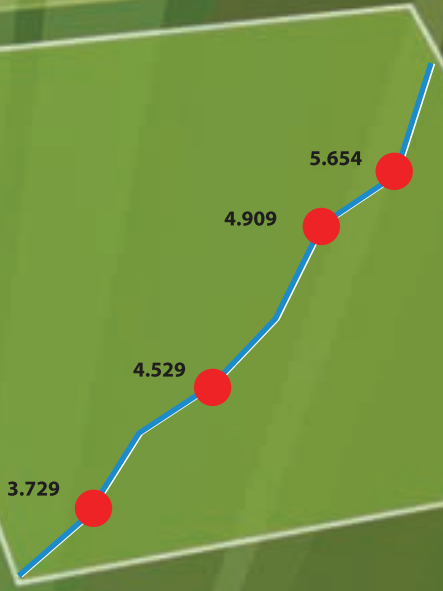
Greek Scientific Publications 1996 - 2010

A Bibliometric Analysis of Greek Publications in International Scientific Journals - Web of Science



ΕΘΝΙΚΟ ΚΕΝΤΡΟ ΤΕΚΜΗΡΙΩΣΗΣ
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Greek Scientific Publications 1996-2010

A Bibliometric Analysis of Greek Publications in International Scientific Journals - Web of Science

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Greek Scientific Publications 1996-2010

A Bibliometric Analysis of Greek Publications
in International Scientific Journals – Web of Science

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Data processing was enabled by software solutions which EKT developed to meet the requirements of this study. The software makes uses of a set of tools that allowed the calculation of bibliometric indicators as well as the presentation of data in a user friendly format. Dr Nikos Houssos was the supervisor of a team comprised of the following members:

• Dr Dimitris Karaiskos - software developer
• Costas Stamatis- data cleaning and control techniques
• Andreas Kalaitzis - developer of the study's electronic edition

Graphic Design: Mrs Dimitra Pelekanou

Translation and editing: Ms Maria Samara and Ms Ioanna Doutsou.

PROLOGUE

Greek Scientific Publications 1996-2010: Bibliometric analysis of Greek publications in international scientific journals" is the second edition of EKT's established study series which records scientific publishing activity in Greece and its international impact.

The study series –a result of collaborative work– aims to create a consistent ground for monitoring and presenting data for the research environment in Greece and thus to enable correlations with levels of research activity in EU and OECD countries. Our goal is to provide reliable evidence on the Greek research area, point to its strengths and contribute to a broader understanding of the potentials and challenges of Reseach and Development (R&D) in Greece.

Scientific publications are the main output of research activity. Research output is traditionally measured on the basis of the overall amount of scientific publications, its share in the international realm, the share of citations received, the number of scientific collaborations and a range of other indicators. However, scientific publications are only a part of a country's research output. Publications in national scientific journals, books, monographs, studies, conferences, patents, academic workshops are all valuable pieces of data which, if processed efficiently, provide a comprehensive picture of research activity at a country level. There is also a recent tendency to record additional data which emerges from online informational resources.

Among all these sources of data in research activity, scientific publications remain a basis for recording and mapping research activity at a national level. Following a long tradition, bibliometric indicators of scientific publications are metrics widely used as measures of scientific activity in a plethora of relevant studies issued by many countries. At the same time, methodologies are constantly evolving to address each country's particularities and needs.

This study produces widely used bibliometric indicators to describe reality in Greek research environment so that results can be further used at the level of policy making in research, technology and innovation.

Data was drawn from the Thomson Reuters databases. Since 2007, there is a lack of available data on Research and Development (R&D) which prevented us from producing additional research indicators which correlate a researcher's productivity and its share in available research funding. However, the General Secretary of Research and Technology (GSRT) is currently planning the collection of all essential data. The study's next edition will fully exploit this data to produce additional research indicators, similar to those found in equivalent studies at the European level.

The current study produced indicators and detailed data for 81 institutions across 8 categories. Along with indicators at the single level of institutions, the study also presents comparative figures regarding their performance. The creation of the study's electronic format was funded by NISRT (National Information System for Research and Technology- Social Networks/ User Generated Content). In the study's electronic edition, readers can access all relevant data and figures and gain a valuable interactive experience which enables them to comprehend results easily in a multimodal way.

Having realized that studies of this kind are relatively new and have evoked a number of debated issues at a national level which are still open to public discussion, we invite readers to submit their online comments at the end of each chapter. Our aim is to collect and publish these reviews so that we identify issues for further development and contribute to the public dialogue surrounding evaluation of research activity both at national and international level.

Evi Sachini

Head, Strategic Planning and
Development Department

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CHAPTER 1

SUMMARY

introduction

The study "Greek scientific Publications 1996-2010: bibliometric analysis of Greek publications in international scientific journals" is the second part of a series of studies undertaken by EKT with an aim to record and analyze Greek scientific activity in the international landscape. The study relies on a range of data related with Greek Publications –such as the amount of publications, citations received, their distribution across scientific fields and institutions – to produce indicators which characterize the country's research activity, describe progress and allow for further correlations with activity at EU and international level.

Bibliometric indicators provide significant information and contribute to a measurable and objective picture of the Research & Development systems. They are commonly used measures of research activity and performance in institutions, research centers, research groups or individual researchers. Moreover, they provide information about research activity across scientific fields, point to the emergence of new subject areas and map research networks created for the achievement of common scientific goals.

Bibliometric indicators are a valuable tool and form part of a broader system of indicators for the evaluation of research activity. It is a fact that an amount of published articles point to certain limitations of bibliometric analyses (e.g. differences in publications practices and citations across scientific fields such as for example the differences observed between the fields of medicine and humanities). However, these limitations can be overcome when bibliometric indicators are interpreted in the right contextual framework, taking into account additional data and statistics but also qualitative research outcomes.

The National Documentation Center (EKT) has applied a robust methodological approach and validation techniques in bibliometrics. It has also developed software tools which enabled the processing of data collected and the calculation of bibliometric indicators (data cleaning, processing and normalisation, distribution of publications across scientific fields and subfields, graphic representation).

The current study recorded the country's output in scientific publications and its performance during a period of fifteen years (1996-2010). To highlight recent trends and progressions, there is a special focus on data of the last five years of the period. The analysis was based on the methodological framework (e.g. databases, range of indicators, method of calculations, range of institutions and scientific fields) followed in the previous study published by EKT two years ago, so as to ensure consistency of calculations and results.

The indicators present the number and share (%) of publications, percentage (%) of cited publications, number and share (%) of citations, citation impact, field normalised citation score, number and percentile breakdown of the highly cited publications.

The following paragraphs summarise findings regarding the total output and performance of Greek publications, the main institution categories in which scientific activity is distributed, scientific fields with the greatest share of publications, scientific collaborations etc. Readers may find detailed information about data and figures throughout the chapters and read about the study's methodological approach in Annex I.

Greece in an international context

In 2009 and 2010, a small decline in the number of publications was observed. However, the number of citations that Greek publications received –the basis of bibliometric analyses- continued to increase and Greece strengthened its international position in terms of the impact, originality, quality, and visibility of scientific publications. Bibliometric indicators for this period were high, Greece's position among EU and OECD countries was also high, citation impact was growing and institutional performance was improved.

In more detail:

• The number of Greek publications displayed a steady increase from 1996 until 2008, outpacing annual growth rates of the EU and the OECD. However, this positive trend was reversed in 2009; the rate of change in Greek publications was almost zero that year, falling behind the average rate of change in the publications in the EU and OECD countries. The situation deteriorated in 2010, with a decline in the number of Greek publications higher than that observed in EU and OECD countries.

• In 2010, Greece's share of EU publications is 2.4% and of OECD publications was 1.14% –almost two-fold compared to 1996–. Greece ranked 20th among the 34 OECD countries.

• With regard to the number of citations, Greek publications surpassed the EU and OECD growth rate during 1996-2010. During the last 5-year period of this study 2006-2010, Greek publications received 222,132 citations, which is 4 times more than those received in 1996-2000.

• The average number of citations per publication (citation impact) gives an estimation of the impact of publications, especially at country level. During the last 5-year period 2006-2010, Greek publications received 4.49 citations on average approaching the EU (5.34) and OECD (5.43) averages. It is to be mentioned that in the previous study of EKT and for the 5-year period 2004-2008, an average of 3.82 citations per publication was recorded.

• The relative citation impact in 2006-2010 was equal to 0.84 in relation to EU countries (0.76 for the 5-year period 2004-2008) and 0.83 in relation to OECD countries (0.73 for the 5-year period 2004-2008). Greece was 22nd in terms of relative citation impact, when compared to that of OECD-34 countries.

• There was also an increase in the visibility and impact of Greek publications in the international community. In terms of figures, over the 5-year period 2006-2010, 65.5% of Greek publications received citations, which is close to the EU (66.3%) and OECD (66.5%) percentages for cited publications. In addition, 509 Greek publications were ranked among the top 1% of most cited publications worldwide, 2,393 publications in the top 5%, 4,591 publications in the top 10%, 11,024 publications in the top 25% and 20,190 in the top 50%. The percentile breakdown of top publications for Greece was 1%, 4.9%, 9.3%, 22.4% and 41%.

Key actors in the production of scientific publications

The study examined the scientific publications of eight major institution categories. More specifically, Greek institutions were classified into categories according to the sector of activities in which they belong –e.g. higher education, research, health services e.tc.-, as well as their legal status as public or private institutions.

The majority of Greek scientific publications were produced by "Universities", "Research Centers supervised by GSRT" and "Public Health Institutions". These were followed by "Technological Educational Institutes", "Other Public Research Centers", "Private Health Institutions", "Other Public Institutions" and "Other Private Institutions".

More specifically, over the period 2006-2010, Universities had a share of 82.5% in the total number of Greek publications (40,697 publications), "GSRT Research Centers" a share of 13.7% (6,755 publications), "Public Health Institutions" 11,5% (5,690 publications), "Technological Educational Institutes" 4.6% (2,263 publications), "Other Public Research Institutions" 3.3% (1,616 publications), "Private Health Institutions" 2.8% (1,393 publications), "Other Private Institutions" 1.8% (891 publications) and "Other Public Institutions" 1.1% (566 publications).

Most of the institution categories had a decline in their publication output in 2009 and 2010. The highest decline was observed in publications issued by "Public Health Institutions".

In the context of a general growth of indicators of Greek scientific activity, the visibility and impact of scientific publications measured during 1996-2010 had a positive course for all institution categories.

During the last 5-year period 2006-2010:

• "GSRT Research Centers" and "Private Health Institutions" had the highest percentage (%) of cited publications among all institution categories, being 74.2% and 70.9% respectively.

• "GSRT Research Centers" and "Private Health institutions" were above the world average in terms of publication impact, with field normalised citation scores 1.11 and 1.05 respectively.

• The number of highly cited publications, i.e. those classified among the top 1% publications worldwide, was 400 for "Universities", 89 for "GSRT Research Centers", 42 for "Public Health Institutions", 23 for "Private Health Institutions", 11 for "Other Public Research Institutions", 10 for "Technological Educational Institutes", 5 for "Other Private Institutions" and 6 for "Other Public Institutions".

• With regard to the percentage of the highly cited publications in each institution category, "GSRT Research Centers" showed a better performance than the world average for all the percentile levels examined 1%, 5%, 10%, 25% and 50%, being 1.3%, 6.8%, 12.6%, 29.2% and 50.9%. "Private Health Institutions" were above the world average for percentile levels 1%, 5% and 10%. "Universities" and "Other Public Institutions" approached the world average for 1% and 10%.

Key scientific fields of Greek publications

With an aim to identify the key scientific fields in which Greek research activity takes place, Greek publications were classified into six major scientific fields: "Natural Sciences", "Engineering & Technology", "Medical & Health Sciences", "Agricultural Sciences", "Social Sciences" and "Humanities" and their subcategories as defined in the Revised Field of Science and Technology Classification in the Frascati manual / OECD (Annex III).

The majority of Greek scientific publications came from the field of "Natural Sciences" (a share of 48.9% in 2010) followed by "Medical & Health Sciences" (39.4%), "Engineering and Technology" (23.6%), "Social Sciences" (6.3%), "Agricultural Sciences" (3.3%) and Humanities (1.5%).

During 1996-2010, Greek publications in the "Natural Sciences" were continuously decreasing. There was a growth in publications from the field of "Medical & Health Sciences" and "Social Sciences". The number of publications in "Engineering and Technology", "Agricultural Sciences" and the "Humanities" remained stable.

During the last 5-year period 2006-2010:

• In all six major scientific fields, the impact of publications improved considerably when compared to the 5-year period 2004-2008 (findings of EKT's previous study). The field-normalised citation score in the field of "Agricultural Sciences" was the highest (0.97), followed by the "Natural Sciences" (0.92), the "Engineering and Technology" (0.87), the "Medical and Health Sciences" (0.86), the "Social Sciences" (0.78) and the "Humanities" (0.54).

• The top performing scientific subfields were the following: in "Natural Sciences" the subfield of "genetics & heredity" with citation score of 1.41, in "Engineering and Technology" the subfield "materials science, composites" (1.23), in "Medical and Health Sciences" the subfield "rheumatology" (1.51), in "Agricultural Sciences" the subfield "agricultural engineering" (1.48) and in "Social Sciences" the subfield "anthropology" (1.59).

• As regards the institution categories that excel in each major scientific field, citation scores above the world average were observed in the following cases: in the field of "Natural Sciences" for the (low number of) publications by "Private Health Institutions" (2.1) and the publications of the "GSRT Research Centers" (1.07); in the field of "Engineering & Technology" for the publications of "GSRT Research Centers" (0.99); in the field of "Medical & Health Sciences" for the publications of "GSRT Research Centers" (1.09), "Private Health Institutions" (1.05) and "Other Public Research Institutions" (1.03); finally, in the field of "Agricultural Sciences" for the publications of "GSRT Research Centers" (1.07).

Scientific Collaboration

The collaboration degree in Greek publications showed a clear increasing trend over the period 1996-2010, both at national and international level.

• In 2010, co-publications accounted for 67.2% of the total Greek publications output, compared to only 49.3% in 1996. This figure was close to the average EU and OECD. 42.3% of Greek publications involved international collaborations while 35.3% national collaborations.

• During the period 1996-2010, there was a remarkable rise in national collaborations, which may be partially explained by an increasing national funding for research collaborative work. After 2008, national collaborations remained stable.

• An increasing trend was also observed in international collaborations, occurring, nevertheless, at a slower pace when compared to national collaborations. During the 5-year period 2006-2010 Greek researchers collaborated with researchers from 154 countries around the world. Greece's main partners were the United States, the UK, Germany, France and Italy.

• The level and type of collaboration varies significantly for the different institution categories. The share of publications with no collaboration is particularly high for Universities, accounting for 38.5% over the last 5-year period 2006-2010. "GSRT Research Centers" had the highest international networking activity, accounting for 52.7% of international collaborations during the last 5-year 2006-2010. Finally, national collaboration holds a significant place in all institution categories; "Private Health Institutions" ranked first (78.5% during 2006-2010) in these type of co-publications.

• The majority of publications produced by national collaborations included Universities as partners. Universities have particularly strong collaborative links with "GSRT Research Centers" and "Public Health Institutions".

Universities

Number and share of (%) publications: The greatest number of publications in the category "Universities" is attributed to the National and Kapodistrian University of Athens and the Aristotle University of Thessaloniki. The National & Kapodistrian University of Athens accounted for 11,311 publications and had a share of 27.8% in the category, while the Aristotle University of Thessaloniki accounted for 8,577 and had a share of 21.3%. The University of Patras (12.3%) and the National Technical University of Athens (10.5%) had a share higher than 10%.

Change in the number of publications: Between 2006 and 2010, there was a rise in the number of publications in 17 out of 20 Universities. In 5 Universities the rate of change increased above the average rate for the "Universities" category (the University of Western Macedonia, the University of Peloponnese, the Harokopio University of Athens, the University of Piraeus and the University of Macedonia of Economic and Social Sciences).

Percentage (%) of cited publications: This indicator was higher than the Greek average (65.5%) for the publications of the University of Crete (74.2%), the Agricultural University of Athens (70.8%), the Harokopio University of Athens (70.3%), the University of Ioannina (69.8%), the National & Kapodistrian University of Athens (68.4%), the University of Thessaly (66.4%), and the University of Patras (66.3%).

Number and share (%) of citations: The higher number of citations was attributed to Universities with the higher number of publications - the National & Kapodistrian University and the Aristotle University of Thessaloniki-. The former had 58,803 citations and a share of 32.9% within the category of "Universities, while the latter had 32,457 publications and a share of 18.2%.

Citation impact indicators*: The Technical University of Crete, the University of Crete, the University of Ioannina and the Harokopio University of Athens ranked first, exceeding the world average (filed normalised citation scores 1,11, 1,08, 1,04 and 1,01 respectively).

* The indicator refers to the impact (field normalised citation score) for the total publications output of each University. In chapter 4, one can find detailed information regarding the citation scores in different scientific fields and subfields (per University).

Number of highly cited publications: During 2006-2010, 16 Universities presented publications ranked among the 1% most highly cited publications worldwide. The National & Kapodistrian University of Athens (124 publications), the University of Ioannina (62 publications) and the Aristotle University of Thessaloniki (60 publications) were the top performers.

Percentile Breakdown of Top X (%) publications: The University of Crete, the University of Ioannina and the Technical University of Crete were above the world average at the percentile levels 1%, 5%, 10% and 25%, as well as the University of Central Greece, although having a small number of publications; the National & Kapodistrian University of Athens at the 1% and 5% levels; the University of Piraeus and the Harokopio University of Athens at the 1% level; the Agricultural University of Athens at the 5% level.

Major scientific fields and impact of publications*: In "Natural Sciences", 18 out of 21 Universities demonstrated an increasing trend in their number of publications. The highest citation score (1.37) was achieved by a small number of publications produced by the Harokopio University of Athens/HUA. In addition, the citation scores exceeded the world average in the following cases: the University of Crete/UOC (1.22), the Technical University of Crete/TUC (1.09), the University of Ioannina/UOI (1.00). The National & Kapodistrian University of Athens/UOA and the University of Patras/UOP were approaching with citation scores above 0.98 and 0.94 respectively.

Sixteeen Universities were active in "Engineering & Technology". The publications with citation scores higher than the world average baseline were those of the University of Crete/UOC (1.31), the Agricultural University of Athens/AUA (1.18), the Technical University of Crete/TUC (1.13), the University of Piraeus/UNIPI (1.05), the University of Western Macedonia/ UOWM (1.01), the University of Ioannina/ UOI (1.00) and the Athens University of Economics and Business/AUEB (0.95).

The majority of publications in "Medical & Health Sciences" came from 10 Universities. Publications with the highest citation scores were those of the Agricultural University of Athens/AUA (1.15), the University of Ioannina/UOI 1.11), the Harokopio University of Athens/HUA (0.96) and the University of Crete/UOC (0.90).

In "Agricultural Sciences" publications emerged mainly from 9 Universities - thus explaining the rise in citation scores during 2006-2010- the highest citation scores were reached by a relatively small number of publications. Those were attributed to the National Technical University of Athens/NTUA (1.57), the University of Patras/UOP (1.41) and the University of Ioannina/UOI (1.24). The citation scores of publications by the Agricultural University of Athens/AUA (1.01), the Aristotle University of Thessaloniki/AUTH (0.97) and the University of Thessaly/UTH (0.93) were close to the world baseline.

In "Social Sciences" there was a large number of active Universities (15 out of 21) but with a much lower publication output relatively to other scientific fields. Overall, the citation scores have improved when compared to the findings of the 5-year period 2004-2008. The publications of the following institutions reached above world average: the University of Piraeus/UNIPI (1.20), the Demokritos University of Thrace/DUTH (1.06), the Technical University of Crete/TUC (1.06), the University of Ioannina/UOI (1.02) and the National Technical University of Athens/NTUA (1.01). The citation score of the Harokopio University of Athens/HUA (0.93) was approaching the world average.

Finally, only three Universities were found to systematically produce publications in the field of "Humanities". Aristotle University of Thessaloniki/AUTH was the University with the highest citation score (0.82).

Scientific Collaboration: Universities had low degrees of collaborations. Many produced their publications based on their own resources, as for example the National Technical University of Athens which had the highest percentage of publications with no collaboration (44.6%). In most of the Universities the national collaboration is higher than the international. The degree of national collaboration is above 50% for eleven (out of the twenty one) Universities while the degree of international collaboration is above 50% only in the Univeristy of Crete.

TEI

Number and share (%) of publications: Among all TEIs in the country, the TEIs of Athens, Crete and Thessaloniki produced the greatest number of publications. During the last 5-year period of the study, the ranking of TEIs in terms of the number of publications and the share in the total number of publications in the relevant category, in descending order, is as follows: TEI of Athens 480 (21.2%), TEI of Crete 373 (16.5%), TEI of Thessaloniki 331 (14.6%). The shares regarding publication activity in the rest of TEIs was less than 10%.

Change in the number of publications: Between 2006 and 2010, 12 out of 16 TEIs accounted for notable growth in their publication figures. However, their annual output of scientific publications remained relatively low and variable over time.

*The field-normalised citation score was calculated only for Universities with more than 75 publications for the period 1996-2010, which is more than 5 publications per year.

Percentage (%) of cited publications: During the five years 2006-2010, the publications of the TEI of Epirus achieved a percentage of cited publications (66,7%) which is greater than the average for Greece. The TEI of Epirus was followed by the TEI of Crete (65,4%).

Number and share (%) of citations: The following TEIs had the highest number of citations and share of citations for relevant categories: Crete (27.5%; 1,601 citations), Athens (20.7%; 1,204 citations) and Thessaloniki (10.6%; 619 citations). The remaining TEIs had a share of less than 5%.

Citation impact indicators*: Regarding citation impact indicators, the TEIs of Patras (1.25) and Epirus (1.05) were above the world average, while the TEIs of Crete (0.93) and West Macedonia (0.90) –although high–, did not exceed the world baseline.

Number of highly cited publications: The TEIs of Athens, Western Macedonia, Epirus, Kavala, Crete, Patras and Chalkida produced publications among the 1% most cited publications worldwide (1-3 publications per TEI).

Major scientific fields and impact of publications:** Fourteen out of the sixteen TEIs excelled in terms of their publication numbers in the field of "Natural Sciences" over time. The publications of the TEI of Patras, although low in number, had the highest impact (field-normalised citation score: 1.74). The TEIs of Western Macedonia (0.94), Crete (0.93) and Kavala (0.92) had an increasing field-normalised citation score, but it remained below the world average.

Eleven TEIs were systematically active in the scientific field "Engineering & Technology". The field-normalised citation scores of publications for the TEIs of Patras (1.27) and Serres (1.14) surpassed the world average, whereas it was still rather high for publications produced by the TEI of Western Macedonia (0.99).
The higher volume of publication output in "Medical & Health Sciences" came from the following TEIs: Crete (1.11), Thessaloniki (0.92) and Athens (0.77).
"Agricultural Sciences" was the field linked to the publishing profile of 3 TEIs whose field normalised citation scores were 1.05 (Epirus), 0.97 (Thessaloniki) and 0.74 (Larissa).

Scientific Collaboration: The number of joint publications was higher with domestic partners than with international partners. More than 60% of co-publications were recorded with national partners for all TEIs; the TEI of Kalamata had the highest ranking (91.8%). ASPAITE (5.4%) and the TEI of Lamia (45.7%) accounted for the lowest and the highest share of publications with international partnerships, respectively, and the TEI of Piraeus (34.5%) ranked first for the number of publications without collaboration.

Research Centers supervised by GSRT

Number and share (%) of publications: The top performing institutions in terms of published output were the "Foundation for Research and Technology – Hellas" (FORTH) and the National Center of Scientific Research, DEMOKRITOS. During the 5-year period 2006-2010, NCSR DEMOKRITOS had 2,101 publications and participated in 31.1% of the publications in the category "GSRT Research Centers" and FORTH had 2,073 publications, participating in 30.7% of the publications in this category. As for the remaining Research Centers, their share accounted for less than 10%.

Change in the number of publications: Comparing the rate at which the number of publications changed from 2006 to 2010, we note that 8 Research Centers had a positive trend over time, while the number of publications for the Biomedical Sciences Research Center "Alexander Fleming" and the Hellenic Pasteur Institute was above the average for institutions in that category.

Percentage (%) of cited publications: For all Research Centers, with the exception of ATHENA, this figure was high, ranging from 66.3% to 80.4%, and above the Greek average of 65.5%.

Number and share (%) of citations: FORTH had 15,307 citations and a proportion of the citations to publications of 37.9%, NCSR DEMOKRITOS had 11,525 citations and a share of 28.5%, and NHRF had 4,348 citations and a share of 10.8%. As for the remaining Research Centers, their share amounted to less than 10%.

Citation impact indicators *:** Eleven out of twelve GSRT Research Centers ranked first in the relative citation impact of their publications, approaching or exceeding the global average. The relatively low number of publications by the Biomedical Sciences Research Center "Alexander Fleming" accounted for the highest citation score (1.43)

* The indicator refers to the impact of publications. In chapter 5, you can find detailed information regarding publications in each major scientific field (per TEI).

** The field-normalised citation score was calculated only for TEIs with more than 50 publications for the period 1996-2010.

*** Αφορά την απήχηση του συνόλου των δημοσιεύσεων κάθε Ερευνητικού Κέντρου. Οι εξειδικευμένες θεματικές περιοχές στις οποίες διακρίνεται το κάθε Ερευνητικό Κέντρο παρουσιάζονται στο αντίστοιχο αναλυτικό κεφάλαιο της μελέτης.

which was followed by that of the Foundation for Research and Technology – Hellas (1.24). The citation score of the following Centers was also rather high: The Center for Research And Technology Thessaly (citation score: 1.13), the Hellenic Pasteur Institute (citation score: 1.11), the National Center of Scientific Research DEMOKRITOS (1.01), the Center for Research and Technology Hellas (1.00), the Hellenic Center for Marine Research (0.97), the National Observatory of Athens (0.94) and the National Hellenic Research Foundation (0.93).

Number of highly cited publications: Publications among the 1% most highly cited publications worldwide were produced by FORTH (36 publications), NCSR DEMOKRITOS (27), HCMR (6), B.S.R.C. Fleming (5), NHRF (4), HPI (4), NOA (3), CERTH (2), ATHENA (2) and CE.RE.TE.TH (1).

Top X% publications (percentile breakdown): B.S.R.C. Fleming, FORTH and NCSR DEMOKRITOS surpassed the world baseline (top 1%, 5%, 10%, 25% and 50% of most cited publications worldwide), as did CERTH (top 5%, 10%, 25% and 50%), HCMR (top 1%, 5% and 10%), ATHENA and HPI (top 1%, 5%), CE.RE.TE.TH (top 1%), GAEC (top 5%) and NHRF (top 50% of most cited publications worldwide).

Major scientific fields and impact of publications*: The field-normalised citation score seems to climb towards or above the world average in the majority of publications by Research Centers.

In the field of "Natural Sciences", the number of publications came from 9 of the 11 Research Centers. The Centers with a field-normalised citation score ranging from 0.89 to 1.42 were: B.S.R.C. Fleming (1.42), FORTH (1.27), NCSR DEMOKRITOS (1.05), NOA (0.97), HCMR (0.95), HPI (0.95), NHRF (0.91) and CERTH (0.89).
Six Research Centers were active in the scientific field "Engineering & Technology". The publications with an impact higher than the world average baseline were those of CERTH and FORTH (field-normalised citation score for both was 1.10), while those of NCSR DEMOKRITOS were close to it (0.97).
The higher volume of publication output in "Medical & Health Sciences" came from 6 Research Centers, and the dominant ones, in terms of impact above the world average baseline, were B.S.R.C. Fleming (1.46), FORTH (1.39), CERTH (1.31), HPI (1.28) and NHRF (1.07). The score of NCSR DEMOKRITOS was 0.81.
"Agricultural Sciences" was the field represented better only for HCMR, accounting for a field-normalised citation score of 1.05.
Scientific Collaboration: The networking activity, in terms of the number of publications with partnerships, was high for the majority of Research Centers. GSRT Research Centers present a high degree of international co-authorship and have only a few publications without partnerships. Publications with international collaboration were higher than those with Greek-based institutions in the case of four Research Centers (B.S.R.C. Fleming, NOA, NHRF and and HCMR). B.S.R.C. Fleming showed the sharpest pattern of association with international institutions in publications (66%). HCMR (45.7%) and CE.RE.TE.TH (91.6%) accounted for the lowest and highest share of publications with national collaboration, respectively, while CERTH (79.6%), FORTH (75.7%) and ATHENA (71.8%) all had a share of over 70%.

Other Public Research Institutions

Number of publications: The National Agricultural Research Foundation and the Academy of Athens stood out in this category, as their publications output was 617 and 608 respectively. These were followed by the Benaki Phytopathological Institute (149), the Research Academic Computer Technology Institute (113), the Institute of Geology and Mineral Exploration (55), the Center for Renewable Energy Sources and Saving (45), the Institute of Engineering Seismology & Earthquake Engineering (25), and the Center of Planning and Economic Research (21).

Change in the number of publications: Regarding the rate at which the number of publications changed from 2006 to 2010, we note that there was growth (rate of change >1) for 4 Public Research Institutions (KEPE, Academy of Athens, IGME and ITSAK).

Percentage (%) of cited publications: The Academy of Athens (73.7%), CRES (68.9%) and BPI (67.1%) presented a higher performance than the world average (65.5%).

Number and share (%) of citations: During 2006-2010, the Academy of Athens had 3,797 citations; the National Agricultural Research Foundation had 1,780, BPI 350, IGME 121, CRES 120, RA-CTI 107, ITSAK 36 and KEPE 28.

Citation impact indicators **: The values of the field-normalised citation score were above the world average in the case of the Academy of Athens (1.08) and CRES (1.03) -the latter having a small number of publications-.

* The indicator refers to the impact of publications. In chapter 6, you can find detailed information regarding publications in each major scientific field (per Research Center).

** The field-normalised citation score was calculated only for Research Centers with more than 75 publications for the period 1996-2010, which is more than 5 publications per year.

Number of highly cited publications: Publications among the 1% most highly cited publications worldwide were produced by the Academy of Athens (5), the National Agricultural Research Foundation (4), BPI (1) and KEPE (1).

Top X% publications (percentile breakdown): Institutions surpassing the world baseline were the Academy of Athens (top 1%, 5%, 10%, 25% and 50% of most cited publications worldwide) and CRES (top 5% and 10%).

Major scientific fields and impact of publications*: In the area of "Natural Sciences", the Academy of Athens, BPI, the National Agricultural Research Foundation, IGME and RA-CTI accounted for the highest number of publications. The field-normalised citation score was above the world average for the Academy of Athens (citation score: 1.07), while the National Agricultural Research Foundation was close to it (citation score: 0.91).
Four Public Research Institutions were active in the scientific field "Engineering & Technology" (CRES, National Agricultural Research Foundation, Academy of Athens and RA-CTI. The field-normalised citation score was high for CRES (1.03), despite its small number of publications.
The higher volume of publication output in "Medical & Health Sciences" came from the Academy of Athens and the National Agricultural Research Foundation. The field-normalised citation score (1.17) for the Academy of Athens exceeded the world baseline average.
"Agricultural Sciences" was the field of highest representation only for the National Agricultural Research Foundation.

Scientific collaboration: The degree of national collaboration was higher than that for international collaboration for all 8 Research Centers, while they had no collaboration in a small number of publications. More than 50% of co-publications were recorded with national partners for all Research Institutions; the Research Academic Computer Technology Institute has the highest ranking (93.8%). RA-CTI (23.8%) and the Academy of Athens (53.9%) account for the lowest and the highest share of publications with international partnerships.

Public Health Institutions

Number and share (%) of publications: This study provided analytical bibliometric data for 16 institutions. The volume of articles published by the Evaggelismos Hospital in Athens (EVAGGELISMOS) was consistently the highest in the "Public Health Institutions" category over the period 1996-2010 (497 publications and a share of 8.7%).

Change in the number of publications: The rate of change in publication output in the "Public Health Institutions" category, between 2006 and 2010, was higher for the following hospitals: the SOTIRIA General Hospital of Athens (SOTIRIA), IPPOKRATEIO THESSALONIKI, the G. Gennimatas General Hospital of Athens (G. GENNIMATAS), the G. Papanikolaou General Hospital of Thessaloniki (G. PAPANIKOLAOU) , the Hospitals supervised by Ministry of National Defense (MOD HOSPITALS), the G. PAPAGEORGIOU General Hospital (G. PAPAGEORGIOU) and the Evaggelismos Hospital of Athens (EVAGGELISMOS).

Percent (%) of cited publications: Throughout the period 1996-2010, the number of citations of publications produced by the hospitals varied from 61% (for the G. PAPAGEORGIOU General Hospital G. PAPAGEORGIOU) to 76% (for the IPPOKRATEIO General Hospital of Athens -IPPOKRATEIO ATHENS).

Number and share (%) of citations: An examination of citation output and the share of citations for each institution in the "Public Health Institutions" category in the period 2006-2010 showed that the Evaggelismos Hospital of Athens-EVAGGELISMOS- (2,263 citations and share of 8.4%) came first.

Citation impact indicators **: The citation score of the G. PAPAGEORGIOU General Hospital (G. PAPAGEORGIOU) was the highest (0.99) and approaches the world average. Other hospitals with citation scores above 0.90 were the IPPOKRATEIO General Hospital of Thessaloniki (0.93), the G. Papanikolaou General Hospital of Thessaloniki (0.92) and G. Gennimatas General Hospital of Athens (0.92).

Number of highly cited publications: Although health institutions (14) had a few publications (1-3), those were among the 1% most highly cited publications worldwide.

Top X% publications (percentile breakdown): Publications surpassing the global average of top 1%, 5%, 10%, 25% and 50% of most cited publications worldwide were the G. Papanikolaou General Hospital of Thessaloniki (top 1%, 5% and10%), the G. PAPAGEORGIOU and SOTIRIA General Hospital of Athens (top 1% and 5%), the IPPOKRATEIO General Hospital of Thessaloniki (top 1%) and the THEAGENIO Cancer Hospital of Thessaloniki (top 5%).

* The indicator refers to the impact of publications. In chapter 7, you can find detailed information regarding publications in each major scientific field (per Public Research Institution).

** The field-normalised citation score was calculated only for Public Research Institutions with more than 75 publications for the period 1996-2010, which is more than 5 publications per year.

Major scientific fields and impact of publications**: Public health institutions were mostly active in the scientific field "Medical & Health Sciences". In this field, the publications with an impact higher than the world average baseline were those of the G. PAPAGEORGIOU General Hospital (citation score 1.04). Papanikolaou General Hospital of Thessaloniki (0.92) and the IPPOKRATEIO General Hospital of Athens (0.92). also had a field-normalised citation score above 0.90.

The following hospitals displayed a low number of publications in the field of "Natural Sciences": "Agios Savvas" Regional Hospital for Cancer Treatment (AGIOS SAVVAS), the General Hospital of Athens LAIKO (LAIKO), the Evaggelismos Hospital of Athens (EVAGGELISMOS) and the "Aghia Sophia" Children's Hospital (AGHIA SOPHIA). In the same field, the "Agios Savvas" Regional Hospital for Cancer Treatment (AGIOS SAVVAS) and the LAIKO General Hospital of Athens (LAIKO) accounted for publications with a field-normalised citation score equal to the global average, defined as 1.

Scientific Collaboration: The majority of publications result from national collaborations, occurring in over 70% of total publications, as is the case for the Tzaneio General Hospital of Piraeus (TZANEIO). The share of publications produced as a result of international collaboration was much lower and ranged from 12.8% (the Metaxa Cancer hospital of Piraeus) to 33.2% (the Onassis Cardiac Surgery Center).

Private Health Institutions

Number and share (%) of publications: HENRY DUNANT hospital (HENRY DUNANT), Alfa Institute of Biomedical Sciences (AIBS) and HYGEIA Group (Hygeia) stood out in this category in terms of their publication output, which was 385, 329 and 209 respectively. Their share of publications in the category "Private Health Institutions", was equal to 27.6%, 23.6% and 15%, respectively. Fewer publications were produced by the Hellenic Cooperative Oncology Group - HeCOG (44) and the St. Luke's Hospital - St. LUKE (32).

Change in the number of publications: The rate of change in the publications of St. Luke's Hospital (St. LUKE) and the Hellenic Cooperative Oncology Group (HeCOG) exceeded that of the category "Private Health Institutions", between the years 2006 and 2010.

Percentage (%) of cited publications: In the period 2006-2010, the Alfa Institute of Biomedical Sciences (AIBS), the HENRY DUNANT hospital (HENRY DUNANT) and the Hellenic Cooperative Oncology Group (HeCOG) accounted for a share of 83.3%, 79.5% and 77.3%, respectively, exceeding the Greek average of 65.5%.

Number and share (%) of citations: As regards the citations and the share of citations of the category "Private Health Institutions", the HENRY DUNANT hospital (HENRY DUNANT) ranks first over the period 2006-2010, with 4,858 citations and a share of 48.3%, and is followed by the Alfa Institute of Biomedical Sciences (AIBS), accounting for 2,810 citations and a share of 28%, and the HYGEIA Group, with 1,103 citations and a share of 10.1%. The rest institutions in the category accounted for a share of less than 5% of the citations (Figure 9.2.3).

Citation impact indicators*: The citation score was the highest for the HENRY DUNANT hospital - HENRY DUNANT (1.65) and the Alfa Institute of Biomedical Sciences - AIBS (1.46), surpassing the world average.

Number of highly cited publications: During 2006-2010, an amount of fifteen publications from the HENRY DUNANT hospital (HENRY DUNANT), five publications from the Alfa Institute of Biomedical Sciences (AIBS) and one from the HYGEIA Group (Hygeia) were among the 1% most highly cited publications worldwide during the period 2006-2010.

Top X% publications (percentile breakdown): The HENRY DUNANT hospital (HENRY DUNANT) and the Alfa Institute of Biomedical Sciences (AIBS) surpassed the global average of the top 1%, 5%, 10%, 25% and 50% of most cited publications worldwide..

Major scientific fields and impact of publications:** Private Health Institutions were principally active in the scientific field "Medical & Health Sciences". The publications with an impact higher than the world average baseline were those of HENRY DUNANT (citation score 1.64) and AIBS (1.39).
In the field of "Natural Sciences", there was a low number of publications mainly from HENRY DUNANT and AIBS, with a field-normalised citation score of 1.70 and 1.68 respectively.

Scientific Collaboration: There was a high share of publications resulting from national and international collaboration, with the highest level occurring in AIBS (97.3%) and IASO (88.2%) respectively.

* The indicator refers to the impact of publications. In chapter 9, you can find detailed information regarding publications in each major scientific field (per Private Health Institution).

** The field-normalised citation score was calculated only for Public or Private Health Institutions with more than 75 publications for the period 1996-2010,which is more than 5 publications per year.

This chapter presents the bibliometric indicators for the total scientific output of Greece -as recorded in the National Science Indicators database of the Web of Science- and compares the yield of research publications to that of the EU-27 and the OECD-34 countries*. It provides an outlook on the productivity and performance regarding Greece's publications over the 15-year period 1996-2010, and highlights recent growth trends.

The table below summarises bibliometric indicators for Greek publications for the most recent 5-year period (2006-2010). It also shows their growth compared to the 5-year period, 2004-2008, which was presented in the previous study published by EKT in 2010.

* In 2010, the OECD was enlarged with 4 new member states: Estonia, Israel, Slovenia and Chile. The phrase "OECD-34" refers to the 34 countries in the OECD, during the period under review (Annex V).

CHAPTER 2

GREEK SCIENTIFIC PUBLICATIONS: INDICATORS AND CHARACTERISTICS

PUBLICATIONS	2008	2010
Number of Greek publications	10.625	10.219
Share (%) of Greek publications in EU countries	2,48%	2,40%
Share (%) of Greek publications in OECD countries	1,17%	1,14%
CITATIONS	**2004-2008**	**2006-2010**
Number of citations to Greek publications	167.274	222.132
Share (%) of Greek citations in EU	1,78%	2,06%
Share (%) of Greek citations in OECD	0,80%	0,95%
CITATION IMPACT	**2004-2008**	**2006-2010**
Citation Impact (average number of citations per publication	3,83	4,49
Relative citation impact of publications from Greece compared to EU	0,76	0,84
Relative citation impact of publications from Greece compared to OECD	0,74	0,83

2.1 Publications

According to the National Science Indicators database, there were 10,219 Greek publications in international scientific journals registered in the Web of Science in 2010. Greece's yield of research publications shows decreasing trends and has slipped from 10,625 publications in 2008 to 10,579 in 2009 and, eventually, to 10,219 in 2010 (Figure 2.1.1).

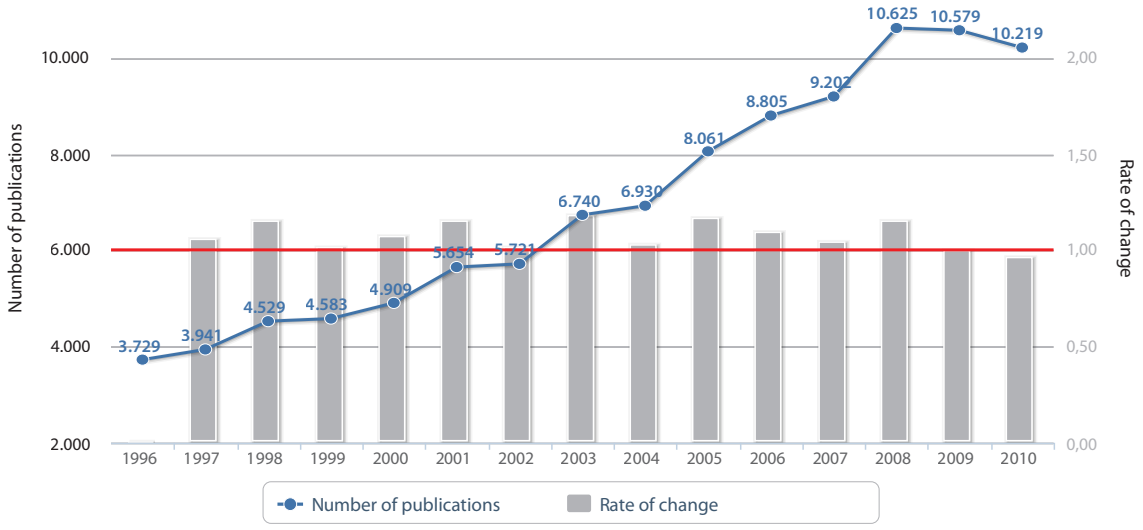


Figure 2.1.1 Development of the number of Greek scientific publications, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

The number of Greek publications displayed a steady increase from 1996 until 2008, outpacing annual growth rates of the EU and the OECD (Figure 2.1.2). However, this positive trend was reversed in 2009; the rate of change in Greek publications was almost zero that year, falling behind the average rate of change in the publications in the EU and OECD countries. The situation deteriorates in 2010, with a decline in the number of Greek publications higher than that observed in EU and OECD countries.

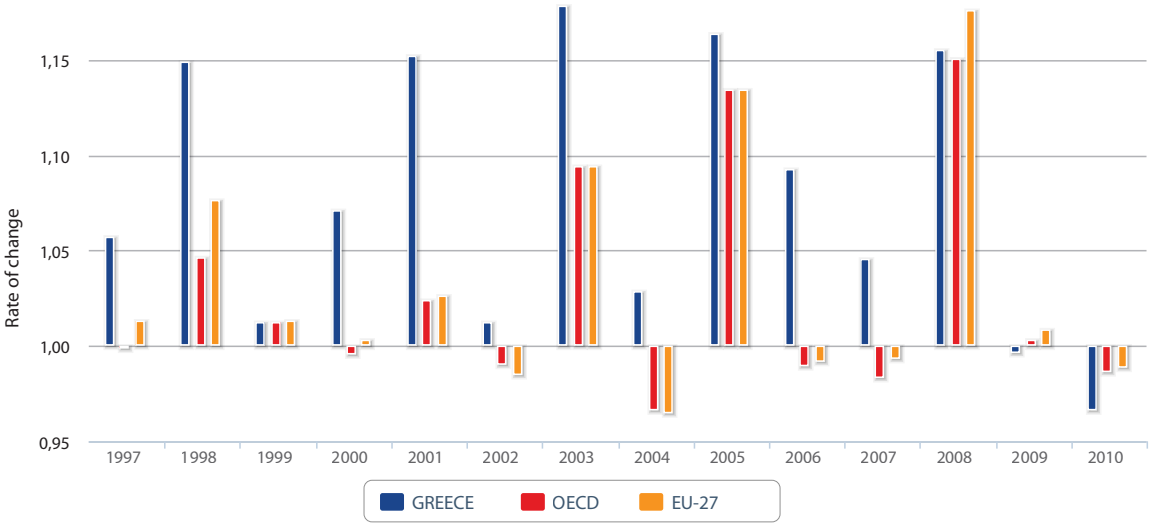


Figure 2.1.2. Change in the number of publications in Greece, EU and OECD, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

During the 15 year period 1996-2010, Greece exhibits a remarkable growth rate in its publishing volumes and is ranked 8th among the OECD-34 countries. More specifically, featuring 10,219 publications in 2010 compared to only 3,729 publications in 1996, Greece presents a rate of change equal to 2.74, above the average rate of change for the EU (1.54) and the OECD countries (1.41) (Figure 2.1.3).

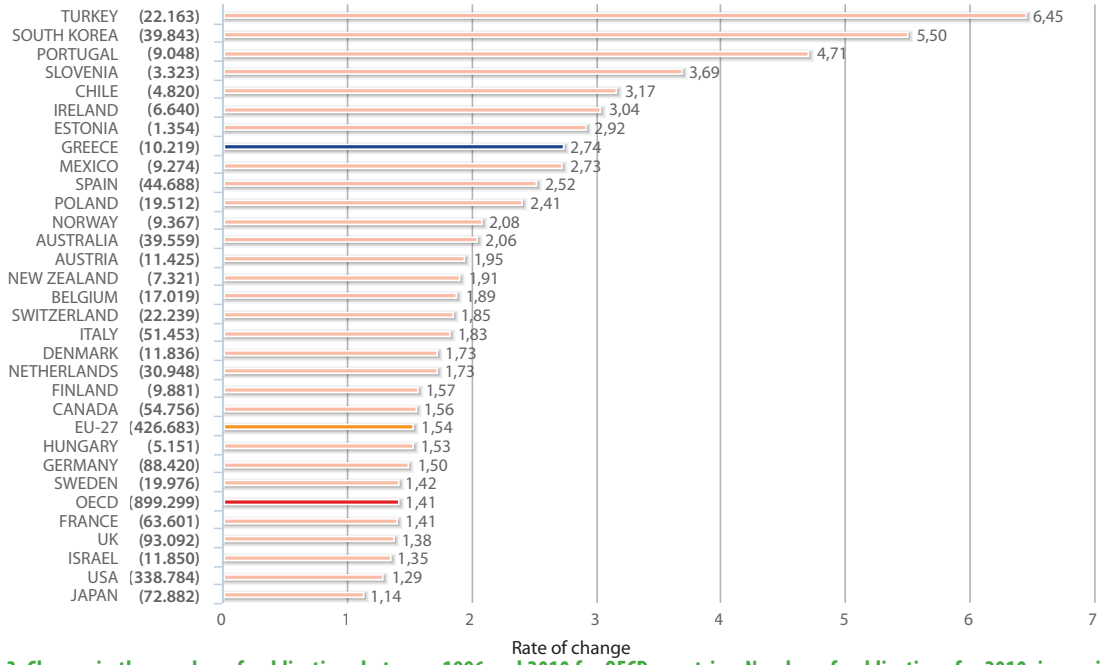


Figure 2.1.3 Change in the number of publications between 1996 and 2010 for OECD countries. Number of publications for 2010, is provided in parenthesis / Source: Thomson Reuters, NSI 1996-2010

Rate of change: 1 + [(number of publications in 2010 – number of publications in 1996)/ number of publications in 1996]. The rate is 1, if the number of publications is the same across the years compared. Data for Iceland and Luxembourg missing because of small overall number of publications (less than 1000)

Greece's share of EU and OECD publications followed a period of constant growth between 1996 and 2007, remaining stable afterwards (Figure 2.1.4). In 2010, Greece's share in EU publications is 2.4% and its share in OECD publications is 1.14%, almost two-fold compared to 1996.

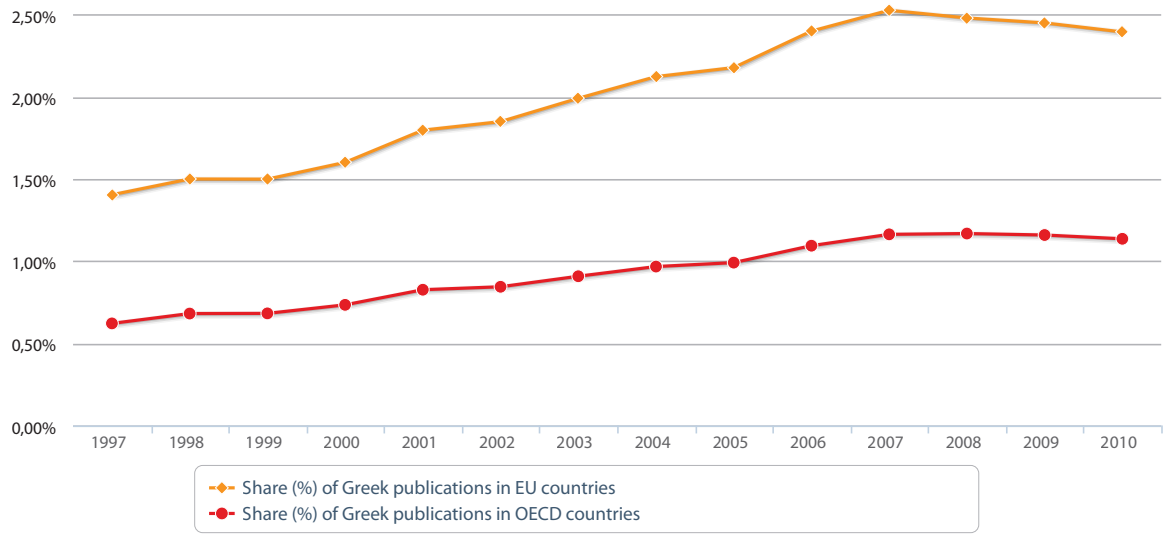


Figure 2.1.4 Share (%) of Greek publications in EU and in OECD, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

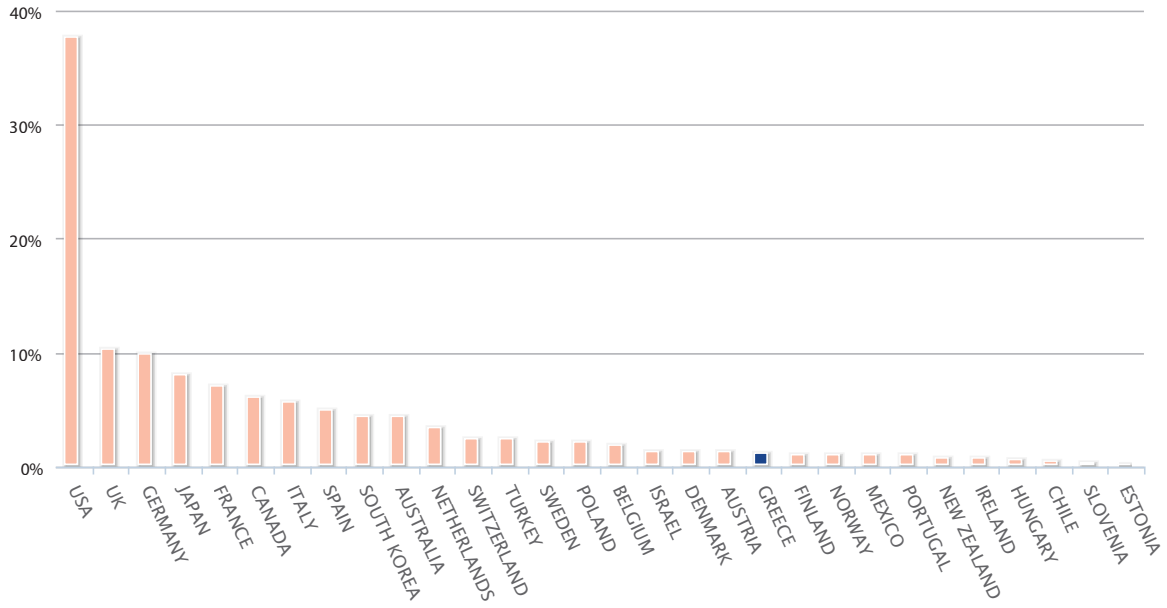


Figure 2.1.5 Publication share (%) of OECD countries, 2010 / Source: Thomson Reuters, NSI 1996-2010

Data for Iceland and Luxembourg missing because of the small number of publications (less than 1,000)

Greece was ranked 20th in terms of its share in the OECD (Figure 2.1.5 – data for year 2010). Holding a share of 37.7%, USA maintained a leading position among OECD countries, followed by the United Kingdom and Germany, with a share of approximately 10% each.

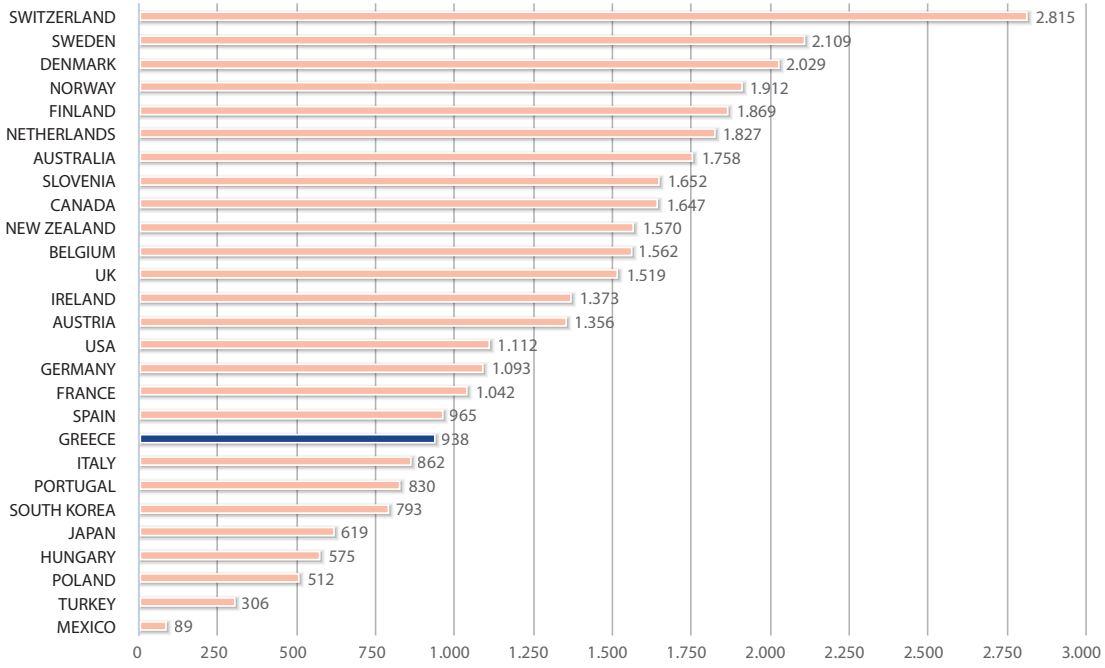


Figure 2.1.6 Number of publications in OECD countries per million population, 2009 / Source: OECD: Main Science and Technology Indicators 2011, Thomson Reuters, NSI 1996-2010

Data for Iceland and Luxembourg missing because of the small number of publications (less than 1,000)

* Due to missing population data corresponding to the four new member states (Estonia, Israel, Slovenia and Chile), there were only 30 OECD countries ranked.

2.2 Citations

Citation counts to scientific publications are among the most common indicators in bibliometrics and constitute quantifiable evidence of the significance and influence of research. Figure 2.2.1 tracks citations received by Greek publications between 1996 and 2010. According to standard bibliometric practices, data is presented in five-year moving windows, from 1996 through to 2010, –a reliable form of representation for citation trends throughout time–. Each five-year window displays the number of citations to those publications produced within the designated time. In the last 5-year window, 2006-2010, Greek publications received 222,132 citations, –4 times more than those received in 1996-2000–. In addition, the growth rate of the number of citations to Greek publications surpassed the EU and OECD baseline (Figure 2.2.2). Accordingly, Greece's share of EU and OECD citations increased (Figure 2.2.3): in 2006-2010 was equal to 2.06% and 0.95%, respectively. Between 1996 and 2010, global trends demonstrated a significant increase in the overall citations counts, both in the EU and the OECD countries. This has been a result of the intense networking activities of the research community and of the wide scientific knowledge diffusion across borders.
Throughout this period, Greece had a satisfactory performance.

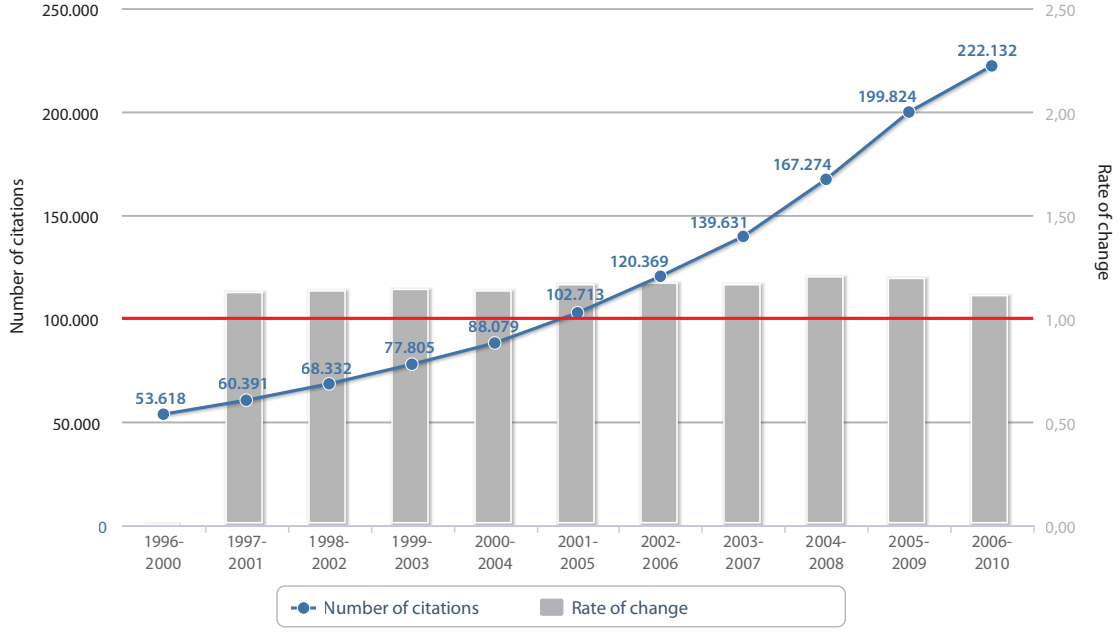
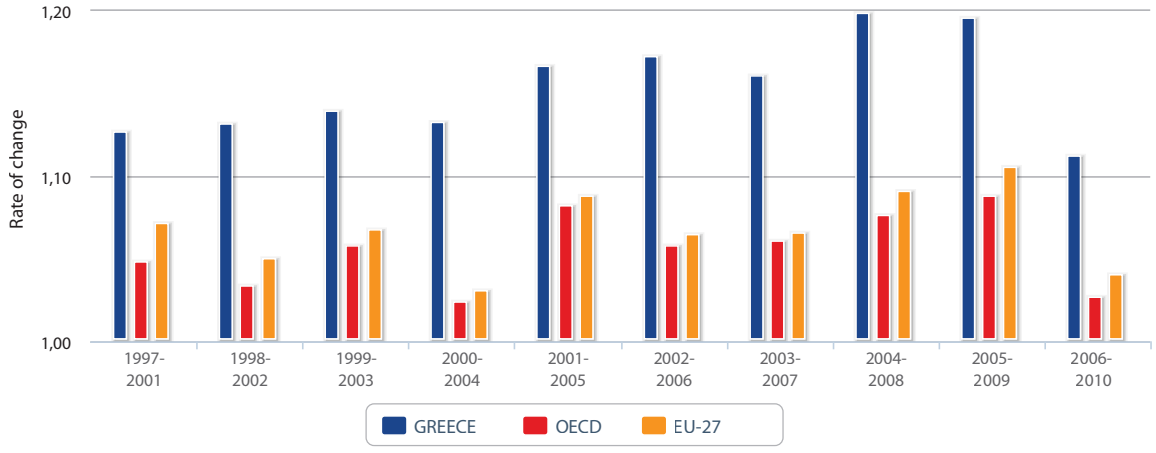


Figure 2.2.1 Development of the number of citations to Greek publications, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.



Change in the number of citations for Greece, EU and OECD, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

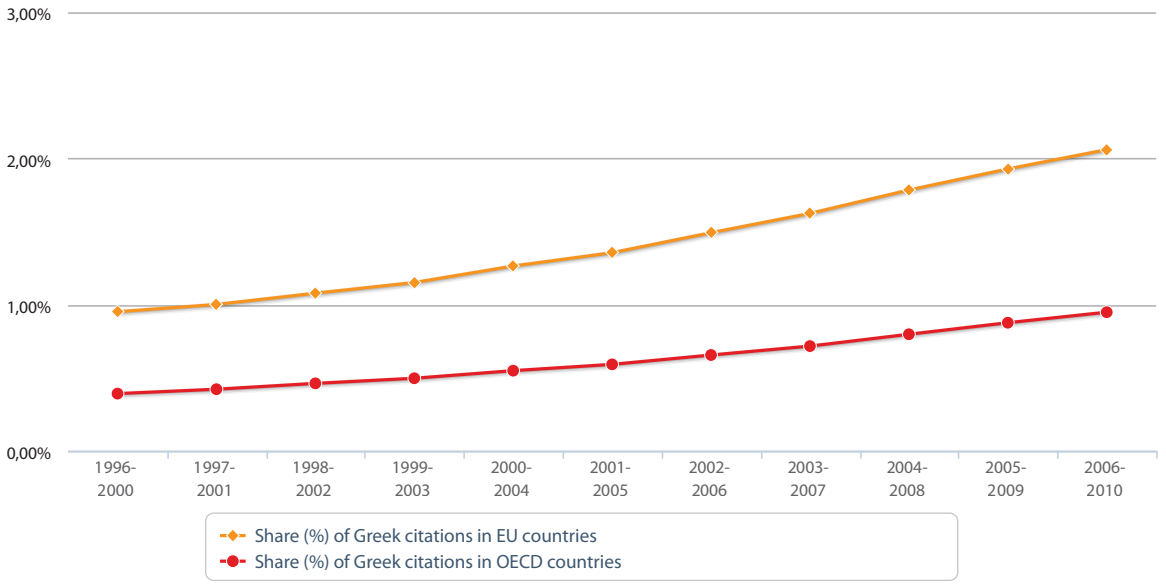


Figure 2.2.3 Share (%) of Greek citations in EU and OECD, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

An additional important indicator regarding visibility and impact of research, is the percentage (%) of cited publications in the total publications output. The percentage (%) of Greek cited publications presented a steady upward trend between 1996-2010, reaching up to 65.5% in 2010, thus closely approaching the EU (66.3%) and the OECD (66.5%) performance (Figure 2.2.4).

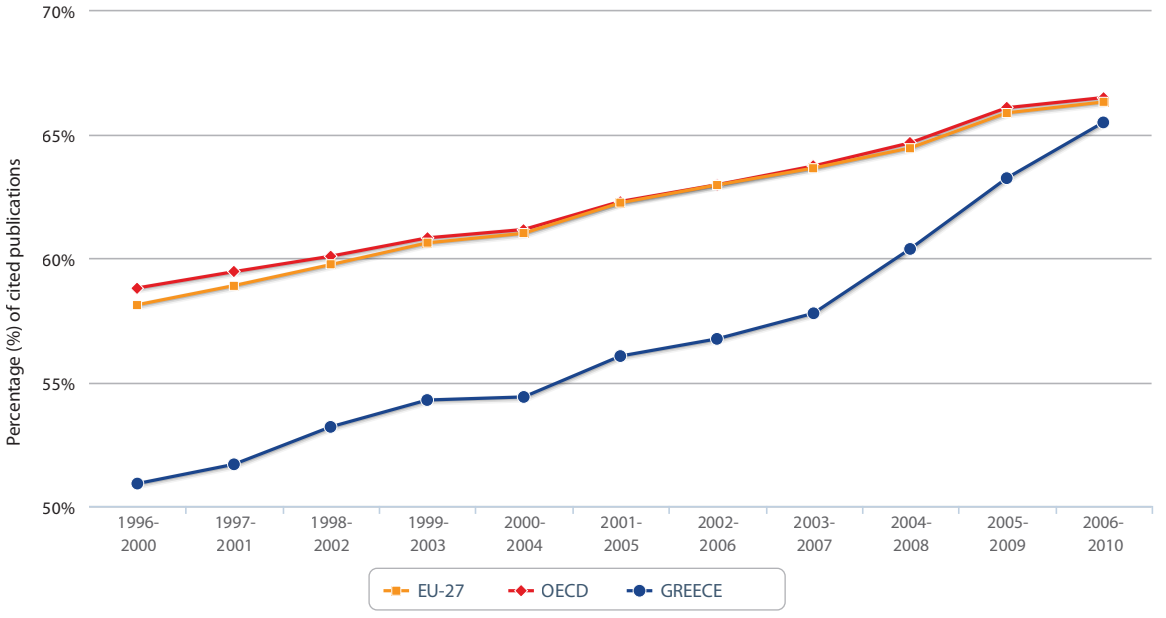


Figure 2.2.4 Percentage (%) of cited publications in Greece, EU and OECD, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

2.3 Citation impact

The average number of citations per publication may be used for assessing the scientific impact of publications, especially at country level. This indicator – henceforth referred to as "citation impact"- is calculated as the ratio of the total number of citations to the total number of publications, without taking into account differences in citation practices among scientific fields.

Figure 2.3.1 presents the citation impact of Greek, EU and OECD publications. In the most recent 5-year period, 2006-2010, Greek publications received 4.49 citations on average, approaching the EU (5.34) and OECD (5.43) average.

Notably, between 1996-2010, the growth rate of the citation impact of Greek publications exceeded the corresponding figure for EU and OECD publications. This rate slowed down during 2006-2010, following the trend of the EU and OECD publications which, in fact, showed a higher decrease compared to that of Greek publications (Figure 2.3.2).

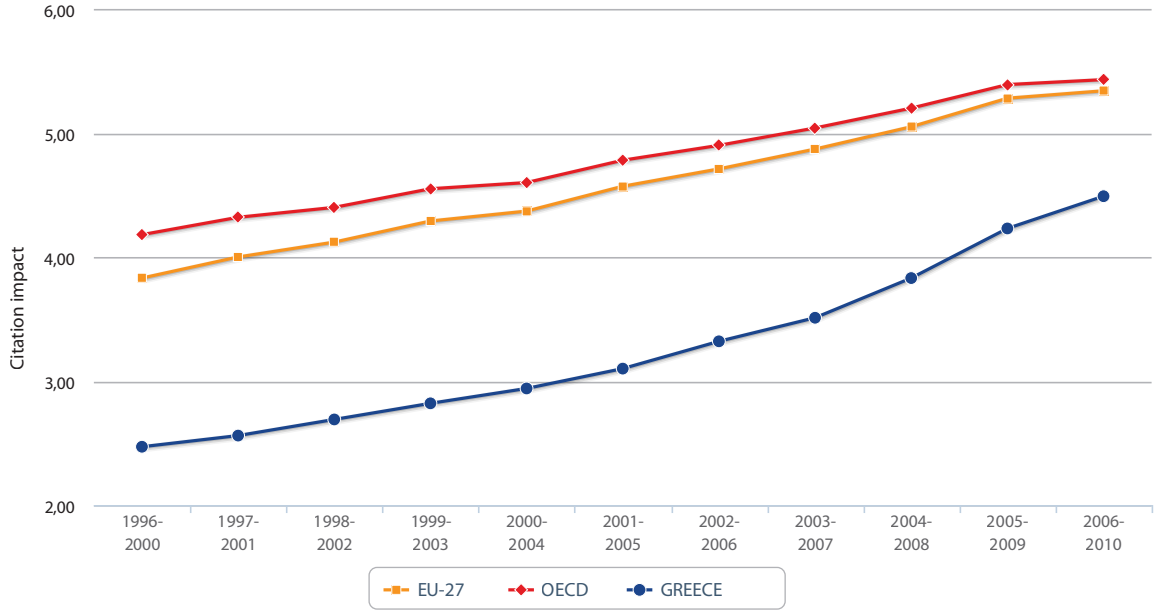


Figure 2.3.1 Citation impact of publications from Greece, EU and OECD, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

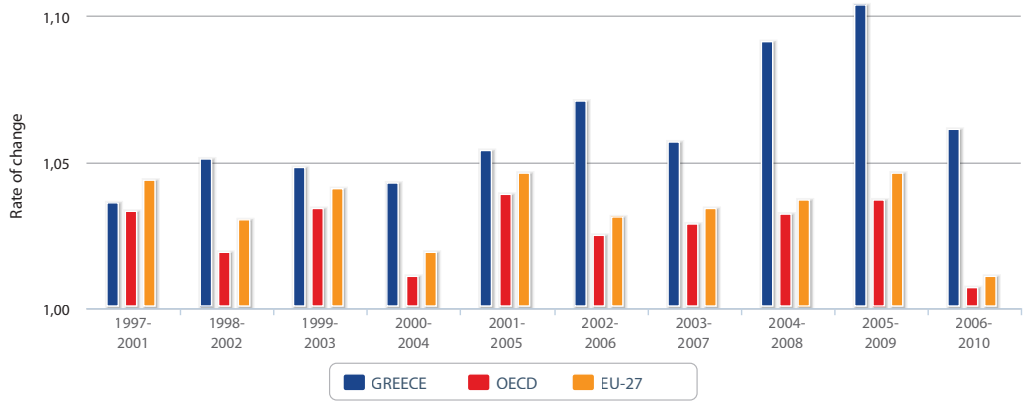


Figure 2.3.2 Change in the citation impact of publications from Greece, EU and OECD, 1996-2010/ Source: Thomson Reuters, NSI 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"].
The rate is 1, if the number of publications is the same across the years compared.

The "relative citation impact" indicator, as described in Figure 2.3.3, compares citations -per-publication average against the EU and OECD baseline figure, represented in the graphs by the figure "1".

Greece's citation impact relative to the EU (0.84) and OECD (0.83) exhibited an ascending trend between 1996-2010, but has yet to exceed the EU and OECD baseline.

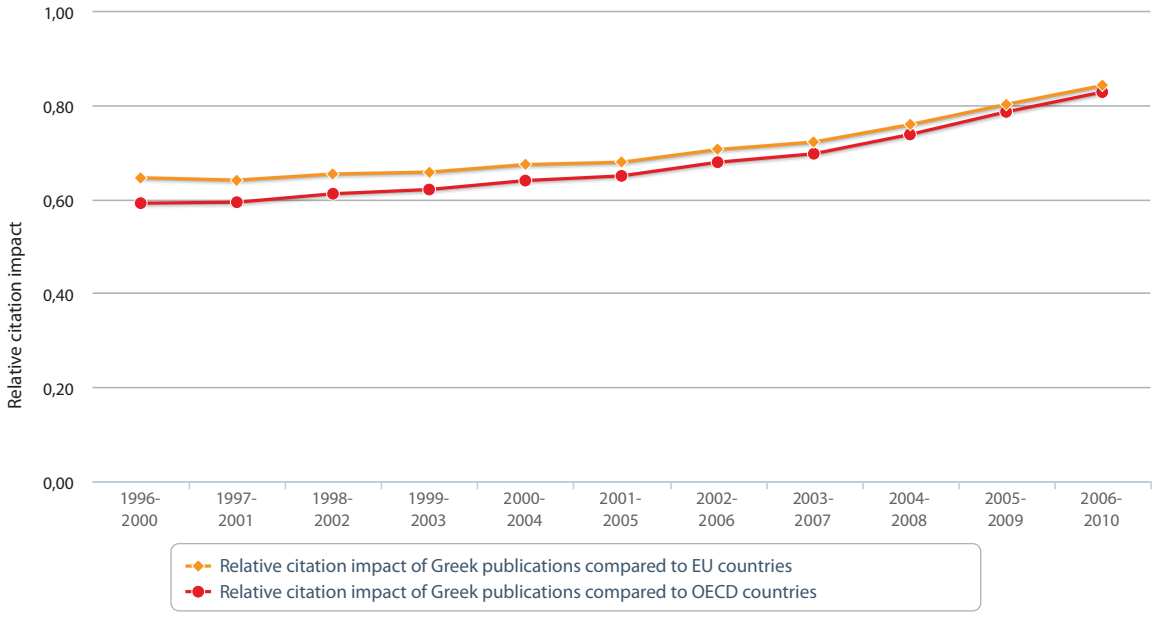


Figure 2.3.3 Relative citation impact of publications from Greece compared to EU and OECD, 1996-2010 / Source: Thomson Reuters, NSI 1996-2010

In terms of its relative citation impact (0.84), in the 5-year period 2006-2010, Greece was ranked 24th among the OECD-34 countries (Figure 2.3.4).

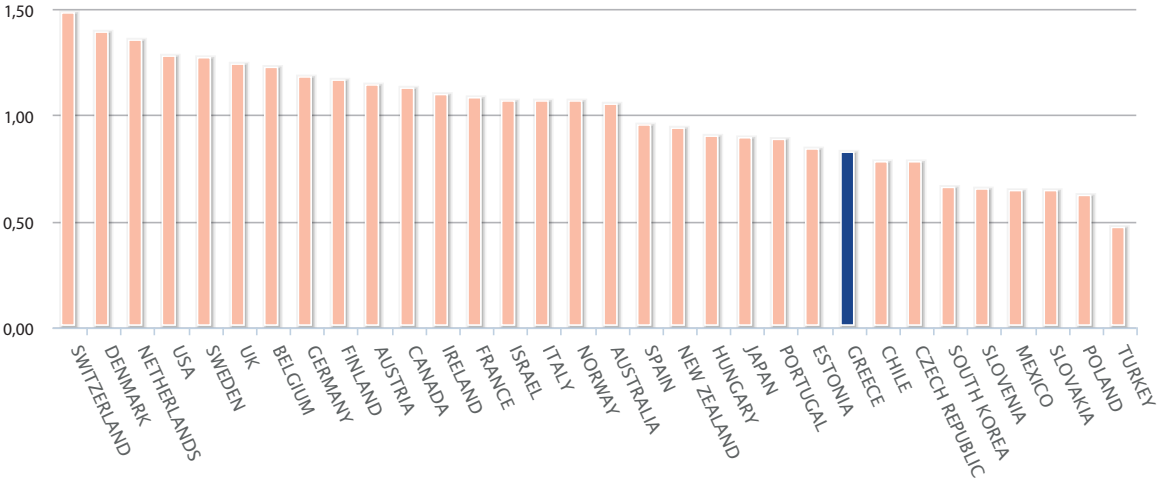


Figure 2.3.4 Ranking of OECD countries by relative citation impact, 2006-2010 / Source: Thomson Reuters, NSI 1996-2010

Data for Iceland and Luxembourg missing because of small number of publications (less than 1,000)

2.4 Highly cited publications

A significant criterion for the evaluation of the impact of the scientific publications is their ranking among the most cited publications in the world, published in the same year and the same subject field. The relevant bibliometric indicators refer to the number and the percentile breakdown of publications that were ranked worldwide in the top 1%, 5%, 10%, 25% and 50% of the most cited publications, per year and per scientific field.

