



# **A Conceptual and Methodological Framework for Statistics on Nanotechnology and other Technological Areas**

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**Background presentation**

**International Symposium on Assessing the Economic Impact of Nanotechnology**

**Section Five: Approaches (new and established) to assess the effects of technology investment**

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# Background

## Global challenges

Continual emergence and dissemination of new technologies

Widespread and increasing interest in monitoring and regulating new S&T areas

OECD-led experience in measuring particular technological developments and innovations (ICT, bio-, nano-)

Need for a common conceptual framework for measuring emerging, enabling and general-purpose technologies (EEGPT)

## Lacking knowledge

# EEGPT: measurement challenges

- ❖ Lacking conventional definitions and classifications (initially)
- ❖ Cross-cutting technology area/ horizontal applications
- ❖ Fuzzy boundaries
- ❖ Multidisciplinary/ converging technologies
- ❖ “Rare” population
- ❖ Potentially disruptive → incomplete knowledge of outputs and impacts

**+ Non-linear model of innovation**

# Key questions

## WHAT to measure?

Emerging or enabling or general purpose technologies or all?

## WHEN S&T fields become relevant for statistical measurement?

as emerging? → as enabling? → as general purpose?

## HOW to identify?

Bibliometrics, patents, statistics, Foresight, other?

## WHICH data sources to use?

National registers, surveys, databases, public opinion polls?

**Scope, methodology, tools, indicators**

# OECD NESTI agenda on measuring EEGPT

## Aim

- Developing an integrated approach for regular EEGPT measurement

## Issues

- National experiences and best practices
- **Operational definitions**
- Classification approach
- **Indicators**
- **Survey strategies**

## Outcomes

- Conceptual and methodological framework for statistical monitoring of development, diffusion and impacts of technologies

# NESTI EEGPT Task Force: participants and timeline

Establishing an  
EEGPT Task Force  
Belgium, Italy,  
Russia (leading),  
Switzerland

## Conceptualization

EEGPT  
Task Force  
Roadmap

Revisiting the  
conceptual  
framework EEGPT  
TF Meeting  
(Moscow)

Annual  
NESTI  
meeting

NESTI  
Advisory  
Board

## Presentation

## Fieldwork

Draft  
Guidelines for  
measuring  
EEGPTs

Stocktaking of national experiences in  
technology measurement:  
responses from 23 OECD and  
observer countries

Nov 2010

Mar 2011

June 2011

Dec 2011

June 2012

# Stocktaking exercise: key findings

## ❖ EEGPT relevant characteristics:

- ◆ newness/novelty (in comparison with existing technologies)
- ◆ potential influence on the applicability of other technologies
- ◆ direct & indirect economic and societal issues
- ◆ strong connection to developments, inventions, innovations

## ❖ Best practices:

- ◆ Available set of indicators on ICT, bio- & nanotechnologies
- ◆ Specification of technology-related activities and/or lists of technology areas
- ◆ Differentiation of survey strategies

## ❖ Problems:

- ◆ EEGPT detection, listing and classification
- ◆ Formulating operational definitions for selected technology areas
- ◆ Aggregation level (one technology, technology domain, wider technology area)
- ◆ Identification of statistical units and sampling
- ◆ Understanding by respondents and achieving a relevant response rate
- ◆ Limited access to existing bibliometric, patent or other databases



