

*Nanosciences, Nanotechnologies,
Materials and new Production*

Technologies

*Hellenic National Scientific and
Technological Initiatives*

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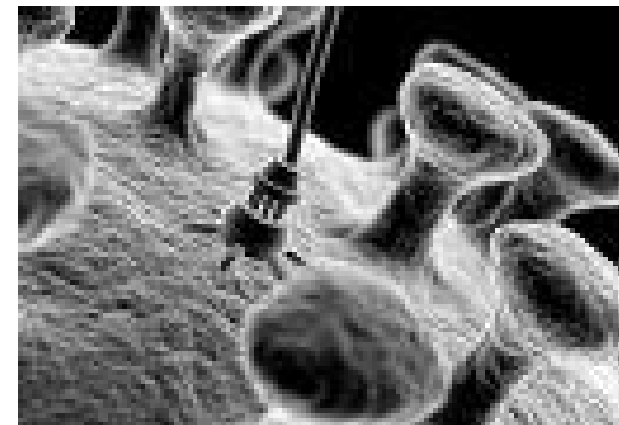
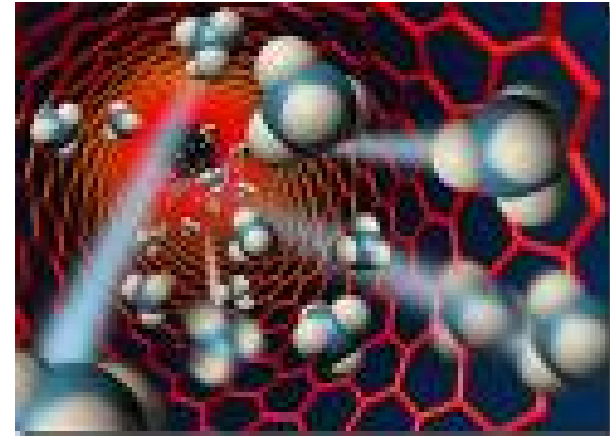
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DEFINITION OF NANOTECHNOLOGY

- **Nanotechnology** is the study, design, creation, synthesis, manipulation, and application of functional materials, devices, and systems through control or tailoring of matter at the nanometer scale

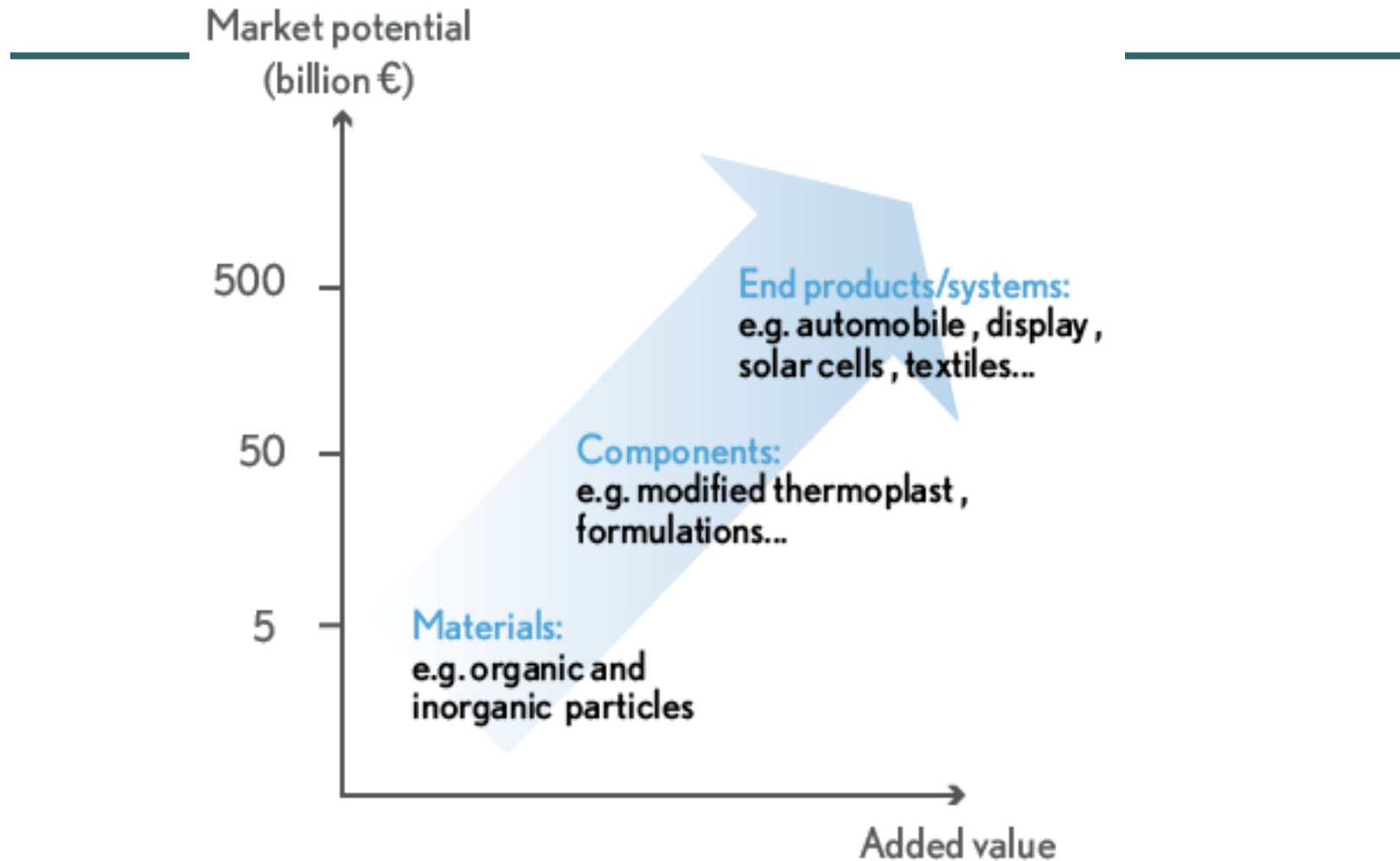
(1–100 nanometers)

