¡MADRID!

madridEmprende
AGENCIA DE DESARROLLO ECONÓMICO

Current status of Nanotechnology in Madrid

Background

1.- Background

- Madrid Emprende is the City of Madrid's Agency for Economic Development. Founded in January 2005 and chartered to engage a broad range of objectives, including efforts to configure and encourage a technologically advanced, diversified and competitive productive net to drive economic growth, internationalization of the economy and the revitalization of the City.

- "Madrid Emprende Agency for Economic Development is committed to the development of municipal policies in the realm of economic matters within the city of Madrid, with a special focus on territorial harmonization, through execution of commercial infrastructure initiatives, promotion of innovation, promotion of competitiveness and the entrepreneurial spirit among SMEs, development of European projects, internationalization of Madrid's local economy, and, in general, through any activities that can boost the economical development and the socioeconomic harmonization of the city". *(Article 2 of Agency Bylaws)*

Current status of Nanotechnology in Madrid

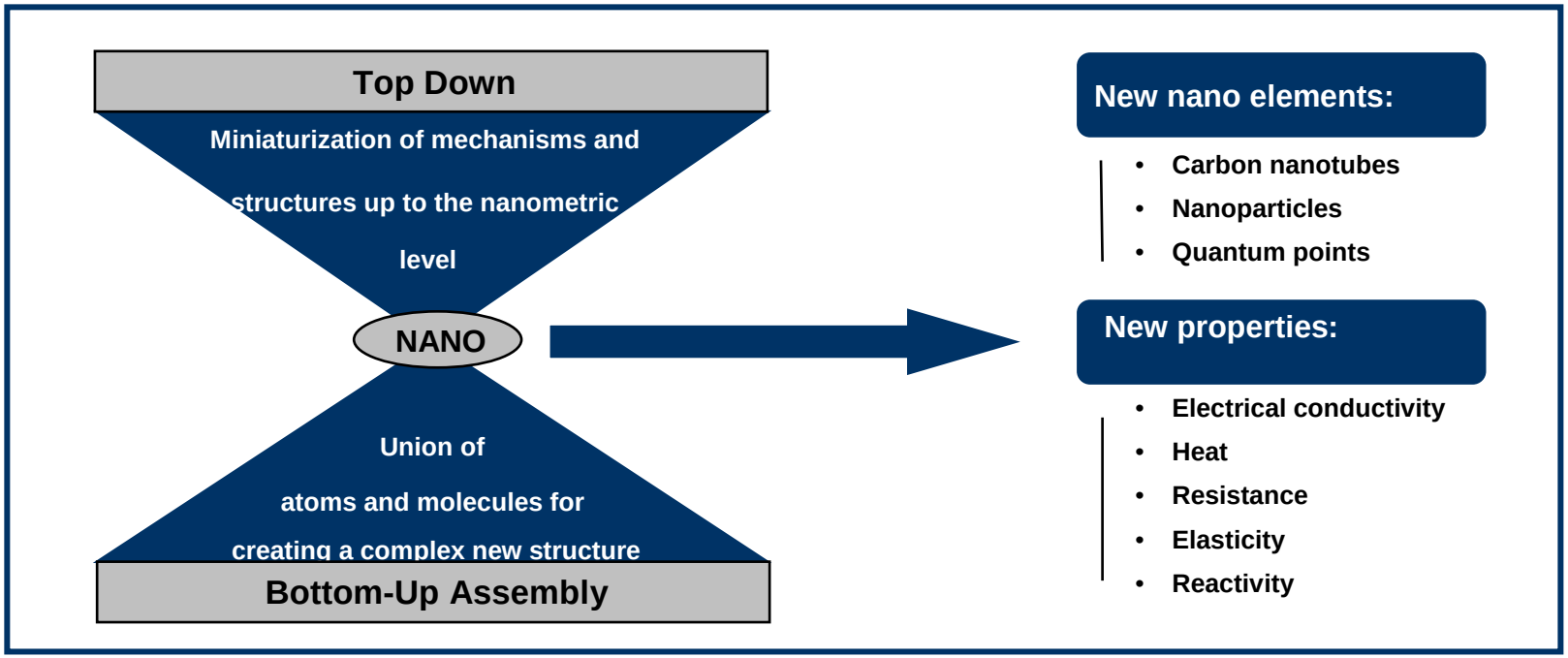
- As part of the support that it provides for innovative processes, Madrid Emprende has launched a strategic project: the creation of the City of Madrid Scientific and Technological Park. New Material Technologies (NTM) and New Living Technologies (NTV), in conjunction with environmental technologies, configure the park model's strategic sectors. These poles are also linked horizontally with New Computing and Communications Technologies (NTICs).

