Regulatory Research in Brazil and the NANoREG Project

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Articulação Institucional dos Institutos de Pesquisa do MCTI

Ministério da Ciência, Tecnologia e Inovação

GOVERNO FEDERAL BRASIL PÁTRIA EDUCADORA

1. IBN;
2. SisNANO;
3. Regulatory Research in Brazil.

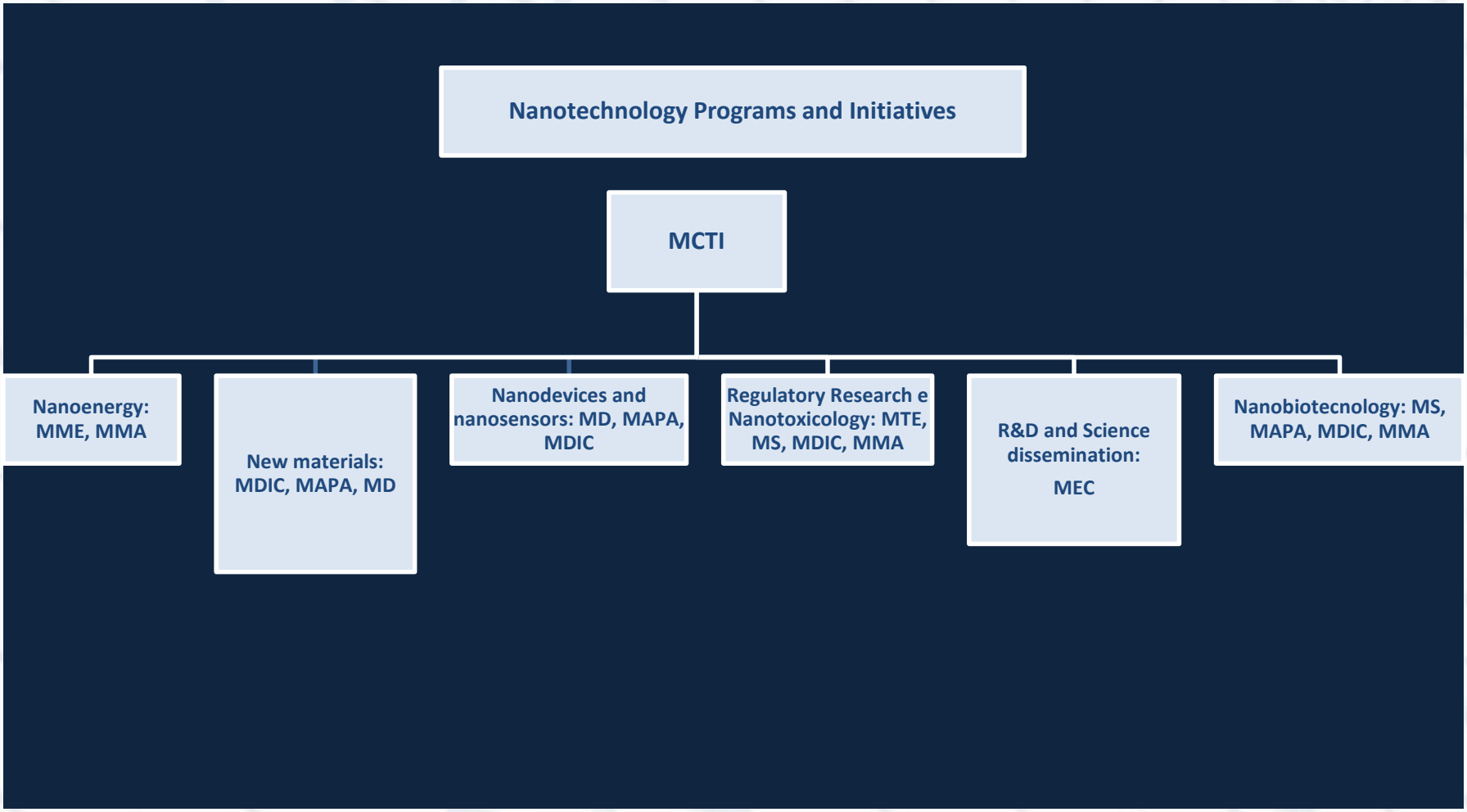
BRAZILIAN NANOTECHNOLOGY INITIATIVE- IBN

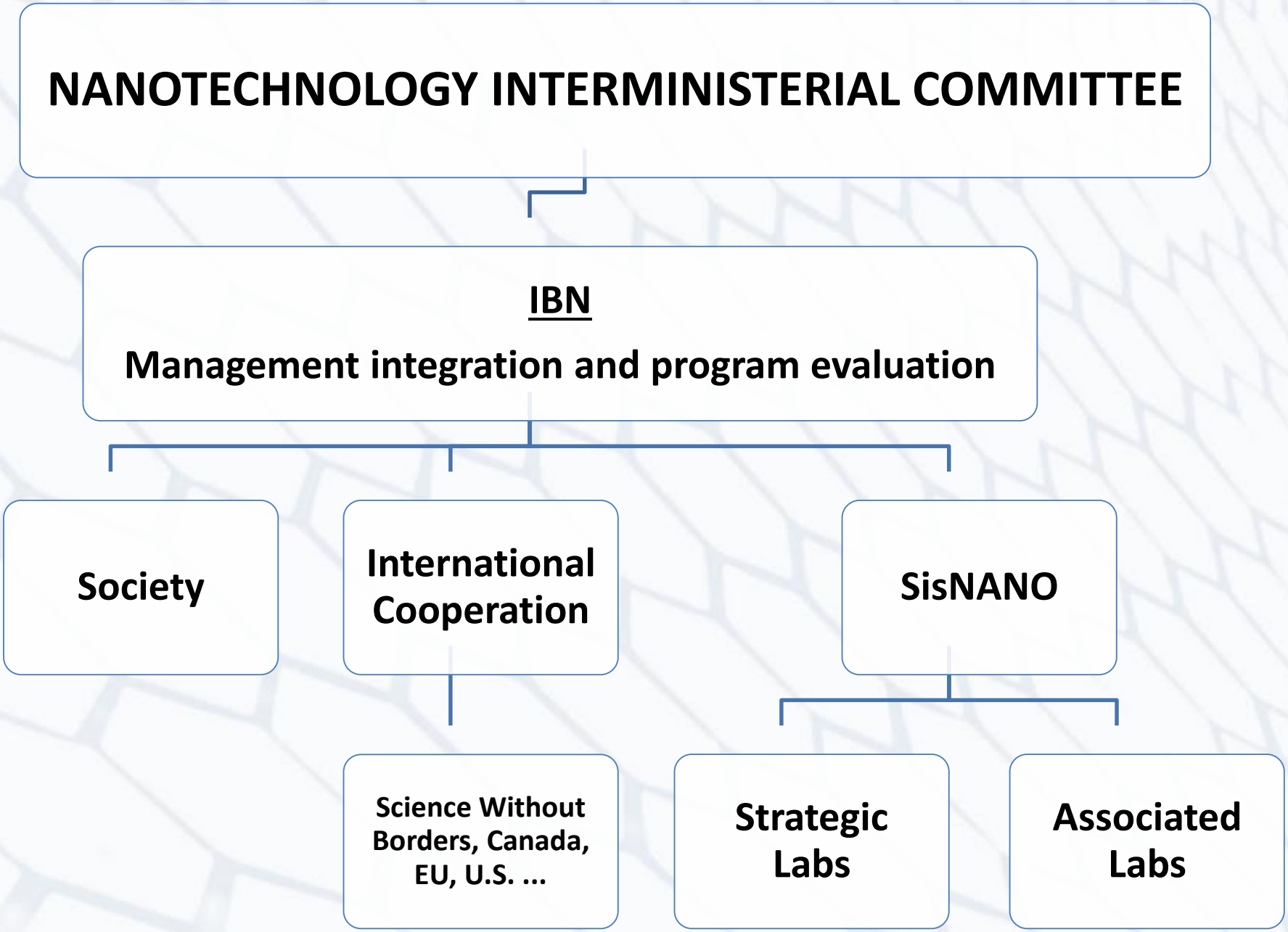
Launched in August 2013

Working Group

Fernando Galembeck – CNPEM
Carlos Alberto Aragão – CNPEM
Antônio José Roque da Silva – CNPEM
André Galembeck – CETENE
Eduardo Couto e Silva – CGEE
Rosangela Argou Marques - ABDI
Silvia Guterres – UFRGS
Oswaldo Luiz Alves – UNICAMP
Coordenação-Geral de Nanotecnologia– MCTI
Secretaria de Inovação - MDIC

