PROJECT FINAL REPORT

Grant Agreement number: 218528

Project acronym: OBSERVATORYNANO

Project title: European observatory for science-based and economic expert analysis of nanotechnologies, cognisant of barriers and risks, to engage with relevant stakeholders regarding benefits and opportunities.

Funding Scheme: Coordination and support actions (Supporting)

Period covered: **from** 01.04.2008 **to** 31.03.2012

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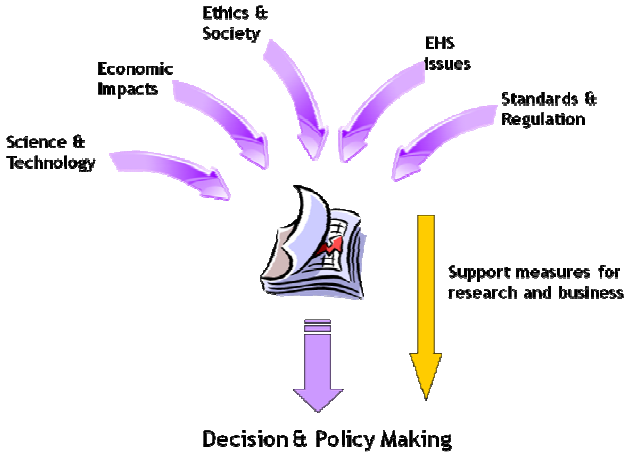

Figure 1. Overview of approach taken by ObservatoryNANO.

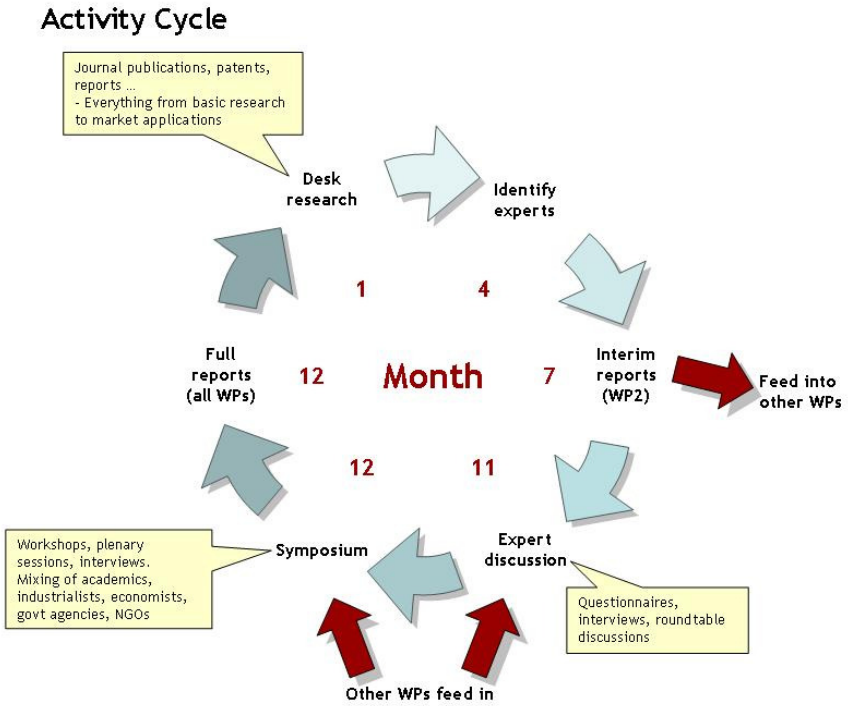

Figure 2. Initial annual activity cycle of the ObservatoryNANO

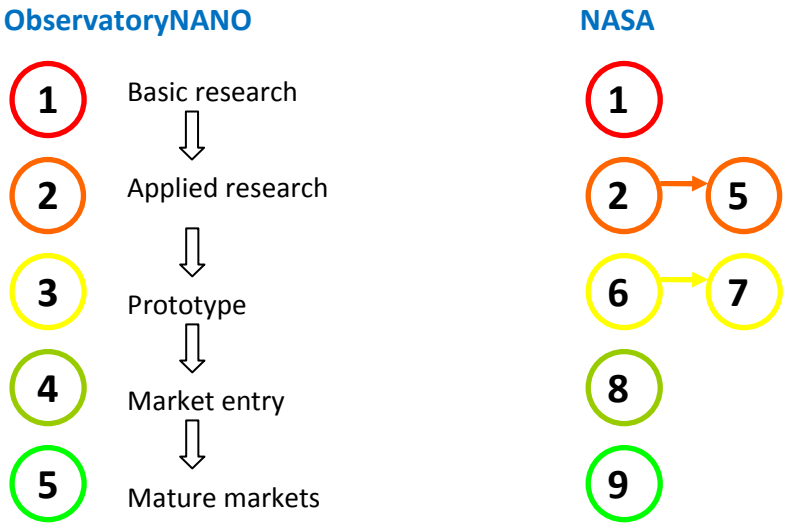

Figure 3. Technology Readiness Level approach adopted by the ObservatoryNANO and comparison with that of NASA

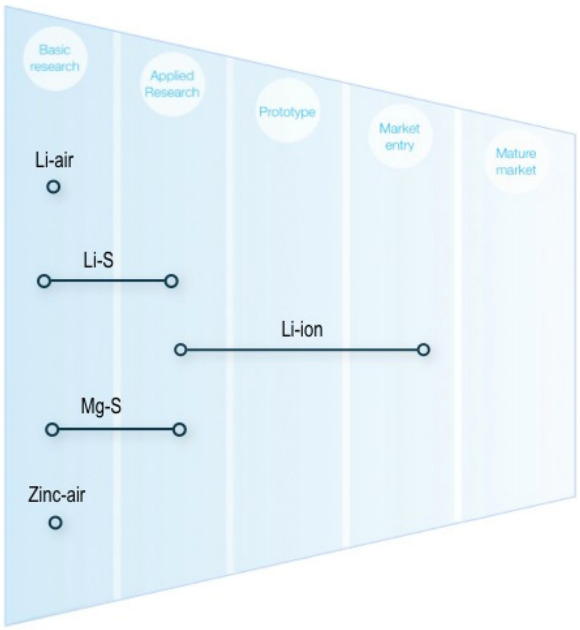

Figure 4. TRL for batteries for electric vehicles

Working Group	ST	Economic	ELSA	EHS	Regulation & Standards	Final editing of documents
Aerospace & Transport	B&W	B&W	MTV	IOM	AIRI	IoN
Agrifood	IoN	TCASCR	MTV	RIVM	IoN	IoN
Chemistry & Materials	VDI	NMTC	MTV	IOM	AIRI	IoN
Construction	VDI	B&W	MTV	IOM	AIRI	IoN
Energy	CEA	Spinverse	MTV	CEA	AIRI	Spinverse
Environment	Empa	Spinverse	MTV	EMPA	RIVM	Spinverse
Health, Medicine & Nanobio	IoN	NMTC	CEA	RIVM	IoN	IoN
ICT	Spinverse	Spinverse	CEA	CEA	AIRI	Spinverse
Security	IoN	Spinverse	CEA	CEA	IoN	IoN
Textiles	AIRI	B&W	CEA	IOM	AIRI	IoN

Table 1. Working group structure to assess implications of different aspects of nanotechnology developments.

Factsheets have 1-2 pages for each TS, and summarising the main developments and opportunities, and wider issues.

Briefings are 4 page documents, topical and responsive, including a more complete assessment of wider issues, specifically written for policy-makers.

General Reports are available for all types of analysis (ST, economic, ELSA, EHS, regulations and standards) and provide greater depth of analysis.

Figure 5. Project output.