- Within the NTM one can find nanotechnologies and engineering, the 2 primary strategic sectors, and Biomedicine and Biotechnologies within the NTV. Among all of these sub sectors, the agency possesses the least knowledge and information pertaining to nanotechnology, especially regarding its current status in the Community of Madrid.

Status of
Nanotechnology in Madrid

1.- Nanotechnology

➔ Nanotechnology refers to the scientific and technological activities performed on the atomic and molecular level, as well as to new properties encompassed and controlled at that level.



2.- Main applications

➔ The main Nanotechnology applications are: materials, electronics, medicine and energy …

Materials

- Reinforced concrete
- Non-conductive metals
- Scratch-resistant surfaces
- Glasses resistant to high temperatures
- Stain-resistant fabrics and smart fabrics
- Biosensors
- Cosmetics

Electronics

- Storage chips
- Biochips
- Brighter screens
- Communications networks

Medicine

- Administration of drugs
- Implants
- Engineering of fabrics
- Diagnostics systems

Energy

- Fuel cells
- More efficient solar cells
- Hydrogen storage

3.- Segmentation of actors

➔ The organizations involved in Nanotechnology in Madrid include public research centers, universities, large businesses, SMEs and Spinoffs.

Public Sector	Private Sector
R&D Centers	Large Businesses
Technology Center	SMEs / Startups
Universities	Spinoffs

4.- Public R&D Centers (1/1)

➔ More than 10 public R&D centers in Madrid, especially the CSIC, conduct research on nano.

Ministry of Education and Science

CSIC High Council of Scientific Research	CIEMAT Center of Environmental and Technological Research
• ICMM Madrid Institute of Material Science • IMM Madrid Institute of Microelectronics • ICP Institute of Catalysis and Petrochemicals • IO Optics Institute • CNB National Biotechnology Center • IEM Material Structure Institute	• Aerosol Instrumentation Laboratory. INIA National Institute of Agricultural Research and Technology • Environmental Chemistry. IMDEA Madrid Institute of Advanced Studies in Nanoscience Nanotechnology center. New joint project between the Ministry and the Community of Madrid

Ministry of Industry

- CEM
  Spanish Metrology Center

Ministry of Defense

- INTA
  National Institute of Aerospace Technology
- CIDA
  Naval Research and Development Center

5.- Universities (1/2)

➔ R&D in nanotechnology draws from a large number of research groups at each of Madrid's universities.

UAM Autonomous University of Madrid

- SMOL Single Molecule Electronics Laboratory.
- Department of Condensed Material Physics:
  - LASUAM Surfaces Laboratory.
  - Low Temperature Laboratory.
  - New Microscopy Laboratory.
  - Optical Spectroscopy Semiconductor Nanostructures.
  - Linings and Nanostructures Lab.
  - MOLE Moving Light and Electrons.
- Department of Material Physics:
  - Phase and Ferroelectricity Transitions.
- Organic Chemistry Department:
  - Nanoscience and Molecular Materials Group
- Nicolás Cabrera Institute of Material Science:
  - Laboratory of Surface Biofunctionalization.
- Chemistry Department:
  - Supramolecular Chemistry of Coordination.
  - Lumila Group: Org-Inorganic Solids and Luminescent Probes.

Complutense University of Madrid

- School of Physical Sciences:
  - Nano and Microcharacterization of Electronic Materials.
  - Surface Science Laboratory.
  - Quantum Dynamics and Coherence.
  - Complutense Applied Optics Group.
  - Superconductivity and Thin Films.
  - Micro-optics and Nanotechnology, CAI Service.
- School of Chemical Sciences:
  - Biohydrometallurgy.
  - Inorganic Chemistry, Inorganic Materials.
  - Group of Organic Molecular Materials (for solar energy).
  - Complex Systems Group.
  - Group of Union Technologies, Advanced Materials and Eco Technologies.
- IMA Institute of Applied Magnetism.

