacles in innovative entreprises in Greek regions (NUTS2), 2010-2012

| Region	Most important obstacle in the region	% innovative entreprises considering the relevant obstacle as highly important
ATTIKI	Lack of demand	43.3%
VOREIO AIGAIO	Lack of adequate finance	53.1%
NOTIO AIGAIO	Lack of adequate finance	79.7%
KRITI	Strong price competition	51.1%
ANATOLIKI MAKEDONIA, THRAKI	Lack of adequate finance	45.9%
KENTRIKI MAKEDONIA	Strong price competition	58.7%
DYTIKI MAKEDONIA	High cost of access to new markets	77.8%
IPEIROS	Lack of demand	66.1%
THESSALIA	Strong price competition	65.2%
IONIA NISIA	Strong price competition	62.0%
DYTIKI ELLADA	Lack of adequate finance	63.2%
STEREA ELLADA	Strong price competition	51.8%
PELOPONNISOS	Lack of demand	49.6%
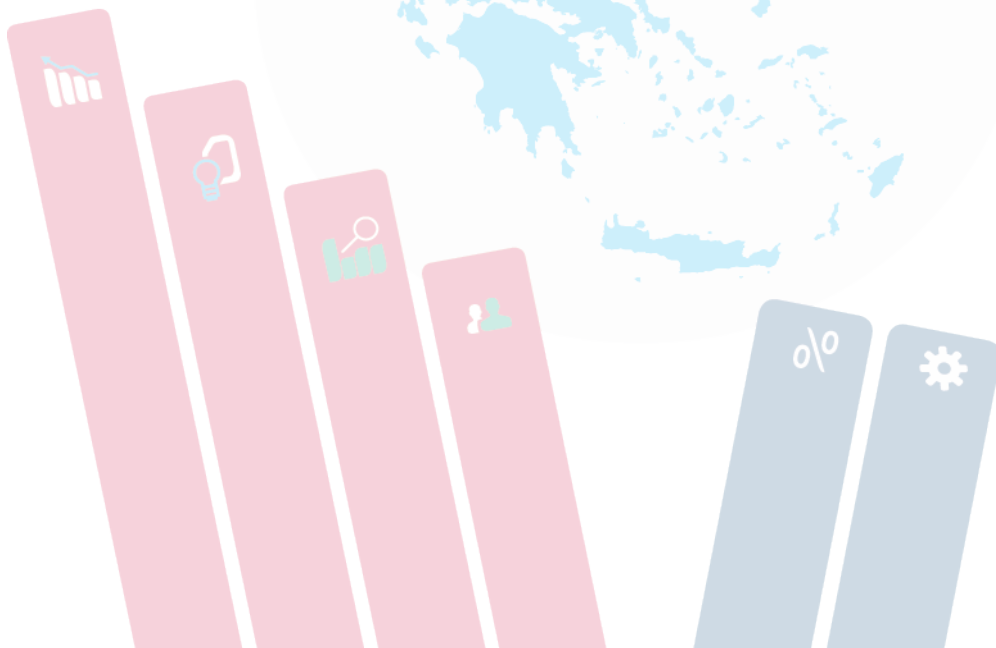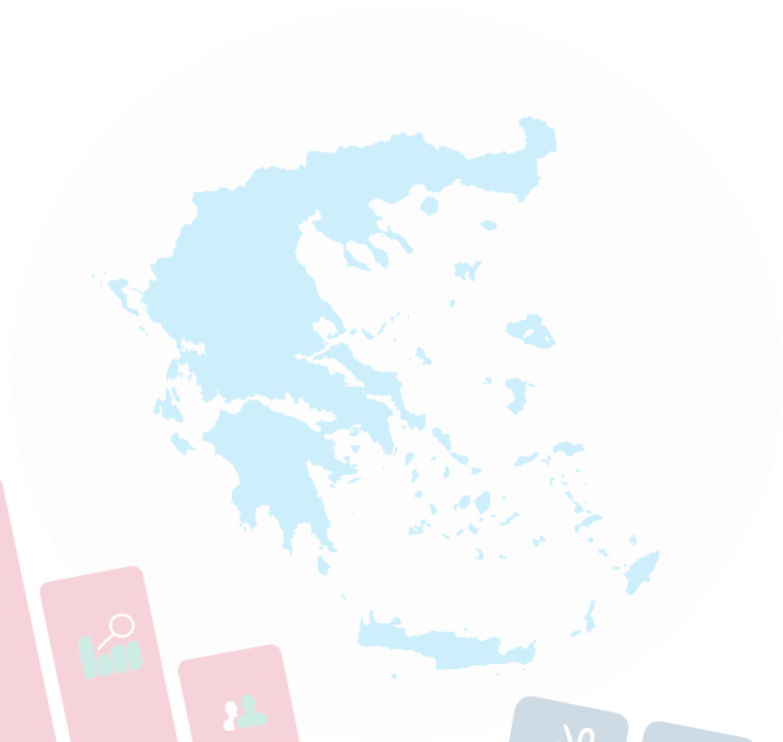
CHAPTER 5
Methodological Notes