- one nanometer being equal to 1×10^{-9} of a meter), that is, at the atomic and molecular levels, and the exploitation of novel phenomena

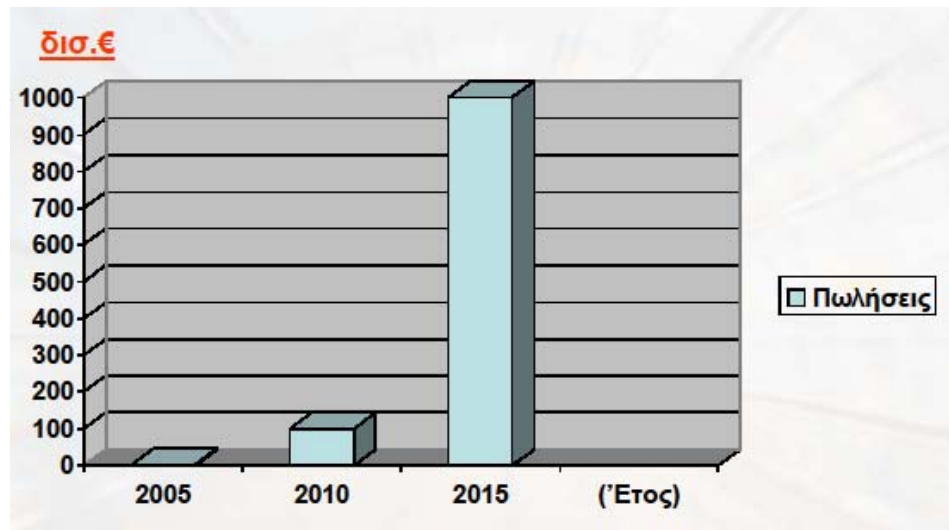


MARKET POTENTIAL

Market potential of nanotechnology.