5.- Universities (2/2)

Polytechnic University of Madrid

- ISOM (UPM)
  Institute of Optoelectronics and Microtechnology Systems.
- Center of Biomedical Technology.
- ETSI Industriales:
  - Chemical Laboratory of Testing and Quality Control.

Carlos III University of Madrid

- Physics Department:
  - Semiconductor Nanostructures Group.

Comillas Pontificate University

- Industrial Engineering:
  - Dimensional Metrology

University of Alcalá

- School of Chemistry:
  - Metallodendrimers Group

6.- Companies

➔ The main Nanotechnology companies in Madrid are: Tolsa and Acciona in the materials sector, Ramem in electronics, Pharmamar in medicine and Repsol YPF in energy.

Materials Sector

- **TOLSA**
  Nanoclays
- **MOLDEO Y DISEÑO**
  Carbon nanofibers
- **PLASTIC OMNIUM**
  Carbon nanofibers
- **ACCIONA INFRAESTRUCTURAS**
  Construction materials
- **EADS CASA**
  R&D applied to its products
- **AIRBUS**
  R&D applied to its products
- **GRUPO SPA**
  Microclimatization of welding, virtual nose
- **REPSOL YPF**
  Polymers

Electronics Sector

- **NANOTEC ELECTRÓNICA**
  Microscopes. Spinoff.
- **RAMEM**
  Precision tooling
- **LÍNEAS Y CABLES**
  Wireless technology

Energy Sector

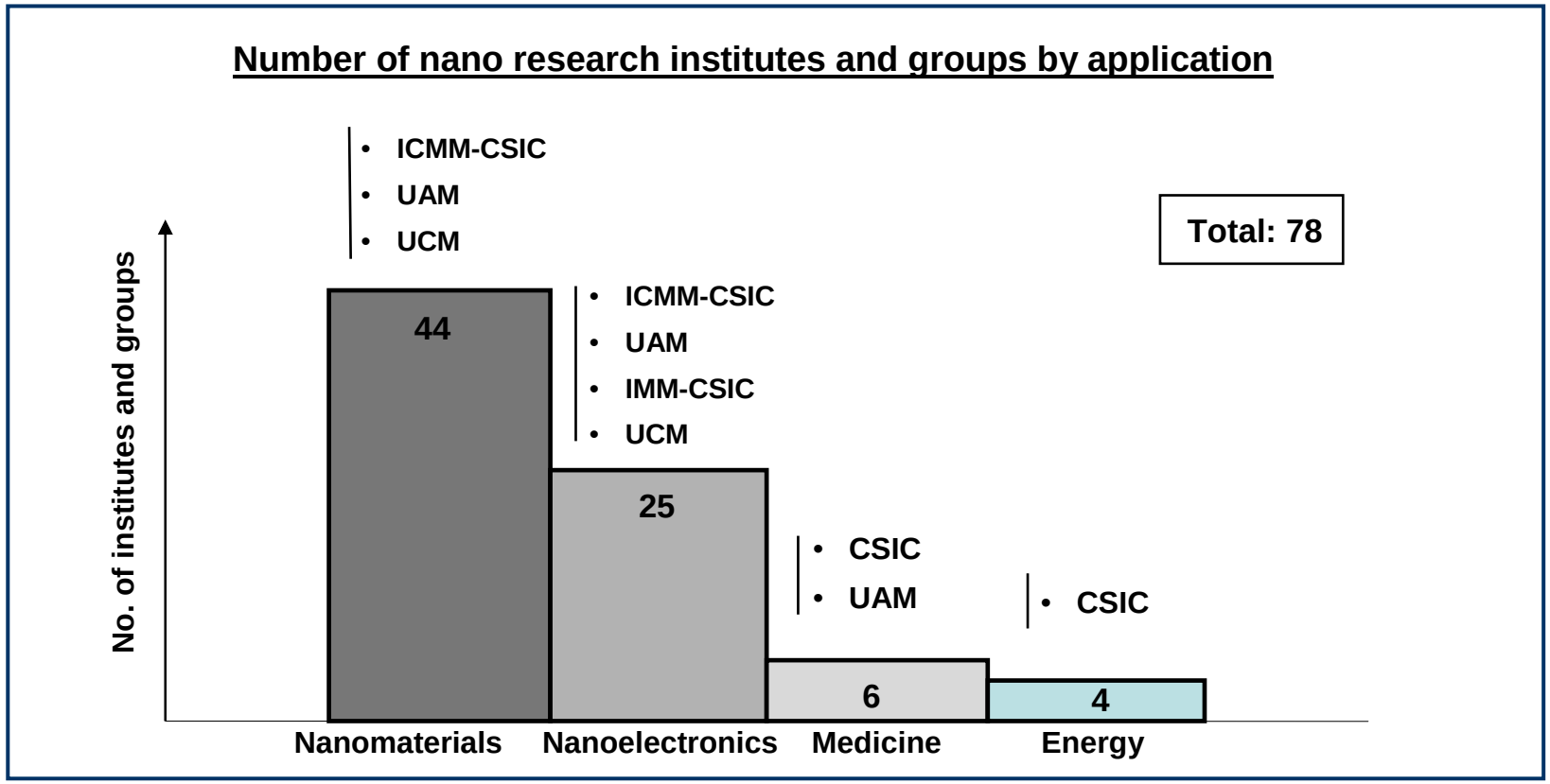
- **REPSOL YPF**
  Nanoparticles in lubricants
- **BP SOLAR**
  Photovoltaic panels
- **CEPSA**
  Nanostructured catalytic oxides