During the most recent 5-year period, 2006-2010, 509 Greek publications ranked among the top 1% of the most cited publications worldwide, 2,393 publications in the top 5%, 4,591 publications in the top 10%, 11,024 publications in the top 25% and 20,190 in the top 50% (Figure 2.4.1).

The percentile breakdown of top publications for Greece was 1%, 4.9%, 9.3%, 22.4% and 41%. When the percentile breakdown of publications reaches or outperforms the top 1%, 5%, 10%, 25% and 50% of the most cited publications worldwide, then this country reaches or outperforms the world average. Greece approached the world average production in the 1%, 5% and 10% percentiles.

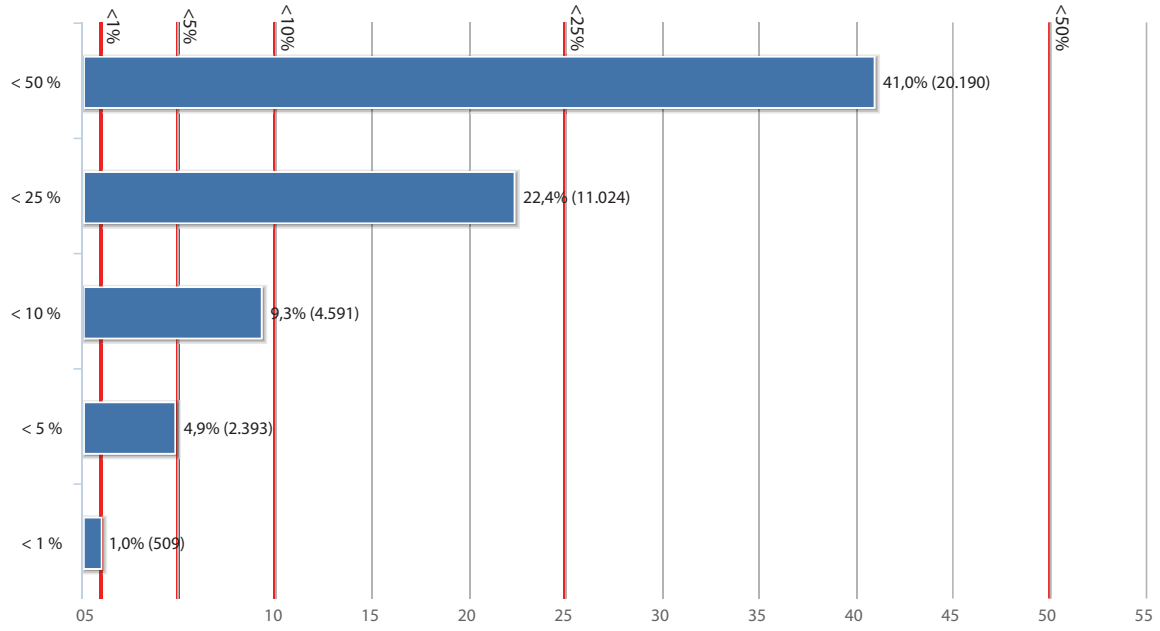


Figure 2.4.1 Number and percentile breakdown (%) of highly cited Greek publications, 2006-2010 / Source: Thomson Reuters, NSI 1996-2010

2.5 Major fields of science

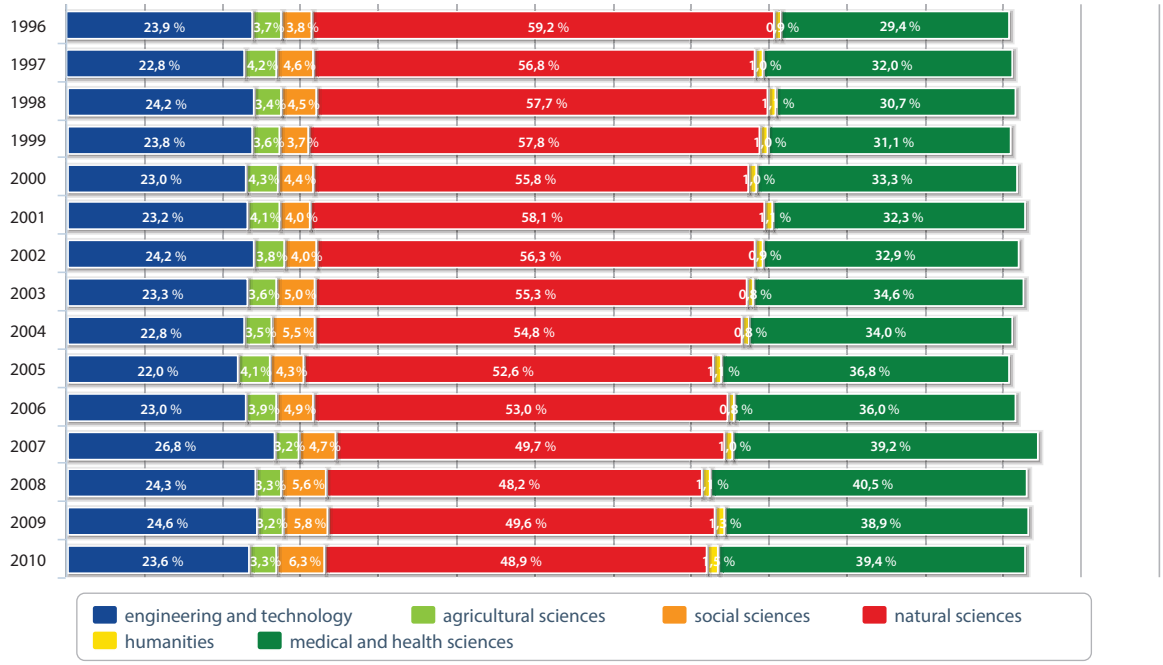
Aiming at identifying the fields of research where Greek research teams were most active and successful, Greek publications were classified into the six major fields of science* "Natural Sciences", "Engineering & Technology", "Medical & Health Sciences", "Agricultural Sciences", "Social Sciences" and "Humanities", and their subcategories, according to the revised edition of the Frascati Manual "Revised Field of Science and Technology Classification" by the OECD (Annex III). The results of this classification corresponding to the entire period between 1996 and 2010, are presented in Figure 2.5.1

"Natural sciences" proved to be Greece's highest representation in the total number of publications, constituting 48.9% in 2010. "Medical & Health Sciences" represented the second highest share of Greece's total publications, with an increasing trend between 1996-2010, and equal to 39.4% of the total publication in 2010.

* Incites database might classify a journal under more than one scientific fields. As a result, the distribution of publications into 6 major fields of science and their sub-fields, may cause overlapping. Publication counts presented in this study are «whole counts» i.e. in the case of a publication classified in more than one scientific field, each scientific field or sub-field got a whole count of the publication.

Publications in "Engineering and Technology" accounted for a more or less stable share, which was equal to 23.6% in 2010. The remaining share of Greek publications was distributed among the "Social Sciences", which had a growing share after 2007 (6.3% in 2010), the "Agricultural Sciences" with a rather stable share (3.3% in 2010), and the "Humanities", with the lowest share (1.5% in 2010).

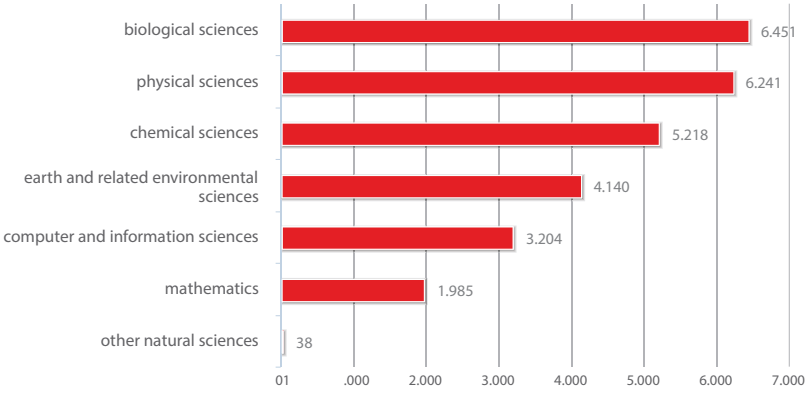
It was somewhat expected that "Humanities" would be the field with the lowest share of publications, given that scientific production in the field is overwhelmed by monographs and books.



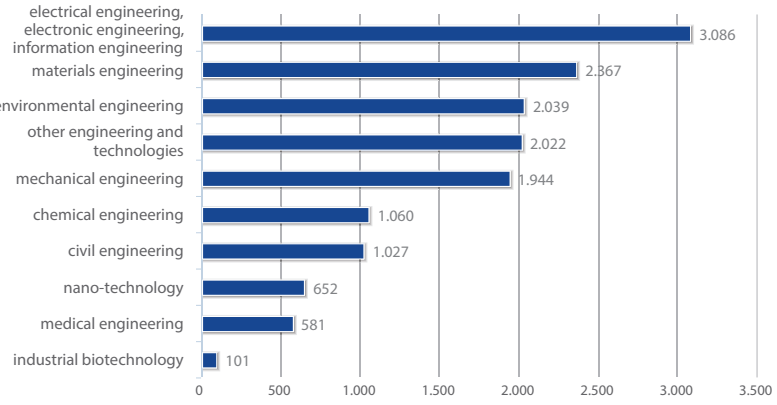
Distribution (%) of Greek publications across major fields of science, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 2.5.2 tracks the number of Greek publications in the subcategories of the six major fields of science. Data refer to the most recent 5-year period, 2006-2010.

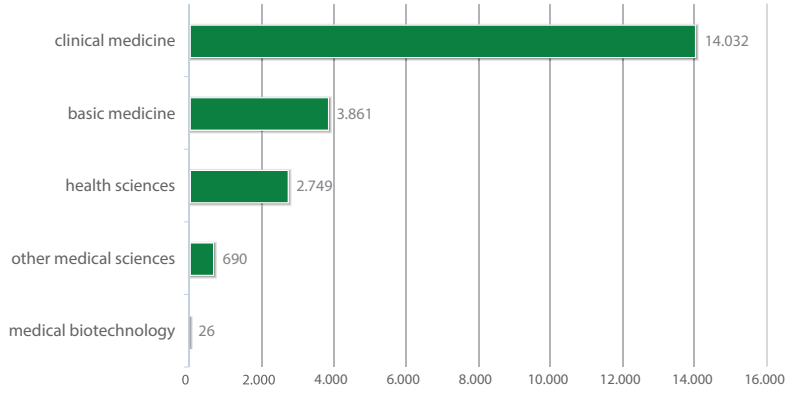
Natural Sciences



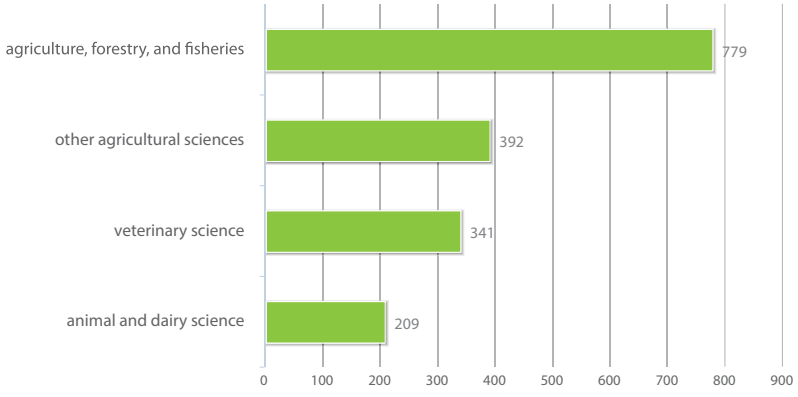
Engineering & Technology



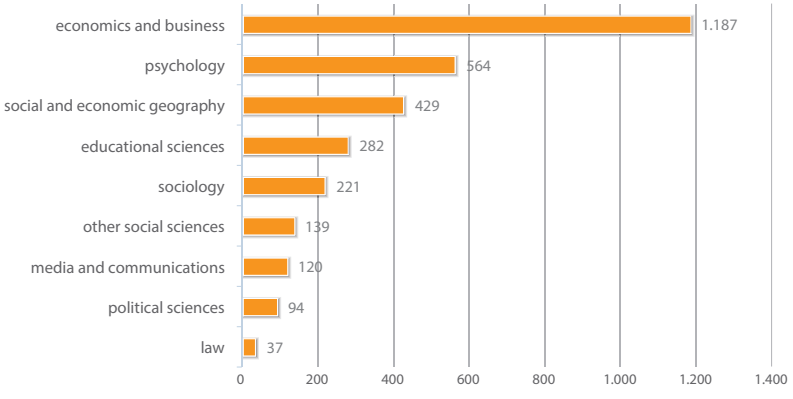
Medical & Health Sciences



Agricultural Sciences



Social Sciences



Humanities

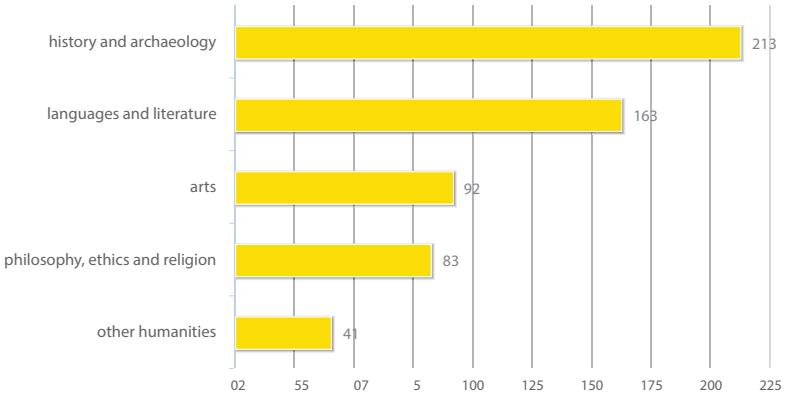


Figure 2.5.2 Number of publications in the major field of science ", during five years 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 2.5.3 shows the "field-normalised citation score" of Greek publications for the 5-year period 2006-2010 in the six major scientific fields. This indicator is the ratio of the average number of citations received by Greek publications to the world average of citations of the same time period and scientific subject field. The normalisation was done at the level of each article/publication according to the 253 NSI scientific subject fields. In the case of a publication attributed to more than one subject field, a mean value of the fields was calculated. The field-normalised citation score or "citation score" was calculated using software developed by EKT. A value greater than 1, indicates that the impact of Greek publications was higher than the world average.

In the most recent 5-year period 2006-2010, Greek publications approached the world average across all major fields, displaying citation scores from 0.78 to 0.97, with the exception of "Humanities". Citation scores had considerably improved for the period 2006-2010 (when compared to those of the earlier period 2004-2008 found in the study's first edition) for the major fields "Agricultural Sciences" (citation scores equal to 0.97 during 2006-2010 and 0.81 during 2004-2008) and "Social Sciences" (citation scores 0.78 during 2006-2010 and 0.62 during 2004-2008). Citation scores were more or less stable for the major fields "Natural Sciences", "Engineering and Technology" and "Medical and Health Sciences", amounting to 0.92, 0.87 and 0.86 respectively.

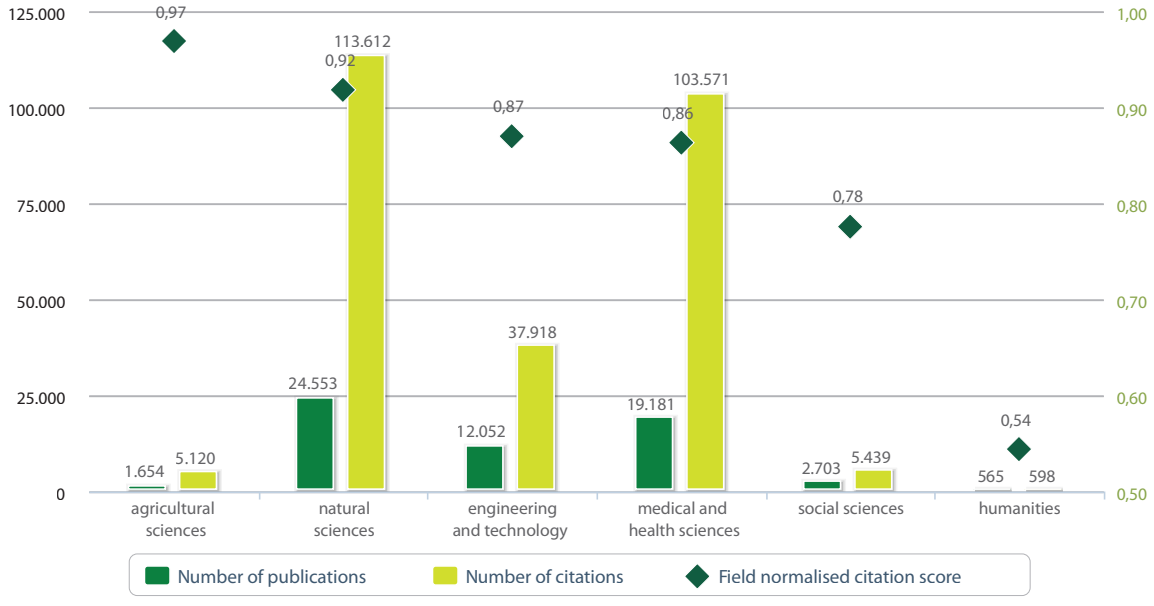


Figure 2.5.3 Publications, citations and field normalised citation score of Greek publications, relative to the world, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

A rather interesting figure for the Greek publishing activity is the citation score of publications in the subfields of the major fields of science compared to those worldwide. Table 2.5.4 shows Greece's contribution to selected subfields of major fields of science compared over the period 2006-2010

NATURAL SCIENCES

Scientific Subfield	Field normalised citation score	Number of publications
genetics & heredity	1,41	532
physics, multidisciplinary	1,37	833
polymer science	1,30	632
physics, nuclear	1,29	323
reproductive biology	1,28	269
physics, particles & fields	1,27	804
chemistry, multidisciplinary	1,24	654
chemistry, inorganic & nuclear	1,24	537
meteorology & atmospheric sciences	1,10	683
crystallography	1,09	192
microbiology	1,07	701
physics, fluids & plasmas	1,05	262
evolutionary biology	1,04	121
chemistry, physical	1,03	1.467
optics	1,01	792
chemistry, applied	1,00	627

ENGINEERING & TECHNOLOGY

Scientific Subfield	Field normalised citation score	Number of publications
materials science, composites	1,23	156
energy & fuels	1,20	881
medical laboratory technology	1,20	172
automation & control systems	1,15	247
thermodynamics	1,15	269
engineering, chemical	1,12	1.060
engineering, environmental	1,08	640
mining & mineral processing	1,01	54

MEDICAL & HEALTH SCIENCES

Scientific Subfield	Field normalised citation score	Number of publications
rheumatology	1,51	340
parasitology	1,29	82
public, environmental & occupational health	1,23	631
health policy & services	1,19	55
medicine, general & internal	1,09	682
allergy	1,08	117
critical care medicine	1,06	257
infectious diseases	1,06	647
nursing	1,03	104
hematology	1,03	607
nutrition & dietetics	1,02	602

AGRICULTURAL SCIENCES

Scientific Subfield	Field normalised citation score	Number of publications
agricultural engineering	1,48	150
agriculture, dairy & animal science	1,15	209
fisheries	1,03	233
veterinary sciences	1,02	341

SOCIAL SCIENCES

Scientific Subfield	Field normalised citation score	Number of publications
anthropology	1,59	77
urban studies	1,20	49
operations research & management science	1,06	429

Figure 2.5.4 Scientific subfields of Greek publications with field normalised citation score >1, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

2.6 Scientific collaboration

Nowadays, collaboration of the scientific community at national and international level is an important factor towards an enhanced knowledge production and scientific excellence. Indeed, interactions and scientific relationships across networks, teams, institutions and countries increase the visibility, the number of citations and the impact of publications. The level of international collaboration can be measured by analyzing author institutional affiliations provided on publications.

The collaboration degree in Greek publications* and its evolution over the period 1996-2010, as displayed in Figure 2.6.1, shows a clear increasing trend, both at national and international level. In 2010, co-publications by Greek researchers accounted for 67.2% of the total publications output, compared to only 49.3% in 1996. This figure is close to EU and OECD averages.

During the years following 2008, the degree of national collaborations remained stable, while the degree of international collaboration continued to increase.

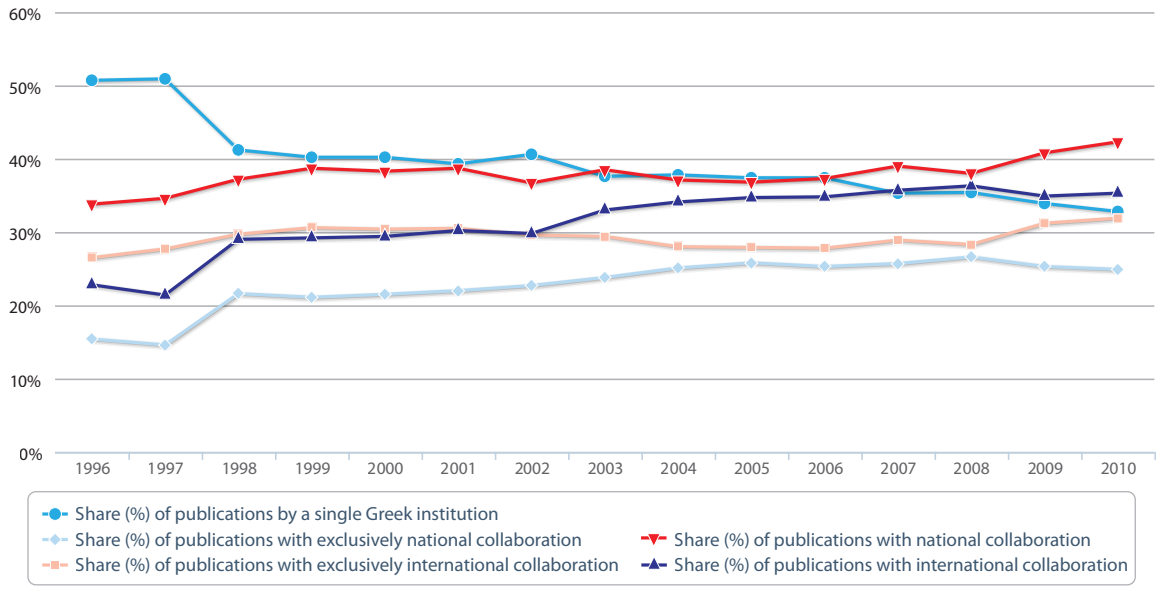


Figure 2.6.1 National and international collaboration in Greek publications, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

*Collaboration degree was calculated on the basis of the whole counting approach. Consequently, in the case of a publication produced by authors who came from different countries, each country received a whole count of the publication.

During the most recent 5-year period 2006-2010, Greek researchers cooperated with scientists from 154 countries. Figure 2.6.2 highlights these links and regions. Greece's main publishing partners were the United States, the UK, Germany, France and Italy.

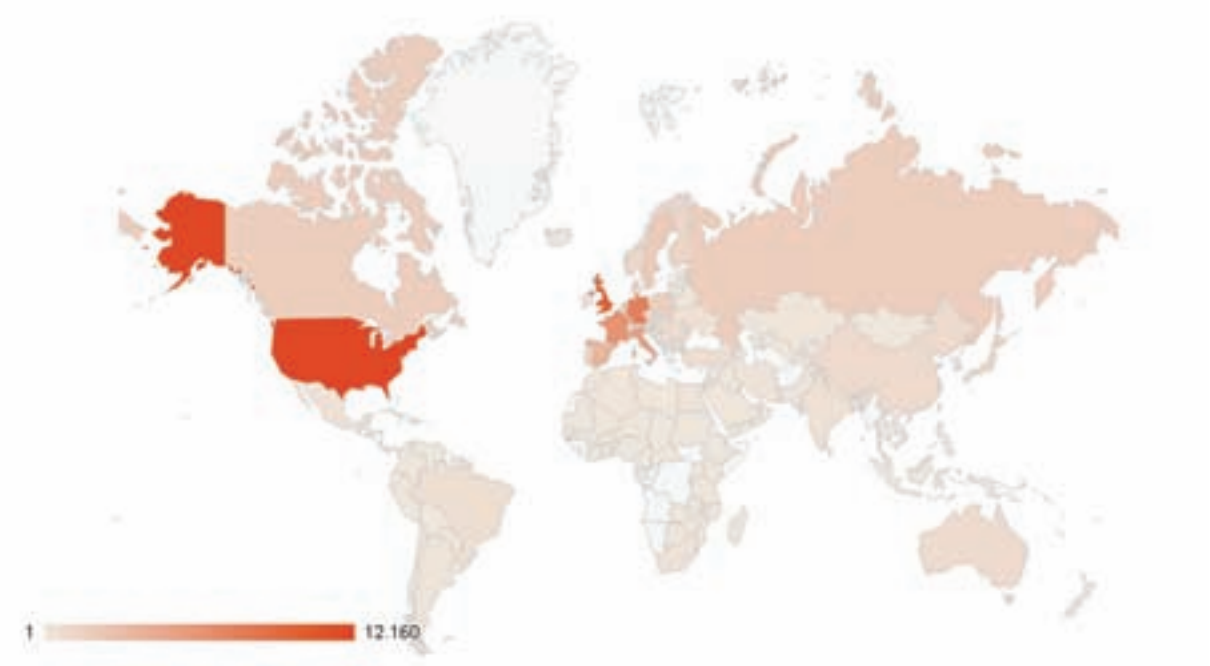


Figure 2.6.2 Countries collaborating in Greek publications, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 2.6.3 illustrates the annual growth in the number of Greek publications with national* , international** and no*** collaboration for the period 1996-2010.

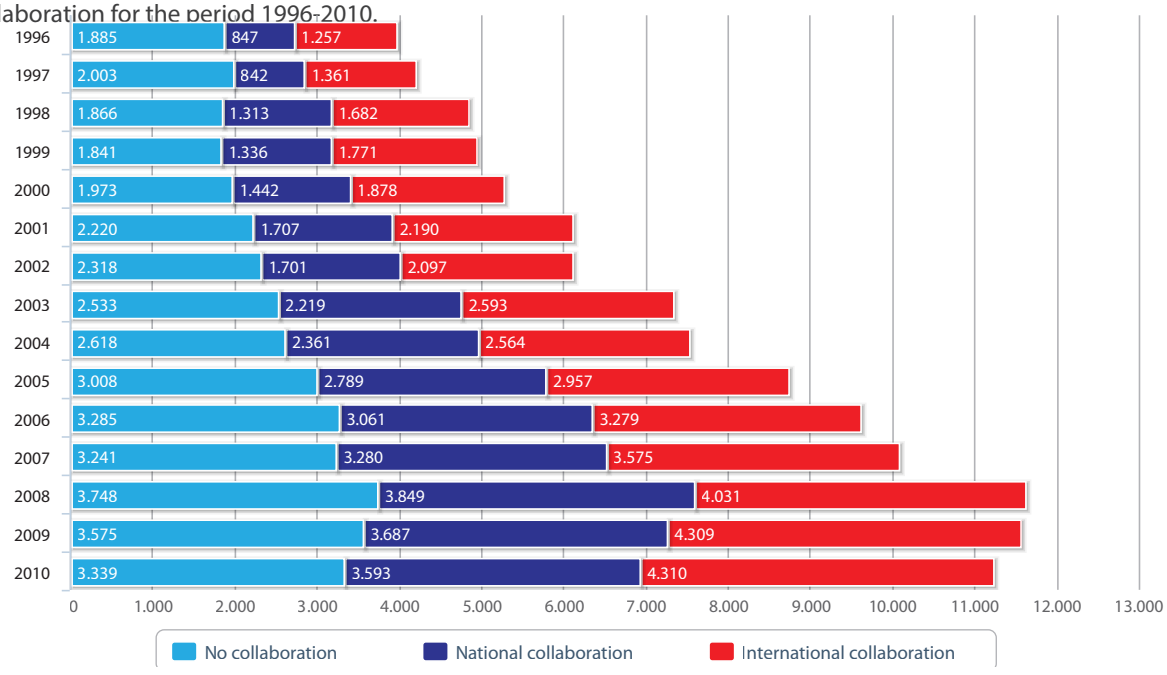


Figure 2.6.3 Distribution of Greek publications by type of collaboration, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration
**Number of publications with at least one international collaboration
*** Number of publications with one single Greek institution

This section presents the bibliometric indicators for the main categories of institutions. Greek institutions were classified into categories according to their sectors – e.g. higher education, research, health services – as well as their legal status –e.g. public or private institutions–.

Specifically, institutions were grouped into 8 categories* (see Table below). The table below shows the number of publications and citations for each institution category for the years 2006-2010. It also demonstrates their growth compared to the preceding 5-year period, 2004-2008 (data from EKT's previous study published in 2010).

* Greek Institutions were classified into 8 instead of 11 categories (as in the study's previous edition). Specifically, the categories "MOD Hospitals", "Banks", "Museums" were no longer presented as separate categories (as in the study's previous edition) and institutions of these categories were included in other categories –in terms of their status-.

CHAPTER 3

SCIENTIFIC PUBLICATIONS BY INSTITUTION CATEGORIES

	2004-2008		2006-2010	
	Number of publications	Number of citations	Number of publications	Number of citations
Universities	35.874	131.979	40.697	178.824
Technological Educational Institutes	1.755	3.192	2.263	5.814
Research Centers supervised by GSRT	6.234	30.675	6.755	40.414
Other Public Research Institutions	1.471	5.000	1.616	6.326
Public Health Institutions	5.186	23.906	5.690	26.819
Private Health Institutions	1.199	9.471	1.393	10.048
Other Public Institutions	485	1.149	566	1.568
Other Private Institutions	915	2.400	891	2.827

3.1 Publications

The majority of the scientific publications were produced by "Universities", "Research Centers supervised by GSRT" and "Public Health Institutions". These were followed by "Technological Educational Institutes", "Other Public Research Centres", "Private Health Institutions", "Other Public Institutions" and "Other Private Institutions".

In detail, during 1996-2010, the category "Universities" was the top performing institution category –in terms of the number of publications–. Indeed, the great majority of Greek publications was produced with the participation of Universities. As a result, the annual change in the number of publications issued by Universities actually defined the change in the total number of Greek publications. Until 2009, Universities experienced a constant growth in their publications. In 2010, a small decline was observed and Universities produced fewer publications (8,387) compared to 2009 (8,742) (Figures 3.1.1 and 3.1.2).

"Research Centres supervised by GSRT" are second in terms of the number of publications –with 1,348 publications in 2010–. Up to 2008, their publications followed an upward trend and started decreasing in 2009 and 2010 (Figures 3.1.1 and 3.1.2).

In the health sector, "Public Health Institutions" were ranked third among the eight institution categories, producing 1,090 publications in 2010 (Figure 3.1.1). It was after 2008, that publications of Public Health Institutions exhibited a considerable decline (Figures 3.1.1 and 3.1.2).

The publication output of "Technological Educational Institutes (TEI)" was lower –with 483 publications in 2010 (Figure 3.1.1)–. Since 2006, the category holds the 4th place among all institution categories. Until 2008, its growth rate was well above the average rate of Greek publications. In 2009 and 2010, similarly to other institution categories, TEI's publications followed a decreasing trend (Figures 3.1.1 and 3.1.2).

The category "Other Public Research Centres" includes 8 research institutions supervised by several Ministries. With a publication output of 356 publications in 2010, the category displayed a steady upward trend (Figures 3.1.1 and 3.1.2).

The publication output of "Private Health Institutions" varied with up-and-downs throughout the period. Following 2008, we observed a negative change rate. In 2010, Private Health Institutions produced 277 publications (Figures 3.1.1 and 3.1.2).

Other Public and Private Institutions made a smaller contribution to the total publication output –e.g in 2010 accounted for 133 and 167 publications respectively (Figure 3.1.1)–.

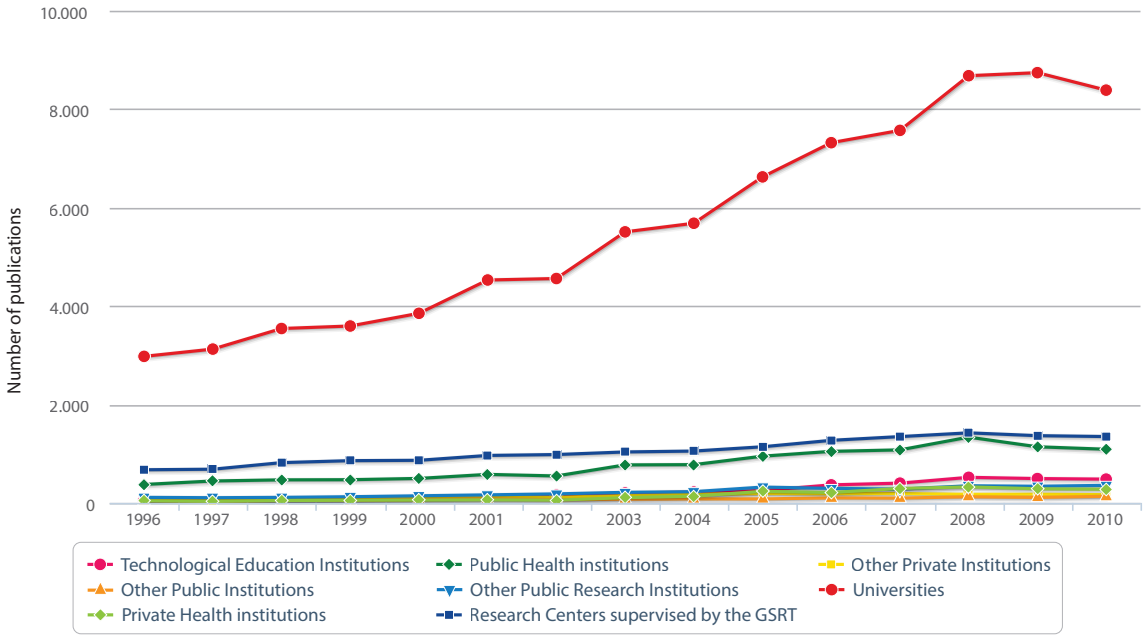
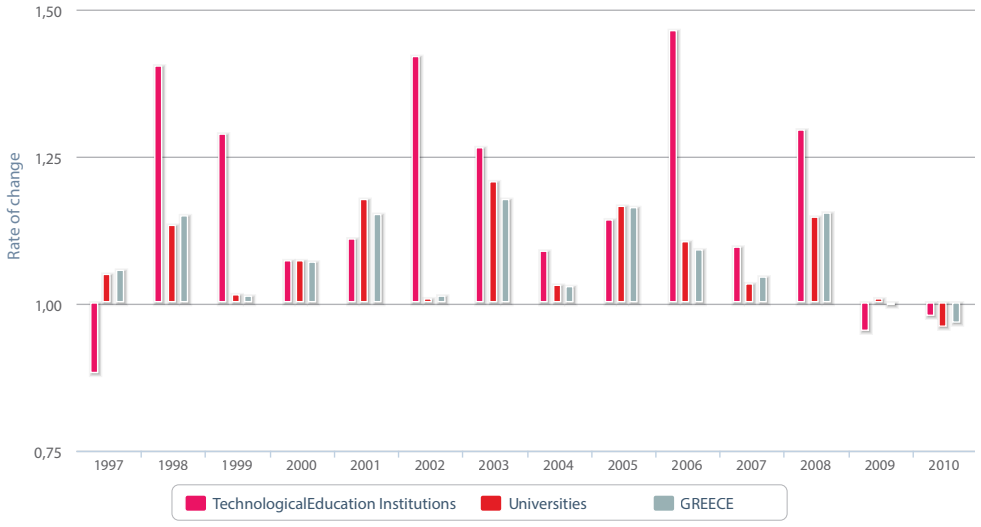
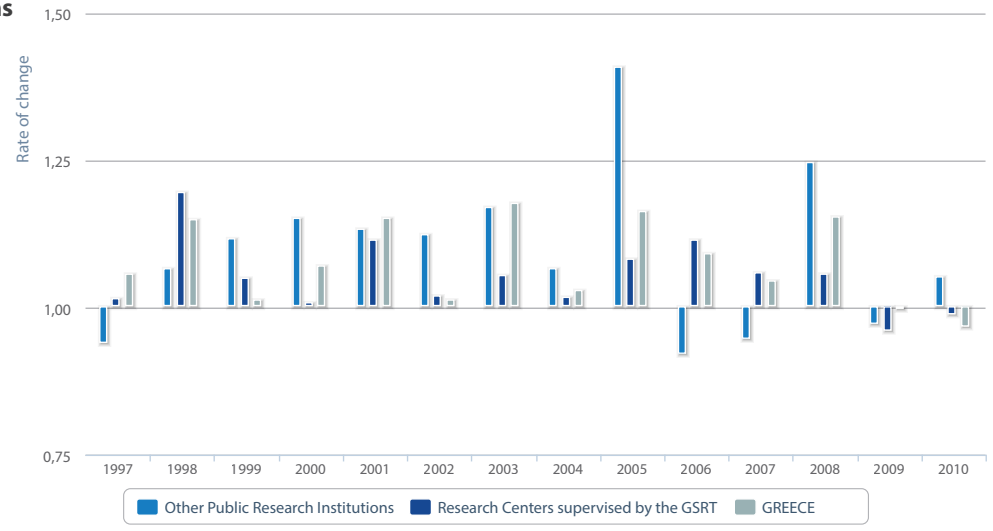


Figure 3.1.1 Development of the number of publications, by institution category, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

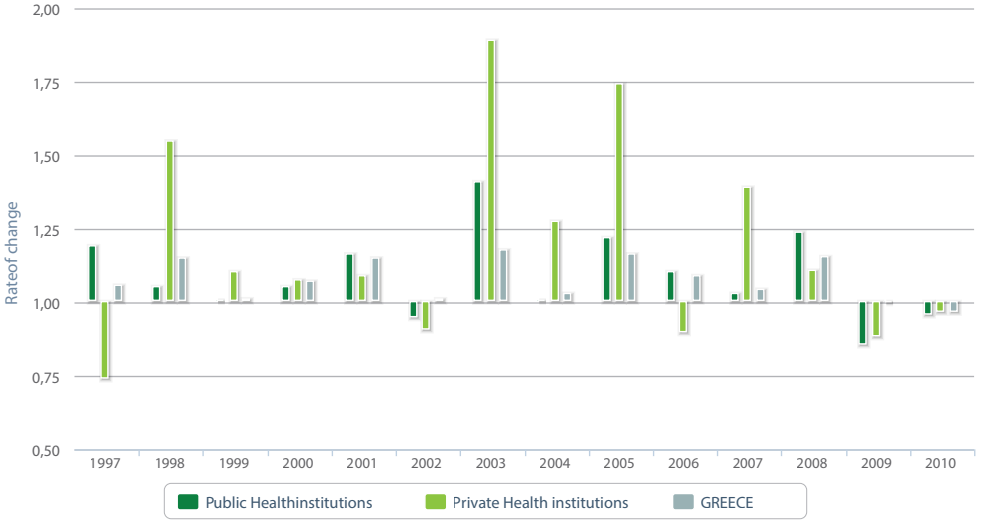
Universities - TEIs



Research Institutions



Health Institutions



● **Other Institutions**

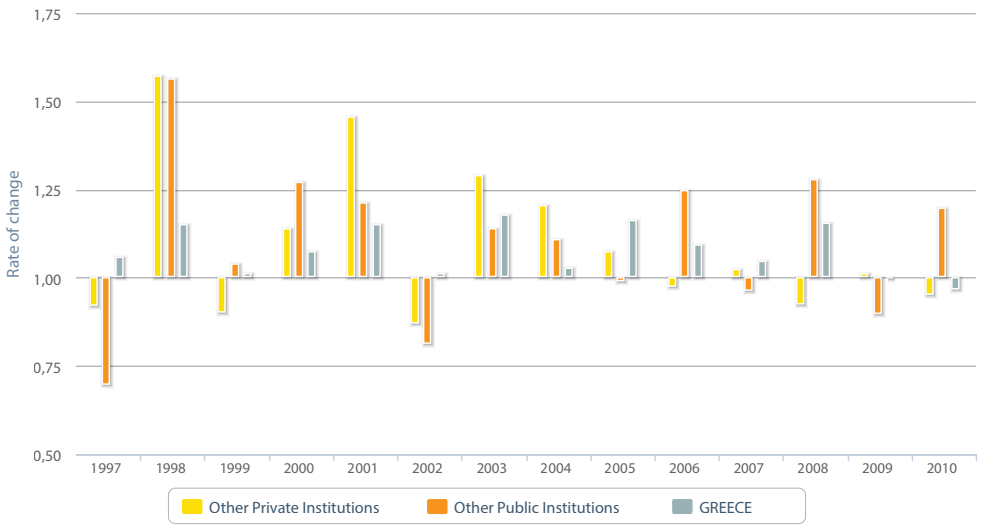


Figure 3.1.2 Change in the number of publications, by institution category / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

Figure 3.1.3 shows the share of the total number of Greek publications* per institution category for the latest five year period 2006-2010. Universities were ranked first with a share of 82.5%. They were followed by Research Centres supervised by GSRT (13.7%), Public Health Institutions (11.5%), Technological Educational Institutes (4.6%), Other Public Research Institutions (3.3%), Private Health Institutions (2.8%), Other Private Institutions (1.8%) and Other Public Institutions (1.1%).

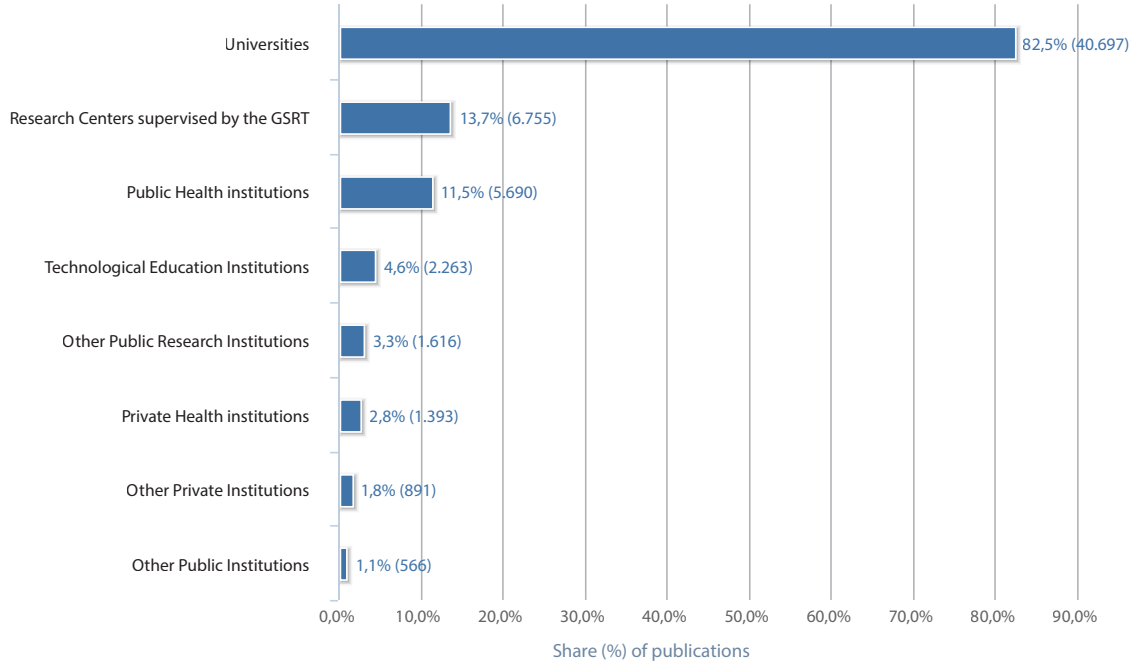


Figure 3.1.3 Number and share (%) of publications, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

* As demonstrated in the Methodology (Annex I), each institution category received a whole count of the publication (whole counting) for publications produced as a result of collaboration between institutions in different institution categories. The (%) share of publications by institution category was calculated as a proportion of the total number of Greek publications (Figure 3.1.3) and indicates the degree of "participation" of each category to Greece's total publication output. Hence, in the case of Universities, a share of 82.5% means that Universities participated in 82.5% of the total number of Greek publications.

3.2 Citations

Between 1996-2010, citation indices grew over time for all Institution Categories following the growth trend of Greek publications and their indicators.

"Research Centres supervised by GSRT" and "Private Health Institutions" had the highest percentage (%) of cited publications among all Institution Categories (Figure 3.2.1). This figure varied from 56.9% for "Technological Educational Institutes" to 74.2% for "Research Centres supervised by GSRT," with the average number of publications for Greece and OECD being 65.5% and 66.5% respectively.

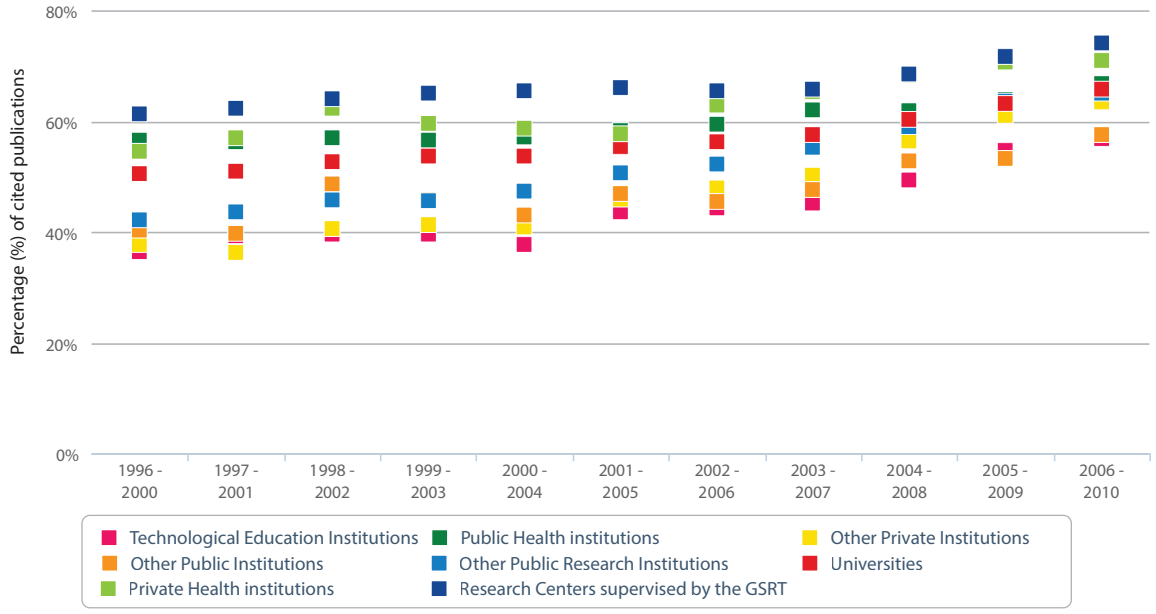


Figure 3.2.1 Percentage (%) of cited publications, by institution category, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 3.2.2 tracks the number of citations and its growth/evolution between 1996-2010. During 1996-2010, the number of citations in the institution categories grew, with the exception of "Public and Private Health Institutions", which followed a downward trend during 2006-2010.

Apart from having the highest representation in the number of publications, "Universities" had also the highest share in the number of citations. More specifically, during 2006-2010, Universities' publications received 178,824 citations, accounting for 80.6% of the total number of citations of Greek publications. The number and share of citations for the rest institution categories was: 40,414 and 18.2% for "GSRT Research Centers", 26,819 and 12.1% for "Public Health Institutions", 10,048 and 4.5% for "Private Health Institutions", 6,326 and 2.9% for "Other Public Institutions", 5,814 and 2.6% for "Technological Educational Institutes", 2,827 and 1.3% for "Other Private Institutions "and 1,568 and 0.7% for "Other Public Institutions" (Figures 3.2.2 and 3.2.3).

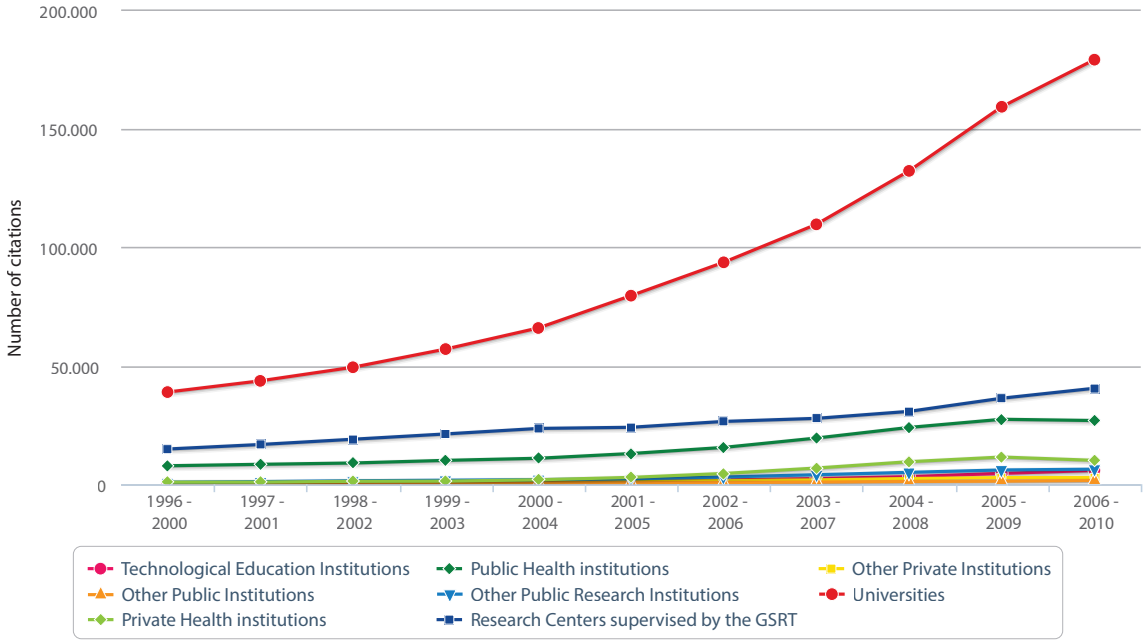


Figure 3.2.2 Number of citations, by institution category, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

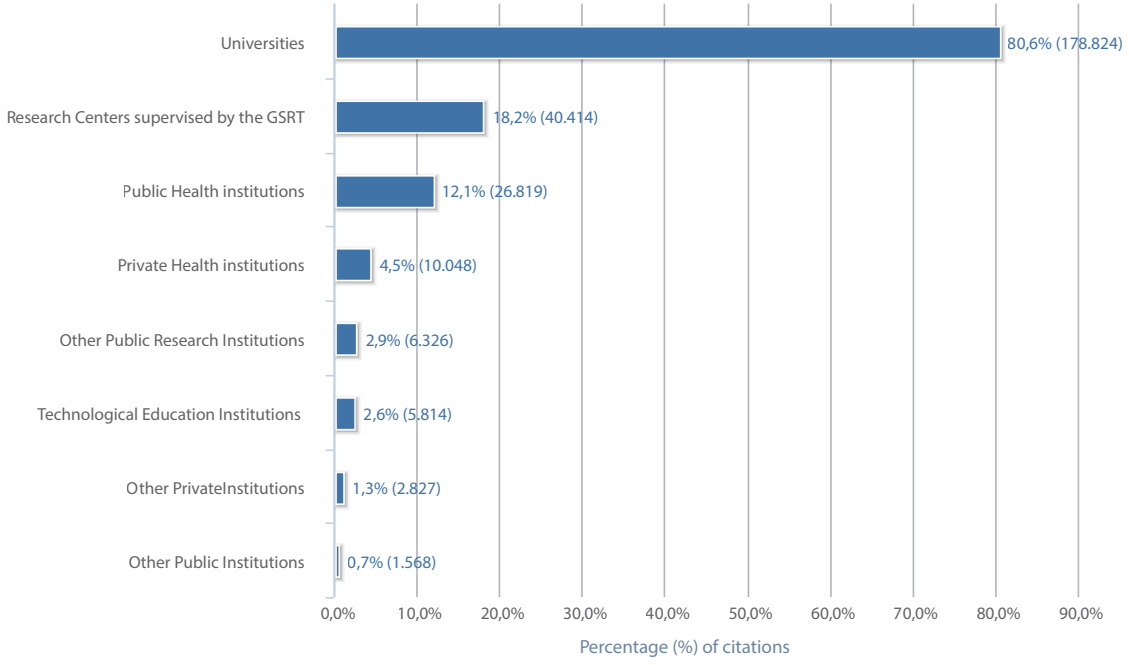


Figure 3.2.3 Number and share (%) of citations by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

3.3 Citation impact

Figure 3.3.1 shows, for each institution category, the number of publications and citations for the latest 5-year period (2006-2010) and the relevant "field-normalised citation score". The field normalised citation score or "citation score" is the relative number of citations to publications of a specific category compared to the world average

of citations to publications of the same time period and scientific subject field. The normalisation is done at the level of publication according to the 253 NSI scientific subject fields. In the case of a publication being attributed to more than one subject field, a mean value of the fields was calculated. The citation score was calculated using software developed by EKT. A value greater than 1, indicates that the impact of publications was higher than the world average.

"Research Centres supervised by GSRT" and "Private Health Institutions" had citation scores above the world average, –1.11 and 1.05 respectively–. Other Institution Categories had lower citation indicators.

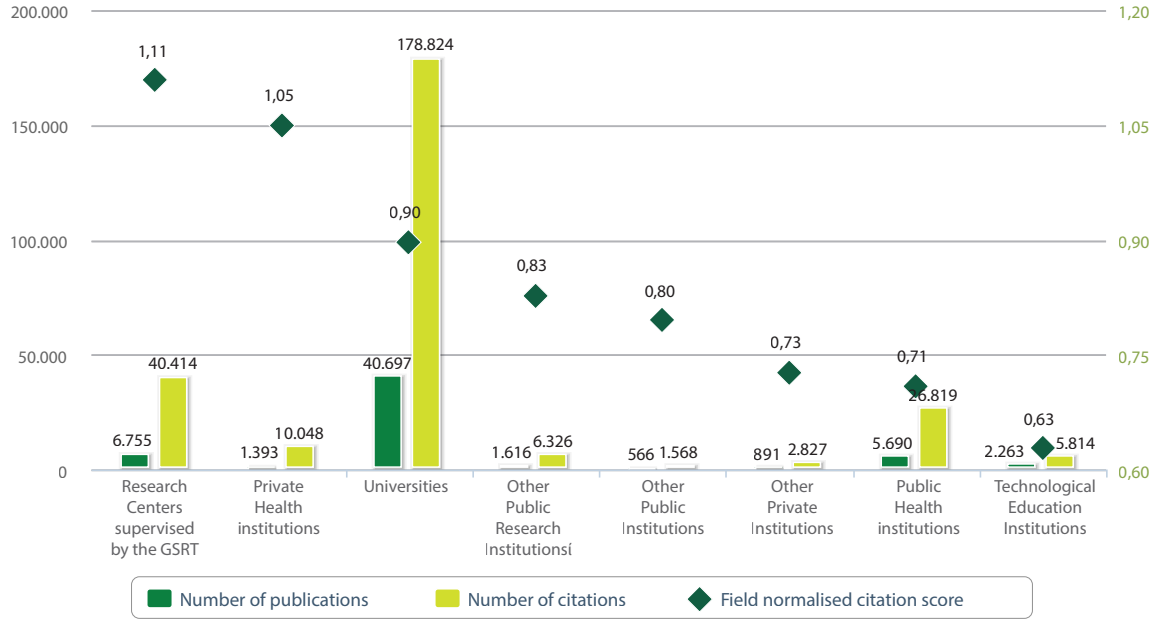


Figure 3.3.1 Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010. Data refers to the total number of publications in each category for all scientific fields / Source: Thomson Reuters, Incites 1996-2010

3.4 Highly cited publications

Figure 3.4.1 illustrates the number of highly cited publications in each institution category for percentile levels 1%, 5%, 10%, 25% and 50%, i.e. the publications attributed to the Category that belong respectively to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

During 2006-2010, the number of top 1% publications for each category was: 400 for "Universities", 89 for "Research Centres supervised by GSRT", 42 for "Public Health Institutions", 23 for "Private Health Institutions", 11 for "Other Public Research Institutions", 10 for "Technological Educational Institutes", 6 for "Other Public Institutions" and 5 for "Other Private Institutions".

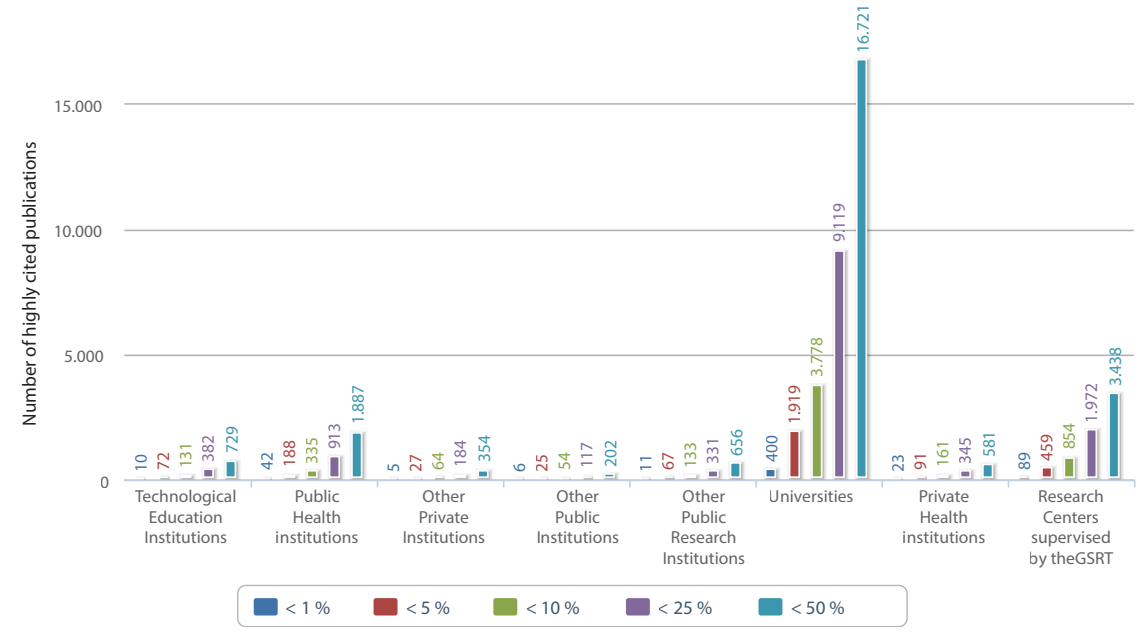


Figure 3.4.1 Number of highly cited publications, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: Publications that belong to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

Figure 3.4.2 displays the percentage of the highly cited publications in each institution category for percentile levels 1%, 5%, 10%, 25% and 50%. Data refers to the latest 5-year period 2006-2010. Values above the percentile levels indicates that the category has the majority of its publications among the top 1%, 5%, 10%, 25% and 50% than the world average.

"Research Centers supervised by GSRT" showed a better performance than the world average for all percentile levels - 1.3%, 6.8%, 12.6%, 29.2% and 50.9%. "Private Health Institutions" were above the world average for percentile levels 1%, 5% and 10%. "Universities" and "Other Public Institutions" approached the world average for 1% and 10%.

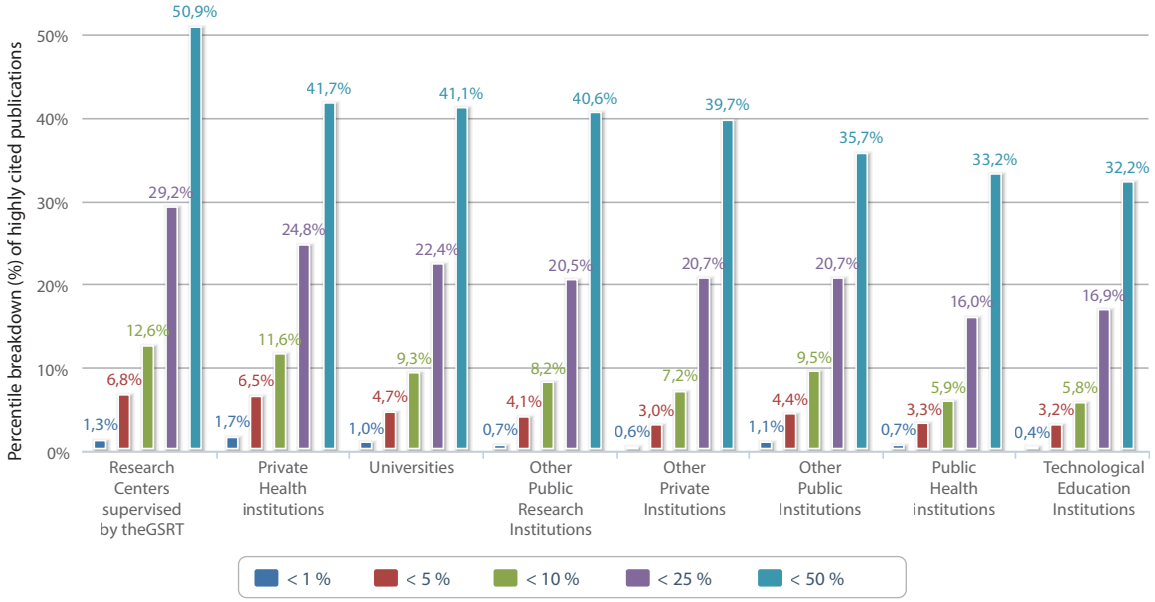


Figure 3.4.2 Percentile breakdown (%) of highly cited publications, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: Publications that belong to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

3.5 Major fields of science

The citation scores of publications across the six major fields of science for all institution categories*, appear in Figure 3.5.1 The Figure also displays the number of publications and citations. Data refers to the most recent 5-year period 2006-2010.

In "Natural Sciences", citation scores for a small number of publications attributed to the "Private Health Institutions" (1.20) and publications of "Research Centres supervised by GSRT" (1.07) were above the world average.

In "Engineering and Technology" the highest citation score was 0.99, –very close to the world average– and was attributed to the publications of "GSRT Research Centres".

In "Medical Sciences", publications of three Institution Categories had a slightly better performance that the world average: "GSRT Research Centres" (1.09), "Private Health Institutions" (1.05) and "Other Public Research Centres" (1.03).

In "Agricultural Sciences" the higher citation scores were attributed to the publications of "GSRT Research Centres" (1.07) and "Universities" (0.97).

In "Social Sciences", citation scores were below the world average for all institution categories. Publications of "GRST Research Centres" had the higher value (0.85).

Finally, in the field of "Humanities", only "Universities" and "GRST Research Centres" produced publications in a systematic way, both with citation scores below the world average.

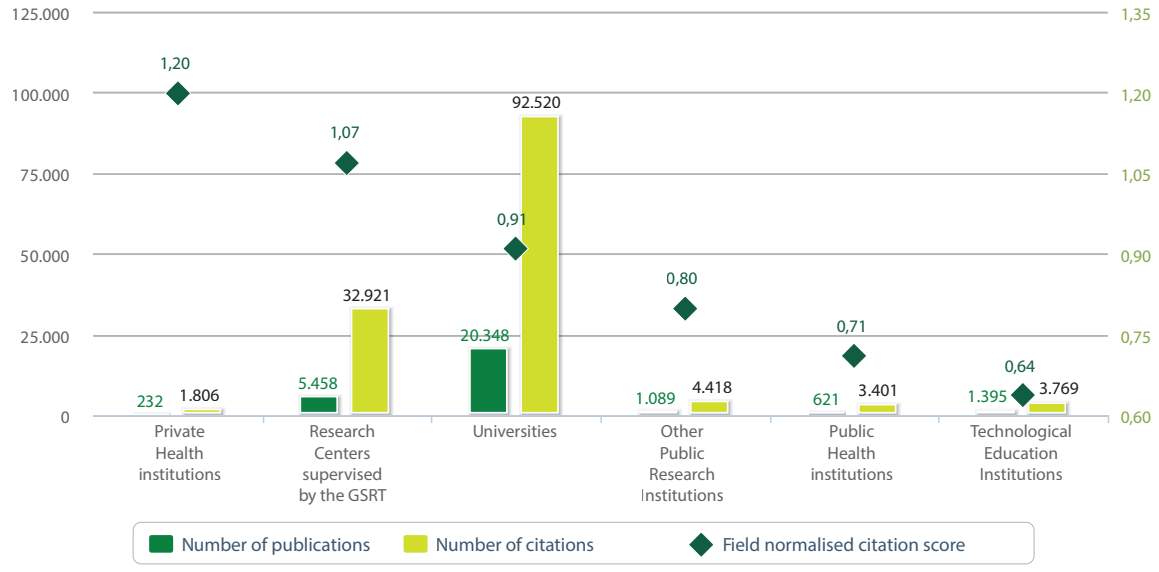


Figure 3.5.1 Major Field of Science "Natural Sciences". Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

* The field normalised citation rate was provided only for the Institution Categories with more than 75 publications for the period 1996-2010.

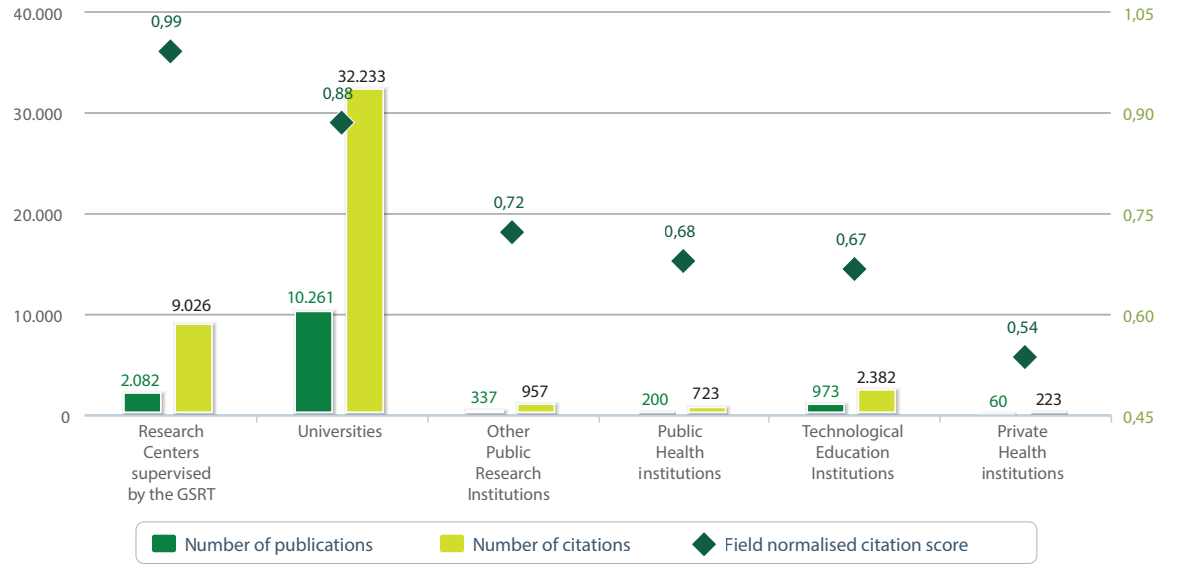


Figure 3.5.1 Major Field of Science "Engineering & Technology". Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

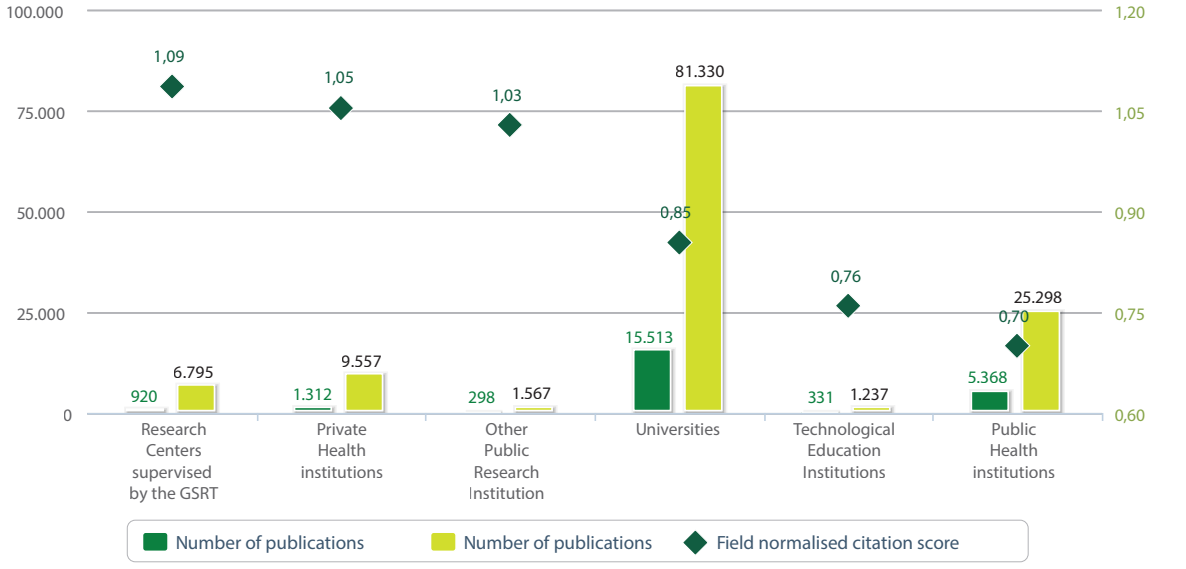


Figure 3.5.1 Major Field of Science "Medical & Health Sciences". Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

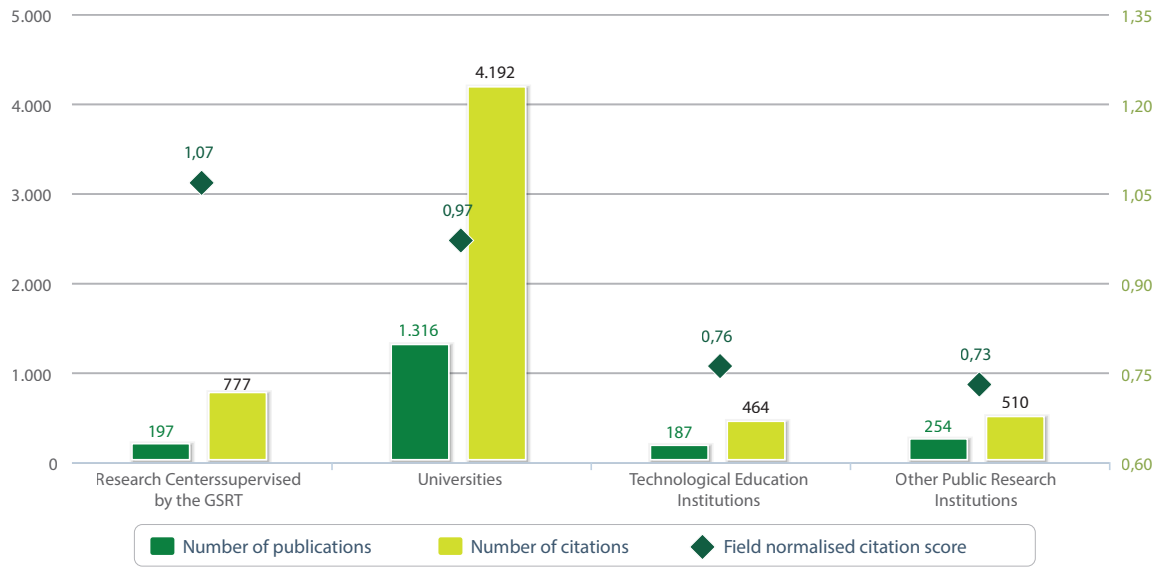


Figure 3.5.1 Major Field of Science "Agricultural Sciences". Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

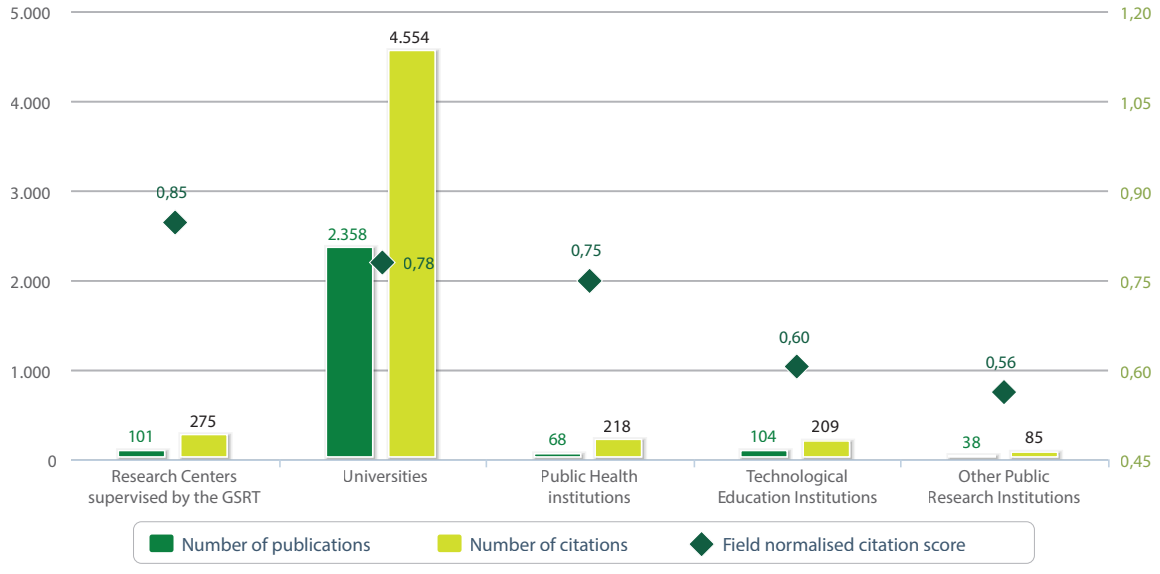


Figure 3.5.1 Major Field of Science "Social Sciences". Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

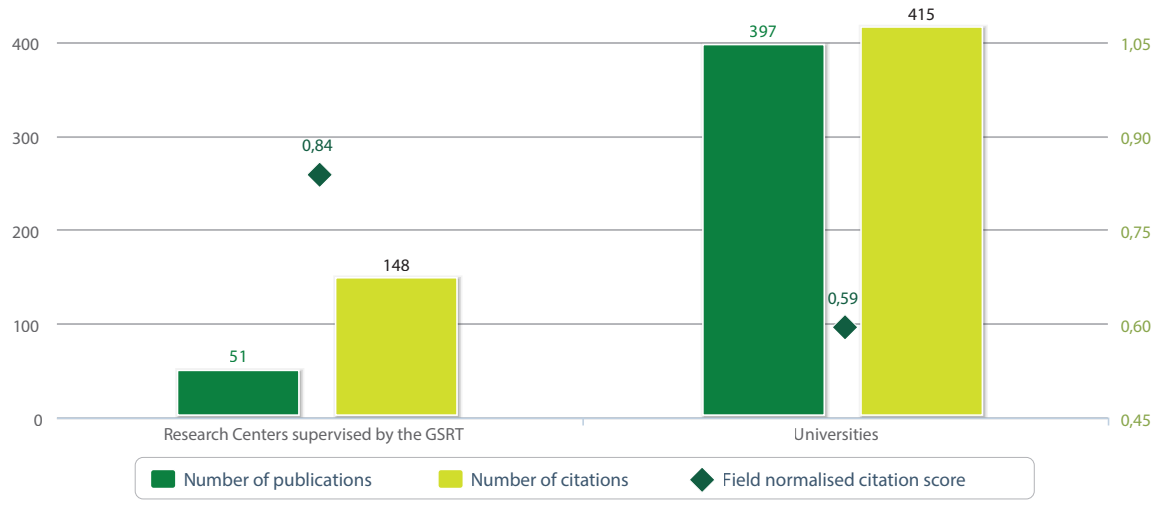


Figure 3.5.1 Major Field of Science "Humanities". Publications, citations and field normalised citation score relative to the world, by institution category, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

3.6 Scientific collaboration

During 1996-2010, all institution categories showed increasing trends in the levels of international and national collaboration.