Overview

This publication is an overview of the performance of the Greek regions in Research, Development and Innovation making use of the most recent indicators produced by the National Documentation Centre (EKT), such as the official statistics for Research & Development and Innovation, the bibliometric indicators of Greek publications in international scientific journals, the Greek National Archive of PhD Theses and the Greek participation in the EU 7th Framework Programme for research.

The selected indicators are presented across 13 Greek regions, listed following the level 2 of NUTS classification - Nomenclature of territorial units for statistics /2013:

Region	NUTS2 classification
ATTIKI	EL30
VOREIO AIGAIO	EL41
NOTIO AIGAIO	EL42
KRITI	EL43
ANATOLIKI MAKEDONIA, THRAKI	EL51
KENTRIKI MAKEDONIA	EL52
DYTIKI MAKEDONIA	EL53
IPEIROS	EL54
THESSALIA	EL61
IONIA NISIA	EL62
DYTIKI ELLADA	EL63
STEREA ELLADA	EL64
PELOPONNISOS	EL65

Specifically, this publication makes use of the following indicators:

Research and Development (chapters 1 & 2): the indicators are extracted from the official national statistics on Research and Development as produced by the National Documentation Centre (EKT) according to EC Regulation 995/2012. Regional indicators are produced according to the regional distribution of the R&D activities as stated by the R&D performers, and not on the basis of the performer's registered office or central administration. Data concerning the EU28 have been extracted from the Eurostat database in July 2015.

National participation in the European R&D programmes/projects (chapter 3): the indicators are produced by EKT after performing an analysis of the data in the European Commission's ECORDA database, in addition to any complementary data being collected by EKT in the framework of its operation as a National Contact Point. In most cases, and only after EKT established a direct line of communication with the actors themselves, the regional indicators have been produced on the basis of the regional distribution of the R&D activities of the actors, and not on the basis of the actor's registered office or central administration.

PhD Theses (chapter 3): The data are derived from the National Archive of PhD Theses, an archive created and managed by EKT according to the national legislation. The regional distribution of the PhD Theses takes into consideration the registered office or central administration of the universities in which the PhD Theses are supervised.

Scientific Publications in International Journals (chapter 3): the indicators are produced by EKT after performing a bibliometric analysis of the data contained in the international Web of Science database (Thomson Reuters). The regional distribution of the scientific publications takes into consideration the registered office or central administration of the actors involved.

Business Innovation (chapter 4): the indicators are selected from the national official Innovation Statistics (Community Innovation Survey) as produced by EKT according to EC Regulation 995/2012. Regional indicators have been produced on the basis of the regional distribution of the innovation activities of the actors, and not on the basis of the actor's registered office or central administration.

In what follows, the basic methodological issues concerning the production of the above indicators are presented.

Research and Development (R&D) Statistics

Data description

The aim of the R&D (Research and Development) survey is to produce statistics about (intramural) R&D Expenditure and R&D personnel covering R&D performing entities in the private and public sectors as follows: Business Enterprise Sector (BES), Government Sector (GOV), Higher Education Sector (HES), Private non-Profit (PNP) as well as for the country as a whole.

R&D Expenditure as a percentage of GDP is used to calculate the R&D Intensity of a country. This indicator is used inter alia to monitor progress towards the EU2020 target that 3% of GDP be invested in R&D.