Medical Sector

- **PHARMAMAR**
  Release of drugs
- **SYLENTIS**
  Release of drugs
- **DENDRICO**
  Release of drugs
- **ROVI**
  Release of drugs
- **NEUROPHARMA**
  Release of drugs
- **FAES FARMA**
  Release of drugs
- **ATOS ORIGIN**
  Early diagnosis of cancer

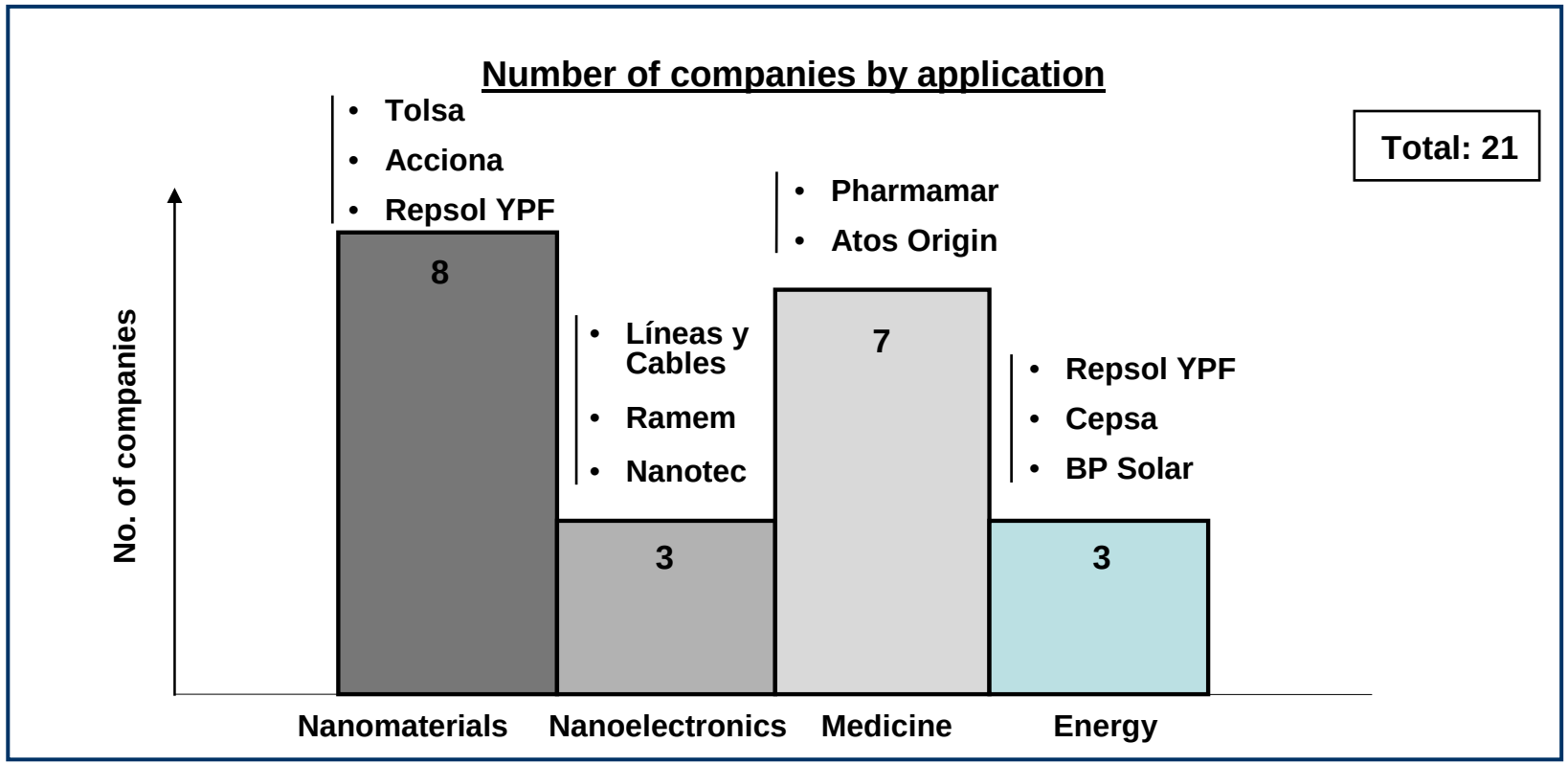
7.- Crossover analysis: by application (1/2)