Notably, up to 2008, there was a considerable growth in the collaborations across national institutions. This can be partly explained by an increase in funding from the national research consortia within national Structural Funds Programmes. For example, the publications being a result of national collaboration* had risen from 796 in 1996 to 3,408 in 2008 for "Universities", from 371 to 888 for "Research Centres supervised by GSRT" and from 32 to 358 for "Technological Educational Institutes" (Figure 3.6.1). However, in the following years, national collaborations had reduced their growth trends for almost all institution categories.

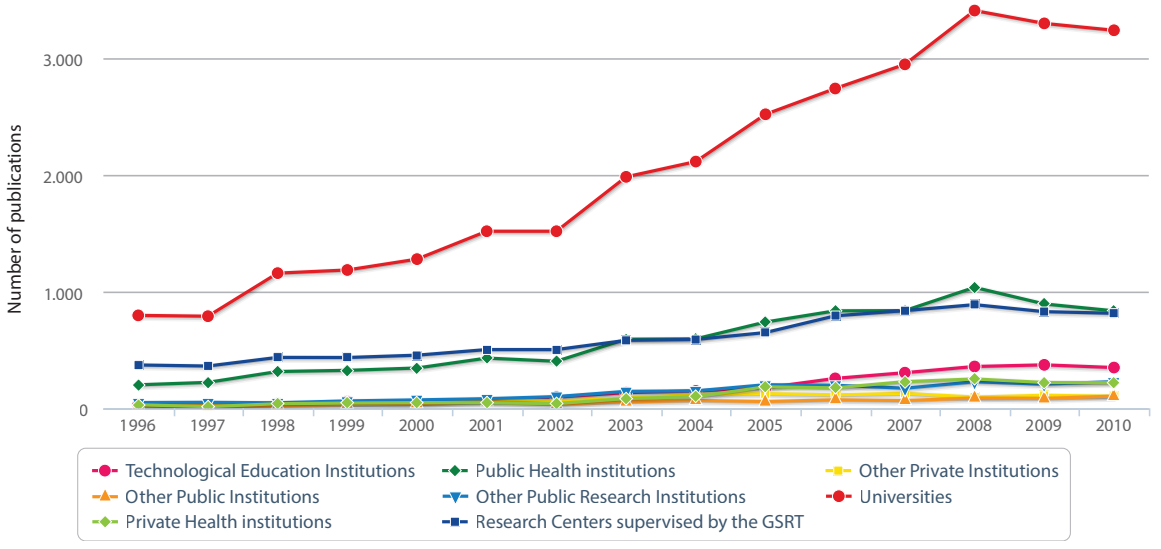


Figure 3.6.1 Number of publications with national collaboration, by institution category, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Publications with national collaboration are publications produced as a result of collaboration between at least two Greek institutions, either of the same category (for example a publication produced as a result of collaboration between 2 Universities) or of different Categories (for example a publication produced as a result of collaboration between a University and a Private Health Institution).

The majority of publications with national collaboration included Universities as partners (Figure 3.6.2). Universities exhibited strong collaborative links with Research Centres supervised by GSRT and Public Health Institutions.

	Universities	TEI	Research Centers supervised by GSRT	Other Public Research Institutions	Public Health Institutions	Private Health Institutions	Other Public Institutions	Other Private Institutions
Universities	7.131	1.732	4.837	1.066	5.870	1.319	423	562
Technological Educational Institutes	1.732	154	263	102	80	28	59	42
Research Centers supervised by GSRT	4.837	263	198	117	155	41	61	78
Other Public Research Institutions	1.066	102	117	17	64	12	14	35
Public Health Institutions	5.870	80	155	64	1.889	820	14	57
Private Health Institutions	1.319	28	41	12	820	359	3	21
Other Public Institutions	423	59	61	14	14	3	16	9
Other Private Institutions	562	42	78	35	57	21	9	10

Figure 3.6.2 Mapping of collaborations between categories of Greek institutions, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

The growth rate of Greek publications with international collaboration was slightly lower than the growth rate of publications produced as a result of national collaboration. More specifically, the number of international publications had risen from 948 in 1996 to 3,322 in 2010 for "Universities", from 342 in 1996 to 746 in 2010 in "Research Centres supervised by GSRT" and from 20 in 1996 to 111 in 2010 for "Technological Educational Institutes" (Figure 3.6.3).

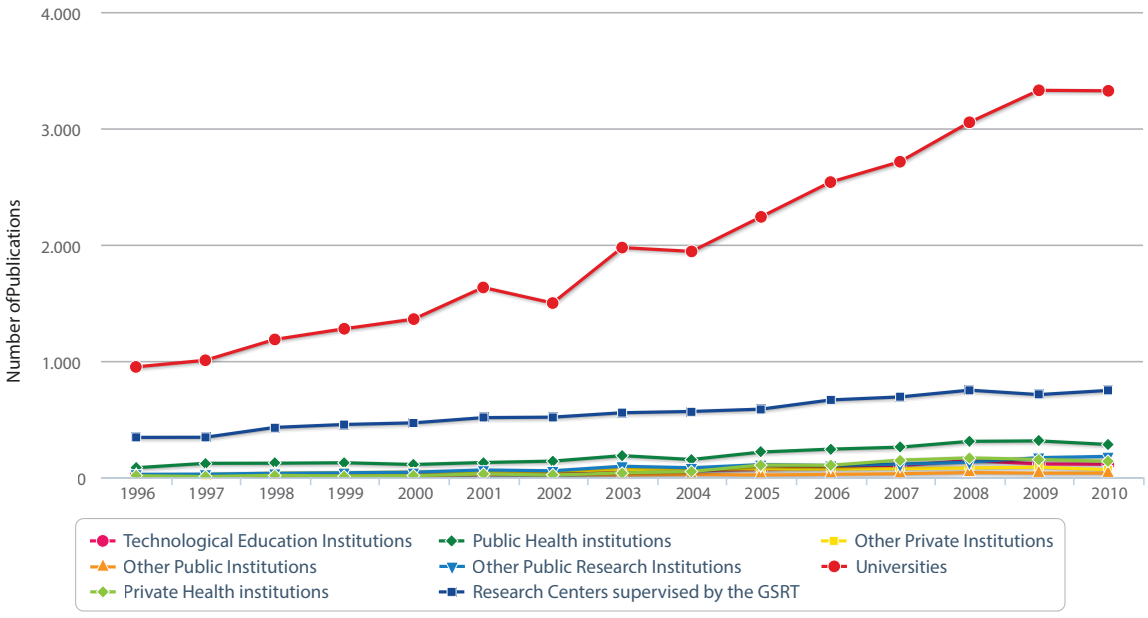


Figure 3.6.3 Number of publications with international collaboration, by institution category, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

The level and the type of collaboration –national or international- varied significantly within institution categories (Figure 3.6.4). "Universities" had the highest share of publications without collaboration*, which was equal to 35.4% during the 5-year period 2006-2010. "GSRT Research Centres" had the highest share of publications with international collaborations* (52.7% during the 5-year period 2006-2010). Finally, "Private Health institutions" had the highest share of publications with national collaborations* (78.5% during the 5-year period 2006-2010).

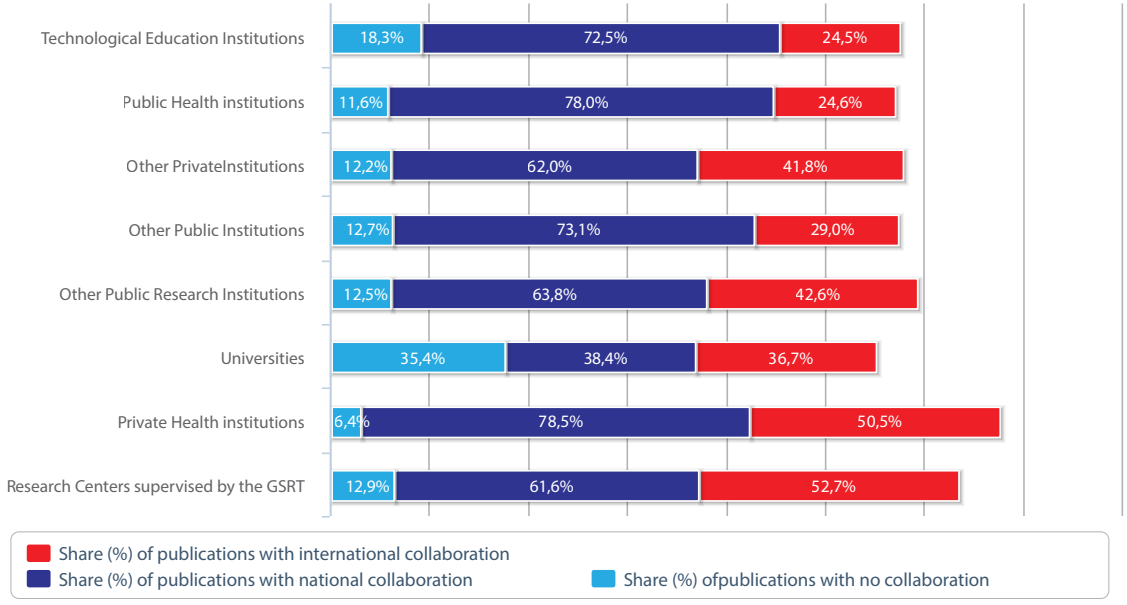


Figure 3.6.4 Share (%) of publications with national, international and no collaboration, by institution category, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

"Universities" account for the majority of scientific output in Greece. The chapter examines bibliometric indicators for the publications produced by 21 Universities.

The table below presents the number of publications and citations for each University. Data corresponds to the period 2006-2010 and displays progression rates when compared to data which emerges from the preceding 5 year period, 2004-2008 – presented in the study that EKT published in 2010-.

Publications by Research Centers and hospitals operating in Universities were also included in the total number of publications by University.

Due to their relatively small output of publications, the International Hellenic University, the Athens School of Fine Arts and the University of Western Greece were not represented in the graphs.

CHAPTER 4

SCIENTIFIC PUBLICATIONS BY UNIVERSITIES

		2004-2008		2006-2010	
		Number of publications	Number of citations	Number of publications	Number of citations
Aristotle University of Thessaloniki	AUTH	7.602	25.504	8.577	32.469
Agricultural University of Athens	AUA	995	3.001	1.140	4.182
Demokritos University of Thrace	DUTH	1.478	3.664	1.827	5.931
National & Kapodistrian University of Athens	UOA	9.836	43.697	11.311	58.803
Hellenic Open University	HOU	118	337	136	290
National Technical University of Athens	NTUA	4.058	9.715	4.261	13.036
Ionian University	IONIO	51	16	63	22
Athens University of Economics and Business	AUEB	514	629	580	897
University of the Aegean	AEGEAN	839	2.024	959	2.340
University of Western Macedonia	UOWM	91	117	183	355
University of Thessaly	UTH	1.738	5.591	2.136	8.443
University of Ioannina	UOI	3.262	16.642	3.481	20.705
University of Crete	UOC	3.458	18.006	3.854	23.755
University of Macedonia of Economic and Social Sciences	OUM	218	277	260	506
University of Patras	UPATRAS	4.536	15.642	4.989	22.093
University of Piraeus	UNIPI	366	422	508	892
University of Peloponnese	UOP	150	242	236	512
University of Central Greece	UCG	10	-	43	96
Panteion University of Social and Political Sciences	PANTEION	78	91	89	149
Technical University of Crete	TUC	683	1.868	856	3.301
Harokopio University of Athens	HUA	444	2.006	616	2.883

4.1 Publications

The greatest number of publications was attributed to the National and Kapodistrian University of Athens/UOA and the Aristotle University of Thessaloniki/AUTH- the country's largest Higher Education Institutions - with 2,368 and 1,734 publications in 2010 respectively (Figure 4.1.1). These were followed by 6 other Universities with more than 400 publications in 2010: the University of Patras/ UOP (960 publications), the National Technical University of Athens/NTUA (820), the University of Crete/UOC (786), the University of Ioannina/UOI (714), the University of Thessaly/UTH (452) and the Demokritos University of Thrace/ DUTH (415). The remaining Universities produced less than 250 publications in 2010.

There was a growth trend in the number of publications by Universities from 1996 to 2008, which leveled off for some of them in 2009 and 2010. However, it has been a steady rise for the Agricultural University of Athens/AUA, the Harokopio University of Athens/HUA, the University of Western Macedonia/UOWM and the University of Piraeus/UNIPI as shown in Figure 4.1.1.

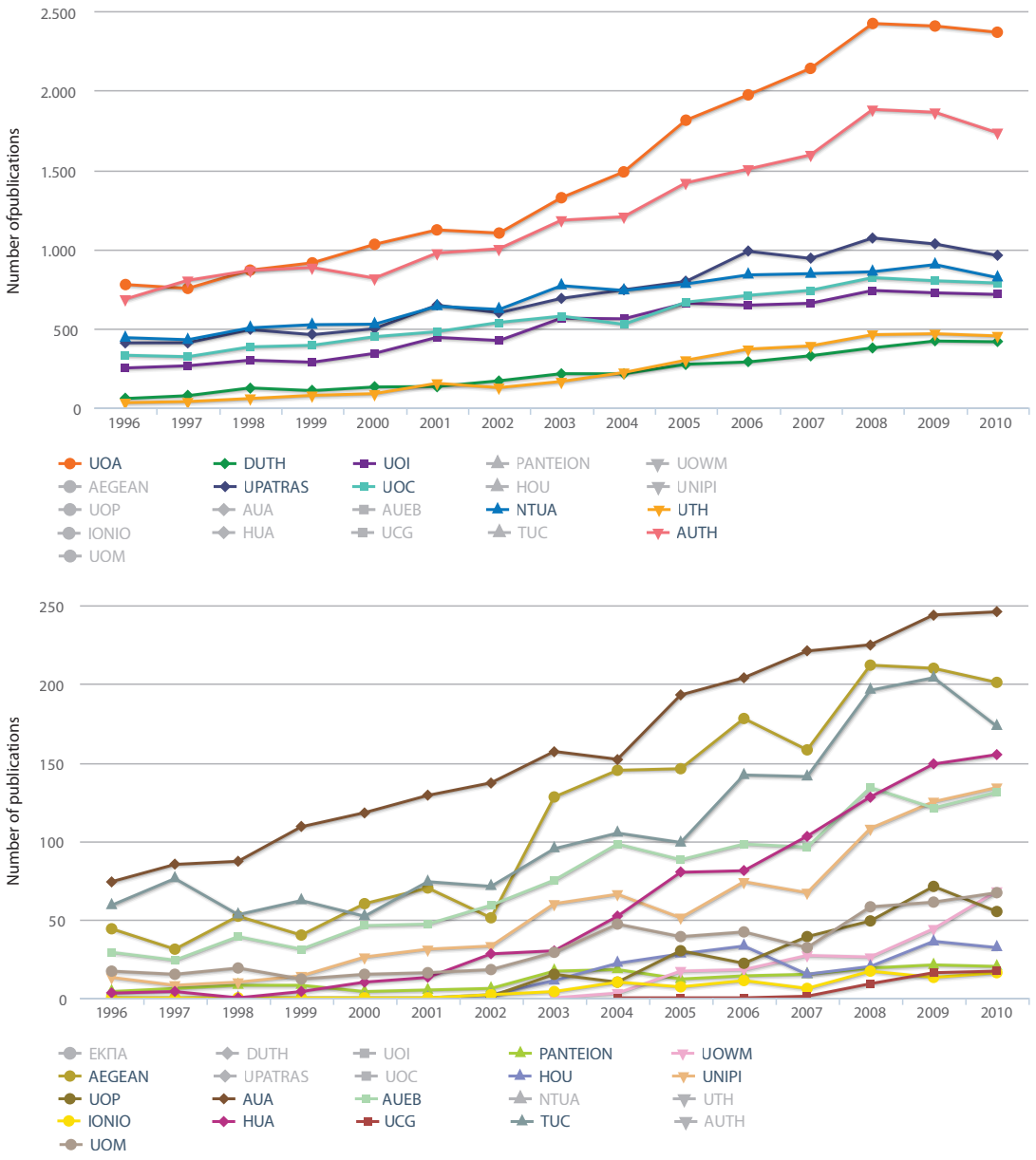


Figure 4.1.1 Development of the number of publications by University, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* The indicators are shown in two separate figures to illustrate them more clearly.

Figure 4.1.2 demonstrates the number of publications and its annual change rate between 1996 and 2010 for each University.

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

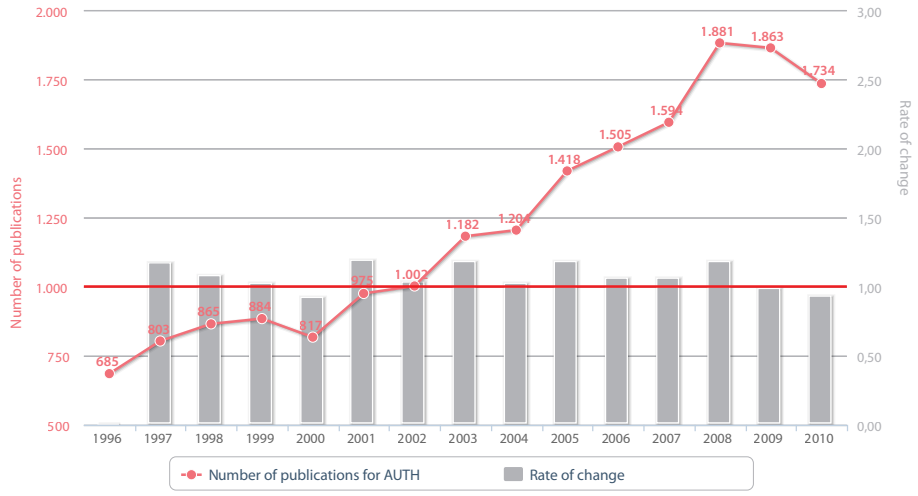


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Aristotle University of Thessaloniki", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

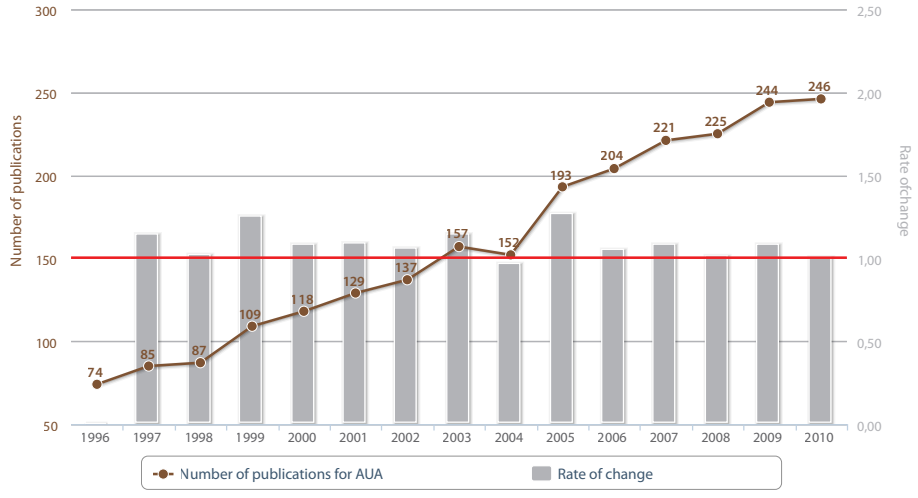


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Agricultural University of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

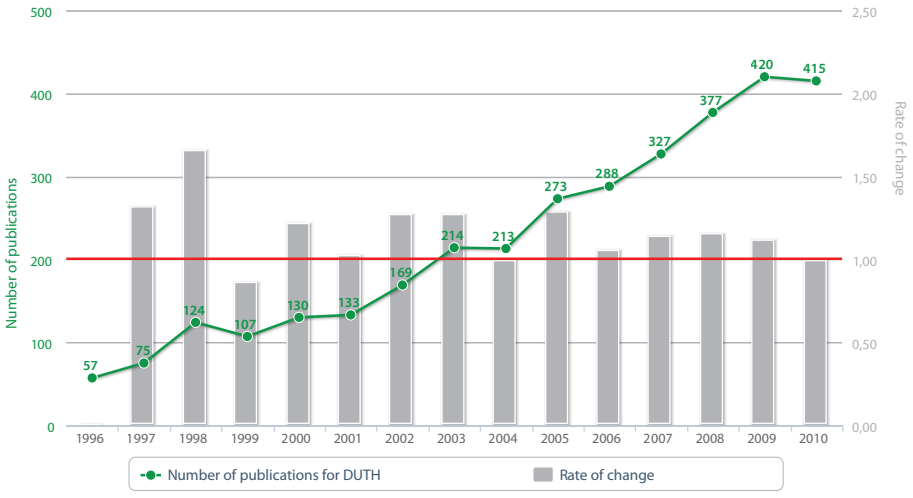


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Demokritos University of Thrace", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

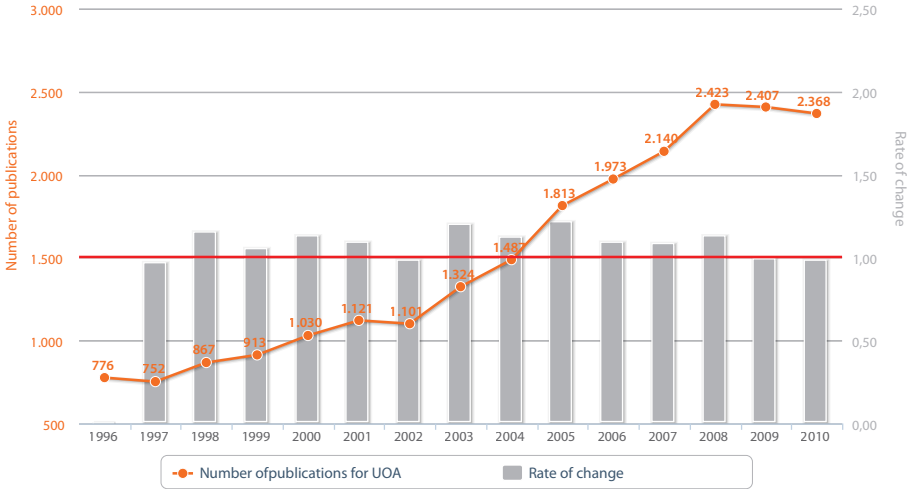


Figure 4.1.2 Number of publications and rate of change in the number of publications by "National & Kapodistrian University of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

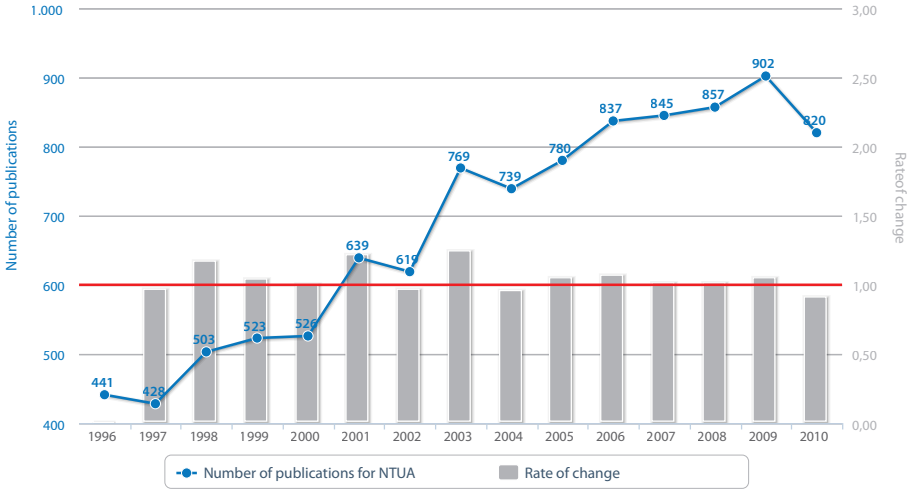


Figure 4.1.2 Number of publications and rate of change in the number of publications by "National Technical University of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

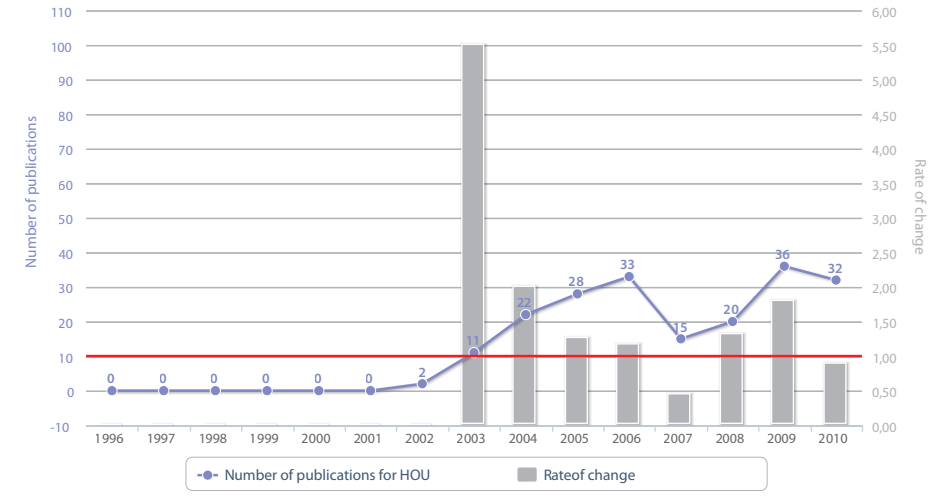


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Hellenic Open University", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

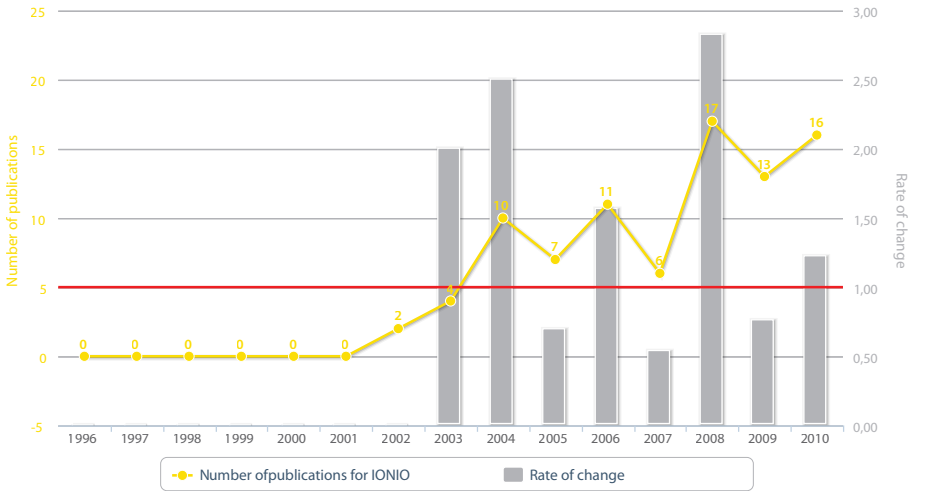


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Ionian University ", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

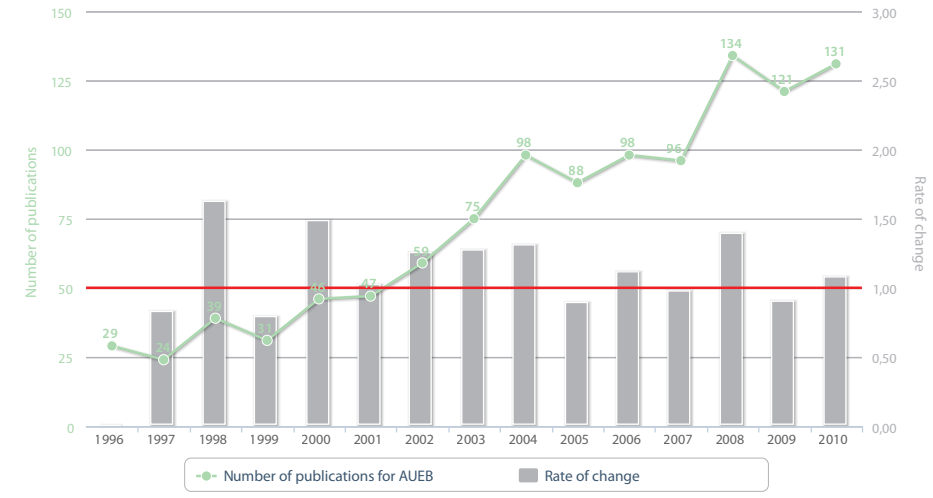


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Athens University of Economics and Business", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

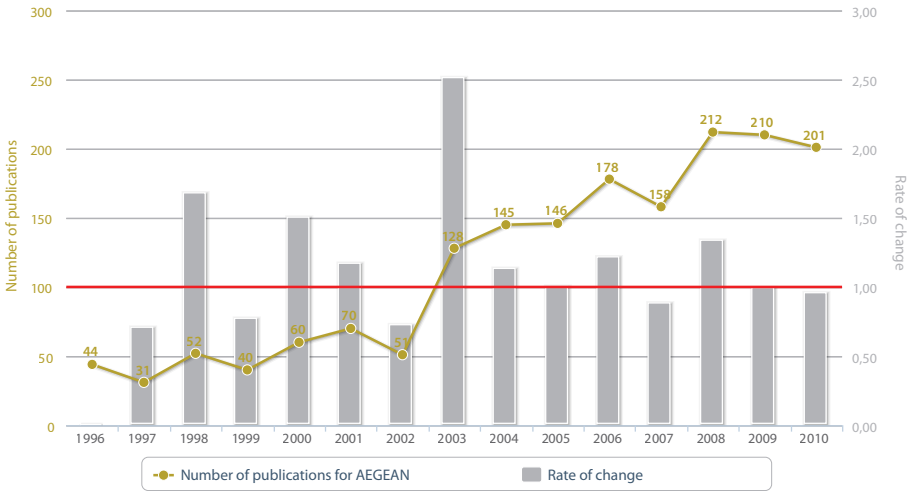


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of the Aegean", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

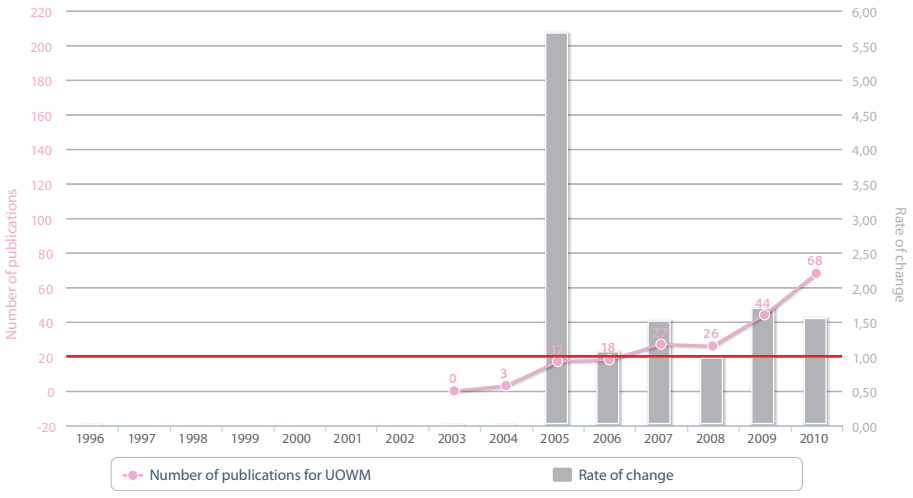


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Western Macedonia", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

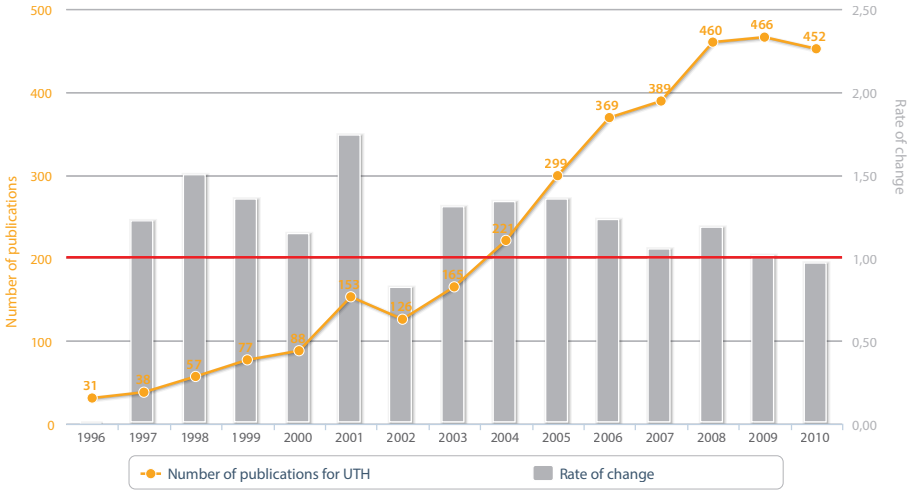


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Thessaly", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

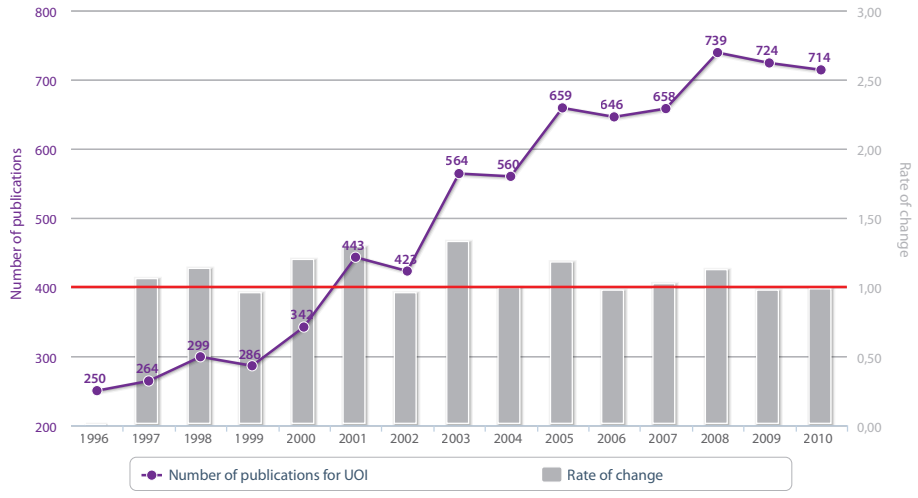


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Ioannina", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

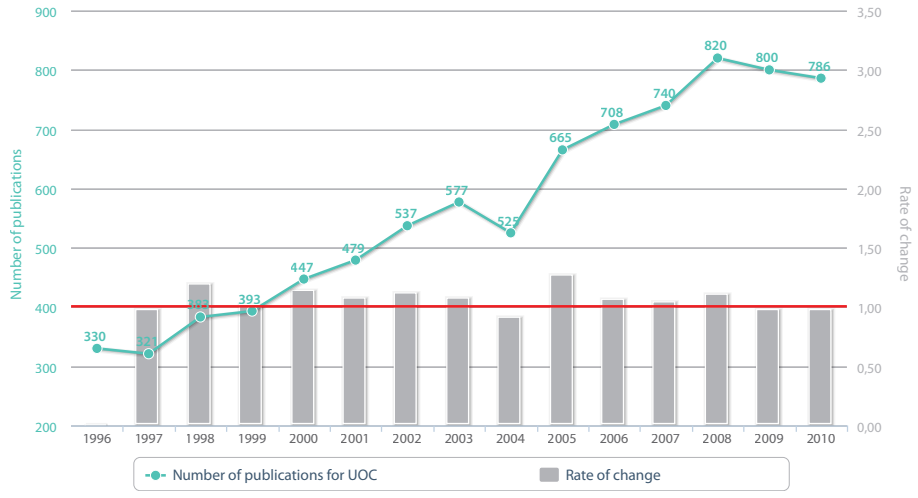


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Crete", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

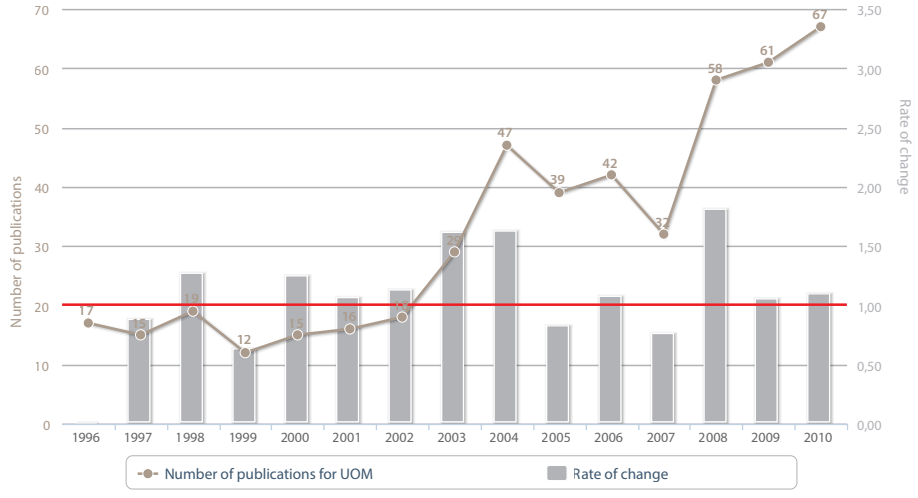


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Macedonia", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

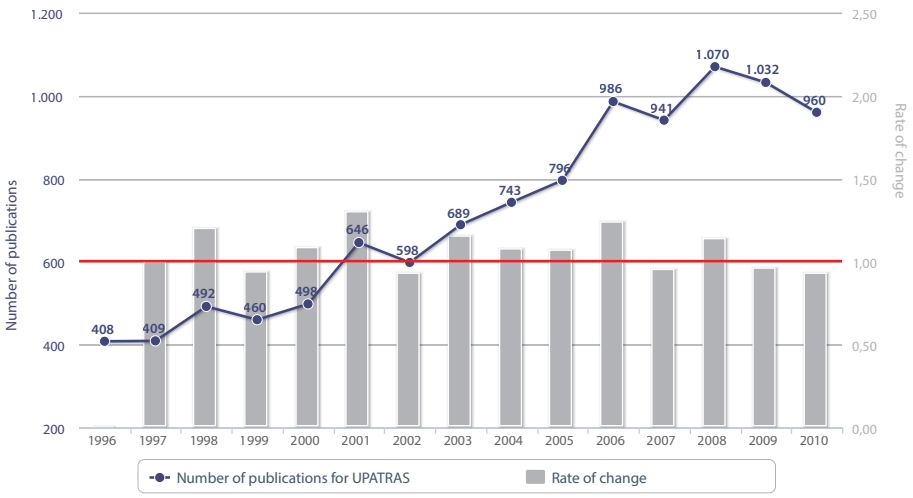


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Patras", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

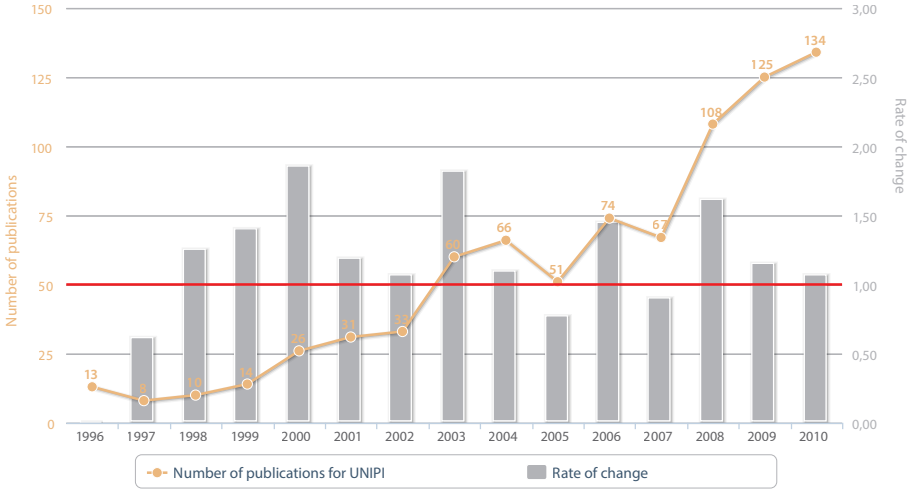


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Piraeus", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

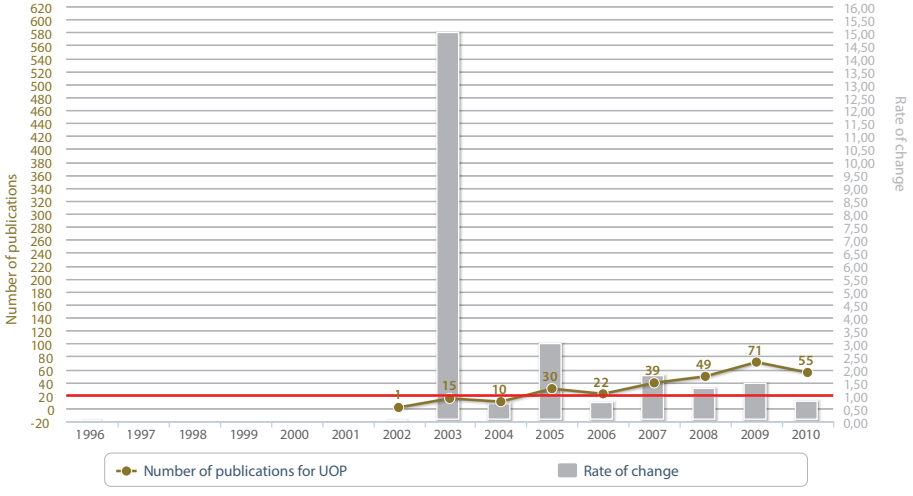


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Peloponnese", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

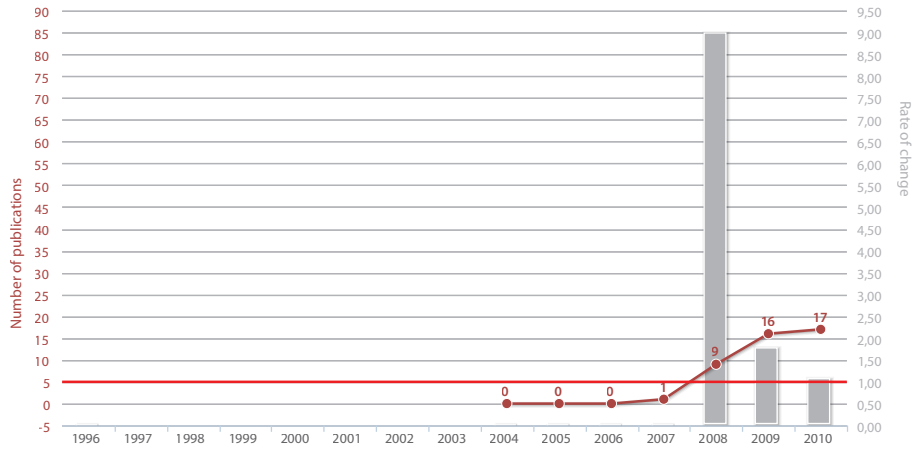


Figure 4.1.2 Number of publications and rate of change in the number of publications by "University of Central Greece ", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

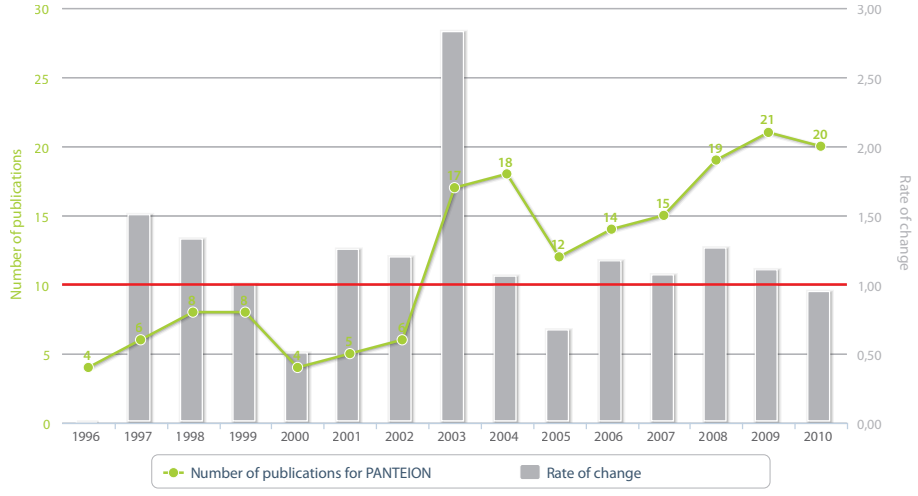


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Panteion University", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

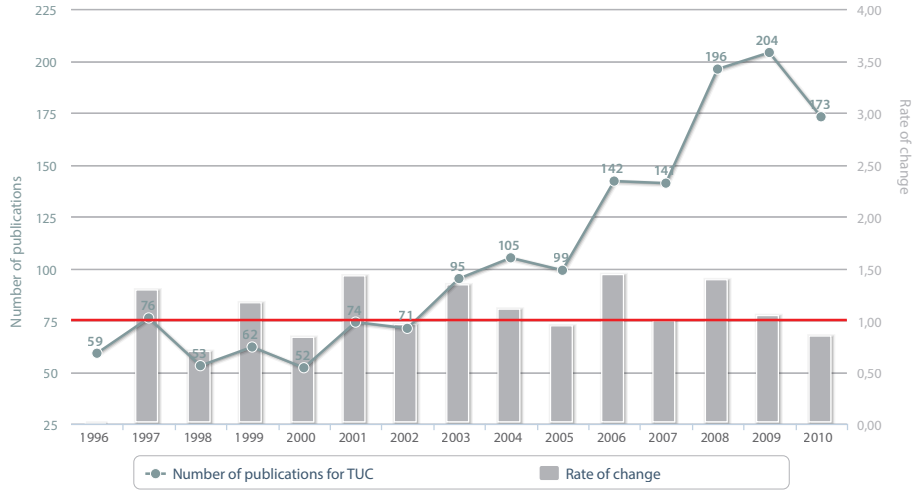


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Technical University of Crete", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

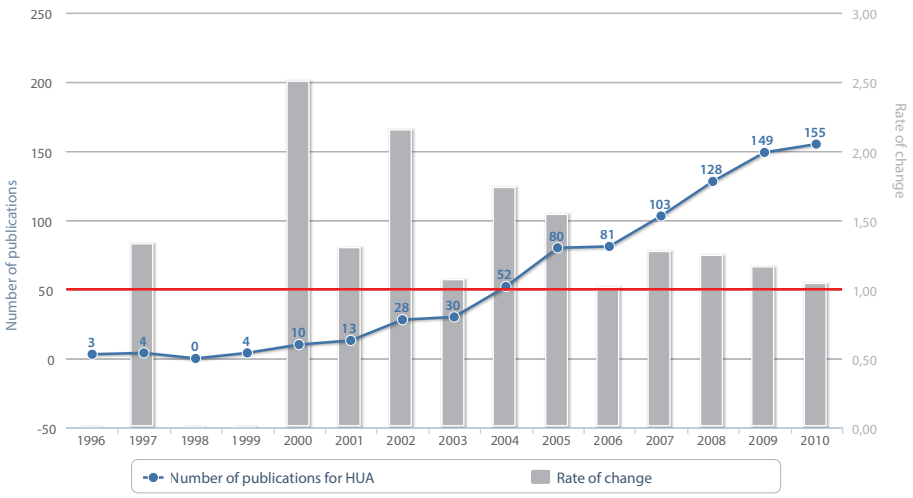


Figure 4.1.2 Number of publications and rate of change in the number of publications by "Harokopio University of Athens ", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Focusing on the last 5-year period, Figure 4.1.3 displays, for each University, the number of publications and the (%) share it holds within the category of "Universities". The National & Kapodistrian University of Athens/UOA accounted for 11,311 publications and a share of 27.8%, the Aristotle University of Thessaloniki/ AUTH for 8,577 publications and a share of 21.3%, the University of Patras/UOP for 4,989 publications and a share of 12.3% and the National Technical University of Athens/ NTUA for 4,261 publications and a share of 10.5%. Other Universities had a share of less than 10%.

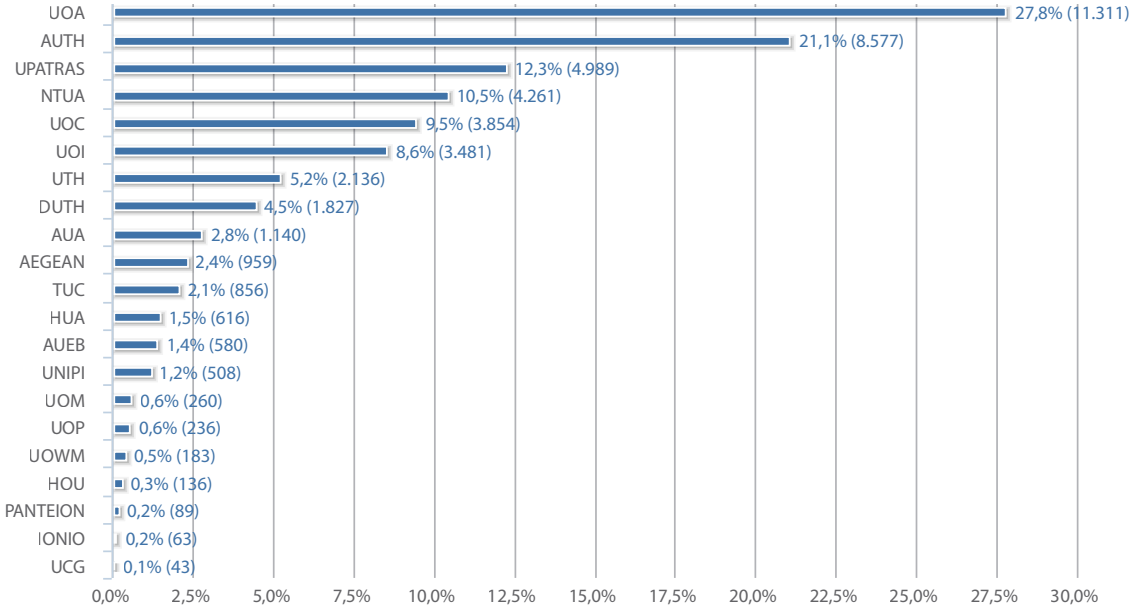


Figure 4.1.3 Number and share (%) of publications, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

As shown in Figure 4.1.4, between 2006 and 2010, there was a rise in the number of publications in 17 Universities while 5 of them had a rate of change above the average rate of the category "Universities" (University of Western Macedonia/ UOWM, University of Peloponnese/UOP, Harokopio University of Athens/HUA, University of Piraeus/UNIPI and University of Macedonia of Economic and Social Sciences/UOM).

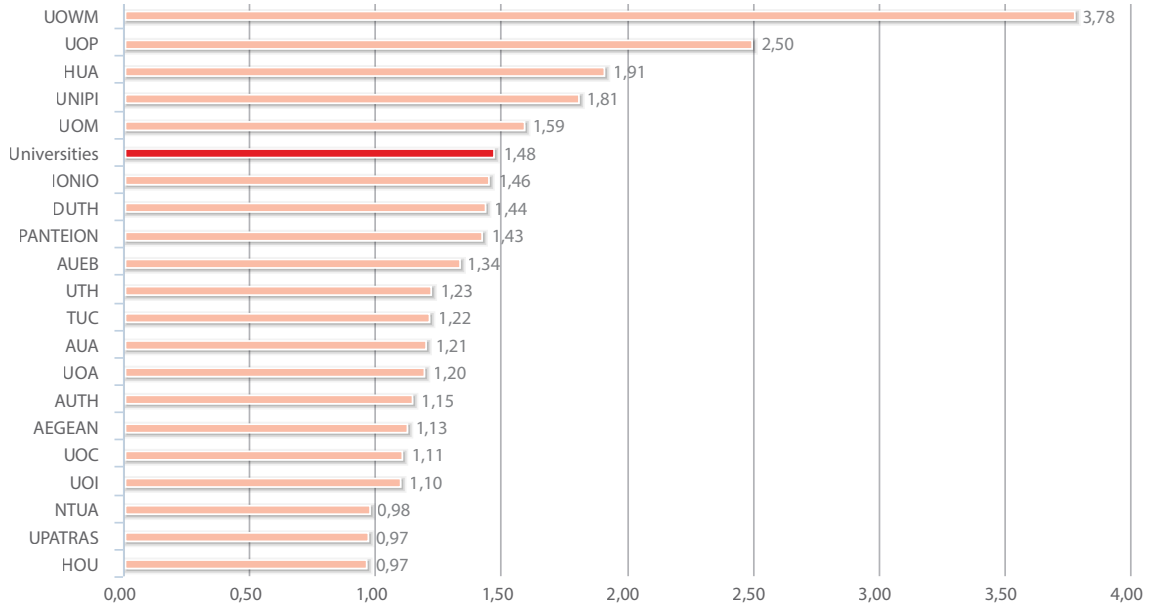


Figure 4.1.4 Change in the number of publications between 2006 and 2010, by University / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

4.2 Citations

Figure 4.2.1 1 demostrates, the percentage (%) of cited publications for each University, and levels of growth over the period 1996-2010. An increasing trend was observed for all Universities, with the University of Crete/UOC, achieving the best performance.

The percentage (%) of cited publications was above Greek average (65.5%) for the following institutions: the University of Crete/UOC (74.2%), the Agricultural University of Athens/AUA (70.3%), the Harokopio University of Athens/HUA (70.3%), the National & Kapodistrian University of Athens/UOA (68.4%), the University of Thessaly/UTH (66.4%) and the University of Patras/UOP (66.3%).

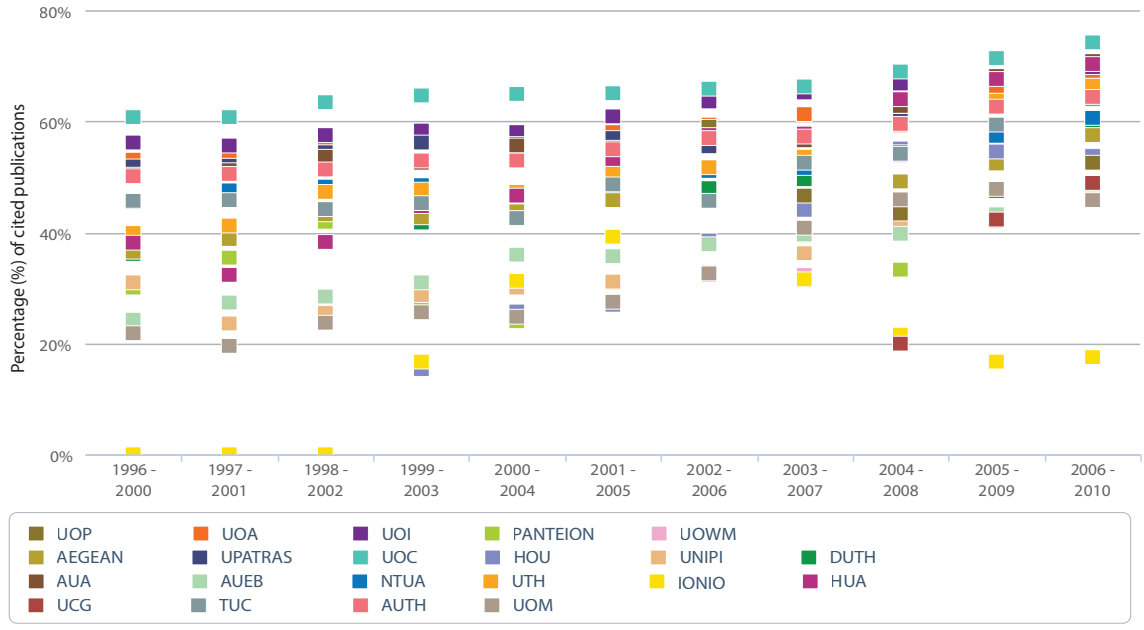


Figure 4.2.1 Percentage (%) of cited publications by University, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Growth was observed in the number of citations received by publications of all Universities (Figure 4.2.2). Universities were ranked as follows in decreasing order of the number of citations received by their publications: National & Kapodistrian University (UOA), Aristotle University of Thessaloniki (AUTH), University of Crete (UOC), University of Ioannina (UOI), University of Patras (UOP), National Technical University of Athens (NTUA), University of Thessaly (UTH) and Demokritos University of Thrace (DUTH).

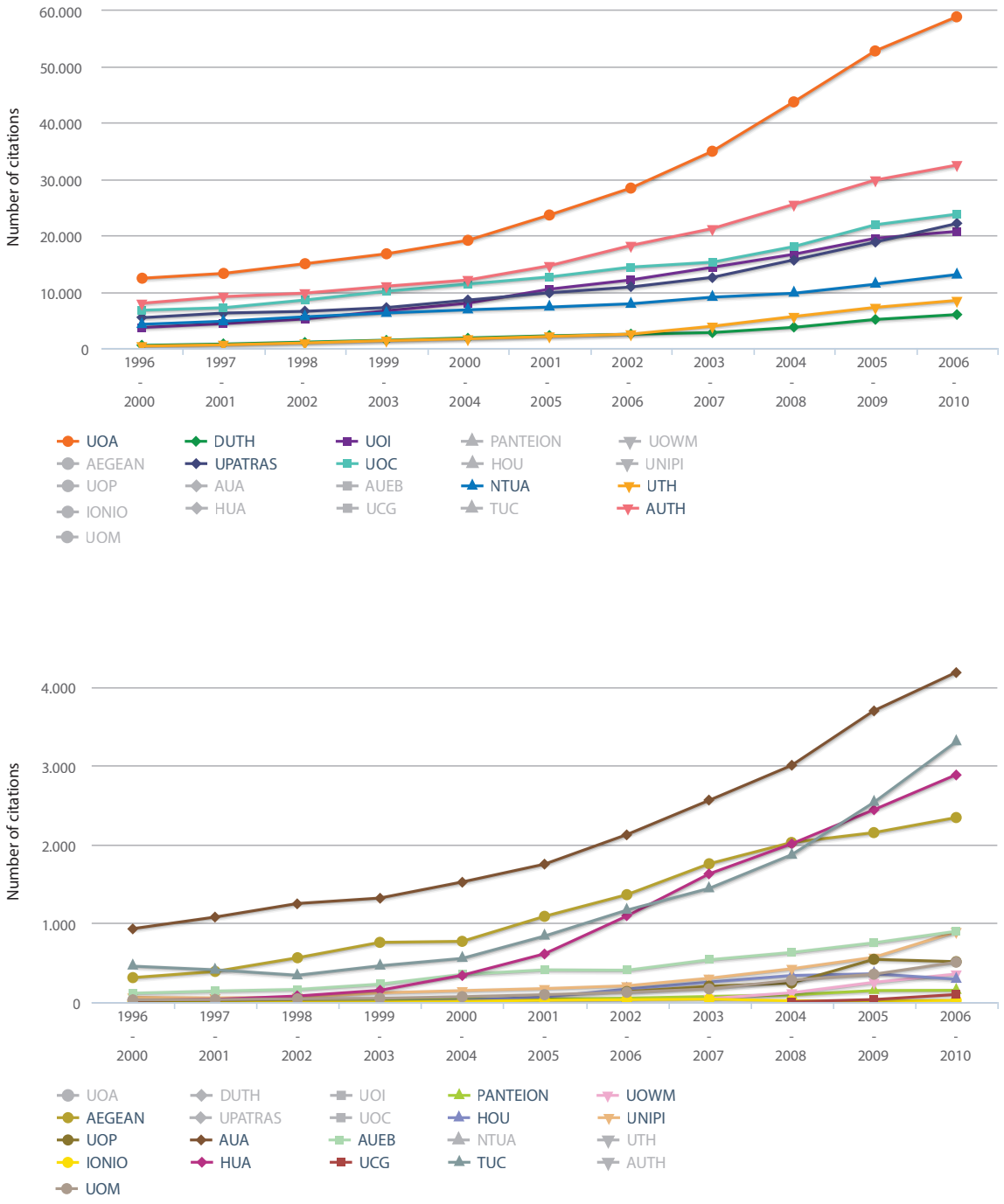


Figure 4.2.2 Number of citations by University, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* The indicators are shown in two separate Figures to illustrate them more clearly.

The Universities with a share of citations in the total citations of the category "Universities" higher than 10% were the National & Kapodistrian University of Athens/UOA (58,803 publications; a 32.9% share), the Aristotle University of Thessaloniki/AUTH (32.469 publications; a share of 18.2%), the University of Crete/UOC (23,755 publications; a share of 13.3%), the University of Patras/UOP (22,093 publications; a share of 12.4%) and the University of Ioannina/ UOI (20,705 publications; a share of 11.6%). The remaining Universities had less than a 10% share (Figure 4.2.3)

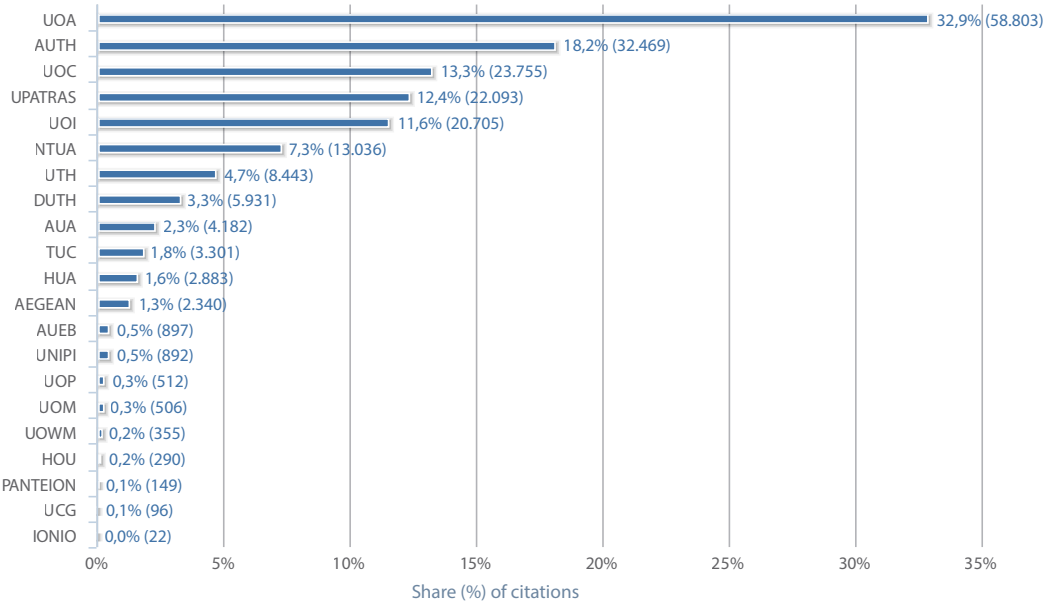


Figure 4.2.3 Number and share (%) of citations by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

4.3 Citation impact

With regard to the 5-year period 2006-2010, Figures 4.3.1 and 4.3.2* display the number of publications and citations as well as the relevant "field-normalised citation score" for each University. The field normalised citation score or "citation score" is the relative number of citations to publications of a University compared to the world average of citations to publications of the same time period and scientific subject field. The normalisation was done on an individual article level according to the 253 NSI scientific subject fields. If an article was originating in more than one scientific fields, a mean value of the fields was calculated. The citation score was calculated using software developed by the National Documentation Centre (EKT). A value greater than 1, indicatesw that the impact of publications is higher than the world average.

Citation score's values and the number of Universities approaching the world average indicate a better performance when compared to those of the preceding years. The Technical University of Crete/ TUC, the University of Crete/UOC, the University of Ioannina/UOI and the Harokopio University of Athens/HUA ranked first, exceeding the world average (citation scores 1.11, 1.08, 1.04 and 1.01 respectively). The citation score was approaching the world average with values over 0.9 - for the University of Piraeus/UNIPI (0.95), the Agricultural University of Athens/AUA (0.94) and the University of Western Macedonia/ UOWM (0.90):

* The indicators are shown in two separate Figures to illustrate them more clearly.

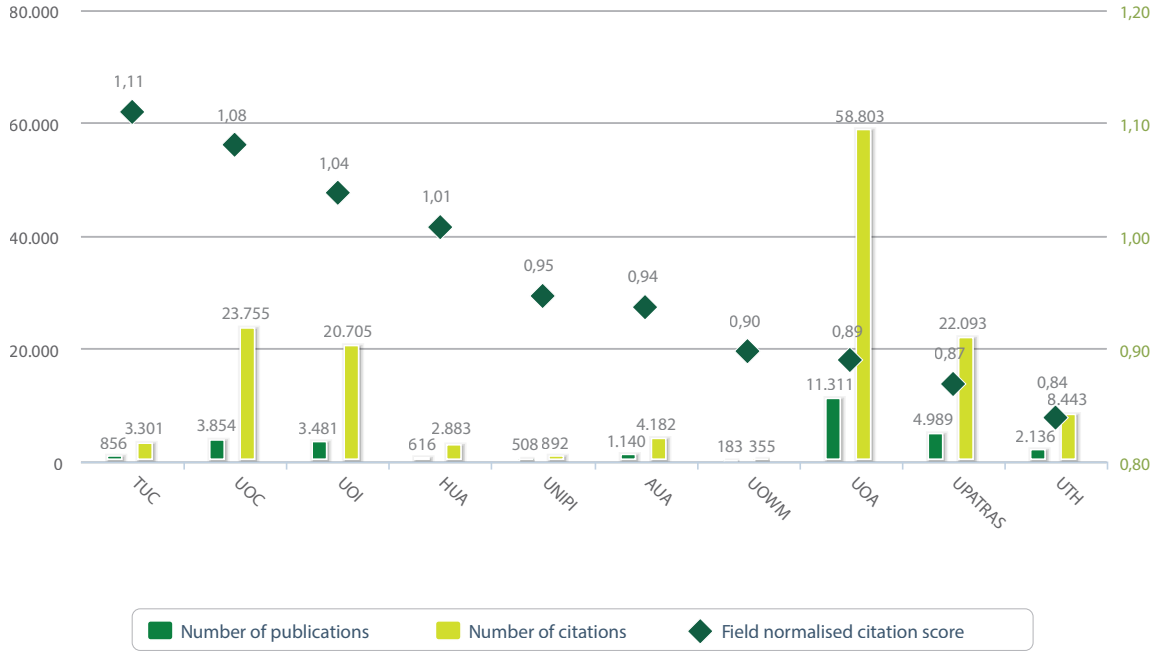


Figure 4.3.1 Publications, citations and field normalised citation score relative to the world, by University, 2006-2010. Data refers to the total number of publications in each University for all scientific fields / Source: Thomson Reuters, Incites 1996-2010

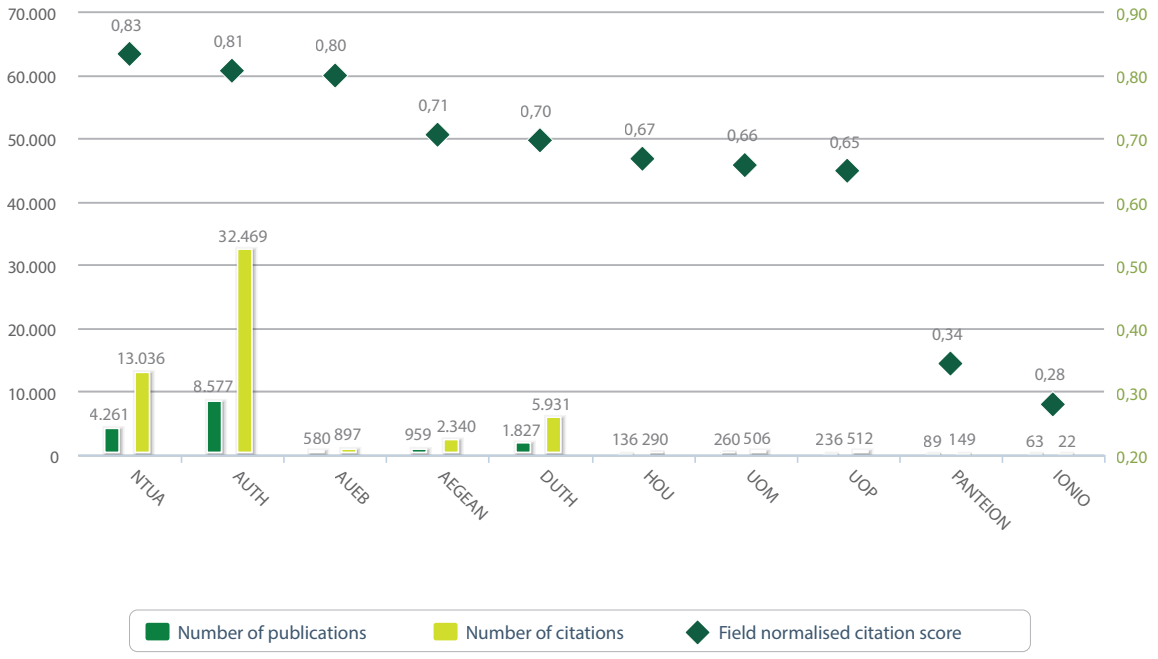


Figure 4.3.2 Publications, citations and field normalised citation score relative to the world, by University, 2006-2010. Data refers to the total number of publications in each University for all scientific fields / Source: Thomson Reuters, Incites 1996-2010

4.4 Highly cited publications

For the period 2006-2010, Figures 4.4.1 and 4.4.2** demonstrate, for each University, the number of highly cited publications for percentile levels 1%, 5%, 10%, 25% and 50%, i.e. the publications that belong respectively to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

The following Universities produced publications which were ranked among the 1% most highly cited publications worldwide: National & Kapodistrian University of Athens/UOA (124), University of Ioannina/UOI (62), Aristotle University of Thessaloniki/AUTH (60), University of Crete/UOC (49), University of Patras/UOP (37), National Technical University of Athens/NTUA (34), Technical University of Crete/TUC (19), University of Thessaly/UTH (15), Agricultural University of Athens/AUA (9), Demokritos University of Thrace/DUTH (9), Harokopio University of Athens/HUA (6), University of Piraeus/ UNIPI (5), University of the Aegean/ AEGEAN (4), University of Western Macedonia/UOWM (2), Athens University of Economics and Business/AUEB (1) and University of Central Greece/UCG (1).

In addition, Figures 4.4.1 and 4.4.2 display the percentage of the highly cited publications in each University for percentile levels 1%, 5%, 10%, 25% and 50%. Data refers to the last 5-year period 2006-2010. Values above the percentile levels indicate that the specific University has the majority of its publications among the top 1%, 5%, 10%, 25% and 50% than the world average.

Being above the world average for percentile levels 1%, 5% and 10% and 25%, the top performing Universities were the University of Crete/UOC , the University of Ioannina/UOI and the Technical University of Crete/TUC. The National & Kapodistrian University of Athens/AUA was above the world average for percentile levels 1% and 5%. Also, the University of Piraeus/UNIPI and the Harokopio University of Athens/HUA were above the world average for the levels of 1% and the Agricultural University of Athens/AUA for 5%. Finally, the small number of publications of the University of Central Greece/ UCG, displays a breakdown above world average for the percentile levels 1%, 5%, 10% and 25%.

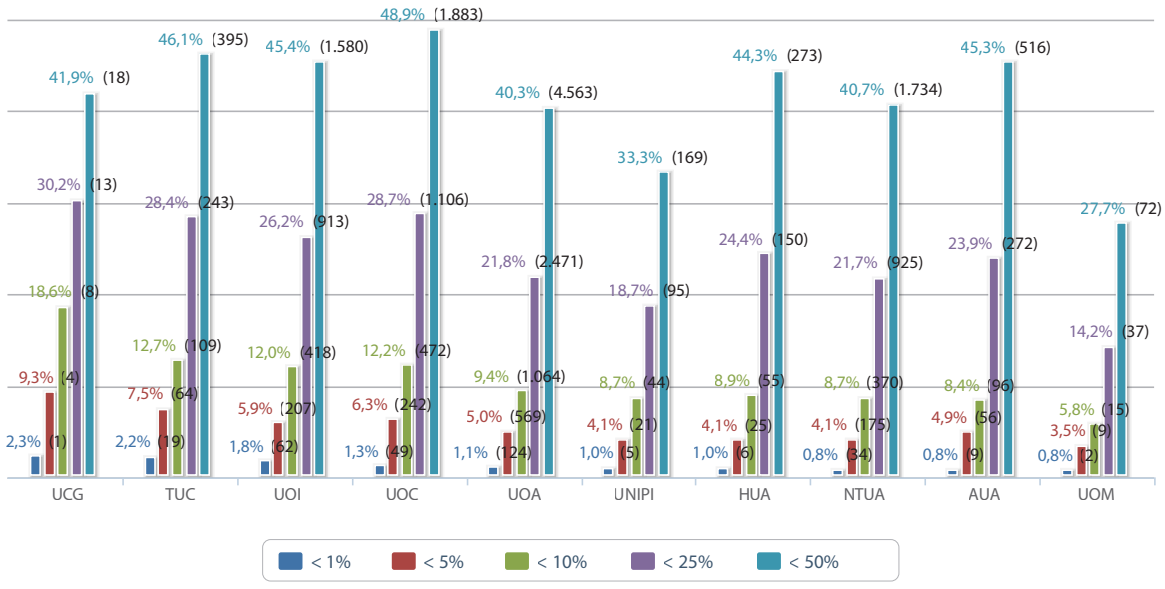


Figure 4.4.1 Number and percentile breakdown (%) of highly cited publications by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: Publications that belong to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world

* The indicators are shown in two separate Figures to illustrate them more clearly.

