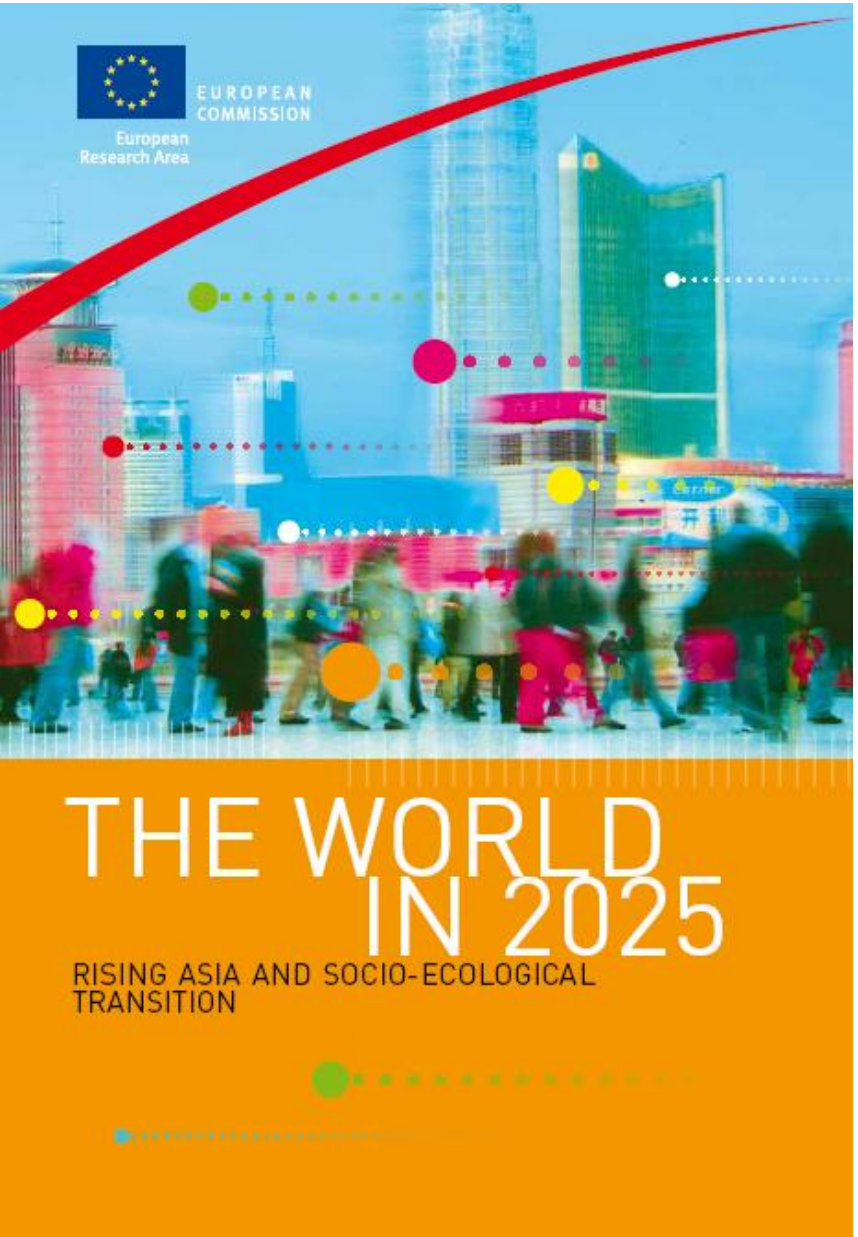


European Commission

Can we predict how far being *nano* for a *material* will be an issue ?

Renzo TOMELLINI

*Head of **Materials** Unit*

Industrial Technologies

DG Research & Innovation

European Commission

renzo.tomellini@ec.europa.eu

Research and Innovation

Innovation from Materials

Some 70 percent of all technical innovations

hinge directly or indirectly on the properties

of the materials they use.

Material innovations can be used in practically all technology sectors and branches of industry.

Material innovations have the potential to reduce environmental pollution, save energy, conserve resources, make mobility less dangerous and improve the quality of life.

Source: ACATECH, 2009,
http://www.research-in-germany.de/dachportal/en/downloads/download-files/9554/high-tech-strategy-2006-112-pages-.pdf