➔ Public organizations perform the majority of nanoresearch on nanomaterials and nanoelectronics.



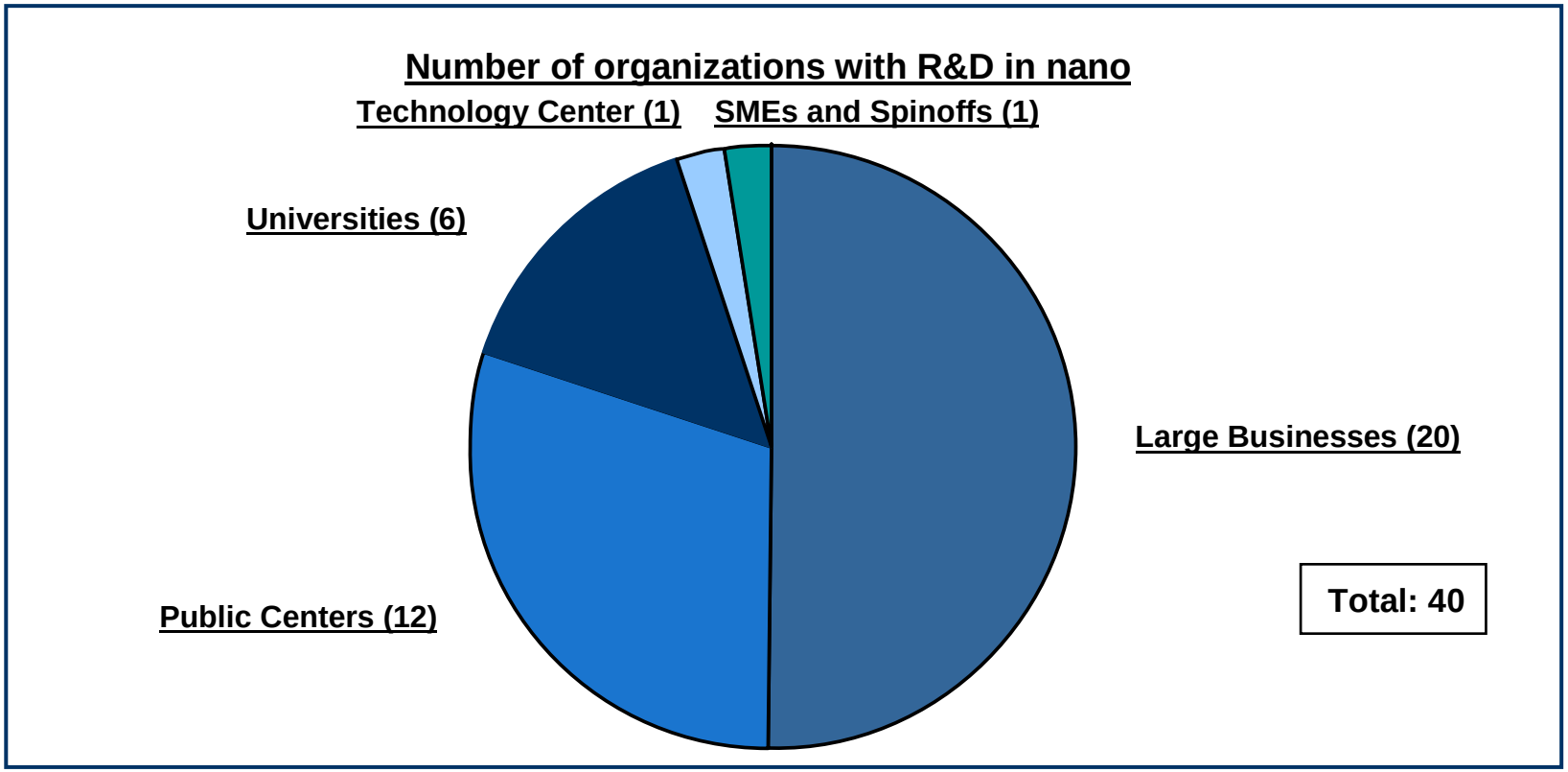
7.- Crossover analysis: by application (2/2)