R&D in Nanotechnology GLOBAL



IN THE REST OF THE WORLD

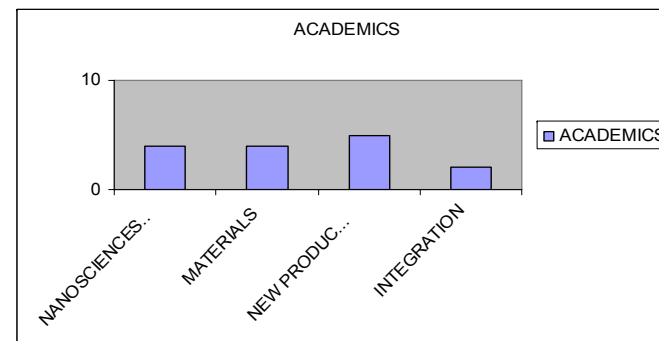
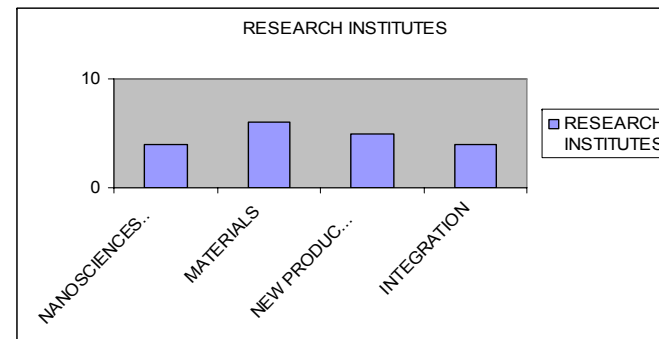
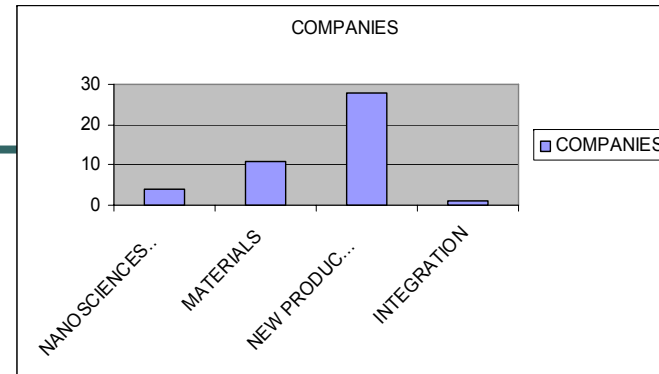
ΕΤΟΣ	2000	2003	2005	2008
ΗΠΑ	0,22	1,07	1,3	3,7
ΚΙΝΑ			0,2	0,5
ΙΑΠΩΝΙΑ	0,4	0,8	1,2	2,5
ΤΟΥΡΚΙΑ			→ 0,8	
ΚΟΡΕΑ				→ 2,0

IN EU

ΕΤΟΣ	1997	2003	2005	2007-2014
ΕΕ	0,2	0,35	1	3,5

R&D MAP of GREECE 2000-2006

- The priorities of the Greek research financed by (GSRT),
- The total funding over the past 6 years (2000-2006) was
~ 800 million Euros (?)
- administered by the General Secretariat for Research and Technology (GSRT), Ministry for Development.
- **8.4 % (~ 6,400,000 Euros)**
- NMP related projects!!!
- (2004 it was 1,2 Meuros, GSRT)



R&D MAP of GREECE 2000-2006

	1.1.Nanosciences and converging sciences	1.2.Nano-scale mechanisms of bio/non-bio interactions	1.3.Impact on Health and Environment	2. MATERIALS	3. NEW PRODUCTION	4.INTEGRATION	Nanomedicine	Nanoelectronics	Security
Universities	3	3	3	4	5	1	1	0	0
Research Institutes	2	2	3	6	5	0	0	1	1
Companies	0	0	2	11	28	0	1	0	0

Table 1: Participation of Greek Organisations in priority 3 of the FP6

R&D MAP of GREECE 2007-2013

	1.1.Nanosciences and converging sciences	1.2.Nano-scale mechanisms of bio/non-bio interactions	1.3.Impact on Health and Environment	2. MATERIALS	3. NEW PRODUCTION	4.INTEGRATION	Nanomedicine	Nanoelectronics	Security
Universities									
Research Institutes									
Companies									

**Table 1: Participation of Greek Organisations in priority 3 of the FP7
EXPECTED TO BE STRONGER (No Data)**

THE GREEK LANDSCAPE



NCSR "D"

- **Nanoporous** membranes, Carbon nanotube production and modification, nanotechnology applications in waste water treatment and desalination
- **Nanomagnetism**, Recording Media, Nanoparticles for medical, biomedical applications
- **Solar** Thermal, PV, **Hydrogen** Storage, Hydrogen Production, **CO₂** capture, Nanofluids
- **Nanoelectronics**, Micro and nano systems (MEMS, NEMS), Bionanotechnology, Microfluidics,
- **Drug delivery**, dendrimers, hyperthermia
- **Nanosafety** and RCS
- Other novel approaches...