This publication presents final data for R&D expenditure and R&D Personnel for 2013 in accordance with the European Regulation (995/2012).

The complete data series and more detailed analyses are available in the following address: http://metrics.ekt.gr/el/statistika-etak.

Concepts and definitions

Basic statistical concepts and definitions, standard classifications and guidelines for the production of R&D statistics are outlined in the Frascati Manual (OECD, 2002).

Research & Development – R&D

According to the Frascati Manual, R&D comprises of creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

The term R&D covers three activities: basic research, applied research and experimental development.

R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

Sectors of performance

Statistics for R&D Expenditure and R&D Personnel are collected and analysed by Sector of R&D performance. The institutions that perform R&D and are used as statistical units to provide the information, are categorized into the four sectors:

Business Enterprise Sector – BES:

which includes all firms, organizations and institutions whose primary activity is the market production of goods or services (other than higher education). In addition, this sector includes public enterprises as well as non-profit institutions mainly serving the enterprises. Economic activity (NACE rev.2) and size class coverage is defined in Commission Regulation 995/2012.

Higher Education Sector - HES:

which includes all Universities and Technological Educational Institutes (TEI), and moreover the University research institutes (EPI) and similar establishments in the Technological Educational Institutes (Technological Research Centres / KTE), University Hospitals, Private Institutes of Vocational Training (IEK) accredited by the Ministry of Education and Religious Affairs, as well as other HE schools/academies (e.g. Higher Ecclesiastical Schools, Military Academies)

Government Sector – GOV:

which includes all departments, offices and other bodies administered or/and financed by Ministries, such as the Public Research Centers and other Research Institutes that are supervised by the General Secretariat for Research and Technology (GSRT) (in alphabetic order in Greek): National Observatory of Athens, National Hellenic Research Foundation, The Centre for Research and Technology (including Center for Research and Technology – Thessaly), National Center for Scientific Research 'DEMOKRITOS', Hellenic Centre for Marine Research, National Centre for Social Research, Greek Atomic Energy Commission, Hellenic Pasteur Institute, "Alexander Fleming" Biomedical Sciences Research Center, Athena-Research and Innovation Center in Information, Communication and Knowledge Technologies, Foundation for Research & Technology – Hellas, Thessaloniki Science Center & Technology Museum – NOESIS), other Public Research Institutions supervised by different Ministries (indicative and non-exhaustive list of GOV institutions is the following: Academy of Athens, Biomedical Research Foundation Academy of Athens, Hellenic Agricultural Organisation DEMETRA (former National Agricultural Research Foundation - NAGREF), Benaki Phytopathological Institute, Center for Renewable Energy Sources and Saving, Mediterannean Agronomic Institute of Chania, Computer Technology Institute and Press "Diophantus", etc), archaeological and cultural institutions, public hospitals, public independent authorities, etc.

Private Non Profit Sector –PNP:

This sector includes non-market, private non-profit institutions serving the general public, such as non-market units, professional and learned societies, charities, relief or aid agencies, trades unions, consumers' associations, etc. An indicative and non-

exhaustive list of PNP institutions is the following: Foundation of the Hellenic World, Hellenic Foundation for European and Foreign Policy, L'Ecole Française d'Athène, Hellenic Cooperative Oncology Group, Lambrakis Foundation, THORAX Institute, Environmental Centre ARCTUROS, WWW Hellas, Institute of Therapy and Environment, Hellenic Institute for Research on Cancer, etc.

Intramural R&D expenditure

R&D Expenditure data are compiled on the basis of performers' reports of intramural expenditure. Intramural expenditure are expenditure for R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds.

Both current (i.e. labour cost and other current cost such as non-capital purchases of materials, supplies and equipment to support R&D) and capital expenditure (i.e. expenditure on land and buildings, instruments and equipment) are included.

Extramural expenditure incurred for the acquisition of R&D performed by other units and grants given to others for performing R&D are excluded.

Source of funds

In accordance with the Frascati Manual, sources of funds fall into the 5 following categories:

Businesses: This includes funding from private Greek businesses and businesses from the wider public sector (eg State-owned Enterprises - SOEs) that is used for internal R&D funding or funding to other sectors.