European Commission

Impact of Advanced Material Technology

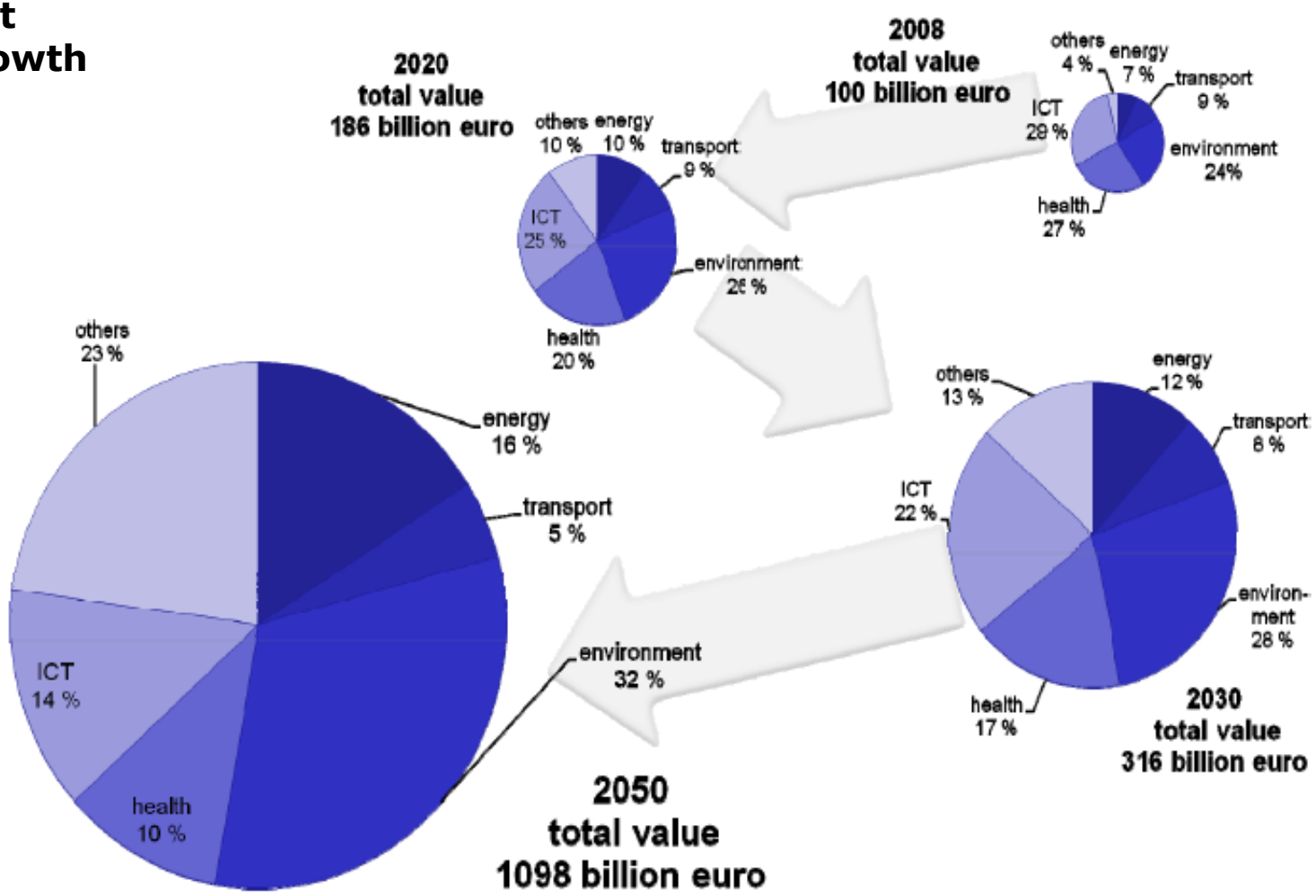
Impact of advanced material technology on ICT, Energy & Biotechnology (% growth attributable to advanced materials)

	1970	*1980*	*1990*	*2000*	*2010*	2020	2030
ICT	***15***	***25***	***40***	***55***	***65***	**75**	**85**
Energy	***10***	***15***	***30***	***45***	***55***	**65**	**70**
Biotechnology	***5***	***10***	***20***	***30***	***45***	**55**	**65**

Advanced materials have an earlier & greater impact in ICT (incl. electronics), followed by Energy (incl. construction) and Biotechnology (incl. health)

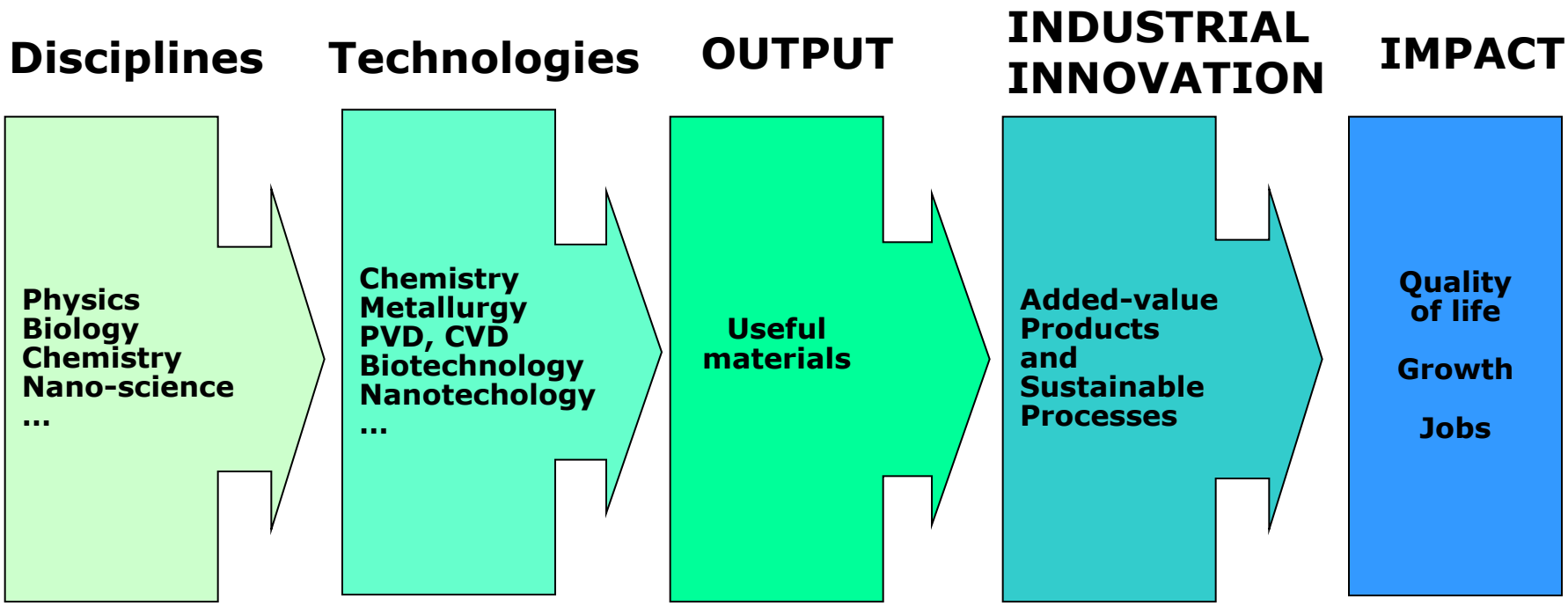
Source: Sanford M. Moskowitz, « The Advanced Materials Revolution », John Wiley & Sons Inc, 2009