BRAZILIAN NANOTECHNOLOGY INITIATIVE AND THE INTERMINISTERIAL COMMITTEE

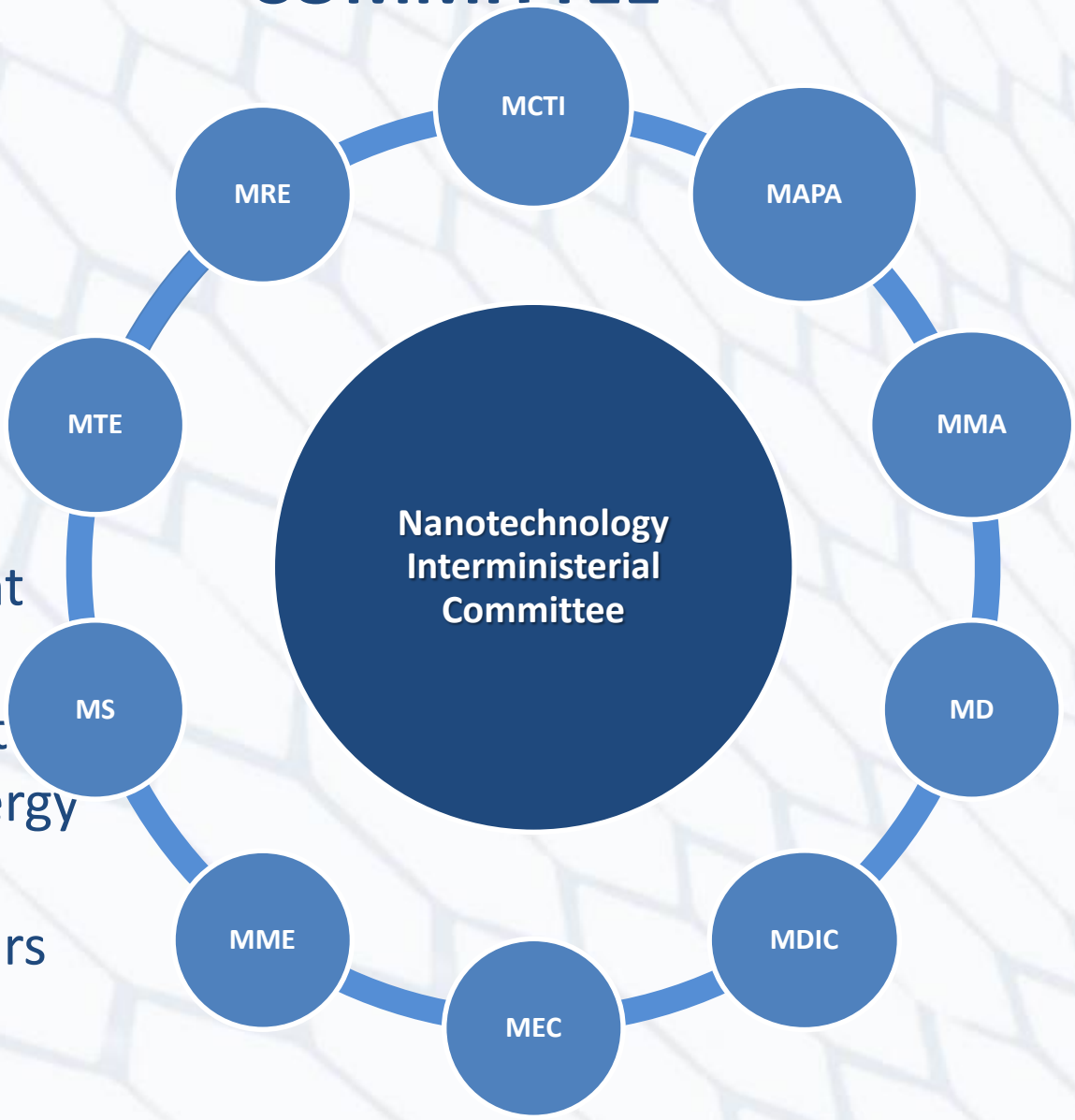



NANOTECHNOLOGY INTERMINISTERIAL COMMITTEE
IBN
Management integration and program evaluation
Society
International Cooperation
SisNANO
Science Without Borders, Canada, EU, U.S. ...
Strategic Labs
Associated Labs

NANOTECHNOLOGY INTERMINISTERIAL COMMITTEE

10 ministries:

- MCTI
- Agriculture
- Defense
- Development
- Education
- Environment
- Mines & Energy
- Health
- Foreign Affairs
- Work