Government: This includes funding from the state (central and regional government) as well as own funding of R&D bodies which belong to the GOV sector. In the table, the government sector is analysed using the following categories:

- Ordinary budget: R&D expenditure funded from the ordinary budget. It mainly covers public organisations, Universities, Technological Educational Institutes, etc.

- NSRF (National Strategic Reference Framework): R&D expenditure funded through the NSRF projects

- Other sources: R&D expenditure funded by the Public Investment Budget except for NSRF, Budget annexed to the General Budget, Regions, Municipalities etc. It also includes R&D carried out by organisations belonging to the GOV sector with their own resources (using their own capital, donations, legacies, bequests, rents, etc.).

Higher Education: This includes funds from institutes in the sector of higher education to other sectors. It also includes own funding of HES institutes, both public (own capital, donations, legacies, bequests, rents, etc) and private Institutes of Vocational Training (IEK).

Private non-profit organisations: This includes funding from PNP institutions to other sectors and internal funding.

Abroad: This includes funding from:

- European Union (eg European Union Framework Programmes)

- Other sources from abroad: R&D which is conducted by Greek institutions and is funded by businesses from abroad, from international organisations or other bodies from abroad.

R&D personnel

R&D personnel consists of all persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical and staff.

R&D personnel includes the following categories.

Researchers: Professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned. Postgraduate students at the PhD level also fall into this category.

Other R&D Personnel: Personnel involved in R&D activities by performing scientific and technical tasks, usually under the supervision of researchers (e.g. developers, programmers, manufacturers, personnel collecting bibliometric material or implementing surveys and interviews, etc.), as well as personnel performing various tasks directly related to R&D activities necessary for the completion of these tasks (e.g. workers, secretaries or other administrators).

R&D personnel data is available in head count (HC) and in full-time equivalent (FTE).

Headcount (HC)

Headcount is the unit for measuring the total number of persons who are mainly or partly employed on R&D. It allows links to be made with other data series, for example education or employment data or the results of population censuses.

Full Time Equivalent (FTE)

Full time equivalent (FTE) is the unit used to measure employed persons or students in a way that makes them comparable although they may work or study a different number of hours per week. It is therefore based on the time a person devotes to R&D activities.

FTE is calculated by comparing the time one devotes to R&D activities with full-time work. One FTE may therefore be thought of as one person-year, while for a part-time

R&D worker FTE is calculated as the percentage of the time that he/she spends on R&D over his/her total working time.

Legal Framework

R&D data collection is based on Commission Regulations 995/2012 (from reference year 2012 onwards) on statistics on Science and Technology.

The National Documentation Centre, the national institution for the collection, documentation and provision of science and technology content (www.ekt.gr), was assigned the responsibility for the collection and compilation of R&D statistics in April 2012 (Official Journal of Government 1359/B/25.04.2012) by the General Secretariat for Research and Technology (GRST).

The collection of the data presented in this publication was made in collaboration with the Hellenic Statistical Authority (Memorandum of Understanding of 28.01.2014 and Memorandum of Understanding of 04.06.2015).

Data collection

The data are collected through census survey for all R&D performers in the HES, GOV and PNP sectors as well as in all previously known enterprises that perform R&D (~700 enterprises). For the needs of the survey, EKT developed a dedicated register of all known R&D performers, based on information from administrative sources. The R&D register is updated on a systematic basis.

Especially for BES, the census part of the survey has been supplemented with sample survey in more than 4 000 enterprises in collaboration with the Hellenic Statistical Authority (ELSTAT). The sample has been drawn from the National Business Register that is maintained by ELSTAT. More than 200 interviewers were drawn from the special ELSTAT register of 'termporary statistical interviewers' and were assigned to collect data for the needs of the R&D survey.

EKT has developed tailor-made software that is based on open-source technologies to support data collection and data processing.