Technology Sector	Focus Report
Aerospace, Automotive & Transport	• Coatings, Adhesives & Sealants
Agrifood	• Nanotechnology for Biodegradable & Edible Food Packaging • Nanotechnology for Nutrient & Biocide Delivery in Agricultural Production
Chemistry & Materials	• Aerogels • CNT & Nanodiamond
Construction	• Adhesives & Sealants
Energy	• Nanotechnology in Photovoltaics • Nanotechnology in Batteries • Nanotechnology in Batteries for Electric Vehicles
Environment	• Nano Zero Valent Iron
Health, Medicine & Nanobio	• Nanotechnology & Therapeutic Delivery • Nanotechnology in Regenerative Medicine
Information & Communication Technology	• Printed Electronics • Optical Interconnects
Security	• Protective Materials for Emergency Responders
Textiles	• Medical & Sport/Outdoor Textiles

Table 2. Focus reports published by ObservatoryNANO.

No.	Technology sector	Briefing title	Publication date
1	Agrifood	Biodegradable Food Packaging	Jul 2010
2	Environment	Photocatalysis for Water Treatment	Aug 2010
3	Construction	Nano-enabled Insulation Materials	Aug 2010
4	ICT	Universal Memory	Oct 2010
6	Health, Medicine & Nanobio	Next Generation Sequencing	Oct 2010
6	Transport	Nano-enhanced Automotive Plastic Glazing	Oct 2010
7	Textiles	Nano-enabled protective textiles	Dec 2010
8	Security	Nanotechnologies for anti-counterfeiting applications	Dec 2010
9	ICT	Nanotechnology for Flat Panel Displays	Jan 2011
10	Chemistry and Materials	Applications of Photocatalysis	Feb 2011
11	Security	Nanosensors for explosive detection	Feb 2011
12	Energy	Organic photovoltaics	Mar 2011
13	Environment	Nanostructured membranes for water treatment	Mar 2011
14	Chemistry and Materials	From microscope to nanoscope	Apr 2011
15	Health, Medicine & Nanobio	Bringing diagnosis closer to the patient	Apr 2011
16	Environment	Nanoenhanced membranes for improved water treatment	Jun 2011
17	Energy	Thermoelectricity for energy harvesting	Jun 2011

No.	Technology sector	Briefing title	Publication date
18	Agrifood	Improving delivery of essential vitamins and minerals	Jul 2011
19	Security	Nanotechnologies for secure communications	Aug 2011
20	Statistical Patent Analysis	Patents: an indicator of nanotechnology innovation	Aug 2011
21	Construction	Nanofillers – improving performance and reducing cost	Sep 2011
22	Environment	Nanosorbents for environmental applications	Sep 2011
23	Transport	Nanotechnology in automotive tyres	Nov 2011
24	Textiles	Nano-enabled automotive textiles	Dec 2011
25	ICT	Nanotechnology for Wireless Communications	Dec 2011
26	Chemistry and Materials	Addressing critical commodity scarcity	Jan 2012
27	Publication Analysis	Geographical Distribution of Nano S&T Publications	Feb 2012
28	Agrifood	Sensors in Food Production & Processing	Mar 2012
29	Health, Medicine & Nanobio	Pacemakers and ICDs	Mar 2012
30	Chemistry and Materials	Nanocomposite Materials	Mar 2012
31	Energy	Supercapacitors	Mar 2012
32	Transport	Nanotech in next-generation electric car batteries: beyond Li-ion	Mar 2012
33	Textiles	Nano-enabled Textiles in Construction and Engineering	Mar 2012

Table 3. Briefings published by ObservatoryNANO.

Country	Total public RTD funding (2011)	N&N funding (2011)	Proportion funding that is N&N
Germany	€12b	€500m	4.17%
France	€19.9b	€400m	2.01%
UK	€12.5b	€250m	2.00%
Italy	€9b	€100m	1.11%
Netherlands	€5b	€70m	1.40%
Spain	€9.7b	€60m	0.62%
Finland	€2.1b	€31.9m	1.52%
USA	€112.2b	€1.44b	1.28%
China	€40b	€1.8b	4.50%
Russia	€23.1b	€1.59b	6.88%
Japan	€34.3b	€710m	2.07%

Table 4. Public funding of N&N by selected countries (from ObservatoryNANO publication 'Public Funding of Nanotechnology' published March 2012)

Major regions	Publication share	Patent application share
USA	13%	40%
EU	33%	17%
Japan	6%	22%
China	7%	0%
Others	41%	21%

Table 5. N&N publications vs patents (1998-2007).