# EEGPT: existing definitions and beyond

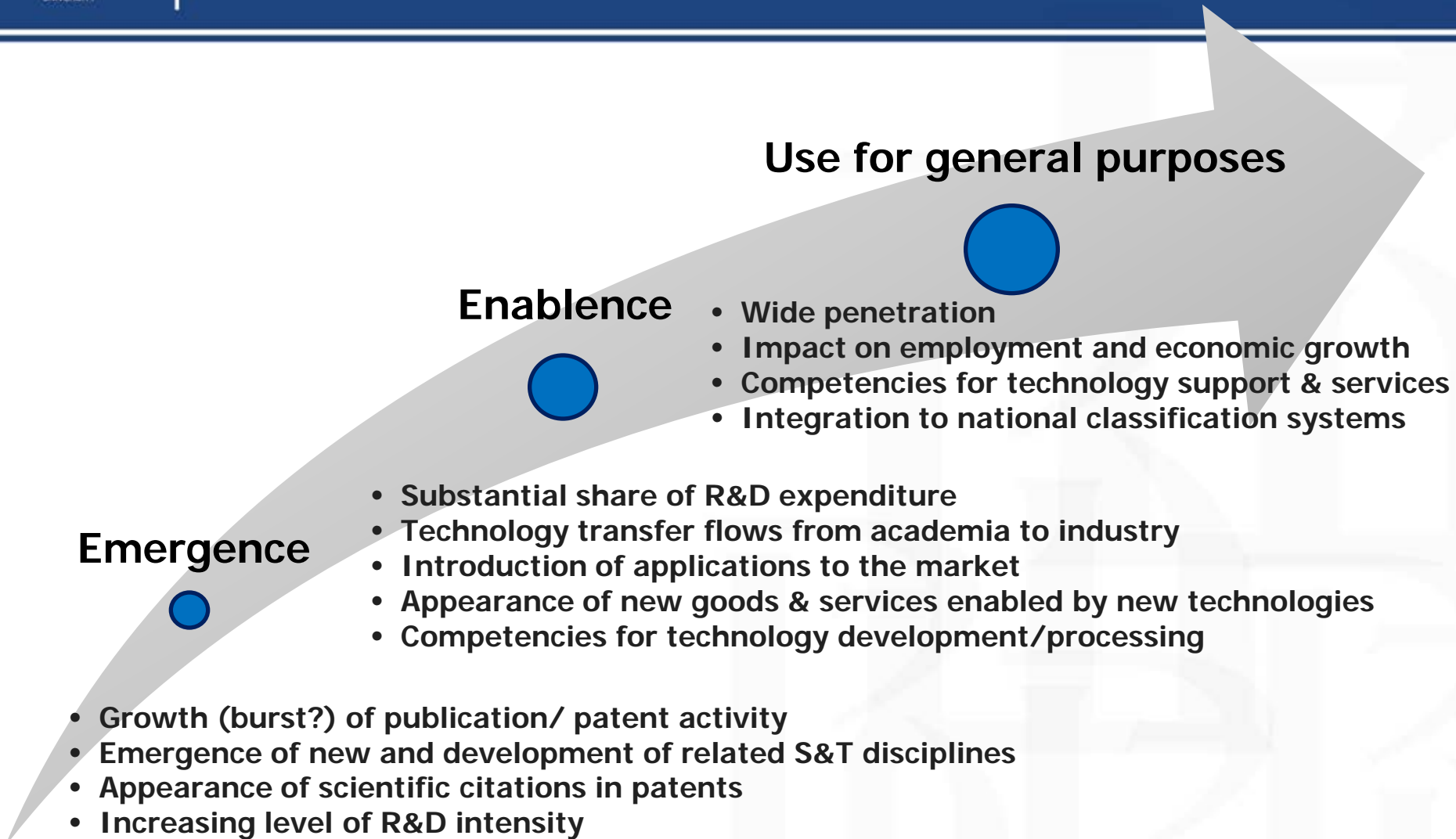
**Emerging technologies** are those resulting from *contemporaneous advances* in a given field of knowledge and that are *rapidly developing* with a *high potential* to result in inventions and/ or innovations with a significant societal and economic impacts.

**Enabling technologies** could be described as *inventions or innovations* that are likely to be applied in a *foreseeable period* of time to drive *radical change* in the capabilities of a user in its use of other technologies.