Market growth



European Commission

Materials profit from all available technologies and approaches

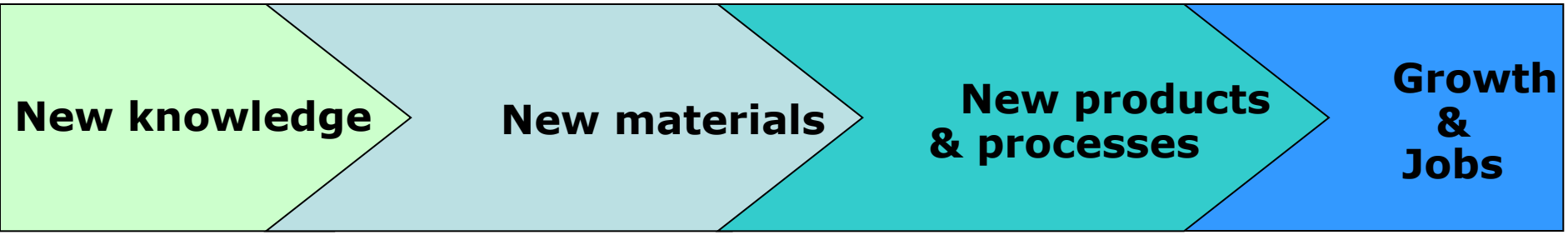


new atomic precision industry

European Commission

Materials are KNOWLEDGEmediaries (intermediaries of knowledge)

Materials embed and «transfer» the new knowledge into new products and processes, therefore we hear of «(re)active» or «intelligent» materials, materials that «perform a work»