IBN - SECTORS

ENERGY

DEFENSE

ENVIRONMENT

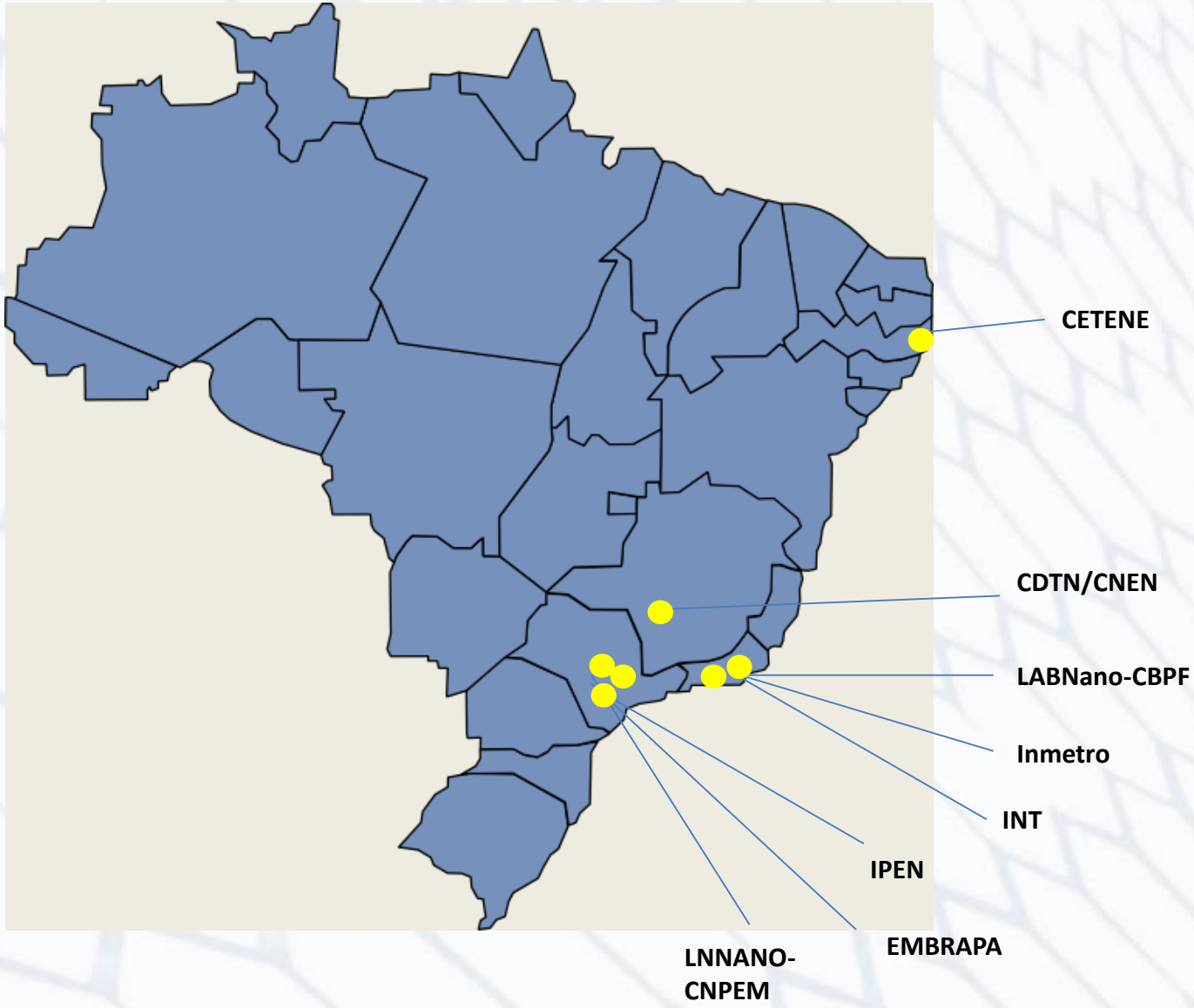
HEALTH

RECOMMENDATION OF THE NANOTECHNOLOGY COMMITTEE FOR 2015-2018: ENERGY, ENVIRONMENT, HEALTH AND **REGULATORY RESEARCH**

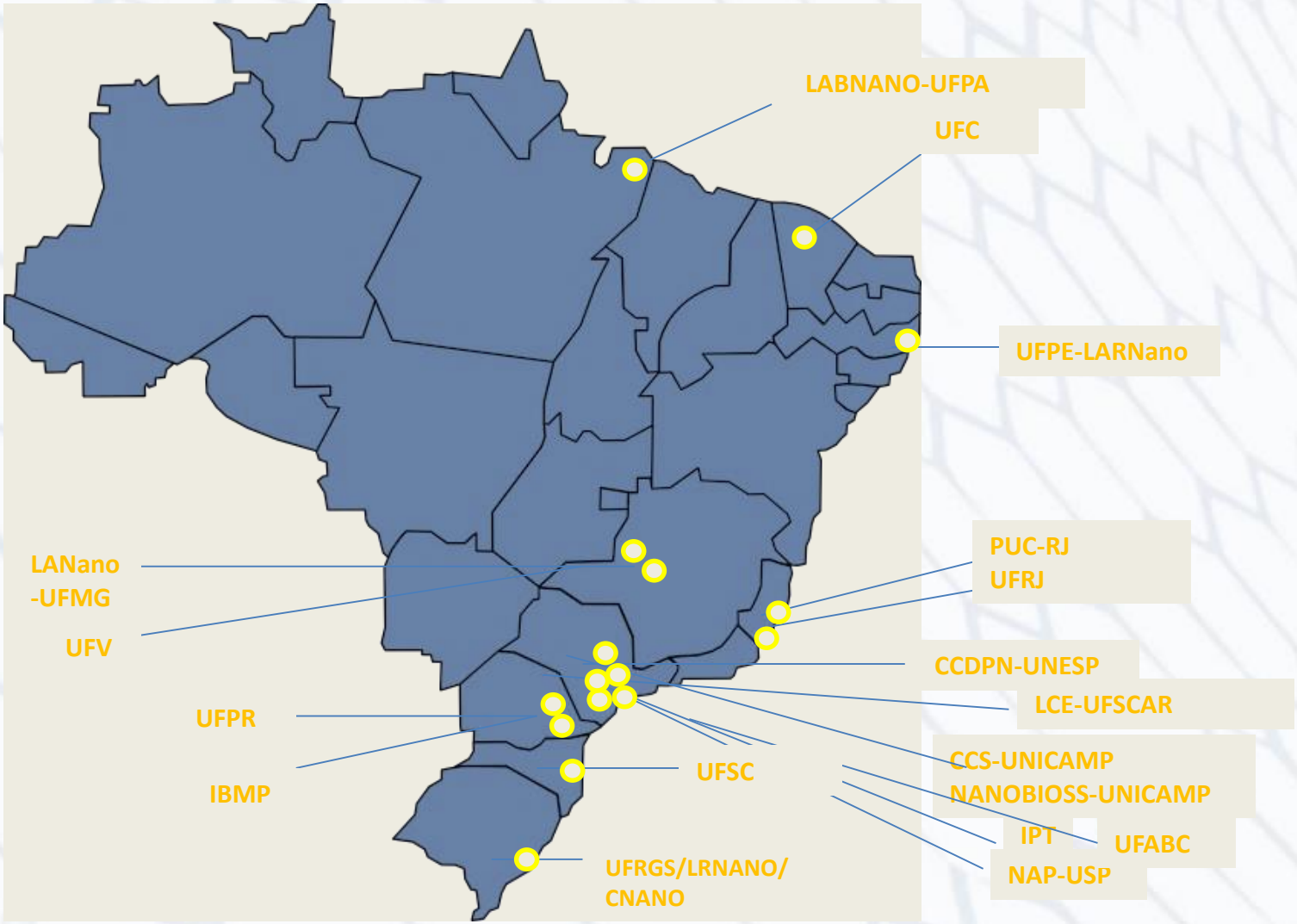
AEROSPACE

AGRICULTURE AND AGRIBUSINESS

LABORATÓRIOS ESTRATÉGICOS SISNANO



LABORATÓRIOS ASSOCIADOS SINANO



NUMBERS AND FACTS OF NANOTECHNOLOGY IN BRAZIL

RESEARCH NETWORKS: 24, 6 OF THEM ON NANOTOXICOLOGY

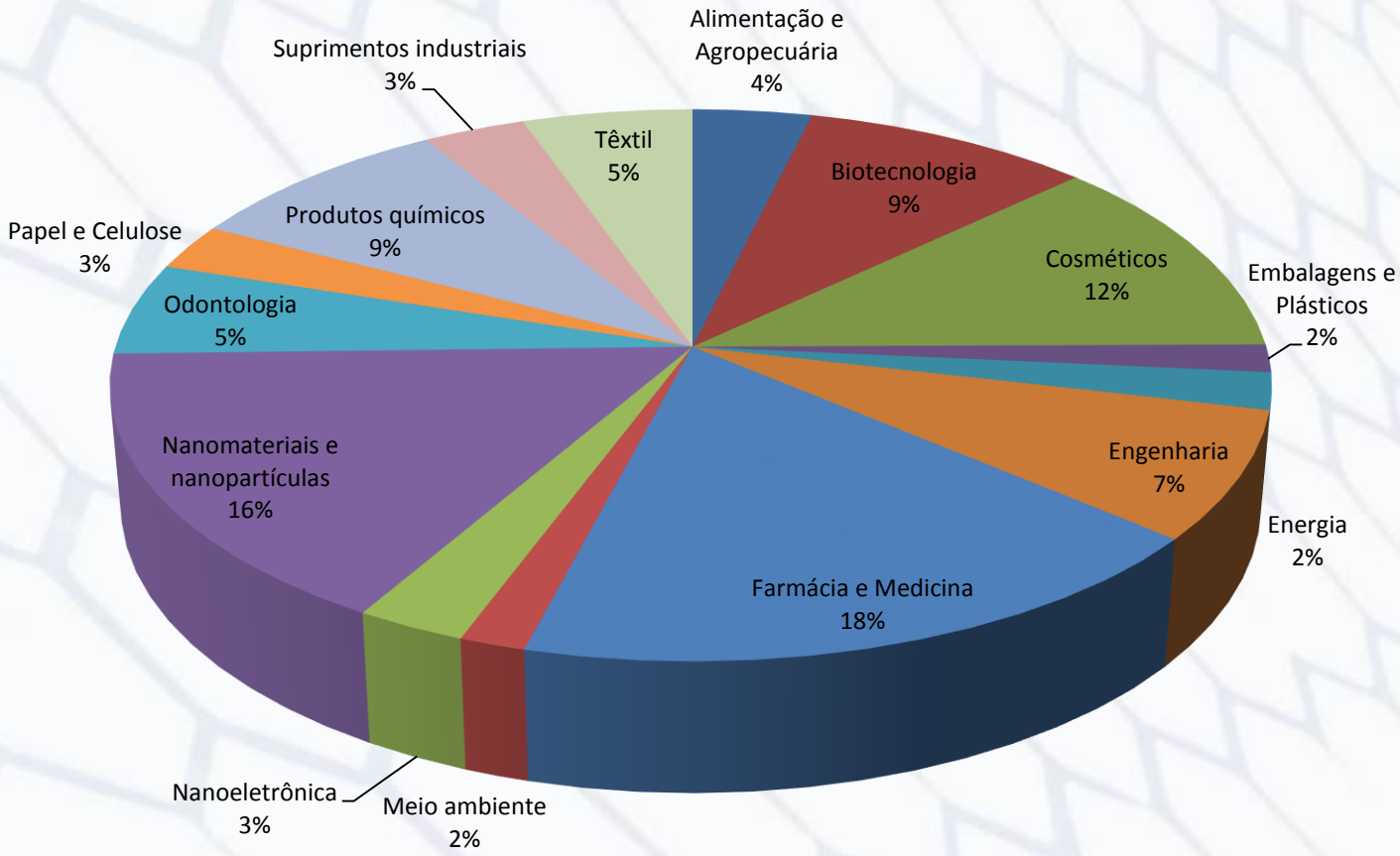
INCT: 16

STUDENTS>3000

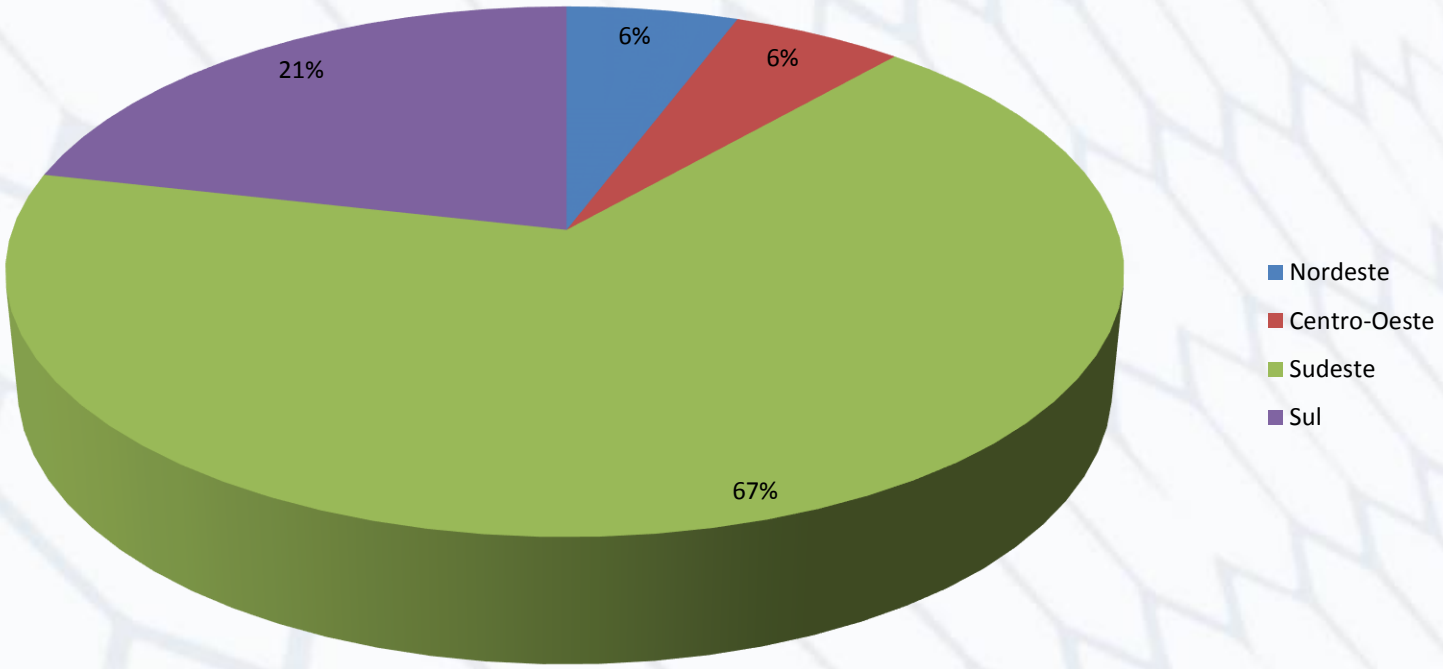
RESEARCHERS > 3000

~ 2% OF ALL PUBLICATIONS ON NANOSCIENCES

EMPRESAS QUE INVESTEM EM NANOTECNOLOGIA
ÁREAS DE ATUAÇÃO



EMPRESAS QUE INVESTEM EM NANOTECNOLOGIA
DISTRIBUIÇÃO REGIONAL



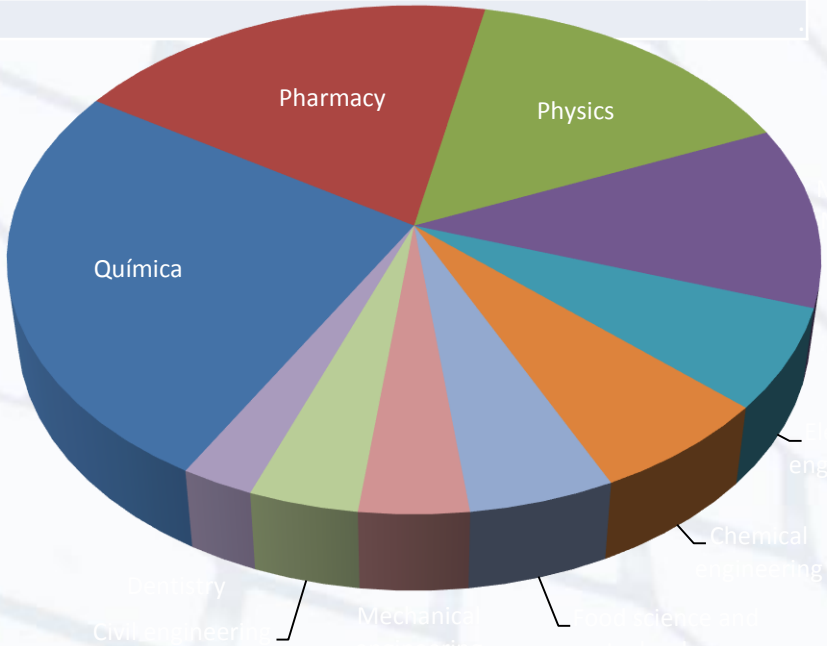
COMPETÊNCIA TECNOLÓGICA EM NANOTECNOLOGIA NO BRASIL- GRUPOS E INSTITUTOS DE PESQUISA (DADOS CNPq)