THE GREEK LANDSCAPE



FORTH

- **Hydrogen** Production, **Fuel cells**, Energy Efficiency, PV, nanoporous membranes,
- **atomistic modeling** of nanomaterials, sensors and actuators, semiconductors for **electronics and photonics**.



EIE

- **Nanostructured** inorganic and inorganic-organic hybrid materials, **carbon based** nanomaterials, **self-assembled** nanostructures,
- nanoprocessing **in thin films** and surfaces, PV, energy Storage, **hydrogen Storage**, **nanomedicine**, **nanobiotechnology**

THE GREEK LANDSCAPE



CERTH

- Clean Fossil **Fuel Conversion**, **Biomass**
- Biofuels, **Hydrogen** Production, **Energy Efficiency** , nanoporous membranes
- Other novel approaches...

NTUA

- **Polymer processing** and modeling, **mineral technology**, carbon,
- ES buildings, **Energy Systems** modelling, **Hydrogen production**, **micromagnetism**

THE GREEK LANDSCAPE



ΑΡΙΣΤΟΤΕΛΕΙΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΘΕΣΣΑΛΟΝΙΚΗΣ

AUTH

- **Thin Films, Organic Electronics**, nanotubes, nanoparticles, **drug delivery**, **hyperthermia**,
- Other novel Approaches

U Patras

- **Catalysts, fuel cell membranes**, PV, Solar,, Hydrogen Production, **Fuel Cells**