new atomic precision industry

Research and Innovation

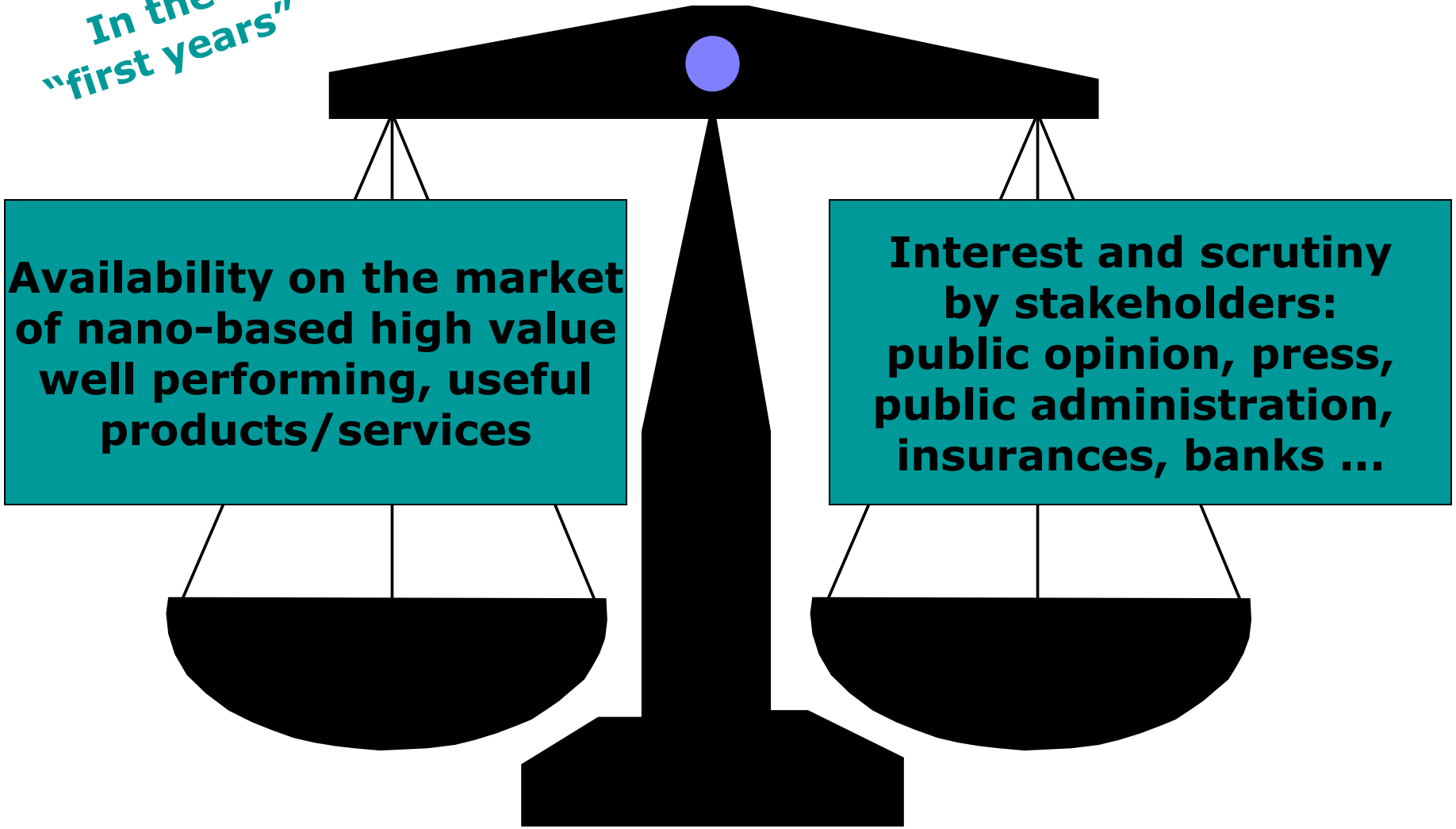
*On the 12th May **2004**, the European Commission adopted the Communication "Towards a European **Strategy** for Nanotechnology" COM(2004) 338. It seeks to bring the discussion on nanoscience and nanotechnology to an institutional level and proposes an integrated and responsible strategy for Europe.*

*On the 7th June **2005**, the European Commission adopted the **Action Plan** "Nanosciences and nanotechnologies: An action plan for Europe 2005-2009" (COM(2005) 243). This Action Plan defines a series of articulated and interconnected actions for the immediate implementation of a safe, integrated and responsible strategy for nanosciences and nanotechnologies, based on the priority areas identified in the above-mentioned Communication*

*Two **Implementation Reports** followed, for the period 2005 to 2009*

European Commission

In the "first years"



Research and Innovation

European Commission

Nano and the question of definition

…more than 10 years ago

"Today, at the beginning of the 21st century, research in the life sciences, the information technologies, and the materials sciences converges upon a commonality: the domain of the nanometer, and the manipulation of atoms and molecules. **Continued technological progress becomes dependent upon achieving control of materials at the nano scale**"

"**Nano-technology cannot be defined in terms of dimension or geometry alone**. In fact, it represents a convergence of the traditional disciplines of physics, chemistry and biology at a common research frontier"

EC Commissioner Busquin
Proceedings EC/NSF workshop Toulouse, Oct. 2001
Office for Official Publications, ISBN 92-894-0793-X

European Commission

C(2008) 424 final

COMMISSION RECOMMENDATION

of 07/02/2008 on

a code of conduct for responsible nanosciences and nanotechnologies research

Research and Innovation

European Commission

*Extract from the **ISO Concept Database** (on 2012-02-03)*
https://cdb.iso.org/cdb/search.action

Nano (ISO 4499-2:2008) with WC grain size < 0,2 µm
Note : Measured by the mean-linear-intercept method described in this part of ISO 4499.

Nanotechnology (ISO/TS 80004-1:2010): application of scientific knowledge to manipulate and control matter in the nanoscale (2.1) in order to make use of size- and structure-dependent properties and phenomena, as distinct from those associated with individual atoms or molecules or with bulk materials
Note : Manipulation and control includes material synthesis.

Nanoscale (ISO/TS 80004-3:2010): size range from approximately 1 nm to 100 nm

Nanomaterial (ISO/TS 80004-1:2010): material with any external dimension in the nanoscale or having internal structure or surface structure in the nanoscale

Nano-object (ISO/TS 80004-3:2010): material with one, two or three external dimensions in the nanoscale

Nanostructured material (ISO/TS 80004-1:2010): material having internal nanostructure (2.6) or surface nanostructure
Note : This definition does not exclude the possibility for a nano-object (2.5) to have internal structure or surface structure. If external dimension(s) are in the nanoscale, the term nano-object is recommended.

Nanomaterial (ISO/TS 80004-1:2010): material with any external dimension in the nanoscale (2.1) or having internal structure or surface structure in the nanoscale
Note 1 :This generic term is inclusive of nano-object (2.5) and nanostructured material (2.7).

Engineered nanomaterial (ISO/TS 80004-1:2010): nanomaterial designed for specific purpose or function

Manufactured nanomaterial (ISO/TS 80004-1:2010): nanomaterial intentionally produced for commercial purposes to have specific properties or specific composition

Incidental nanomaterial (ISO/TS 80004-1:2010): nanomaterial generated as an unintentional by-product of a process
Note : The process includes manufacturing, bio-technological or other processes.