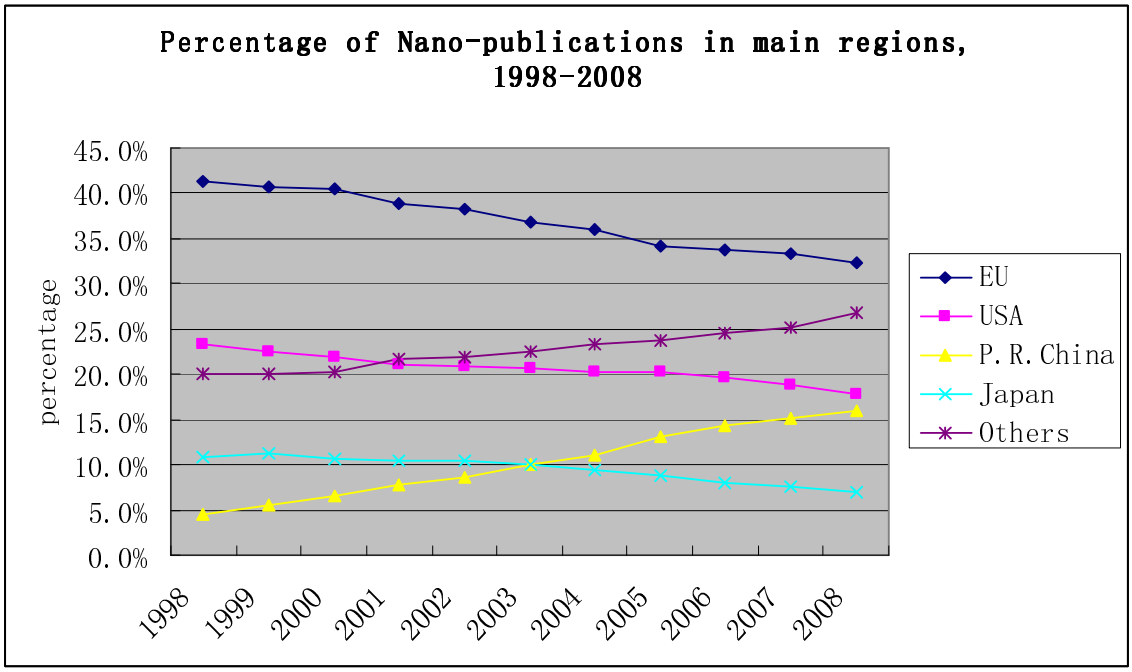

Figure 6. N&N publications as a percentage of total global output, 1998-2008

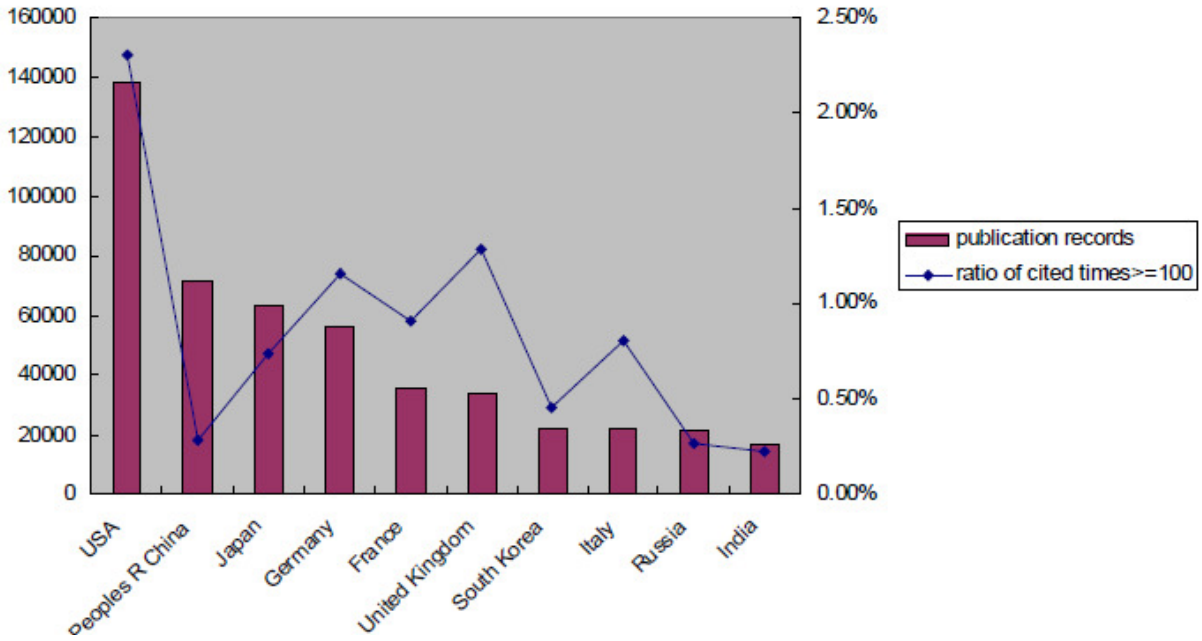

Figure 7. Numbers of publications and citation ratios.

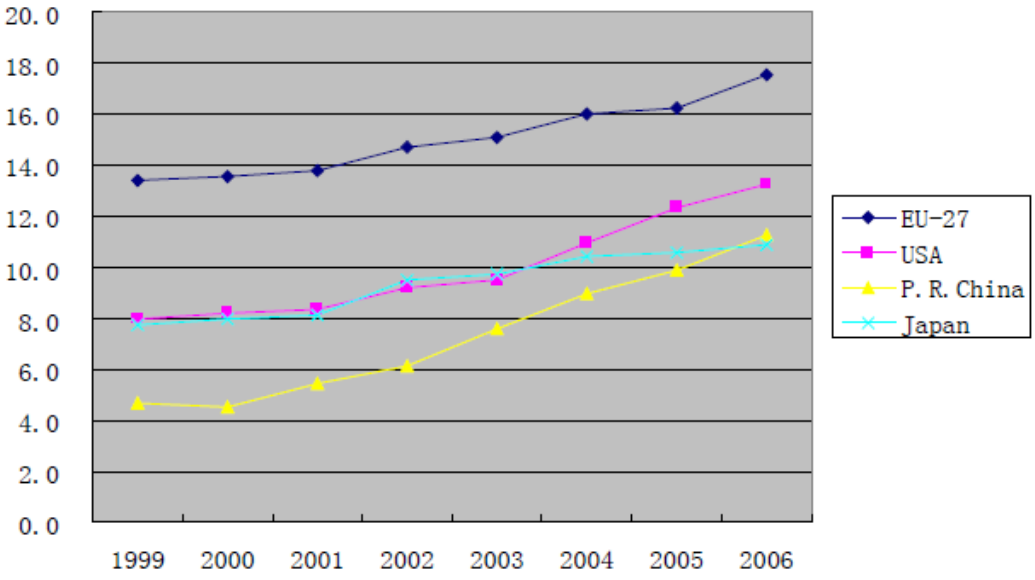

Figure 8. Publication records per 1000 researchers (full-time equivalents).

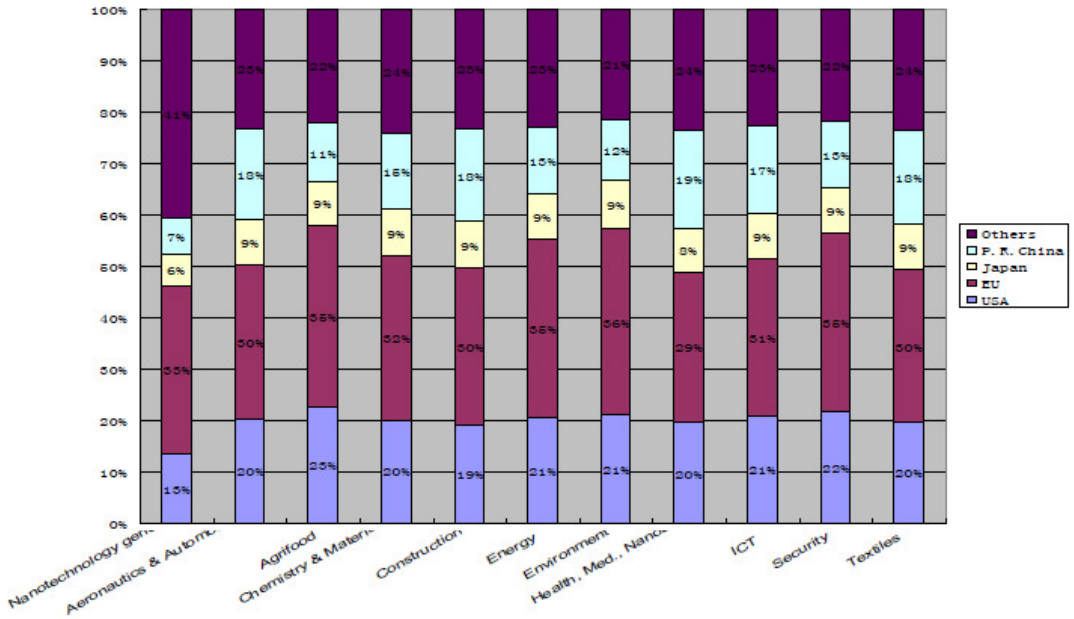

Figure 9. Share of N&N publications 1998-2008, per industrial sector.

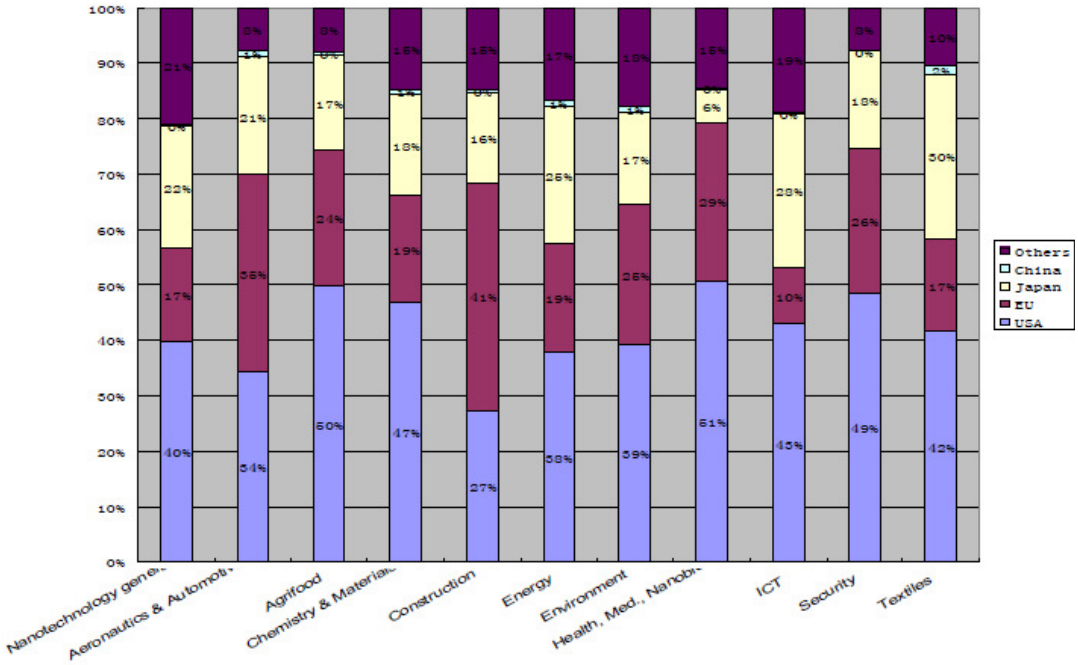

Figure 10. Share of N&N patent applications 1998-2008, per industrial sector.