➔ The majority of private actors in nanotechnology located in Madrid focus on the nanomaterials and nanomedicine sectors.



7.- Crossover analysis: by organizations

➔ The main actors are public R&D centers and large companies: there are very few SMEs, spinoffs and technology centers.



8.- Geographical analysis:

➔ Nanotechnology R&D is dispersed across the whole region with no geographical concentrations.

- Nanomaterials, nanoelectricity and energy companies
- Nanomedicine companies
- Public R&D Centers
- Universities

9.- Analysis by relationship (1/2)

➔ In Madrid, there are collaborative nano networks, programs and projects.

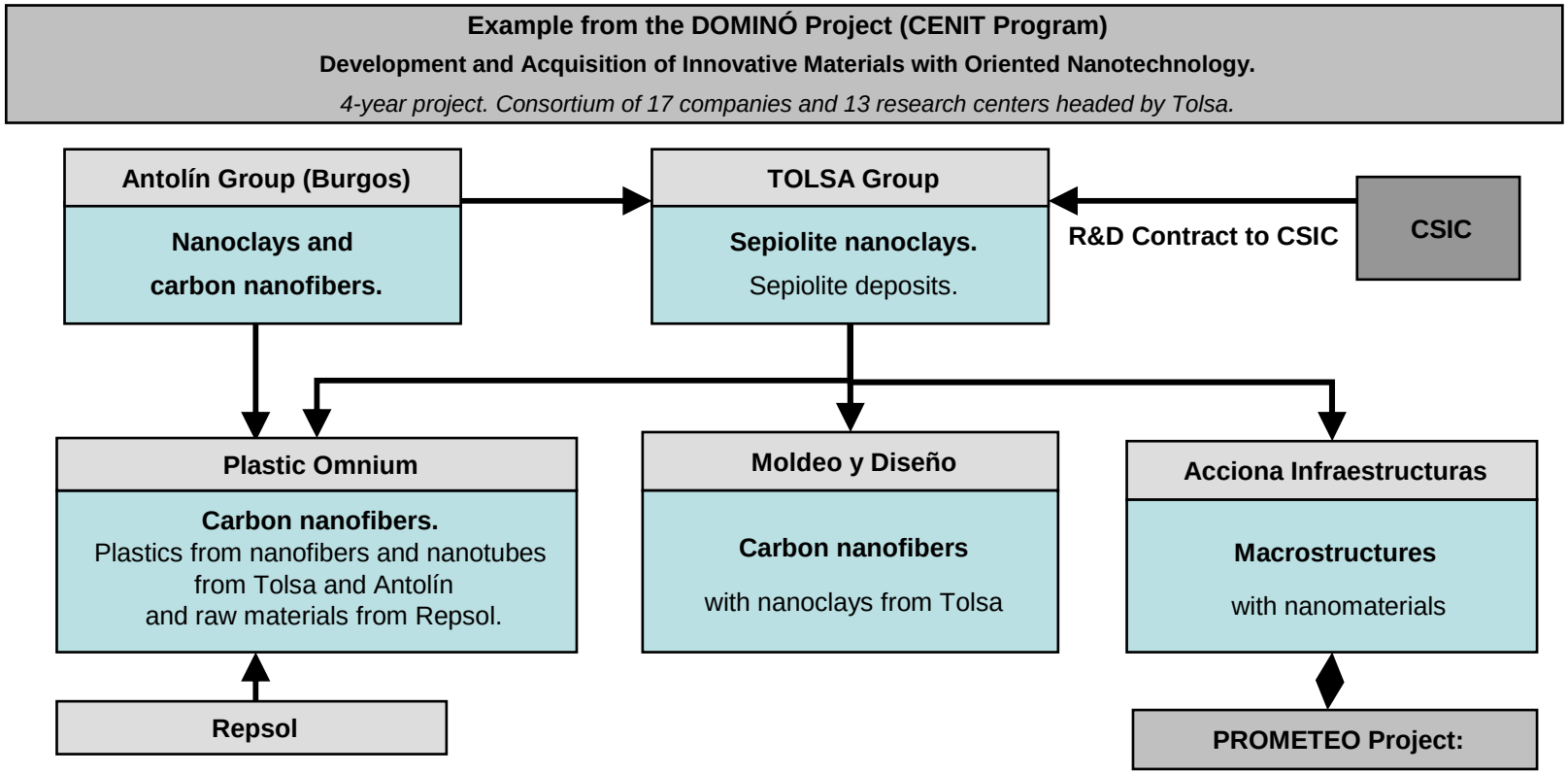
Ministry of Industry - CDTI
CENIT Program **Strategic National Consortiums for Technical Research**
DOMINÓ Project: - Development of Innovative Materials with Guided Nanotechnology. - 17 companies and 13 research centers, headed by Tolsa.
PROMETEO Project: - Development of new materials originating from nanomaterials. Headed by Acciona.
NANOFARMA Project: - Systems for release of drugs. - 7 companies led by Pharmamar.