European Commission

On 18 October ***2011*** *the Commission adopted the Recommendation on the* ***definition of a nanomaterial.***

According to this Recommendation a "Nanomaterial" means:

A natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm - 100 nm.

In specific cases and where warranted by concerns for the environment, health, safety or competitiveness the number size distribution threshold of 50 % may be replaced by a threshold between 1 and 50 %.

By derogation from the above, fullerenes, graphene flakes and single wall carbon nanotubes with one or more external dimensions below 1 nm should be considered as nanomaterials.

next ! *Review by December 2014*

Definition

vs

Scope Statement

European Commission

Brussels, 17.6.2008, COM(2008) 366 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL AND THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE ON

REGULATORY ASPECTS OF NANOMATERIALS

next !

The Commission intends to report on progress in these areas 3 years after presentation of this Communication.

European Commission

*The first registration deadline under **REACH** on 30 November 2010 applied to substances manufactured or imported at 1000 tonnes or more per year. The registrations of nanomaterials in this tonnage band will help to generate more information useful for the assessment of risks. The next registration deadline is on 31 May 2013 and applies to substances manufactured or imported at or above 100 tonnes per year. The European Chemicals Agency (ECHA) receives the registrations and the Agency plays a central role in the collection, evaluation and dissemination of information on substances and preparations, including nanomaterials.*

Nanomaterials that fulfil the criteria for classification as hazardous under Regulation 1272/2008 on classification, labelling and packaging (CLP) of substances and mixtures must be classified and labelled. This applies to nanomaterials as substances in their own right, or nanomaterials as special forms of the substance. Many of the related provisions, including safety data sheets and classification and labelling apply already today, independently of the tonnage in which the substances are manufactured or imported. Substances, including nanomaterials, meeting the classification criteria as hazardous should have been notified to ECHA by 3 January 2011. Any further update to the classification must also be notified without undue delay. ECHA is working on a classification and labelling inventory.

*The Commission prepares advice on how to manage nanomaterials in accordance with REACH and the CLP Regulation. The first paper "**Nanomaterials in REACH**" provides an overview of how the provisions of REACH apply to nanomaterials. The second paper, **Classification, Labelling and Packaging of Nanomaterials in REACH and CLP**, focuses on the classification of nanomaterials in accordance with REACH and particularly the CLP Regulation. Additional papers are planned on registration, communication in the supply chain and substance identification*

Development of an inventory for consumer products containing nanomaterials

Study published in 2011 *http://ec.europa.eu/environment/chemicals/nanotech/pdf/study_inventory.pdf*

next !

Towards a European Patent

At the request of 12 Member States, the Commission proposed to launch enhanced cooperation in the area of unitary patent protection on 14 December 2010. Following the Commission's decision, another 13 Member States submitted their request to join the enhanced cooperation. The European Parliament gave its consent on 15 February and on 10 March 2011, the Competitiveness Council authorised the launch of enhanced cooperation with the participation of 25 Member States.

The implementation of the authorising Council decision requires ***the adoption of two regulations; one on the creation of unitary patent protection and a second on the applicable translation arrangements.*** *On 13 April 2011, the Commission adopted the proposals for the implementing regulations*

European Commission

…since markets are global

Where do we all most benefit when tackling issues at global level?

(ontologies, taxonomies, nomenclature, definitions, level playing field, …)

European Commission

Transatlantic Economic Council (TEC)
Annexes to the TEC Joint Statement
29 November 2011

Research and Innovation

TEC principals … welcome the existence of the U.S. ***Emerging Technologies Interagency Policy Coordination Committee*** *(ETIPC) nanotechnology working group, chaired by the Office of Information and Regulatory Affairs of the U.S. Office of Management and Budget, and of the* ***European Commission's Interservice Group on Nanotechnology****.*

The TEC calls upon these two groups to enter into a regular dialogue and to report periodically to the High Level Regulatory Cooperation Forum on existing cooperation…

The TEC encourages the leaders of the dialogue to reach out in their work to ***private sector*** *stakeholders and U.S. and EU* ***legislators****.*

Points of interest *include, but are not limited to:*

- *Newly developed nanotechnology-related nomenclature, terms, and definitions;*
- *Consistent use of the results of our cooperation in existing fora, in particular on risk assessment;*
- *Information on the developments of regulations and guidance in relation to specific sectors;*
- *Cooperation on the development of materials standards and harmonized test methods related to informing nanotechnology regulation and guidance;*
- *Views on underpinning research needs and how they inform regulatory developments;*
- *Views and approaches regarding hazard, risk and benefit assessment;*
- *Approaches to enhance responsible development and accelerate innovation.*

European Commission

In Europe

COM(2008)699
The Key Enabling Technologies Initiative
Preparing our future: developing a common strategy for key enabling technologies in the EU

KET are at the forefront of managing the shift to a **low carbon, knowledge-based economy**. Of systematic relevance as they enable the development of new goods and services and the restructuring of industrial processes needed to modernise EU industry and secure the research, development and innovation base in Europe. ***Advanced materials*** *offer major improvements in a wide variety of different fields, e.g. in aerospace, transport, building and health care. They facilitate recycling, lowering the carbon footprint and energy demand as well as limiting the need for raw materials that are scarce in Europe.*