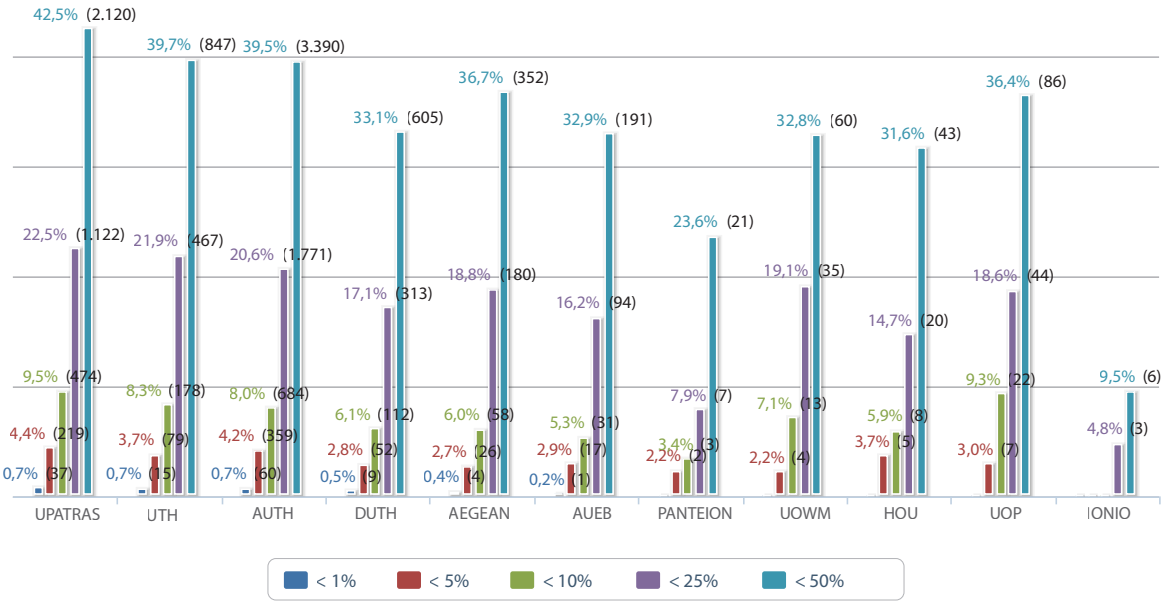


Figure 4.4.2 Number and percentile breakdown (%) of highly cited publications by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: Publications that belong to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world

4.5 Major fields of science

Figure 4.5.1 displays the number of publications and citations and the field-normalised citation score by "Universities" in the six major scientific fields* during the most recent 5-year period 2006-2010. The Figure presents the overall performance of each University in each of the six major fields. Indicators were calculated, after normalisation on an individual article level, as the mean values of the different subject fields included in each major scientific field. Figure 4.5.2 displays subject fields with citation scores above 1.5 and thus provides a detailed picture regarding the Universities' performance.

In "Natural Sciences", 18 out of 21 Universities demonstrated an increasing trend in their number of publications. The highest citation score (1.37) was achieved by a small number of publications produced by the Harokopio University of Athens/HUA. In addition, the citation scores exceeded the world average in the following cases: the University of Crete/UOC (1.22), the Technical University of Crete/TUC (1.09), the University of Ioannina/UOI (1.00). The National & Kapodistrian University of Athens/UOA and the University of Patras/UOP were close, with citation scores above 0.98 and 0.94 respectively.

Sixteeen Universities were active in "Engineering & Technology". The publications with citation scores higher than the world average baseline were those of the University of Crete/UOC (1.31), the Agricultural University of Athens/AUA (1.18), the Technical University of Crete/TUC (1.13), the University of Piraeus/UNIPI (1.05), the University of Western Macedonia/UOWM (1.01), the University of Ioannina/ UOI (1.00) and the Athens University of Economics and Business/AUEB (0.95).

The majority of publications in "Medical & Health Sciences" came from 10 Universities. Publications with the highest citation scores were those of the Agricultural University of Athens/AUA (1.15), the University of Ioannina/UOI (1.11), the Harokopio University of Athens/HUA (0.96) and the University of Crete/UOC (0.90).
In "Agricultural Sciences", publications emerged mainly from 9 Universities - thus explaining the rise in citation

* For each major scientific field, the field normalized citation score was calculated only for Universities with at least 75 publications in the field.

scores during 2006-2010- the highest citation scores were reached by a relatively small number of publications. Those were attributed to the National Technical University of Athens/NTUA (1.57), the University of Patras/UOP (1.41) and the University of Ioannina/UOI (1.24). The citation scores of publications by the Agricultural University of Athens/AUA (1.01), the Aristotle University of Thessaloniki/AUTH (0.97) and the University of Thessaly/UTH (0.93) was close to the world baseline.

In "Social Sciences", there was a large number of active Universities (15 out of 21) but with a much lower publication output relatively to other scientific fields. Overall, the citation scores have improved when compared to the findings of the 5-year period 2004-2008. The publications of the following institutions were above world average: the University of Piraeus/UNIPI (1.20), the Demokritos University of Thrace/DUTH (1.06), the Technical University of Crete/TUC (1.06), the University of Ioannina/UOI (1.02) and the National Technical University of Athens/NTUA (1.01). The citation score of the Harokopio University of Athens/HUA (0.93) was close to the world average.
Finally, only three Universities were found to systematically produce publications in the field of "Humanities". Aristotle University of Thessaloniki/AUTH was the University with the highest citation score (0.82).

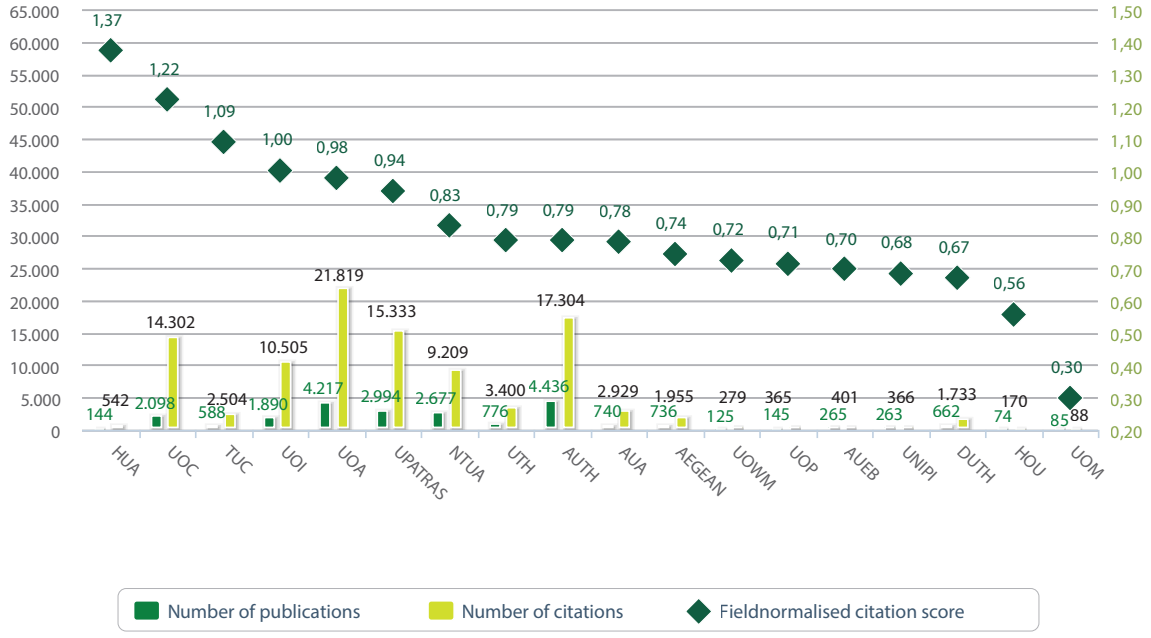


Figure 4.5.1 Major field of science "Natural Sciences". Publications, citations and field normalised citation score relative to the world, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

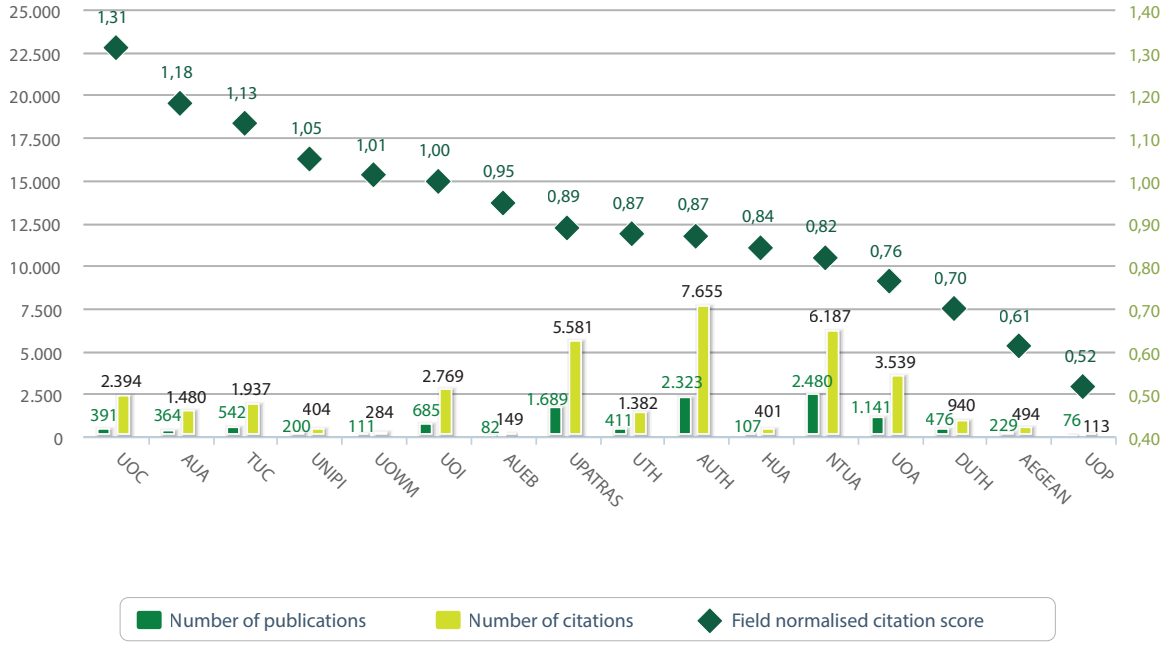


Figure 4.5.1 Major field of science "Engineering & Technology". Publications, citations and field normalised citation score relative to the world, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

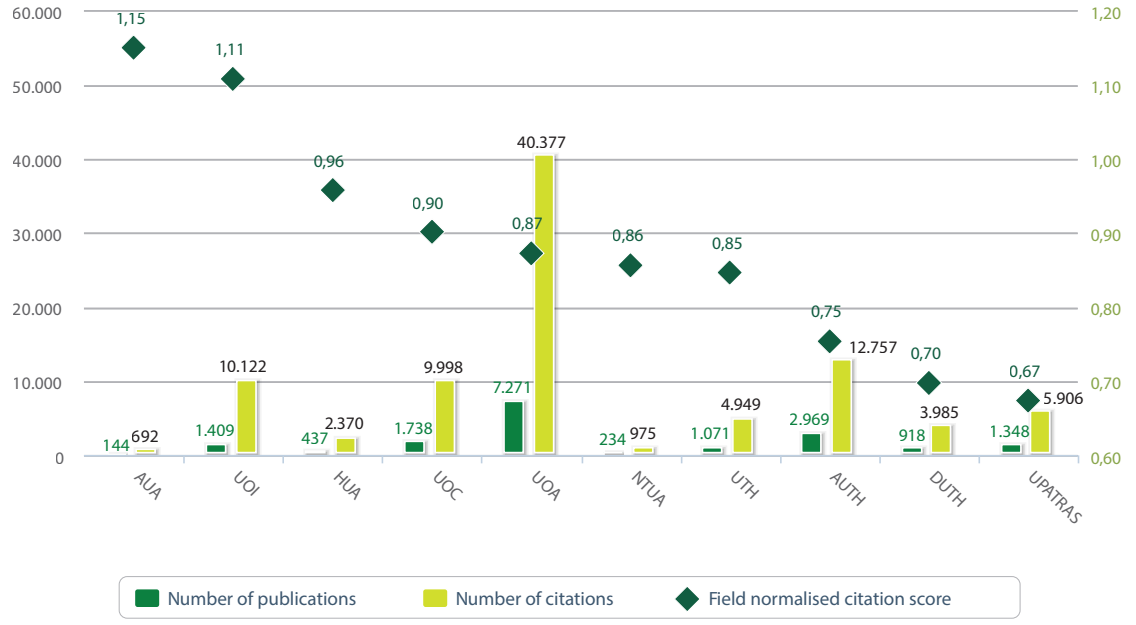


Figure 4.5.1 Major field of science "Medical & Health Sciences". Publications, citations and field normalised citation score relative to the world, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

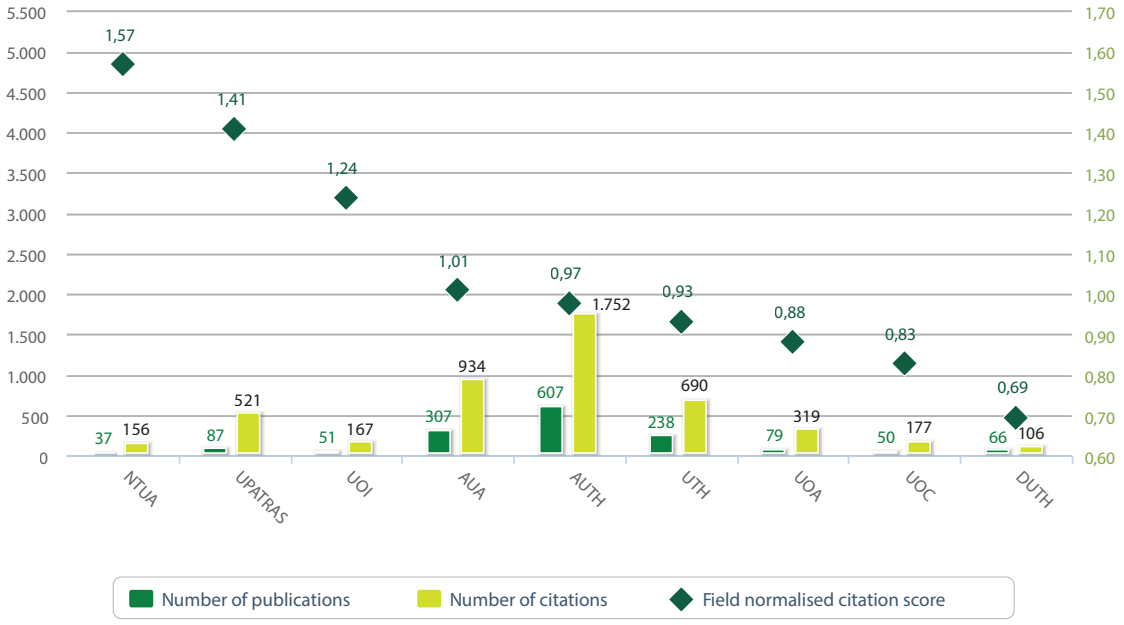


Figure 4.5.1 Major field of science "Agricultural Sciences". Publications, citations and field normalised citation score relative to the world, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

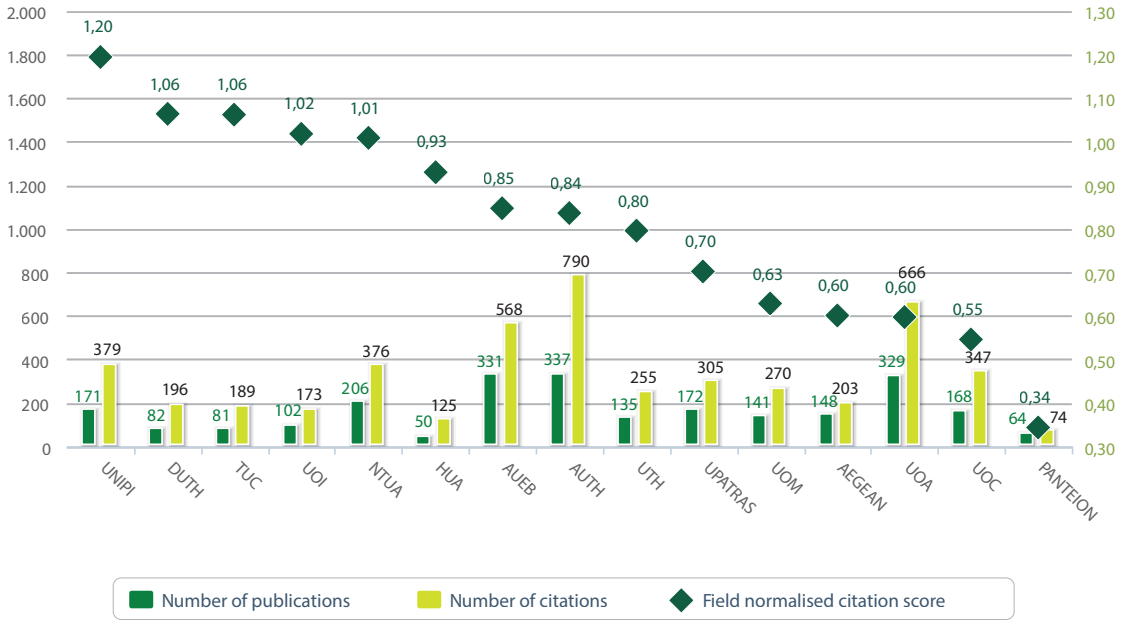


Figure 4.5.1 Major field of science "Social Sciences". Publications, citations and field normalised citation score relative to the world, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

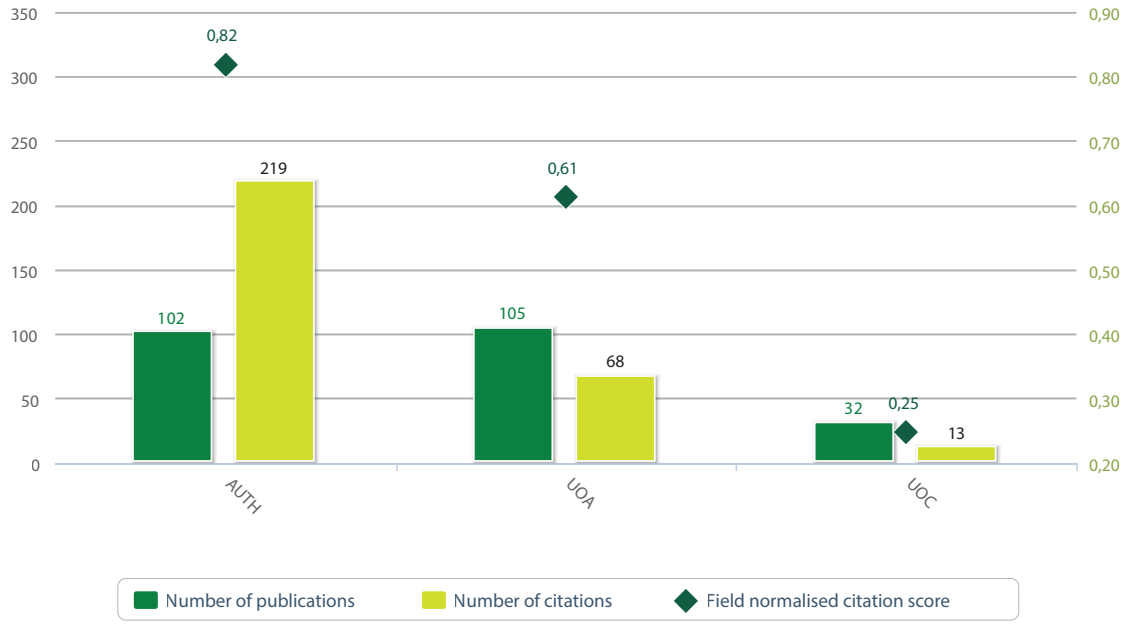


Figure 4.5.1 Major field of science "Humanities". Publications, citations and field normalised citation score relative to the world, by University, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

NATURAL SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**University**	**Field normalized citation score**	**Number of publications**
biological sciences	genetics & heredity	HUA	8,87	9
biological sciences	genetics & heredity	UOI	3,18	55
physical sciences	optics	UOC	2,90	97
physical sciences	acoustics	UOI	2,50	8
earth & related environmental sciences	meteorology & atmospheric sciences	UOP	2,45	48
physical sciences	acoustics	TUC	2,13	9
physical sciences	physics, multidisciplinary	UOA	2,10	223
physical sciences	physics, particles & fields	UOC	2,05	77
physical sciences	physics, nuclear	UOA	1,98	63
computer and information sciences	computer science, artificial intelligence	UOC	1,96	41
physical sciences	physics, particles & fields	UOI	1,92	88
chemical sciences	chemistry, physical	UTH	1,92	18
physical sciences	physics, fluids & plasmas	UOC	1,84	21
chemical sciences	polymer science	UOC	1,82	50
biological sciences	biodiversity conservation	AEGEAN	1,81	12
chemical sciences	chemistry, inorganic & nuclear	UOP	1,77	167
earth and related environmental sciences	environmental sciences	UNIPI	1,73	24
physical sciences	physics, multidisciplinary	UOC	1,72	104
mathematics	mathematics, interdisciplinary applications	TUC	1,71	9
chemical sciences	chemistry, analytical	AEGEAN	1,69	14
chemical sciences	chemistry, multidisciplinary	TUC	1,69	25

physical sciences	physics, nuclear	UOI	1,69	87
other natural sciences	microscopy	UOC	1,69	8
earth and related environmental sciences	meteorology & atmospheric sciences	UOC	1,68	71
mathematics	mathematics, applied	TUC	1,65	31
chemical sciences	chemistry, multidisciplinary	UOC	1,64	94
earth and related environmental sciences	geosciences, multidisciplinary	TUC	1,64	43
biological sciences	reproductive biology	UOA	1,61	82
chemical sciences	chemistry, physical	TUC	1,60	33
chemical sciences	chemistry, analytical	TUC	1,59	24
computer and information sciences	computer science, interdisciplinary applications	AUEB	1,58	31
computer and information sciences	computer science, artificial intelligence	UOI	1,58	34
chemical sciences	crystallography	UOP	1,58	66
earth and related environmental sciences	geochemistry & geophysics	UOC	1,57	8
physical sciences	physics, multidisciplinary	NTUA	1,53	99
computer and information sciences	computer science, interdisciplinary applications	UNIPI	1,51	33

ENGINEERING & TECHNOLOGY

Subfield of major field of science (Frascati manual)	Specific scientific fields (NSI & Incites)	University	Field normalized citation score	Number of publications
environmental engineering	engineering, marine	NTUA	3,36	15
environmental engineering	energy & fuels	UNIPI	2,99	15
mechanical engineering	mechanics	UOC	2,58	31
civil engineering	engineering, civil	UNIPI	2,16	11
mechanical engineering	engineering, mechanical	AUA	2,08	8
mechanical engineering	engineering, aerospace	NTUA	2,07	13
environmental engineering	energy & fuels	AUA	2,00	26
materials engineering	materials science, composites	DUTH	2,00	11
materials engineering	materials science, composites	AUTH	1,97	15
environmental engineering	engineering, environmental	UTH	1,92	17
civil engineering	transportation science & technology	TUC	1,86	20
electrical, electronic, information engineering	computer science, hardware & architecture	TUC	1,83	38
medical engineering	medical laboratory technology	UOC	1,76	12
materials engineering	materials science, ceramics	UOP	1,74	30
mechanical engineering	engineering, industrial	UOA	1,73	8
civil engineering	engineering, civil	UOI	1,73	27
mechanical engineering	mechanics	UOA	1,67	21
chemical engineering	engineering, chemical	AUA	1,61	35
electrical, electronic, information engineering	computer science, hardware & architecture	AUTH	1,57	10
environmental engineering	engineering, environmental	UOP	1,55	72
civil engineering	transportation science & technology	UNIPI	1,54	16
materials engineering	materials science, composites	NTUA	1,54	31
chemical engineering	engineering, chemical	UOP	1,53	123
other engineering and technologies	engineering, multidisciplinary	UOC	1,52	8
environmental engineering	mining & mineral processing	TUC	1,52	8
mechanical engineering	engineering, manufacturing	UNIPI	1,51	14
electrical, electronic, information engineering	telecommunications	AUTH	1,51	180

MEDICAL AND HEALTH SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**University**	**Field normalized citation score**	**Number of publications**
health sciences	parasitology	UOA	4,30	9
clinical medicine	rheumatology	ΧΑΡΟΚΟΠΕΙΟ	2,86	8
clinical medicine	medicine, general & internal	UOI	2,75	74
clinical medicine	rheumatology	UOC	2,71	56
health sciences	public, environmental & occupational health	UOI	2,64	55
clinical medicine	psychiatry	UOI	2,25	33
health sciences	health care sciences & services	UOI	2,24	10
other medical sciences	medicine, legal	UOA	2,15	12
health sciences	sport sciences	UOC	1,95	8
health sciences	parasitology	AUTH	1,77	15
clinical medicine	rheumatology	UOP	1,77	20
basic medicine	toxicology	DUTH	1,75	15
health sciences	sport sciences	UOI	1,71	19
health sciences	medical informatics	UOI	1,68	23
clinical medicine	dermatology	UOI	1,58	9
health sciences	public, environmental & occupational health	UTH	1,56	35
basic medicine	chemistry, medicinal	NTUA	1,53	18
clinical medicine	rheumatology	UTH	1,52	30

AGRICULTURAL SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**University**	**Field normalized citation score**	**Number of publications**
other agricultural sciences	agricultural engineering	UOI	1,95	8
other agricultural sciences	agricultural engineering	UOP	1,94	30
other agricultural sciences	agricultural engineering	AUTH	1,59	31
other agricultural sciences	agricultural engineering	DUTH	1,58	10
other agricultural sciences	agricultural engineering	NTUA	1,57	22

SOCIAL SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**University**	**Field normalized citation score**	**Number of publications**
educational sciences	education & educational research	UNIPI	2,72	9
social and economic geography	environmental studies	UNIPI	2,20	14
educational sciences	education & educational research	DUTH	1,89	13
educational sciences	education & educational research	UTH	1,66	21
economics and business	business	UNIPI	1,65	9
economics and business	operations research & management science	UOI	1,64	19

Figure 4.5.2 Scientific subfields of "Universities" publications with field normalised citation score > 1, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: Publications that belong to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world

4.6 Scientific collaboration

Universities' publications produced as a result of scientific collaboration at the national and international level increased significantly during 1996-2010. Figure 4.6.1 shows the progressive rate of publications produced with collaborations at the national level and Figure 4.6.2 demonstrates those produced as a result of collaborations at an international level.

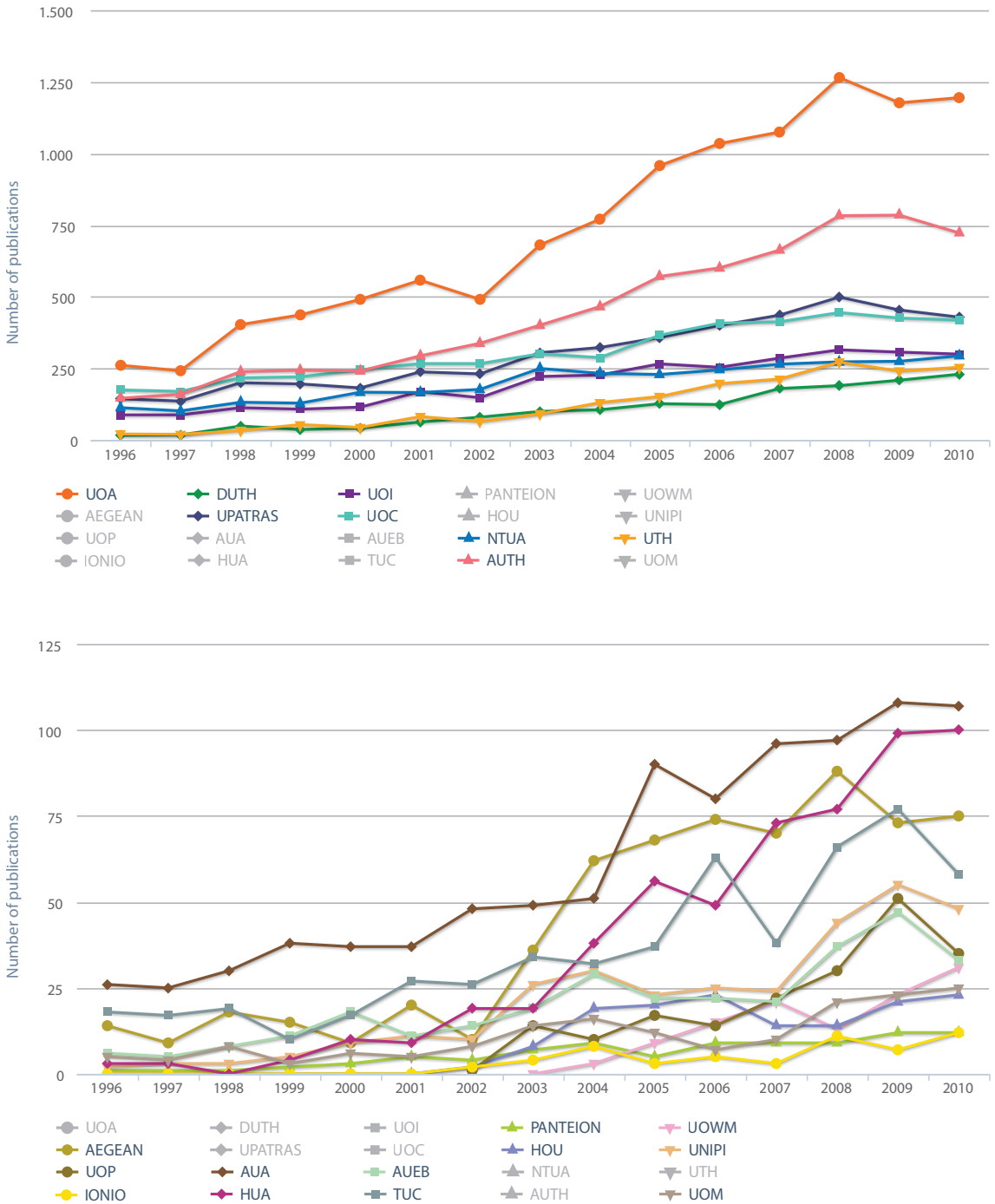


Figure 4.6.1 Number of publications with national collaboration, by University, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* The indicators are shown in two separate figures to illustrate them more clearly.

** The indicators are shown in two separate figures to illustrate them more clearly.

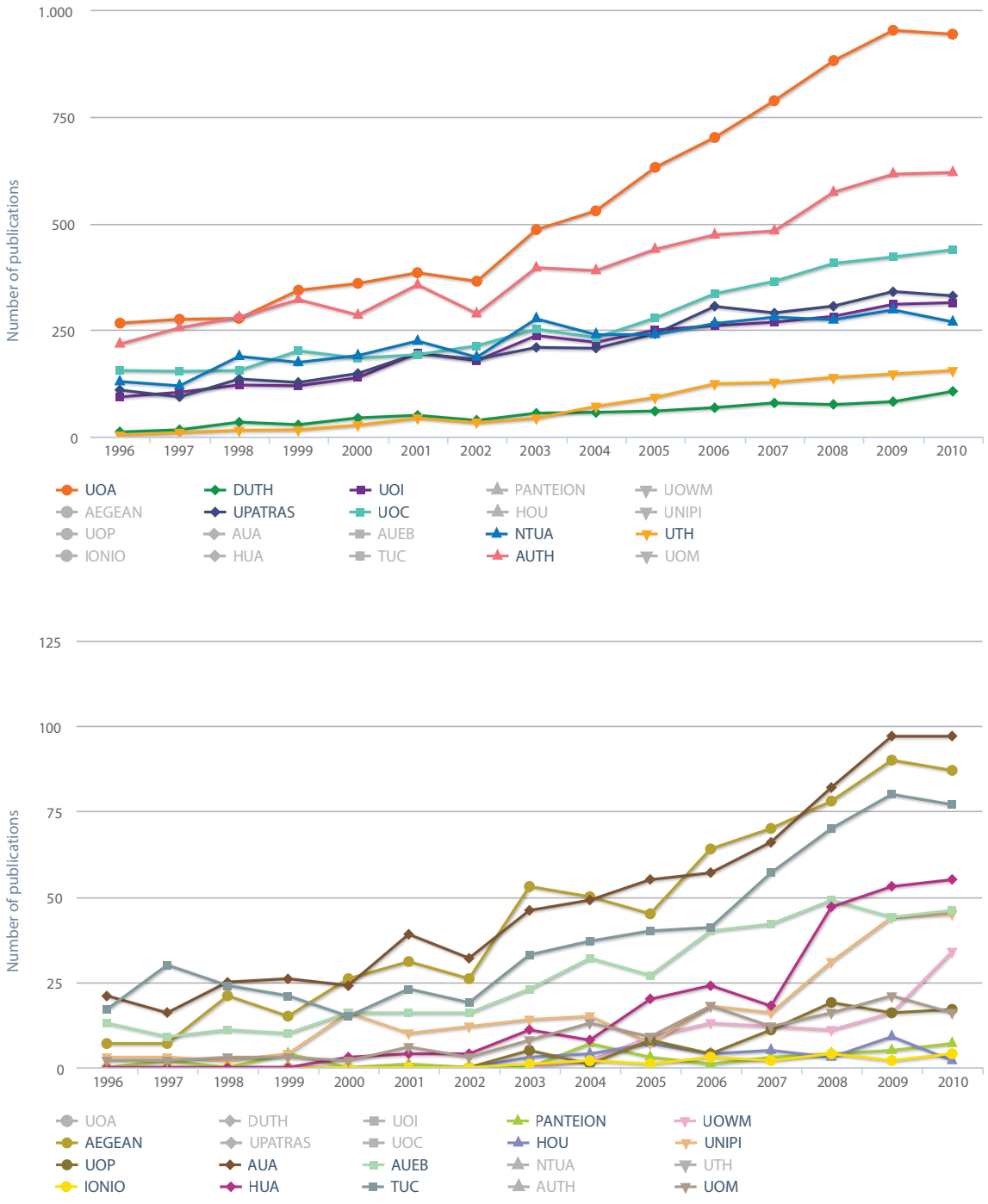


Figure 4.6.2 Number of publications with international collaboration, by University, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 4.6.3 highlights the distribution (%) of publications with national*, international** and no collaboration***per University.

Overall, publications produced with international collaboration lag behind those produced with Greek-based institutions. Eleven Universities displayed a sharp pattern of association with domestic institutions, producing more than 50% of their publications with national collaboration. The University of Central Greece/UCG ranked first (83.7%) in this category.

The degree of international collaboration was much lower. The University of Crete/UCG ranked first with 51% of its publications involving international co-authorship, followed by three Universities with a percentage above 40% (University of Western Macedonia/UOWM, University of Ioannina/UOI and University of the Aegean/AEGEAN). The majority of Universities showed values in the range between 30%-40%.

Finally, the National Technical University of Athens/NTUA (44.6%), the University of Western Macedonia/UOWM (40.8%) and Athens University of Economics and Business/AUEB (40.7%) accounted for the highest share of publications produced without partnerships.

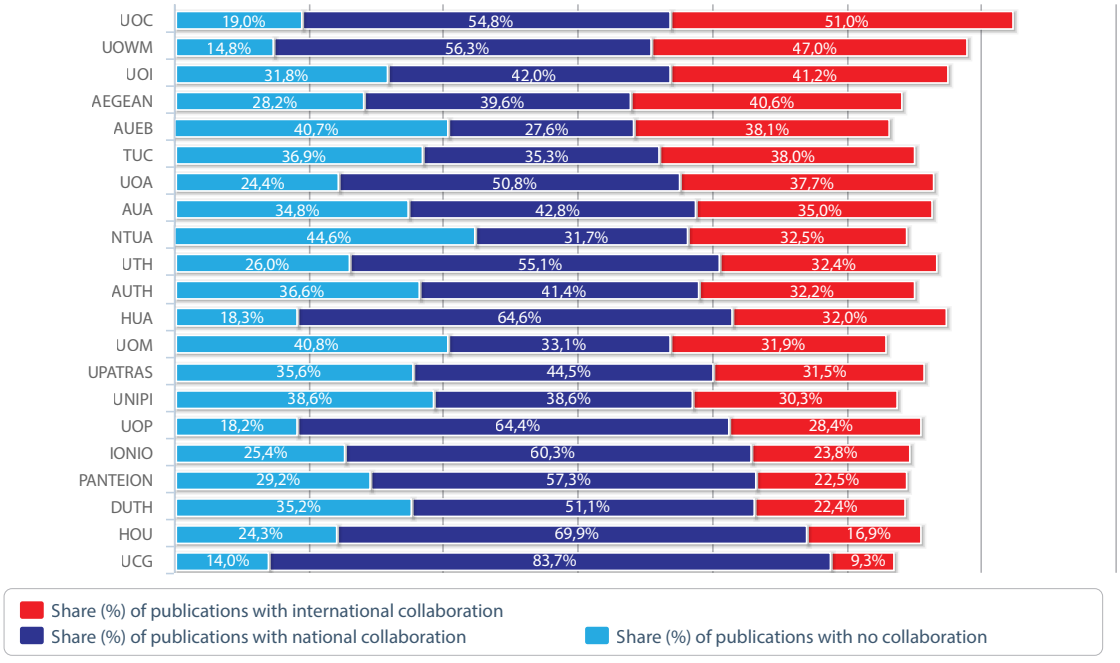


Figure 4.6.3 Share (%) of publications produced by national, international and no collaboration, by University, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration

** Number of publications with at least one international collaboration

*** Number of publications with no collaboration, per institution

The Technological Education Institutes (TEIs) are a significant component of the Greek Higher Education Sector. In the frame of this study, "TEIs" constitute a separate institution category which was estimated to contribute in the country' s output of scientific publications. More specifically, "TEIs" were ranked fourth, among other institutions in terms of their scientific publications output.

"TEIs" had a relatively low publication output (< 10 publications per year). TEI's publication output also displayed an unstable rate of growth. As a result, even slight variations in the number of publications could greatly affect the dependability of bibliometric indicators. Due to this observation in the nature of data, we have avoided broad conclusions regarding "TEIs" publishing activity, scientific fields of excellence and patterns of scientific collaborations. Recognizing these limitations, this study presents the main bibliographic indicators for 16 TEIs –including the Higher School of Pedagogical and Technological Education (ASPETE)–.

The table below summarizes the number of TEIs' publications and their citations for the period (2006-2010). It also demonstrates their progression rates when compared to data emerging from the preceding 5-year period, 2004-2008, –according to a study that EKT published in 2010–.

CHAPTER 5

SCIENTIFIC PUBLICATIONS BY TECHNOLOGICAL EDUCATIONAL INSTITUTES

	2004-2008		2006-2010	
	Number of publications	Number of citations	Number of publications	Number of citations
1. Higher School of Pedagogical and Technological Education - ASPETE	44	48	56	57
2. TEI of Athens	375	755	480	1.204
3. TEI of West Macedonia	90	188	131	489
4. TEI of Epirus	90	217	99	257
5. TEI of Thessaloniki	264	388	331	619
6. TEI of Ionian Islands	21	53	28	82
7. TEI of Kavala	71	69	108	178
8. TEI of Kalamata	58	65	85	184
9. TEI of Crete	298	837	373	1.601
10. TEI of Lamia	71	83	94	175
11. TEI of Larissa	128	238	170	374
12. TEI of Messolonghi	36	40	64	96
13. TEI of Patras	61	96	82	332
14. TEI of Piraeus	114	208	142	285
15. TEI of Serres	60	48	71	119
16. TEI of Chalkida	88	62	98	188

5.1 Publications

In the period 1996-2010, the TEIs of Athens, Thessaloniki and Crete were found to produce the majority of publications in this category. However, their output decreased in the period following 2008.

In 2010, there were 9 TEIs which produced above 20 scientific publications: (Figure 5.1.1): TEI of Athens (102), TEI of Thessaloniki (72), TEI of Crete (69), TEI of Larissa (41), TEI of Piraeus (30), TEI of Kavala (29), TEI of Western Macedonia (28), TEI of Lamia (27), TEI of Kalamata (20).

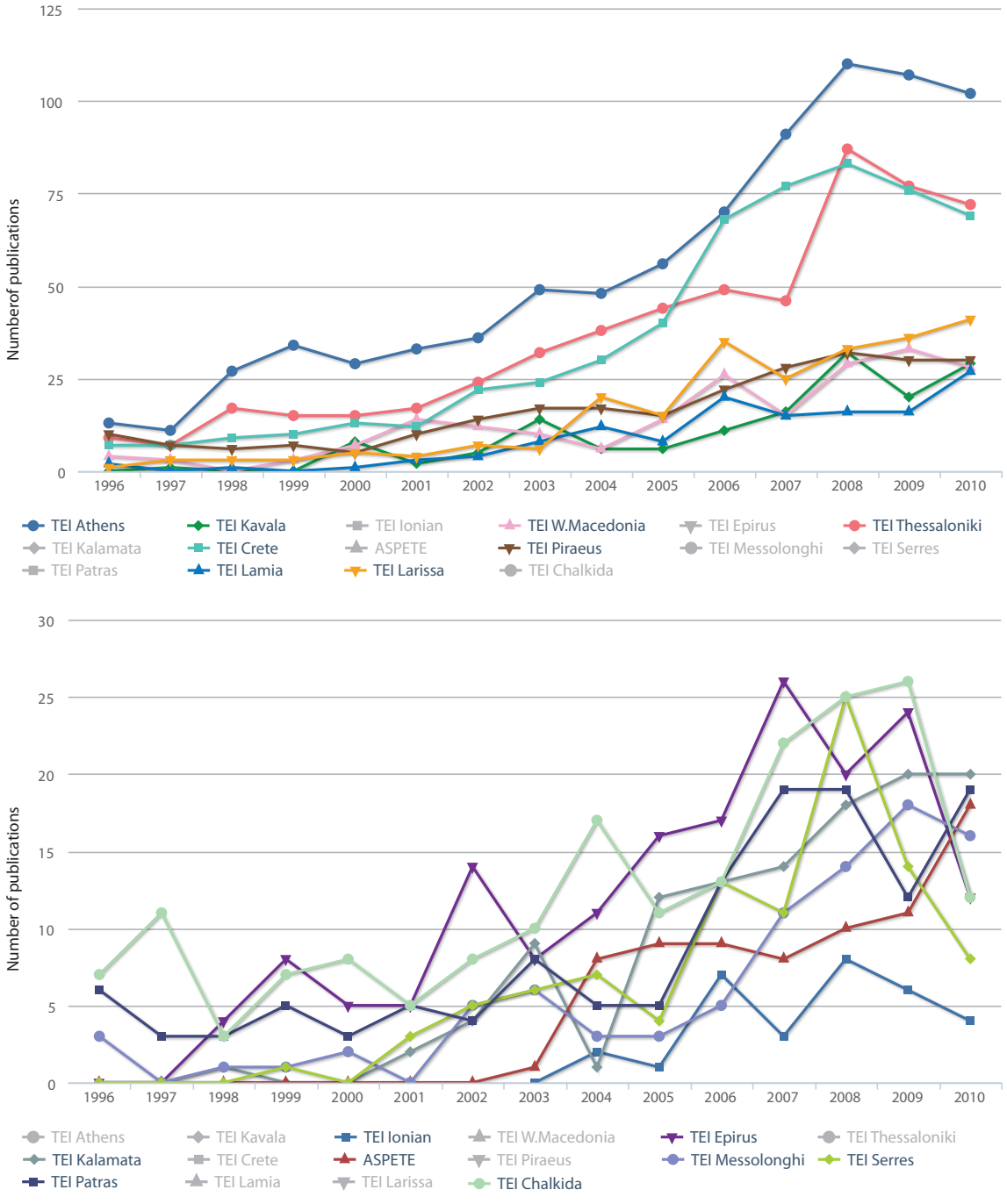


Figure 5.1.1 Development of the number of publications by TEI, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* The indicators are shown in two separate figures to illustrate them more clearly.

Figure 5.1.2 presents the level of growth for "TEIs" publications output. This is further complemented by Figure 5.1.2, which plots the number of publications by TEI and their year-on-year rate of change from 1996 to 2000.

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

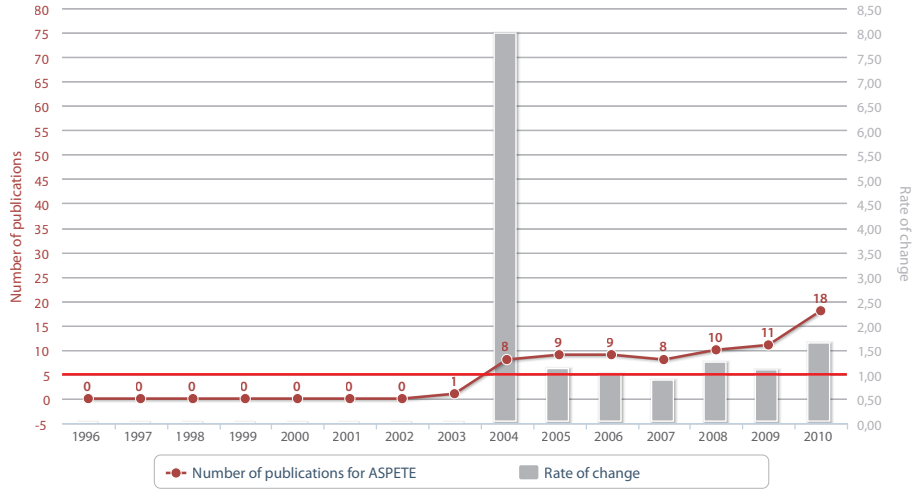


Figure 5.1.2 Number of publications and rate of change in the number of publications by "Higher School of Pedagogical and Technological Education - ASPETE", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

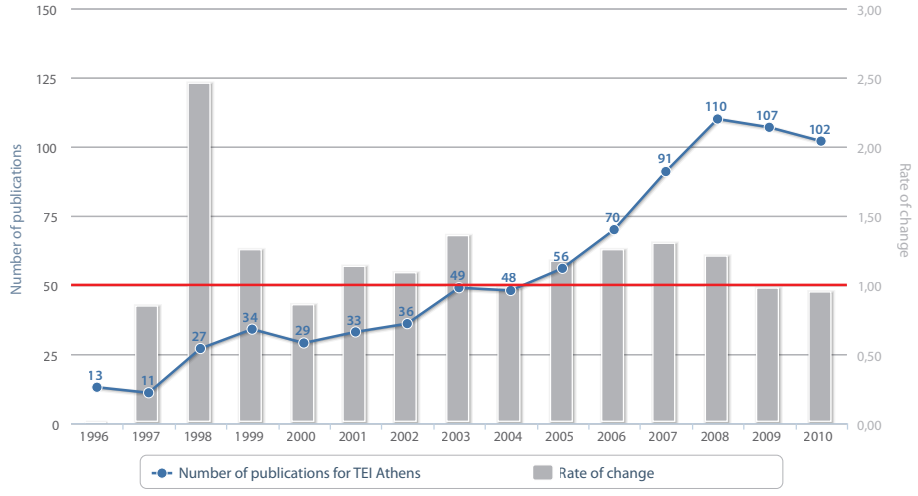


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

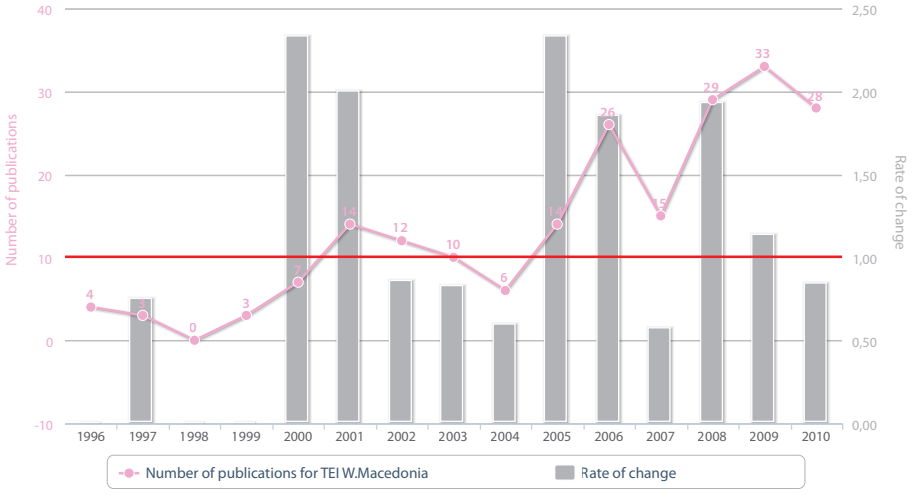


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of West Macedonia", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

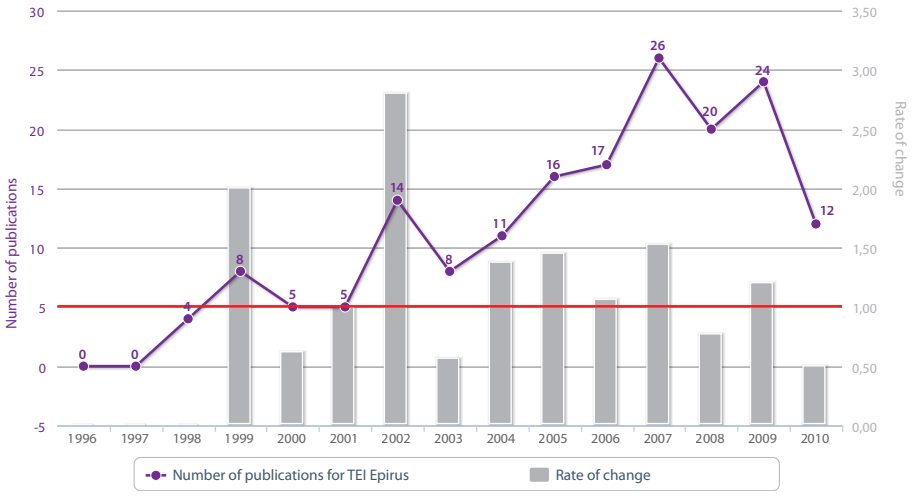


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Epirus", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

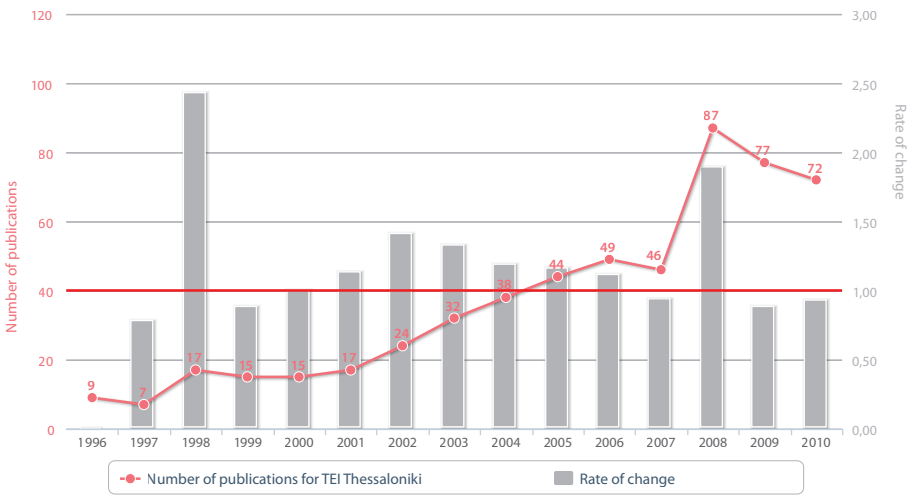


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Thessaloniki", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

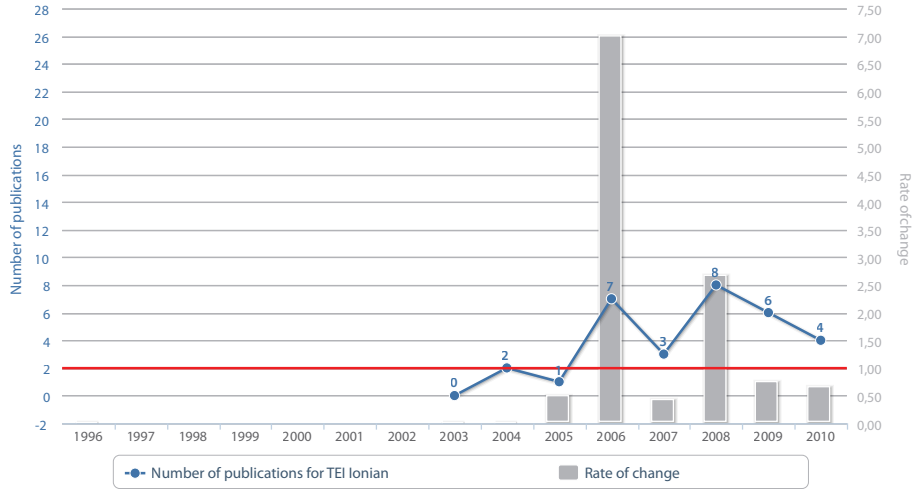


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Ionian Islands", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

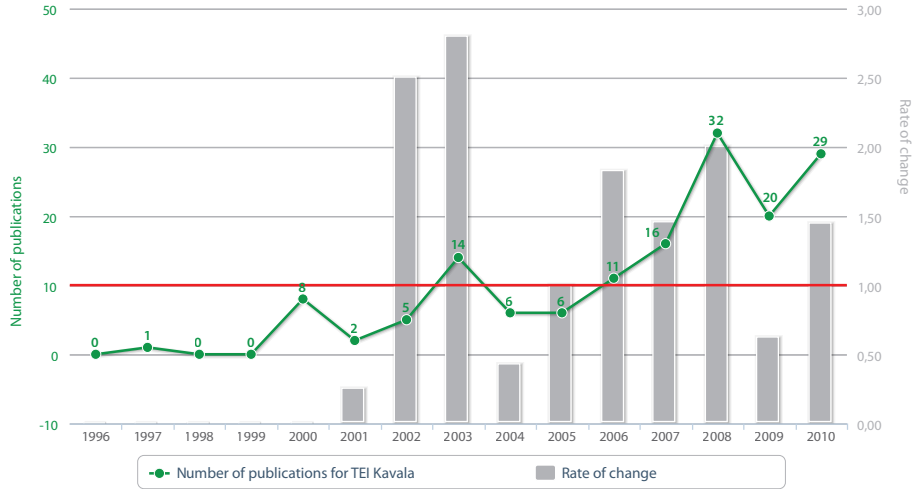


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Kavala", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

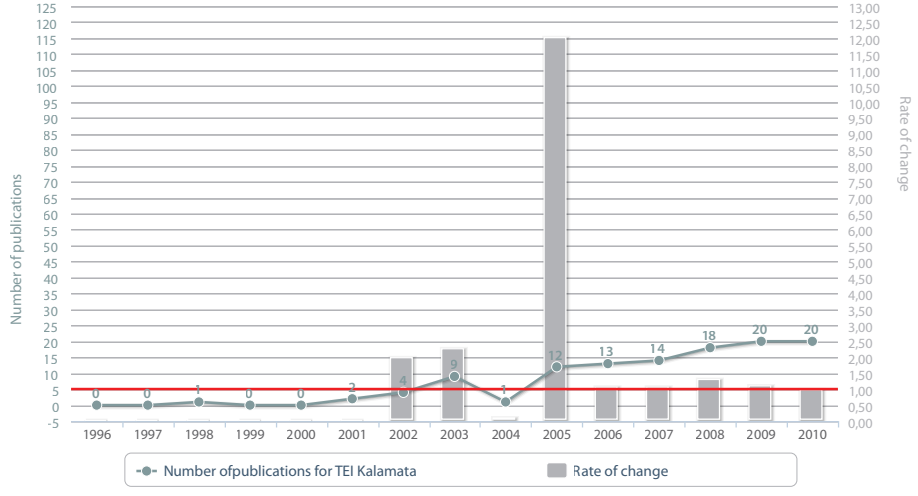


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Kalamata", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

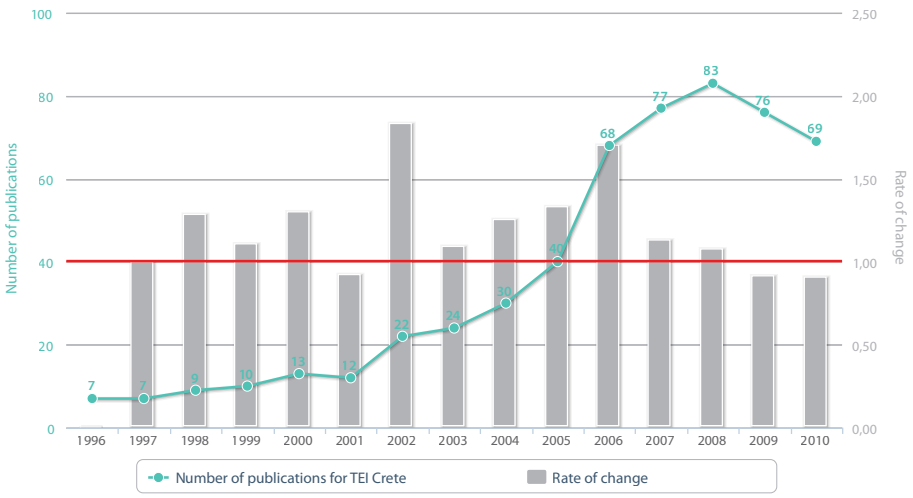


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Crete", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

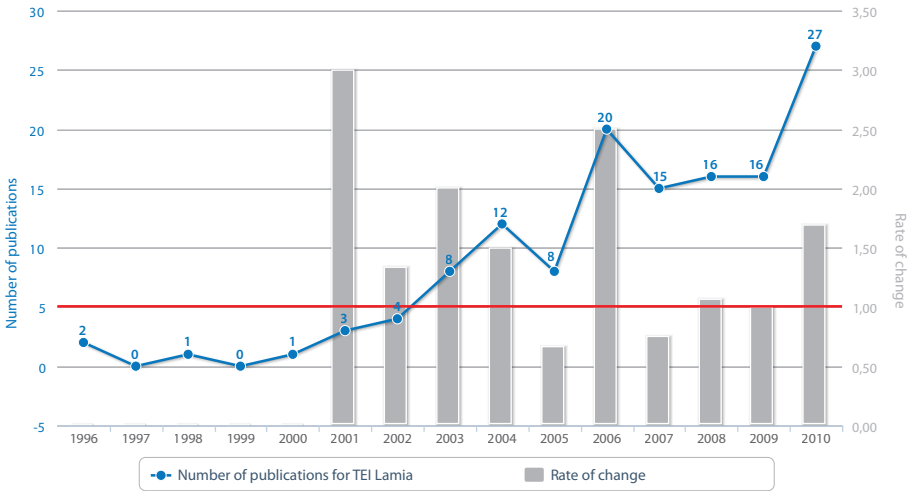


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Lamia ", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

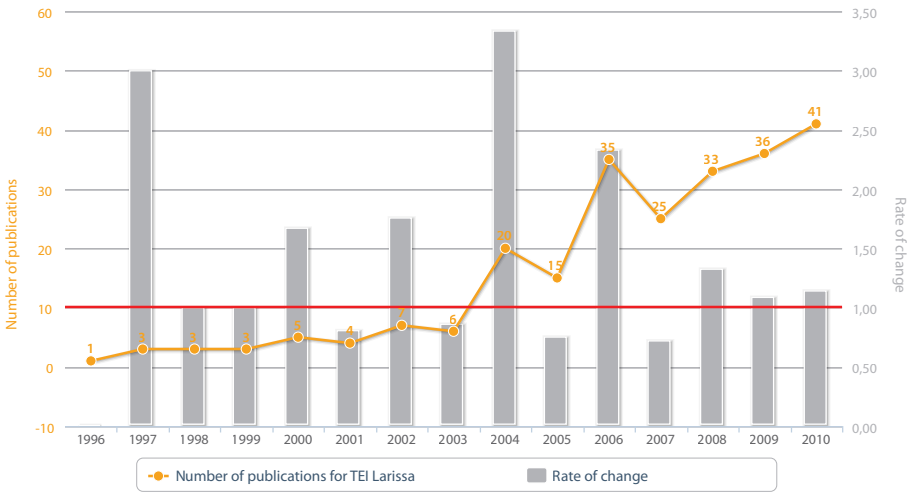


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Larissa", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

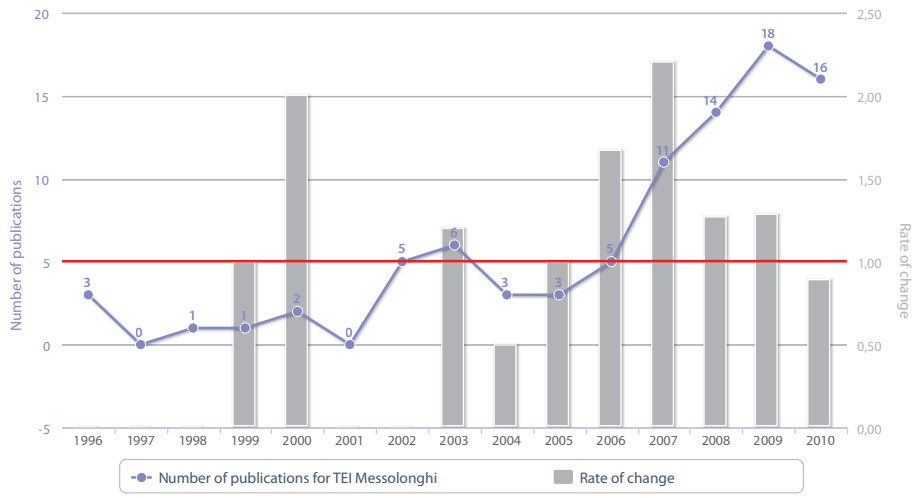


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Messolonghi", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

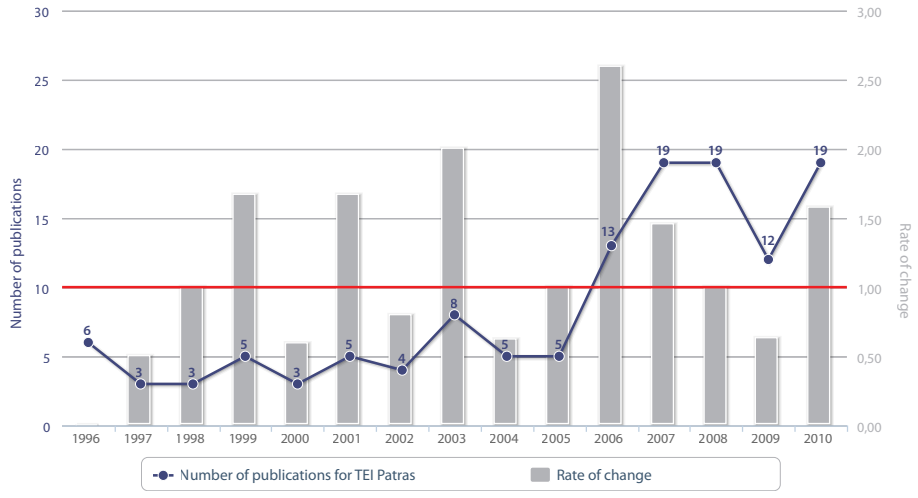


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Patras", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

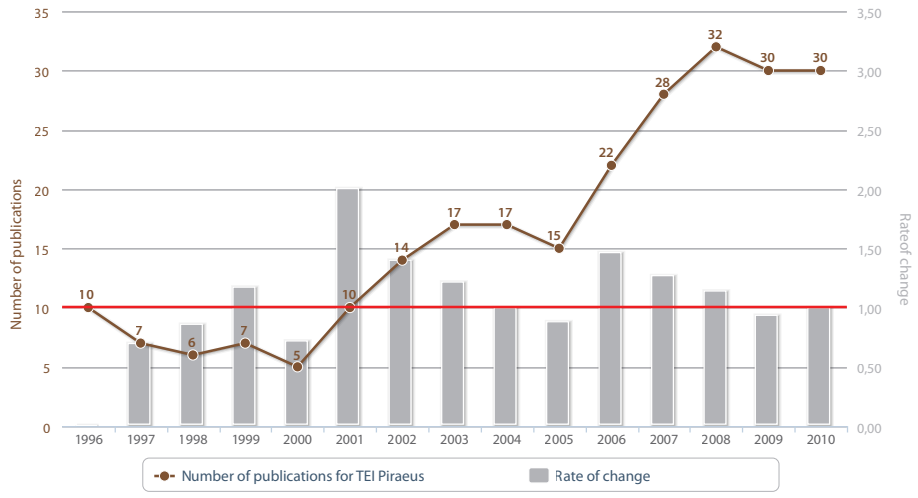


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Piraeus" , 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

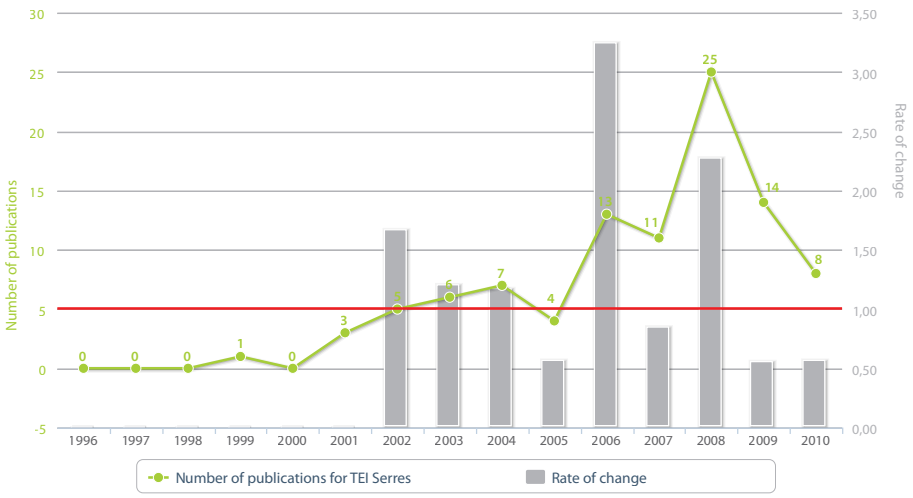


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Serres", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

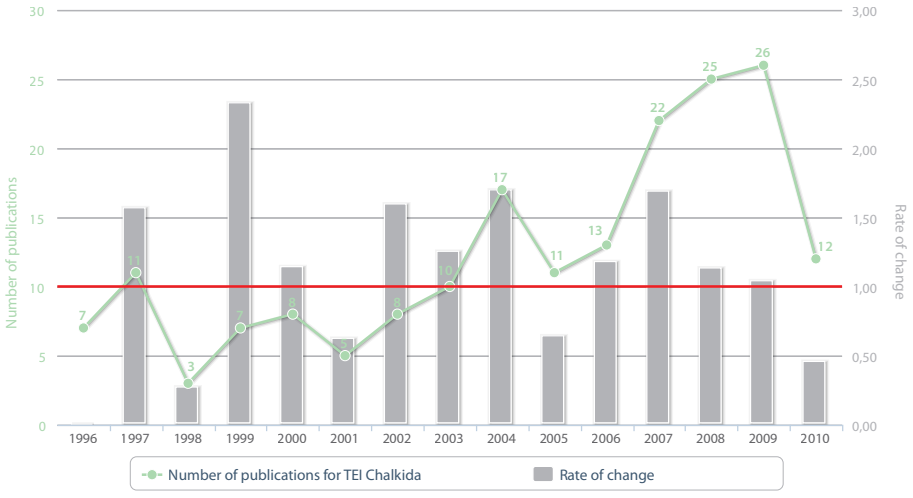


Figure 5.1.2 Number of publications and rate of change in the number of publications by "TEI of Chalkida", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 5.1.3 presents data related to the quantity of publication output by each TEI and its share in the total output of the category "TEIs" –over the period 2006-2010–. "TEIs" were ranked in a descending order as follows: TEI of Athens 480 (21.2%), TEI of Crete 373 (16.5%), TEI of Thessaloniki 331 (14.6%), TEI of Larissa 170 (7.5%), TEI of Piraeus 142 (6.3%), TEI of Western Macedonia 131 (5.8%). The rest had a share of less than 5%.

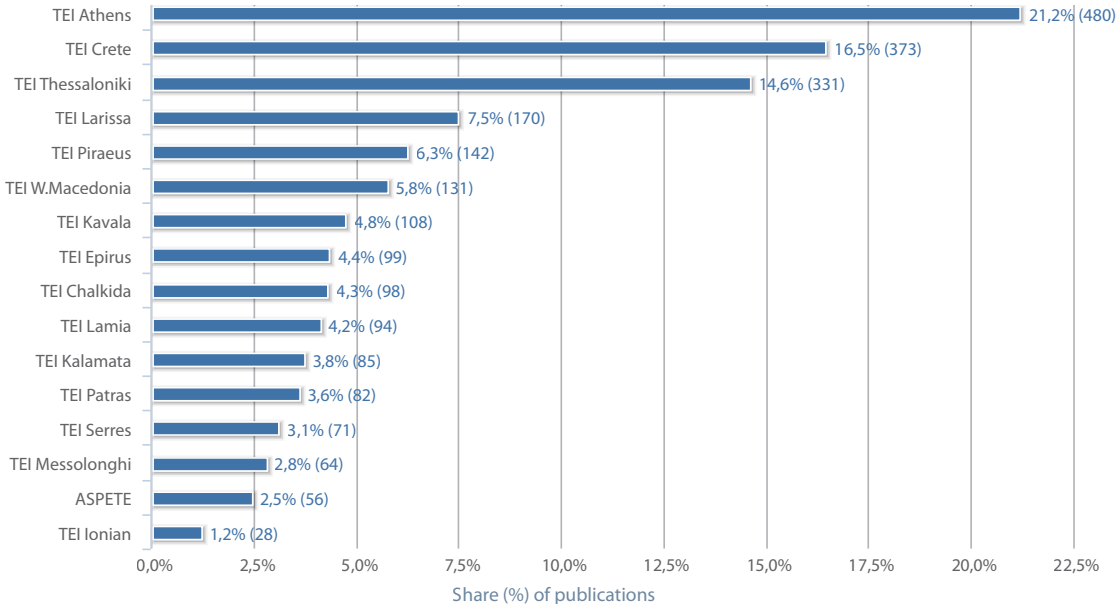


Figure 5.1.3 Number and share (%) of publications, by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Between 2006 and 2010, 12 (out of 16 TEIs) experienced a significant growth in their publication figures. TEIs of Messolonghi, Kavala, ASPETE, Kalamata, Thessaloniki, Patras, and Athens exceeded the average growth of the category (Figure 5.1.4). However, the number of publications produced by "TEIs" was still relatively low and varied over time.

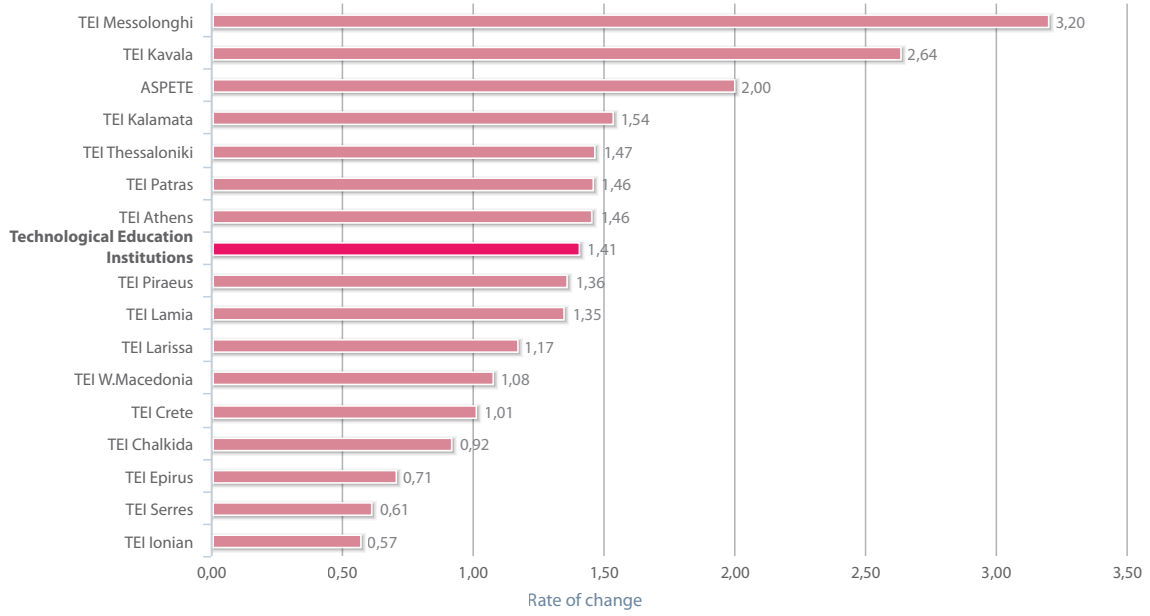


Figure 5.1.4 Change in the number of publications between 2006 and 2010, by TEI / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

5.2 Citations

Figure 5.2.1 shows, for each TEI, the percentage of cited publications that received at least one citation and their growth over the period 1996-2010. TEIs of Athens, West Macedonia, Epirus, Kalamata, Crete and Larissa were found to have the highest percentage of cited publications, with a relatively stable progression over time. In the case of the TEI of Epirus, this percentage reached the level of 66.7% (higher than the EU average). TEI of Crete (65.4%) was close to the EU average of 65.5%.

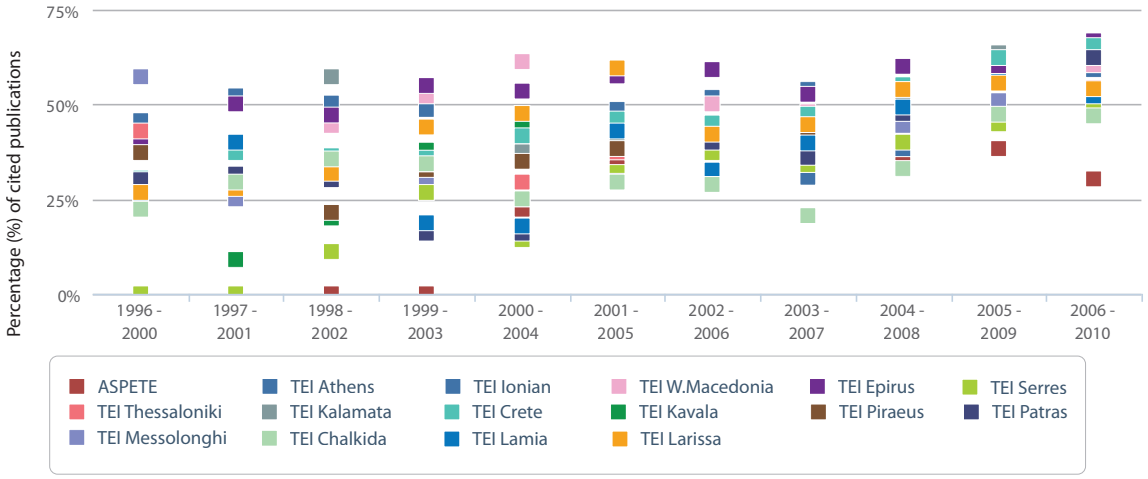
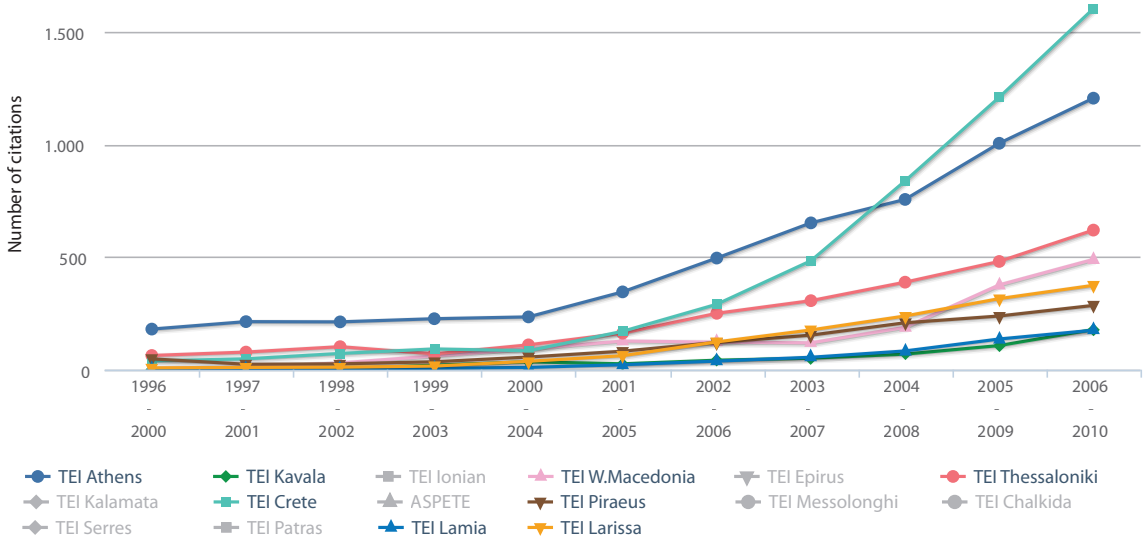


Figure 5.2.1 Percentage (%) of cited publications by 'TEI', 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 5.2.2 demonstrates that there was a positive trend in the number of citations of publications produced by "TEIs" over the period 1996-2010. The TEI of Crete, displayed the greatest number of citations for its publications. The TEIs of Athens, Thessaloniki, Western Macedonia Larissa, Patras, Piraeus and Epirus followed.