UF	Nº	%
SP	60	25%
RJ	36	15%
MG	32	13%
RS	20	8%
PE	17	7%
PR	12	5%
SC	12	5%
PB	8	
PA	7	
SE	6	
DF	5	
PI	5	
BA	4	
CE	4	
AM	3	
AC	2	
AL	2	
GO	2	
MS	2	
RN	2	
AP	1	
ES	1	
MT	1	
Total	**244**	**100%**

Research groups per state

Main areas of expertise of the Brazilian research groups in nanotechnology

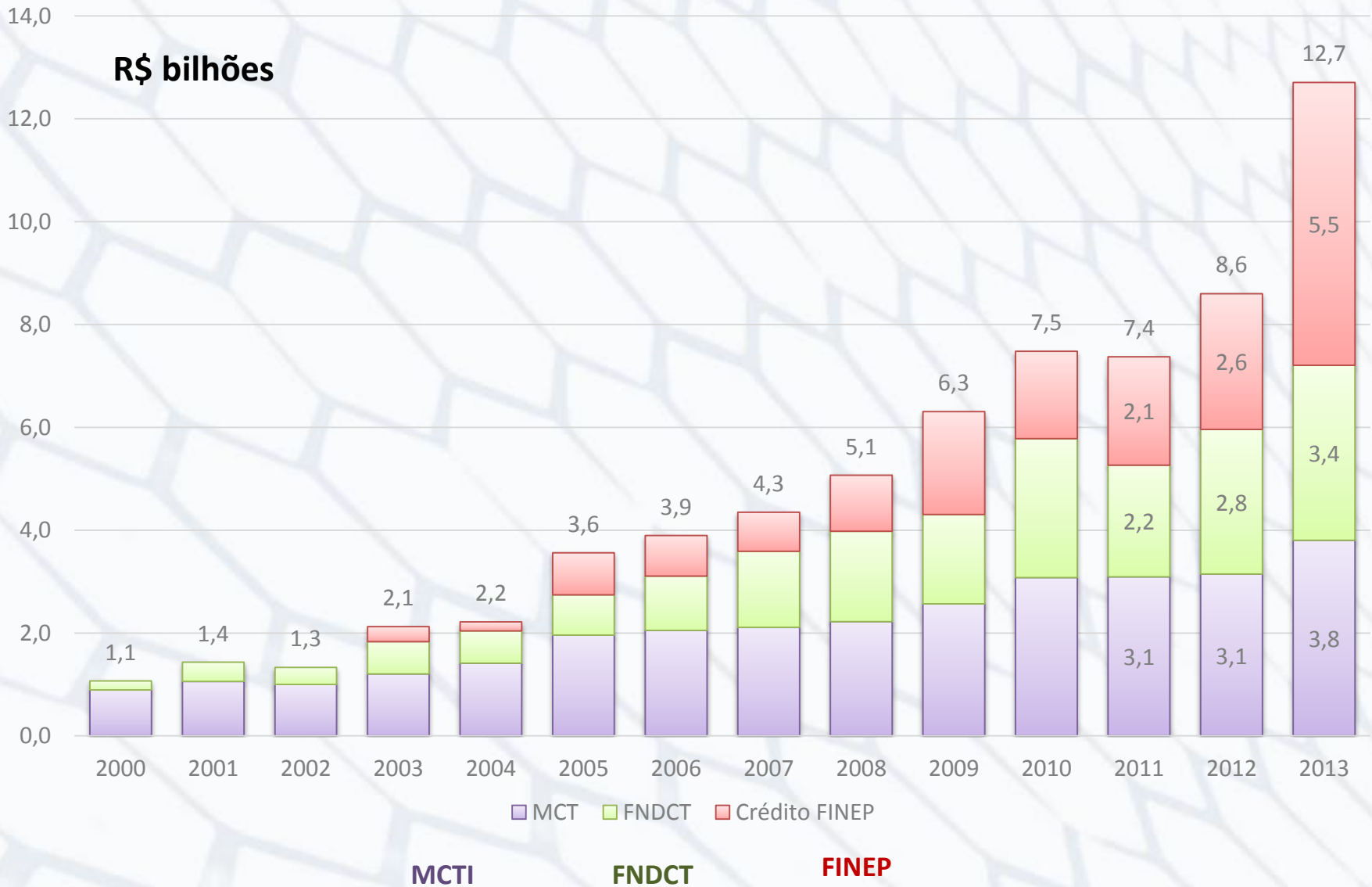
Area	Number of research groups	%
Chemistry	48	20%
Pharmacy	37	15%
Physics	30	12%
Materials and metallurgical engineering	22	9%
Electrical engineering	11	5%
Chemical engineering	11	5%
Food Science and Technology	10	4%
Mechanical enginnering	8	3%
Civil engineering	7	3%
Dentistry	6	2%

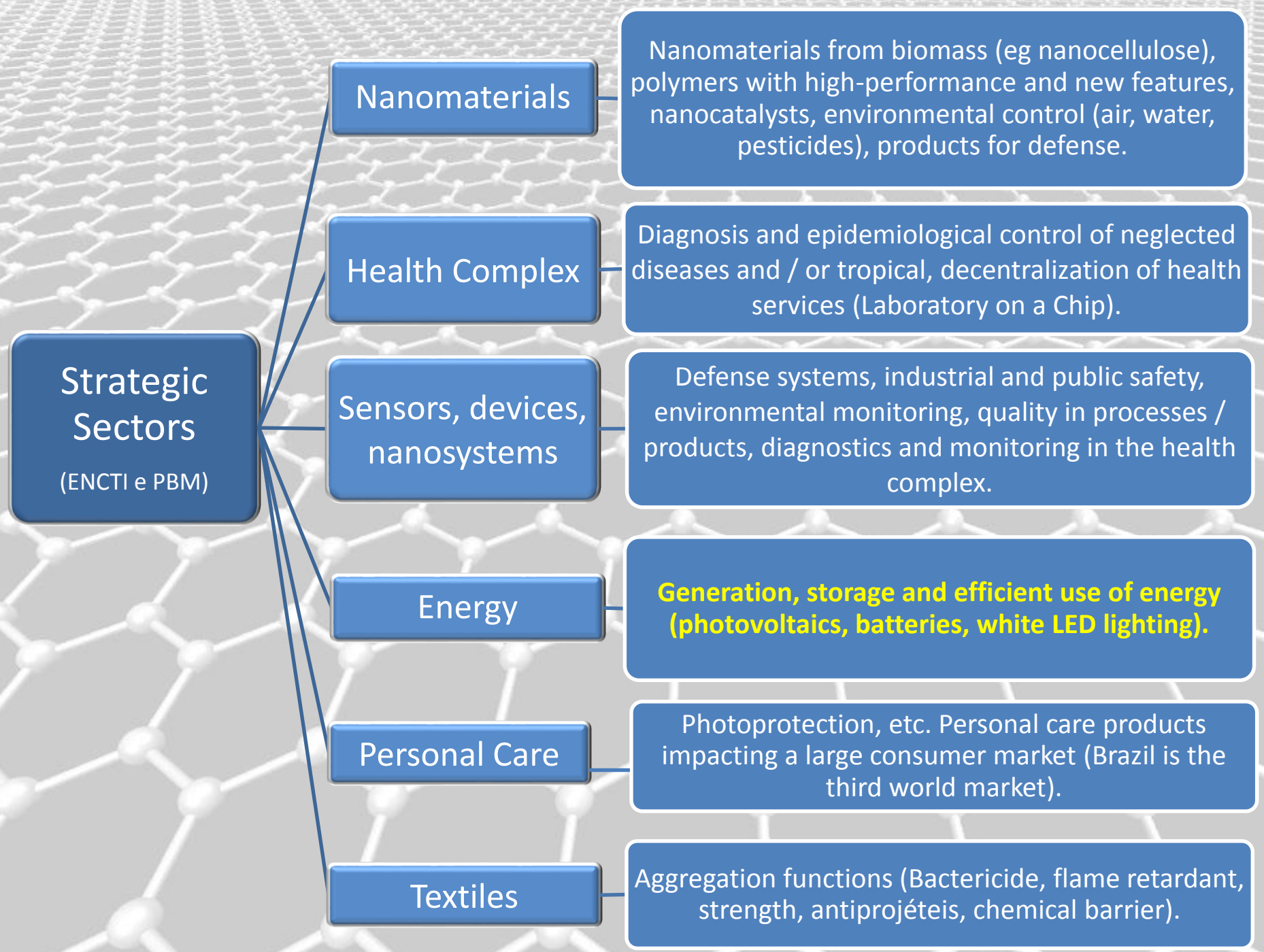


Area	Number of research groups	%
Pharmacology	5	2%
Agronomy	4	2%
Biochemistry	4	2%
Nuclear engineering	4	2%
Genetics	4	2%
Biophysics	3	1%
Morphology	3	1%
Public health	3	1%
Biology	2	1%
Biomedical engineering	2	1%
Forestry engineering	2	1%
Math	2	1%
Medicine	2	1%
Microbiology	2	1%
Parasitology	2	1%
Computer Science	1	0%
Aerospace engineering	1	0%
Mines engineering	1	0%
Sanitary engineering	1	0%
Physiology	1	0%
Physiotherapy and Occupational Therapy	1	0%
Geosciences	1	0%
Immunology	1	0%
Veterinary	1	0%
Fisheries Resources and Fishing Engineering	1	0%