Key Enabling Technologies:
nanotechnology, micro- and nanoelectronics including semiconductors, advanced materials, biotechnology and photonics.

http://ec.europa.eu/enterprise/sectors/ict/key_technologies/index_en.htm

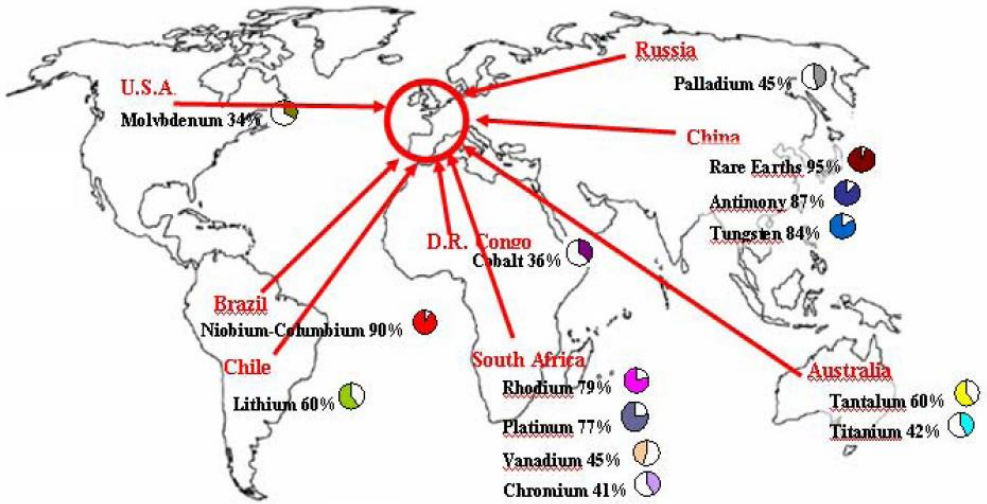
European Commission

COM(2008)699

The EU Raw Materials Initiative:

meeting our critical needs for growth and jobs in Europe

In Europe



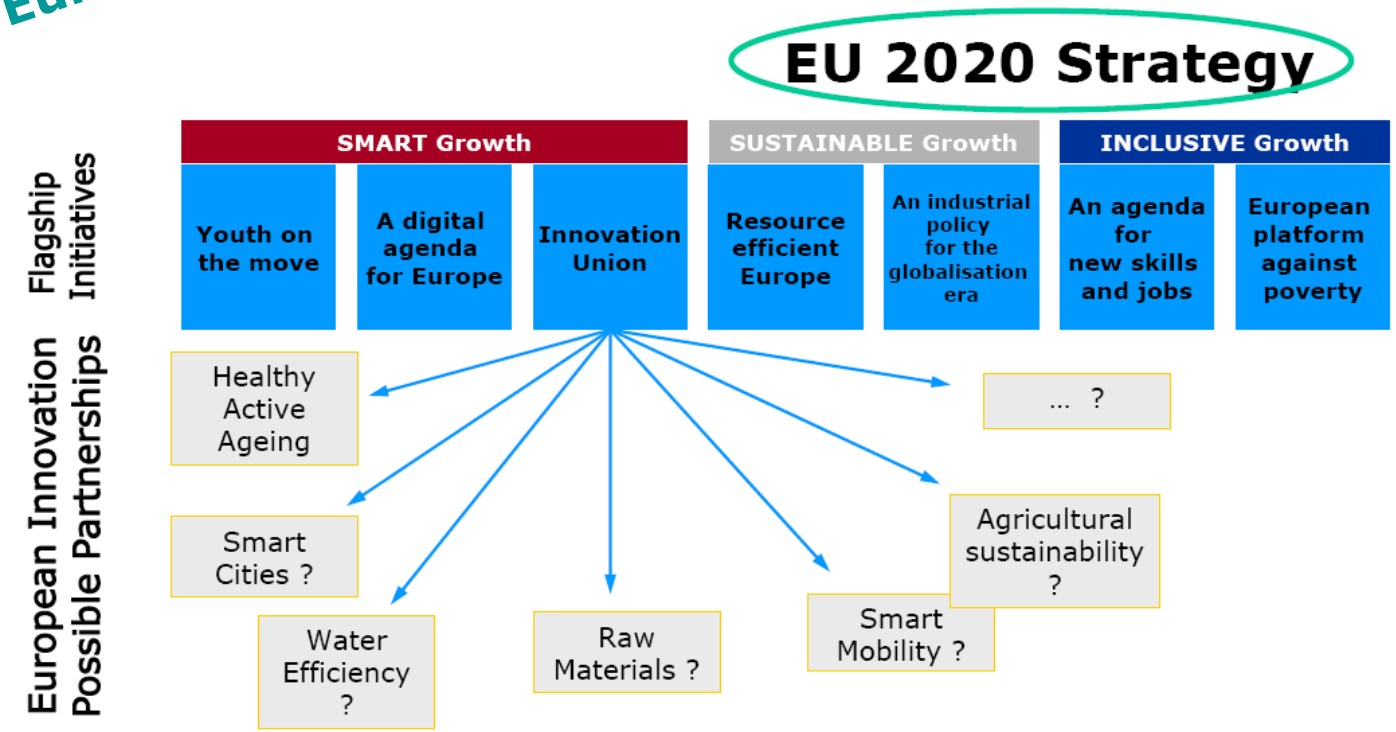
Data source : World Mining Data (2008) **=USGS (2008)
The figures and pie graphs indicate the proportion of world production

Securing reliable and undistorted access to raw materials is increasingly becoming an important factor for the EU's competitiveness and crucial to the success of the Lisbon Partnership for growth and jobs.