Data validation and editing has been performed in collaboration with respondents, whenever necessary. Consistency checks have also been conducted between the collected data and relevant data provided by the following administrative sources:

- Monitoring Information System (M.I.S.), which is the central information system about projects financed under the National Strategic Reference Framework (NSRF) – Source: Special Service for the Monitoring Information System (M.I.S.)
- eCORDA database with information about signed grants and beneficiaries with regards to EU Framework Programme for Research (FP7) – Source: European Commission

- General University Funds (GUF) and University personnel data – Source: Ministry of Education, Research and Religious Affairs
- Government funding and R&D Personnel for archaeological and cultural institutions – Source: Ministry of Culture and Sports
- Funds for Public Hospitals – Source: Ministry of Health
- Private Balance Sheets database – Source: ICAP
- GBAORD data – Source: Official GBAORD data that have been collected and compiled by EKT and made available through Eurostat dissemination database

Data processing and data analysis have been conducted using standard methodological techniques and Eurostat guidelines on the harmonized production of R&D statistics across Member States.

Participation in the 7ᵗʰ EU Framework Programme

Data description

The indicators concerning the Greek participation in European competitive programmes, as those for the 7ᵗʰ Framework Programme, are produced by EKT. The data are extracted from the official ecorda database of the European Commission, are, subsequently, processed and, where available, are enriched with any further empirical data possessed by EKT as a National Contact Point.

The data presented in this publication refer to the whole span of the 7ᵗʰ Framework Programme 2007-2013. While certain minor corrections may be required due to continuous updates of the ecorda database, important alterations are not to be expected since FP7 has been concluded.

In most cases, and after EKT established a direct line of communication with the actors themselves, the regional indicators have been produced on the basis of the regional distribution of the R&D activities of the actors, and not on the basis of the actor's registered office or central administration.

The complete account of the Greek participation in the 7ᵗʰ Framework Programme and Horizon 2020 can be accessed through this address: http://metrics.ekt.gr/en/eidikes-ektheseis.

Basic definitions

Number of projects: refers to the number of projects as signed and approved by the European Commission.

Number of participations: refers to the number of Greek participations in FP7 projects and not to the number of single participants. For example, if a Greek organisation participates in two projects, then it is documented twice.

EC financial contribution: refers to the amount of EU funding granted to the participants in FP7 projects and not the total projects' costs.

Categories of participants: for comparability reasons, the participants have been categorized by EKT into the four sectors of R&D performance (BES, HES, GOV, and PNP see above) following the classification of the Frascati manual, a manual in worldwide use for producing the official Research and Development statistics. The classification followed by ECORDA follows a different set of criteria.

Specific programmes / themes of projects: the standard typology of the European Commission is followed. The structure of the 7ᵗʰ Framework Programme, and its analysis, can be found here: https://ec.europa.eu/research/fp7/ .

PhD Theses

Data Description

The data are derived from the National Archive of PhD Theses (EADD), an archive created and managed by EKT according to the relevant national legislation.

EADD compiles the full stock of PhD Theses having been concluded in Greek universities by Greek or foreign doctorate students, in addition to PhD theses having been concluded in foreign universities by Greek doctorate students under the requirement that the thesis has been approved by the Hellenic National Academic Recognition Information Center (DOATAP- Hellenic NARIC).

Data concerning 18 935 PhD Theses attributable to a scientific field and for the period starting from 2000 to 2014 are presented. The regional distribution of the PhD Theses takes into consideration the registered office or central administration of the universities.

Concepts and Definitions

The thematic classification of the PhD Theses amongst scientific fields follows the Frascati classification (Revised Fields of Science, 2007), categorizing in 6 main fields of science and 42 subcategories:

Fields of Science	Subcategory
Natural Sciences:	• Mathematics • Computer and information sciences (excluding • hardware development and social aspects) • Physical sciences • Chemical sciences • Earth and environmental sciences • Biological sciences (excluding medical and • agricultural sciences) • Other natural sciences
Engineering & Technology:	• Civil engineering • Electrical engineering, electronic engineering, • information engineering • Mechanical engineering • Chemical engineering • Materials engineering • Medical engineering • Environmental engineering • Environmental biotechnology • Industrial biotechnology • Nanotechnology • Other engineering and technologies (food, • beverages and other)