Boa Vista
INPA
INPE
São Gabriel da Cachoeira
INPA
Manaus
INPA
INPE
Tefé
IDSM*
Rio Branco
INPA
Porto Velho
INPA
Santarém
MPEG
Caxiuanã
MPEG
Macapá
MPEG
Belém
MPEG
INPE
Alcântara
INPE
Teresina
CETEM
Fortaleza
CTI
Natal
INPE
Campina Grande
INSA
Recife
CETENE
Cuiabá
INPP
INPE
Brasília
CGEE*
IBICT
EMBRAPII*
Foz do Iguaçu
INA
Criciúma
CETEM
Santa Maria
INPE
Itajubá
LNA
Santa Teresa
INMA
Cachoeiro de Itapemirim
CETEM
Petrópolis
LNCC
Rio de Janeiro
CBPF
CETEM
IMPA*
INT
ON
MAST
RNP*
Cachoeira Paulista
INPE
São José dos Campos
INPE
Campinas
CNPEM*
CTI
*Organizações Sociais
INSTITUTOS DE PESQUISA
NÚCLEOS REGIONAIS PREVISTOS
NÚCLEOS REGIONAIS IMPLANTADOS

RECURSOS INVESTIDOS EM C,T & I




Strategic Sectors
(ENCTI e PBM)
Nanomaterials
Nanomaterials from biomass (eg nanocellulose), polymers with high-performance and new features, nanocatalysts, environmental control (air, water, pesticides), products for defense.
Health Complex
Diagnosis and epidemiological control of neglected diseases and / or tropical, decentralization of health services (Laboratory on a Chip).
Sensors, devices, nanosystems
Defense systems, industrial and public safety, environmental monitoring, quality in processes / products, diagnostics and monitoring in the health complex.
Energy
Generation, storage and efficient use of energy (photovoltaics, batteries, white LED lighting).
Personal Care
Photoprotection, etc. Personal care products impacting a large consumer market (Brazil is the third world market).
Textiles
Aggregation functions (Bactericide, flame retardant, strength, antiprojéteis, chemical barrier).

Promoting the Implementation of Safe by Design

NANoREG
Context of the project

Aart Dijkzeul
Programme Manager NANoREG
Prague; 19 February 2015

Funded by
The European Union

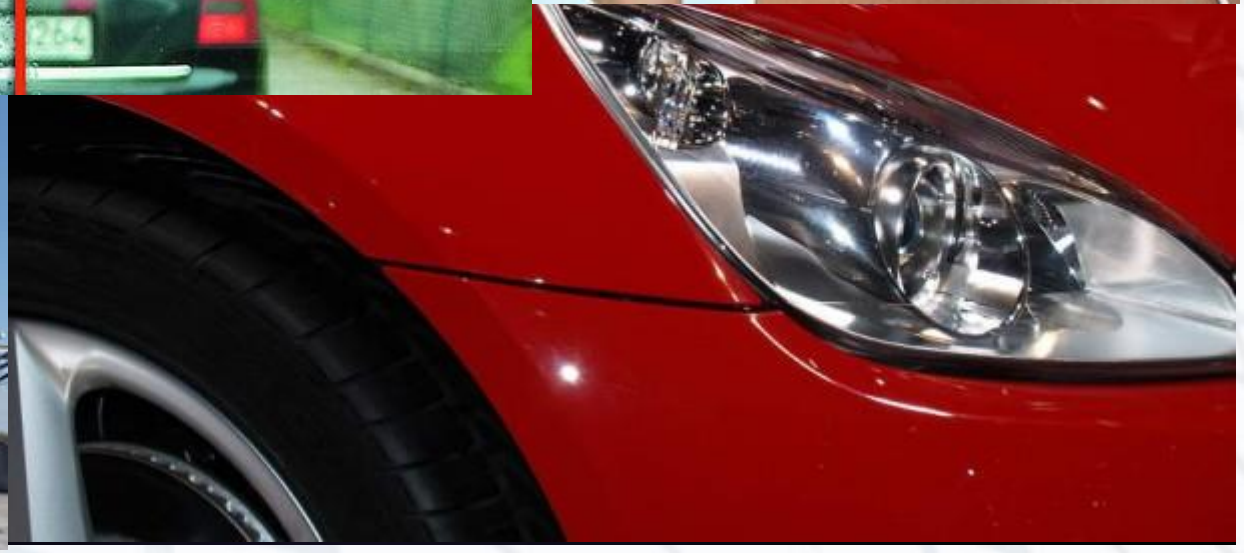
Content

- Nanotechnology: unlimited possibilities
- Uncertainty on EHS aspects
- 10 years of research
- What is needed
- Role of NANoREG

Nanotechnology: unlimited possibilities

- Nanotechnology is one of the six “Key Enabling Technologies” (KET’s) in the EC,
- Of paramount importance for the transition to a knowledge-based and low carbon resource-efficient economy.
- Important for the competitiveness of European industries in the knowledge economy.

Nanotechnology: unlimited possibilities



Uncertainty on EHS aspects

- Limited understanding of the Environmental, Health and Safety (EHS) aspects of NanoMaterials (NMs) is threat to capitalisation of potential of nanotechnology.
- It leads to uncertainty on how to judge the EHS aspects of these materials in a regulatory context.
- This has a negative impact on the investment climate and on societal appreciation of products containing NMs.
- Especially negative for SME's.

Ten years of research

- >>100 milion euro investment and 10 years of research on EHS aspects
- Research on characterization, release, kinetics, mode of action etc.
- Dramatically increase of number of publications on EHS aspects.
- Still no-one can answer the question: are Nanomaterials a serious thread to environment and health?

Ten years of research

- Cause of this frustrating conclusion
- No central coordination: it's all bottom up; "Let a 100 flowers bloom".
- Maybe appropriate for science and innovation; but for addressing societal worries and regulatory questions its rather inefficient
- $V_{Data} = R^2EC$

$V_{RD} = R^2EC$

- V_{RD}: Value of generated data
- **R**eliability of generated EHS data is unknown
- **R**elevance of data is questionable
- **E**xchangeability of data is limited (no standardized ontology, no standardized way of reporting meta data, no system for data exchange
- **C**omparability insufficient because of difference in
  - methods,
  - materials,
  - operating practise

NANoREG: top-down

- Experience so far indicate there is a strong need for:
- Focus on regulatory needs and not (only) scientific needs: Methods and data that can be used in a regulatory context.
- Top down approach to assure R^2EC. Basic condition for linking *in vitro-in vivo, categorization, read across etc*
- This, in a nutshell, is the basic philosophy of NANoREG.

NANoREG
State of the art

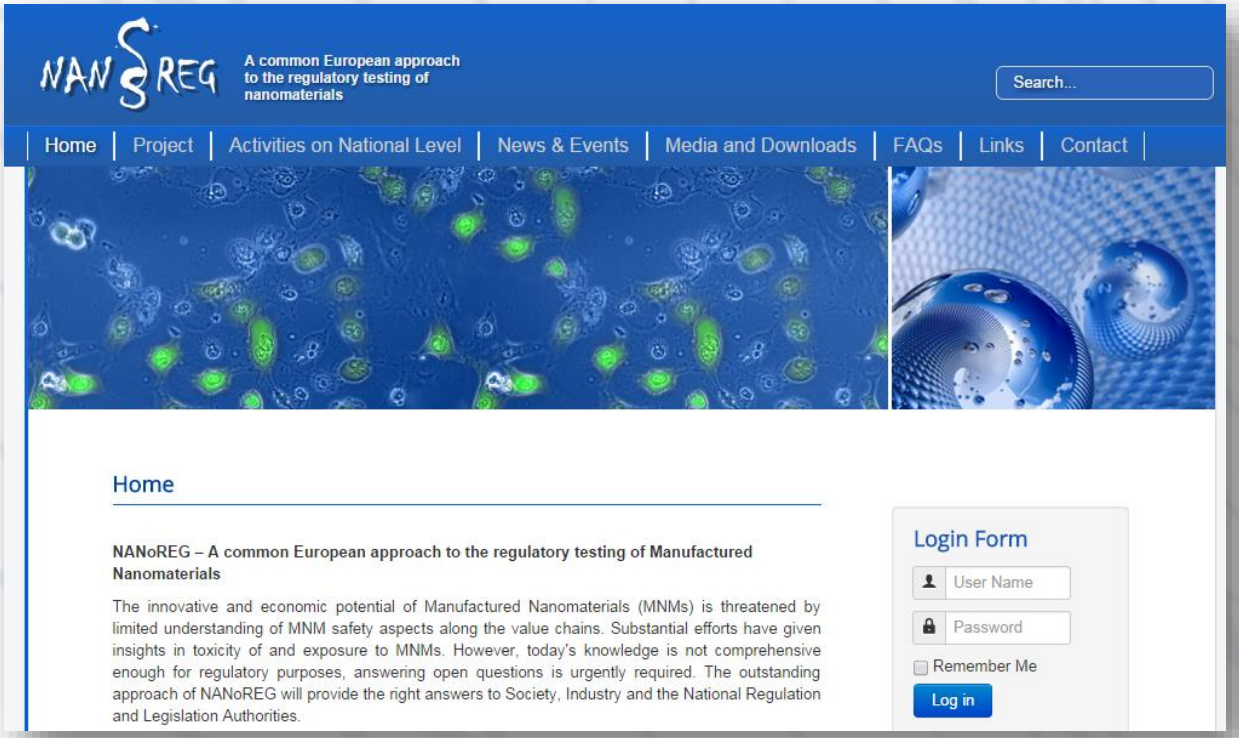
Funded by
The European Union

Project Factsheet

- Collaboration between 63 partners from:
  - - 13 EU Member States
  - - 2 Associated States (CH, NO),
- Involvement of industry (individual companies, CEFIC, NIA…)
- Interest from: **Brazil,** Korea, Australia, Canada, Turkey, China, …
- Links to ECHA, OECD, ISO
- Links to ongoing EU FP7 projects
- Ca. 50 M€, (20% EC)
- 42 months duration; Started March 2013