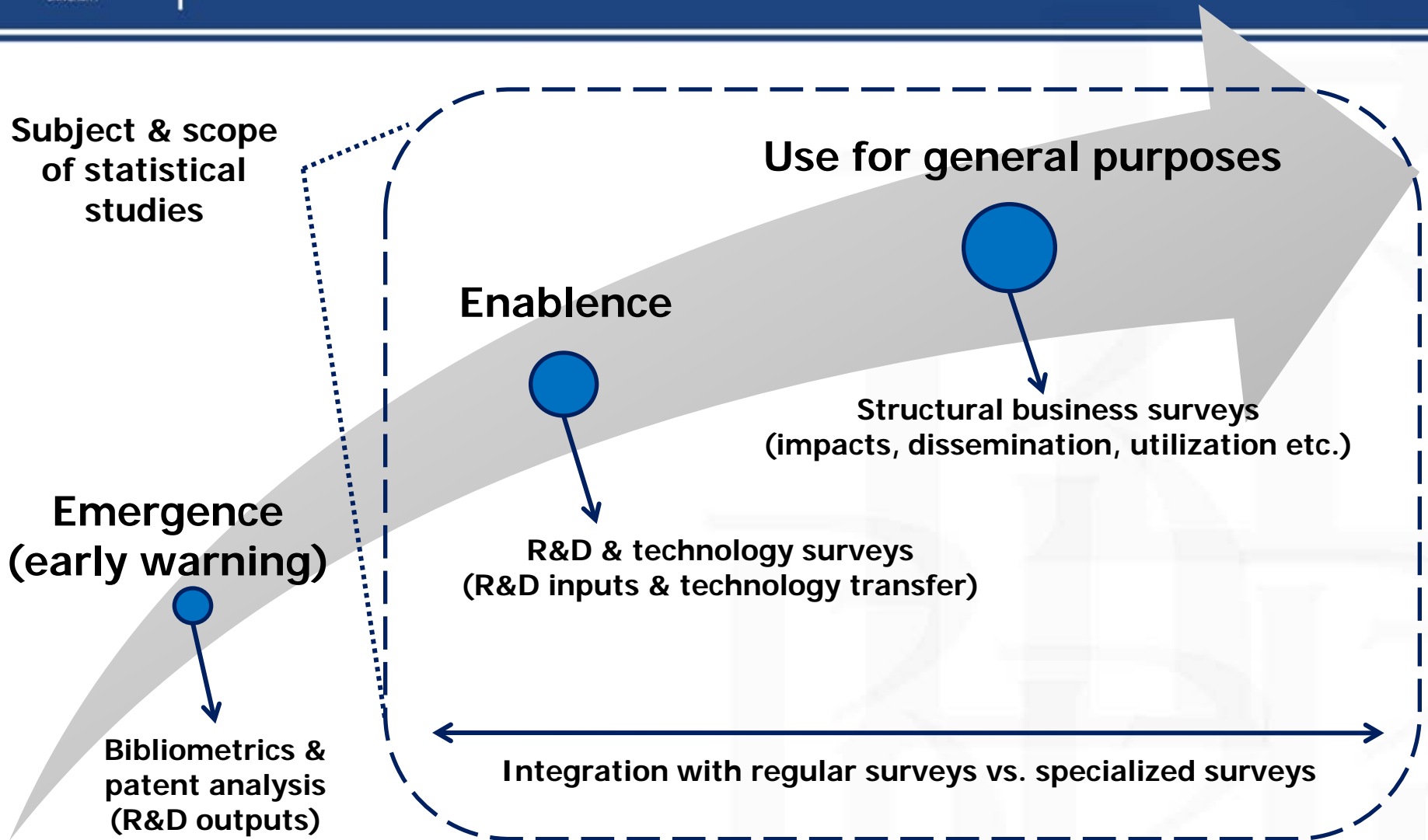
**General-purpose technologies** are new enabling technologies which have the potential to become *widely used* across the entire economy.