* The indicators are shown in two separate figures to illustrate them more clearly.

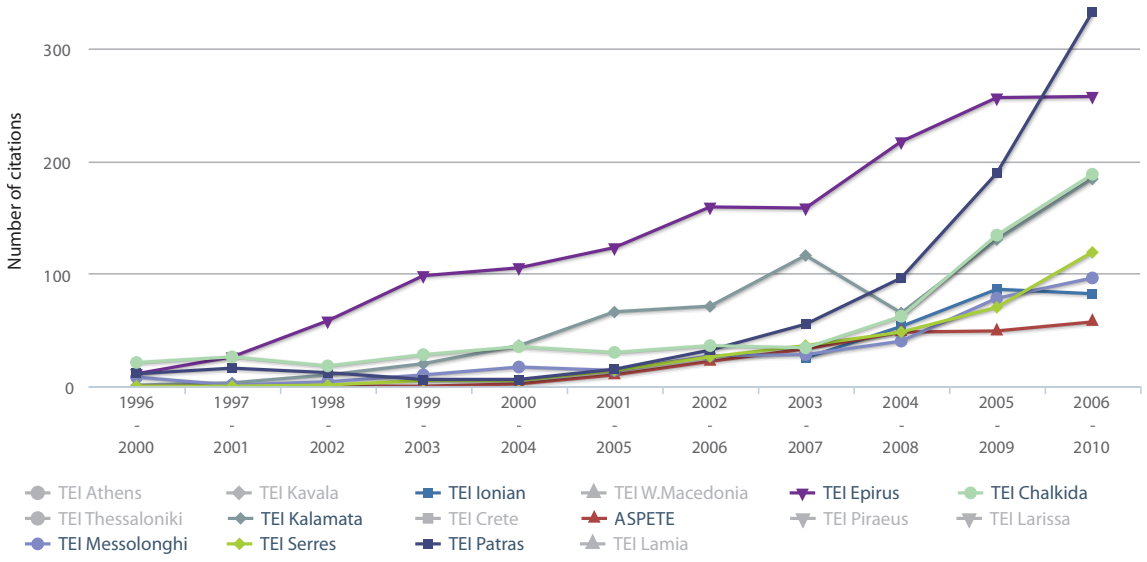


Figure 5.2.2 Number of citations by TEI, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

More specifically, according to the data displayed in Figure 5.2.3 (corresponding to the 5-year period 2006-2010), the highest number of citations and their share in the total citations across "TEIs" category, was observed for the following TEIs: Crete (27.5%; 1,601 citations), Athens (20.7%; 1,204 citations), Thessaloniki (10.6%; 619 citations), Western Macedonia (8,4%; 489 citations), Larissa (6.4%; 374 citations) and Patras (5.7%; 332 citations). The remaining TEIs had a smaller share (less than 5%).

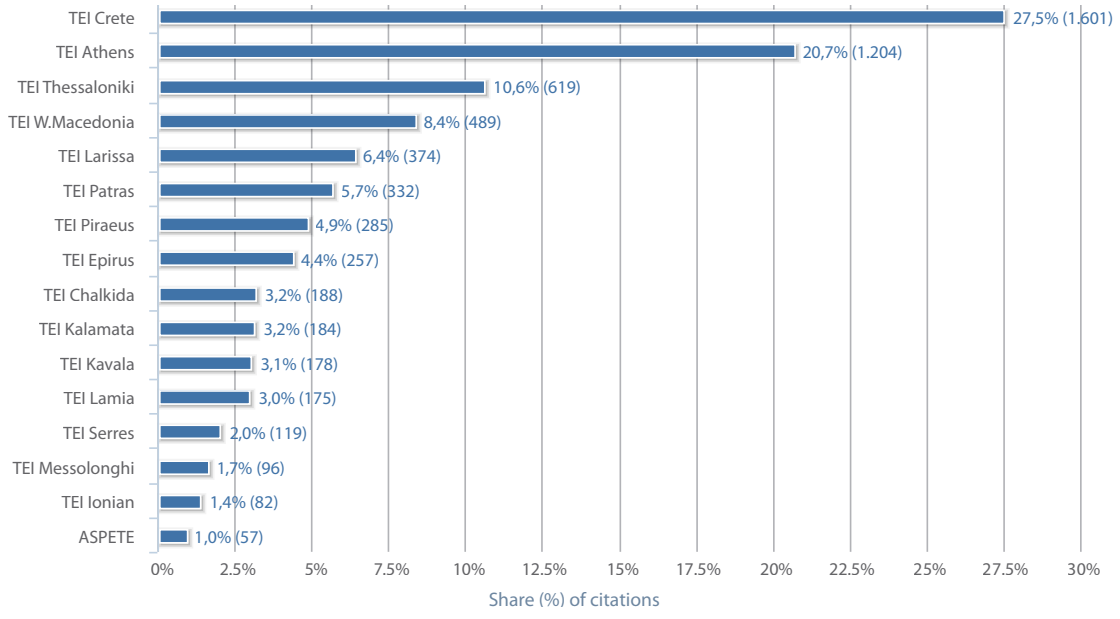


Figure 5.2.3 Number and share (%) of citations by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

5.3 Citation impact

Figure 5.3.1 presents the number of publications and citations for each TEI and the relevant field-normalised citation score corresponding to the 5-year period 2006-2010. When referring to the field normalised citation score or "citation score", we point out to the number of citations that TEIs' publications received compared to the world average of citations received over the same time period and per scientific field. The normalisation was processed at the level of each publication according to the 253 NSI scientific subject fields. In the case of an article being categorized in more than one subject fields, a mean value for the fields was calculated. The citation score was calculated using software developed by EKT. A value greater than 1, indicated that the impact of publications was higher than the world average.

Publications of the TEI of Patras achieved the highest citation score with a value of 1.46, well above the world average. The TEIs of Western Macedonia (0.95) and Crete (0.91) were close to the world baseline.

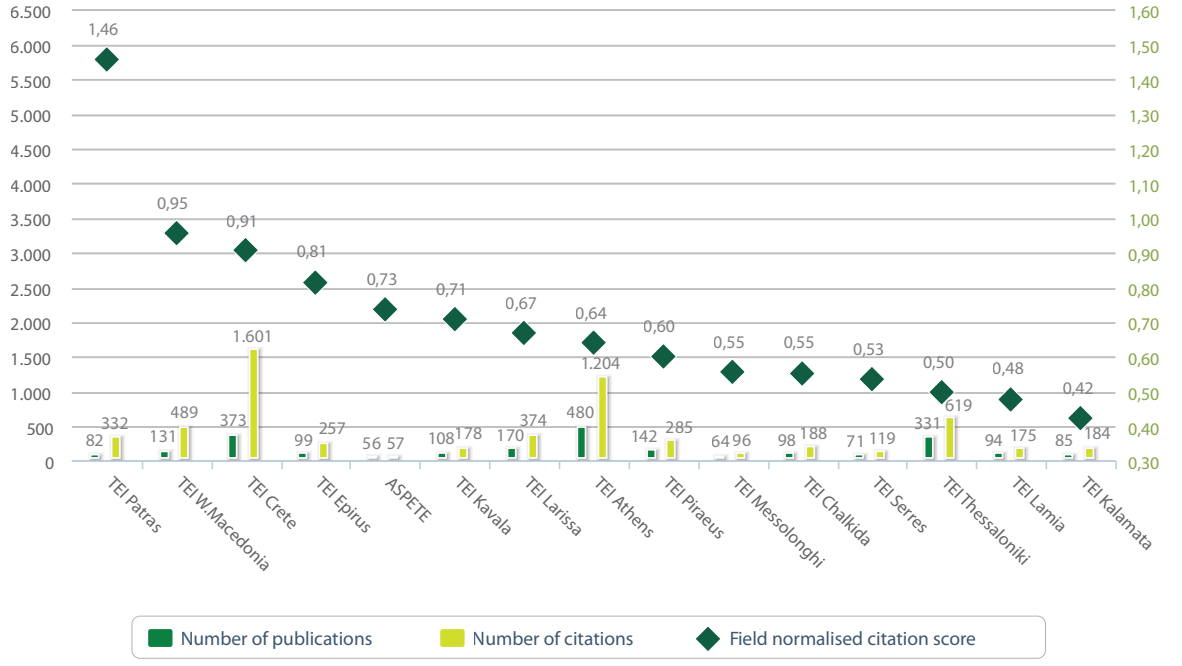


Figure 5.3.1 Publications, citations and field normalised citation score relative to the world, by TEI, 2006-2010. Data refers to the total number of publications in each TEI for all scientific fields / Source: Thomson Reuters, Incites 1996-2010

5.4 Highly cited publications

For the period 2006-2010, Figures 5.4.1 and 5.4.2* point to the number of highly cited publications for percentile levels 1%, 5%, 10%, 25% and 50%, i.e. the publications that belong respectively to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

Publications produced by the TEIs of Athens, Western Macedonia, Epirus, Kavala, Crete, Patras and Chalkida were found to be among the 1% most highly cited publications worldwide.

In addition, Figures 5.4.1 and 5.4.2 display the percentage of the highly cited publications in each TEI for percentile levels 1%, 5%, 10%, 25% and 50%. Data refers to the last 5-year period 2006-2010. Values above the percentile levels indicate performance levels higher than the world average.

* We present results in two separate Figures. This classification serves a more comprehensive representation of data.

The TEI of Patras achieved scores that were above world average for percentile levels 1%, 5%, 10% and 25%, the TEI of Western Macedonia for percentile levels 5%, 10% and 25%, the TEI of Crete for percentile levels 5% and 10%, the TEI of Epirus for 1% and the TEI of Serres for 5%. It should be noted, however, that in most cases we refer to a small amount of publications.

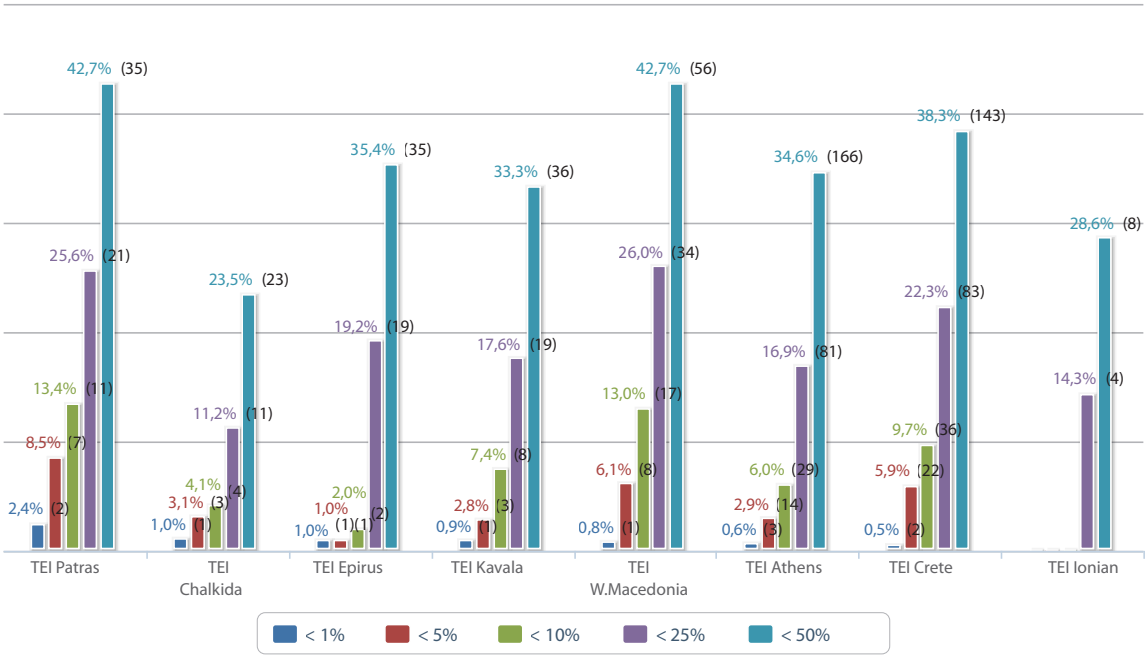


Figure 5.4.1 Number and percentile breakdown (%) of highly cited publications by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: top 1%, 5%, 10%, 25% and 50% most cited papers in world production.

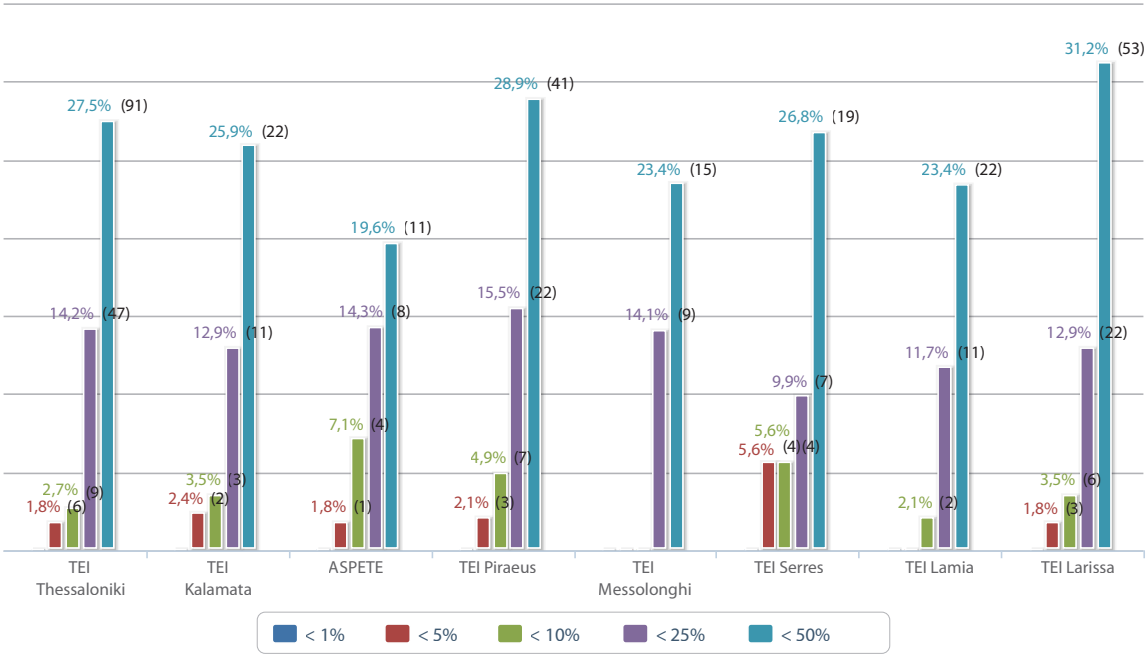


Figure 5.4.2 Number and percentile breakdown (%) of highly cited publications by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: top 1%, 5%, 10%, 25% and 50% most cited papers in world production.

5.5 Major fields of science

The majority of publications* produced by "Technological Educational Institutes" fell under the scope of the following fields: "Natural Sciences", "Engineering and Technology", "Medical and Health Sciences" and "Agricultural Sciences". Figure 5.5.1 provides a comprehensive picture of each TEI's performance -number of publications, citations and the relevant citation scores- in these fields. It also provides information on the specific subfields with citation scores above 1.5.

There were 14 TEIs with scientific activity in field "Natural Sciences". The publications of the TEI of Patras, although low in number, had the highest impact (citation score: 1.74) while the TEIs of Western Macedonia (0.94), Crete (0.93) and Kavala (0.92) were close to the world average.

In "Engineering & Technology" publications were produced by 11 TEIs. The citation scores of publications produced by the TEIs of Patras (1.27) and Serres (1.14) surpassed the world average. Publications by the TEI of Western Macedonia followed with a citation score of 0.99.

The higher volume of publications in "Medical & Health Sciences" came from three TEIs: Crete (1.11), Thessaloniki (0.92) and Athens (0.77).

"Agricultural Sciences" was the field linked to the publishing profile of three TEIs: TEI Epirus (citation scores 1.05), TEI Thessaloniki (0.97) and TEI Larissa (0.74).

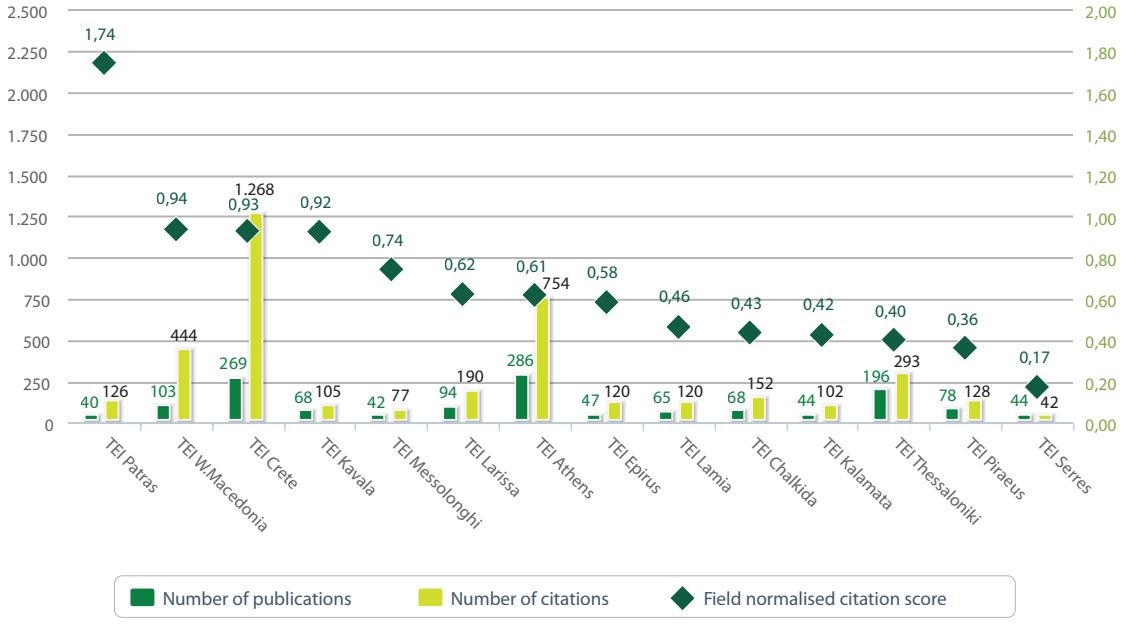


Figure 5.5.1 Major field of science "Natural Sciences". Publications, citations and field normalised citation score relative to the world, by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

* The field normalised citation score was calculated only for TEIs with more than 50 publications for the period 1996-2010.

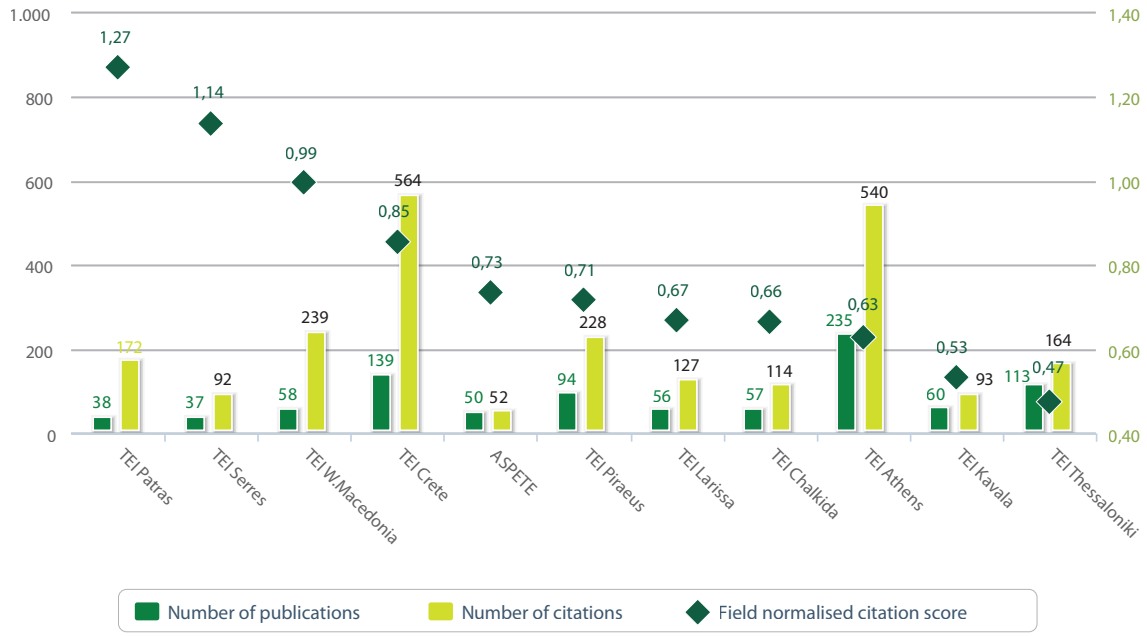


Figure 5.5.1 Major field of science "Engineering & Technology". Publications, citations and field normalised citation score relative to the world, by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

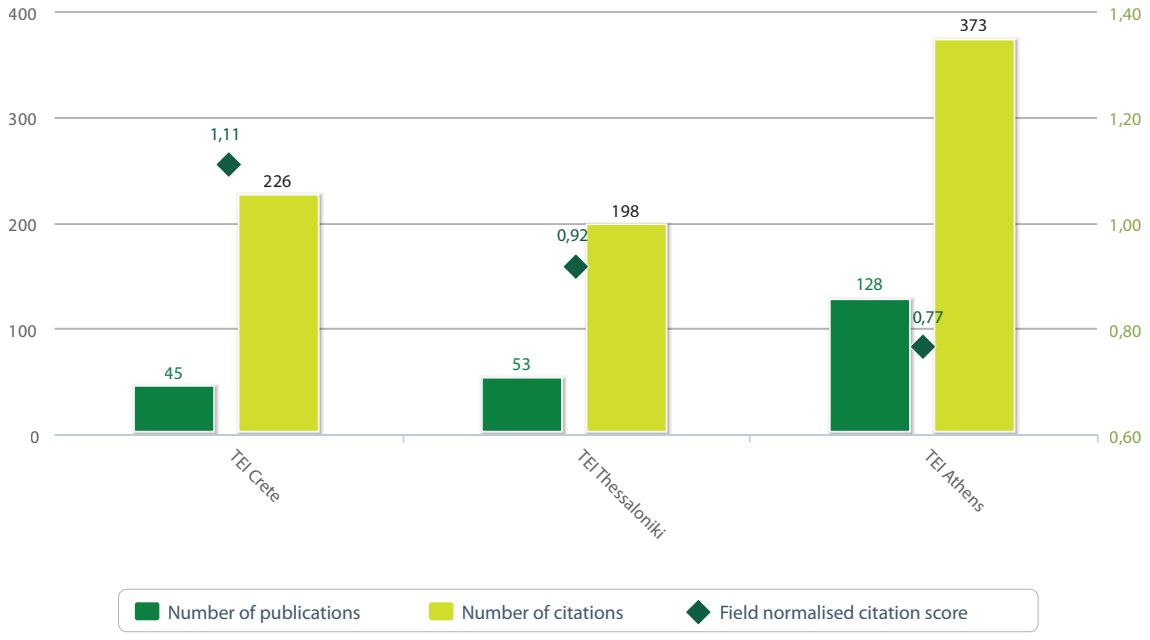


Figure 5.5.1 Major field of science "Medical & Health Sciences". Publications, citations and field normalised citation score relative to the world, by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

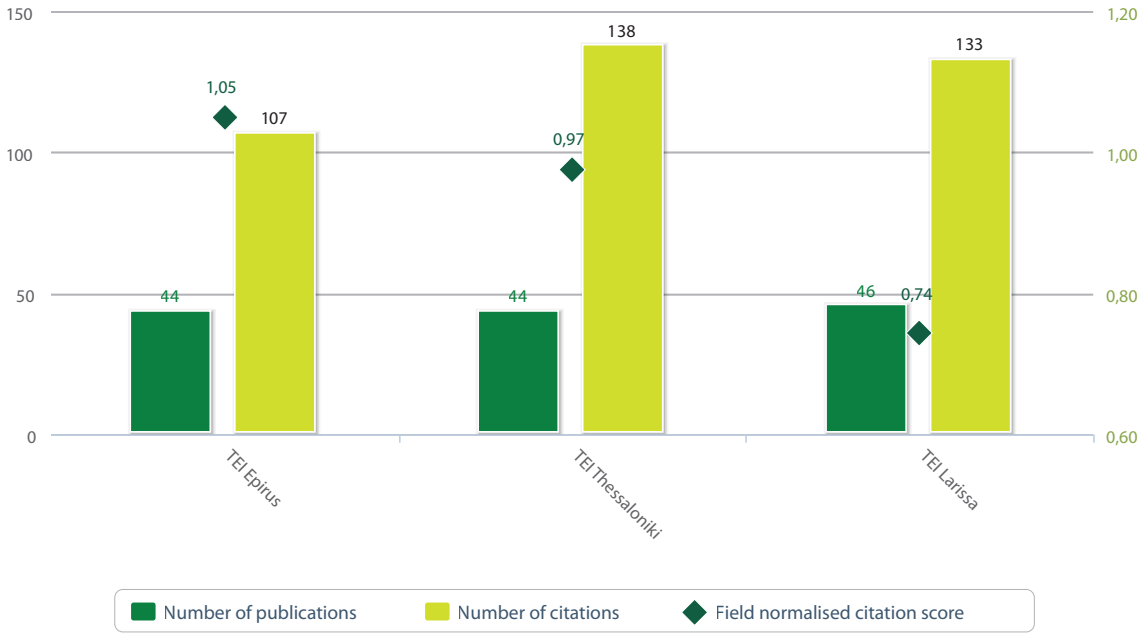


Figure 5.5.1 Major field of science "Agricultural Sciences". Publications, citations and field normalised citation score relative to the world, by TEI, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

NATURAL SCIENCES

Subfield of major field of science (Frascati manual)	Specific scientific fields (NSI & Incites)	TEI	Field normalised citation score	Number of publications
physical sciences	physics, applied	TEI PATRAS	2,12	7
physical sciences	physics, condensed matter	TEI CRETE	1,67	30
mathematics	mathematics, interdisciplinary applications	TEI PATRAS	1,66	6
computer and information sciences	computer science, theory & methods	TEI KAVALA	1,63	6
mathematics	mathematics, applied	TEI W.MACEDONIA	1,59	6
computer and information sciences	computer science, software engineering	TEI ATHENS	1,55	6
physical sciences	physics, fluids & plasmas	TEI CRETE	1,54	11
physical sciences	physics, applied	TEI CRETE	1,53	40

ENGINEERING AND TECHNOLOGY

Subfield of major field of science (Frascati manual)	Specific scientific fields (NSI & Incites)	TEI	Field normalised citation score	Number of publications
nano-technology	nanoscience & nanotechnology	TEI CRETE	1,81	7
chemical engineering	engineering, chemical	TEI ATHENS	1,79	12
environmental engineering	energy & fuels	TEI CHALKIDA	1,78	7
other engineering and technologies	engineering, multidisciplinary	TEI PATRAS	1,74	7
environmental engineering	engineering, environmental	TEI W.MACEDONIA	1,66	13
materials engineering	materials science, coatings & films	TEI CRETE	1,64	16

MEDICAL AND HEALTH SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**TEI**	**Field normalised citation score**	**Number of publications**
health sciences	nursing	TEI ATHENS	1,53	6

Figure 5.5.2 Scientific subfields of "TEIs" publications with field normalised citation score ≥ 1, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

5.6 Scientific collaboration

Figure 5.6.1 highlights the distribution (%) of publications produced as a result of collaborations at the national* and international level**. It also depicts publications which were not produced in the frame of any scientific collaborations***. Overall, the number of co authorships with national partners was higher than this of publications carried out with international partners. More specifically, all TEIs produced more than 60% of their publications with collaborations at the national level. The TEI of Kalamata had the highest ranking (91.8%). On the other hand, the degree of international collaboration was lower, ranging between 5.4% (ASPETE) and 45.7% (TEI of Lamia). Finally, the TEI of Piraeus (34.5%) had the greatest share of publications which were not carried out under any collaboration scheme.

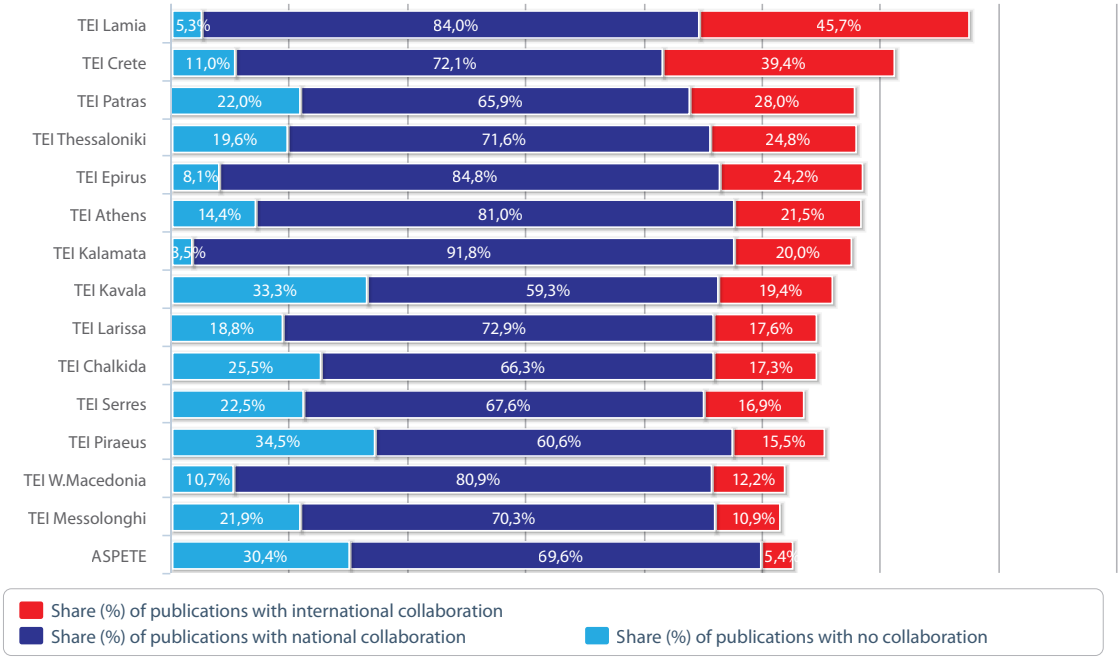


Figure 5.6.1 Share (%) of publications with national, international and no collaboration by TEI, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration

** Number of publications with at least one international collaboration

*** Number of publications with no collaboration, per institution

This section presents bibliometric indicators for 1* Research Centers, supervised by the General Secretariat for Research and Technology (GSRT). "GSRT Research Centers" emerges as the second –following "Universities"– most productive Institution Category in terms of the number of publications produced.

The table below summarizes the number of publications and citations received for publications produced from each Center for the latest period (2006-2010) of this study. It also displays publications' growth trends and compares them to the preceding 5-year period, 2004-2008 (data emerges from EKT's previous study which was published in 2010).

*Since the National Center for Social Research (EKKE) has a rather low number of publications indexed in international journals, it was not included in the analysis.

CHAPTER 6

SCIENTIFIC PUBLICATIONS BY GSRT RESEARCH CENTERS

		2004-2008		2006-2010	
		Number of publications	Number of citations	Number of publications	Number of citations
ATHENA - Research and Innovation Center in Information, Communication and Knowledge Technologies	ATHENA	74	94	103	230
National Observatory of Athens	NOA	480	1.867	545	2.363
National Hellenic Research Foundation	NHRF	542	2.752	597	4.348
Center for Research and Technology Hellas	CERTH	428	1.313	504	2.261
National Center of Scientific Research "Demokritos"	NCSR "DEMOKRITOS"	1.972	8.781	2.101	11.525
Hellenic Center for Marine Research	HCMR	502	1.874	573	2.375
Greek Atomic Energy Commission	GAEC	43	79	40	129
Hellenic Pasteur Institute	PASTEUR	141	725	167	1.084
Biomedical Sciences Research Center	BSRC FLEMING	100	1.063	153	1.673
Foundation for Research and Technology Hellas	FORTH	2.084	12.818	2.073	15.307
Center for Research and Technology Hellas	CE.RE.TE.TH	31	32	83	329

6.1 Publications

The top performing institutions in the category "Research Centers supervised by GSRT", in terms of publications output, were the Foundation for Research and Technology Hellas/FORTH and the National Center for Scientific Research "DEMOKRITOS"/NCSR "DEMOKRITOS".

Looking at data from 2010, GSRT Research Centers were ranked in terms of their number of publications, in the following order: National Center for Scientific Research "DEMOKRITOS"/NCRS "DEMOKRITOS" (400), the Foundation for Research and Technology Hellas/FORTH (379), the Hellenic Center for Marine Research/HCMR (130), the National Observatory of Athens/NOA (116), the National Hellenic Research Foundation/NHRF (114) and the Center for Research and Technology Hellas/CERTH (107). The category 'Other Research Centers' produced fewer than 50 publications (Figure 6.1.1). Following a growth period which lasted until 2008, there was a decline in the number of publications produced by certain GSRT Research Centers – including the top performing ones– corresponding to a general declining trend in Greek publications. However, in the cases of the Hellenic Center for Marine Research/HCMR, the Center for Research and Technology Hellas/FORTH, the Biomedical Sciences Research Center/BSCR FLEMING, the Hellenic Pasteur Institute/PASTEUR and the Athena-Research and Innovation Center in Information, Communication and Knowledge Technologies/ ATHENA, publications output display growing trends.

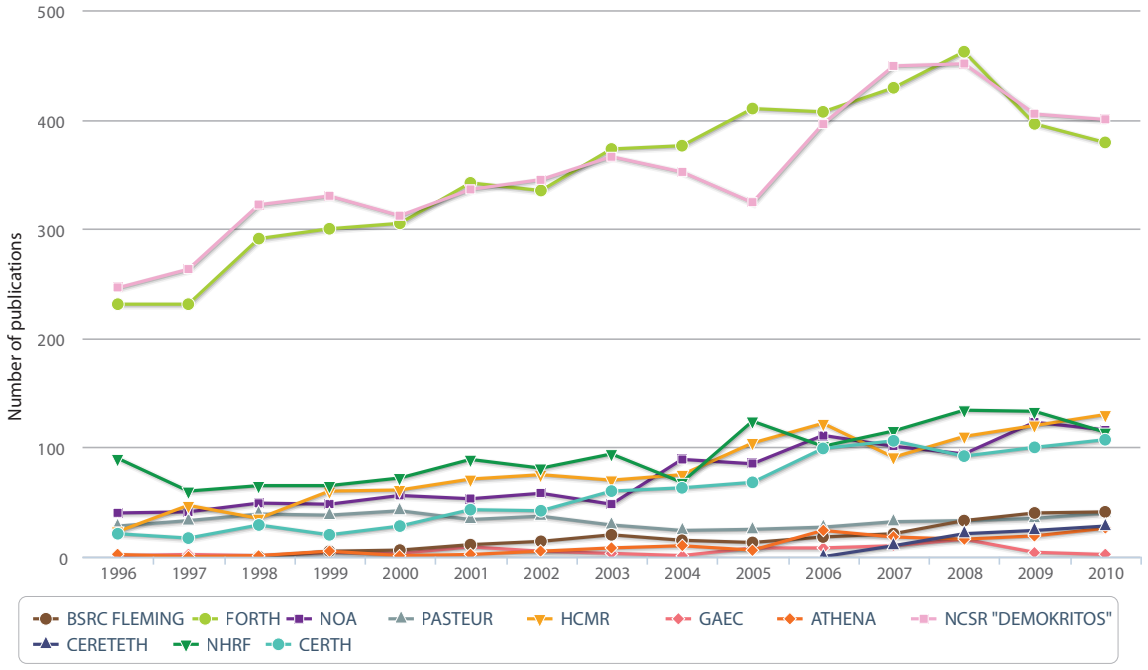


Figure 6.1.1 Development of the number of publications by GSRT Research Center, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 6.1.2 displays the number of publications and the annual rate of change for each GSRT Research Center for the years 1996-2010.

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

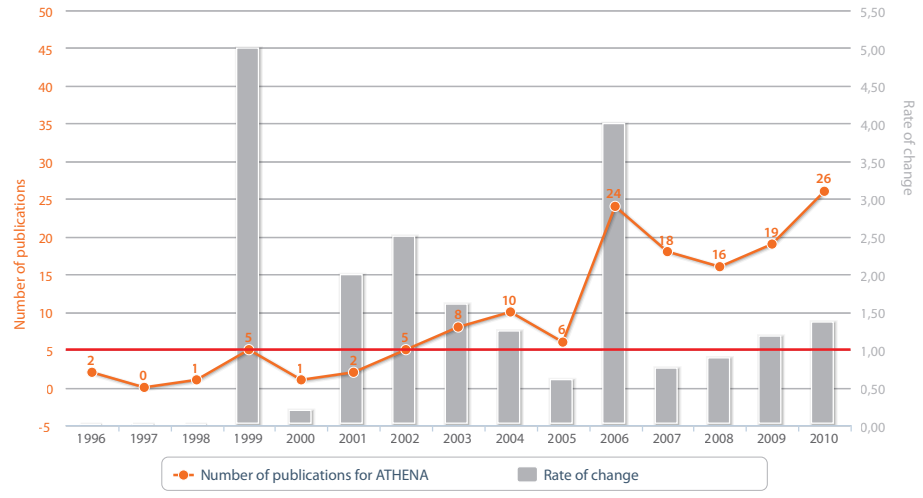


Figure 6.1.2 Number of publications and rate of change in the number of publications by ATHENA, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

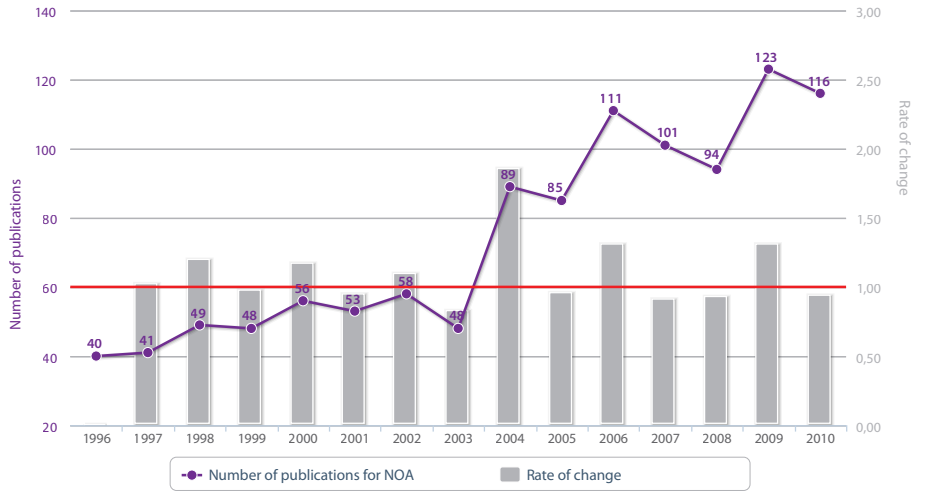


Figure 6.1.2 Number of publications and rate of change in the number of publications by NOA 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

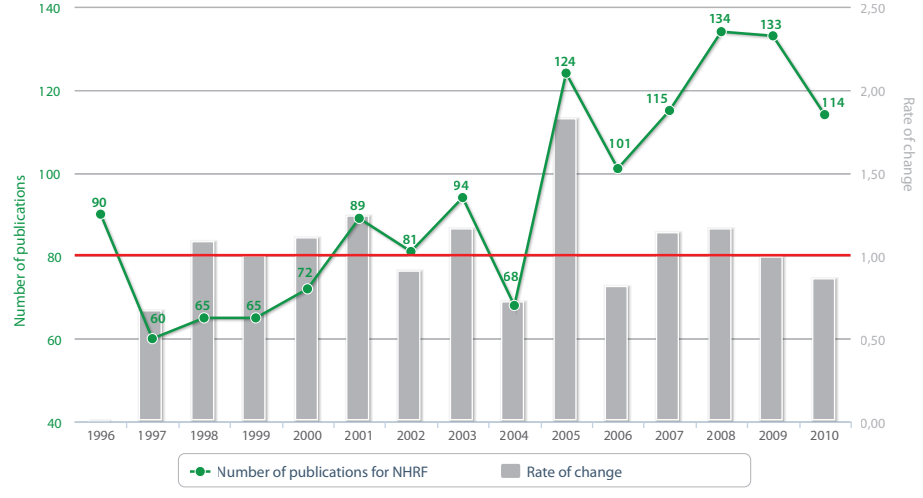


Figure 6.1.2 Number of publications and rate of change in the number of publications by NHRF, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

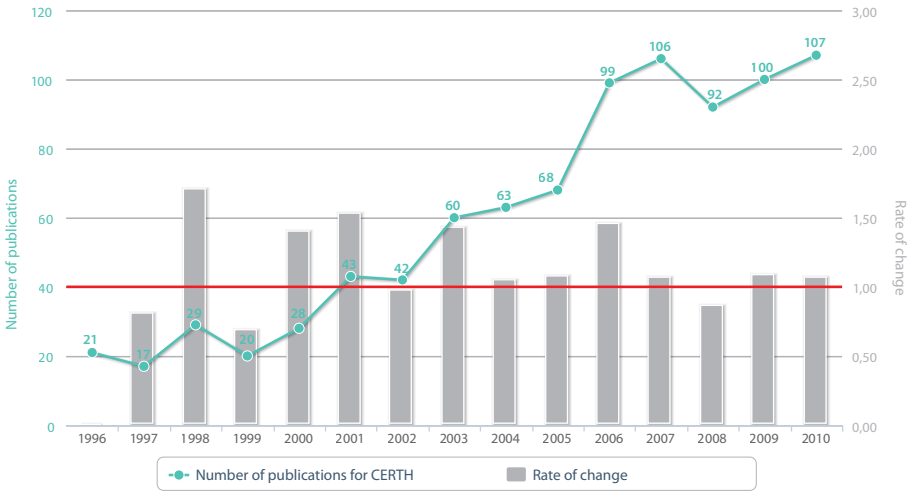


Figure 6.1.2 Number of publications and rate of change in the number of publications by CERTH, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

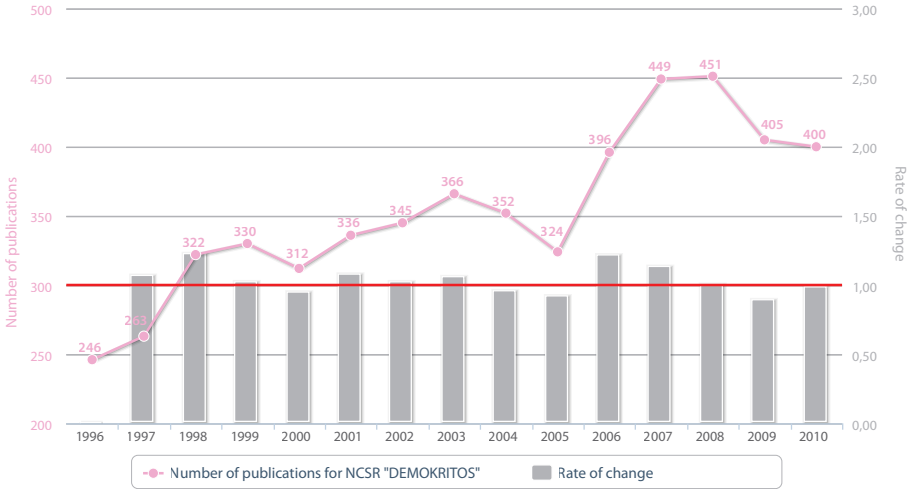


Figure 6.1.2 Number of publications and rate of change in the number of publications by NCSR "DEMOKRITOS", 1996-2010 /
Source: Thomson Reuters, Incites 1996-2010

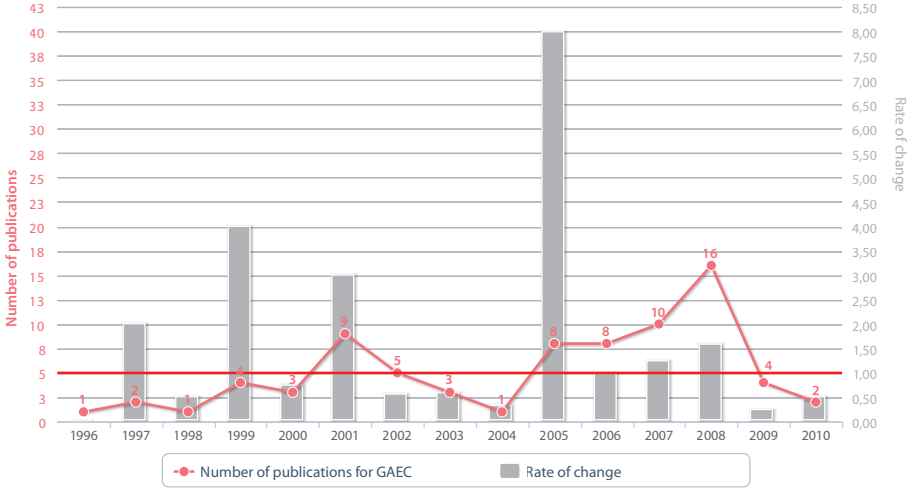


Figure 6.1.2 Number of publications and rate of change in the number of publications by GAEC, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

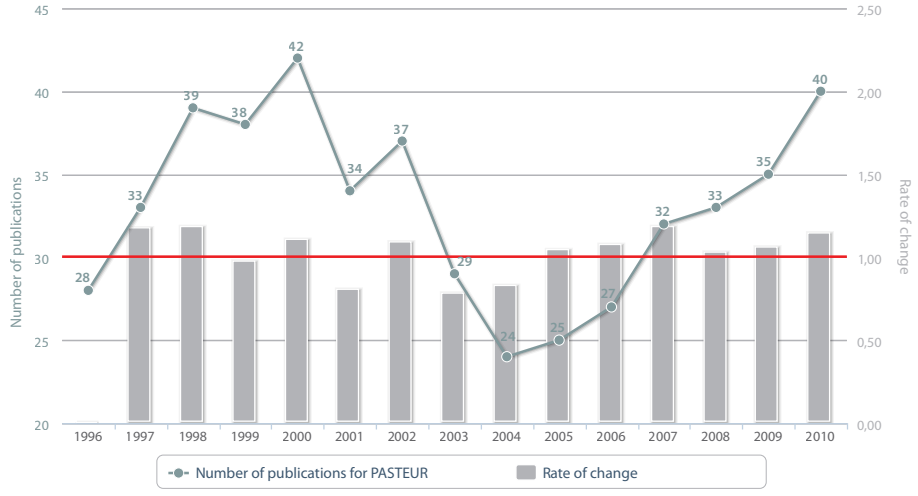


Figure 6.1.2 Number of publications and rate of change in the number of publications by PASTEUR, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

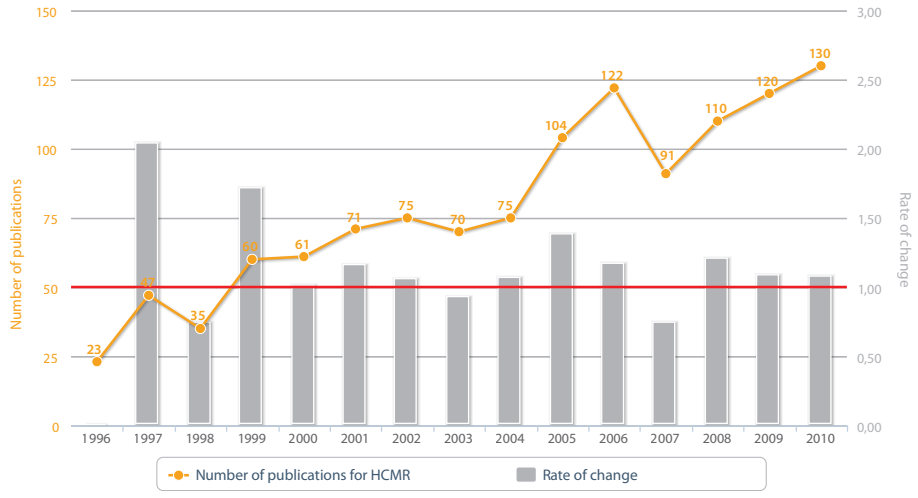


Figure 6.1.2 Number of publications and rate of change in the number of publications by HCMR, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

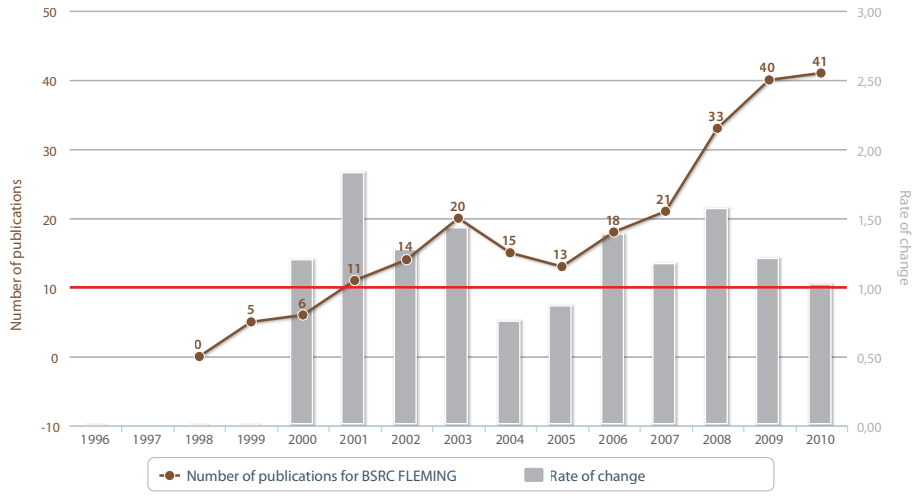


Figure 6.1.2 Number of publications and rate of change in the number of publications by BSRC FLEMING 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

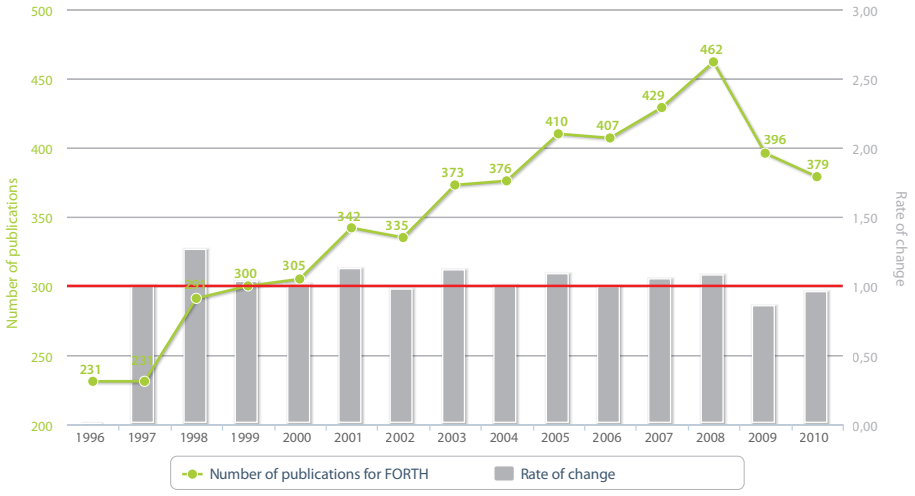


Figure 6.1.2 Number of publications and rate of change in the number of publications by FORTH, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

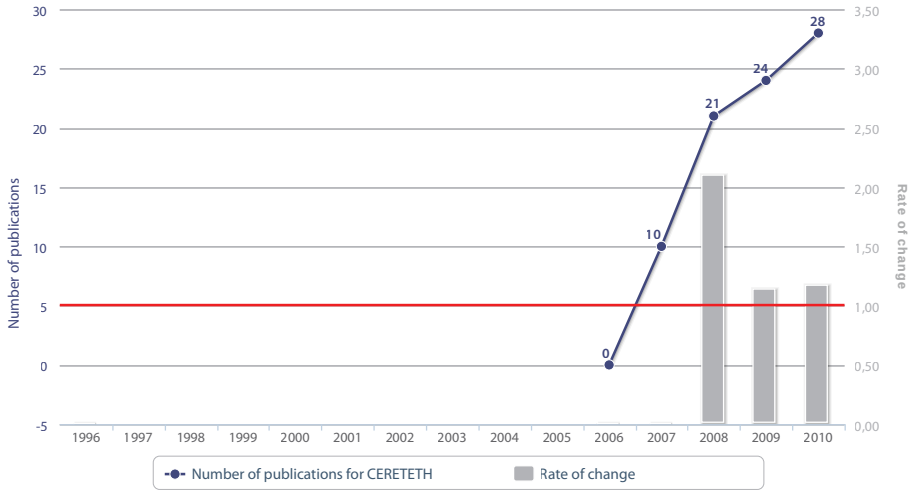


Figure 6.1.2 Number of publications and rate of change in the number of publications by CERETETH, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 6.1.3 presents data for the latest 5-year period 2006-2010 and for the category "Research Centers supervised by GSRT". It demonstrates the number of publications and its share in the total number of publications of the category. The National Center for Scientific Research "DEMOKRITOS"/NCSR "DEMOKRITOS" had 2,101 publications and a share of 31.1%. The Foundation for Research and Technology Hellas/FORTH produced 2,073 publications and had a 30.7% share, the National Hellenic Research Foundation/NHRF had 597 publications and 8.8% share, the Hellenic Center for Marine Research/HCMR 573 publications and 8.5% share, the National Observatory of Athens/NOA 545 publications and 8.1% share and the Center for Research and Technology Hellas/CERTH 504 publications and 7.5% share. As for the remaining Research Centers, their share accounted for less than 2.5%.

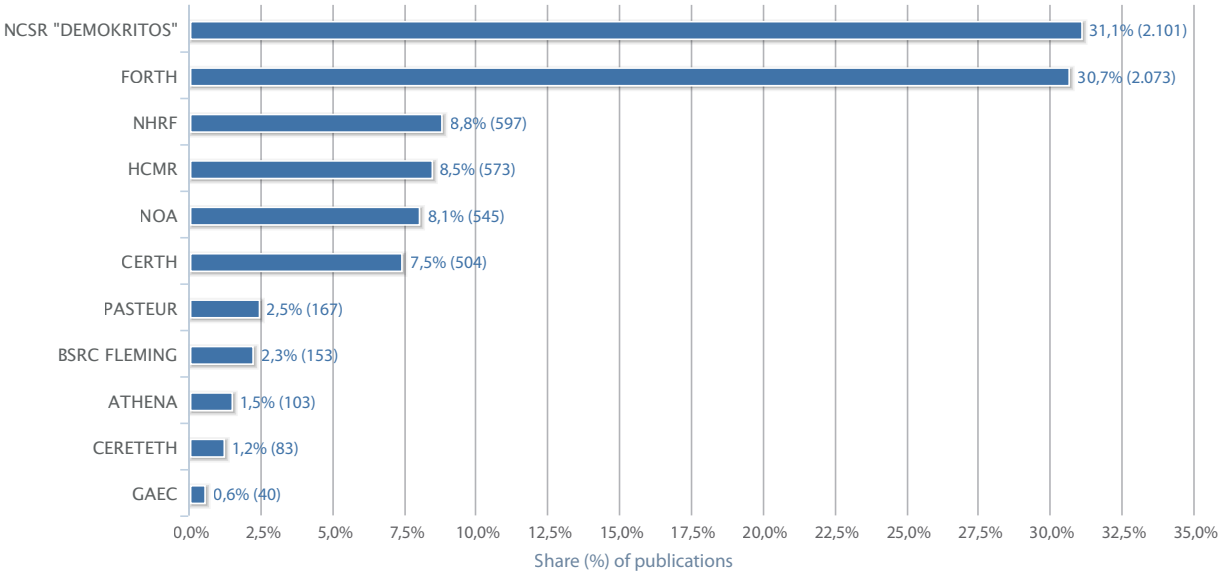


Figure 6.1.3 Number and share (%) of publications, by GSRT Research Center, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Comparing the rate of transition in the number of publications from 2006 to 2010, we observed that 8 Research Centers displayed a positive trend. The number of publications for the Biomedical Sciences Research Center/BSCR FLEMING and the Hellenic Pasteur Institute/PASTEUR were above the average for Institutions in the category (Figure 6.1.4).

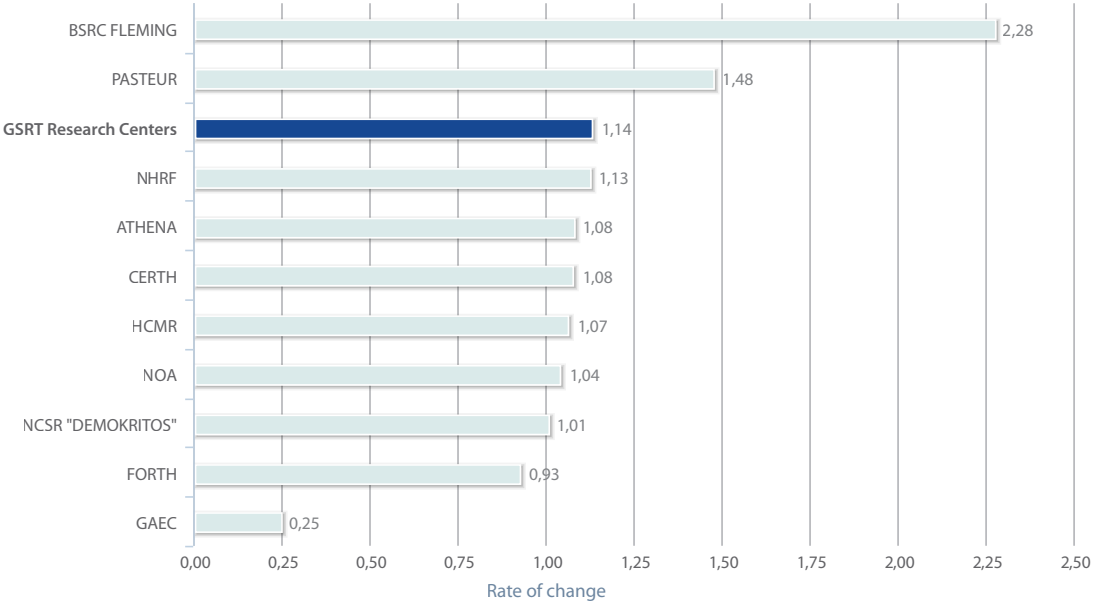


Figure 6.1.4 Change in the number of publications between 2006 and 2010, by GSRT Research Center / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in 2010 – number of publications in 2006)/ number of publications in 2006]. The rate is 1, if the number of publications is the same across the years compared.
The Center for the Research and Technology Thessaly (CE.RE.TE.TH) produced its first publications in 2006 and therefore its rate of change is considerably high and is thus not included in the Figure.

6.2 Citations

Figure 6.2.1 tracks the percentage of cited publications for each GSRT Research Center and demonstrates a significant progress in the period 1996-2010. In most cases, the values recorded were above the Greek average. For the most recent 5-year period 2006-2010, the percentage of cited publications varied between 66.3% and 80.4%, with the exception of ATHENA (Figure 6.2.1).

Figure 6.2.1 Percentage (%) of cited publications by GSRT Research Center, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

During 1996-2010, there was a remarkable increase in the number of citations to publications issued by "GRST Research Centers" (Figure 6.2.2). The highest numbers were attributed to the Foundation for Research and Technology Hellas/ FORTH and the National Center for Scientific Research "DEMOKRITOS"/NCRS "DEMOKRITOS" –which also accounted for the highest number of publications–. These Centers were followed by the National Hellenic Research Foundation/NHRF, the Hellenic Center for Marine Research/HCMR, the National Observatory of Athens/NOA and the Center for Research and Technology Hellas/CERTH.

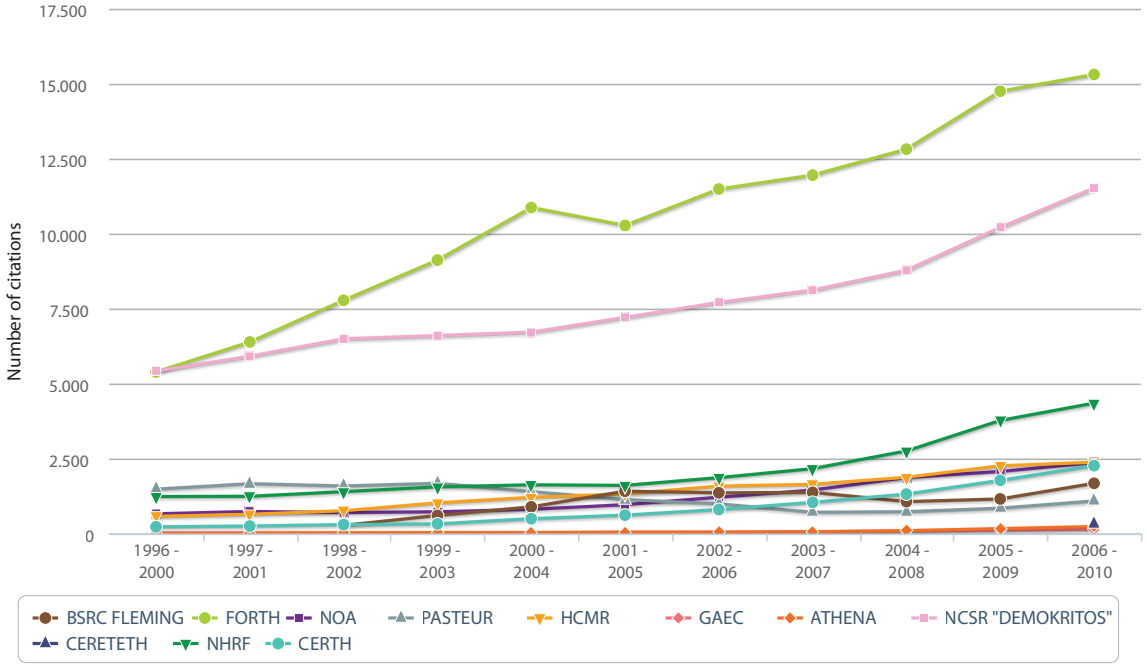


Figure 6.2.2 Number of citations by GSRT Research Center, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010.

Focusing on the latest 5-year period 2006-2010, Figure 6.2.3 displays the number of citations received for each GSRT Research Center and its corresponding share (%) in total citations across the category "GSRT Research Centers". The top performing Centers were the following: Foundation for Research and Technology Hellas/ FORTH with 15,307 citations (37.9%), National Center for Scientific Research "DEMOKRITOS"/NCRS "DEMOKRITOS" with 11,525 citations (28.5%), National Hellenic Research Foundation/NHRF with 4,348 citations (10.8%), Hellenic Center for Marine Research/HCMR with 2,375 citations 5.9%), National Observatory of Athens/NOA with 2,363 citations (5.8%) and Center for Research and Technology Hellas/CERTH with 2,261 citations (5.6%). The remaining Research Centers had a share of less than 5%..

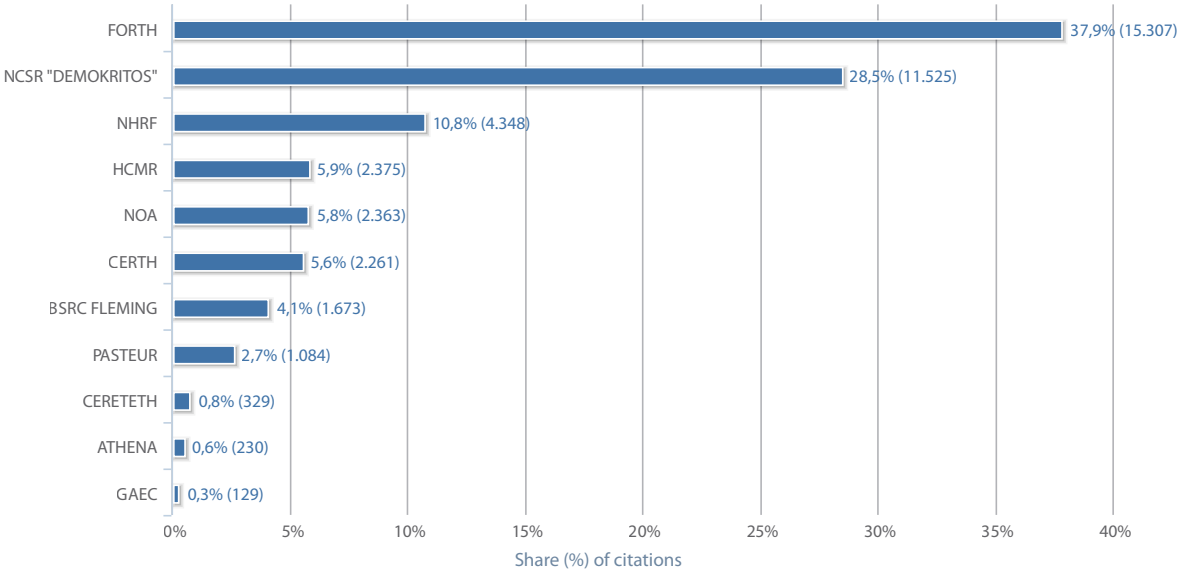


Figure 6.2.3 Number and share (%) of citations by GSRT Research Center, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

6.3 Citation impact

Figure 6.3.1 presents the number of publications and citations and the field normalised citation score of each GSRT Research Center in relation to the world average. Data refers to the most recent 5-year period 2006-2010. The field normalised citation score, or "citation score", is the relative number of citations to publications of a Center compared to the world average of citations to publications of the same time period and scientific subject field. The normalisation is at the level of each publication according to the 253 NSI scientific subject fields. If an article belongs to several subject fields, a mean value of the fields was calculated. The citation score was calculated using software developed by EKT. A value greater than 1, indicated that the impact of publications was higher than the world average.

The values of the field-normalised citation score surpassed or approached the world average in the case of 9 Research Centers.

The relatively low number of publications by the Biomedical Sciences Research Center/BSCR FLEMING accounted for the highest citation score (1.43). This was followed by the citation score achieved by the Foundation for Research and Technology Hellas/FORTH (1.24) and then by a small number of publications coming from the Center for Research and Technology of Thessaly/CERETETH (citation score: 1.13) and the Hellenic Pasteur Institute/PASTEUR (citation score: 1.11). Finally, citation scores around world baseline were calculated for the publications of the National Center for Scientific Research "DEMOKRITOS"/NCRS "DEMOKRITOS" (1.01), the Center for Research and Technology Hellas/CERTH (1.00), the Hellenic Center for Marine Research/HCMR (0.97), the National Observatory of Athens/NOA (0.94) and the National Hellenic Research Foundation/NHRF (0.93).

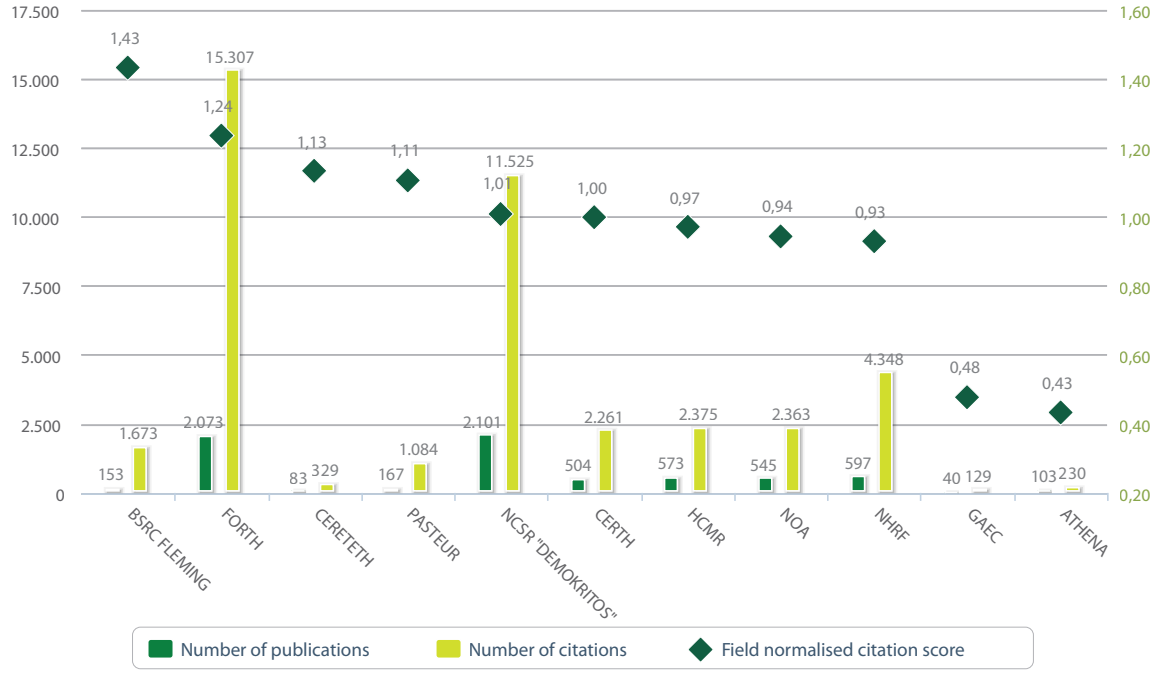


Figure 6.3.1 Publications, citations and field normalised citation score relative to the world, by GSRT Research Center, 2006-2010
Data refers to the total number of publications in each Research Center for all scientific fields.
πεδία / Source: Thomson Reuters, Incites 1996-2010

6.4 Highly cited publications

Figure 6.4.1 shows, for each GSRT Research Center, the number of highly cited publications of the period 2006-2010 for percentile levels 1%, 5%, 10%, 25% and 50%, i.e. the publications that belong respectively to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

Publications among the 1% most highly cited publications worldwide were produced by FORTH (36 publications), NCSR "DEMOKRITOS" (27), HCMR (6), BSCR FLEMING (5), NHRF (4), PASTEUR (4), NOA (3), CERTH (2), ATHENA (2) and CE.RE.TE.TH (1).

In addition, Figure 6.4.1 displays the percentage of the highly cited publications in each GSRT Research Center for percentile levels 1%, 5%, 10%, 25% and 50%. Data refers to the last 5-year period 2006-2010. Values above the percentile levels indicate that the specific Center has the majority of its publications among the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

BSRC FLEMING, FORTH and NCSR "DEMOKRITOS" surpassed the world baseline in all percentile levels 1%, 5%, 10%, 25% and 50%. A better performance than the world average was also noted in the case of CERTH for percentile levels 5%, 10%, 25% and 50%, HCMR for 1%, 5% and 10%, ATHENA and PASTEUR for 1%, and 5%, CE.RE.TE.TH for 1%, GAEC for 5% and NHRF for 50%.

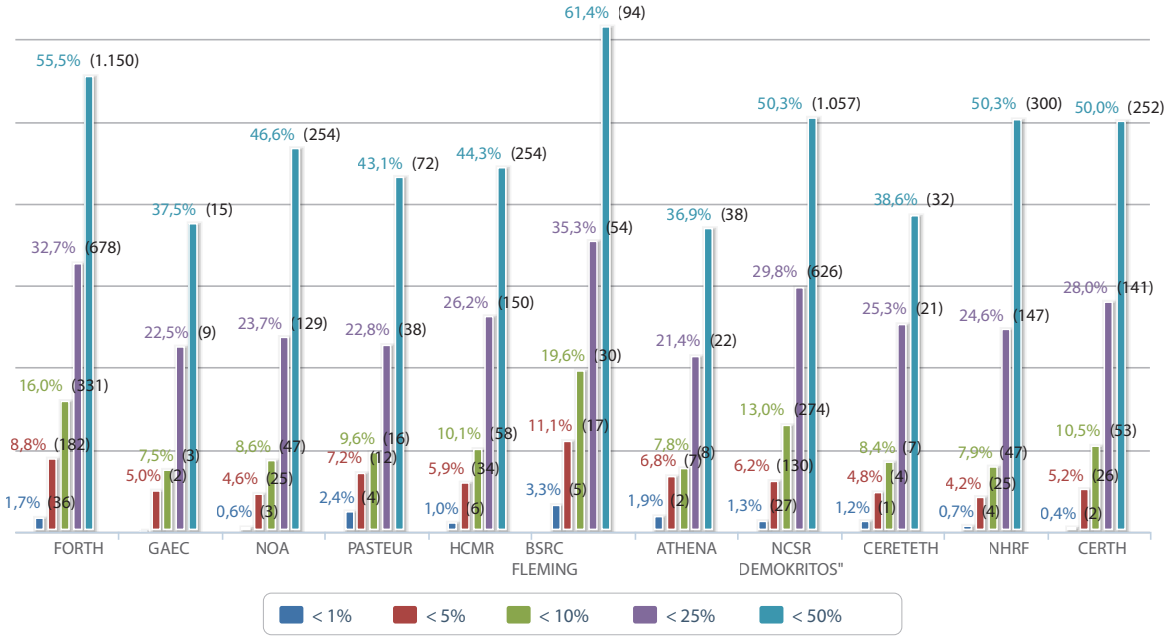


Figure 6.4.1 Number and percentile breakdown (%) of highly cited publications by GSRT Research Center, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: top 1%, 5%, 10%, 25% and 50% most cited publications in world production.

6.5 Major fields of science

Figure 6.5.1 captures the impact of publications by GSRT Research Centers in the major fields of science "Natural Sciences", "Engineering and Technology", "Medical and Health Sciences" and "Agricultural Sciences" during 2006-2010. The Figure displays the number of publications and citations and the field normalised citation score for each major field, giving the overall performance of each Research Center in each major field. The citation scores are calculated, after normalisation at the level of its publication, as the mean values of the different subject fields included in each major scientific field. Figure 6.5.2 presents in detail each institution's performance.

In "Natural Sciences", the number of publications came from 9 of the 11 Research Centers. They all had high citation scores ranging from 0.89 to 1.42. They were ranked as follows: BSCR FLEMING (1.42), FORTH (1.27), NCSR "DEMOKRITOS" (1.05), NOA (0.97), HCMR (0.95), PASTEUR (0.95), NHRF (0.91) and CERTH (0.89). This score is lower for ATHENA (0.44).

Six Research Centers were active in the scientific field "Engineering & Technology". The publications with a citation score higher than the world average baseline were those of CERTH and FORTH (citation score for both is 1.10) while those of NCSR "DEMOKRITOS" came close to that baseline (0.97).