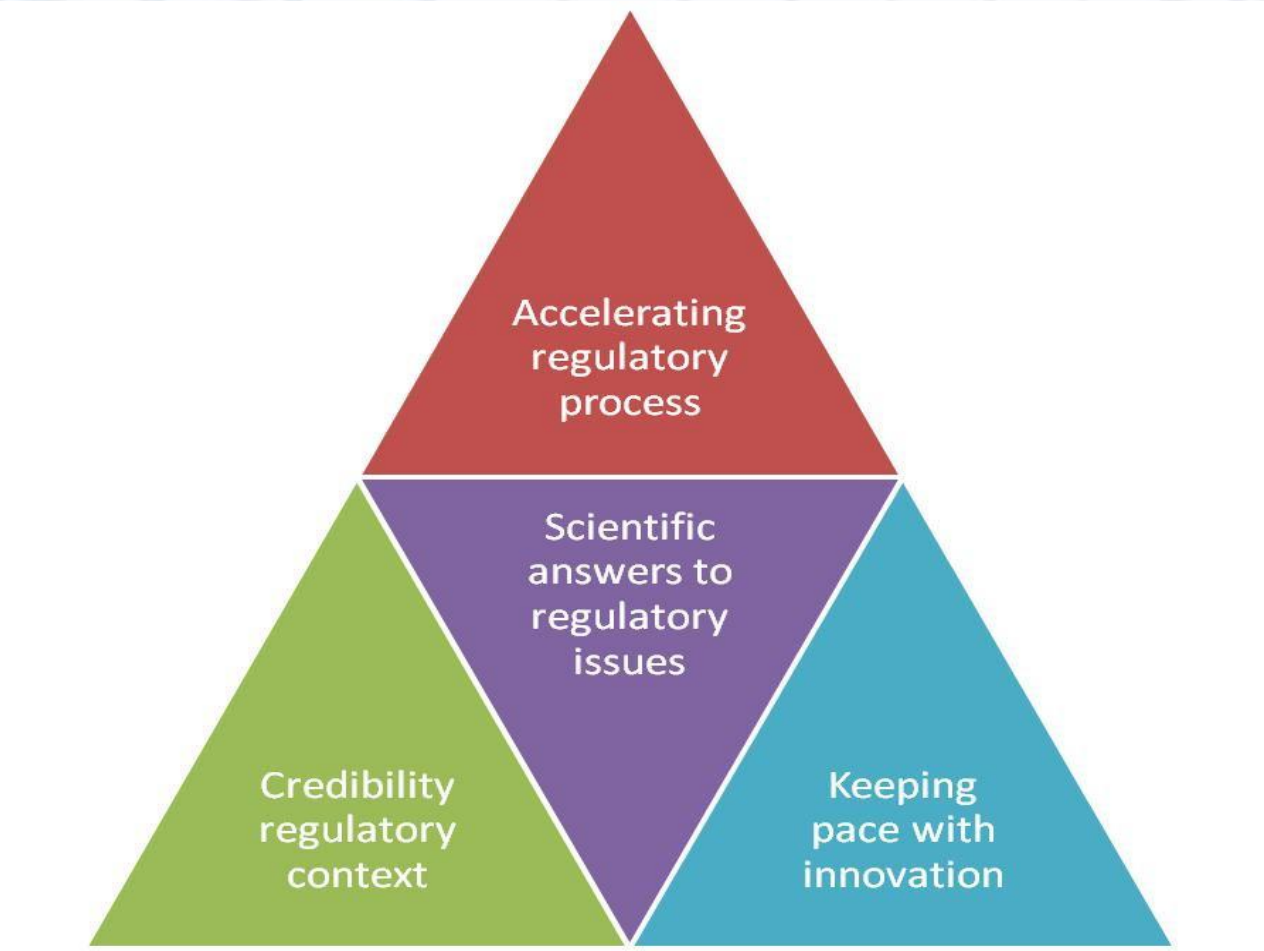
NANoREG:

A common Euro



- [www.nanoreg.eu]

Overall NANoREG Structure



Specific NANoREG Objectives

- Provide regulators with a **set of tools for risk assessment and decision making instruments** for the short to medium term, by gathering data and performing pilot risk assessment, including exposure monitoring and control, for a selected number of nanomaterials used in products,

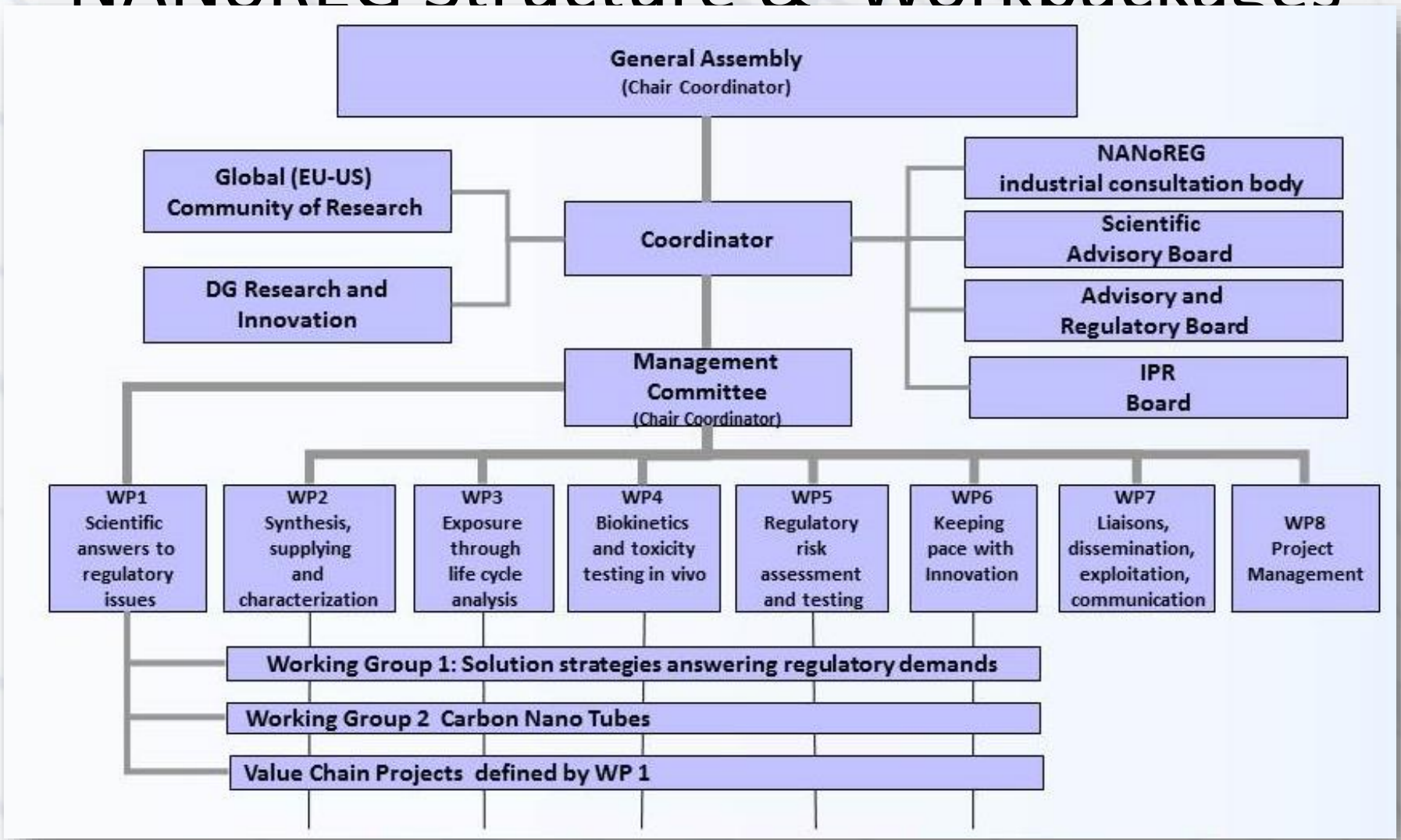
- Develop for the long term, **new characterization and testing strategies** adapted to a high number of nanomaterials where many factors can affect their environmental and health impact, and

- Establish a **close collaboration among authorities and industry with regard to the knowledge required for appropriate risk management**, and create the basis for common approaches, mutually acceptable datasets and risk management practices.