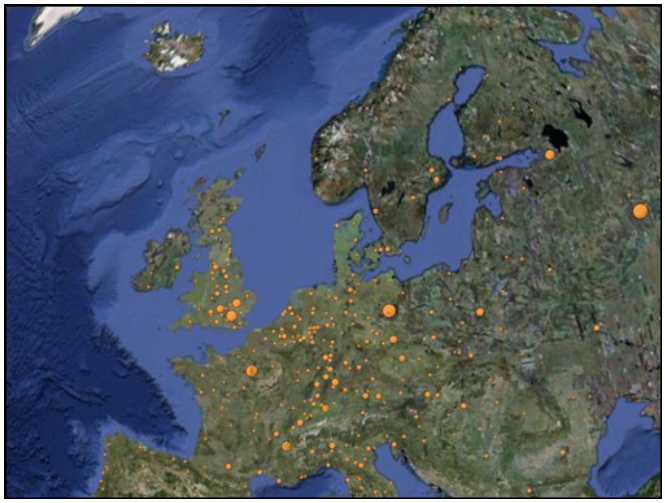

Figure 11. European Basic Nano S&T Clusters, 1998-2007

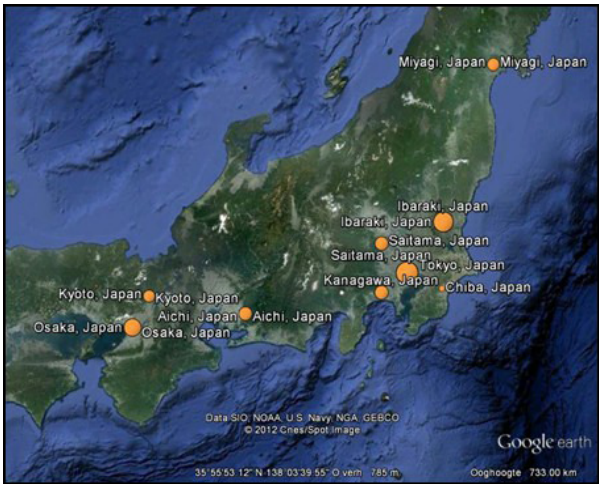

Figure 12. Tokaido Corridor visualisation using 2010 Nano S&T research output.

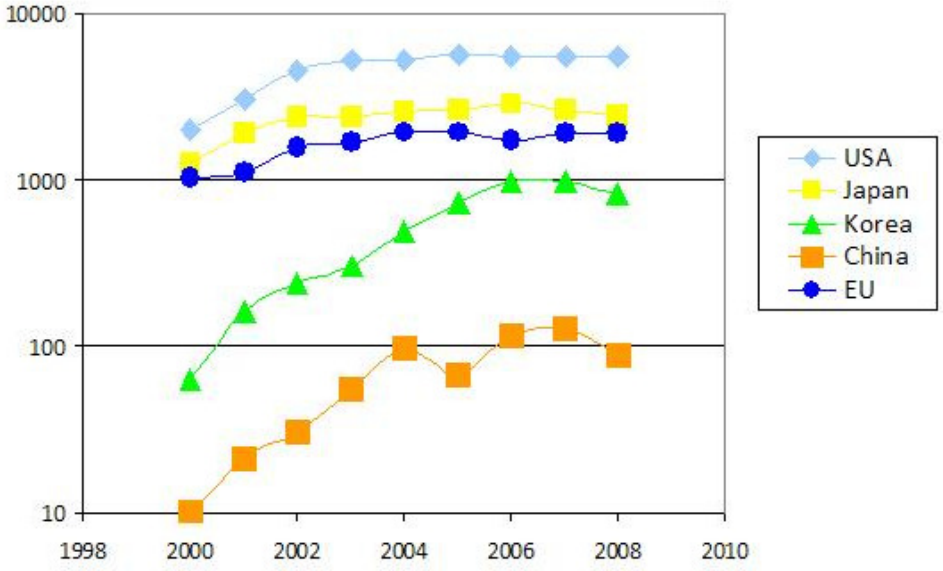

Figure 13. N&N patent applications from 1998- 2010.

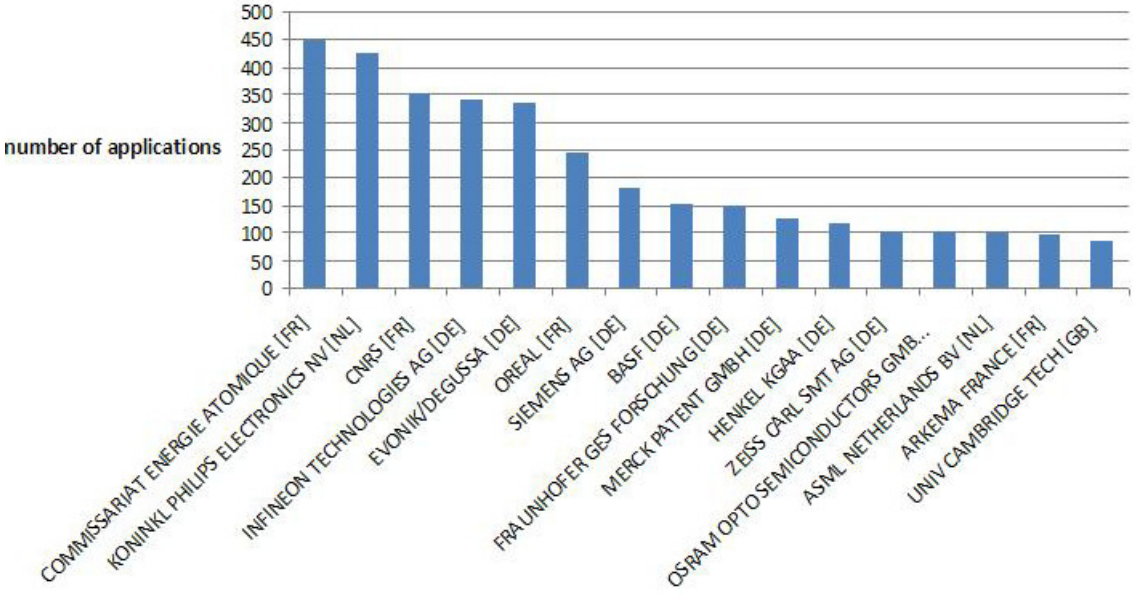

Figure 14. Total number of N&N patent application by EU organisation.