THE GREEK LANDSCAPE

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

- Biofuels

ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

- Waste water treatment

ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ

- Hydrogen, modeling, etc

ΠΑΝΕΠΙΣΤΗΜΙΟ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ

- Fuel cells, hydrogen production

ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ

- minerals, polymers

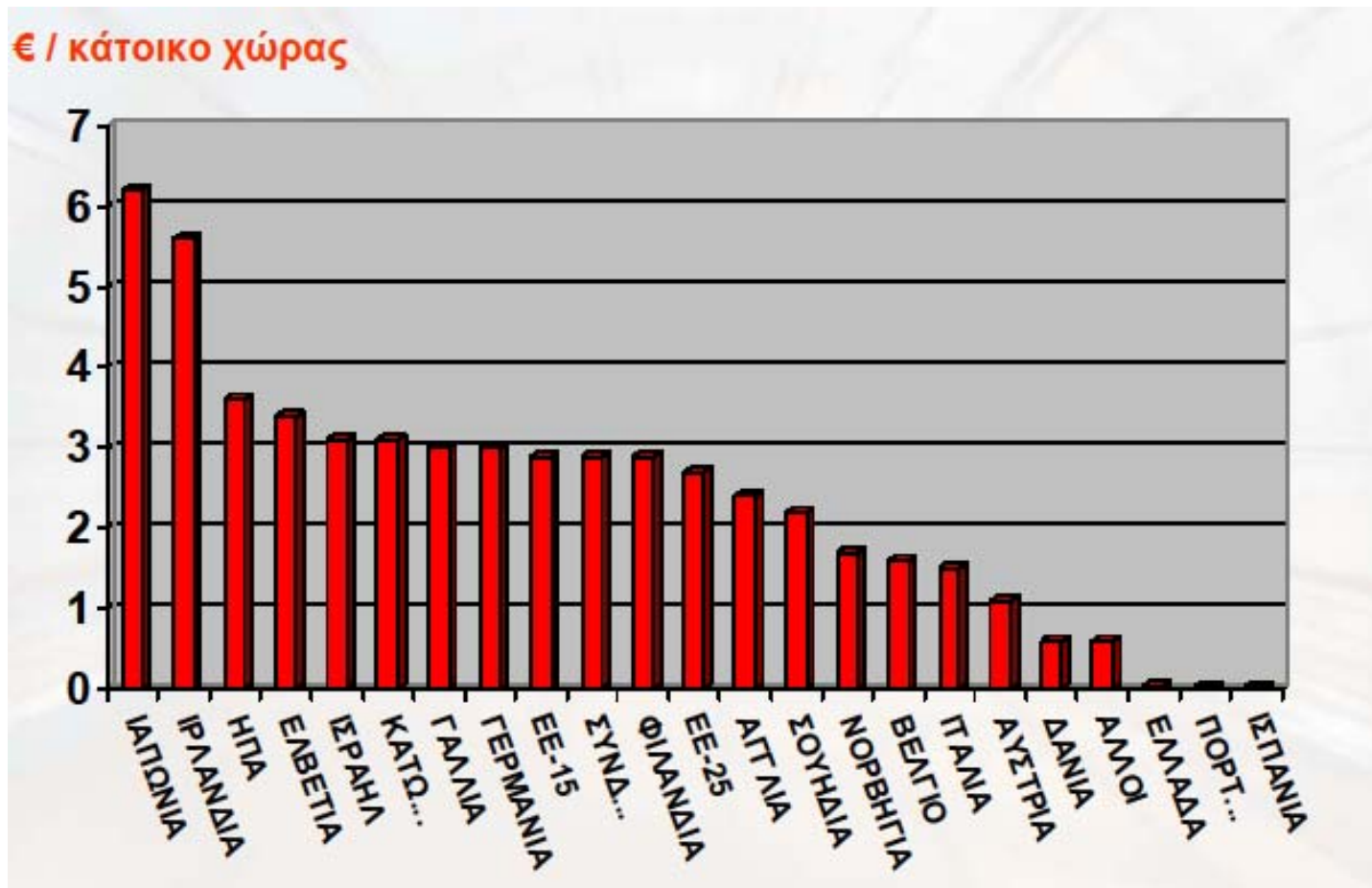
THE GREEK LANDSCAPE

(COMPANIES)

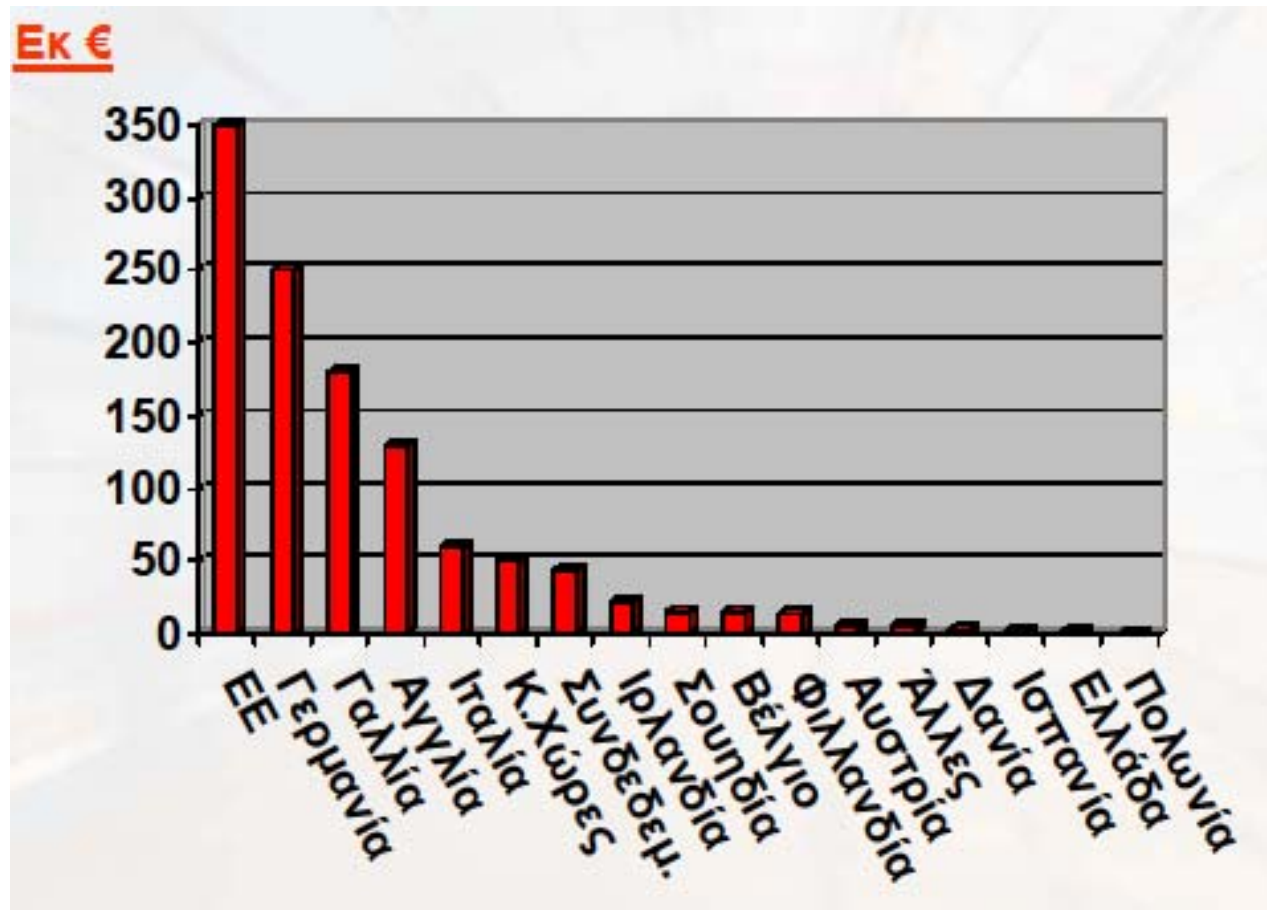
- **Silver & Baryte Co S.A.**
- **Hellenic Aerospace Industry SA,**
- **Hellenic Defence Systems S.A.,**
- **Intracom Group of Companies,**
- **Theon Sensors SA,**
- **Economides Group of Companies,**
- **PPC (Public Power Corporation)-**
power production,
- **Many Public Water Supply and**
Waste Treatment Companies
- **DEPA (Gas sector),**
- **Motor Oil, Phosphorous**
Fertilizers
- **Industry SA,**
- **Zenon S.A.,**
- **Greek Oil**
- **SUC Hellas,**
- **HERACKLES-E.K.E.T. SA,**
- **LAVA-BIOR SA,**
- **ECOTECH Ltd,**
- **Soya Hellas SA,**
- **Lavipharm SA,**
- **TITAN SA,**
- **Petzetakis Group of Companies,**
- **Plastika Kriti is SA,**
- **Plastica Makedonias S.A.,**
- **Argo SA,**
- **Tropical SA,**