*Sources: DSTI/EAS/STP/NESTI(2011)6, expert discussions, stocktaking results*

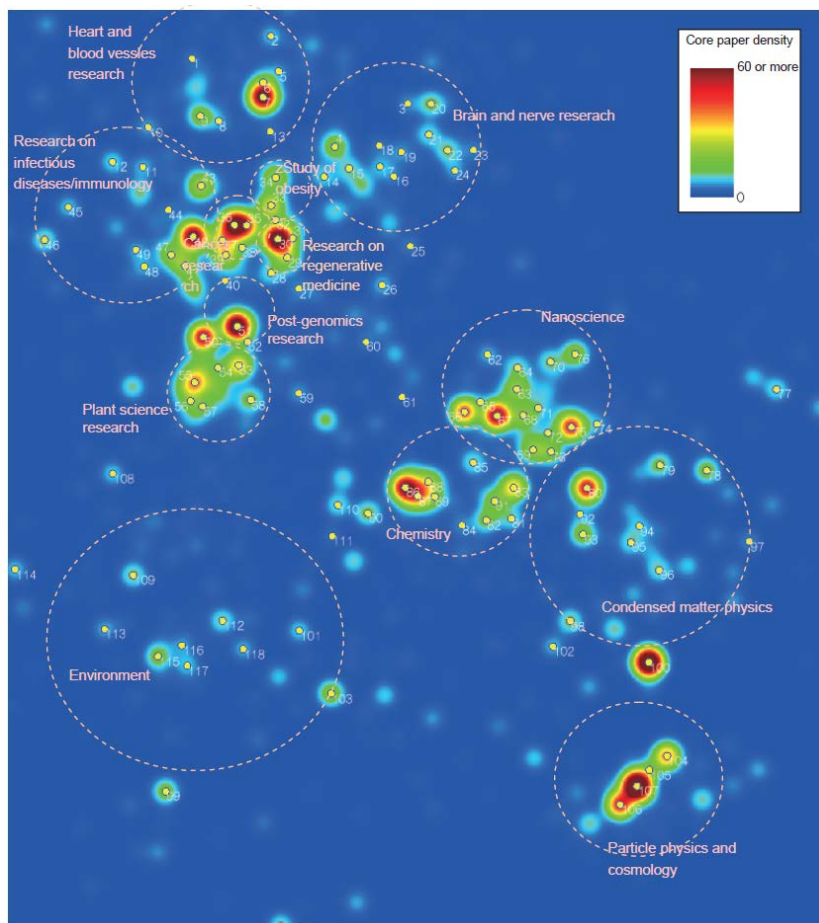
# EEGPT: criteria for distinction



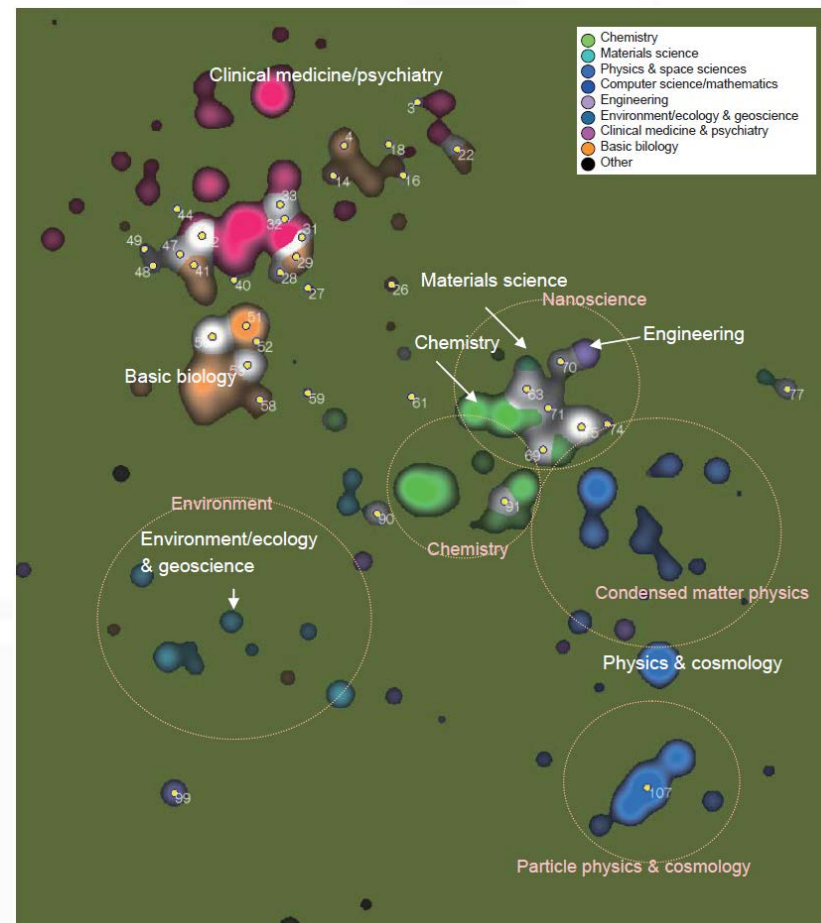
# General framework for statistics on EEGPT