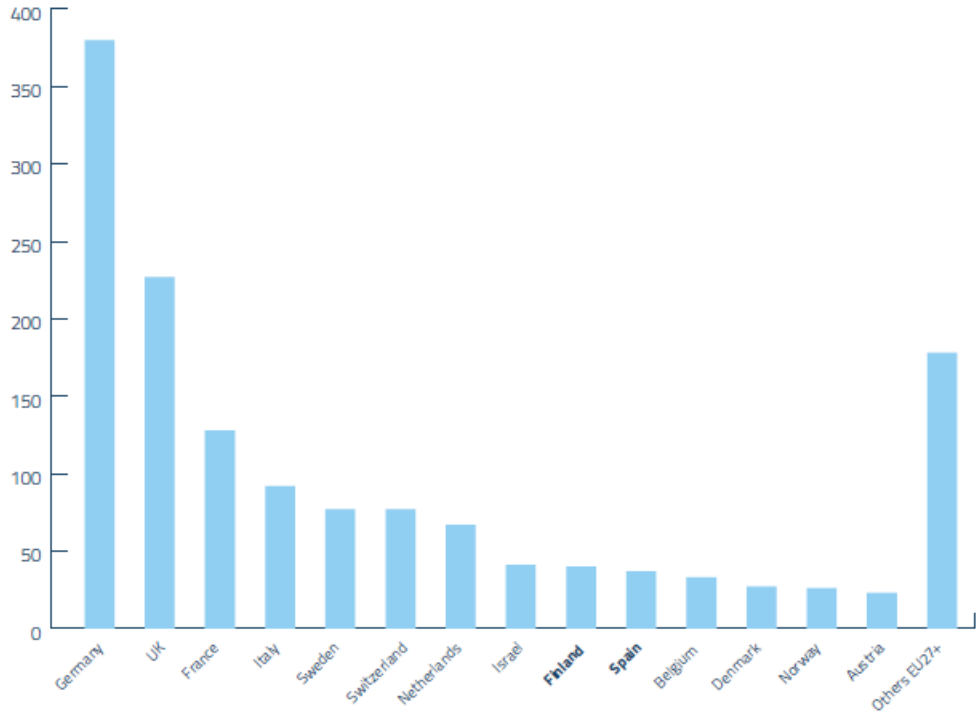

Figure 15. Numbers of nanotechnology companies identified in different EU Member States.

Level of satisfaction	European Union	National Government	Local Government
Very satisfied	16%	19%	12%
Somewhat satisfied	36%	39%	33%
Neither satisfied nor dissatisfied	37%	29%	42%
Somewhat dissatisfied	7%	8%	9%
Very dissatisfied	4%	5%	4%

Table 6. Extract from European Nanotechnology Landscape report showing respondent companies' level of satisfaction with government support (EU, National and Local).

Level of impact	Technological	Economic	Policy	Society	EHS
Major impact	24%	22%	4%	8%	11%
Moderate impact	42%	27%	21%	17%	24%
Some impact	19%	32%	41%	33%	37%
No impact at all	15%	19%	34%	42%	28%

Table 7. Extract from European Nanotechnology Landscape report showing respondent companies' perception of the level of impact that different barriers (technological, economic, policy, society, and EHS) have on commercial success.

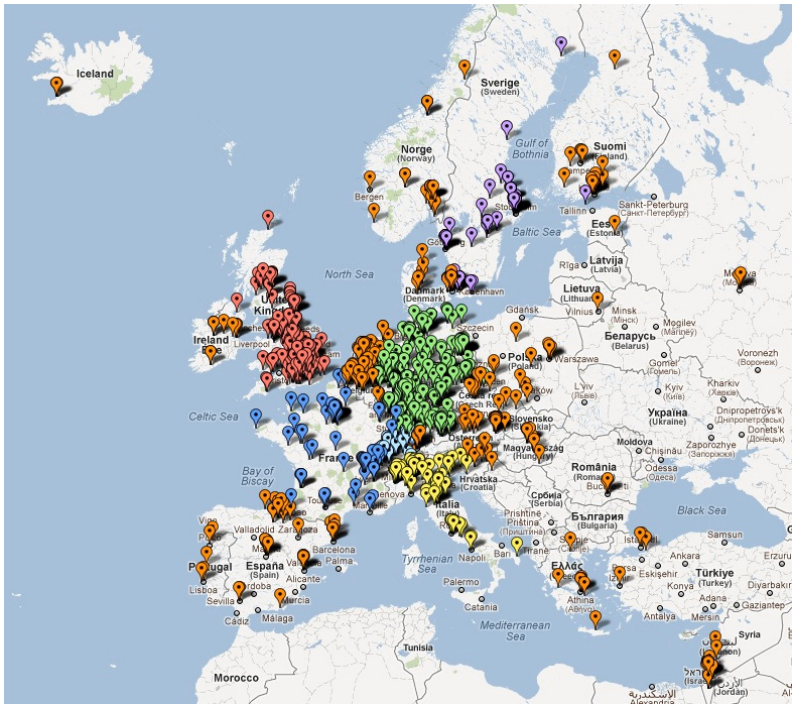

Figure 16. Online map of N&N companies

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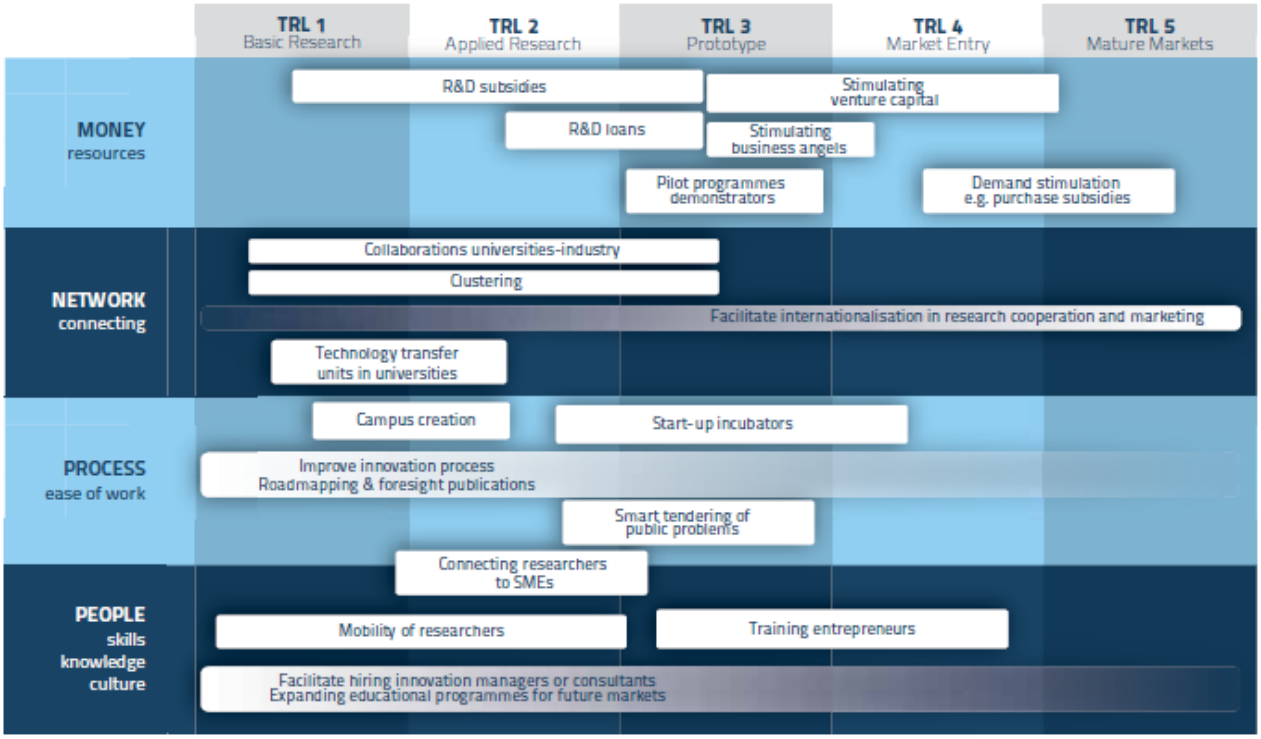


Figure 17. Nanotechnology innovation policies (from the 'European Nanotechnology Landscape' report).