NANoREG Approach

- **Project structured to deliver answers to questions relevant to regulators**
- Interlinking industry, regulatory authorities and researchers (networks)
- Establish a set of standard operation procedures (SOPs)
- **Generation of reliable, comparable and exchangeable data**
- Grouping of nanomaterials based on physico-chemical and toxicological properties
- **Top down (mandatory framework for partners regarding materials, methods, characterisation)**

NANoREG Structure & 'Workpackages'



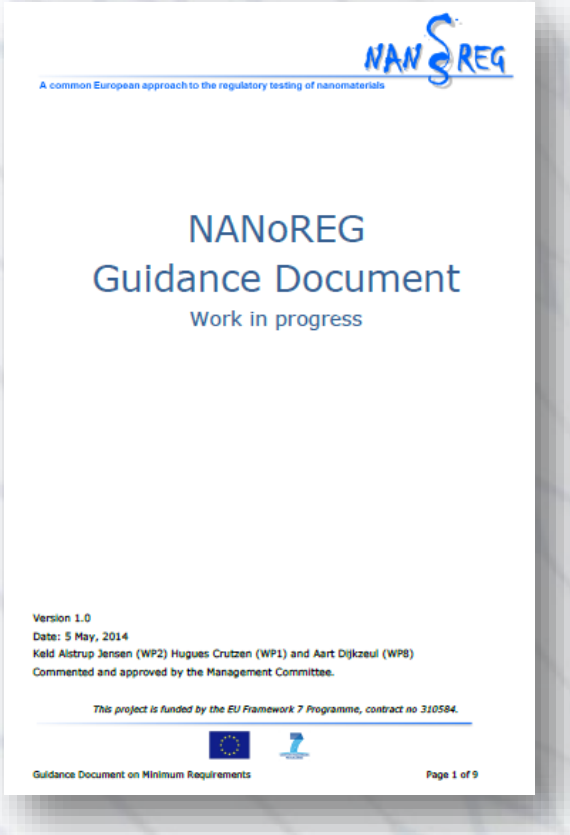
What has been achieved so far? (1)

- The Regulatory Questions have been refined (after a round of consultation) to focus on:

- measurement, characterisation, identification,
- transformation,
- dose metrics, metrological aspects,
- persistence and long term effects,
- kinetics,
- grouping,
- hazard, risk,
- exposure, etc

What has been achieved so far? (2)

- A Guidance Document on Minimum Requirements (for measurement and characterisation during testing)



What has been achieved so far? (3)

- 19 manufactured nanomaterials (**supplied by industry**) and additional alternative materials have been selected for mandated (!) use by NANoREG partners,

Type of MNM	MNM Identification codes used by NANoREG
Titanium Dioxide	NM101, NM102, NM103
Silicon Dioxide	NM200, NM203
Zinc Oxide	NM110, NM111
Cerium Dioxide	NM212
Barium Sulphate	NM220
Silver	NM300K, NM302
Nanotubes (single and multi-walled)	NM400, NM401, NM410
Nanofibrillar cellulose	NFC Fine, NFC Medium-coarse, UPM Biofibrils AS, UPM Biofibrils NS, UPM Bleached Birch Pulp
Final material closing knowledge gaps	Under evaluation

What has been achieved so far? (4)

- A Gap Analysis has been run to identify the regulatory data gaps and research needs,
- SOPs for the creation of MNM dispersions for measurement and toxicity testing have been set and prescribed:

Type of test	Protocol
Defining conditions for Ultrasound bath	Calorimetic method combined with adjustment using the NM400 and NM401a as benchmark materials
Defining conditions for Probe-sonication	Calorimetic method combined with adjustment using the NM200 benchmark material
***In vitro* studies**	NANOGENOTOX
***In vivo* studies**	NANOGENOTOX or ENPRA
Eco-toxicity studies	PROSPECT as the basis and a NOM-water protocol for CNT

What has been achieved so far? (5)

- Minimum characterisation requirements for the toxicological studies have been set and prescribed, and

3.2 Minimum characterization requirements for dispersions and exposure media

3.2.1 Test item preparation and exposure characterization protocols

To ensure high-quality assessment of the in-use performance of the dispersion protocols, *in vitro* and eco-toxicological test results, and finally to catch the potential outliers, the MC has decided on the means to produce a limited set of mandatory characterization data and how they should be reported.

The minimum characterization requirements are:

- Analysis of the hydrodynamic size(-distribution) of NM in the batch dispersion.
- Analysis of the initial hydrodynamic size(-distribution) of NM in the exposure medium.
- Analysis of the final hydrodynamic size(-distribution) in the exposure medium.

[excerpt from NANoREG Guidance Document]

- A literature review supporting the development of nanomaterial categorisation criteria has started and will soon be finalised.

What has been achieved so far? (6)

… and what else are we doing:

Most of planned R&D activities are pending; e.g.

- Characterisation of NMs; SOPs for primary particle size, VSSA, evaluation OECD TGs,
- (Critical) exposure scenarios, dustiness testing, exposure measurements, mesocosms, minimum characterisation requirements
- Long term inhalation study, prenatal study, in vivo genotoxicity and immune study
- (Preparatory work for) in vitro testing, comet assay,

… and much more:

NANoREG

- Brazil's participation in NANoREG was established in 09/2014;
- Eight Brazilian laboratories will provide contributions for five of the seven work packages proposed by NANoREG;
- The scientific coordination of NANoREG in Brazil is done by INMETRO while management within government is done by the Ministry of Science, Technology and Innovation (MCTI).

NANoREG

- Instituto Nacional de Metrologia, Qualidade e Tecnologia INMETRO – coordenação científica do NANoREG Brasil;
- Centro de Tecnologias Estratégicas do Nordeste (CETENE), Laboratório Multiusuario de Nanotecnologia;
- Empresa Brasileira de Pesquisa Agropecuária EMBRAPA;
- Universidade Federal do Rio Grande do Sul UFRGS;
- Universidade de São Paulo (USP);

NANoREG

- **Universidade Federal do Rio Grande (FURG); Instituto de Ciências Biológicas (ICB)**

- **Universidade Federal de Minas Gerais (UFMG), Instituto de Ciências Biológicas (ICB);**

- **Universidade Estadual de Campinas (UNICAMP); Departmento de Química Inorgânica NanoBioss/Instituto de Química.**

Promoting the Implementation of Safe by Design

FINAL REPORT

Tom van Teunenbroek
Coordinator ProSafe

September 2015

Funded by
The European Union

Safe design is a process defined as the integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of a structure being designed.

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The European Union

Context

Promoting the Implementation of Safe by Design

Main aim of ProSafe:

Present a way forward to reduce the uncertainties regarding nanosafety in such a way that:

- the innovation potential of nanotechnology can be fully exploited
- while at the same time unacceptable risks for human health and the environment can be avoided.

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Context

Promoting the Implementation of Safe by Design

Main actions aimed at:

- Strengthen the NANoREG project:
  - additional data, expertise and capacity
  - extending the platform of support
- Foresight study: what will come in the next 3-10 years regarding product development and risk management.
- Establishing standard approaches for (EHS) data management.
- Acceptance and further elaboration of the NANoREG safe innovation and safe-by-design concept

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Main deliverables

Promoting the Implementation of Safe by Design

Results of activities: integrated in the White Paper

- Policy oriented document with recommendations for regulators and policymakers for short and long term on the assessment of nanomaterials within existing REACH framework
- Relevant for Industry
- Assessment framework and accompanying instruments for the short and the long term
- Safe Innovation/Safe by design for the long(er) term

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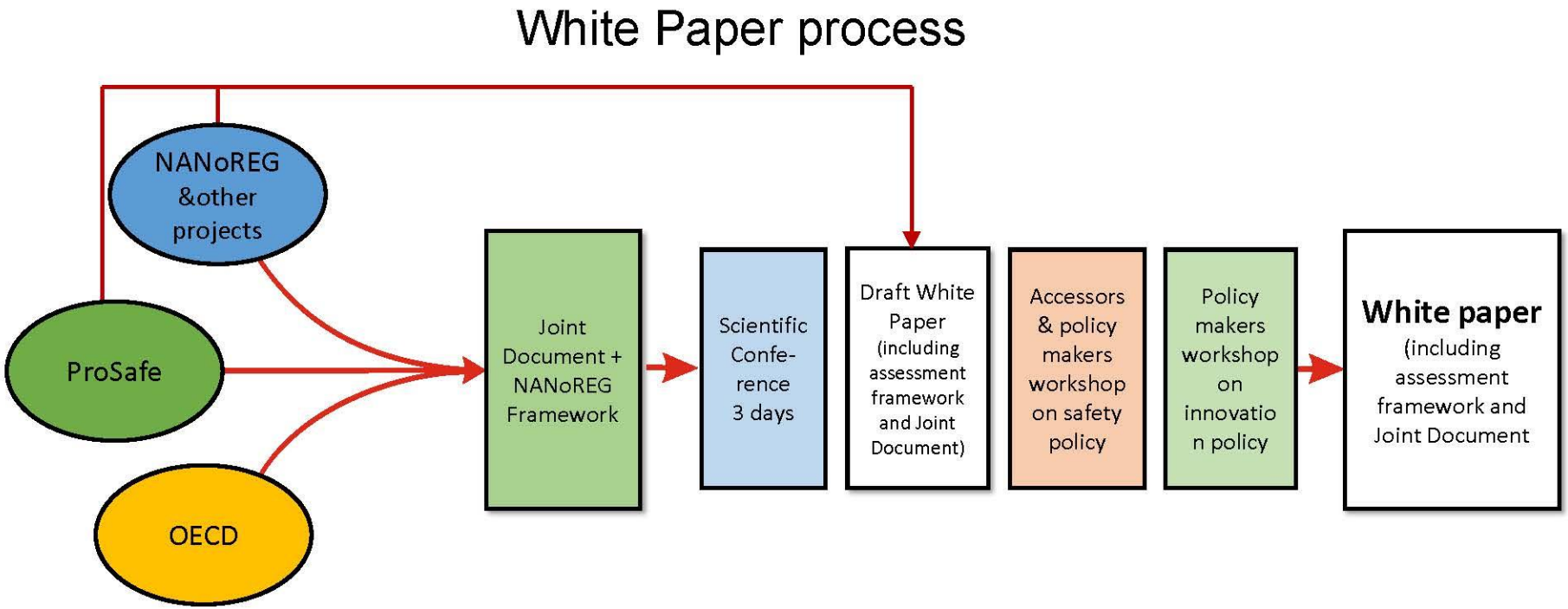
Development of White paper