The majority of publications in the "Medical & Health Sciences" came from six Research Centers. Five of them achieved citation scores above the world average baseline: BSCR FLEMING (1.46), FORTH (1.39), CERTH (1.31), PASTEUR (1.28) and NHRF (1.07). The score for NCSR "DEMOKRITOS" was 0.81.

In "Agricultural Sciences", the only Center with a significant publication output was HCMR. Its publications presented a citation score of 1.05.

Finally, there were not any Research Centers systematically involved in publications in the field of "Social Sciences" and "Humanities". This does not allow us to reach reliable conclusions related to publishing activity.

* The field-normalised citation score was calculated only for Research Centers with more than 75 publications for the period 1996-2010, which is more than 5 publications per year.

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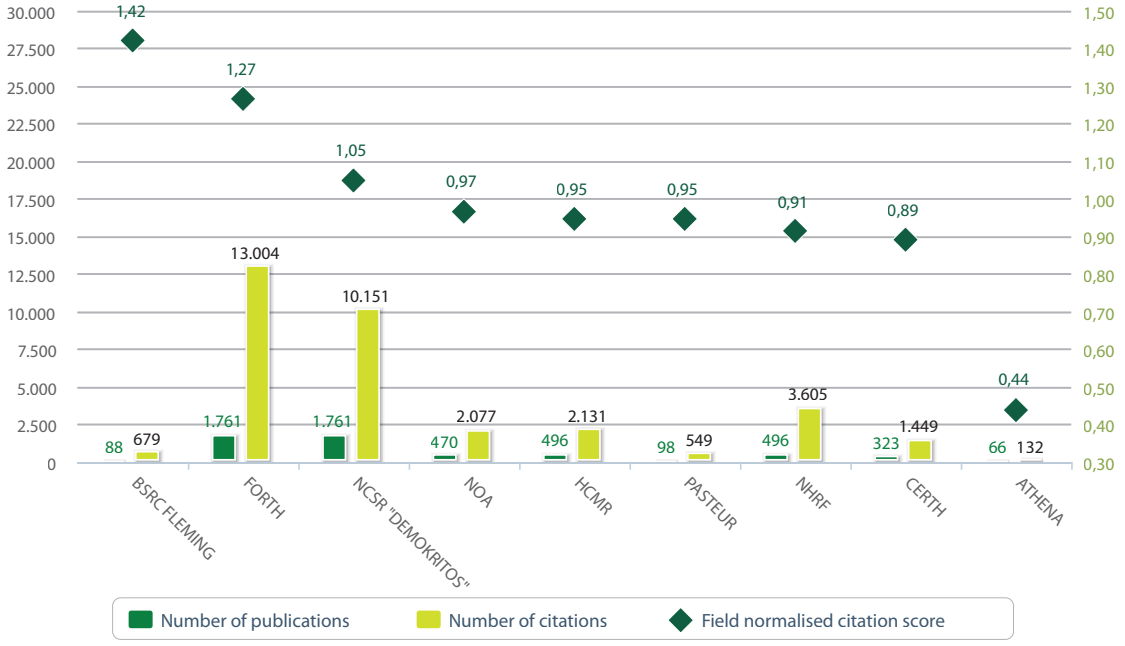

Figure 6.5.1 Natural Sciences: Publications, citations and field normalised citation score relative to the world, by GSRT Research Center, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 6.5.1: Engineering and Technology: Publications, citations and field normalised citation score relative to the world, by GSRT Research Center, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

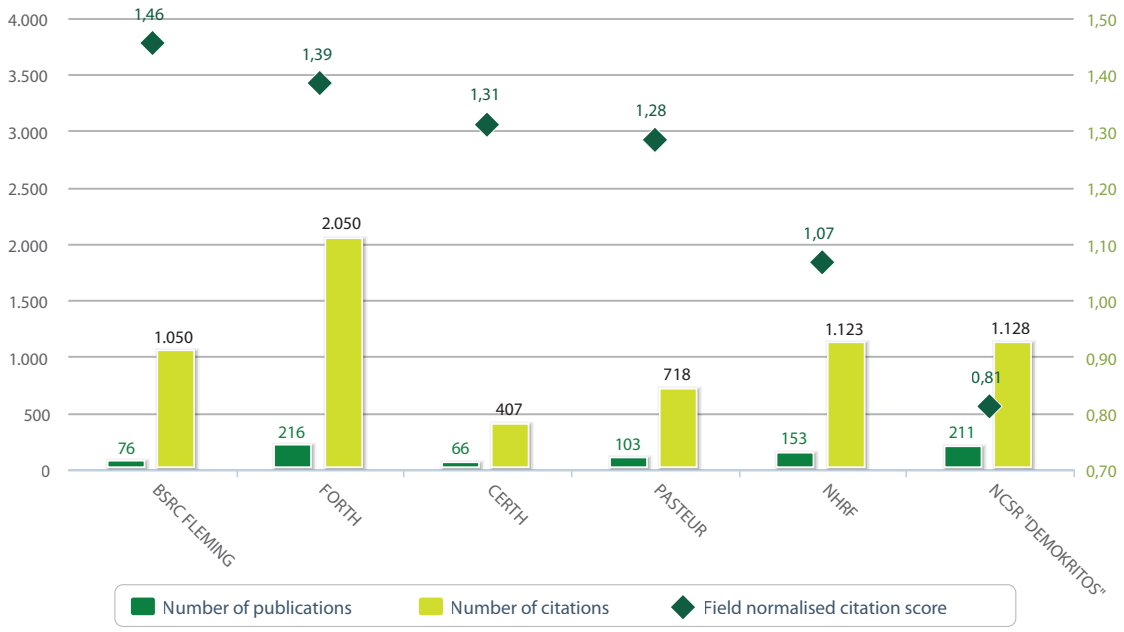

Figure 6.5.1: Medical and Health Sciences: Publications, citations and field normalised citation score relative to the world, by GSRT Research Center, 2006-2010 / Πηγή: Thomson Reuters, Incites 1996-2010

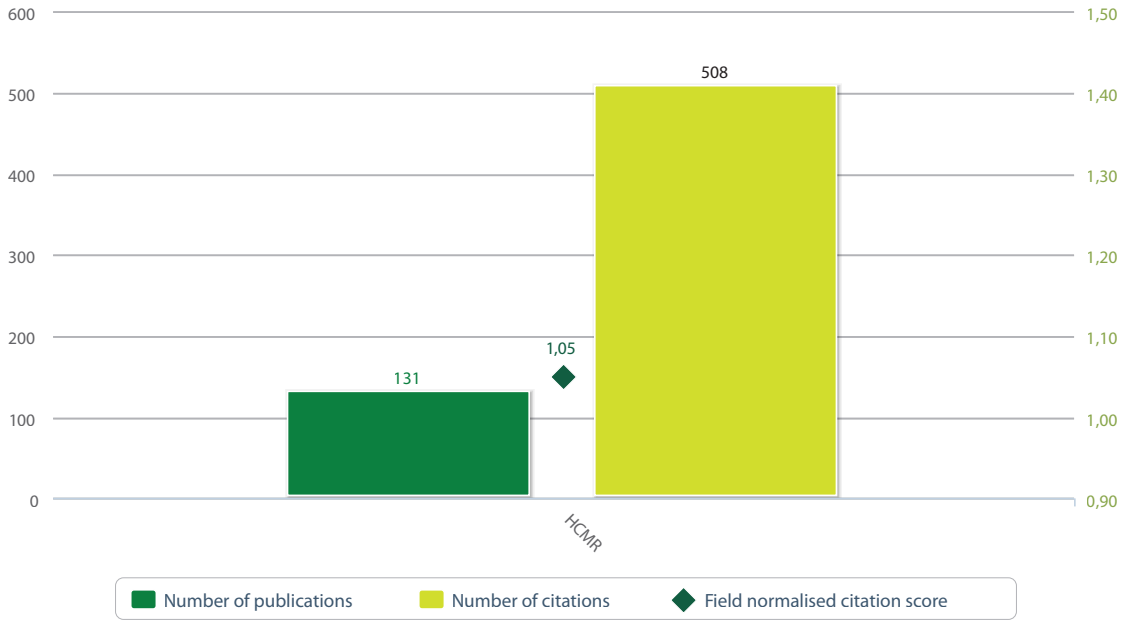

Figure 6.5.1: Agricultural Sciences: Publications, citations and field normalised citation score relative to the world, by GSRT Research Center, 2006-2010 / Πηγή: Thomson Reuters, Incites 1996-2010

NATURAL SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Research Centers**	**Field-normalised citation score**	**Number of publications**
biological sciences	genetics & heredity	FORTH	3,94	38
physical sciences	optics	FORTH	2,34	131
chemical sciences	chemistry, multidisciplinary	NHRF	2,29	40
chemical sciences	chemistry, multidisciplinary	NCSR "DEMOKRITOS"	2,16	80
earth and related environmental sciences	meteorology & atmospheric sciences	FORTH	2,16	40
chemical sciences	polymer science	FORTH	1,80	122
earth and related environmental sciences	water resources	NOA	1,76	41
biological sciences	cell biology	FORTH	1,75	72
chemical sciences	polymer science	CERETETH	1,75	24
biological sciences	cell biology	NHRF	1,72	22
physical sciences	physics, multidisciplinary	FORTH	1,67	76
biological sciences	biochemistry & molecular biology	BSCR FLEMING	1,67	45
biological sciences	microbiology	PASTEUR	1,64	37
physical sciences	astronomy & astrophysics	NCSR "DEMOKRITOS"	1,62	9
physical sciences	physics, particles & fields	NCSR "DEMOKRITOS"	1,59	117
physical sciences	physics, fluids & plasmas	FORTH	1,59	22
mathematics	mathematics	FORTHITE	1,55	22
computer and information sciences	computer science, interdisciplinary applications	NCSR "DEMOKRITOS"	1,54	20

ENGINEERING AND TECHNOLOGY				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Research Centers**	**Field-normalised citation score**	**Number of publications**
civil engineering	engineering, civil	NOA	1,69	20
mechanical engineering	mechanics	FORTH	1,68	44
other engineering and technologies	engineering, multidisciplinary	NCSR "DEMOKRITOS"	1,66	41
environmental engineering	engineering, environmental	CERTH	1,57	13
civil engineering	engineering, civil	CERTH	1,57	9

MEDICAL AND HEALTH SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Research Centers**	**Field-normalised citation score**	**Number of publications**
health sciences	public, environmental & occupational health	FORTH	3,58	17
clinical medicine	endocrinology & metabolism	FORTH	3,57	12
health sciences	infectious diseases	PASTEUR	3,57	15
health sciences	sport sciences	CERTH	1,63	18
clinical medicine	geriatrics & gerontology	NHRF	1,61	8
clinical medicine	oncology	FORTH	1,59	18
basic medicine	immunology	BSCR FLEMING	1,57	20

Figure 6.5.2 Scientific subfields of "GSRT Research Centers" publications with field normalised citation score ≥ 1, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

6.6 Scientific collaboration

Publications with national and international collaboration by "GSRT Research Centers" displayed a rising trend– although not steady- during the period 1996-2010. Figure 6.6.1 and 6.6.2 highlight the evolution of publications with national and international collaboration year on year, by each Research Center, for the period 1996-2010.

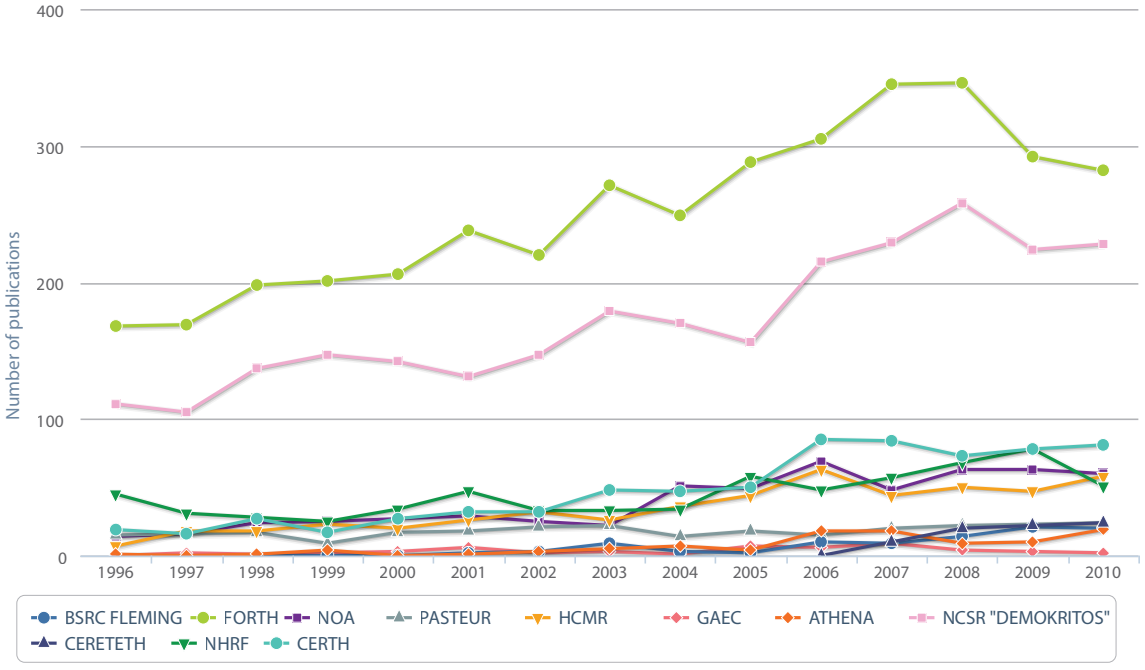

Figure 6.6.1 Number of publications with national collaboration, by GSRT Research Center, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

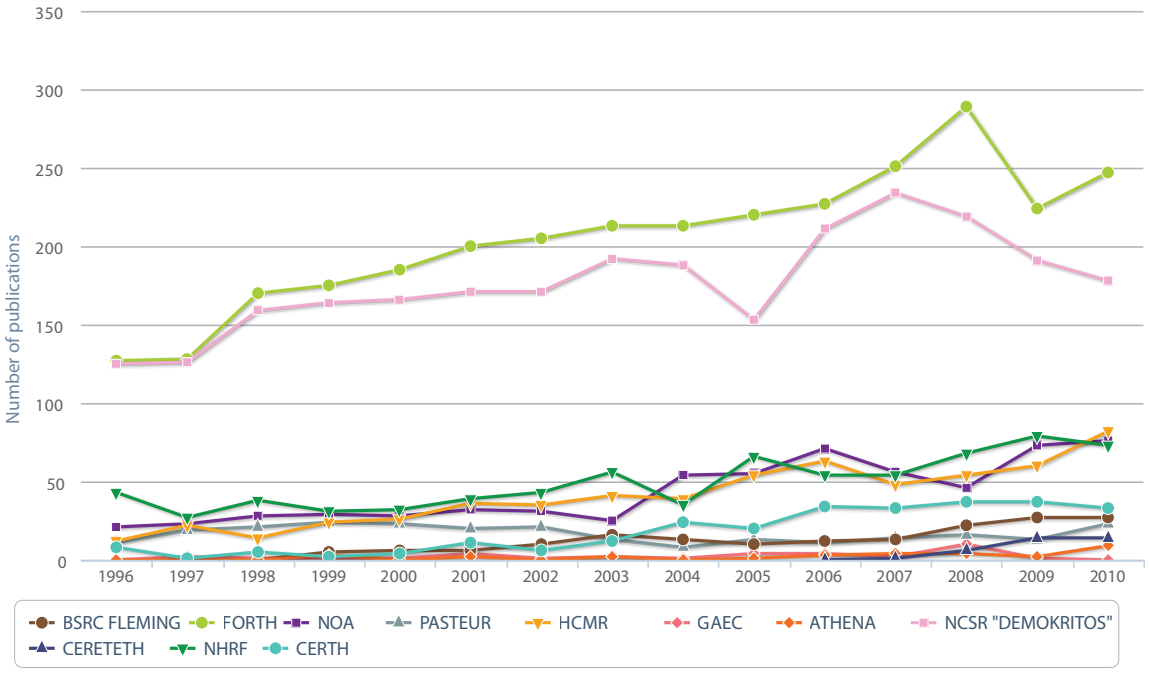

Figure 6.6.2 Number of publications with international collaboration, by GSRT Research Center, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 6.6.3 highlights the distribution (%) of publications with national*, international** and no collaboration*** by each GSRT Research Center for the most recent 5-year period 2006-2010. In terms of the number of publications produced by networking activity, the majority of Research Centers were higher than other Greek Institutions. There were only a few publications without partnerships. The ATHENA Research Center presented the highest percentage (23.3%) of publications with no collaboration, a value below the Greek average (32.8%).

Publications with international collaboration were higher than those with Greek- based institutions in the case of four Research Centers: BSCR FLEMING, NOA, NHRF and HCMR. BSCR FLEMING shows the sharpest pattern of association with international institutions in publications (66%).

The percentage of nationally-co authored publications ranged from 45.7% in HCMR and 91.6% in CE.RE.TE.TH. A high percentage above 70% was recorded for CERTH (79.6%), FORTH (75.7%) and ATHENA (71.8%).

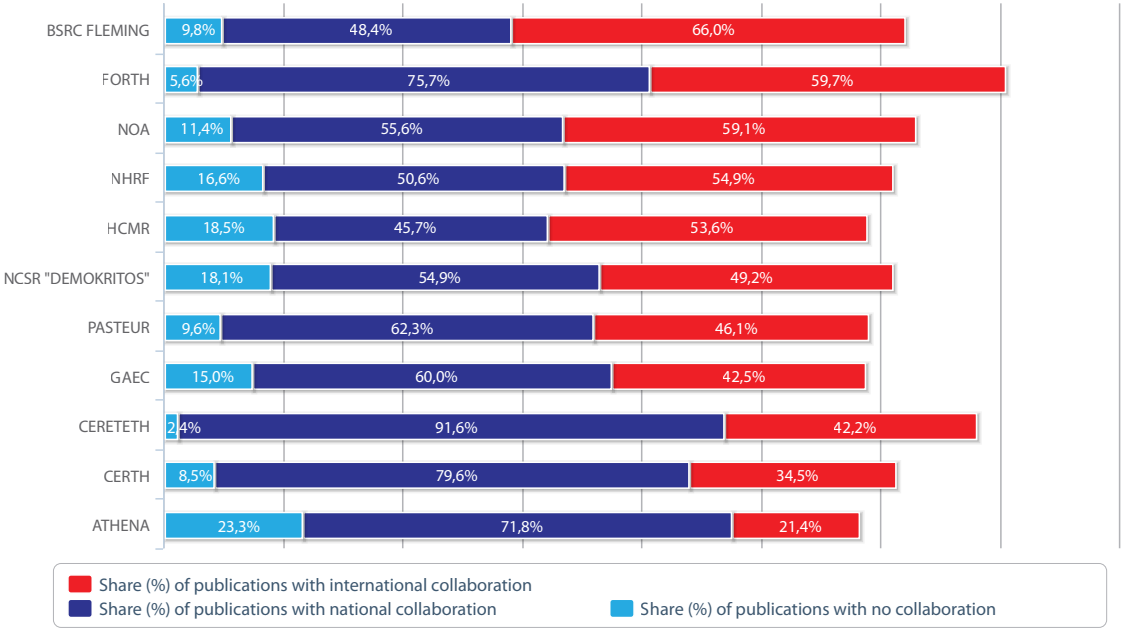

Figure 6.6.3 Share (%) of publications with national, international and no collaboration by GSRT Research Center, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration

** Number of publications with at least one international collaboration

*** Number of publications with no collaboration, per institution

This chapter presents bibliometric indicators corresponding to the Institution Category "Other Public Research Institutions", which includes 8 research institutions supervised by different Ministries. In particular, the category includes: the Academy of Athens, the Research Academic Computer Technology Institute, the National Agricultural Research Foundation, the Institute of Geology and Mineral Exploration, the Institute of Engineering Seismology and Earthquake Engineering, the Center for Renewable Energy Sources and Saving, the Center of Planning and Economic Research and the Benaki Phytopathological Institute.

The table below presents the number of publications and citations received for publications of each Center corresponding to the latest period (2006-2010) of this study. It also demonstrates growth trends compared to the 5-year period 2004-2008 (data emerges from the preceding study that EKT published in 2010).

CHAPTER 7

SCIENTIFIC PUBLICATIONS BY OTHER PUBLIC RESEARCH INSTITUTIONS

		2004-2008		2006-2010	
		Number of publications	Number of citations	Number of publications	Number of citations
Academy of Athens*	ACADEMY OF ATHENS	423	2.736	608	3.797
National Agricultural Research Foundation*	NAGREF	623	1.372	617	1.780
Research Academic Computer Technology Institute*	RA-CTI	164	232	113	107
Institute of Geology and Mineral Exploration *	IGME	46	134	55	121
Institute of Engineering Seismology and Earthquake Engineering*	ITSAK	31	47	25	36
Center for Renewable Energy Sources and Saving *	CRES	46	116	45	120
Center of Planning and Economic Research *	KEPE	16	3	21	28
Benaki Phytopathological Institute *	BPI	133	377	149	350

* Supervised by the Ministry of Education, Lifelong learning and Religious affairs, including publications by the Medical and Biological Research Foundation (IIBEAA) as part of publications from the Academy of Athens.

* Supervised by the Ministry of Rural Development and Food.

* Supervised by the Ministry of Environment, Energy and Climate change. The Center for Renewable Energy Sources was supervised by GSRT up to 2008 and therefore was included in the category "Research Centers supervised by GSRT" in the previous study of EKT.

* Supervised by the Ministry of Finance.

* Supervised by the Ministry of Environment, Energy and Climate change.

* Supervised by the Ministry of Infrastructure, Transport and Networks. In 2011 ITSAK merged with the Institute for Earthquake Protection Planning. Given that this study covers the publication activity up to 2010, ITSAK was studied as an individual entity.

* Supervised by the Ministry of Rural Development and Food.

* Supervised by the Ministry of Education, Lifelong learning and Religious affairs. In 2011, the Computer Technology Institute (CTI) was renamed as the Computer Technology Institute and Press "Diophantus". Since the present study examines publications issued until 2010, we refer to the Institure with its former name.

7.1 Publications

Over the period 1996-2010, the Academy of Athens showed a stable upward trend in the number of publications, especially after 2002, finishing with 174 publications in 2010. As for the other Public Research Institutions, their performance varied during the period; in 2010 their publication output was as follows: 113 publications by the National Agricultural Research Foundation/NAGREF, 25 by the Benaki Phytopathological Institute/BPI 19 by the Research Academic Computer Technology Institute/RA-CTI, 13 by the Institute of Geology and Mineral Exploration/IGME, 6 by the Center of Planning and Economic Research/KEPE, and 4 publications by both the Institute of Engineering Seismology & Earthquake Engineering/ITSAK and the Center for Renewable Energy Sources and Saving/ CRES.

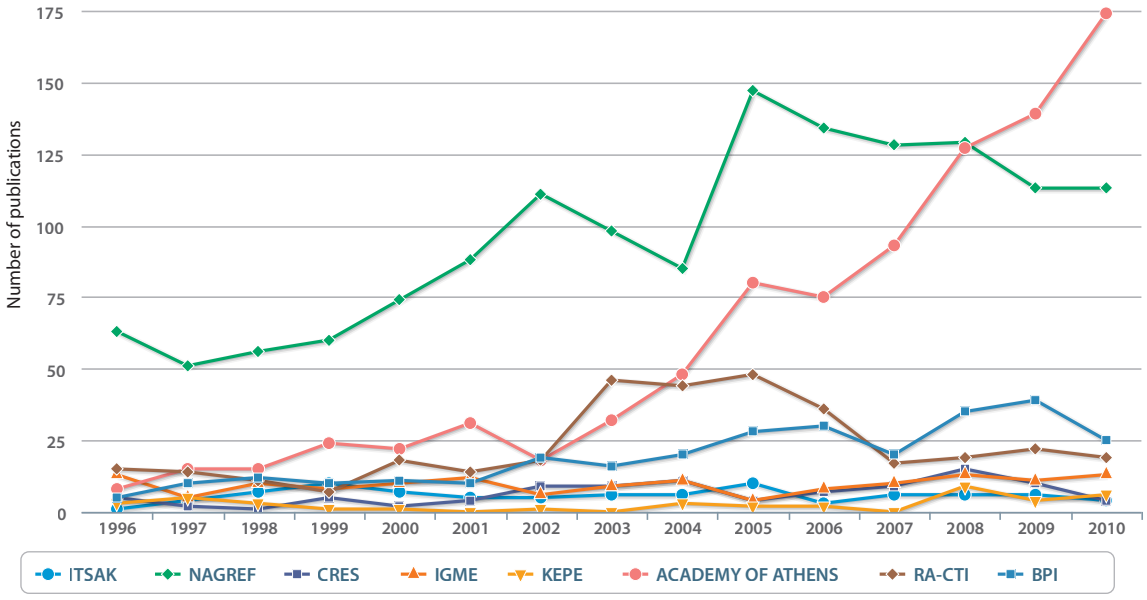

Figure 7.1.1 Development of the number of publications by Public Research Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 7.1.2 displays the number of publications and the annual rate for publications of each Public Research Institution for the years 1996-2010.

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

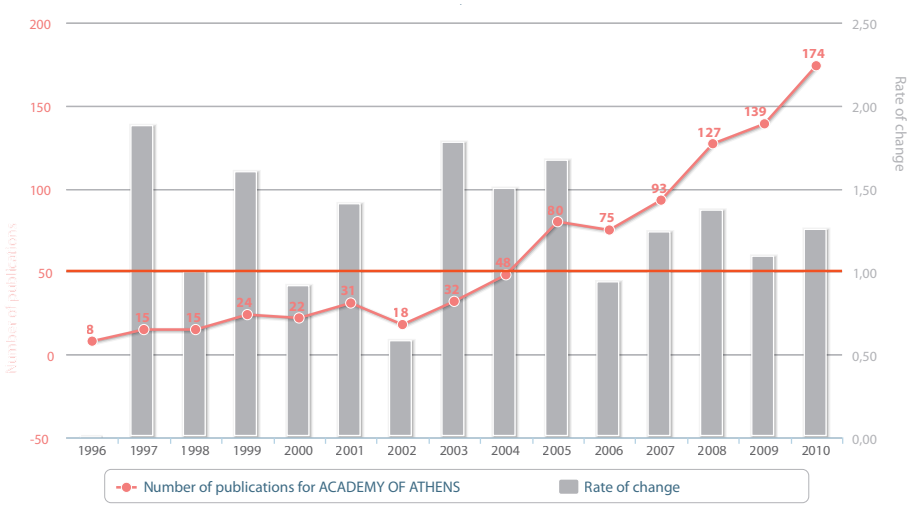

Figure 7.1.2 Number of publications and rate of change in the number of publications by "Academy of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

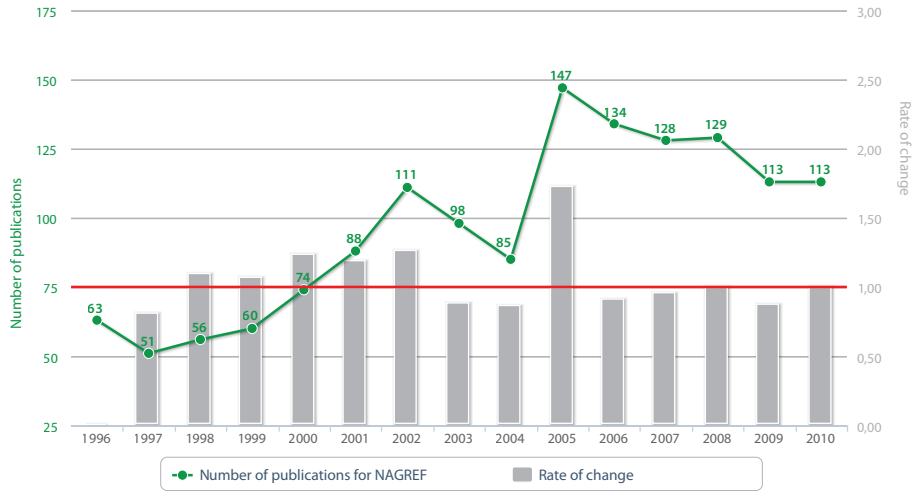

Figure 7.1.2 Number of publications and rate of change in the number of publications by "National Agricultural Research Foundation", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

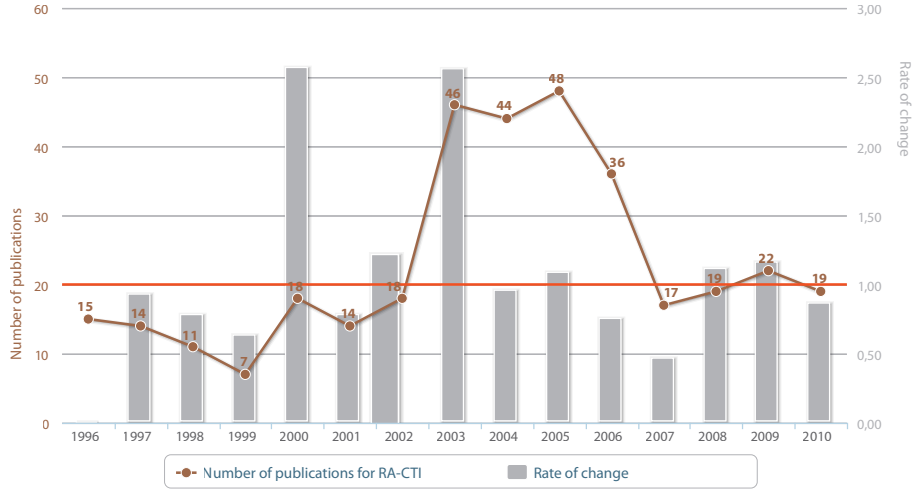

Figure 7.1.2 Number of publications and rate of change in the number of publications by "Research Academic ", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

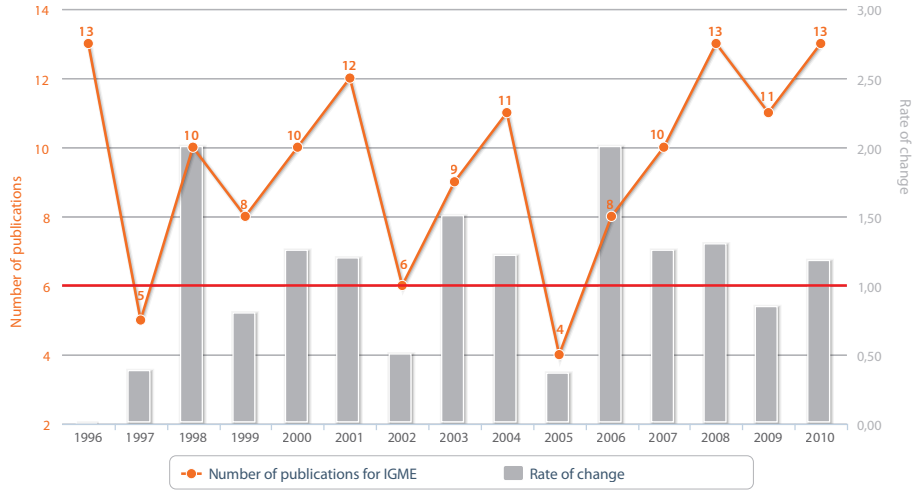

Figure 7.1.2 Number of publications and rate of change in the number of publications by "Institute of Geology and Mineral Exploration", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

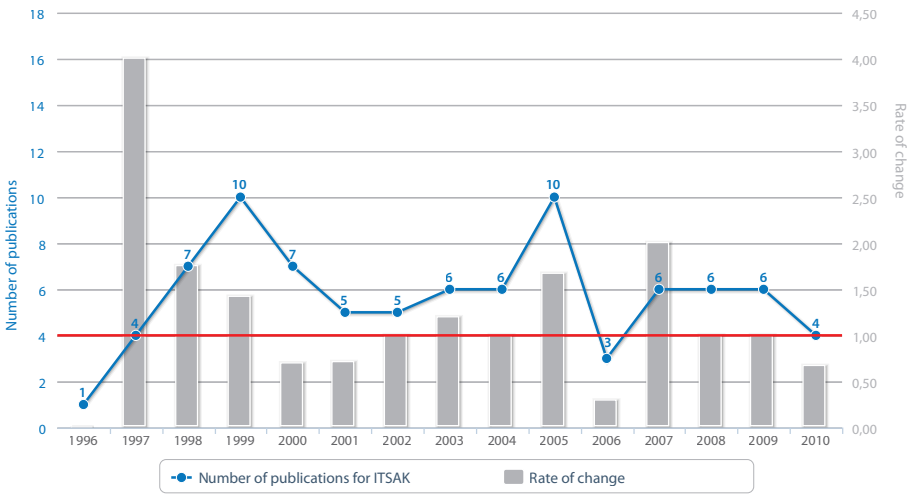

Figure 7.1.2 Number of publications and rate of change in the number of publications by "Institute of Engineering Seismology and Earthquake Engineering", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

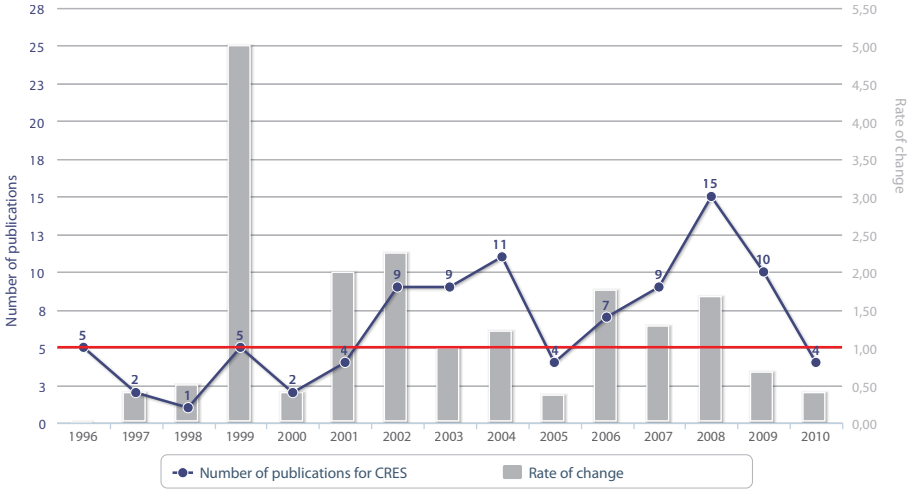

Figure 7.1.2 ANumber of publications and rate of change in the number of publications by "Center for Renewable Energy Sources and Saving", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

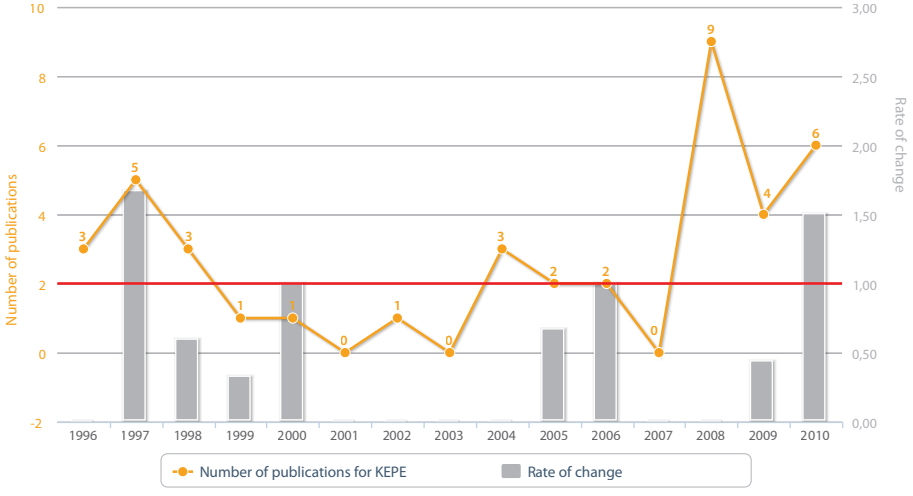

Figure 7.1.2 Number of publications and rate of change in the number of publications by "Center of Planning and Economic Research", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

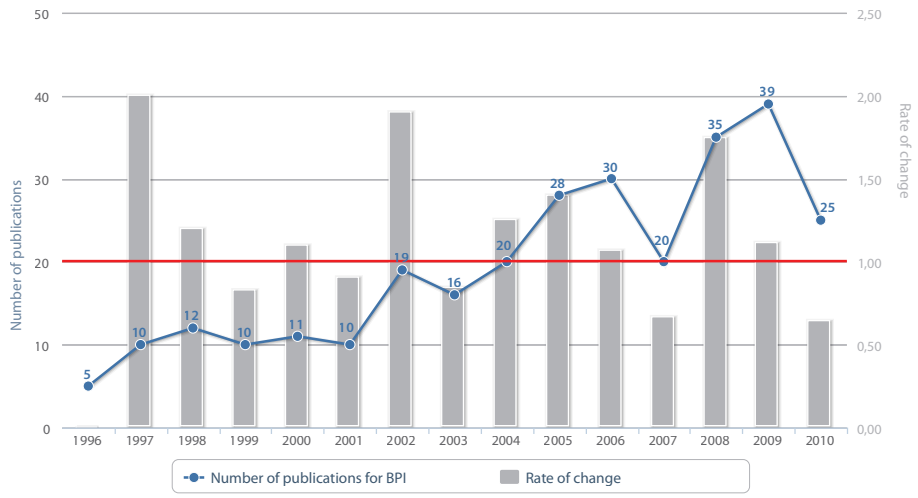

Figure 7.1.2 Number of publications and rate of change in the number of publications by "Benaki Phytopathological Institute", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 7.1.3 shows the publication output of each Public Research Center. For the most recent 5-year period 2006-2010: the National Agricultural Research Foundation/NAGREF produced 617 publications, the Academy of Athens/ ACADEMY OF ATHENS had 608, the Benaki Phytopathological Institute/BPI produced 149, the Research Academic Computer Technology Institute/RA-CTI had 113, the Institute of Geology and Mineral Exploration/IGME had 55, the Center for Renewable Energy Sources and Saving/CRES produced 45, the Institute of Engineering Seismology and Earthquake Engineering/ITSAK had 25, and the Center of Planning and Economic Research/KEPE had 21.

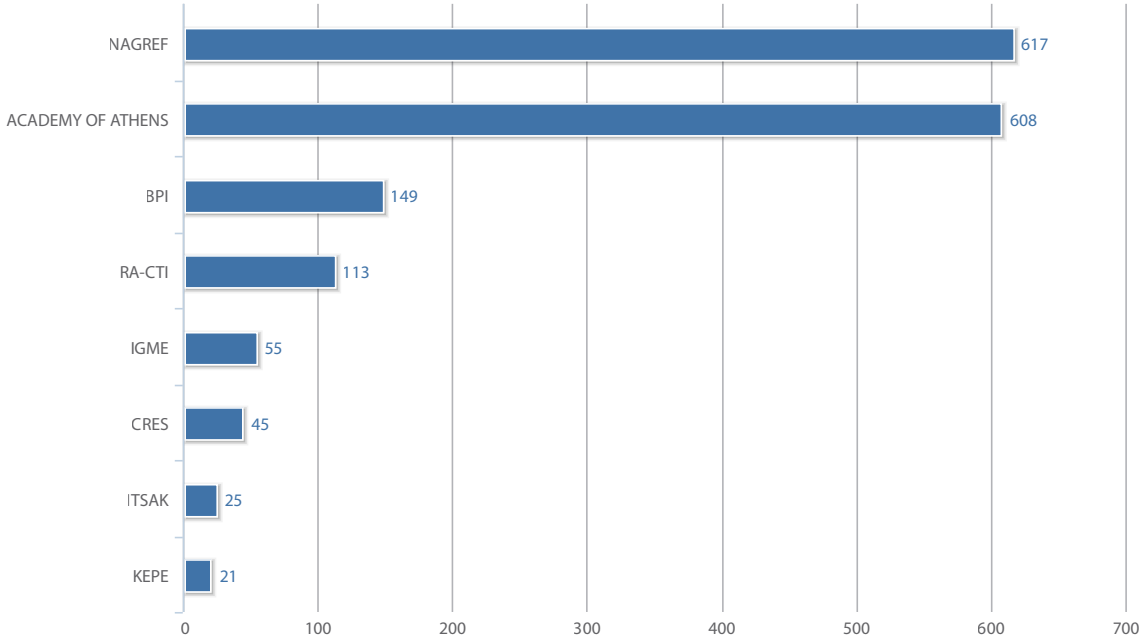

Figure 7.1.3 Number of publications by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Regarding the rate at which the number of publications changed from 2006 to 2010, we observe growth (rate of change >1) for 4 Public Research Institutions (KEPE, ACADEMY OF ATHENS, IGME and ITSAK).

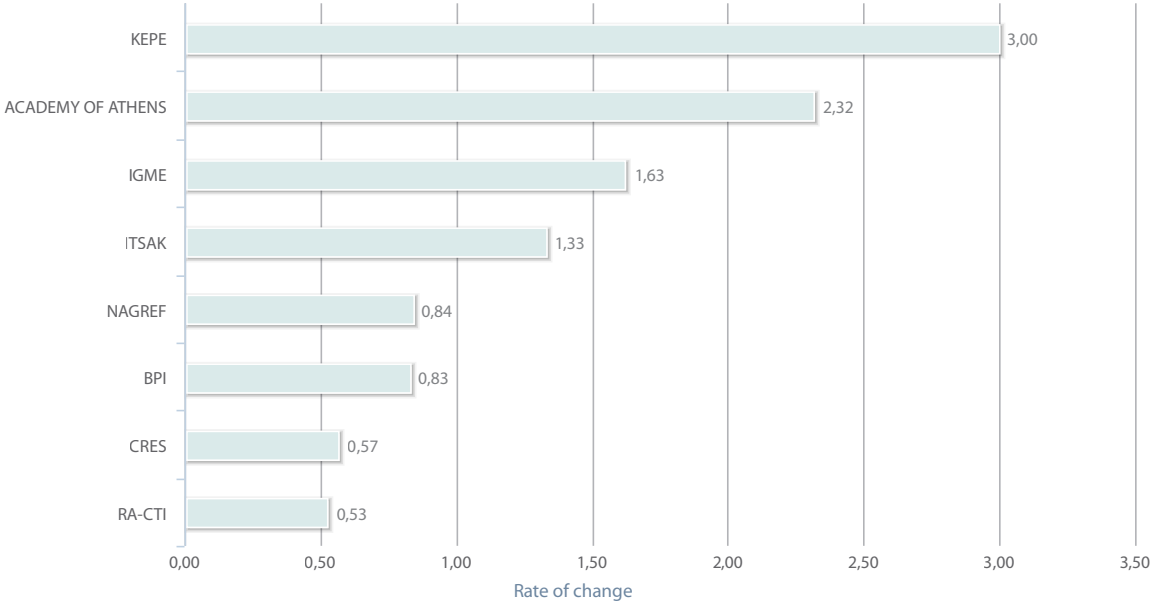

Figure 7.1.4 Change in the number of publications between 2006 and 2010, by Public Research Institution / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in year "2010" – number of publications in year "2006")/ number of publications in year "2006"]. The rate is 1, if the number of publications is the same across the years compared.

7.2 Citations

Figure 7.2.2 displays the number of citations received by publications produced by "Public Research Institutions". It also presents growth rates during the period 1996-2010. Overall, there was an increase in the number of citations.

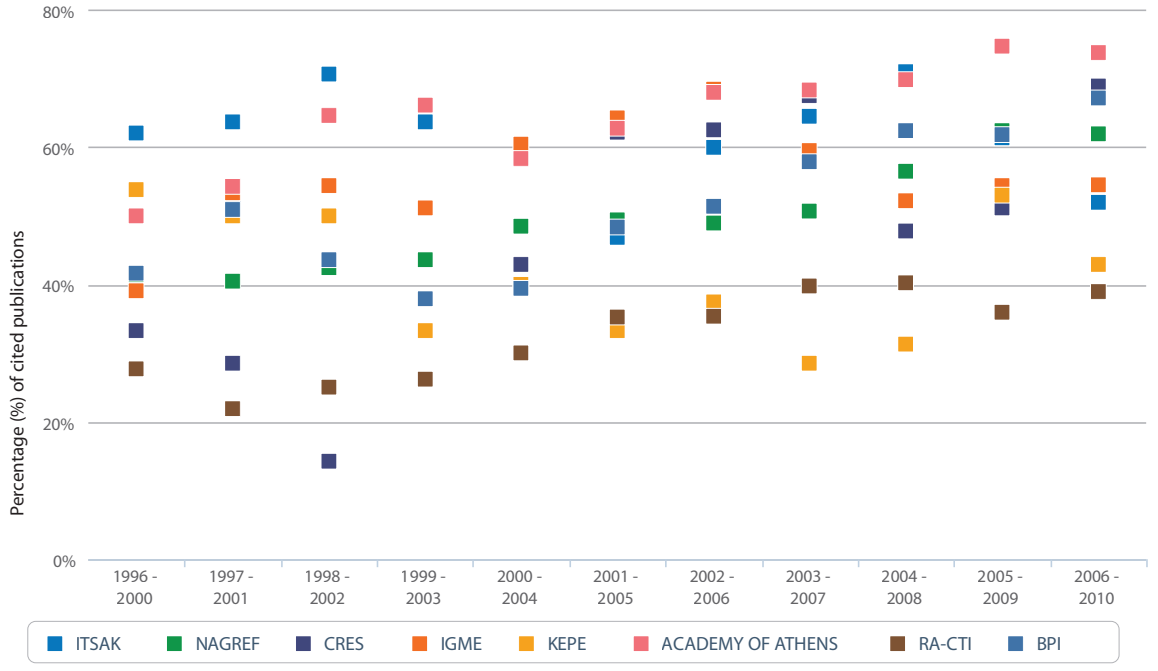

Figure 7.2.1 Percentage (%) of cited publications by Public Research Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 7.2.2 displays the number of citations received by publications produced per "Public Research Institutions". It also presents growth rates during the period 1996-2010. Overall, there was an increase in the number of citations.

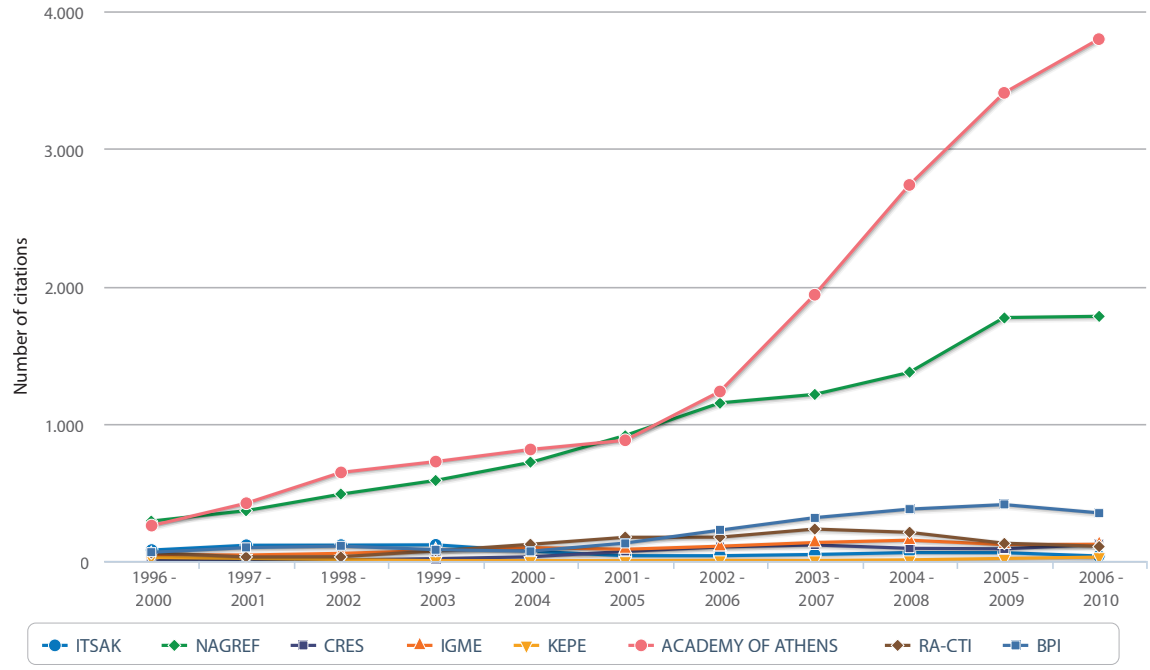

Figure 7.2.2 Number of citations by Public Research Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

The number of citations for publications of each Public Research Institution (during 2006-2010), is also illustrated in Figure 7.2.3. The publications produced by the ACADEMY OF ATHENS received 3,797 citations. NAGREF follows with 1,780 citations, BPI with 350, IGME with 121, CRES with 120, RA-CTI with 107, ITSAK with 36 and KEPE with 28 citations.

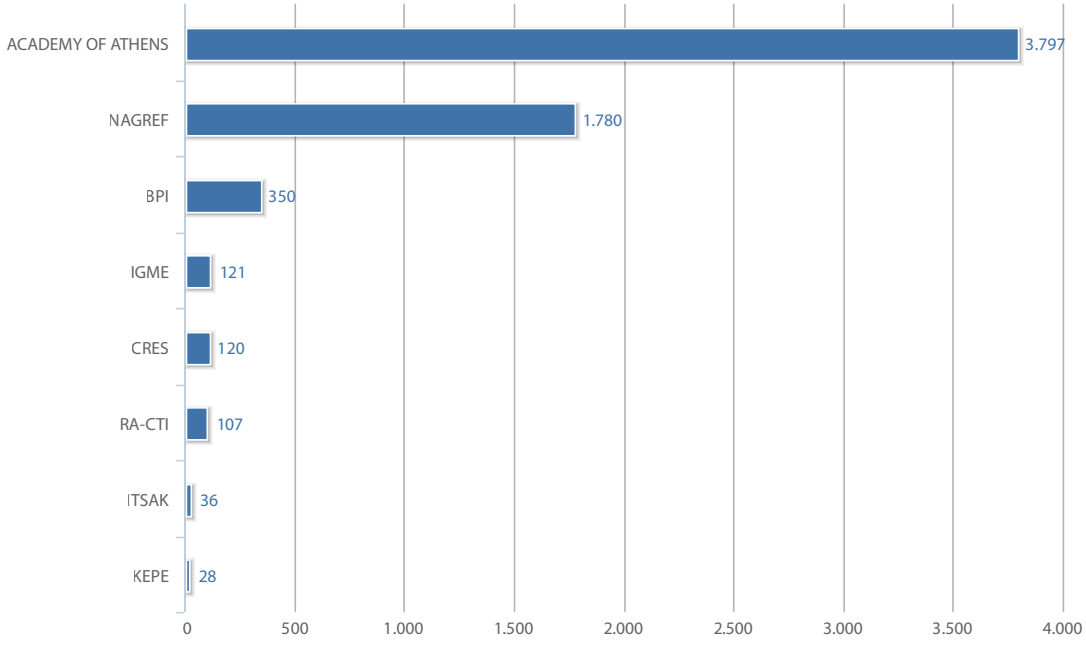

Figure 7.2.3 Number of citations by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

7.3 Citation impact

Figure 7.3.1 presents the number of publications and citations as well as the field normalised citation score for each Public Research Institution* n relation to the world average. Data refers to the latest 5-year period 2006-2010. The field normalised citation score, or "citation score", is the relative number of citations to publications of an institution compared to the world average of citations to publications of the same time period and scientific subject field. The normalisation was done at the level of each publication according to the 253 NSI scientific subject fields. In the case that a publication was attributed to more than one scientific field, a mean value of the fields was calculated. The citation score was calculated using software developed by EKT. A value greater than 1, indicated that the impact of publications was higher than the world average.

The values of the field-normalised citation score were above the world average in the case of the ACADEMY OF ATHENS (1.08) and CRES (1.03) –although the latter had a small number of publications–.

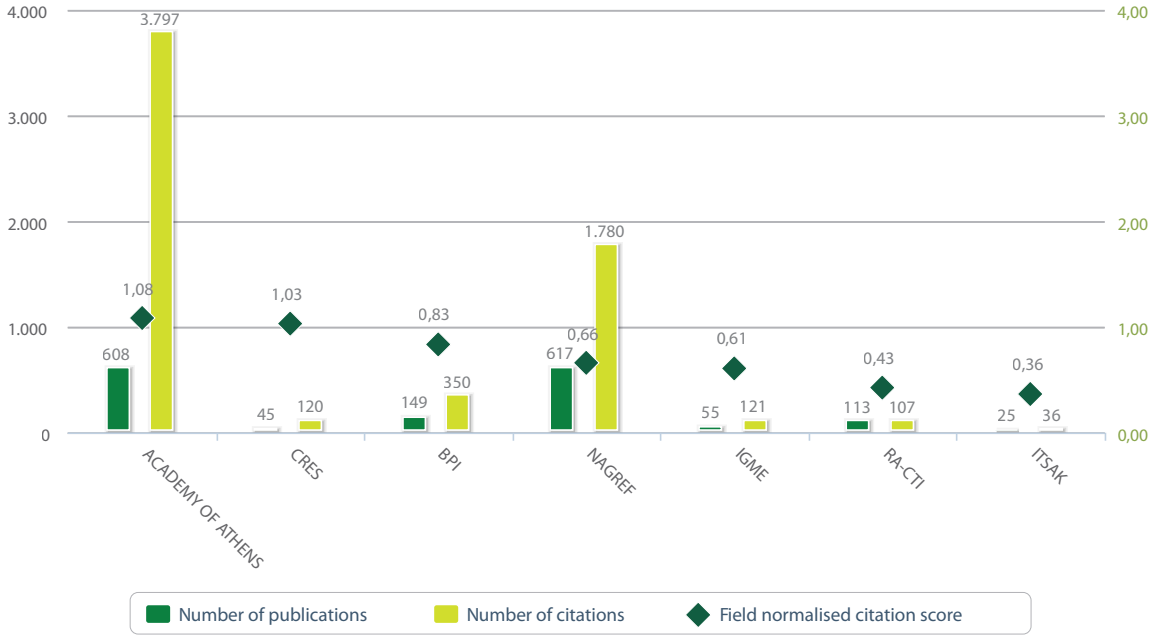

Figure 7.3.1 Publications, citations and field normalised citation score relative to the world, by Public Research Institution, 2006-2010. Data refers to the total number of publications in each Public Research Institution for all scientific fields. / Source: Thomson Reuters, Incites 1996-2010

7.4 Highly cited publications

Figure 7.4.1 shows for each Public Research Institution, the number of highly cited publications for the period 2006-2010, for percentile levels 1%, 5%, 10%, 25% and 50%, i.e. the publications that belong respectively to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.

Publications among the 1% most highly cited publications worldwide were produced by the ACADEMY OF ATHENS (5), NAGREF (4), BPI (1) and KEPE (1).

In addition, Figure 7.4.1 displays the percentage of the highly cited publications in each institution for percentile levels 1%, 5%, 10%, 25% and 50%. Data refers to the last 5-year period 2006-2010. Values above the percentile levels indicated that the specific institution had the majority of its publications among the top 1%, 5%, 10%, 25% and 50%. Institutions surpassing the world baseline were the Academy of Athens for percentile levels 1%, 5%, 10%, 25% and 50% and CRES for 5% and 10%.

* The field-normalised citation score was calculated only for Public Research Institutions which had more than 75 publications for the period 1996-2010, –more than 5 publications per year–.

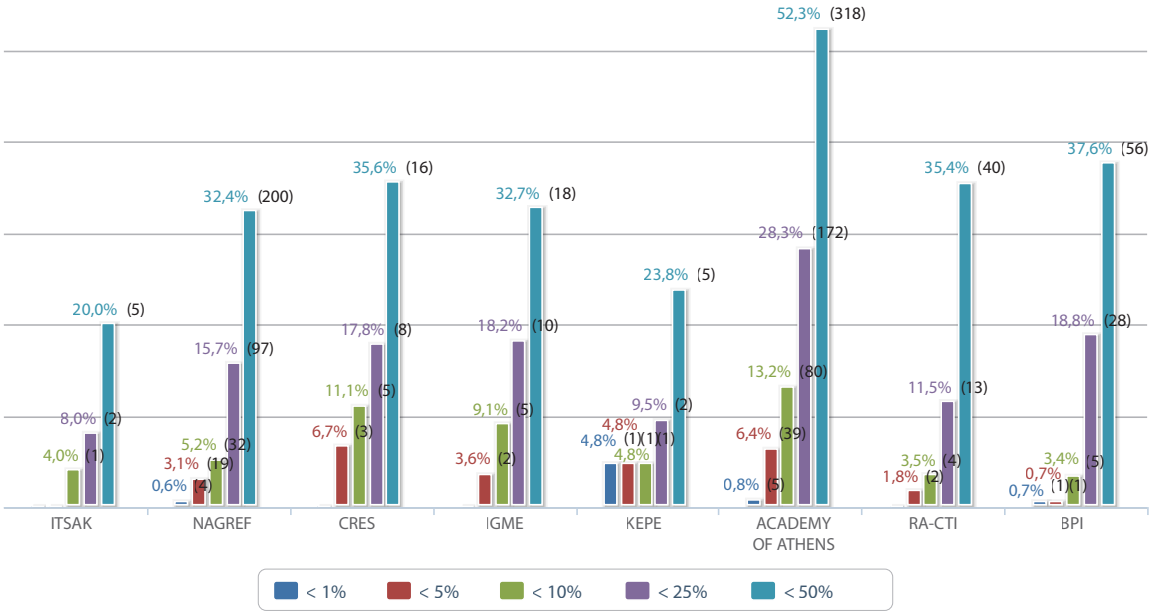

Figure 7.4.1 Number and percentile breakdown (%) of highly cited publications by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: top 1%, 5%, 10%, 25% and 50% most cited publications in world production.

7.5 Major fields of science

Figure 7.5.1 describes the impact of publications by "Public Research Institutions" in the major scientific fields with the highest publication activity*, during 2006-2010 ("Natural Sciences", "Engineering and Technology", "Medical and Health Sciences" and "Agricultural Sciences"). The Figure displays the number of publications and citations and the field normalised citation score for each major field, thus giving information about the overall performance of each Research Institution in each major field. The citation scores were calculated after normalisation at the level of each publication. Figure 7.5.2 provides a more detailed picture of the Institutions' performance.

In the area of "Natural Sciences", the ACADEMY OF ATHENS, BPI, NAGREF, IGME and RA-CTI accounted for the highest number of publications. The citation score for the ACADEMY OF ATHENS was above the world average (1.07), while NAGREF's citation score approached the world average (0.91).

Four Public Research Institutions were active in the scientific field "Engineering & Technology": CRES, NAGREF, ACADEMY OF ATHENS and RA-CTI. A small number of publications coming from CRES achieved a citation score of 1.03, –slightly above the world average–.

The majority of publications in the scientific field "Medical & Health Sciences" came from the ACADEMY OF ATHENS and NAGREF. ACADEMY OF ATHENS exceeded the world baseline average of citation score (1.17) NAGREF had the majority of its publications under the scientific field "Agricultural Sciences".

* The field-normalised citation score was calculated only for Public Research Institutions with more than 75 publications for the period 1996-2010.

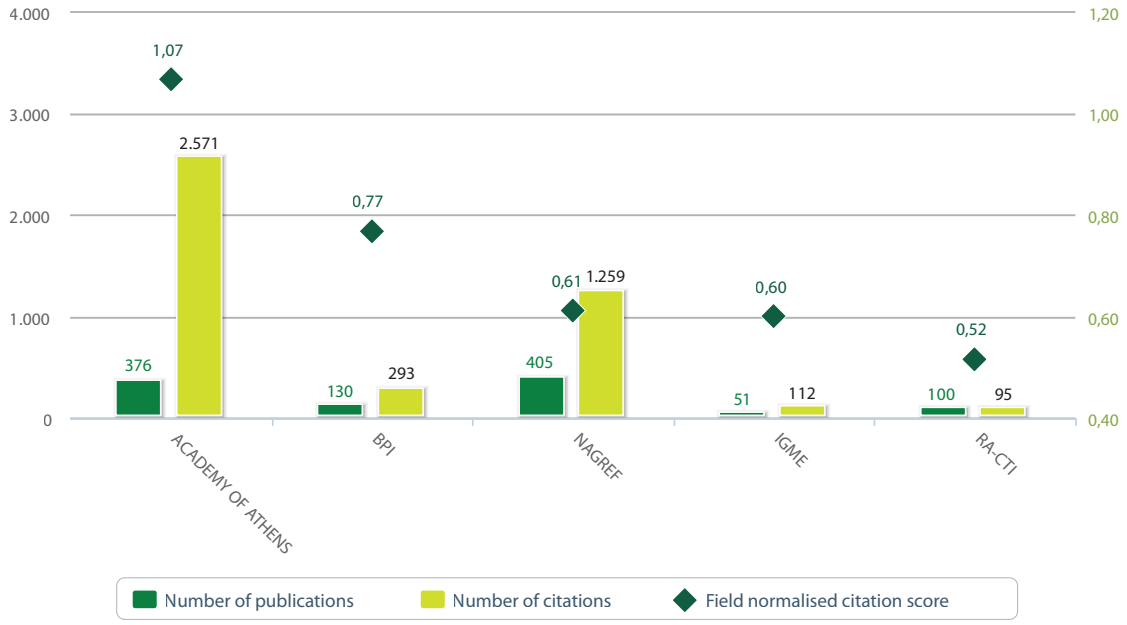

Figure 7.5.1 Major field of science "Natural Sciences". Publications, citations and field normalised citation score relative to the world, by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

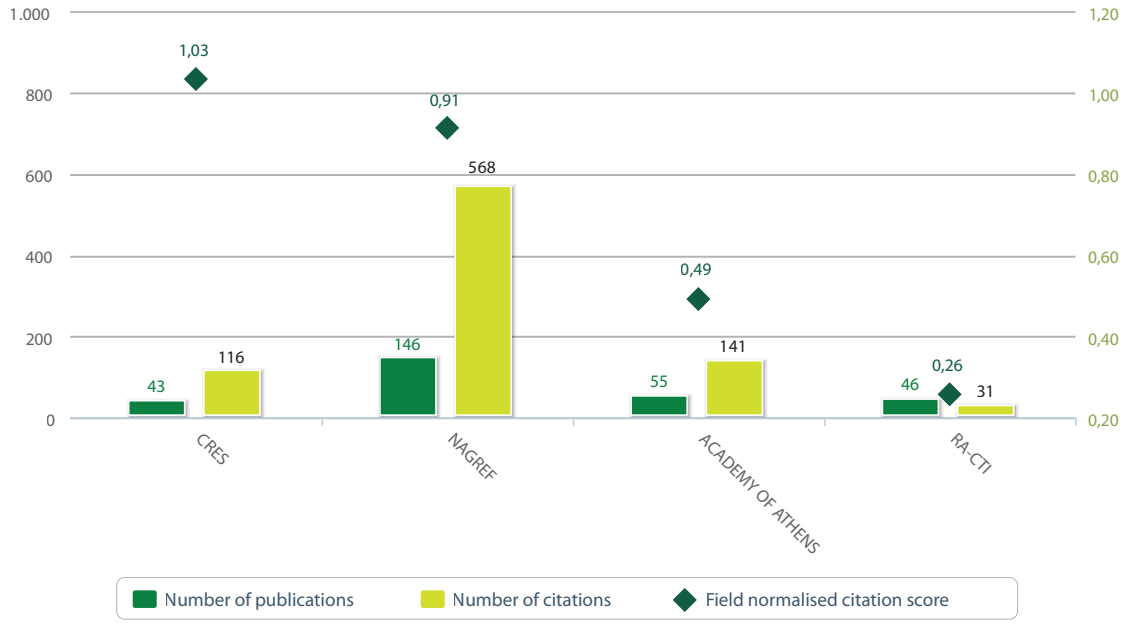

Figure 7.5.1 Major field of science "Engineering & Technology". Publications, citations and field normalised citation score relative to the world, by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

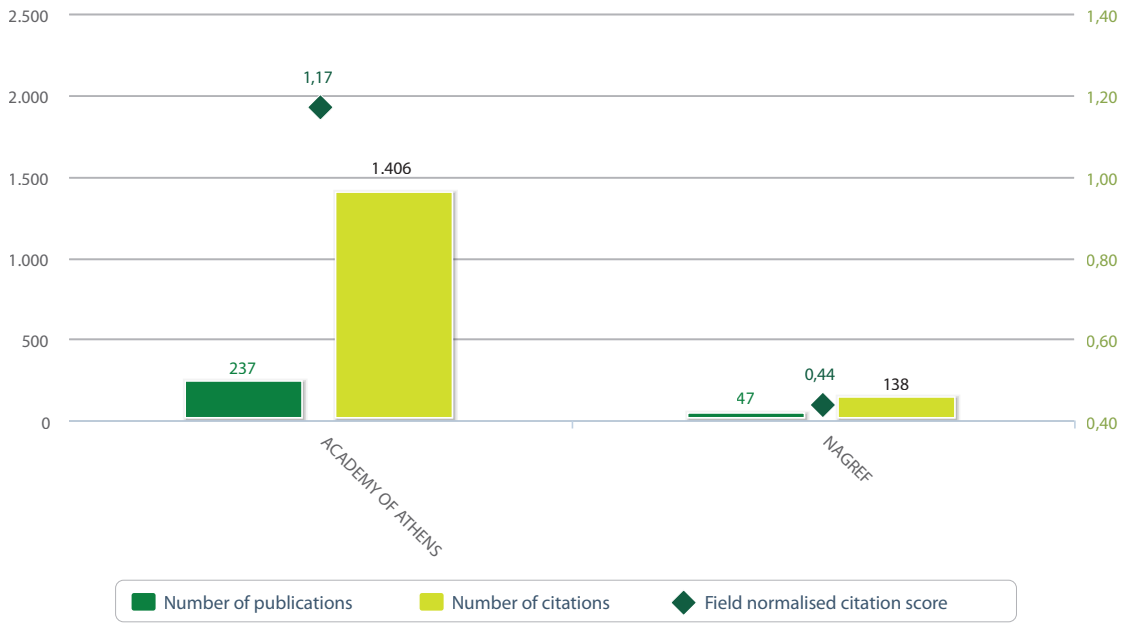

Figure 7.5.1 Major field of science "Medical & Health Sciences". Publications, citations and field normalised citation score relative to the world, by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 7.5.1 Major field of science "Agricultural Sciences". Publications, citations and field normalised citation score relative to the world, by Public Research Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

NATURAL SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Research Centers**	**Field-normalised citation score**	**Number of publications**
biological sciences	genetics & heredity	ACADEMY OF ATHENS	2,17	23
earth and related environmental sciences	optics	ACADEMY OF ATHENS	1,78	9
physical sciences	chemistry, multidisciplinary	ACADEMY OF ATHENS	1,61	31
biological sciences	chemistry, multidisciplinary	NAGREF	1,49	24

ENGINEERING AND TECHNOLOGY				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Research Centers**	**Field-normalised citation score**	**Number of publications**
chemical engineering	engineering, chemical	NAGREF	1,57	16

MEDICAL AND HEALTH SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Research Centers**	**Field-normalised citation score**	**Number of publications**
basic medicine	neurosciences	ACADEMY OF ATHENS	1,69	20
clinical medicine	hematology	ACADEMY OF ATHENS	1,63	28
clinical medicine	endocrinology & metabolism	ACADEMY OF ATHENS	1,58	20
clinical medicine	surgery	ACADEMY OF ATHENS	1,50	10

Figure 7.5.2 Scientific subfields of "Public Research Institutions" publications with field normalised citation score ≥ 1, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

7.6 Scientific collaboration

Figures 7.6.1 and 7.6.2. present the number of publications produced as a result of national and international collaboration for each Public Research Institution, as well as their trends over time.

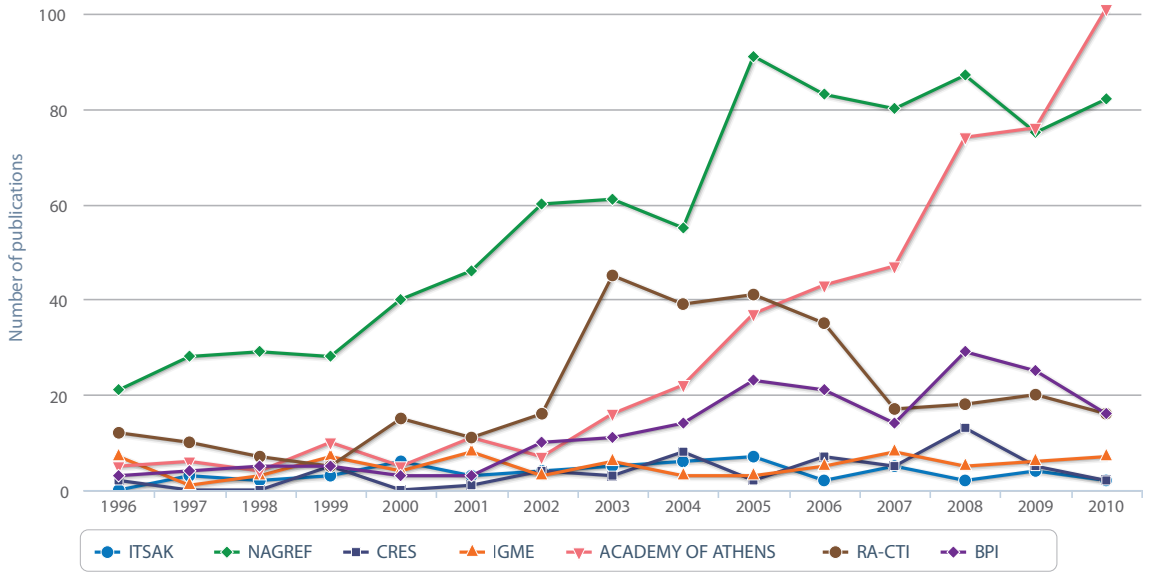

Figure 7.6.1 Number of publications with national collaboration, by Public Research Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

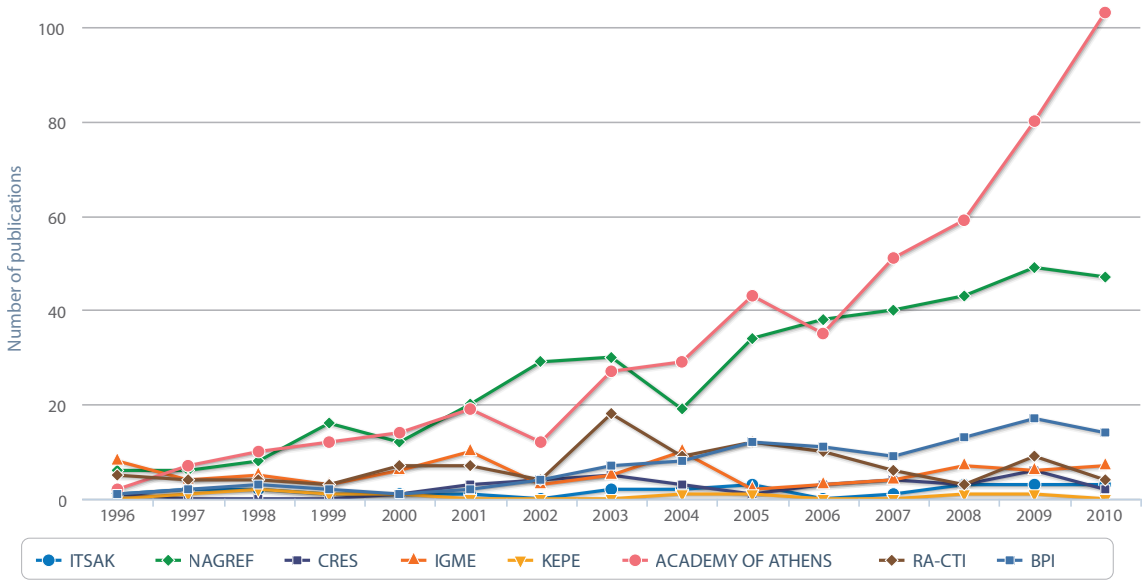

Figure 7.6.2 Number of publications with international collaboration, by Public Research Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 7.6.3 highlights the distribution (%) of publications produced as a result of national*, international** and no collaboration*** for each of the 8 Public Research Institutions over the period 2006-2010.

There were only a few publications produced without partnerships. Publications produced with national collaboration outpaced those produced as a result of international collaboration for all Research Institutions.

ITSAK and NAGREF had the highest percentage of publications produced without collaboration -reaching 16%, a value which is lower than the Greek average of 32.8%-.

The share of publications with national collaboration exceeded 50% for all Institutions; among them, RA-CTI had the highest share (93.8%).

The share of publications with international collaboration was lower, ranging from 23.8% (RA-CTI) to 53.9% (ACADEMY OF ATHENS).

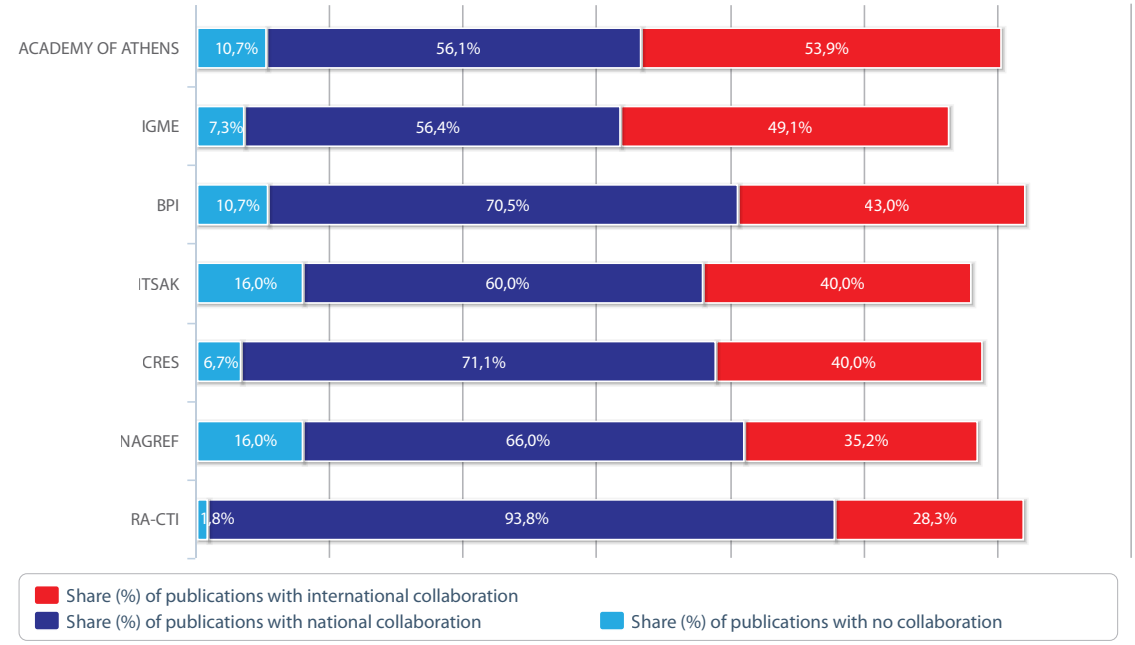

Figure 7.6.3 Share (%) of publications with national, international and no collaboration, by Public Research Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration
** Number of publications with at least one international collaboration
*** Number of publications by a single Greek institution

"Public Health Institutions" were the third most productive institution category in terms of publication output. Public Hospitals dominated the category. This chapter provides analytical data and bibliometric indicators for 16 hospitals, each having more than 150 publications over the period 2006-2010. The chapter also presents summary data regarding the number of publications and citations for 20 additional institutions. The category "Public Health Institutions" includes the hospitals supervised by the Ministry of National Defence (MOD hospitals) -counted as one institution-.