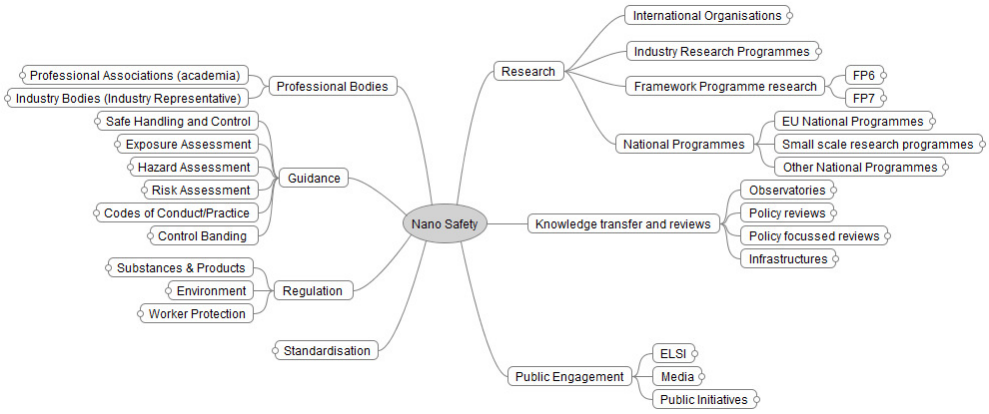


Figure 18. The Nanotechnology EHS Landscape Map

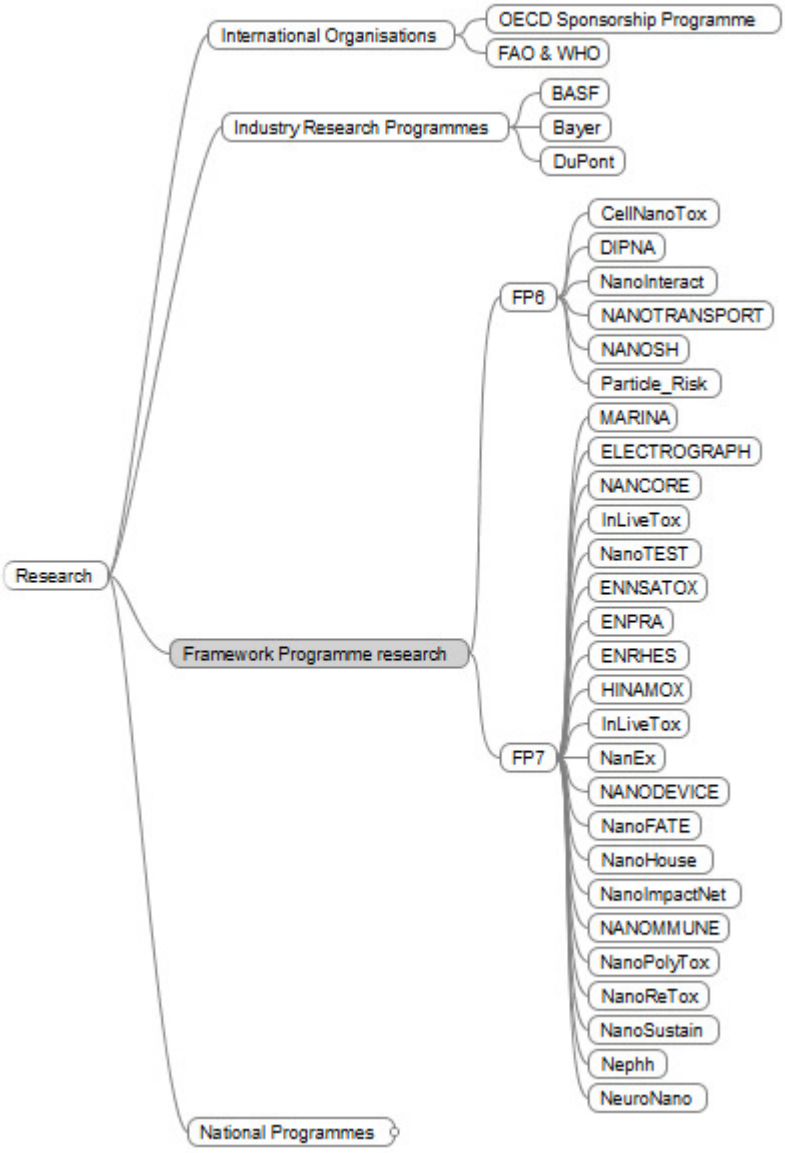


Figure 19. Mindmap of the research node - international organisations, industry and FP research.

	Foods, Agri-culture	Chemistry & Materials			Cos-metics		Medicinal products & medical devices		Occup-ational issues (OSH)	Environ-ment	Cross sectoral (nanomaterials, nanotech in general)	
European Commission	C	A	B		A	C	A		A		A	C
France			B				A		A		A	B
Germany		A							A		A	
The Netherlands		A							A		A	
Switzerland		A							A	A	A	
United Kingdom	A						A		A		A	
USA	A	A	B		A		A		A	A	A	B
Canada		A	B		A		A		A		A	C
Australia		A	B	C					A		A	C
Japan					A		A		A		A	
Other Countries									A		A	

Table 8. Summary of regulatory approaches adopted for nanotechnologies in different application areas by different government agencies.

A. Provide/improve technical guidelines and procedures to support safety assessment for specific types of nanomaterials/nano-related products.

B. Adapt/strengthen premarket notification procedures to ensure nanomaterials are reviewed before entering the market, including options for mandatory reporting schemes.

C. Introduce amendments and changes into existing legislation to ensure inclusion of nanomaterials and nano-related products (including issues such as specific definitions for nanotechnologies/nanomaterials, mandatory risk management procedures, labelling, restrictions, etc).

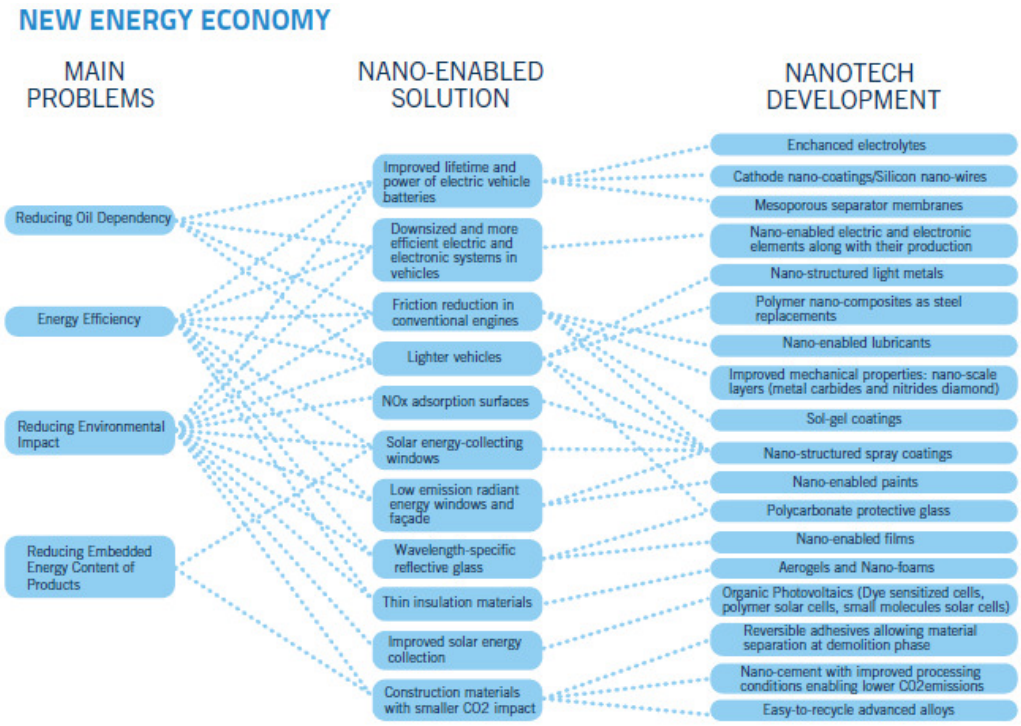


Figure 20. Example of a societal grand challenge ('New Energy Economy') and nanotechnology developments which could help address key issues.