Promoting the Implementation of Safe by Design



Funded by
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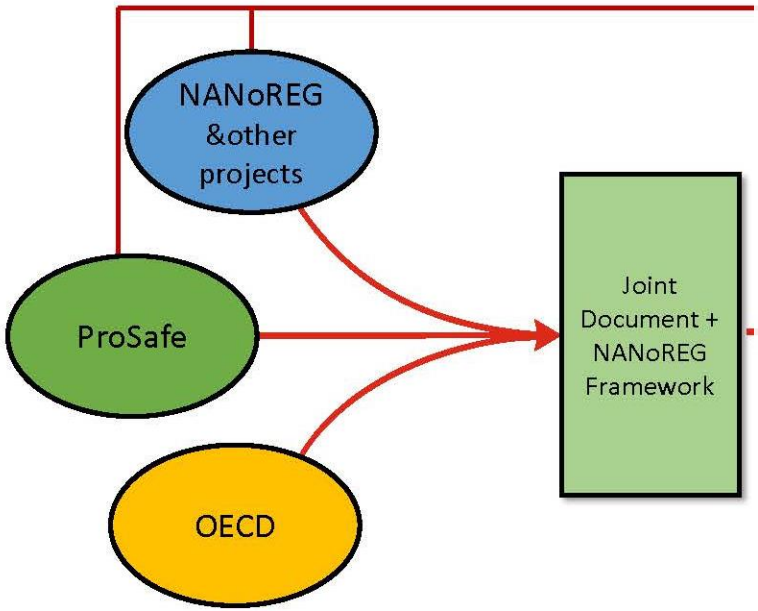
Development of White Paper



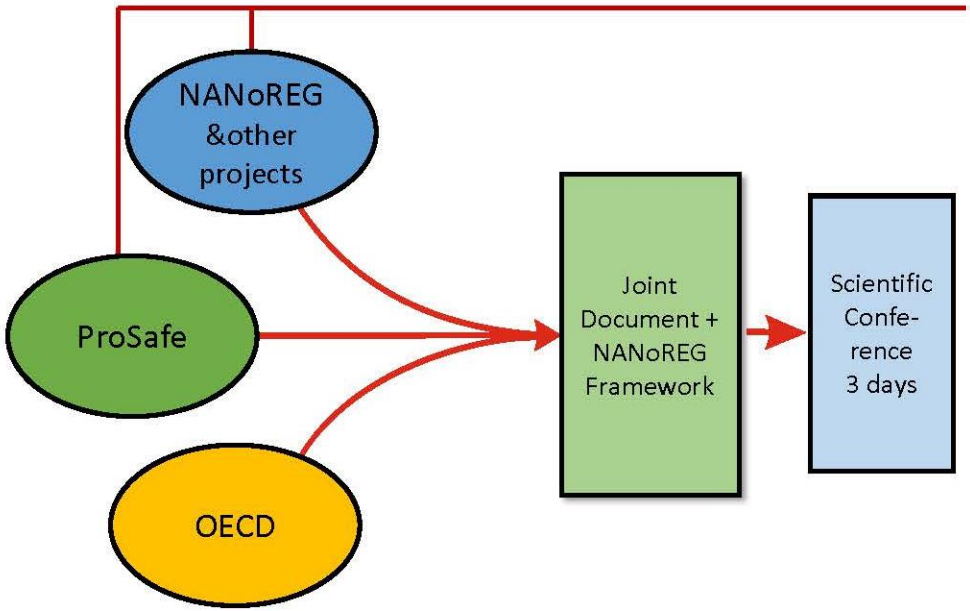
Joint Document:

- Review of results, protocols, guidance documents of NANoREG and other projects by Task Force chaired by Klaus Steinhauser and Phill Sayer
- relevant themes such as grouping, read across, characterisation, toxicity, environmental fate, ecotoxicity, exposure, waiving

Funded by
The European Union

Development of White Paper

Promoting the Implementation of Safe by Design



Scientific Conference

- 3 day event; co-organised by OECD; November 2016
- relevant themes such as grouping, read across, characterisation, toxicity, environmental fate, ecotoxicity, exposure, waiving
- Input: Joint Document + NANoREG framework

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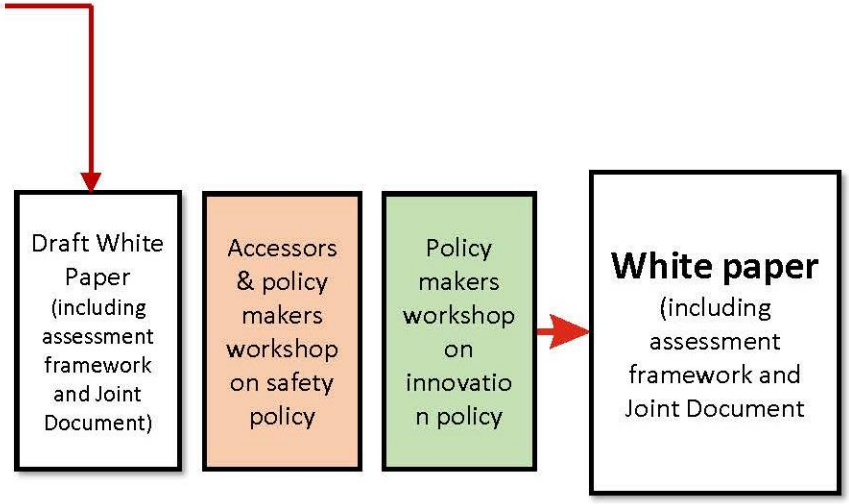
Development of White Paper

Promoting the Implementation of Safe by Design

Draft White paper

Input:

- Results scientific conference
- Results PS foresight study
- Results PS data management
- Results NR/NR Safe by Design
- Other relevant results NR



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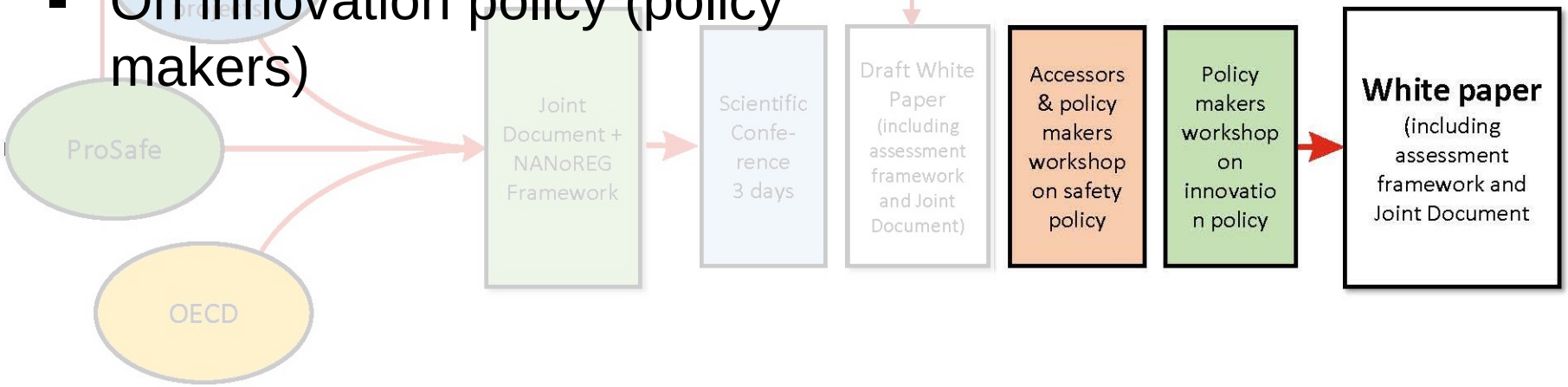
Development of White Paper

Promoting the Implementation of Safe by Design

Workshops:

- On safety policy (accessors and policymakers)
- On innovation policy (policy makers)



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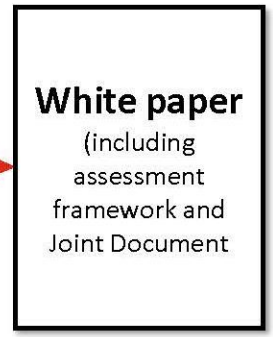
Development of White Paper

Promoting the Implementation of Safe by Design

White Paper Elements

- Analysis of present situation
- Recommendations for policy framework
- Recommendations for Assessment framework: -
  - for “classic nanomaterials”. Basis will be the NANoREG Framework and the Joint Document
  - for “novel nanomaterials (for the long term) Based on NR/PS results SbD/Safe Innovation
- Additional/future needs: e.g. Datamanagement
- First discussion on White Paper elements: MC
- Later this year: discussion with stakeholders



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Development of White Paper

Promoting the Implementation of Safe by Design

Planning:

- 04/2016 Results NR and other projects available
- 09/2016 Joint Document and NR Framework
- 11/2016 Scientific Conference
- 01/2017 Workshops on safety policy and innovation policy with accessors and regulators
- 02/2017 White Paper

- Development draft White Paper: ongoing activity already started.

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Thank you for your attention.

SEVENTH FRAMEWORK PROGRAMME