# EEGPT identification: adjusting methodologies – bibliometrics

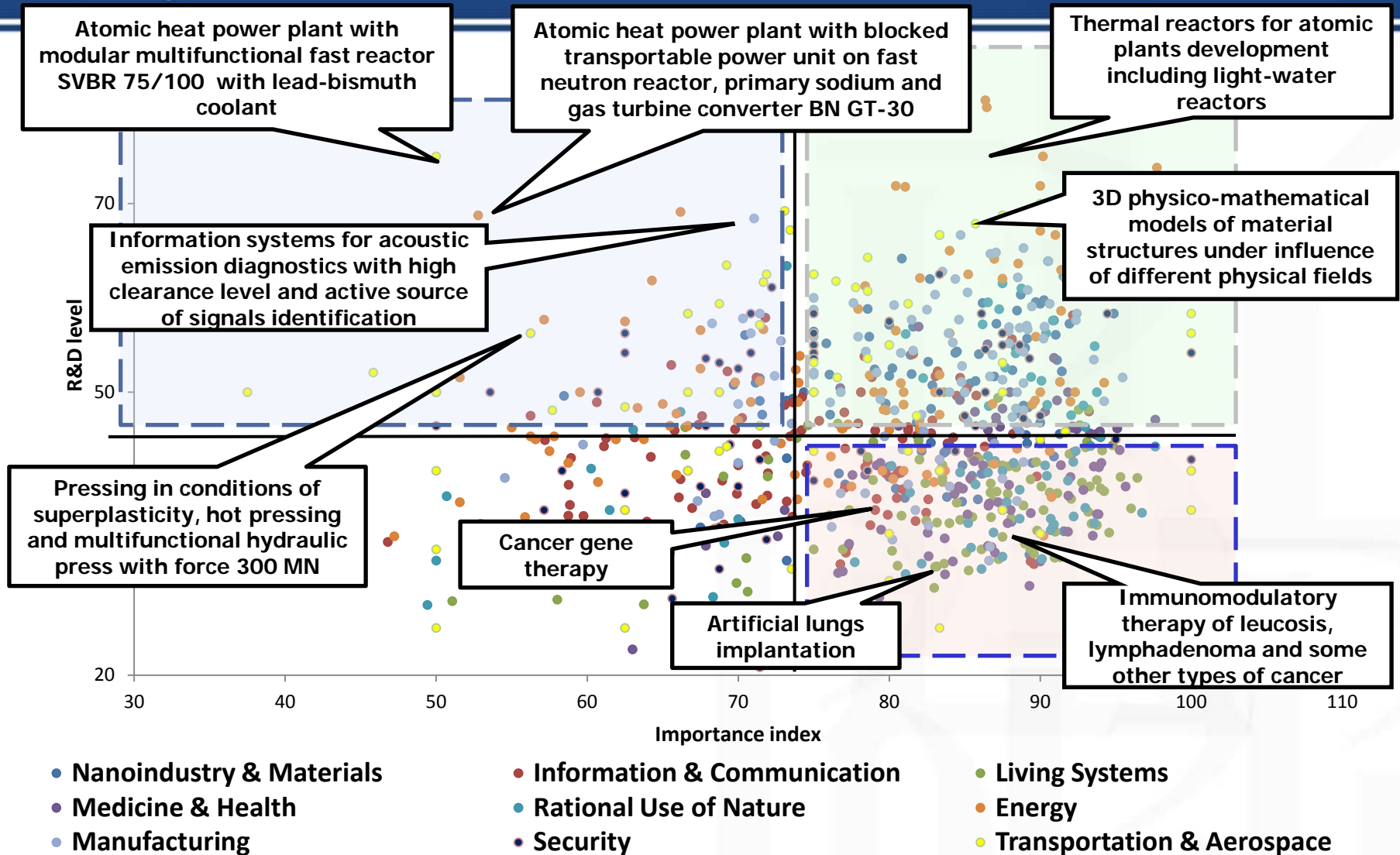


Hot topics: research area correlation map