International discussion addressed at the United Nations, G8 and G20

European Commission

In Europe



European Commission

In Europe

Roadmap on Materials for the SET-Plan

Brussels, 13.12.2011

SEC(2011) 1609 final

COMMISSION STAFF WORKING PAPER

Materials Roadmap

Enabling Low Carbon Energy Technologies

http://ec.europa.eu/research/industrial_technologies/pdf/materials-roadmap-elcet-13122011_en.pdf

Research and Innovation

European Commission

Roadmap on Materials for the SET-Plan

- Based on 11 scientific assessments which show that materials are at the core of technological developments
- **11 technologies covered: wind, solar PV, solar CSP, geothermal , electricity grids, storage, bioenergy, CCS, nuclear fission, H2&FCs, energy efficient materials for buildings**
- More than 50 material classes to be developed or further improved
- About 60 manufacturing processes proposed
- Focus on material R&D+I for low-carbon energy technologies for the next 10 years with market implementation horizons for both 2020/2030 and 2050

Synergies

- *Several **material classes** are common to more than one technology.*
- *A broad range of **activities** proposed are of similar nature calling upon similar research and industrial capacities.*
- ***Leveraging commonalities and synergies** is of critical importance for the implementation of the Roadmap:*
  - **Realisation of economies of scale and scope;**
  - **Pooling of cross-technology knowledge;**
  - **Integration of innovative materials into low-carbon energy technologies.**
- **International alliances** and partnerships with third countries.

Recommendations for Implementation

- **Implementation**
  - **Value-chain perspective:** need to be implemented within the SET-Plan (EIIs/EERA)
  - **Need for critical mass of capacity and resources**
    - ✓ **Programmatic document for both EU and MSs**
    - ✓ **Base for partnership with industry**
  - **Importance of Cross-cutting activities** (standardization, supply of critical raw materials, resources sustainability, education and training)
  - **International alliances** and partnerships with third countries

European Commission

In Europe:
a proposal for 80 B€

HORIZON 2020

the EU framework programme for research and innovation

www.ec.europa.eu/research/horizon2020

Research and Innovation

European Commission

Three priorities:

1 **Excellent science**

2 **Industrial leadership**

3 **Societal challenges**

European Commission

Indicative breakdown of funding (million euro, 2014-20, at constant 2011 prices)

Leadership in enabling and industrial technologies	***13 781***
ICT (Photonics & nano and microelectronics*)	***7 939 (1 588*)***
Nanotechnologies, Advanced Materials, Advanced Manufacturing*	***3 797****
Biotechnology*	***509****
Space	***1 536***
(KETs*)	***(5 894*)***
Access to risk finance	***3 538***
Innovation in SMEs	***619***

Leadership in Enabling and Industrial Technologies

To maintain and build global leadership in enabling technologies and space research and innovation, which underpin competitiveness across a range of existing and emerging industries and sectors.

- **Europe 2020 goals for smart, sustainable and inclusive growth;**
- **Accelerate innovation and transform the knowledge generated to enhance existing products and services and to create new ones;**
- **Exploit innovation in the widest sense: technology and business, organisational and social aspects.**

European Commission

Leadership in Enabling and Industrial Technologies

An integrated approach to Key Enabling Technologies (KETs)

Activities based on research and innovation agendas defined by industry and business, with the research community;

Emphasis on R&D, large-scale pilots and demonstration activities, test beds and living labs, prototyping and product validation in pilot lines;

Activities designed to boost industrial competitiveness by stimulating industry, and in particular SMEs;

Strong focus on leveraging private sector investment;

Integration in solutions for societal challenges will be supported (e.g. cross-cutting actions).

Achieve critical mass through partnering, clusters and networks;

Develop links with the EIT to breed entrepreneurial talents and speed up innovation;

Activities to support standardisation, interoperability, safety and pre-regulatory activities for new technologies and emerging products and services.