Comparison of Investment in EU in nanotechnology per country/

2003 data



Investment in Nanotechnologie in EU (Meuro)



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Weaknesses:

- Lack of access to **large infrastructures** and research facilities.
- Lack of an **adequate database** and accessibility schemes of the relevant large infrastructures and research facilities in Greece.
- Lack of adequate **national funding** and especially of a NMP Initiative
- Lack of **venture capital funds**
- Lack of **sufficient, efficient and suitable** performance assessment methods
- The Greek **Industrial Sector has not entered** the “Nanotechnology” and advanced materials and productions methods era, yet.
- **Fragmentation** of research personnel in “micro scale” research groups,
- Greek research groups and SMEs have an impressive proven record with respect to participation in R&D initiatives during both the FP5 and FP6 Programmes, but.....
- Lack of a well defined and realistic **National NMP policy**.

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Stenghts:

- **Greek Scientists** at the individual level are considered among the European or Worldwide **elite** in their respective scientific areas. In addition most of them have strong ties with Greek scientists abroad.
- Overall the scientific and technological level of the Greek research personnel is by analogy **one of the highest** worldwide.
- **The micro-research groups**, which constitute the majority of the Greek research infrastructure, provide, by definition, increased levels of flexibility in the development and redevelopment and refining of research objectives.
- The **labour and operating costs** of the Greek research groups and laboratories are *well below the European average* thus providing an economic advantage with respect to conducting contracted research projects.
- The competitiveness of Greek Research Groups has been demonstrated in both the FP5 and FP6 WorkProgrammes during which the funds that were directed to projects that included a partner from Greece were almost twice the amount that was officially allocated (**2.9 % compared to 1.9 % contributed**).

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Opportunities:

- The Greek scientific and research society has been **successfully integrated** with EU and non-EU research groups under the FP5 and FP6 WorkProgrammes.
- There exist a number of technology oriented research performing and innovative Greek SMEs and spin-offs which in conjunction to the existing high-quality scientific personnel provides a sound basis for the transformation higher knowledge into high tech products enhancing the competitiveness of the materials and other sectors in Greece.
- Greece may **capitalise on its scientific resources and overall competitive scientific and economic advantage**, as far as scientific ventures are concerned and in conjunction to the two cases above, not only participate in FP7, but also to actively undertake demonstration and/or development efforts through sub-contracting or outsourcing contracts from western and central European organisations

THE GREEK LANDSCAPE

UN Millenium Goals:

These are:

- **Eradicate** Extreme Poverty and Hunger
- Achieve Universal **Primary Education**
- Promote Gender Equality and empower women
- Reduce **Child Mortality**
- Improve **Maternal Health**
- Combat **HIV/AIDS, malaria and other diseases**
- Ensure **environmental sustainability**
- **Develop a global partnership** for development