Fields of Science	Subcategory
Medical & Health Sciences:	• Basic medicine • Clinical medicine • Health sciences • Medical biotechnology • Other medical sciences (forensic and other • medical sciences)
Agricultural Sciences:	• Agriculture, forestry and fisheries • Animal and dairy science • Veterinary science • Agricultural biotechnology • Other agricultural sciences
Social Sciences:	• Psychology • Economics and business • Educational sciences • Sociology • Law • Political science • Social and economic geography • Media and communications • Other social sciences
Humanities:	• History and Archaeology • Languages and literature • Philosophy, ethics and religion • Arts (arts, history of arts, performing arts, • music) • Other humanities

Bibliometric indicators – analysis of Greek publications in international scientific journals

Data Description

EKT publishes annually biblometric analyses and indicators for the Greek publications in international scientific journals. EKT's study series aims to create a consistent ground for monitoring and presenting data for the research output in Greece and thus to enable correlations with levels of research activity in EU and OECD countries. Studies are based on data from either the Web of Science – Thomson Reuters (even years) or the Scopus – Elsevier databases (odd years).

Scientific publications in journals are a traditional indicator of research output. It is customary to evaluate the results of research activities based on the number of scientific articles produced and the share the articles have on the global map, the share of citations the articles received, the collaborations formed to produce them as well as other standard bibliometric indicators.

The bibliometric indicators that EKT publishes are included in the official statistics of the Ministry of Education, Research and Religious Affairs.

The indicators presented in this particular publication are based on data from the Thomson Reuters' Web of Science (WoS) database. The regional distribution of the scientific publications take into consideration the registered office or central administration of the actors involved.

The full series of EKT's bibliometric publications can be accessed through this address: http://metrics.ekt.gr/en/epistimonikes-dimosiefseis.

Concepts and Definitions

The production of bibliometric indicators by EKT is in compliance with established methodological practices in scientometrics. In addition, EKT developed its own software which enables data cleaning and integrity check for WoS databases, calculation of non-trivial bibliometric indicators and presentation of the results using interactive visualizations.

The basic methodological notes follow below while the full methodology can be found in the full version of the studies published by EKT.

Number of publications: Only document types *articles*, *research notes* and *reviews* are considered. Editorials, letters, correction notes and abstracts are excluded.

Publication counts presented in this study are «whole counts» i.e. in the case of multi authored publications each participating institution or country receives a whole count and not a fraction of the publication. Similarly, in the case of a publication classified in more than one scientific field, each scientific field or sub-field receives a whole count of the publication.

Number of citations: The number of citations that a publication is likely to receive depends on its impact in the research community but also on the time period that has passed since it was first published. Older publications usually have more citations.

To normalize differences observed between high numbers of citations received by older publications and low numbers in the latest publications, citation count in this study was made using overlapping 5-year windows. Particularly, we recorded citations received in a certain 5-year period for publications edited within the same 5 year period.

Institution Categories: Greek institutions were classified into four sectors (BES, GOV, HES, PNP) according to the sector of activities in which they belong and the classification criteria used in the Frascati Manual (for more information on the four sectors of performance see above in R&D statistics). The aim is to ensure the comparability across indicators from multiple sources that are presented in this study.

International collaborations: International collaboration rate is calculated as the percentage of publications with at least one international collaboration.

Highly cited publications (Top 10%): the percentage of total publications that, compared with other publications in the same field and in the same year, belong to the top 10% most frequently cited publications worldwide.

Fields of Science: Web of Science allow for categorization of publications in 253 scientific subject fields, according to the journal in which the publication appears in. It should be noted that a journal may be classified in more than one scientific subject field and so is the case for its publications. Furthermore, Greek publications were classified into 6 major scientific fields and their 42 sub-fields, according to the Frascati classification scheme. The Frascati classification scheme of fields of science and technology allows for data comparability with standard practices at an international context. It also provides a more consistent framework for the identification of major fields of science in which Greek Institutions were active. To this end, the 253 subject fields of the Thomson Reuters databases were mapped and included into the following major fields and sub-fields of science of the Frascati Manual (for further information on Frascati 6 major scientific fields and their 42 sub-fields see above in PhD theses).

It is to be noted that publication and citation practices vary among disciplines given that differences between fields of research exist in terms of citation practices, the life-span of publications, publishing and citation patterns.