The table below presents the number of publications and citations of 16 Public Health Institutions for the latest period (2006-2010) of this study. It also shows their growth rate compared to the 5-year period 2004-2008 (data emerges from the study's preceding edition which EKT published in 2010).

CHAPTER 8

SCIENTIFIC PUBLICATIONS BY PUBLIC HEALTH INSTITUTIONS

		2004-2008		2006-2010	
		Number of publications	Number of citations	Number of publications	Number of citations
THEAGENIO Cancer Hospital of Thessaloniki	THEAGENIO	166	972	196	971
"Agios Savvas" Regional Hospital for Cancer Treatment	AGIOS SAVVAS	244	1.225	226	1.053
Metaxa Cancer hospital of Piraeus	METAXA	170	1.655	172	604
G. Gennimatas General Hospital of Athens	G. GENNIMATAS	229	1.087	274	1.182
Evaggelismos Hospital Athens	EVAGGELISMOS	444	1.681	497	2.263
IPPOKRATEIO General Hospital of Athens	IPPOKRATEIO ATHENS	322	1.496	333	2.131
KORGIALENIO-BENAKIO Hospital of Athens	KORGIALENIO	157	643	187	754
General Hospital of Athens LAIKO	LAIKO	281	1.188	258	1.029
G. Papanikolaou General Hospital of Thessaloniki	G. PAPANIKOLAOU	140	1.044	181	1.235
IPPOKRATEIO General Hospital of Thessaloniki	IPPOKRATEIO THESSALONIKI	261	799	297	1.109
SOTIRIA General Hospital of Athens	SOTIRIA	149	708	196	958
"Aghia Sophia" Children's Hospital	AGHIA SOPHIA	347	1.468	378	1.641
G. PAPAGEORGIOU General Hospital	G. PAPAGEORGIOU	139	884	172	924
Tzaneio General Hospital of Piraeus	TZANEIO	149	427	159	466
Hospitals supervised by Ministry of National Defence	MOD HOSPITALS	338	1.887	372	1.825
Onassis Cardiac Surgery Center	O.C.S.C.	268	1.372	283	1.410

8.1 Publications

Over the period 1996-2010, Evaggelismos Hospital in Athens had the greatest volume of publications consistently across the Category "Public Health Institutions". In terms of publication activity, the relative performance of institutions in this category varied (Figure 8.1.1)- with the exception of Evaggelismos-.

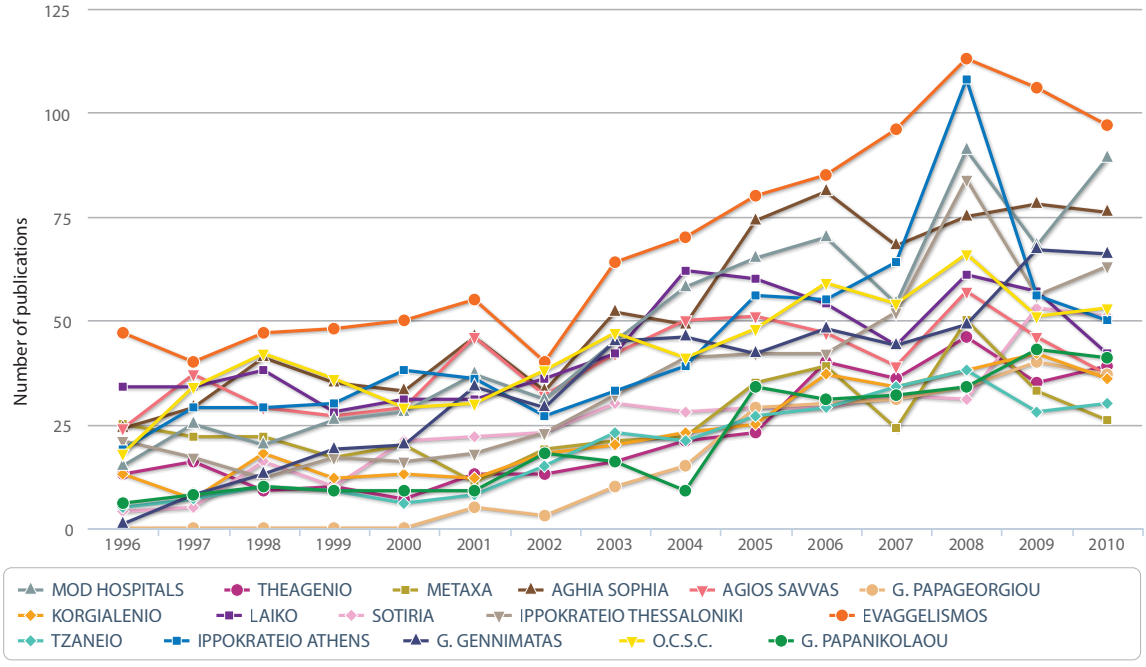

Figure 8.1.1 Development of the number of publications by Public Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 8.1.2 presents the number of publications and its rate of change for each of the 16 Health Institutions from 1996 to 2010.

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1")/ number of publications in year "n-1"]. The rate is 1, if the number of publications is the same across the years compared.

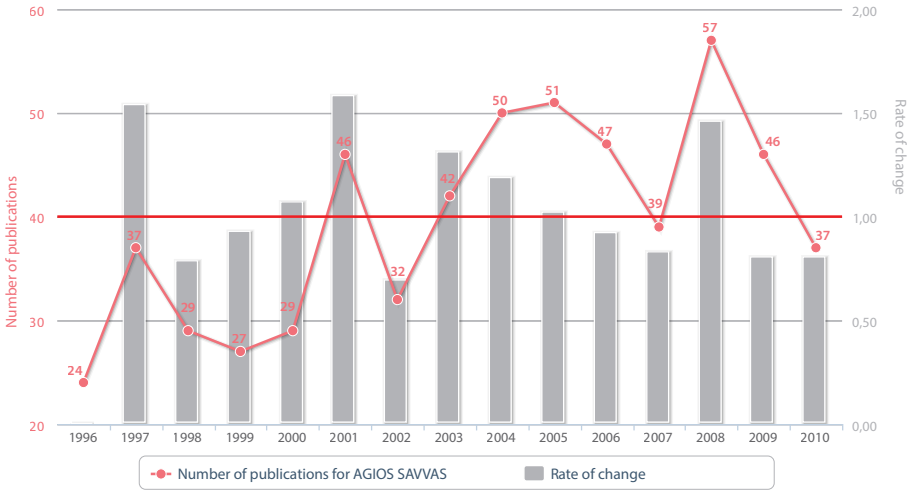

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Agios Savvas" Regional Hospital for Cancer Treatment, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

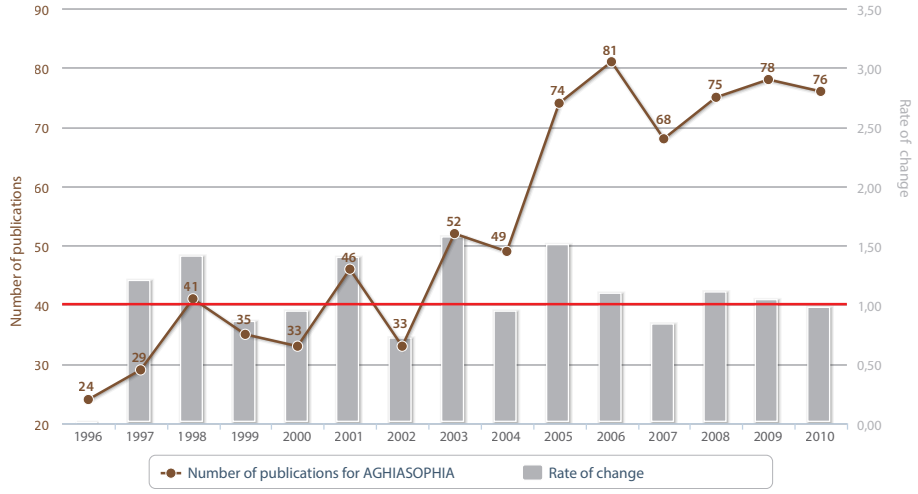

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Aghia Sophia" Children's Hospital, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

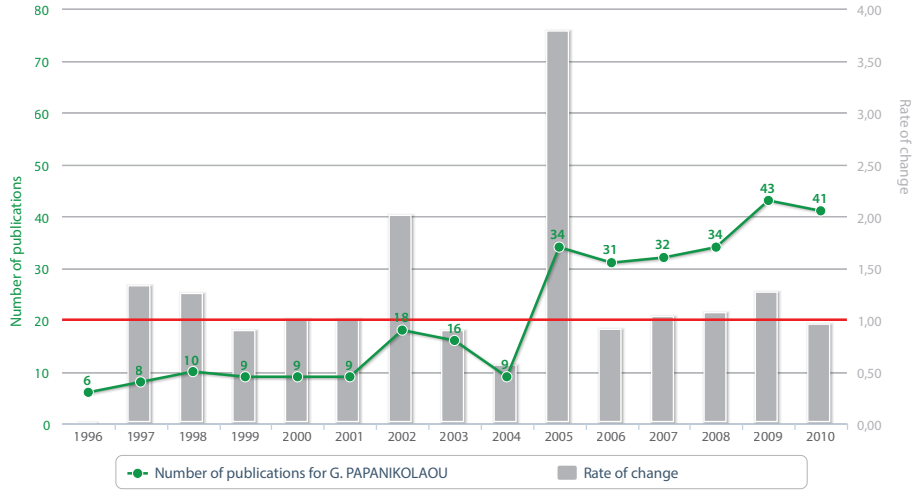

Figure 8.1.2 Number of publications and rate of change in the number of publications by "G. Papanikolaou General Hospital of Thessaloniki", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

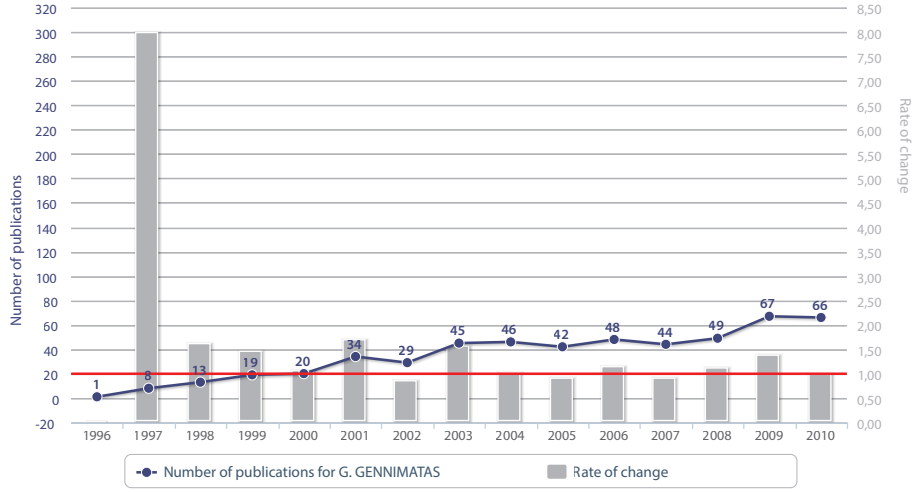

Figure 8.1.2 Number of publications and rate of change in the number of publications by "G. Gennimatas General Hospital of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

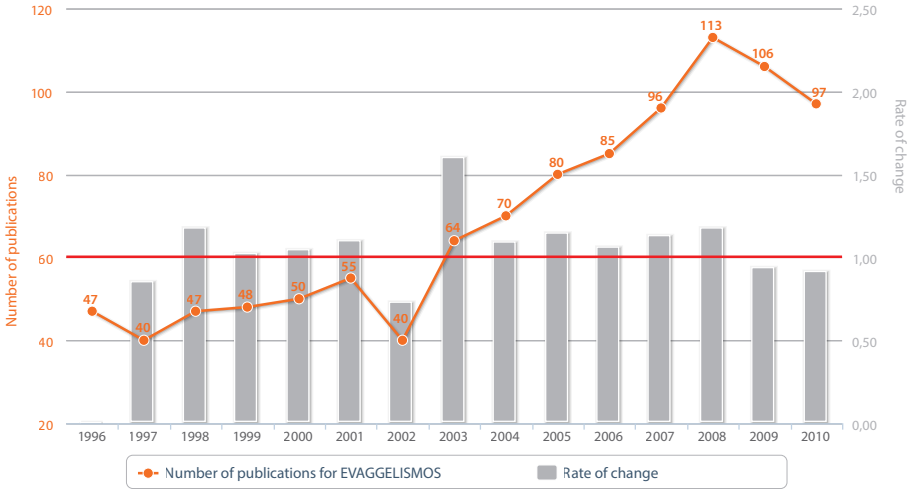

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Evaggelismos Hospital Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

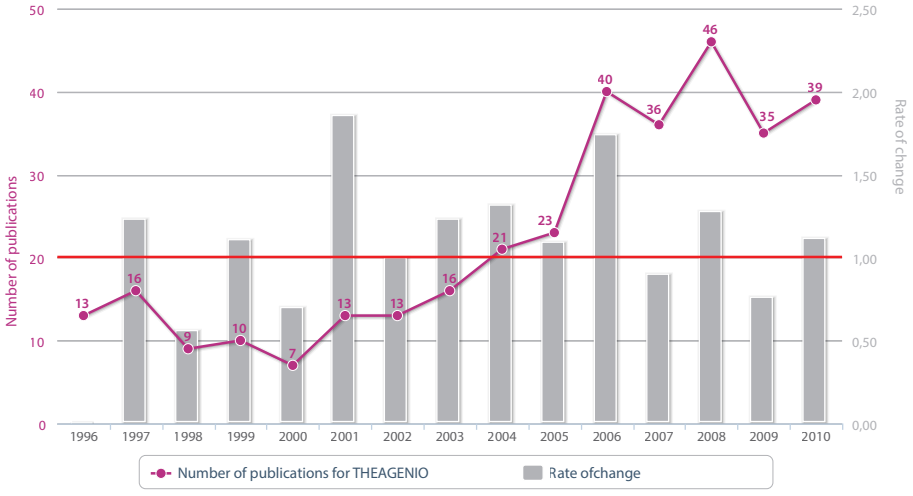

Figure 8.1.2 Number of publications and rate of change in the number of publications by "THEAGENIO Cancer Hospital of Thessaloniki", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

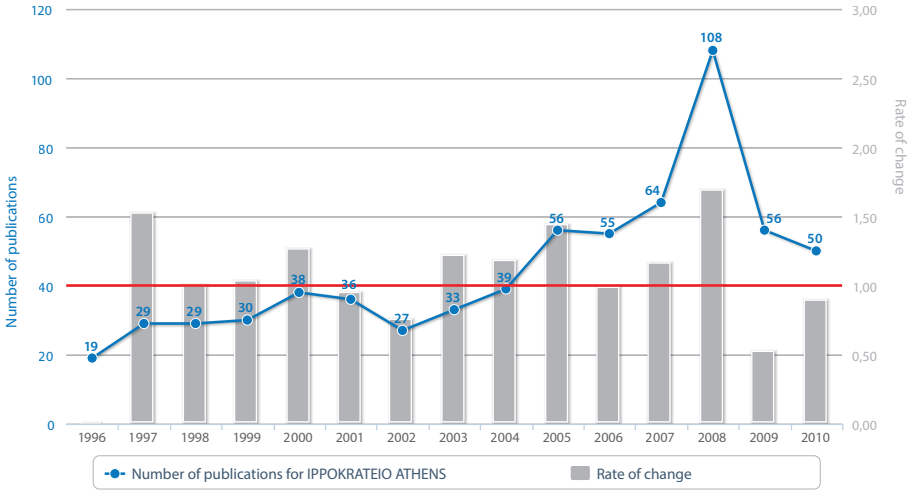

Figure 8.1.2 Number of publications and rate of change in the number of publications by "IPPOKRATEIO General Hospital of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

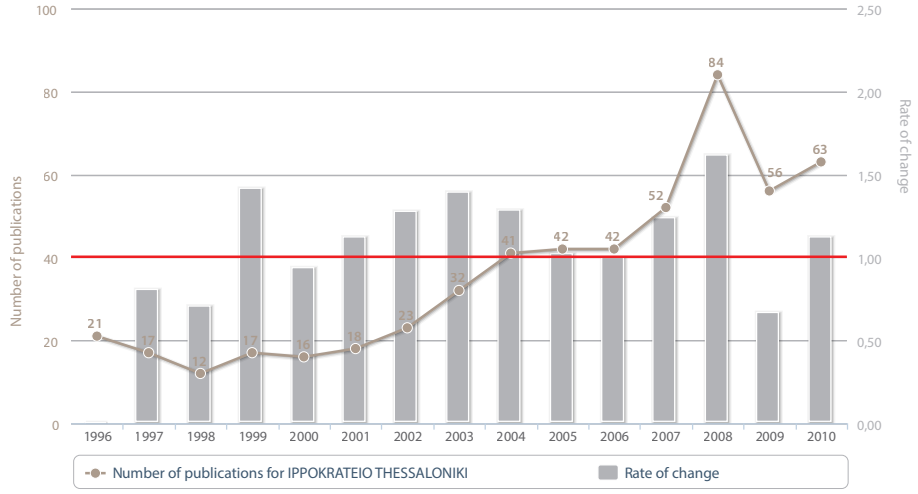

Figure 8.1.2 Number of publications and rate of change in the number of publications by "IPPOKRATEIO General Hospital of Thessaloniki", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

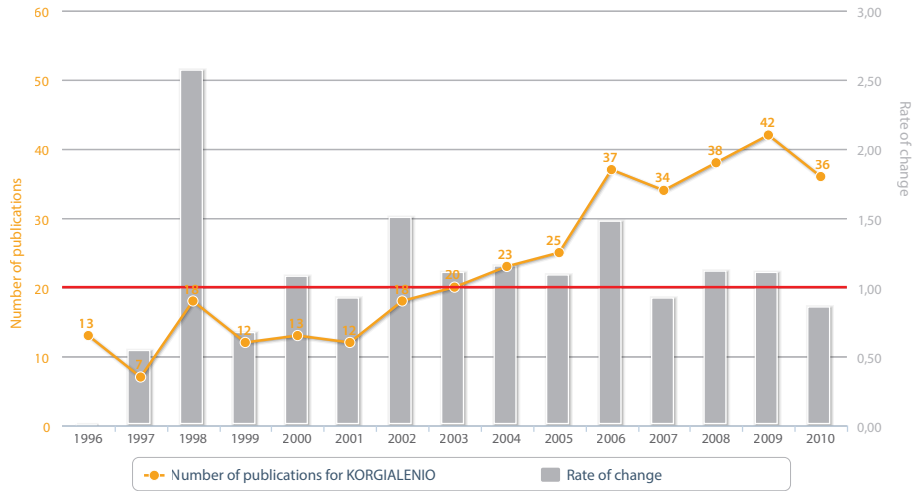

Figure 8.1.2 Number of publications and rate of change in the number of publications by "KORGIALENIO-BENAKIO Hospital of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

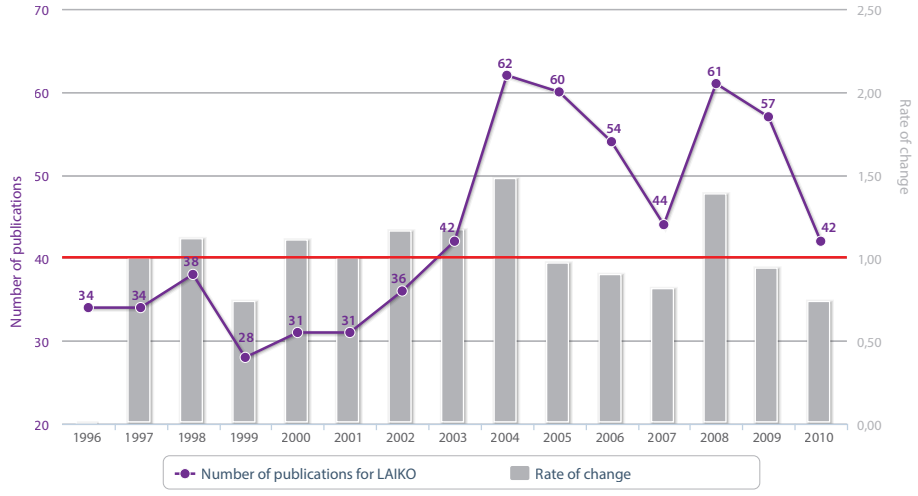

Figure 8.1.2 Number of publications and rate of change in the number of publications by "General Hospital of Athens LAIKO", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

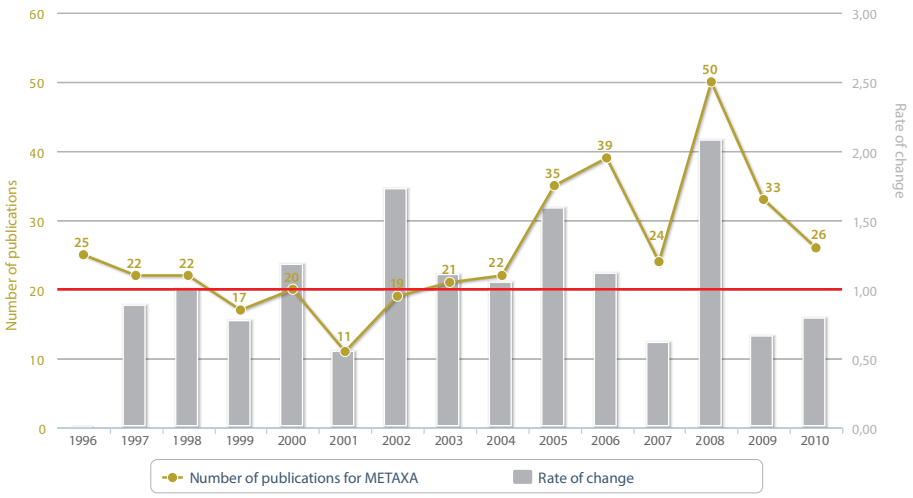

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Metaxa Cancer hospital of Piraeus" , 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

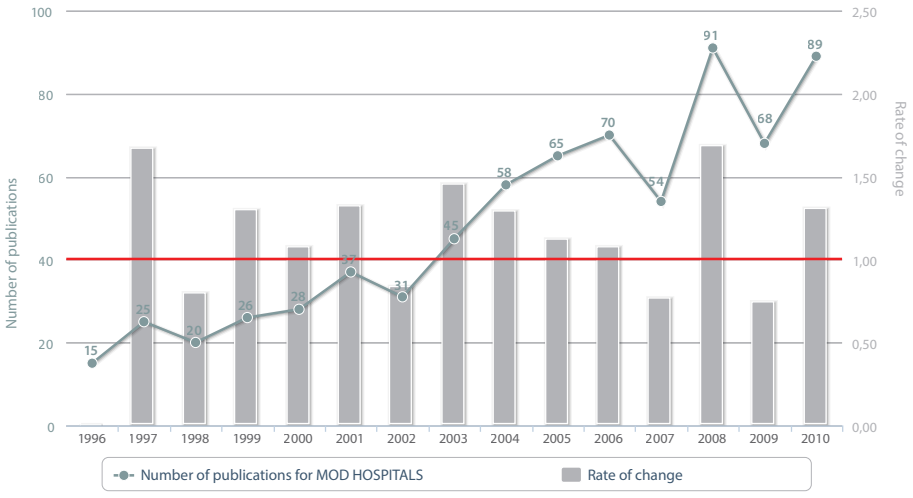

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Hospitals supervised by Ministry of National Defence", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

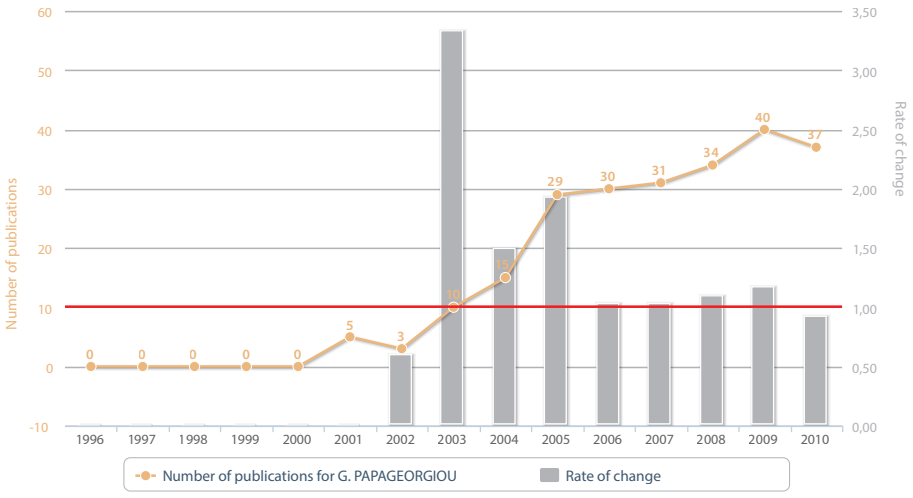

Figure 8.1.2 Number of publications and rate of change in the number of publications by "G. PAPAGEORGIOU General Hospital", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

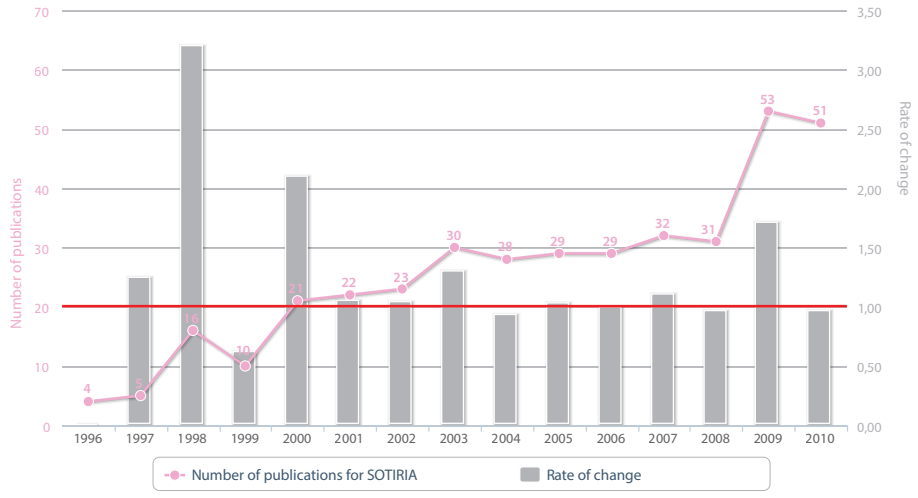

Figure 8.1.2 Number of publications and rate of change in the number of publications by "SOTIRIA General Hospital of Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

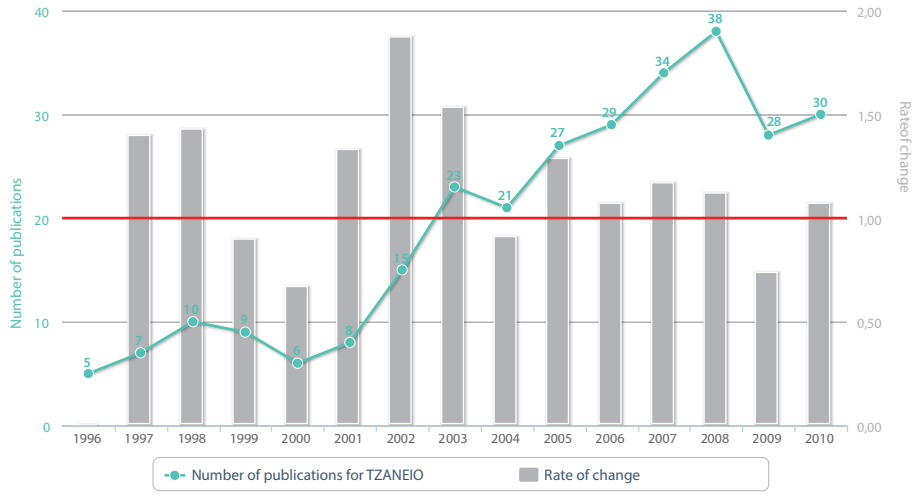

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Tzaneio General Hospital of Piraeus", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

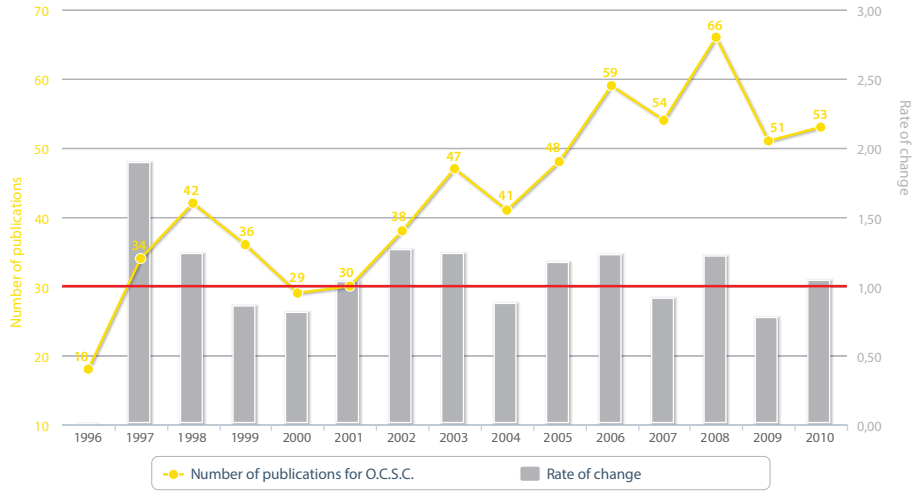

Figure 8.1.2 Number of publications and rate of change in the number of publications by "Onassis Cardiac Surgery Center", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Focusing on the latest 5-year period 2006-2010, Figure 8.1.3 presents the number of publications per each of the 16 Health Institutions, as well as for each institution's share of publications in the category "Public Health Institutions". The "Evaggelismos Hospital of Athens" /EVAGGELISMOS had 497 publications and a share of 8.7%. This was followed by the "Aghia Sophia" Children's Hospital/AGHIA SOPHIA with 378 publications and a share of 6.6%, the "Hospitals supervised by the Ministry of National Defence" /MOD HOSPITALS with 372 publications and a share of 6.5%, the IPPOKRATEIO General Hospital of Athens/ IPPOKRATEIO ATHENS with 333 publications and a share of 5.9%, the IPPOKRATEIO General Hospital of Thessaloniki /IPPOKRATEIO THESSALONIKI with 297 publications and a share of 5.2%, and then the Onassis Cardiac Surgery Center/O.C.S.C. with 283 publications and a share of 5.0%. The share for the rest institutions accounted for less than 5% of publications in the category.

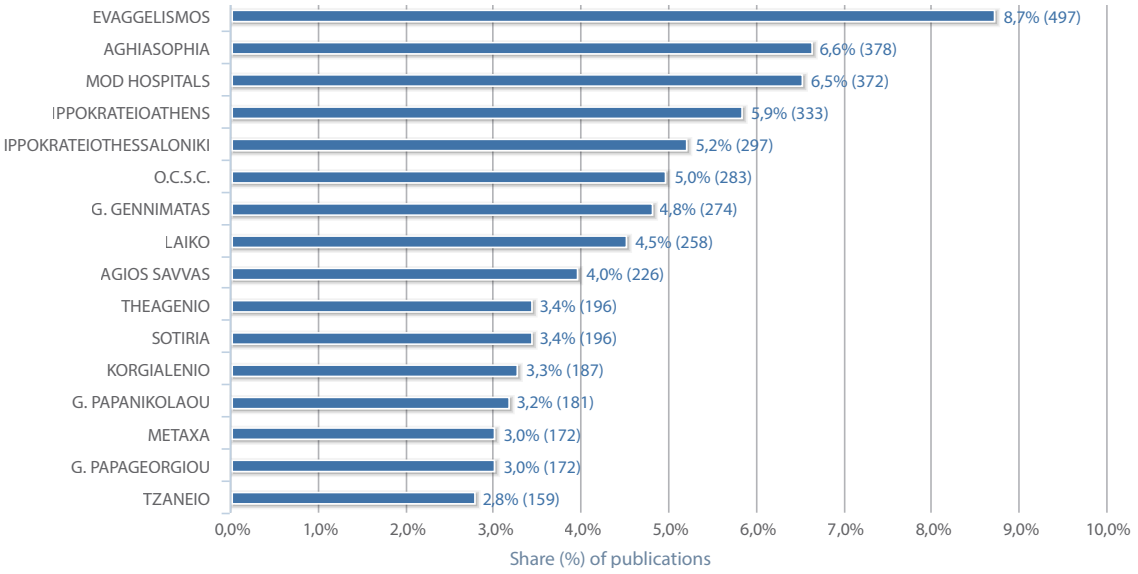

Figure 8.1.3 Number and share (%) of publications, by Public Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 8.1.4 shows that, during the period 2006-2010, the rate of change in publication output in the "Public Health Institutions" Category was higher for the following hospitals: the SOTIRIA General Hospital of Athens/SOTIRIA, the G. Gennimatas General Hospital of Athens/G. GENNIMATAS, the G. Papanikolaou General Hospital of Thessaloniki/G. PAPANIKOLAOU, the Hospitals supervised by Ministry of National Defence/MOD HOSPITALS, the G. PAPAGEORGIOU General Hospital/G. PAPAGEORGIOU and the Evaggelismos Hospital of Athens/EVAGGELISMOS. However, for the majority of institutions, the number of publications was rather low and ranged over time.

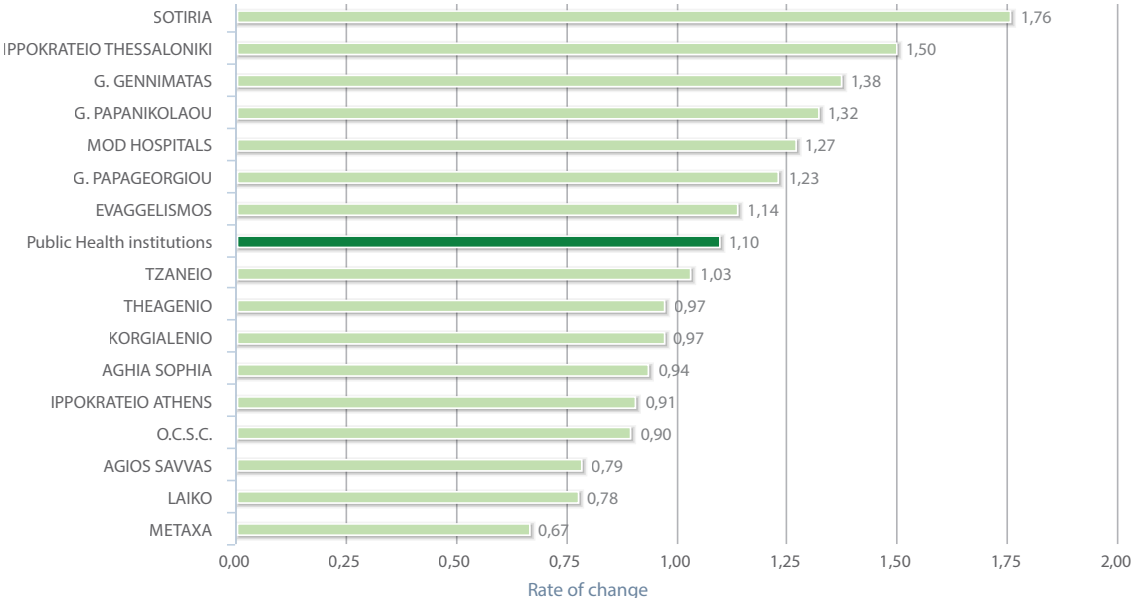

Figure 8.1.4 Change in the number of publications between 2006 and 2010, by Public Health Institution / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in year "2010" – number of publications in year "2006") / number of publications in year "2006"]. The coefficient is 1 –if the number of publications remains the same across the years compared–

The table below summarizes the number of publications and citations for the rest 20 Institutions in the "Public Health Institutions" Category for the period 2006-2010.

Public Health Institutions	Number of publications	Number of citations
General Hospital ALEXANDRA	148	966
Nikaia's General Hospital AG. PANTELEIMON	140	595
Attica's Hospital SISMANOGLIO	137	951
Children's General Hospital A &P KYRIAKOU	126	435
Nea Ionia's General Hospital KONSTANTOPOULEIO	120	616
Accident's Hospital KAT	108	338
Penteli's General Children's Hospital	86	328
VENIZELEIO/ PAPANEIO General Hospital	80	388
AGIOS ANDREAS General Hospital	79	313
Obstetrical General Hospital of Athens ELENA VENIZELOU	69	314
N. Kifissia's General Cancer Hospital "AGIOI ANARGYROI"	64	319
Hellenic Center for Disease Control & Prevention	62	448
National School of Public Health	60	364
Elefsina's General Hospital THRIASIO	55	163
Venereal Diseases Hospital ANDREAS SYGROS	51	364
Voula's General Hospital "Asklipiio"	48	205
General Hospital of Athens "Polykliniki"	41	263
Melission General Hospital AMALIA FLEMING	38	89
Athens General Hospital ELPIS	31	118
Institute of Child Health	30	128
National Center for the Research, Prevention and Treatment of Diabetes Mellitus and its Complications - EKEDI	25	176

8.2 Citations

Throughout the period 1996-2010, the percentage of cited publications for the hospitals listed was rather high– usually above the Greek average–. For the 5-year period 2006-2010, it varied from 61% for the G. PAPAGEORGIOU General Hospital/G. PAPAGEORGIOU to 76% for the IPPOKRATEIO General Hospital of Athens/IPPOKRATEIO ATHENS (Figure 8.2.1).

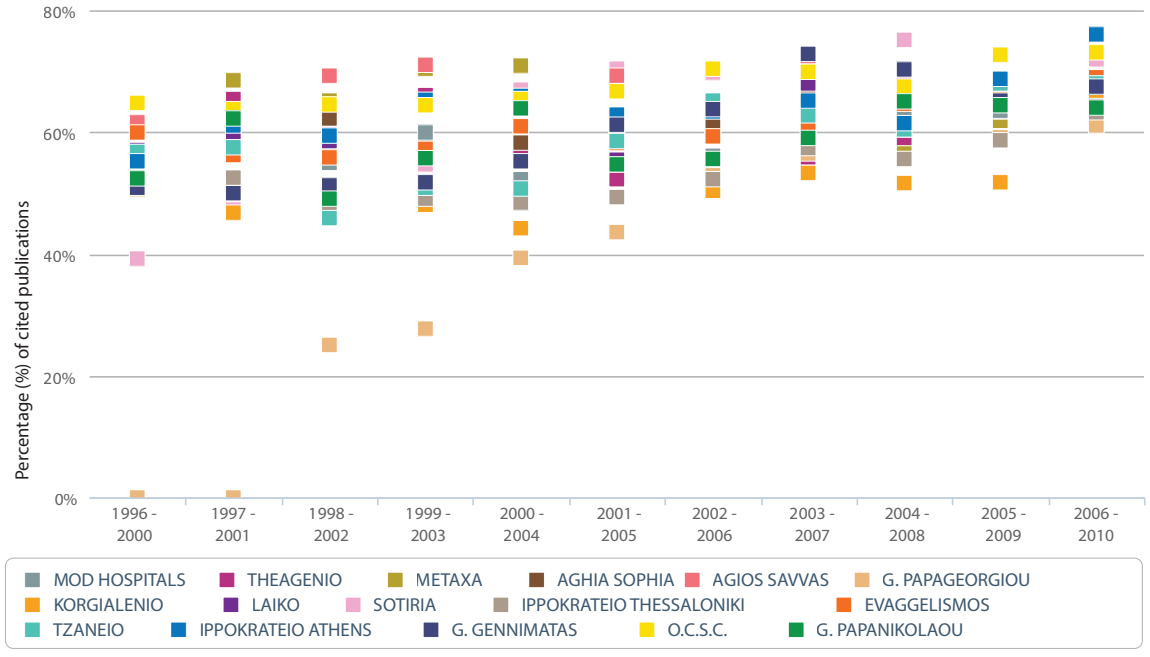

Figure 8.2.1 Percentage (%) of cited publications by Public Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 8.2.2 presents the growth trends in number of citations for the sixteen Public Health Institutions during 1996-2010.

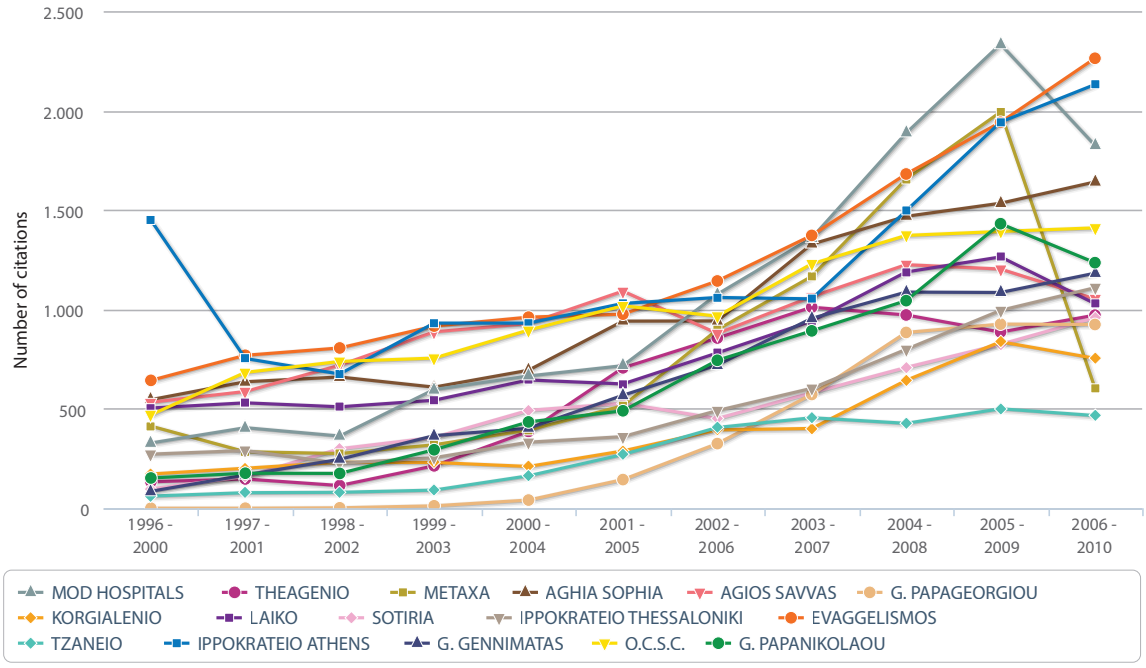

Figure 8.2.2 Number of citations by Public Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

An examination of citation output and the share of citations in the "Public Health Institutions" category for each institution for the period 2006-2010 reveals that the Evaggelismos Hospital of Athens/EVAGGELISMOS (2,263 citations and share of 8.4%) was first. It was followed by the IPPOKRATEIO General Hospital of Athens/ IPPOKRATEIO ATHENS (2,131 citations and share of 7.9%), the Hospitals supervised by Ministry of National Defence/MOD HOSPITALS (1,825 citations and share of 6.8%), the Aghia Sophia Children's Hospital/AGHIA SOPHIA (1,641 citations and share of 6.1%), and the Onassis Cardiac Surgery Center/O.C.S.C. (1,410 citations and share of 5.3%). The share of other institutions accounted for less than 5% of citations in this category (Figure 8.2.3).

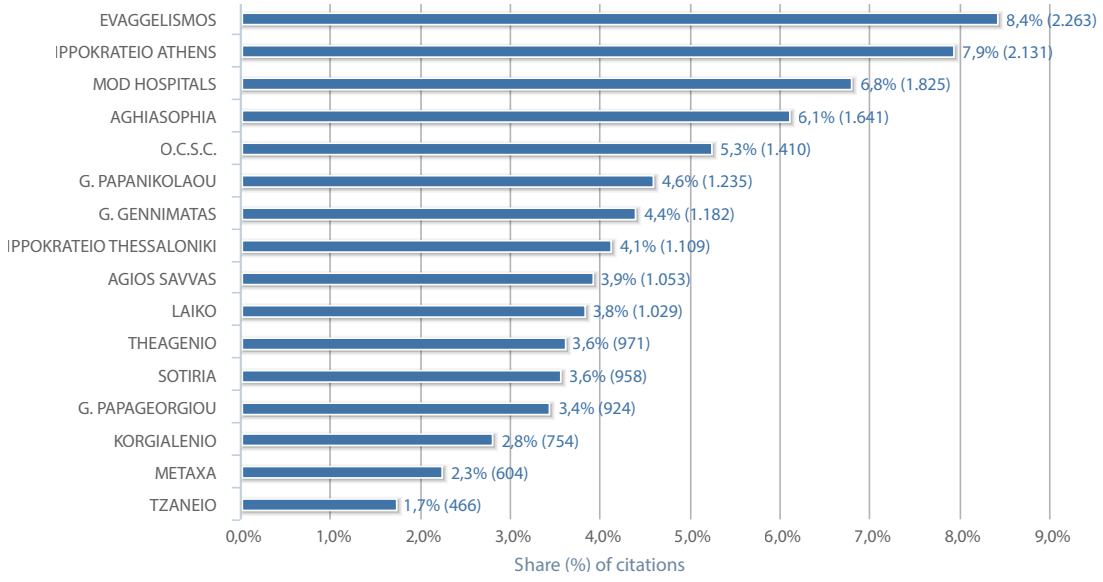

Figure 8.2.3 Number and share (%) of citations by Public Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

8.3 Citation impact

Figure 8.3.1 presents the number of publications and citations and the field normalised citation score for each institution in relation to the world average. Data refers to the latest 5-year period 2006-2010. The field normalised citation score, or "citation score", is the relative number of citations to publications of an institution compared to the world average of citations to publications of the same time period and scientific subject field. The normalisation was applied at the level of each publication according to the 253 NSI scientific subject fields. In the case that a publication was attributed to several subject fields, a mean value of the fields was calculated. The citation score was calculated using software that EKT developed. A value greater than 1, indicated that the impact of publications was higher than the world average.
The citation score was the highest for the G. PAPAGEORGIOU General Hospital/ G. PAPAGEORGIOU and it was equal to the world average. Other hospitals with citation scores above 0.90 were the IPPOKRATEIO General Hospital of Thessaloniki (0.93), the G. Papanikolaou General Hospital of Thessaloniki (0.92) and G. Gennimatas General Hospital of Athens (0.92).

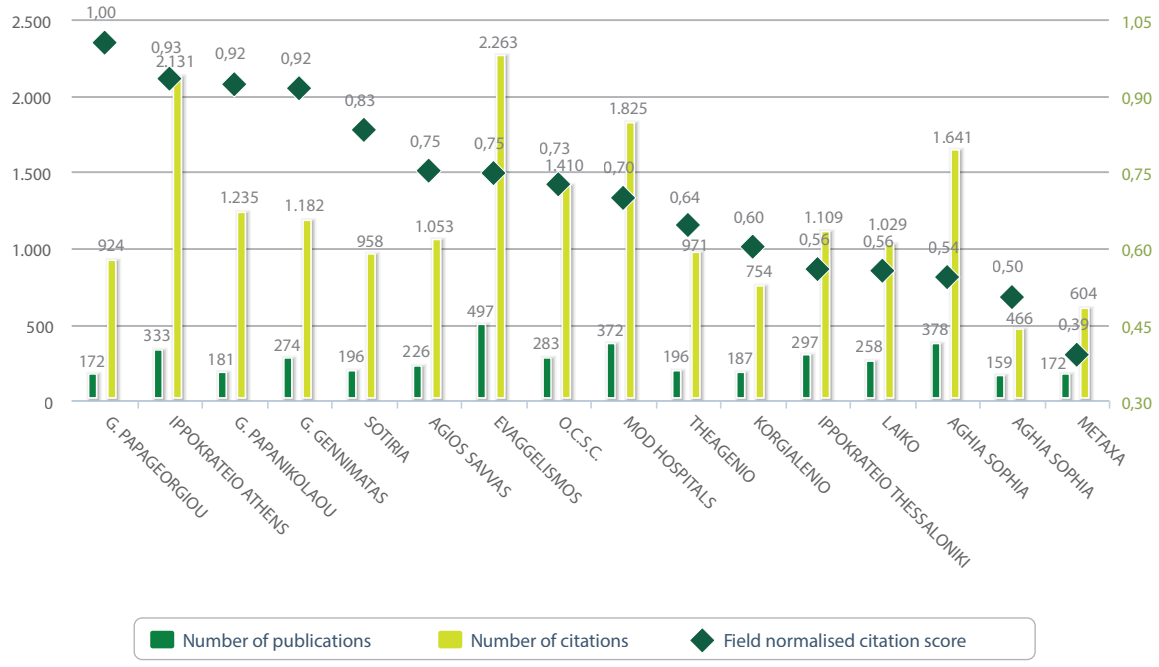

Figure 8.3.1 Publications, citations and field normalised citation score relative to the world, by Public Health Institution, 2006-2010. Data refered to the total number of publications in each Public Health Institution for all scientific fields / Source: Thomson Reuters, Incites 1996-2010

8.4 Highly cited publications

Figure 8.4.1 and 8.4.2* presents, for each institution, the number of highly cited publications for the period 2006-2010 for percentile levels 1%, 5%, 10%, 25% and 50%, i.e. the publications that belong respectively to the top 1%, 5%, 10%, 25% and 50% of the most cited publications in the world.
The publications of 14 Health Institutions –though a few (1-3)– were among the 1% most highly cited publications worldwide.
In addition, Figures 8.4.1 and 8.4.2 display the percentage of the highly cited publications for each Health Institution for percentile levels 1%, 5%, 10%, 25% and 50%. Data refered to the last 5-year period 2006-2010. Values above the percentile levels indicate that the specific institution had the majority of publications among the top 1%, 5%, 10%, 25% and 50% of the most cited publications worldwide. Those surpassing the global average wer the G. Papanikolaou General Hospital of Thessaloniki (for percentile levels 1%, 5% and 10%), the G. PAPAGEORGIOU and SOTIRIA General Hospital of Athens (for 1% and 5%), the IPPOKRATEIO General Hospital of Thessaloniki (for 1%) and the THEAGENIO Cancer Hospital of Thessaloniki (for 5%).

* The indicators were best illustrated in two diagrams – so that the citation impact values for each state hospital were highlighted–.

Figure 8.4.1 Number and percentile breakdown (%) of highly cited publications by Public Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Highly cited publications: the top 1%, 5%, 10%, 25% and 50% of the most cited publications worldwide

8.5 Major fields of science

Figure 8.5.1 presents values related to the the impact of publications by "Public Health Institutions" in the major scientific fields with higher publication activity (more specifically, in the "Medical & Health Sciences" and "Natural Sciences") *, for the 5-year period 2006 to 2010. The Figure displays the number of publications and citations and the field normalised citation score for each major field, as well as information on the overall performance of each institution in each major field. The citation scores were normalised and then calculated at the level of each publication. Figure 8.5.2 provides a detailed picture of each institution's performance.

As expected, Public Health Institutions were mostly active in the scientific field "Medical & Health Sciences". The publications with an impact higher than the world average baseline were those of the G. PAPAGEORGIOU General Hospital (citation score 1.04). Papanikolaou General Hospital of Thessaloniki (0.92) and the IPPOKRATEIO General Hospital of Athens (0.92) also had a citation score above 0.90.

There was a low number of publications in the field of "Natural Sciences", mainly coming from the "Agios Savvas" Regional Hospital for Cancer Treatment/AGIOS SAVVAS, the LAIKO General Hospital of Athens /LAIKO, the Evaggelismos Hospital of Athens/EVAGGELISMOS and the "Aghia Sophia" Children's Hospital/AGHIA SOPHIA. In this field, "Agios Savvas" Regional Hospital for Cancer Treatment and the LAIKO General Hospital of Athens accounted for publications with a citation score equal to the global average (defined as 1).

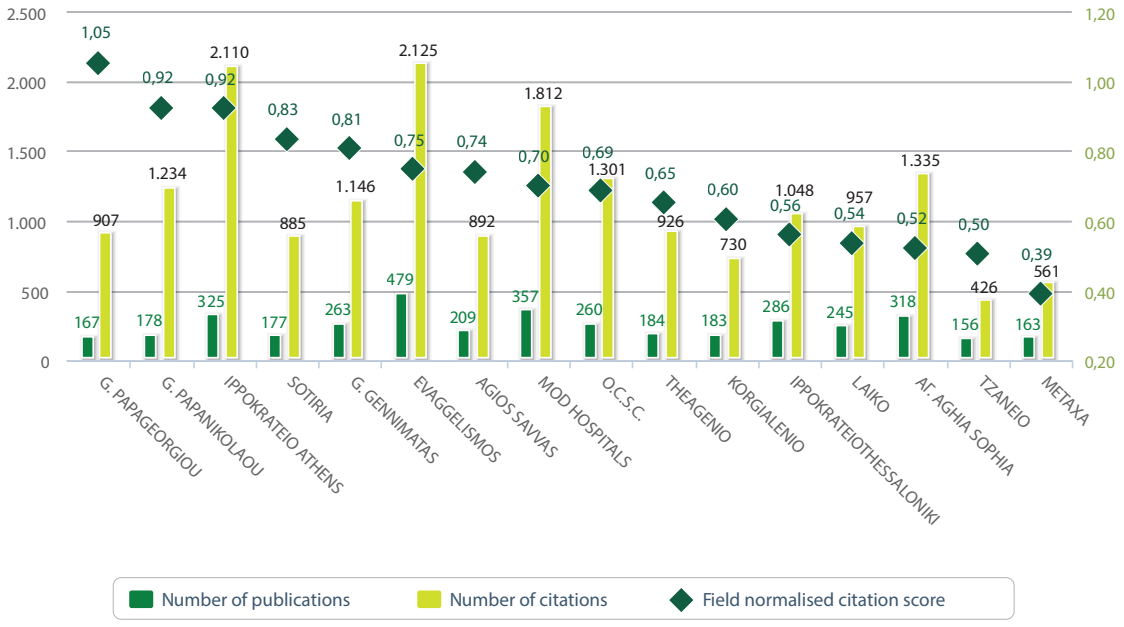

Figure 8.5.1 Major field of science "Medical & Health Sciences". Publications, citations and field normalised citation score relative to the world, by Public Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

* The field-normalised citation score was only calculated for Public Health Institutions which produced more than 75 publications for the period 1996-2010, –or 5 publications annually–.

Figure 8.5.1 Major field of science "Natural Sciences". Publications, citations and field normalised citation score relative to the world, by Public Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

MEDICAL AND HEALTH SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Public Health Institutions**	**Field-normalised citation score**	**Number of publications**
clinical medicine	gastroenterology & hepatology	PAPAGEORGIOU	3,32	9
health sciences	infectious diseases	G. GENNIMATAS	2,36	19
clinical medicine	hematology	AGIOS SAVVAS	1,97	11
clinical medicine	cardiac & cardiovascular systems	IPPOKRATEIO ATHENS	1,78	43
clinical medicine	obstetrics & gynecology	PAPAGEORGIOU	1,77	15
clinical medicine	dentistry, oral surgery & medicine	AGIOS SAVVAS	1,68	10
clinical medicine	gastroenterology & hepatology	G. PAPANIKOLAOU	1,67	12
basic medicine	pharmacology & pharmacy	KORGIALENEIO	1,62	15
clinical medicine	peripheral vascular disease	SOTIRIA	1,60	20
clinical medicine	surgery	PAPAGEORGIOU	1,55	15

Figure 8.5.2 Scientific subfields of "Public Health Institutions" publications with field normalised citation score ≥ 1, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

8.6 Scientific collaboration

Figure 8.6.1 highlights the share of publications produced as a result of national*, international** and no collaboration*** for each of the 16 Public Health Institutions over the period 2006-2010.

The majority of publications resulted from national collaborations –over 70% of total publications in most cases–. Tzaneio General Hospital of Piraeus/TZANEIO had the highest percentage of publications with national collaborations (94.3%).

The percentage of publications with international collaboration was lower, ranging from 12.8% (the Metaxa Cancer hospital of Piraeus) to 33.2% (the Onassis Cardiac Surgery Center).

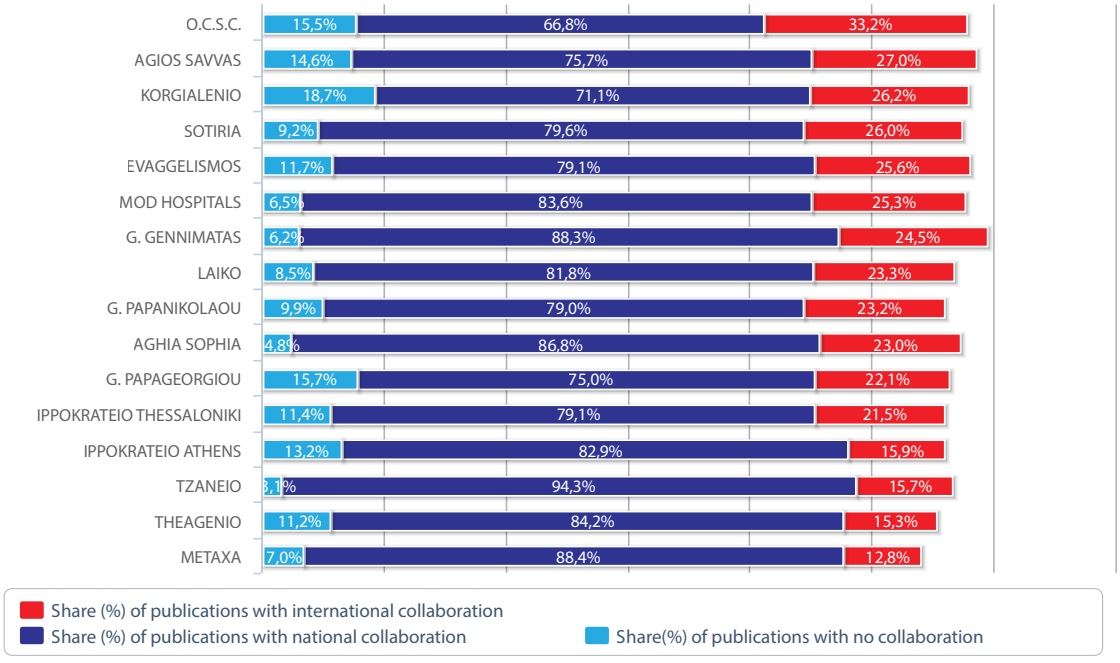

Figure 8.6.1 Number of publications with national, international and no collaboration, by Public Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration

** number of publications with at least one international collaboration

*** Number of publications by a single Greek institution

The category "Private Health Institutions" includes Private Health Institutions active in the health sector such as private hospitals, clinics, diagnostic centers, research centers etc. When compared to the rest institution categories –presented in the previous chapters–, this category made the least contribution to the total number of Greek publications. However, the category displays the highest citation impact indicator values.

This chapter includes analytical data for the key players in this Category. More specifically, these are: St. Luke's Hospital, the Alfa Institute of Biomedical Sciences, the Henry Dunant hospital, the Hellenic Cooperative Oncology Group, the IASO Group, the HYGEIA Group (which includes Hygeia General Hospital, MITERA and LETO Maternity Hospitals).

The table below presents the number of publications produced by the institutions, as well as citations that their publications received for the period 2006-2010, and compares them to relevant data obtained for the period 2004-2008 (data emerged from EKT's previous study).

CHAPTER 9

SCIENTIFIC PUBLICATIONS BY PRIVATE HEALTH INSTITUTIONS

		2004-2008		2006-2010	
		Number of publications	Number of citations	Number of publications	Number of citations
Alfa Institute of Biomedical Sciences	AIBS	239	1.211	328	2.810
Hellenic Cooperative Oncology Group	HeCOG	32	1.079	45	349
Metropolitan Hospital	Metropolitan	76	468	90	800
St. Luke's Hospital	St. LUKE	32	51	35	104
HENRY DUNANT hospital	HENRY DUNANT	364	4.395	385	4.858
Euroclinic Athens	Euroclinic	82	445	106	419
Athens Medical Group	Iatriko	96	253	103	365
IASO Group	IASO	66	213	68	229
HYGEIA Group	Hygeia	201	1.123	209	1.013

9.1 Publications

The HENRY DUNANT hospital (HENRY DUNANT), the Alfa Institute of Biomedical Sciences (AIBS) and the HYGEIA Group (Hygeia) stand out in this category –in terms of their publication output–. However, their number of publications leveled off in 2010, amounting to 67, 44 and 33 respectively (Figure 9.1.1). There were fewer publications from the IASO Group (12), the Hellenic Cooperative Oncology Group (10) and St. Luke's Hospital (8).

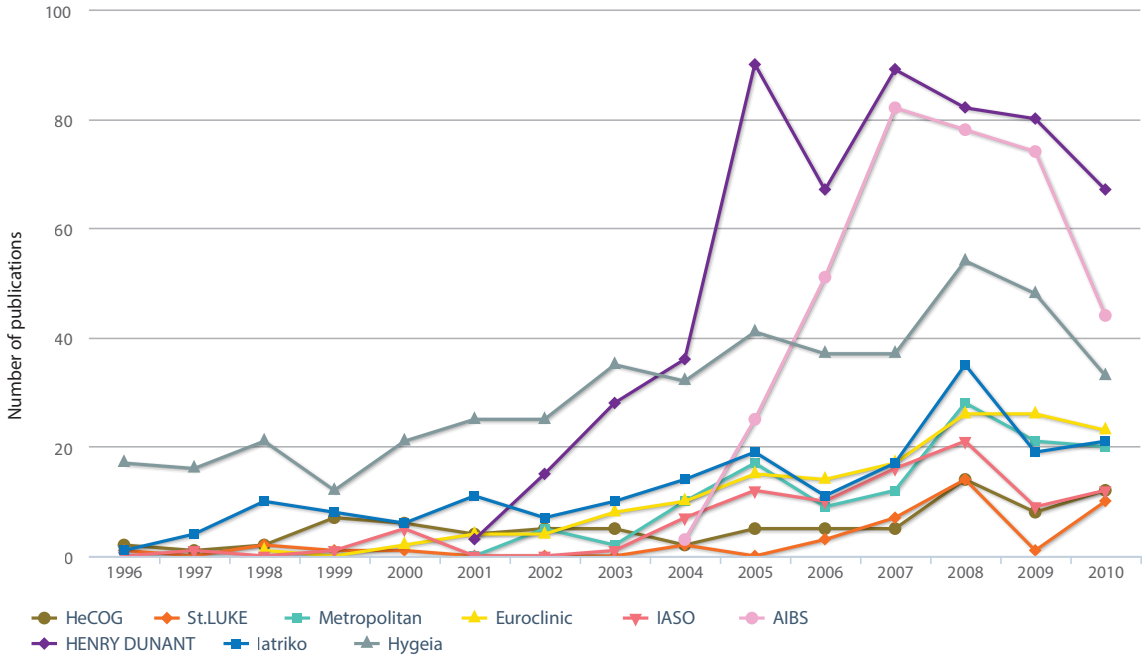

Figure 9.1.1 Development of the number of publications by Private Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 9.1.2 presents the number of publications and its rate of change for each Private Health Institution from 1996 to 2010.

Rate of change: 1 + [(number of publications in year "n" – number of publications in year "n-1") / number of publications in year "n-1"]. The coefficient is 1, if the number of publications is the same across the years compared.

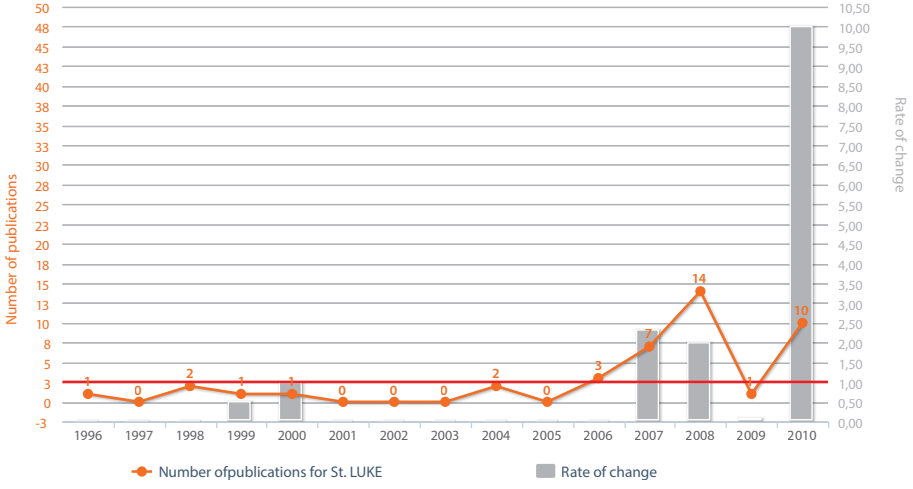

Figure 9.1.2 Number of publications and rate of change in the number of publications by "St. Luke's Hospital", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

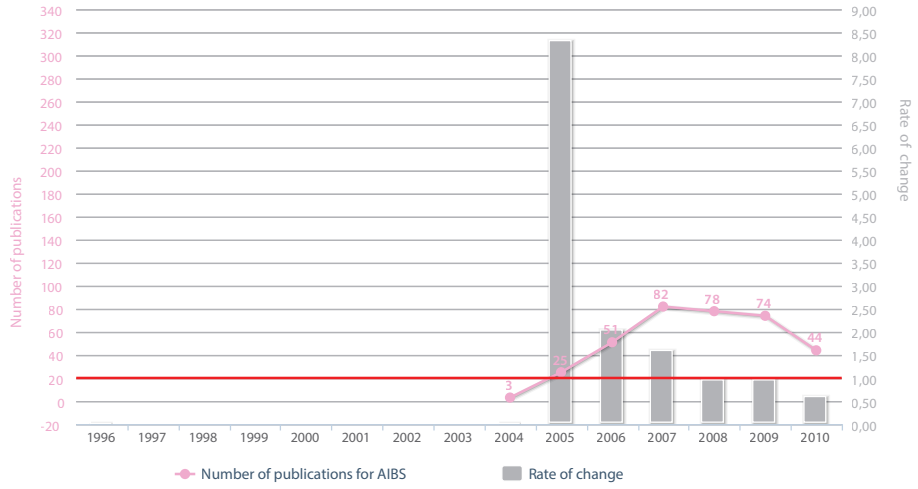

Figure 9.1.2 Number of publications and rate of change in the number of publications by "AIBS", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

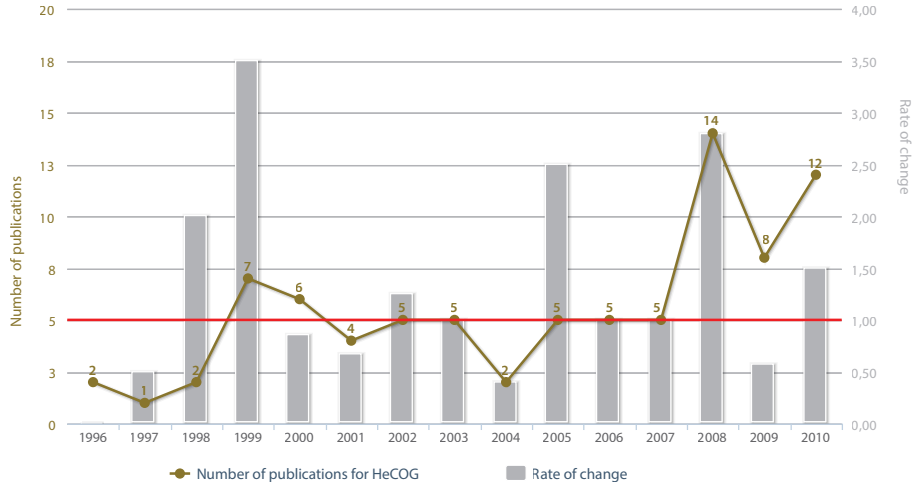

Figure 9.1.2 Number of publications and rate of change in the number of publications by "HeCOG", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

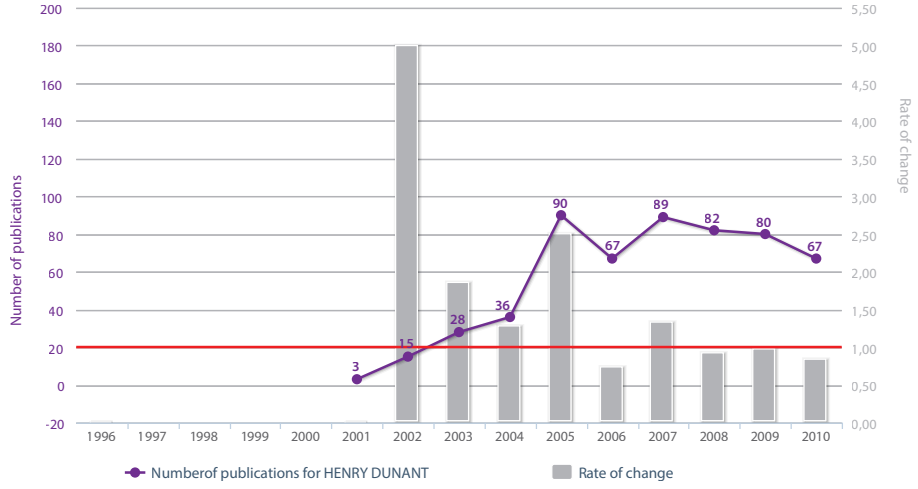

Figure 9.1.2 Number of publications and rate of change in the number of publications by "HENRY DUNANT hospital", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

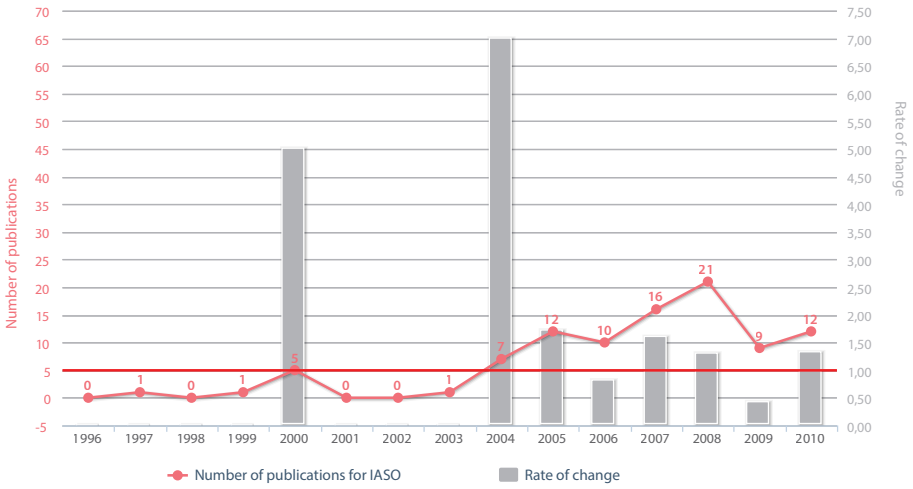

Figure 9.1.2 Number of publications and rate of change in the number of publications by "IASO Group", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

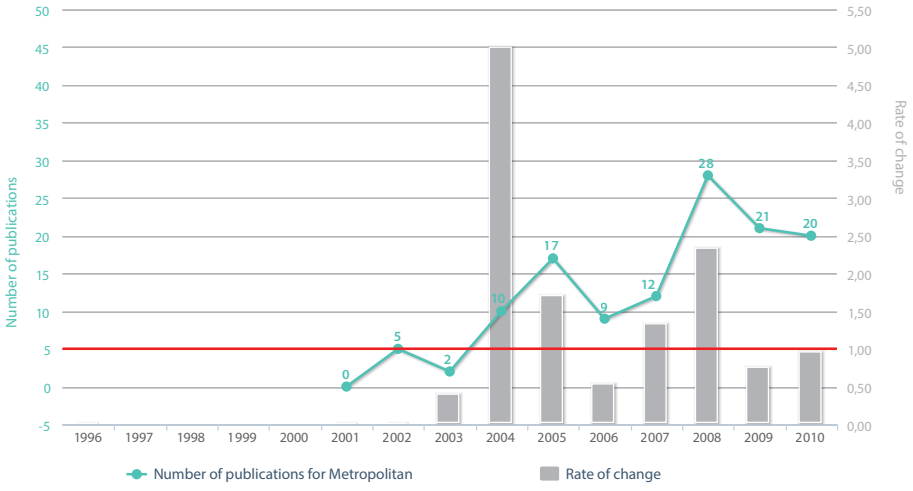

Figure 9.1.2 Number of publications and rate of change in the number of publications by "Metropolitan Hospital", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

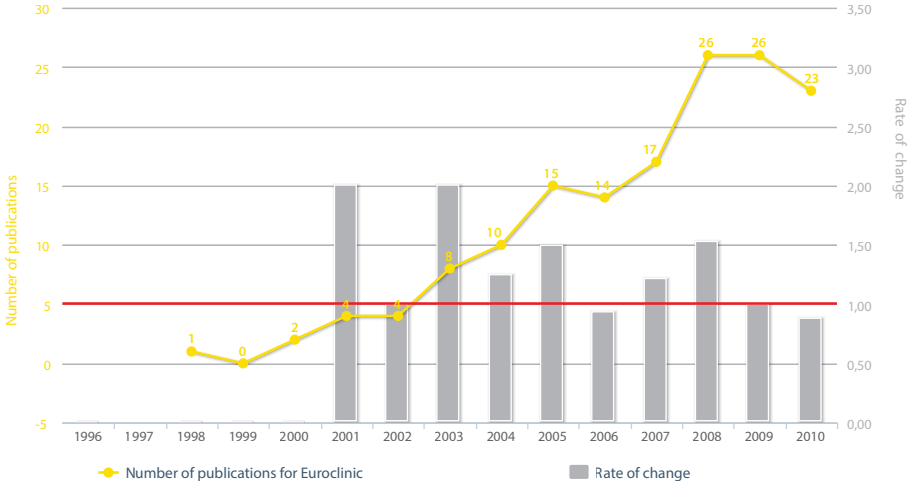

Figure 9.1.2 Number of publications and rate of change in the number of publications by "Euroclinic Athens", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

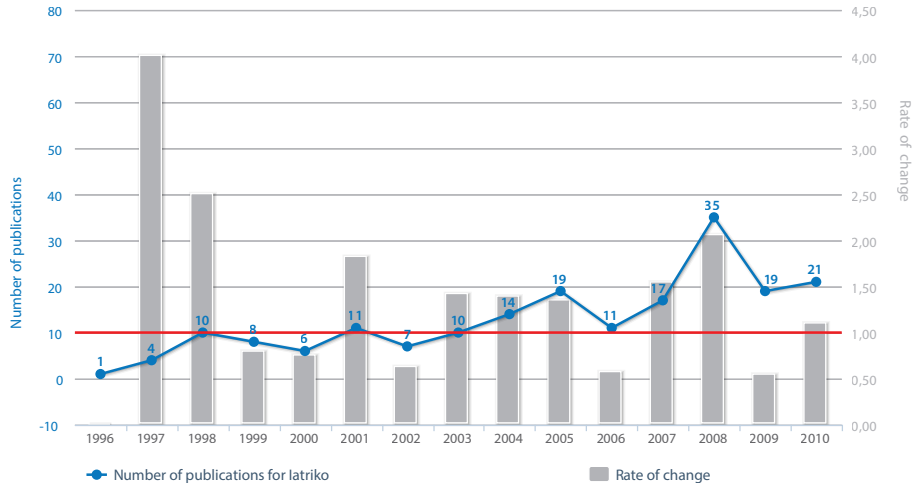

Figure 9.1.2 Number of publications and rate of change in the number of publications by "Iatriko", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

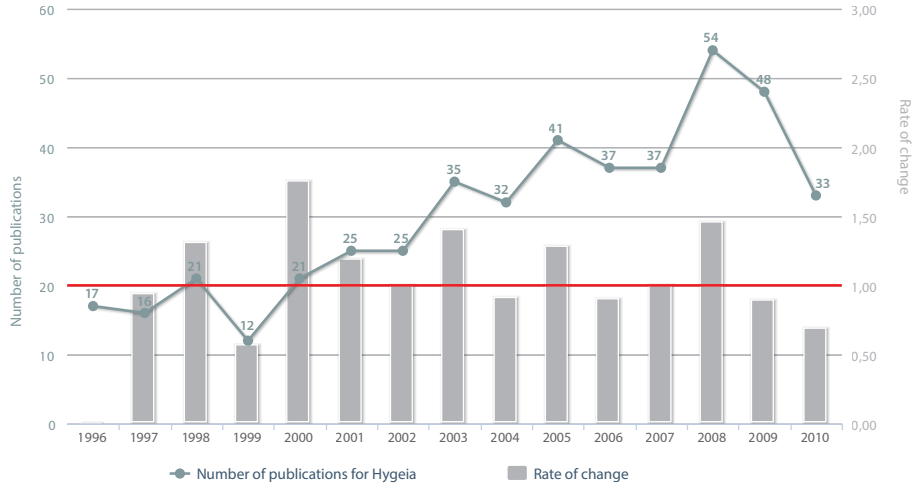

Figure 9.1.2 Number of publications and rate of change in the number of publications by "HYGEIA Group", 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 9.1.3 presents the scientific output and each institution's share of publications in the category "Private Health Institutions" for the period 2006-2010. The HENRY DUNANT hospital (HENRY DUNANT) ranked first with 385 publications and a share of 27.6%. The Alfa Institute of Biomedical Sciences (AIBS) followed with 329 publications and a share of 23.6%. The HYGEIA Group (Hygeia) had 209 publications and a share of 15%. The share of other institutions accounted for less than 5% of the publications in this category.