THE GREEK LANDSCAPE

Nanosciences:

- 1a. Nanomedicine and nano-biotechnology (biosensors, drug delivery, toxicity, etc.)
- b. Nanoelectronics & nanophotonics
- c. Mastering nano-scale complexity in materials
- d. **Self**-assembling and self-organisation
- e. Modeling of microstructural evolution under work conditions and in materials processing
- f. Pilot lines to study, develop and up-scale nanotechnology-based processes from laboratory
- g. Nanoparticle synthesis and (bio-)applications
- h. Nanostructured magnetic, semiconducting, superconducting, ferroelectric and hybrid materials

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Materials:

- 2a. High added value materials based on Greek minerals
- 2b. New knowledge-based multifunctional materials
 - b1. Advanced material architectures for energy conversion and environmental applications
 - b2. Novel biomaterials and bioinspired materials
 - b3. Nanostructured catalysts with tailor-made functional surfaces
 - b4. Health monitoring
 - b5. Construction
 - b6. Bulk magnetic, superconducting, ferroelectric, magnetoelectric, hybrid materials and metamaterials.

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Converging Technologies:

- 3a. Development of new processes based on coal and natural gas
- 3b. Development of novel biomass processes
- 3c. Energy production, storage and conversion
- 3d. Development of novel CO2 capture technology
- 3e. Air pollution and remediation
- 3f. **Food** processing and storage
- 3g. Development of novel **waste water** and **water desalination** systems
- 3h. **Agricultural** productivity enhancement

LINKAGE WITH EXISTING EU JOINT TECHNOLOGY PLATFORMS-1

- Neuroelectronics and biosensors, nano-biotechnology (drug delivery, toxicity, etc.).
- Relevant platforms:
 - [European Nanoelectronics Initiative Advisory Council](#) – ENIAC
 - [Nanotechnologies for Medical Applications](#) - NanoMedicine
 - [Innovative Medicines for Europe](#) - IME
 - [Forest based sector Technology Platform](#) - Forestry
 - [Global Animal Health](#) - GAH
- Nanoelectronics (ENIAC platform roadmap, ARTEMIS) and nanophotonics.
- Relevant Platforms:
 - [Photonics21](#) - Photonics
 - [Photovoltaics](#) - Photovoltaics
 - [European Nanoelectronics Initiative Advisory Council](#) – ENIAC

NANO-DEMOKRITOS-2010

1

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LINKAGE WITH EXISTING EU JOINT TECHNOLOGY PLATFORMS-2

- Energy-biofuels(natural gas, solar cells, novel nanotechnologies).
- Relevant Platforms:
 - [Hydrogen and Fuel Cell Platform](#) - HFP
 - [Zero Emission Fossil Fuel Power Plants](#) - ZEP
- Environmental applications -development of systems for air and water treatment (water platform roadmap).
- Relevant Platforms:
 - [Water Supply and Sanitation Technology Platform](#) - WSSTP
 - [Waterborne ETP](#) - Waterborne
- Food, Agriculture, Biotechnology, chemical and food industry applications.
- Relevant Platforms:
 - [Sustainable Chemistry](#) - SusChem
 - [Future Manufacturing Technologies](#)- MANUFUTURE
- [Food for Life](#) - Food

LINKAGE WITH EXISTING EU JOINT TECHNOLOGY PLATFORMS-3

- Nanomaterials (nanoparticles, dendrimers, nanoporous materials N&N roadmap).
- Relevant Platforms:
 - [Advanced Engineering Materials and Technologies](#) - EuMaT
 - [Future Textiles and Clothing](#) - FTC
 - [European Steel Technology Platform](#) - ESTEP
- Transport, Space & Security.
- Relevant Platforms:
 - [European Space Technology Platform](#) - ESTP
 - [Industrial Safety ETP](#) – Industrial Safety
 - [European Road Transport Research Advisory Council](#) – ERTRAC

ΣΑΣ ΕΥΧΑΡΙΣΤΩ ΓΙΑ ΤΗΝ ΠΡΟΣΟΧΗ ΣΑΣ

References: ETEP Document, www.Researchcenters.gr

K. Kefalas, NMP rep , presentation

Inter. J. nanotechnology, 6, 1/2 , 2009

(Some Greek Nanoactivities)