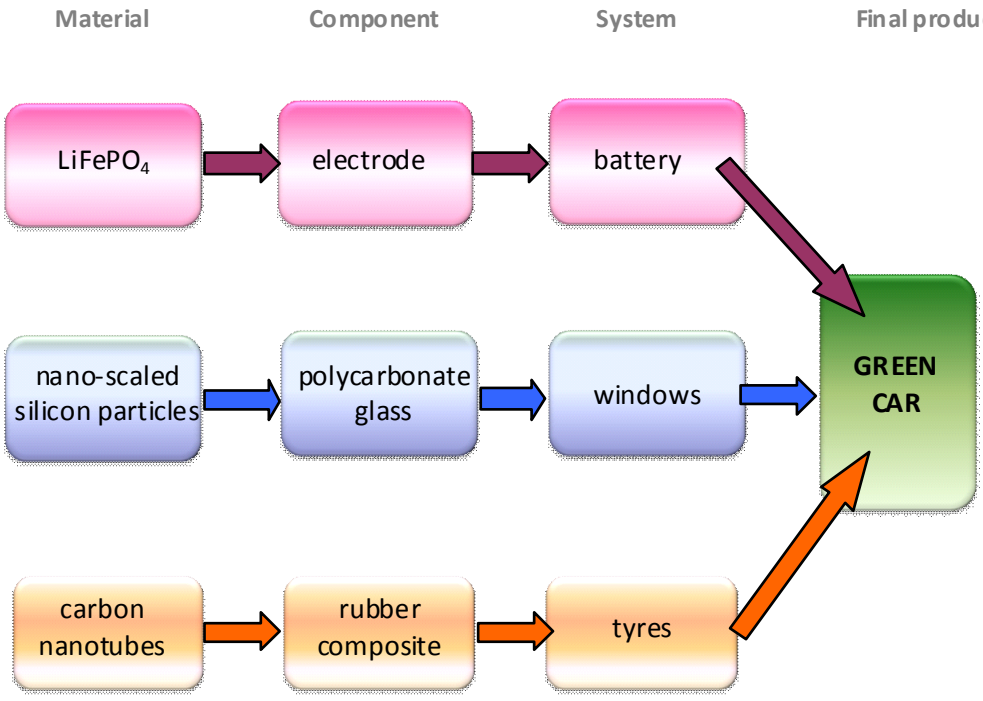


Figure 21. Some key stages in the Green Car Value Chain.

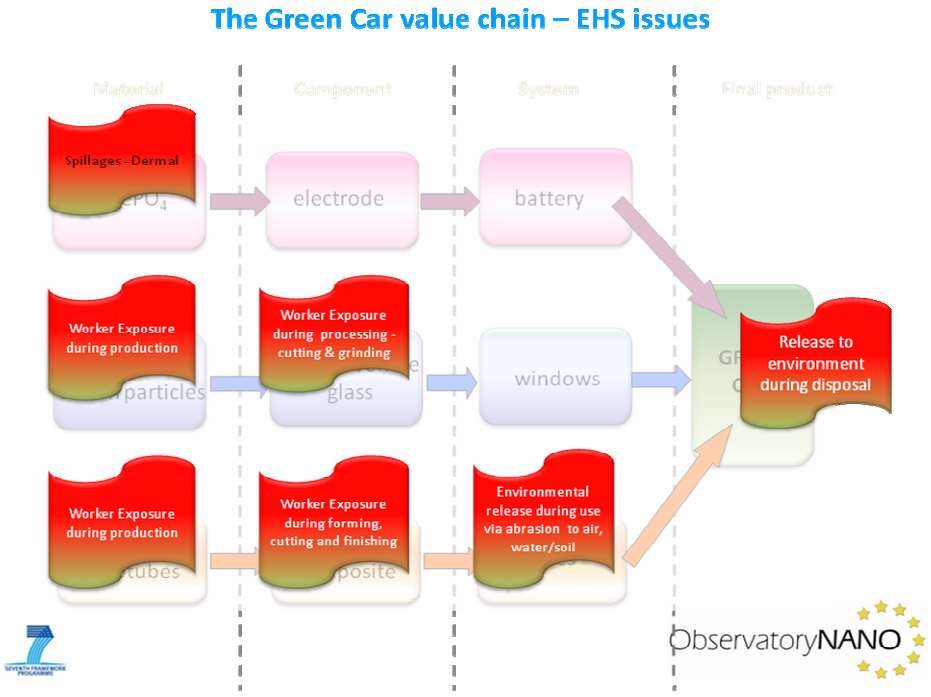


Figure 22. Some EHS issues associated with different stages of the Green Car value chain.

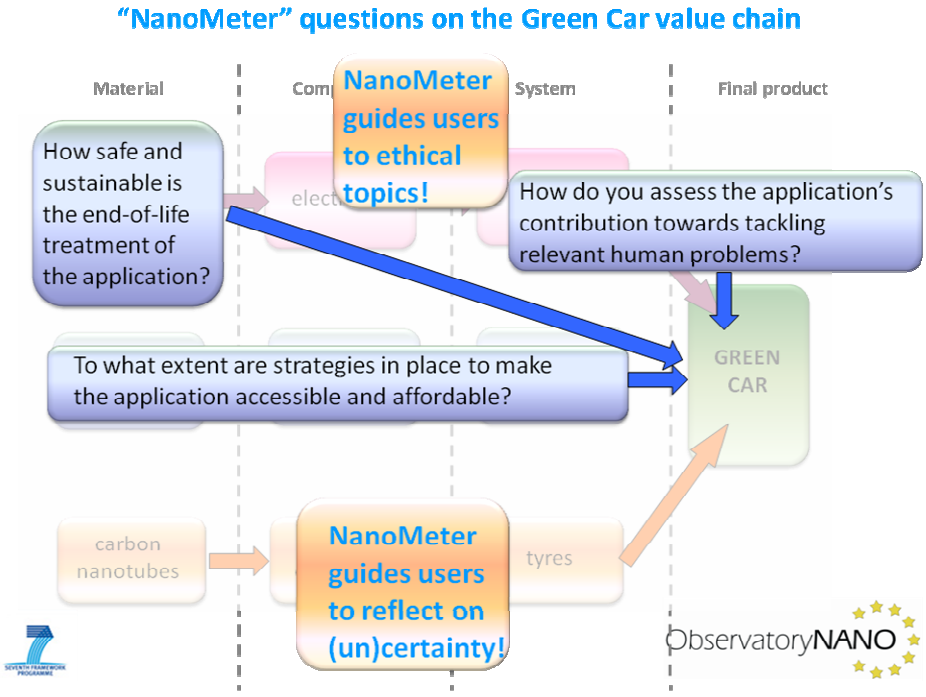


Figure 23. Some ethical issues associated with different stages of the Green Car value chain.