For instance, in medicine and molecular biology the annual publication output is high and the level of citations increases significantly within a relative short time period following the publication. On the contrary, in the Social Sciences the publication rate is rather low and many studies may still be cited decades after their release. In the Humanities, the greatest part of publications is books, monographs and articles, often published in national journals, usually undetected by international databases.

Citation Impact Indicators: In bibliometric analysis, a range of indicators are used for evaluating the impact (or, influence) of the published work on the scientific community. These indicators are principally based on the number of citations of publications for a specific time period.

The citation impact, –a widely used indicator-, is the average number of citations per publication. The indicator is calculated as the ratio of the number of citations recorded for a specific time period to the total number of publications of the same time period.

A number of scientific studies have confirmed that factors such as the different citation practices in various scientific fields or the type of publication affect significantly the citation indicators. Hence, comparison between indicators of different scientific fields and sub-fields may lead to misleading results. To tackle the issue of different citation practices, it was decided to use the field normalised citation score.

The field normalised citation score or citation score is the key indicator used in this study to estimate the scientific excellence of the publications in relation to the world. The field normalised citation score was calculated using software developed by EKT allowing for calculations at the level of each publication for each of the 253 subject fields provided by the WoS database. More specifically, the number of citations of each of the unit's publications is normalised by dividing it with the world average of citations to publications of the same publication year and subject field. The citation score is the mean value of all normalised citation scores for the unit's publications. When the value of the citation score is greater than 1, the publications of the analysed unit have a greater impact than the world average.

Finally, it is to be noted that in order to avoid fragmented and invalid comparisons, a combined interpretation of bibliometric indicators is required on the part of the reader. Hence, when interpreting indicators such as the citation score or the percentage of highly cited publications, one has to also consider the number of publications as well as their systematic production over time.

Innovation Statistics

Data description

The indicators are selected from the national official Innovation Statistics (Community Innovation Survey) as produced by EKT according to EC Regulation 995/2012.

The Community Innovation Survey is the official statistical survey for measuring innovation in the European Union. It is carried out every two years in all EU member states using a common model questionnaire and in accordance with the European legislation, the methodological guidelines of the Oslo Manual and the recommendations of Eurostat. As a result, indicators of high quality which are comparable with other countries in the European Union are ensured.

The survey provides data concerning four types of innovation, innovation activities, introduction of new products to the enterprise and to the market, the role of the public sector in supporting innovation through procurement contracts, co-operations, strategies and obstacles met by enterprises in developing innovations.

This publication presents selected indicators from the survey on innovations and innovation activities of Greek enterprises for the three-year period starting from 2010 to 2012. Regional indicators have been produced on the basis of the regional distribution of the innovation activities of the actors, and not on the basis of the actor's registered office or central administration.

The full data series, metadata and related publications are published analytically via EKT's website http://metrics.ekt.gr/el/statistika-etak .

Concepts and Definitions

Measurement of innovation is made in accordance with the concepts and terms of the Oslo Manual, developed jointly by the OECD and Eurostat.

According to the Manual:

An innovation is the introduction of a new or significantly improved product (good or service), process, organizational method, or marketing method by an enterprise.

An innovation must have characteristics or intended uses that are new or which provide a significant improvement over what was previously used or sold by the enterprise.

An innovation need only be new or significantly improved for the enterprise itself. This condition covers, as an innovation for an enterprise, the production or implementation

of a process/method which has been originally developed by other enterprises or organisations, as long as it is used for the first time by that enterprise.

The following are the four types of innovation (an enterprise can develop more than one type):

Product innovation: the introduction to the market of a product, the characteristics or the intended uses of which are significantly improved. The term 'product' refers to either a good or a service.

Process innovation: the implementation of a new or significantly improved production process, delivery method or supporting activity for the processes of the enterprise.

Organisational innovation: the implementation of a new organisational method in the enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by the enterprise.

Marketing innovation: the implementation of a new marketing concept or strategy that differs significantly from the enterprise's existing marketing methods and which has not been used before. Such an innovation would show significant changes in product design or packaging, product placement, product promotion or pricing.