7PM - European Commission
CONCORDE Project: - Co-ordination of Nanostructured Catalytic Oxide Research and Development in Europe. - Synthesis of catalytic oxides. - Consortium: 16 countries. Coordination: ICP-CSIC. - CEPSA is the only company from Madrid.
LOCCANDIA Project: - Nanotechnology applied to cancer diagnosis through Lab-on-Chip technology, CEA-LETI development.

Networks
NANOSPAIN Network: - Spanish Nanotechnology Network. - 226 research groups and 1200 investigators. - Coordination: Phantoms and CSIC.
NANOMED Network: - Spanish NanoMedicine Platform. - Public and private sector.
BIOSENS Network: - Biosensor devices. Public and private sector.

9.- Analysis by interrelation (2/2)

➔ Thanks to these programs, different actors in the nano sector have begun to collaborate.



10.- Synthesis (1/2)

- **More than 10 public R&D centers in Madrid, most notably CSIC, are involved in nano research and there is a large number of research groups in all of Madrilian universities.**

- **The main Nanotechnology companies in Madrid are: Tolsa and Acciona in the materials sector, Ramem in electronics, Pharmamar in medicine and Repsol YPF in energy.**

10.- Synthesis (2/2)

- **Public organizations conduct most nano research on nanomaterials and nanoelectronics, while the majority of private actors in Madrid focus on the nanomaterials and nanomedicine sectors.**
- **The main actors are public R&D centers and large entreprises: there are very few SMEs, spinoffs and technology centers.**
- **Thanks to the collaborative networks, programs and projects, such as CENIT, related to nano in Madrid, the different actors in the nano sector have begun to collaborate.**

Information from Madrid's public actors in the nanotechnology sector

1.- CSIC

About the Center

- **Largest public research body in Spain**.
- **Established**: 1939.
- **Sponsor:** Ministry of Education and Science.
- **Headquarters**: Madrid City and Cantoblanco.
- **Sector**: Basic research and technological development.
- **Areas**: 8 scientific/technical areas.
- **Knowledge transfer:** over 3,000 contracts in the commercial realm in 2006.
- **Funding**: Ministry of Education and Science (65%), National R&D Plan(14%), Autonomous Community (4%), EU (7%), Industry (7%),…
  - The institution captures the most funding from calls for assistance on research projects from the National R&D Plan.
  - Spanish leader and the 4th European institution in financing in the 6PM.
- **Partnerships**: In 2007, 211 agreements and pacts have been completed.
- **Projects**: In 2007, it participated in 9 projects under the CENIT Program and 11 under the CONSOLIDER Program.