European Commission

Standards and IPR are key

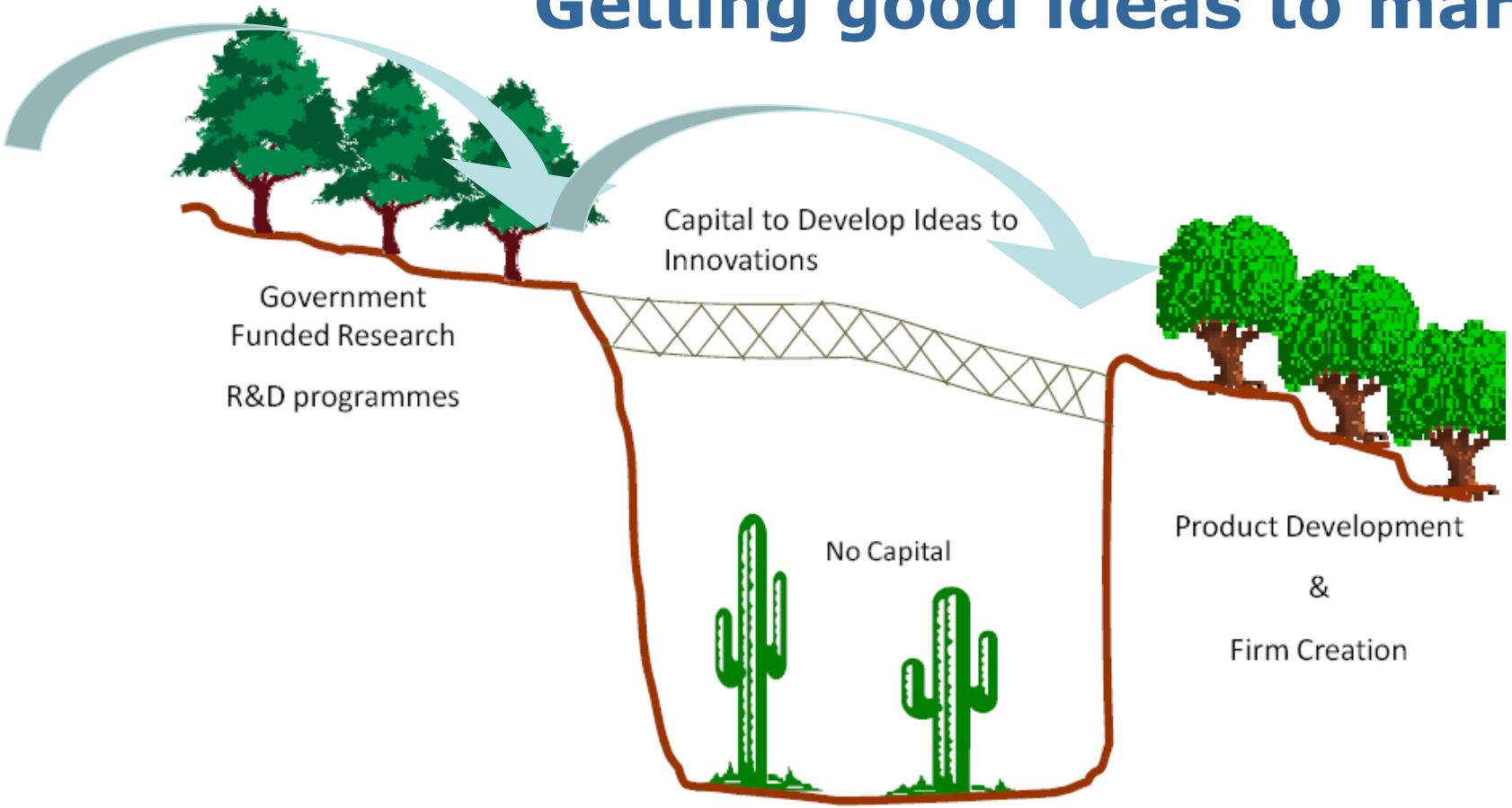
- GSM = Europe world leader
  (EU-funded R&D; common EU standard set quickly; a single legal framework)

- Wi-Fi = Europe follower
  (EU-funded R&D but process too slow to set an EU standard => result = non-EU, US industry-driven standard has become market leader)

- Electric vehicle

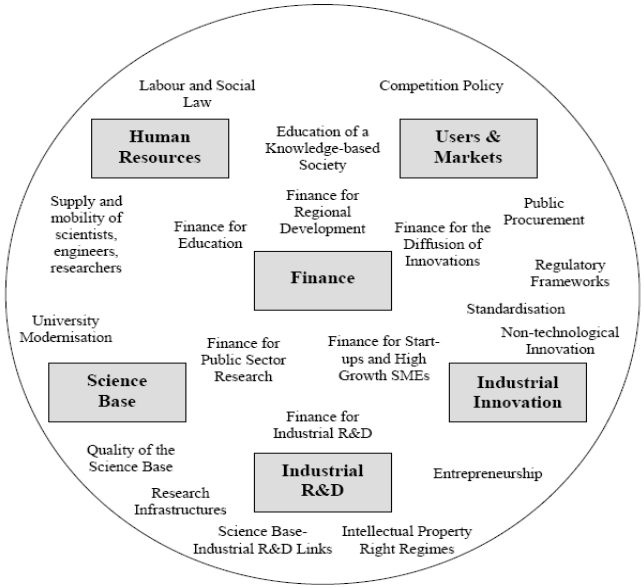
http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=keydocs

Getting good ideas to market



"We miss the bridges that can transform RTD into commercial services and products"
25/05/2010, at the WCIT 2010 - World Congress on IT

Exhibit 6: Research and Innovation System Components and Policy Concerns



Source: JRC-IPTS

Thank you for your attention !

… and visit: http://tinyurl.com /MATERIALS-BLOG