A common characteristic of an innovation is that it must have been implemented. Product innovation is implemented when the product is introduced to the market. New processes, marketing methods or organizational methods are implemented when they are brought into actual use in the enterprise's operations.

Innovation activities include all scientific, technological, organisational, financial and commercial actions which actually, or are intended to, lead to the implementation of product and/or process innovations.

Innovation activities include all types of R&D activities, as well as the acquisition of machinery, equipment buildings, software and licenses. Engineering and development work, design, training and marketing are also included when they are specifically undertaken to develop and/or implement a product and/or process innovation.

Legal Framework

Data collection for the Community Innovation Survey is carried out in compliance with the Decision 1608/2003/ EC of the European Parliament and of the Council concerning the production and development of Community statistics on science and technology, and the Commission Implementing Regulation (EU) 995/20125.

The Implementing Regulation defines the data to be collected, the activities and sectors to be covered by the survey as well as the frequency of data collection, the deadlines for the data submission to Eurostat and the survey reference period.

The official Greek statistics for Innovation and Research & Development are produced by the National Documentation Centre (EKT) / National Hellenic Research Foundation

(NHRF) following the decision of the General Secretariat for Research and Technology (Government Gazette 1359/vol. B/25.04.2012)6.

The collection of the data presented in this publication was made in collaboration with the Hellenic Statistical Authority - ELSTAT (Memorandum of Understanding of 28.01.2014 and Memorandum of Understanding of 04.06.2015).

Survey population

The target population of the CIS survey for the three-year period 2010-2012 was the total population of enterprises with 10 or more employees in any of the following sectors of economic activity:

Sector of economic activity (NACE rev.2)	
Industry	B (05-09): Mining and Quarrying
	C (10-33): Manufacturing
	D (35): Electricity, gas, steam and conditioning supply
	E (36-39): Water supply; Sewerage, waste management and remediation activities
Services	G (46): Wholesale trade, except for motor vehicles and motorcycles
	H (49-53): Transportation and storage
	I (58-63): Information and communication
	K (64-66): Financial and insurance activities
	M (71-73): Professional, scientific and technical activities (Architectural and engineering activities; technical testing and analysis / Scientific research and development / Advertising and market research)

According to the national statistical business register, which is maintained by the Hellenic Statistical Authority, the population of the survey was 14 987 enterprises. The following table lists them in the two main sectors of economic activity (Industry & Services) and the three size classes of enterprise based on the number of employees (10-49, 50-249 and 250 or more).

	10 to 49 employees	50 to 249 employees	250 employees or more	Total
Industry	6,092	790	150	7,032
Services	6,924	911	120	7,955
Total	**13,016**	**1,701**	**270**	**14,987**

Data Collection

Data for the Community Innovation Survey was collected by using a combination of census and sample survey. The statistical unit was the enterprise.

Enterprises with 500 or more employees and, in addition, known R&D performers (based on the results from the statistical survey on R&D carried out by EKT with reference to the year 2011) were surveyed by census.

Remaining enterprises of the target population were surveyed using a sample drawn from the statistical business register that is maintained by the Hellenic Statistical Authority (ELSTAT).

A one-stage stratified sampling was applied with the following stratification criteria for the enterprises:

- Regions (NUTS-2 level): total 13 regions
- Two-digit sector of economic activity: total 11 clusters (as presented in the above table)
- Size class of the enterprise: 10-49, 50-249, 250 and more employees

The size of the sample of enterprises was calculated according to the specifications and the precision levels recommended by Eurostat in the survey methodological guidelines.

In all, 4,212 enterprises from the population participated in the survey with 214 being covered by census and 3,998 comprising the survey sample.

EKT conducted the Community Innovation Survey in Greece in co-operation with ELSTAT.

The data collection was carried out using electronic questionnaires via a specially designed online platform developed by EKT, that is based on open-source technologies. Automatic procedures for monitoring the progress of the survey in real time and validating the collected data, based on predefined quality indicators, were implemented on a daily basis.

200 interviewers were drawn from the ELSTAT register of interviewers and were assigned to collect the data for the needs of CIS. The established network of co-operation with the interviewers as well as with the regional statistical offices of ELSTAT ensured the quality of the data collection and the optimisation of the fieldwork period.

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