Nano Activity

- **Nano R&D Areas**: nanomaterials, nanoelectronics, nanomedicine, energy.
- **Nano R&D centers**:
  Material Science Institute, Microelectronics Institute, Optical Institute, National Biotechnology Center, Material Structure Institute.

2.- CIEMAT AND INIA

Environmental and Technological Research Center (CIEMAT)
• **Largest public research body in Spain**. • **Established**: 1951 when known as JEN and since 1986 as CIEMAT. • **Sponsor:** Ministry of Education and Science. • **Headquarters**: 3 centers distributed between Madrid, Almería and Soria and one devoted to development in Extremadura, • **Sector**: Public Research Body committed to excellence in energy and environmental issues, as well as in multiple cutting-edge technoloiges and in various areas of basic research • **Areas**: 6 scientific/technical areas. • **Number of Employees**: 1200 persons • **Nano R&D areas:** Aerosol Instrumentation Laboratory

National Agricultural Research Institute (INIA)
• **Sponsor:** Ministry of Education and Science. • **Headquarters**: 3 centers in Madrid: - **Forestry Research Center (CIFOR)** - **Animal Research Health Center (CISA)** - **Phytogenetics Resource Center (CRF)** • **Sector**: Research, Development and Innovation in the realm of agriculture, food, forestry and the environment • **Number of Employees**: 500 persons • **Areas:** 5 research departments • **Nano R&D Area:** Environmental chemistry

3.- IMDEA, MINISTRY OF INDUSTRY AND MINISTRY OF DEFENSE

Madrid Institute of Advanced Nanoscience Studies (IMDEA)

- **Headquarters**: Madrid
- **Activities**:
  - Encourage IDI activities in environments that are of the greatest interest to society
  - Develop leading and internationally competitive science and technology
  - Reach critical mass of internationally qualified researchers and equipment
  - Leverage and train excellence in human capital
  - Encourage interdisciplinary collaboration. Post-graduate courses
  - Train technical and scientific personnel
  - Attract companies and create a competitive environment driven by generation of knowledge which contributes to the prosperity of Madrid and Spain
- **Nano R&D areas:** Nanotechnology center. New project of the Ministry and the Community of Madrid

Ministry of Industry

- **Nano R&D Area:**
  - Spanish Meteorology Center

Ministry of Defense

- **Nano R&D Centers:**
  - National Aerospace Technical Institute (INTA)
  - Naval Research and Development Center

4.- SCHOOL OF SCIENCES, AUTÓNOMA UNIVERSITY

Nano Activity
• **Nano R&D centers**: - SMOL Single Molecule Electronics Laboratory. - Department of Condensed Material Physics: · LASUAM Surfaces Laboratory. · Low Temperature Laboratory. · New Microscopy Laboratory. · Optical Spectroscopy Semiconductor Nanostructures. · Lab. Linings and Nanostructures. · MOLE Moving Light and Electrons. - Department of Material Physics: · Phase and Ferroelectricity Transitions. - Organic Chemistry Department: · Nanoscience and Molecular Materials Group - Nicolás Cabrera Institute of Material Science: · Laboratory of Surface Biofunctionalization. - Chemistry Department: · Supramolecular Chemistry Coordination. · Lumila Group: Org-Inorganic Solids and Luminescent Probes

5.- COMPLUTENSE UNIVERSITY, MADRID, UCM

Nano Activity
• **Nano R&D centers**: - School of Physical Sciences: · Nano and Microcharacterization of Electronic Materials · Surface Science Laboratory · Quantum Dynamics and Coherence · Grupo Complutense Applied Optics Group · Superconductivity and Thin Films · Micro-optics and Nanotechnology, CAI Service - School of Chemical Sciences: · Biohydrometallurgy · Inorganic Chemistry, Inorganic Materials · Group of Organic Molecular Materials (for solar energy) · Complex Systems Group · Group of Union Technologies, Advanced Materials and Eco Technologies. - IMA Institute of Applied Magnetism

6.- UPM, U3CM, ALCALA UNIVERSITY AND UPCMO

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