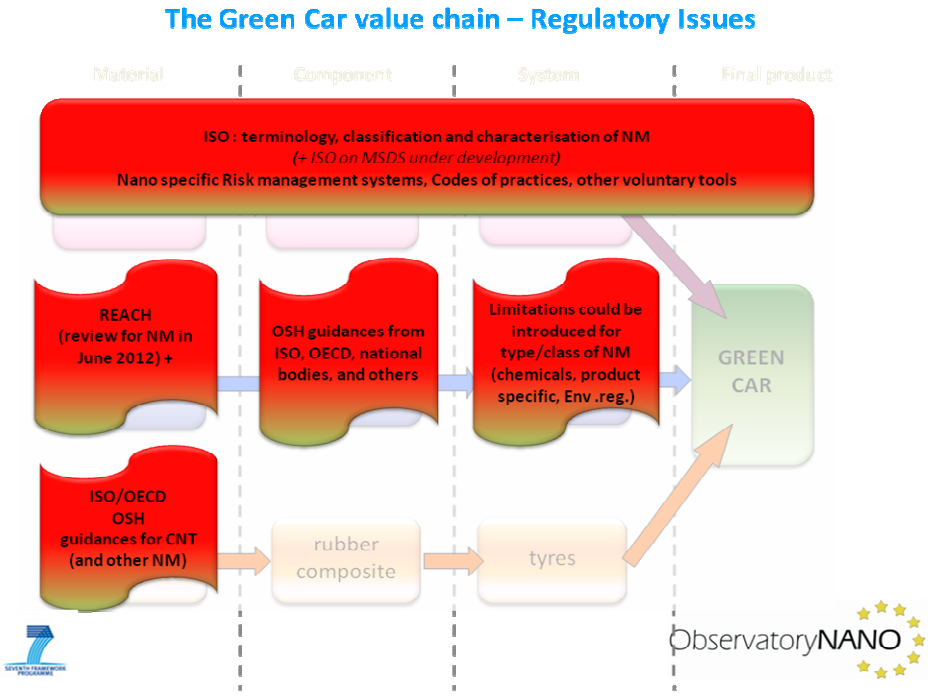


Figure 24. Some regulatory issues associated with different stages of the Green Car value chain.

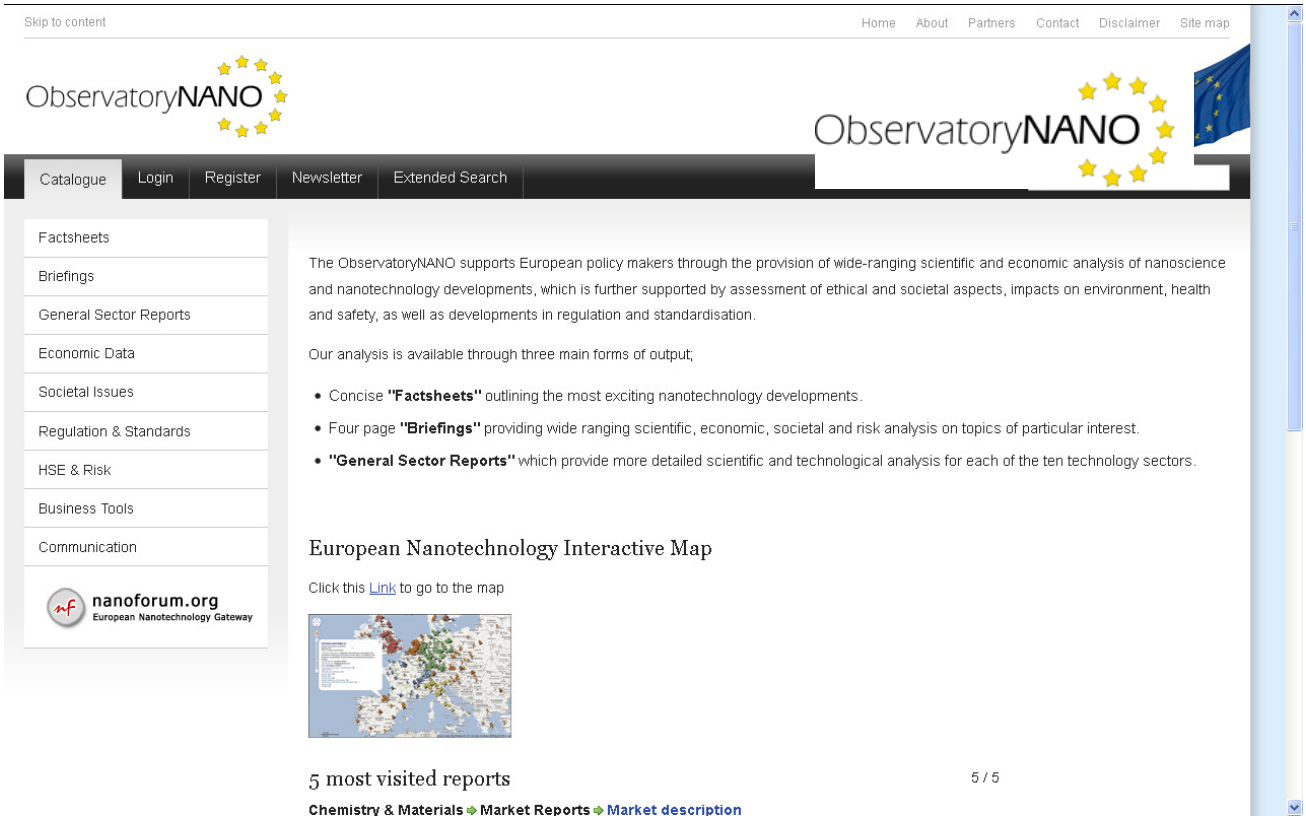
Indicator	ObservatoryNANO Contribution	Future Needs/Recommendations
Public investment	Review of public investment strategies in a number of different countries, first reported in 2009 and updated in 2012.	Ongoing work, remaining connected with the relevant individuals in different public funding agencies to ensure up-to-date figures.
Private investment	Review of private investment related to specific developments (reported in Briefings).	Engagement with a mixture of Venture Capitalists and business/industry decision makers to ensure that a broad contribution is maintained.
Publications	Creation of a nanotechnology specific publication database (over 600,000 entries). Analysis of this database with respect to the ten industrial sectors. Initial mapping of the key organisations involved in N&N research.	Maintaining this by running regular updates from Web of Science (and perhaps other sources). Creation of additional keyword sets to further interrogate data, and use of network analysis tools to identify and measure the strength of research connections between different organisations.
Patents	Analysis of patents published in the ten different industrial sectors, and mapping of key organisations that have N&N patents.	Maintaining this analysis and providing further mapping of linkages between organisations, which policymakers could make use of to target support to existing (successful) clusters.

Indicator	ObservatoryNANO Contribution	Future Needs/Recommendations
Numbers of companies	Company survey and online map.	Building on this through an ongoing annual survey (perhaps delivered through Eurostat) and review of new publications, patents and grant awards to identify companies for inclusion. Mapping these effectively to value chains to assist in the assessment of European strengths and weaknesses, and identification of gaps.
Market growth	Interaction with experts and publication in economic reports and Briefings.	Regular expert workshops to evaluate economic impacts, focused on key areas identified through an understanding of the European landscape (from the other indicators listed above).

Table 9. Data provided by ObservatoryNANO that can be used in indicators analysis

Information on Project Website and Consortium

All information on the ObservatoryNANO can be accessed at www.observatory-nano.eu (see below for a screenshot of the homepage).



Project consortium:

Partner	Country	Website	Main Contact
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Commissariat à l'énergie atomique (CEA)	FR	www.cea.fr	Alexei Grinbaum alexei.grinbaum@cea.fr
Institute of Occupational Medicine (IOM)	UK	www.iom-world.org	Rob Aitken rob.aitken@iom-world.org
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