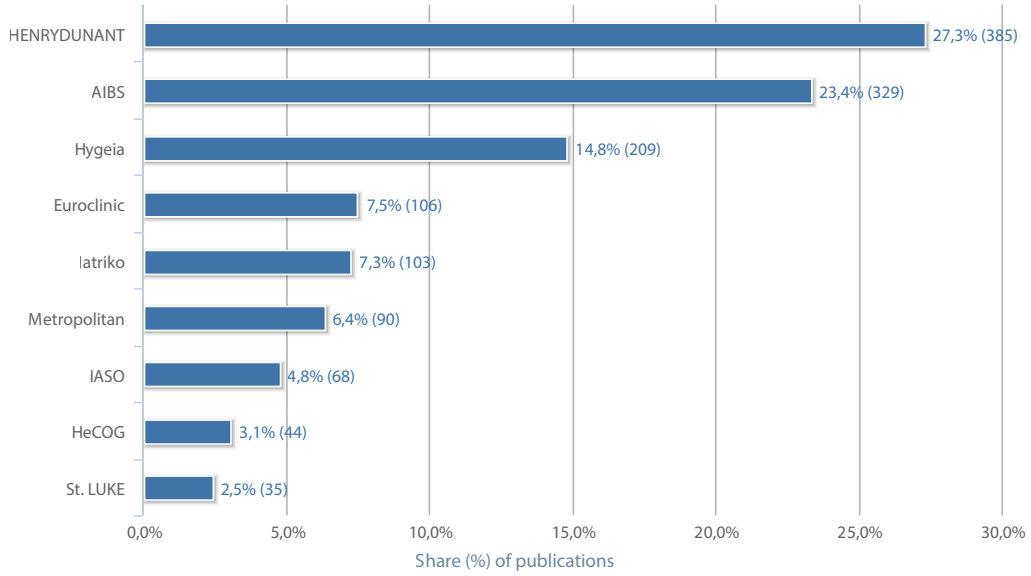

Figure 9.1.3 Number and share (%) of publications, by Private Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

The rate of change in the publications of St. Luke's Hospital (St. Luke) and the Hellenic Cooperative Oncology Group (HeCOG) exceeded that of the "Private Health Institutions" Category. It should be noted, though, that the actual number of publications for these hospitals was rather low.

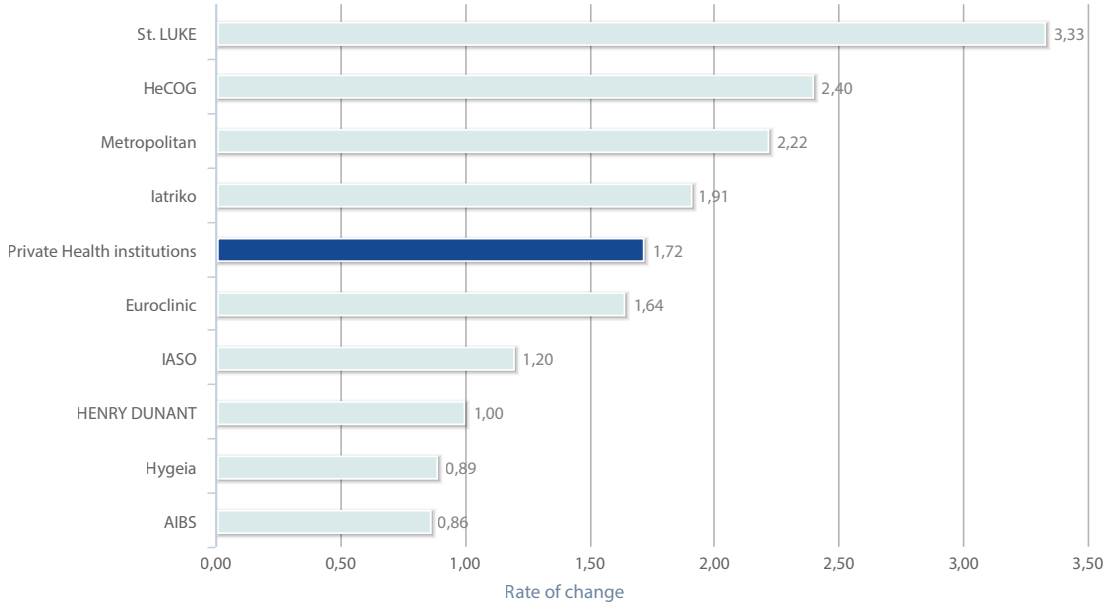

Figure 9.1.4 Change in the number of publications between 2006 and 2010, by Private Health Institution / Source: Thomson Reuters, Incites 1996-2010

Rate of change: 1 + [(number of publications in 2010 – number of publications in 2006) / number of publications in 2006]. The coefficient is 1 if the number of publications is the same across the years compared.

9.2 Citations

Figure 9.2.1 presents the share of citations that publications in different institutional categories received. For the period 2006-2010, the Alfa Institute of Biomedical Sciences (AIBS), the HENRY DUNANT hospital (HENRY DUNANT) and the Hellenic Cooperative Oncology Group (HeCOG) accounted for a share of 83.3%, 79.5% and 77.3%, respectively - exceeding the Greek average of 65.5%.

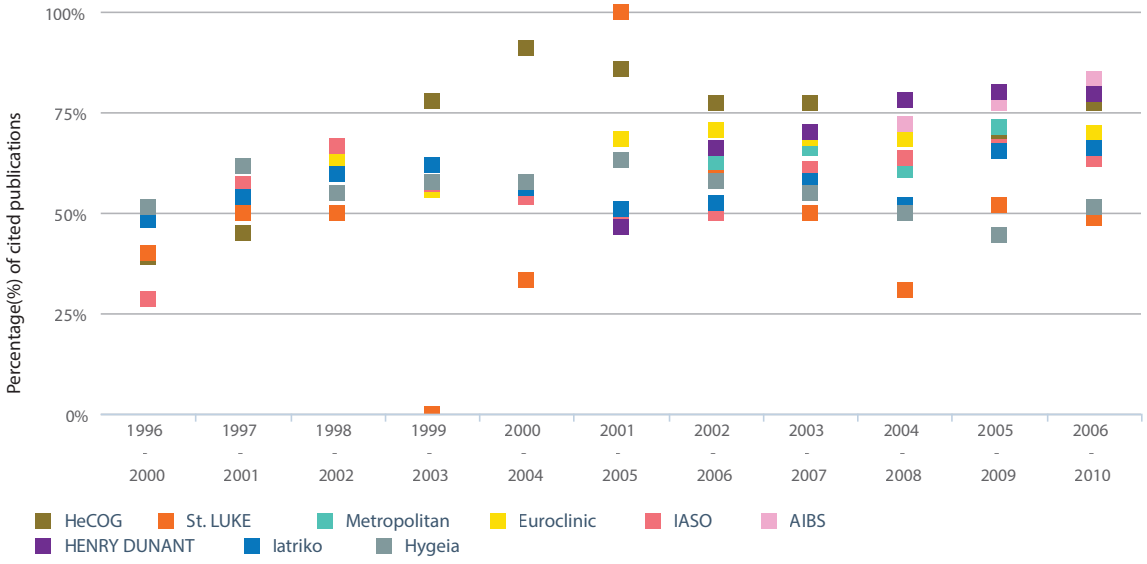

Figure 9.2.1 Percentage (%) of cited publications, by Private Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

Figure 9.2.2 displays growth trends in the number of citations for the "Private Health Institutions" during 1996-2010.

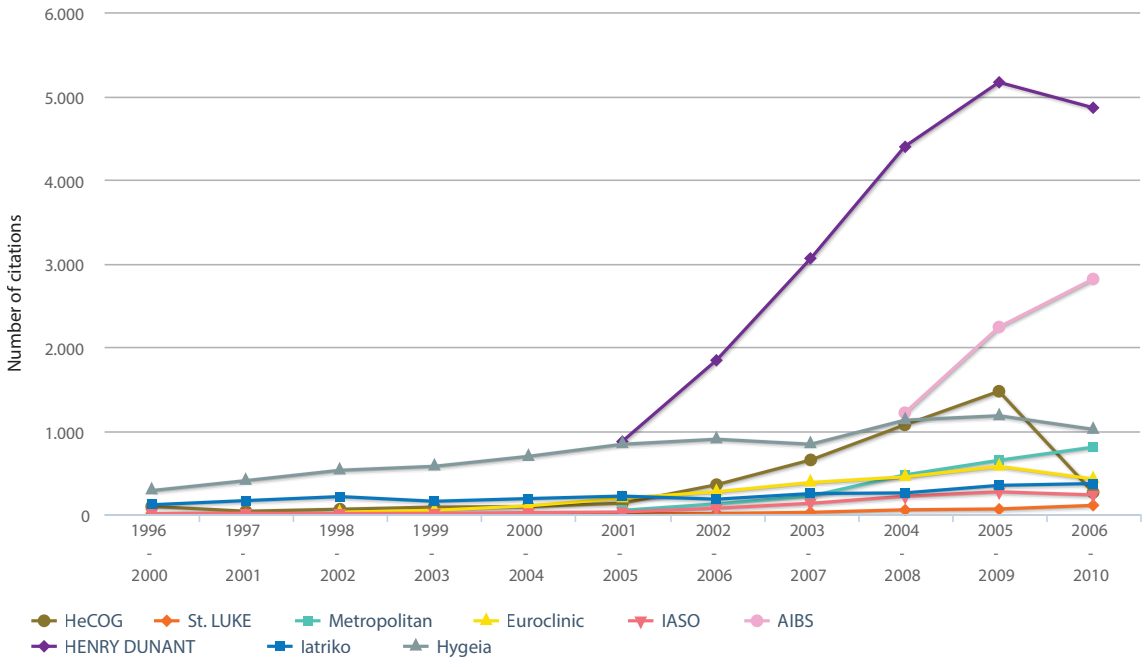

Figure 9.2.2 Number of citations, by Private Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

9.3 Citation impact

Figure 9.3.1 presents the publications, citations and field-normalised citation score for each institution*, compared to the world average, for the period 2006-2010. The field-normalised citation scores were adjusted to institutions' differing citation practices across the 253 subject fields. This indicator was used for assessing the average impact of publications from each institution across different scientific fields.

The citation scores were the highest for the HENRY DUNANT hospital (HENRY DUNANT) and the Alfa Institute of Biomedical Sciences (AIBS). Their scores –1.65 and 1.46 respectively– surpassed the world average.

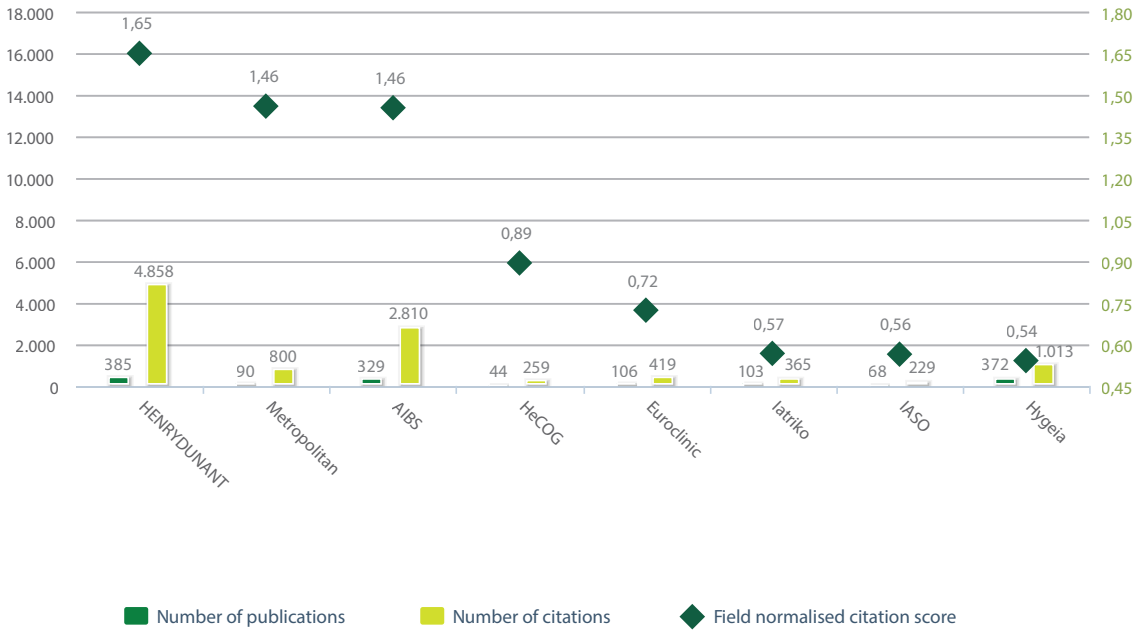

Figure 9.3.1 Publications, citations and field-normalised citation score relative to the world, by Private Health Institution, relative to the world, 2006-2010. Data refers to the total number of publications in each Private Health Institution for all scientific fields / Source: Thomson Reuters, Incites 1996-2010

9.4 Highly cited publications

Figure 9.4.1 presents the number of publications for the Health Institutions studied from 2006 to 2010, which were ranked according to the 1%, 5%, 10%, 25% and 50% most cited publications worldwide, on a yearly basis and across the major fields of science.

Among the 1% most highly cited publications worldwide, there were 15 publications from the HENRY DUNANT hospital (HENRY DUNANT), 5 from the Alfa Institute of Biomedical Sciences (AIBS) and 1 from the HYGEIA Group (Hygeia).

The same figure also depicts the share of publications with high citation impact compared to the total share of publications produced by each institution and in relation to the world's share for levels of 1%, 5%, 10%, 25% and 50%. HENRY DUNANT and AIBS exceeded the world average for all levels.

* The field-normalised citation score is calculated only for Private Health Institutions with more than 75 publications for the period 1996-2010, or 5 publications annually

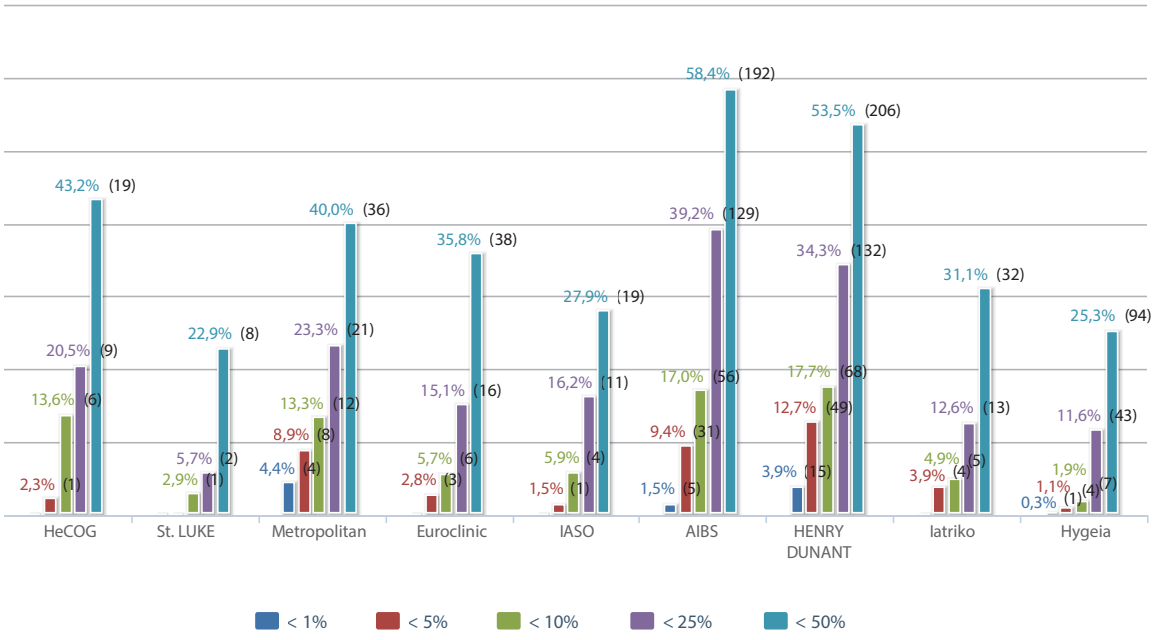

Figure 9.4.1 Number and percentile breakdown (%) of highly cited publications, by Private Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

9.5 Major fields of science

Figure 9.5.1 captures, for the five-year period 2006 to 2010, the impact of publications by "Private Health Institutions" in the scientific fields that demonstrate higher publication activity*: "Medical & Health Sciences" and "Natural Sciences".

The field-normalised citation scores reflect the average impact of the publications of a Private Health Institution in each major scientific field by taking the average number of citations of publications from each Health Institution within the relevant fields and subfields. Figure 9.5.2 presents the publications and the scientific sub-fields of publications with high citation scores for each Private Health Institution.
Private Health Institutions were mostly active in the scientific field of "Medical & Health Sciences". The publications with an impact higher than the world average baseline came from the institutions of HENRY DUNANT (citation score of 1.64) and AIBS (1.39).

There was a low number of publications in the field of "Natural Sciences", mainly from the HENRY DUNANT and AIBS with field-normalised citation scores of 1.70 and 1.68 respectively.

* The field-normalised citation score is calculated only for Private Health Institutions with more than 75 publications for the period 1996-2010, or 5 publications annually.

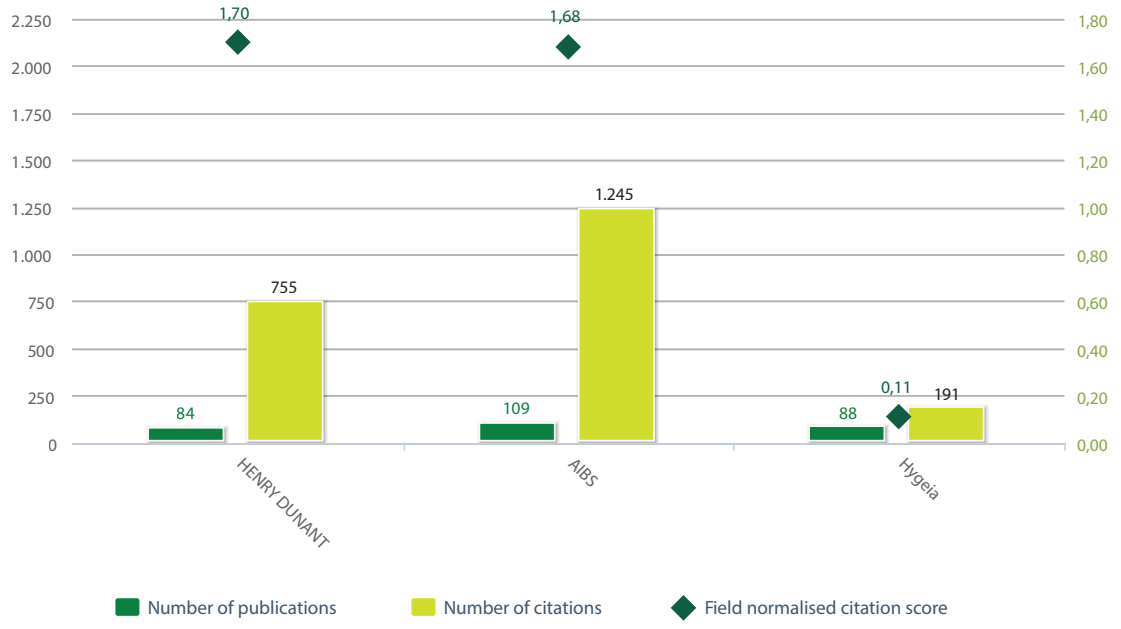

Figure 9.5.1 Major field of science "Natural Sciences" Publications, citations and field-normalised citation score relative to the world, by Private Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

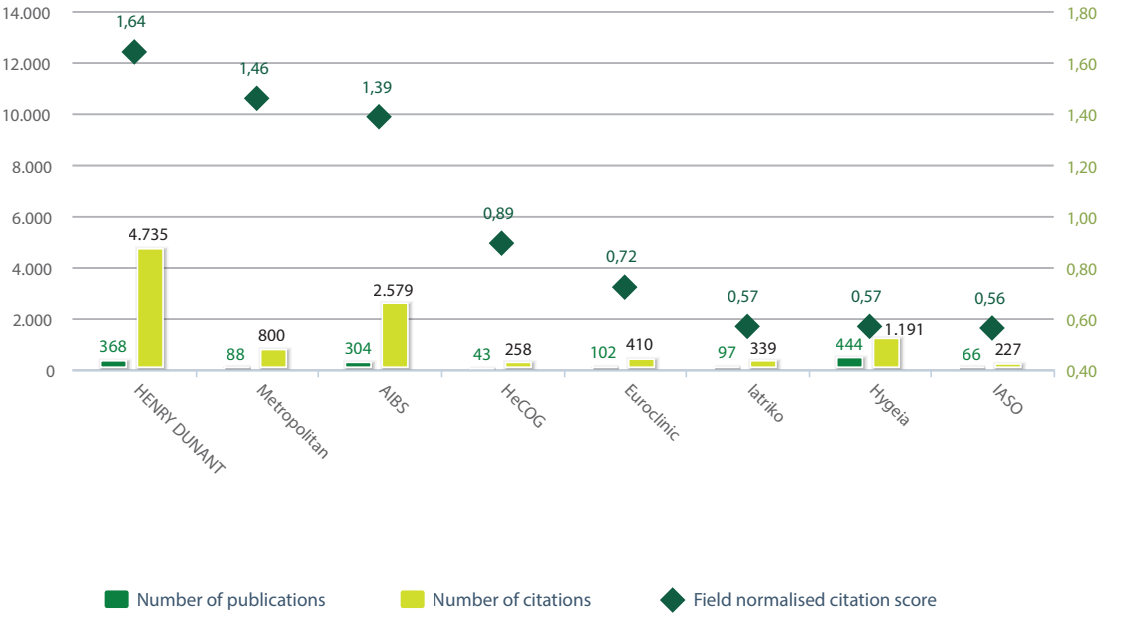

Figure 9.5.1 Major field of science "Medical & Health Sciences": Publications, citations and field normalised citation score relative to the World, by Private Health Institution, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

Natural Sciences				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Public Health Institutions**	**Field-normalised citation score**	**Number of publications**
biological sciences	microbiology	AIBS	1,86	83
biological sciences	microbiology	HENRY DUNANT	1,76	58
biological sciences	biochemistry & molecular biology	AIBS	1,57	8

MEDICAL AND HEALTH SCIENCES				
Subfield of major field of science (Frascati manual)	**Specific scientific fields (NSI & Incites)**	**Public Health Institutions**	**Field-normalised citation score**	**Number of publications**
clinical medicine	gastroenterology & hepatology	HENRY DUNANT	3,99	50
clinical medicine	critical care medicine	AIBS	2,77	14
clinical medicine	critical care medicine	HENRY DUNANT	2,74	13
clinical medicine	gastroenterology & hepatology	METROPOLITAN	2,16	9
clinical medicine	rheumatology	EUROCLINIC	1,98	10
health sciences	infectious diseases	HENRY DUNANT	1,77	85
basic medicine	pharmacology & pharmacy	AIBS	1,61	95
health sciences	infectious diseases	AIBS	1,61	124
clinical medicine	endocrinology & metabolism	HENRY DUNANT	1,51	12

Figure 9.5.2 Scientific subfields of "Private Health Institutions" publications with field-normalised citation score ≥ 1.5, 2006-2010 / Source: Thomson Reuters, Incites 1996-2010

9.6 Scientific collaboration

Figure 9.6.1 highlights the share of publications with national*, international** and no collaboration *** for each of the Private Health Institutions over the period 2006-2010. The majority of publications were a result of national and international collaborations. The most active in this respect were HeCOG (100%) and AIBS (97.3%).

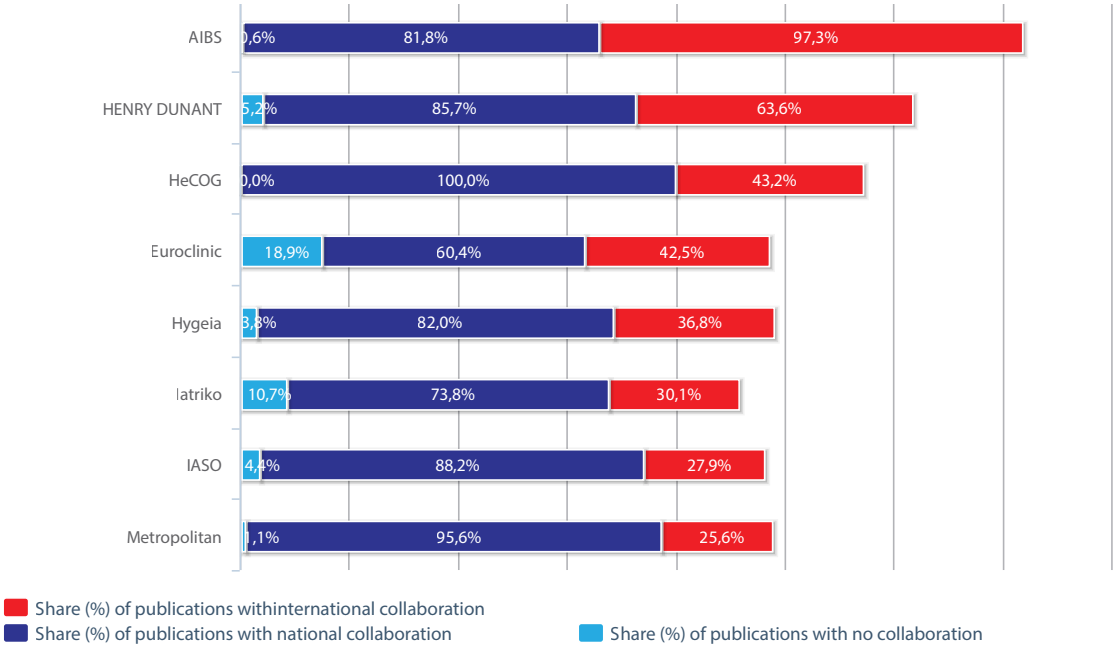

Figure 9.6.1 Share (%) of publications with national, international and no collaboration, by Private Health Institution, 1996-2010 / Source: Thomson Reuters, Incites 1996-2010

* Number of publications with at least one national collaboration

* ** Number of publications by a single Greek institution

** Number of publications with at least one international collaboration

ANNEXES

Annex I: METHODOLOGY

Annex II: INDICATORS

Annex III: SCIENTIFIC FIELDS

Annex IV: INSTITUTIONS EXAMINED

Annex V: OECD MEMBER COUNTRIES

ANNEX I: METHODOLOGY

Introduction

Bibliometrics deal with the quantitative analysis of scientific literature and particularly with the analysis of citations that scientific publications receive within the international research community. Bibliometric indicators include publication and citation counts, scientific impact indices, collaboration degree, scientific fields of excellence etc.

Bibliometric analysis is a significant tool for the evaluation of research activity, both individual institutions and for national research systems or sectors. Bibliometrics offer a sound basis to measure the scientific output and performance, its international impact, the research networks among institutions and nations, the knowledge flows and links among scientific disciplines. The number of studies using bibliometric analysis is constantly growing at international level.

The present study consists part of a study series launched by the National Documentation Center (EKT). The study is based on bibliometrics to evaluate Greek scientific publishing activity at international level. Its first edition was published in 2010 under the title "Greek Scientific Publications 1993-2008: A bibliometric analysis of Greek publications in international scientific journals". The study was widely used as a reference point by research institutions, universities and policy stakeholders.

The study's second edition reviews Greek publications in international scientific journals for the 15-year period which extends from 1996 to 2010 and highlights the trends and developments in the most recent years, namely after 2005. The study's methodological design remains the same with the framework designed for the study's first edition. The following paragraphs present the study's methodological framework in detail:

Bibliometric Indicators

The study presents the following bibliometric indicators that are widely used throughout international literature:
Αναλυτικότερα υπολογίστηκαν οι ακόλουθοι δείκτες:

- Number of publications
- Share (%) of publications
- Percentage (%) of cited publications
- Number of citations
- Share (%) of citations
- Citation impact
- Relative citation impact
- Field normalised citation score
- Number of highly cited publications (Top X%)
- Share (%) of highly cited publications (P Top X%)

For detailed information on bibliometric indicators and methods of their calculation see Annex II.

Bibliometric Databases

Web of Science (from Thomson Reuters), Scopus (from Elsevier) and Google Scholar are among the most recognizable and internationally established publication and citation databases.

Google Scholar offers access to a huge number of digital sources including scientific articles, conference proceedings, reports etc. Nonetheless, it is not recommended for bibliometric analysis since it lacks detailed metadata necessary for the attribution of publications to research organisations, scientific fields or countries. In addition, it does not offer quality criteria for the inclusion of the different scientific items presented.

On the other hand, Web of Science and Scopus provide access to detailed metadata for publications which are published in scientific journals with well established selection criteria and peer review processes. The Web of Science provides data

for more than 12,000 peer-reviewed journals. Its indexed records concern publications since 1900. Scopus, a more recent service, indexes a continuously expanding range of journals with more than 18,500 titles, but citation analysis is available only for articles published after 1996. Both services, fail to fully cover certain scientific sub fields, especially those concerning the fields of "Social Sciences" and "Humanities".

In order to maintain data consistency between the current and the previous study, it was decided to use the Web of Science databases. We intend, however to expand our data sources by including data from the Scopus database in a forthcoming version of the study.

More specifically, data was drawn from the following databases of Thomson Reuters:

National Science Indicators (NSI): database with publication and citation statistics for 194 countries and seven geopolitical regions, covering the thirty years between 1981 and 2010. Publications are divided into 253 fields. The information reflects the total number of publications and citations by country, year and scientific field. However, analysis per publication is not provided.

InCites™- Greece: customized citation based research evaluation tool on the web. It uses publication and citation data from Thomson Reuters (http://incites.isiknowledge.com/). Within the framework of this study, the relevant data was processed in collaboration with Thomson Reuters so as to ensure consistency with NSI database.

Data for indicators related to the total number of Greek publications and their benchmark worldwide, was drawn from the NSI database. The Incites databases served as a source for data pertaining to indicators such as research collaborations, the distribution of publications by institution or category of institutions and by field of science.

Fields of Science

Both NSI and InCites allow for categorization of publications in 253 scientific subject fields. Both databases allocate each publication to a specific subject field 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 the same is the case for its publications.

The classification of Greek publications provided by Thomson Reuters databases was used in this study for the calculation of bibliometric indicators such as field normalisation citation score (normalisation process). It is also used to present the specific subject fields where Greek institutions excelled.

Furthermore, Greek publications were classified into 6 major scientific fields and their 42 sub-fields, according to the revised version of the Frascati Manual of OECD. 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:

1. **Natural Sciences** (Mathematics / Computer and information sciences / Physical sciences / Chemical sciences / Earth and related environmental sciences / Biological sciences / Other natural sciences)

2. **Engineering & Technology** (Civil engineering / Electrical engineering - electronic engineering - information engineering / Mechanical engineering / Chemical engineering / Materials engineering / Medical engineering / Environmental engineering / Environmental biotechnology / Industrial Biotechnology / Nano-technology / Other engineering and technologies)

3. **Medical & Health Sciences** (Basic medicine / Clinical medicine / Health sciences / Health biotechnology / Other medical sciences)

4. **Agricultural Sciences** (Agriculture, forestry, and fisheries / Animal and dairy science / Veterinary science / Agricultural biotechnology / Other agricultural sciences)

5. **Social Sciences** (Psychology / Economics and business / Educational sciences / Sociology / Law / Political Science / Social and economic geography / Media and communications Other social sciences)

6. **Humanities** (History and archaeology / Languages and literature / Philosophy, ethics and religion / Art (arts, history of

arts, performing arts, music) / Other humanities)

The detailed mapping of the 253 subject fields of the Thomson Reuters databases with the 6major fields and 42 subfields of science of the Frascati Manual is provided in Annex III.

Institution Categories

Bibliometric indicators for Greek scientific publications were calculated at three different levels of aggregation:

- The total number of Greek publications
- Eight (8) specific institution categories
- Individual institutions.

Greek institutions were classified into categories according to the sector of activities in which they belong –e.g. higher education, research, health services etc-, as well as their legal status as public or private institutions. The classification of institutions as public or private was based on the latest version (October 2011) of the "Register of institutions and services of the Greek Public Administration". It is to be noted that the Register included those institutions which serve the public interest but may operate according to the private law.

Specifically, institutions which produced scientific publications were grouped in the following categories*:

Higher Education Institutions – Universities: this category includes Greek Universities and Technical Universities, which are referred to as "Universities". It also includes Research Centers and hospitals operating in Universities.

Annex IV provides the list of the institutions included in this category. Chapter 4 discusses findings regarding bibliometric indicators which represented them.

Higher Education Institutions – Technological Educational Institutes: this category consists of the Technological Educational Institutes as well as the Higher School of Pedagogical and Technological Education (ASPETE).

Annex IV provides the list of the institutions included in this category. Chapter 5 discusses findings regarding bibliometric indicators which represented them.

Research Centers supervised by the General Secretariat of Research and Technology (GSRT): this category includes research institutions supervised by the General Secretariat for Research and Technology.

Annex IV provides the list of the institutions included in this category. Chapter 6 discusses findings regarding bibliometric indicators which describe them.

* Aiming at a more coherent presentation of the study's results, Greek institutions were classified into 8 Categories instead of 11 –as in the study's previous edition-. In this edition, 11 categories merged to 8 on the basic of their characteristics-. More accurately, institutions in the categories "YPETHA bodies", "Banks" and "Museums" have been incorporated into the remaining 8 categories.

Institution categories			
Sector	**Category**	**Abbreviation**	**Description**
Higher Education	Universities	Universities	Universities and Technical Universities, University Research Institutes (U.R.I.) and University Hospitals
	Technological Education Institutes	TEI	Technological Education Institutes
Research	Research Centers supervised by the General Secretariat of Research and Technology	GSRT Research Centers	Research Centers supervised by the General Secretariat of Research and Technology
	Other Public Research Institutions	Other Public Research Institutions	Other Public Research Institutions supervised by various Ministries
Health	Public Health Institutions	Public Health Institutions	Public Health Institutions of the national health system, hospitals, Institutions supervised by the Ministry of Health and Social Solidarity and Hospitals supervised by the Ministry of Defence
	Private Health Institutions	Private Health Institutions	Private Institutions active in the health sector such as private hospitals, diagnostic centers, research centers etc.
Other Public Institutions		Other Public Institutions	Ministries, Museums, Higher Military Education Institutions, Other Public Institutions and Public Enterprises
Other Private Institutions		Other Private Institutions	Other Private Institutions such as Private Educational Institutions, Museums, Banks, non-profit organisations, non-governmental organisations and private enterprises

Other Public Research Institutions: the category includes 8 research institutions supervised by various Ministries as following:

- Academy of Athens: Publications by the Academy of Athens also include the publications by the Medical and Biological Research Foundation (IIBEAA) / Ministry of Education, Lifelong learning and Religious affair
- Research Academic Computer Technology Institute (RA-CTI) / Ministry of Education, Lifelong learning and Religious affairs. In 2011 it was renamed as: Computer Technology Institute and Press "Diophantus". Since the study covers up to 2010, the institution was mentioned by its previous name.
- National Agricultural Research Foundation (NAGREF) / Ministry of Rural Development and Food.
- Institute of Geology and Mineral Exploration (IGME) / Ministry of Environment, Energy and Climate change.
- Institute of Engineering Seismology and Earthquake Engineering (ITSAK) / Ministry of Infrastructure, Transport and Networks. In 2011 ITSAK merged with the Institute for Earthquake Protection Planning. Given that this study covers institutions' publication activity until 2010, ITSAK was examined as an autonomous body.
- Center for Renewable Energy Sources / Ministry of Environment, Energy and Climate change.
- Center of Planning and Economic Research / Ministry of Finance.
- Benaki Phytopathological Institute / Ministry of Rural Development and Food.

Annex IV provides the list of the institutions included in this category. Chapter 7 discusses findings regarding their bibliometric indicators.

Public Health Institutions: this category includes public hospitals part of the National Health System, hospitals and institutions supervised by the Ministry of Health and Social Solidarity and by the Ministry of National Defence. University hospitals and clinics were excluded from this category since they were part of the category "Universities".

More specifically, institutions in this category include the National School of Public Health (ESDY), the Research Center for Biomaterials (EKEBYL), the Hellenic National Diabetic Center (HNDC), the Hellenic Center for disease control and prevention (HCDCP), the Child Health Institute (CHI), the Onassis Cardiac Surgery Center etc.

It should be noted that the matching of publications with certain institutions of the category was incomplete because relevant information appeared in abbreviation or was missing. As a result, a 9.5% of publications for this institutions category could not be identified.

Annex IV provides the list of 16 institutions examined in this category. Chapter 8 discusses findings regarding bibliometric indicators which describe them.

Private Health Institutions: the category includes private institutions with activities in the health sector such as private hospitals, clinics, diagnostic centers, research centers etc. It should be noted that about 30% of publications in this category – mainly those produced by small diagnostic centers and research centers- were not identified due to missing information.

Annex IV provides the list of 9 institutions examined in this category. Chapter 9 discusses findings regarding bibliometric indicators which describe them.

Other Public Institutions: this category includes those institutions listed in the "Register of Institutions and Services of the Greek Public Administration" which could not be classified in the previous categories, institutions supervised by the Ministry of Defence –with the exception of hospitals– as well as public museums. In detail, this category includes Ministries, public institutions and enterprises they supervise, the Hellenic Army Academy (Evelpidon), the Hellenic Naval Academy, the Hellenic Air Force Academy (Icarus School), the School of Nursering officers, military schools, the Hellenic National Meteorological Service etc.

This category also includes institutions which are not supervised directly by the public sector but were included in the aforementioned Register, as institutions providing goods and services of public interest. The most important institutions in terms of publication activity were the following: Military Academies, institutions of public administration, Public Power Corporation (PPC), the Hellenic Aerospace Industry (HAI), the Ormilia Foundation, General Chemical State Laboratory, the Ceramics and Refractories Technological Development Company S.A. (CERECO), the Hellenic Telecommunications Organisation SA (OTE), the Ephoreia for Palaeoanthropology and Speleology for Southern Greece (having highly cited publications) and other public museums.

Other Private Institutions: this category includes private educational institutions, banks, museums, non profit organizations, non governmental organizations and enterprises of the private sector. Institutions outstanding in this category are the Mediterranean Agronomic Institute of Chania, the Athens Information Technology, the American College of Greece -DEREE, the American School of Classic Studies in Athens, the CITY College of the University of Sheffield, the ALBA Graduate Business School, museums, banks and other enterprises.

Data Processing

For the purpose of this study, 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.

- calculation of complex bibliometric indicators such as the field normalised citation score per scientific field, the count and type of collaborations among institutions etc.
- classification of Greek publications adopting the Frascati/OECD taxonomy for scientific areas and mapping of the Frascati/OECD taxonomy with that employed by the Incites and NSI databases.
- production of analytical customized reports per institution category, per institution etc.
- effective cleaning of data and identification of Greek organizations. Cleaning the provided data was critical. The cleaning process allowed the export of reliable indicators since certain organizations appeared in the Incites database with multiple names and there was a lack of unique identifiers and authority files. The identification problem would pose difficulties when exporting reliable reports at organization level. By developing specialized software for this purpose – to resolve matters related with documentation and information organization- EKT implemented systematic procedures for cleaning the primary data. These procedures included identifying alternative names for Greek organizations and the homogenization of data -resulting in a new database version-. EKT's previous bibliometric study, describes this procedure in detail.
- automated generation of interactive charts –embedded in the study's online edition- so that the study's results could be communicated in a comprehensive way.

The software developed by EKT employed a set of tools that allowed the processing of primary data of different types (XML, relational databases), their representation as an independent data model and their processing and categorization. The data model facilitated the calculation of descriptive and complex bibliometric indicators which were visualized using interactive charts and exported to multiple formats (CSV, Excel, JSON) for use in different media (text files, spreadsheets).
Furthermore, the software was heavily parameterized, in order to allow parallel execution of different data workflows, which significantly accelerated the process of calculating the necessary indicators. Note that the system was designed to be largely independent of specific software and technologies, both in the incorporation of raw data and in the production of intermediate and final results.
Moreover, the system was developed with the aim to contribute to the automation of the production of bibliometric indicators calculated by EKT on a systematic basis, and to allow any update necessary for the calculation of new indicators. It also aimed to support the processing of primary data as extracted from a range of other databases (such as NCR including articles cited by Greek publications, Scopus etc.).
Finally, special attention was given to the presentation of Greek bibliometric indicators. In addition to the print edition, findings are also presented in the form of an online book. The selected presentation format enhances accessibility and dissemination of the results and offers a range of navigation, interactive and browsing functions to its readers.

Types of Publications

Throughout the international literature, the types of scientific publications studied -articles, research notes and reviews- are treated as the most important sources for knowledge production and science development. Also, the NSI database is based on these types of publications to provide summary descriptors for publications per country. Therefore, in this study we used data related with articles, research notes and reviews and we excluded editorials, letters, correction notes and abstracts.

It is also important to note that in the field of natural sciences, the publication type "letter" corresponds to short articles with novel scientific results and usually high numbers of expected citations. When calculating bibliometric indicators, such "letters" are usually classified as publications or as research notes. However, in the WoS databases the type "letter" refers to types of publications such as letters to the journals' editors, letters including corrections or comments about past articles etc.

Year of Publication

The distribution of publications across years is an important parameter in bibliometric analysis. Publications are commonly categorized according to the official date of their release in printed form. InCites database provides information for both the date of a publication's official release as well as the date of its registration in the Web of Science system. However, in the case of the NSI database, publications across years are distributed according to the year of registration in WoS.

For reasons of data consistency, indicators were calculated according to information derived from both databases. it was therefore decided to treat the year of a publications' registration in the WoS as the year of its publication. It should be noted that the publication date differs from the registration date in the WoS in about 18% of registrations on the Incites database.

Time frame for analysis 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 normalise differences observed between high numbers of citations received by older publications and small in the latest publications, citation counting 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.

As a result, trends in the number of citations and relevant bibliometric indicators were presented on the basis of 11 overlapping 5-year periods throughout the overall period of analysis (1996-2010).

Since the author's practice of citing her/his previous work in a publication is a common practice among authors, we included self citations in the overall number of citations per publications.

Counting of publications

In most cases, publications have more than one authors. Their authors are likely to be affiliated with different institutions in different countries. In addition, the NSI and Incites database might classify a journal under more than one scientific fields. As a result, the distribution of publications into 6 major fields of science and their sub-fields, may cause overlapping. However, we should note that data analysis showed that 80% of publications were classified under a single scientific field.

Publication counts presented in this study are «whole counts» i.e. in the case of multi-authored publications each participating institution or country got 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 got a whole count of the publication. Whole counting is also followed in both NSI and Incites databases.

As a result, within a given frame of reference, the sum of publications compiled from different unit of analysis -institutions, institution categories or scientific fields –was higher than the actual total numbers of publications. The "share" (%) of publications of each analytical unit was calculated as the number of its publications divided by the actual total number of publications of the frame of reference and not by the sum of individual units. Consequently, "shares" express the participation of a given unit of analysis in the total output of its frame of reference and not its contribution to it. For example, a publication share of 80% for the institution category "Universities" means that in the 80% of Greek publications we record Universities as participating organizations.
The same rule applies when calculating the share (%) of citations and the share of scientific fields.

Finally, the same methodology is used for calculating the number of collaborations at national and international level. Collaboration is defined as co-authorship involving different institutions. International collaboration refers to Greek publications co-authored with institutions in another country (-ies). Exclusively international collaboration refers to Greek publications co-authored only with institutions in another country (-ies). National collaboration refers to Greek publications co-authored with Greek institutions. Exclusively national collaboration refers to Greek publications co-authored only with Greek institutions. No collaboration refers to Greek publications not involving co-authorship across institutions and includes articles either by only one author or articles being the product of intra-institutional collaboration.

Citation Impact Indicators

In bibliometric analysis, a range of indicators is 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. The relative citation impact is used for comparative analysis of publications and compares the citations to publications per unit of analysis (e.g. Greece) in relation to the citations to publications within a certain frame of reference (e.g. OECD countries). The relative citation impact is calculated as the ratio of the corresponding citation impacts. When the value of the relative citation impact is greater than 1, the publications of the analysed unit have a greater impact than those within the reference frame.

A large number of scientific studies confirms that factors such as the different citation practices in various scientific fields or the type of publication affect significantly the citation indicators.

Indeed, publication and citation practices vary among disciplines. There often exist differences between fields of research 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 usually published in national journals, thus affecting citation patterns. Other scientific areas, such as ICT, have conference proceedings as their main publication source. 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**, which is an incremental improvement of the Crown indicator.

The field normalised citation score, or citation score, is the key indicator used in this study to estimate the impact of the publications of the analytical units examined (e.g. institution category, institution, subject filed etc) in relation to the world. The field normalised citation score was calculated using software developed by the National Documentation Center (EKT) allowing for calculations at the level of each publication for each of the 253 subject fields provided by NSI and InCites databases.

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. As an example, the citation score of the institution category "Universities" is the mean value of the citation scores calculated for each of the Universities publications; the citation score of each publication is represented by its citations divided by the world average of citations to publications of the same publication year and the subject field it belongs to.

Finally, another important issue in the calculation of citation impact is the skewed distribution of citations. In many cases, within a given number of publications, a few publications are disproportionately highly cited while a large proportion has only few or no citations at all. This distribution would differ significantly per case (e.g. for scientific fields or institutions). The issue of skewed distribution of citations is not adequately addressed by the common bibliometric indicators. An interesting approach is the logarithm-based citation z-score, which takes both the citation rate variability of different fields into account, as well as the skewed distribution of citations over publications. However, this indicator is rather complicated and was not used in this study since it was not possible to calculate it from Incites and NSI databases.

In this study, we present highly cited publications using indicators for the number **(P Top X%) and percentile (Top X%)** of publications that were ranked worldwide in the 1%, 5%, 10%, 25% and 50% of the most cited publications by publication year and scientific field. These indicators were used complementary to the field normalised citation score (citation score).

Rate of Change

Results regarding the bibliometric indicators throughout the period 1996-2010 were displayed either on an annual basis or within rolling 5-year periods.

The progression and growth for indicators was evaluated using the rate of change determined as follows:

$$\Delta_{t1\text{-}t2} = \frac{1 + (v2 - v1)}{v1}$$

Where: $\Delta_{t1 - t2}$ is the rate of change

n1, n2 are the values of the indicator for the years (or period of years) t1 and t2, respectively.

The indicator is equal to 1 if the values n1, n2 remain the same for the years (or period of years) t1 and t2.

Least number of publications

Field normalised citation scores were calculated per institution, institution category or scientific field only in the case of a "considerable" number of publications i.e. a number that would ensure the reliability of analysis and minimize the influence of random factors without excluding from the analysis organizations with a rather low publications output. Data analysis showed that a threshold of 75 publications for the period 1996-2010, corresponding to 5 publications per year, constituted a good compromise. Given the low number of publications by Greek institutions in most of the cases, the above threshold aims to ensure the reliability of information on the majority of institutions.

Interpretation of results

The study's aim was to provide reliable bibliometric data -an important source of information for the Greek research landscape. Along with the indicators used, there exists a wide range of indicators for the measurement of research activity -such as the number of patents, licenses, research projects, social impact etc-. Within this range, bibliometric indicators are among the most significant metrics.

However, 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 rate of change, the relative citation impact or citation score, the percentage of cited publications or the percentile breakdown of highly cited publications, one has to also consider the number of publications as well as their systematic production over time.

The overall aim of the analysis carried out was not just to identify trends and tendencies but also to highlight outstanding aspects which characterize the output of Greek publications. To this end, we applied a wide range of indicators to compile a comprehensive picture. In order to minimize the influence of random factors, we had to make the following choices and decisions:

- To reflect information regarding current research activity, figures present information and indicators corresponding to the last 5-year period 2006-2010, and not of the last year, so as to control abnormal annual variations.
- We provide, when applicable, a trend analysis throughout the period 1996-2010.
- Cases of low number of publications are highlighted
- To ensure the reliability of results, indicators were calculated only for institutions with a publication output above the threshold (75 publications for the period 1996-2010).

• The calculations did not take into account certain extremely random cases. For example, when calculating citation scores per scientific subfields we excluded extremely highly cited publications produced by institutions with low and unstable number of publications in the field.

• Finally, the study involved a robust infrastructure and appropriate software tools, which will support future bibliometric studies, part of the series. By ensuring consistency in procedures, methodology and software used, we make possible the accurate mapping of research activity for each given period and we may enable comparisons across data.

At last, we should mention that the average number of publications per researcher or per full time equivalent is an indicator widely used in comparative evaluation of research activity of institutions. This indicator allows comparisons in terms of "productivity" and gives more reliable results regarding each institution's performance. Since there was a lack of data about the country's base of researchers, the study presents indicators regarding the volume of publications per institution or institution category which cannot be used as a measure for the evaluation of institutional performance/ productivity.

ANNEX II: INDICATORS

List of bibliometric indicators used

INDICATOR	DESCRIPTION	USAGE/ DEFINITION
Number of publications	The number of publications is calculated on the basis of:	An indication of the volume of research output or productivity for:
	• country total.	• Greece.
	• institution category.	• each category of institutions.
	• scientific field.	• each scientific field.
	• institution.	• each institution.
Share (%) of publications	It is calculated as a percentage of:	An indication for the participation of:
	• Greek publications in relation to EU and OECD publications.	• Greece within EU and OECD publications.
	• publications per institution category in relation to the total number of Greek publications.	• each institution category within all Greek publications.
	• publications falling under one scientific field in relation to the total number of Greek publications.	• each scientific field within all scientific fields.
	• publications issued by an institution in relation to the total number of publications in the same category of institutions.	• each institution within the category it belongs to.
Percent cited publications (%)	The percentage of publications that have received at least one citation. It is calculated using overlapping 5-year periods for the following units of analysis:	An indication for the levels of visibility of scientific publications produced by:
	• country total.	• Greece.
	• institution category.	• each institution category.
	• institution.	• each institution.

INDICATOR	DESCRIPTION	USAGE/ DEFINITION
Number of citations	The number of citations within a specific time period to articles published by the analysed unit during the same time period. It is calculated using overlapping 5-year periods on the following levels:	An indication of the influence and visibility of scientific publications produced by:
	• country total.	• Greece.
	• institution category.	• each institution category.
	• scientific field.	• each scientific field.
	• institution.	• each institution.
Share of citations (%)	It is calculated using overlapping 5-year periods as the percentage of citations received by the publications of:	An indication for the influence and visibility of:
	• Greece in relation to the number of citations that EU and OECD's publications received.	• Greece within the EU and OECD.
	• citations in one institution category in relation to the total number of citations for Greek publications.	• each institution category within Greece
	• citations found in each scientific field in relation to the total number of citations for Greek publications.	• each scientific field within all scientific fields.
	• citations in each institution in relation to the total number of citations for the category of institutions.	• each institution within the category it belongs to.

INDICATOR	DESCRIPTION	USAGE/ DEFINITION
Citation impact	The citation impact is the average number of citations per publication and 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. Calculations have been performed using overlapping 5-year periods. As this indicator does not take into account the variations of citation practices within the different scientific fields, it was only used for the calculation of the citation impact of all Greek scientific publications.	An indication of the impact of publications.
Relative citation impact	The relative citation impact compares the citations to publications per unit of analysis [e.g. Greece] in relation to the citations to publications within a certain frame of reference [e.g. the EU countries]. It is calculated as the ratio of the corresponding citation impacts. When the value of the relative citation impact is greater than 1, the publications of the analysed unit have a greater impact than those within the reference frame. The indicator does not take into account the variations of citation practices within the different scientific fields. In this study the relative citation impact was only used to establish Greece's place amongst the member countries of the EU and the OECD and was calculated as the ratio of the citation impact for all Greek publications to the citation impact for the countries of the EU and the OECD.	With reference to all Greek publications in all scientific fields, comparison can be made between the impact of Greek publications and those of EU and OECD publications.

INDICATOR	DESCRIPTION	USAGE/ DEFINITION
Field normalised citation score (abv: citation score)	This indicator expresses the citation impact normalised according to subject field. It compares the average number of citations to the publications of an analysed unit to the average number of citations to international publications from the same year, in the same research field. The Field Normalised Citation Score, or citation score, is the key indicator used in this study to estimate the impact of the publications of an analyzed unit in relation to world. It was calculated using software particularly developed by EKT. The specific software permitted normalisation of the citation values on an individual article level on the basis of the distribution of publications over the 253 subject fields designated by NSI and NCR-Greece. 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. In the study citation scores were calculated after normalisation for:	An indication for the impact of publications taking into account differences in citation practices across scientific fields. The impact of publications relative to world is derived for:
	• the sum of Greek publications.	• Greece.
	• Greek publications by scientific fields.	• Greece within the 6 major scientific fields.
	• the sum of publications for an institution category.	• each institution category.
	• the publications for an institution category by scientific field.	• each institution category within the 6 major scientific fields.
	• the sum of publications for an institution.	• each institution.

INDICATOR	DESCRIPTION	USAGE/ DEFINITION
Number of top publications (P Top X%)	It is the number of publications attributed to a unit that belongs to the X% most cited publications in the world from the same year, in the same subject field. The ranking was carried out based on the number of citations. The indicator was calculated for 5-year periods to the percentile levels 1%, 5%,10%, 25% and 50% [that is the number of publications that were ranked worldwide in the 1%, 5%, 10%, 25% and 50% most cited publications] on the following levels:	An indication of the volume of high impact publications produced by:
	• for country total.	• Greece.
	• per institution category.	• each institution category.
	• per institution.	• each institution.
Percentile breakdown of top publications (Top X%)	It is the share (%) of publications attributed to a unit that belong to the X% most cited publications in the world from the same year, in the same subject field. It is calculated at percentile levels of 1%, 5%, 10%, 25% and 50%. When the percentile breakdown of a unit is approximately that of the corresponding world breakdown (or surpasses it) 1%, 5%, 10%, 25% and 50%, then the performance of the unit is considered equal or above the world average. The indicator is calculated over time periods of five years:	Comparison to the world average for percentile breakdown of top publications is made for:
	• for country total.	• Greece.
	• per institution category.	• each institution category.
	• per institution.	• each institution.

ANNEX III: SCIENTIFIC FIELDS

Classification of the Subject fields of the NSI and Incites Thomson Reuters databases into the six major scientific fields and the Field categories of the Frascati manual/ OECD

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
Natural Sciences	Mathematics	• mathematics
		• mathematics, applied
		• mathematics, interdisciplinary applications
		• comp critical reviews
		• statistics & probability
	Computer and Information Sciences	• computer science, artificial intelligence
		• computer science, cybernetics
		• computer science, information systems
		• computer science, interdisciplinary applications
		• computer science, software engineering
		• computer science, theory & methods
		• mathematical & computational biology
		• acoustics
	Physical Sciences	• astronomy & astrophysics
		• optics
		• physics, applied
		• physics, atomic, molecular & chemical
		• physics, condensed matter
		• physics, fluids & plasmas
		• physics, mathematical
		• physics, multidisciplinary
		• physics, nuclear
		• physics, particles & fields
		• chemistry, analytical
	Chemical Sciences	• chemistry, applied
		• chemistry, inorganic & nuclear
		• chemistry, multidisciplinary
		• chemistry, organic
		• chemistry, physical
		• crystallography
		• spectroscopy
		• electrochemistry
		• polymer science

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
	Earth and related Environmental Sciences	• oceanography
		• paleontology
		• geochemistry & geophysics
		• geography, physical
		• geology
		• geoSciences, multidisciplinary
		• meteorology & atmospheric Sciences
		• mineralogy
		• water resources
		• environmental Sciences
	Biological Sciences	• behavioral Sciences
		• biochemical research methods
		• biochemistry & molecular biology
		• biodiversity conservation
		• biology
		• biology, miscellaneous
		• biophysics
		• cell biology
		• developmental biology
		• ecology
		• entomology
		• evolutionary biology
		• genetics & heredity
		• limnology
		• marine & freshwater biology
		• microbiology
		• mycology
		• ornithology
		• plant Sciences
		• reproductive biology
		• virology
		• zoology
	Other Natural Sciences	• microscopy
Engineering & Technology	**Civil Engineering**	• construction & building technology
		• engineering, civil
		• transportation science & technology
	Electrical Engineering, Electronic Engineering, Information Engineering	• automation & control systems
		• computer science, hardware & architecture
		• engineering, electrical & electronic
		• robotics

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
		• telecommunications
	Mechanical Engineering	• engineering, aerospace
		• engineering, industrial
		• engineering, manufacturing
		• engineering, mechanical
		• mechanics
		• nuclear science & technology
		• thermodynamics
	Chemical Engineering	• engineering, chemical
	Materials Engineering	• materials science, ceramics
		• materials science, characterization & testing
		• materials science, coatings & films
		• materials science, composites
		• materials science, multidisciplinary
		• materials science, paper & wood
		• materials science, textiles
		• metallurgy & metallurgical engineering
		• metallurgy & mining
	Medical Engineering	• engineering, biomedical
	Environmental Engineering	• energy & fuels
		• engineering, environmental
		• engineering, geological
		• engineering, marine
		• engineering, ocean
		• engineering, petroleum
		• mining & mineral processing
		• remote sensing
	Industrial Biotechnology	• materials science, biomaterials
		• medical laboratory technology
		• neuroimaging
	Nano-technology	• nanoscience & nanotechnology
	Other Engineering and Technologies	• food science & technology microbiology
		• engineering, multidisciplinary
		• imaging science & photographic technology
		• instruments & instrumentation
Medical & Health Sciences	**Basic Medicine**	• anatomy & morphology
		• chemistry, medicinal
		• cytology & histology
		• immunology
		• neuroSciences

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
		• pathology
		• pharmacology & pharmacy
		• physiology
		• toxicology
	Clinical Medicine	• allergy
		• andrology
		• anesthesiology
		• cardiac & cardiovascular systems
		• clinical neurology
		• critical care medicine
		• dentistry, oral surgery & medicine
		• dermatology
		• emergency medicine
		• endocrinology & metabolism
		• gastroenterology & hepatology
		• geriatrics & gerontology
		• hematology
		• medicine, general & internal
		• obstetrics & gynecology
		• oncology
		• ophthalmology
		• orthopedics
		• otorhinolaryngology
		• pediatrics
		• peripheral vascular disease
		• psychiatry
		• radiology, nuclear medicine & medical imaging
		• respiratory system
		• rheumatology
		• surgery
		• transplantation
		• urology & nephrology
	Health Sciences	• health care Sciences & services
		• health policy & services
		• infectious diseases
		• medical ethics
		• medical informatics
		• nursing
		• nutrition & dietetics
		• parasitology
		• public, environmental & occupational health

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
		• primary health care
		• social Sciences, biomedical
		• sport Sciences
		• substance abuse
		• tropical medicine
	Other Medical Sciences	• integrative & complementary medicine
		• medicine, legal
		• medicine, miscellaneous
		• medicine, research & experimental
	Medical Biotechnology	• cell & tissue engineering
Agricultural Sciences	**Agriculture, Forestry, and Fisheries**	• agronomy
		• fisheries
		• forestry
		• horticulture
	Animal and Dairy Science	• agriculture, dairy & animal science
	Veterinary Science	• veterinary Sciences
	Other Agricultural Sciences	• agricultural economics & policy
		• agricultural engineering
		• agriculture, multidisciplinary
Social Sciences	**Psychology**	• ergonomics
		• psychology
		• psychology, applied
		• psychology, biological
		• psychology, clinical
		• psychology, developmental
		• psychology, educational
		• psychology, experimental
		• psychology, mathematical
		• psychology, multidisciplinary
		• psychology, psychoanalysis
		• psychology, social
	Economics and Business	• business
		• business, finance
		• economics
		• industrial relations & labor
		• management
		• operations research & management science
	Educational Sciences	• education & educational research
		• education, scientific disciplines
		• education, special
	Sociology	• anthropology

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
		• cultural studies
		• demography
		• ethnic studies
		• family studies
		• gerontology
		• social issues
		• social work
		• sociology
		• women's studies
	Law	• criminology & penology
		• law
	Political Sciences	• international relations
		• political science
		• public administration
	Social and Economic Geography	• area studies
		• environmental studies
		• geography
		• planning & development
		• transportation
		• urban studies
	Media and Communications	• communication
		• information science & library science
	Other Social Sciences	• history of social Sciences
		• social Sciences, interdisciplinary
		• social Sciences, mathematical methods
Humanities	**History and Archaeology**	• archaeology
		• history
	Languages and Literature	• classics
		• linguistics
		• literary reviews
		• literary theory & criticism
		• literature
		• literature, African, aust, can
		• literature, american
		• literature, british isles
		• literature, german, dutch, scandinavian
		• literature, romance
		• medieval & renaissance studies
	Philosophy, Ethics and Religion	• asian studies
		• ethics
		• history & philosophy of science

MAJOR FIELDS OF SCIENCE & TECHNOLOGY Frascati Manual	FIELD CATEGORIES Frascati Manual	SUBJECT FIELDS NSI & Incites Databases
		• philosophy
		• religion
	Arts	• architecture
		• art
		• dance
		• film, radio, television
		• folklore
		• music
		• poetry
		• theater
	Other Humanities	• humanities, multidisciplinary

ANNEX IV: INSTITUTIONS
Institutions examined

Institution categories			
Sector	**Category**	**Abbreviation**	**Description**
Higher Education	Universities	Universities	Universities and Technical Universities, University Research Institutes (U.R.I.) and University Hospitals
	Technological Education Institutes	TEI	Technological Education Institutes
Research	Research Centers supervised by the General Secretariat of Research and Technology	GSRT Research Centers	Research Centers supervised by the General Secretariat of Research and Technology
	Other Public Research Institutions	Other Public Research Institutions	Other Public Research Institutions supervised by various Ministries
Health	Public Health Institutions	Public Health Institutions	Public Health Institutions of the national health system, hospitals, Institutions supervised by the Ministry of Health and Social Solidarity and Hospitals supervised by the Ministry of Defence
	Private Health Institutions	Private Health Institutions	Private Institutions active in the health sector such as private hospitals, diagnostic centers, research centers etc.
Other Public Institutions		Other Public Institutions	Ministries, Museums, Higher Military Education Institutions, Other Public Institutions and Public Enterprises
Other Private Institutions		Other Private Institutions	Other Private Institutions such as Private Educational Institutions, Museums, Banks, non-profit organisations, non-governmental organisations and private enterprises

1. Higher Education Institutions - Universities

1. Athens School of Fine Arts	ASFA
2. Aristotle University of Thessaloniki	AUTH
3. Agricultural University of Athens	AUA
4. Demokritos University of Thrace	DUTH
5. International Hellenic University*	IHU
6. National & Kapodistrian University of Athens	UOA
7. Hellenic Open University	HOU
8. National Technical University of Athens	NTUA
9. Ionian University	IONIO
10. Athens University of Economics and Business	AUEB
11. University of the Aegean	AEGEAN
12. University of Western Greece**	UWG
13. University of Western Macedonia	UOWM
14. University of Thessaly	UTH
15. University of Ioannina	UOI
16. University of Crete	UOC
17. University of Macedonia of Economic and Social Sciences	UOM
18. University of Patras	UPATRAS
19. University of Piraeus	UNIPI
20. University of Peloponnese	UOP
21. University of Central Greece	UCG
Panteion University of Social and Political Sciences	PANTEION
23. Technical University of Crete	TUC
24. Harokopio University of Athens	HUA

University publications also include the publications produced by affiliated Research Institutes as well as the publications by the University Hospitals:

1. Eginition Hospital
2. Aretaieio Hospital
3. University General Hospital "ATTIKON"
4. University General Hospital of Thessaloniki AHEPA
5. University Hospital of Alexandroupolis / Academic General Hospital of Alexandroupolis
6. University General Hospital Of Heraklion / Venizelio-Panakio Hospital of Heraklion
7. General University Hospital of Larissa
8. University Hospital of Ioannina / Hadjukosta General Hospital of Ioannina
9. General University Hospital of Patras / "Agios Andreas" General Hospital Patras

* Due to a low number of publications, the International Hellenic University and the Athens School of Fine Arts have not been examined.

* University of Western Greece was founded in 2009 and it includes three Departments. Until 2009, these Departments (Department of Administration, Department of Natural Resources and Department of Business) were part of the University of Ioannina. Given that it was not possible to isolate publications produced by these Departments from the sum of publications produced by the University of Ioannina, University of Western Greece was not represented in the University list.

2. Higher Education Institutions - TEI

1. School of Pedagogical and Technological Education - ASPETE
2. TEI (Technological Educational Institution) of Athens
3. TEI (Technological Educational Institution) of West Macedonia
4. TEI (Technological Educational Institution) of Epirus
5. TEI (Technological Educational Institution) of Thessaloniki
6. TEI (Technological Educational Institution) of Ionian Islands
7. TEI (Technological Educational Institution) of Kavala
8. TEI (Technological Educational Institution) of Kalamata
9. TEI (Technological Educational Institution) of Crete
10. TEI (Technological Educational Institution) of Lamia
11. TEI (Technological Educational Institution) of Larissa
12. TEI (Technological Educational Institution) of Messolonghi
13. TEI (Technological Educational Institution) of Patras
14. TEI (Technological Educational Institution) of Piraeus
15. TEI (Technological Educational Institution) of Serres
16. TEI (Technological Educational Institution) of Chalkida

3. Research Centers supervised by the General Secretariat of Research and Technology (GSRT)

1. Athena - Research and Innovation Center in Information, Communication and Knowledge Technologies	ATHENA
2. National Observatory of Athens	NOA
3. National Hellenic Research Foundation	NHRF
4. The Center for Research and Technology Hellas	CERTH
5. National Center of Scientific Research DEMOKRITOS	NCSR DEMOKRITOS
6. Hellenic Center for Marine Research	HCMR
7. National Center for Social Research	EKKE
8. Greek Atomic Energy Commission	GAEC
9. Hellenic Pasteur Institute	HPI
10. Biomedical Sciences Research Center "Alexander Fleming"	B.S.R.C. Fleming
11. Foundation for Research and Technology - Hellas	FORTH
12. Center For Research And Technology Thessaly	CE.RE.TE.TH

*In the publications produced by ATHENA and CERTH we included publications produced by independent Institutes that subsequently merged with ATHENA and CERTH.

* Due to a low number of publications, we do not present analytical information for the National Center of Social Research.

4. Other Public Research Institutions

1. Academy of Athens	Academy of Athens
2. National Agricultural Research Foundation	NAGREF
3. Research Academic Computer Technology Institute	RA-CTI
4. Institute of Geology and Mineral Exploration	IGME
5. Institute of Engineering Seismology and Earthquake Engineering Research and Technical Institute	ITSAK
6. Center for Renewable Energy Sources and Saving	CRES
7. Center of Planning and Economic Research	KEPE
8. Benaki Phytopathological Institute	BPI

* In publications by the Academy of Athens, we also included publications by the Medical and Biological Research Foundation (IIBEAA).

*In 2011, Computer Technology Institute (CTI) was renamed in Computer Technology Institute and Press "Diophantus". Given that the study extends until 2010, we refer to the institute with its former name - CTI.

*n 2011, the Institute of Engineering Seismology and Earthquake Engineering Research and Technical Institute (ITSAK) merged with the Institute for Earthquake Protection Planning. Given that the study extends until 2010, we refer to the institute with its former name as "ITSAK".

*Today, the Center for Renewable Energy Sources (KAPE) is supervised by the Ministry of Environment, Energy and Climate change. Given that KAPE was supervised by GSRT since 2008,in our previous study (Greek Scientific Publications 1993-2008), the Institute was included in the category "GSRT Research Centers".

5. Public Health Institutions

1. "Agios Savvas" Regional Hospital for Cancer Treatment	AGIOS SAVVAS
2. "Aghia Sophia" Children's Hospital	AGHIA SOPHIA
3. G. Gennimatas General Hospital of Athens	G. GENNIMATAS
4. G. Papanikolaou General Hospital of Thessaloniki	G. PAPANIKOLAOU
5. Evaggelismos Hospital Athens	EVAGGELISMOS
6. THEAGENIO Cancer Hospital of Thessaloniki	THEAGENIO
7. "Ippokratio" Regional General Hospital of Athens	IPPOKRATEIO ATHENS
8. IPPOKRATEIO General Hospital of Thessaloniki	IPPOKRATEIO THESSALONIKI
9. KORGIALENIO-BENAKIO Hospital of Athens	KORGIALENIO
10. General Hospital of Athens LAIKO	LAIKO
11. Metaxa Cancer hospital of Piraeus	METAXA
12. Hospitals supervised by Ministry of National Defence	MOD HOSPITALS
13. G. PAPAGEORGIOU General Hospital	G. PAPAGEORGIOU
14. SOTIRIA General Hospital of Athens	SOTIRIA
15. Tzaneio General Hospital of Piraeus	TZANEIO
16. Onassis Cardiac Surgery Center	O.C.S.C.

6. Private Health Institutions

1. Alfa Institute of Biomedical Sciences	AIBS
2. Hellenic Cooperative Oncology Group	HeCOG
3. METROPOLITAN hospital	METROPOLITAN
4. St. Luke's Hospital	St. Luke
5. Henry Dunant hospital	Henry Dunant
6. EUROCLINIC Group	EUROCLINIC GROUP
7. IASO Hospital	IASO
8. Athens Medical Group	ATHENS MEDICAL GROUP
9. HYGEIA Group	Hygeia

*The HYGEIA Group includes HYGEIA General Hospital, MITERA and LETO Maternity Hospitals.

ANNEX V: OECD MEMBER COUNTRIES

Member countries of the OECD and the EU (2010)

A. OECD Member Countries

In 2010, the OECD was enlarged with 4 new member states: Estonia, Israel, Slovenia and Chile. The bibliometric indicators of Greece are compared to those of the following OECD- 34 countries:

1. Australia	18. Canada
2. Austria	19. Luxembourg
3. Belgium	20. Mexico
4. France	21. New Zealand
5. Germany	22. Norway
6. Denmark	23. South Korea
7. Switzerland	24. Netherlands
8. Greece	25. Hungary
9. Estonia	26. Poland
10. United States	27. Portugal
11. United Kingdom	28. Slovakia
12. Japan	29. Slovenia
13. Ireland	30. Sweden
14. Iceland	31. Czech Republic
15. Spain	32. Turkey
16. Israel	33. Finland
17. Italy	34. Chile

B. Members States of the European Union

The bibliometric indicators of Greece are compared to those of the following 27 member states of the European Union:

1. Austria
2. Belgium
3. Bulgaria
4. France
5. Germany
6. Denmark
7. Greece
8. Estonia
9. United Kingdom
10. Ireland
11. Spain
12. Italy
13. Cyprus
14. Latvia
15. Lithuania
16. Luxembourg
17. Malta
18. Netherlands
19. Hungary
20. Poland
21. Portugal
22. Romania
23. Slovakia
24. Slovenia
25. Sweden
26. Czech Republic
27. Finland

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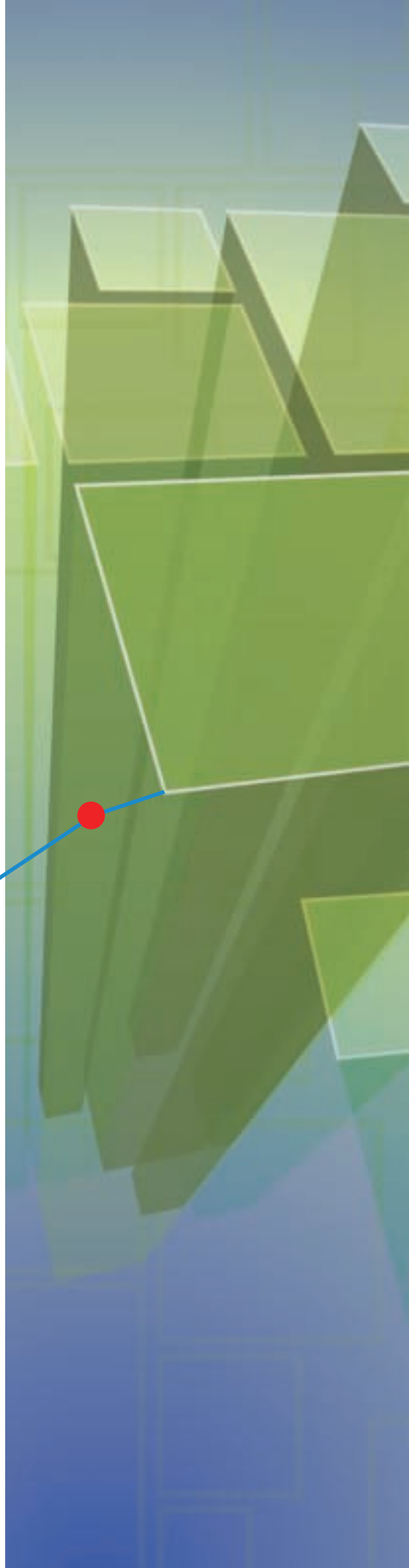

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