Positioning of inter/ multidisciplinary research areas

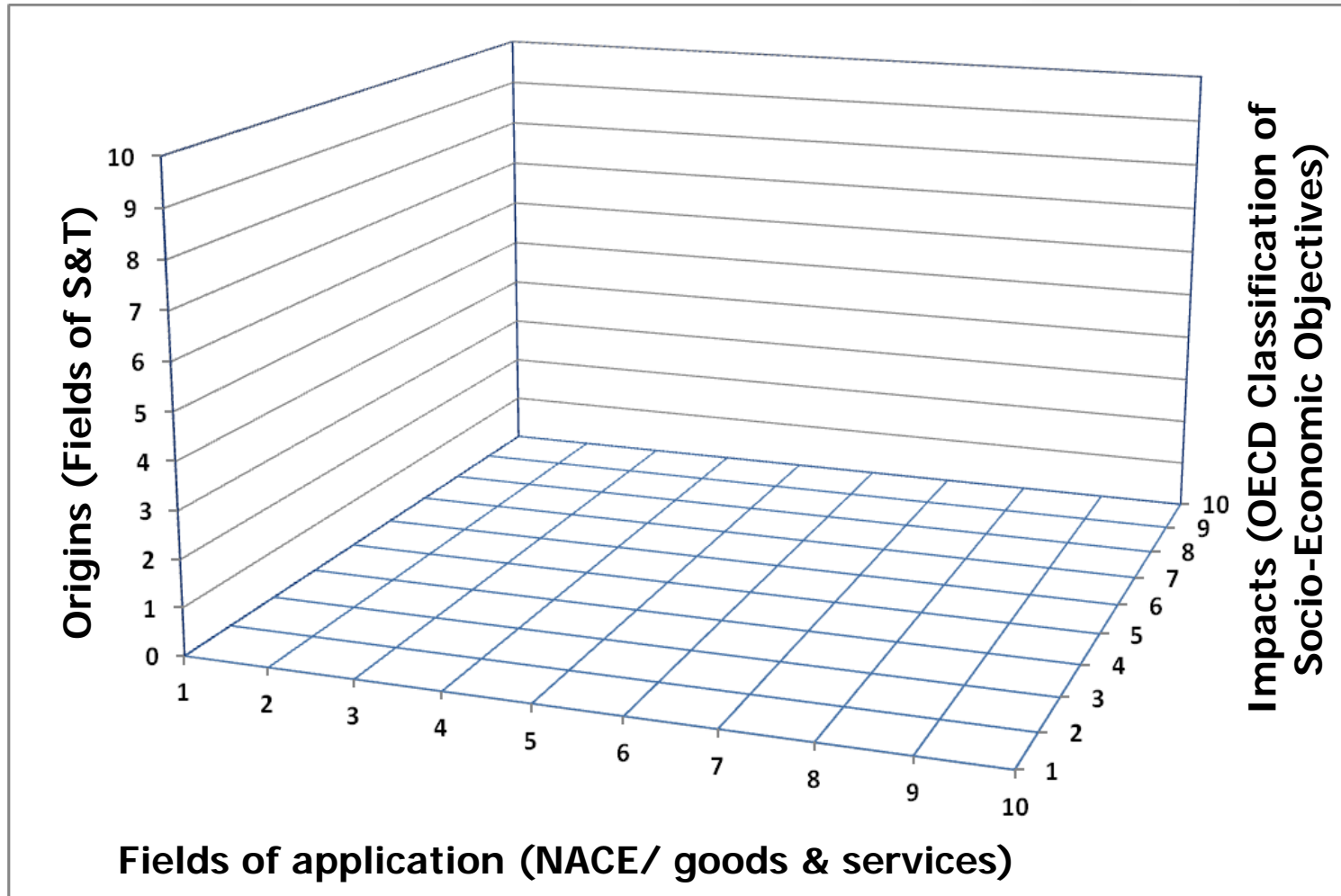
# EEGPT identification: adjusting methodologies – Foresight



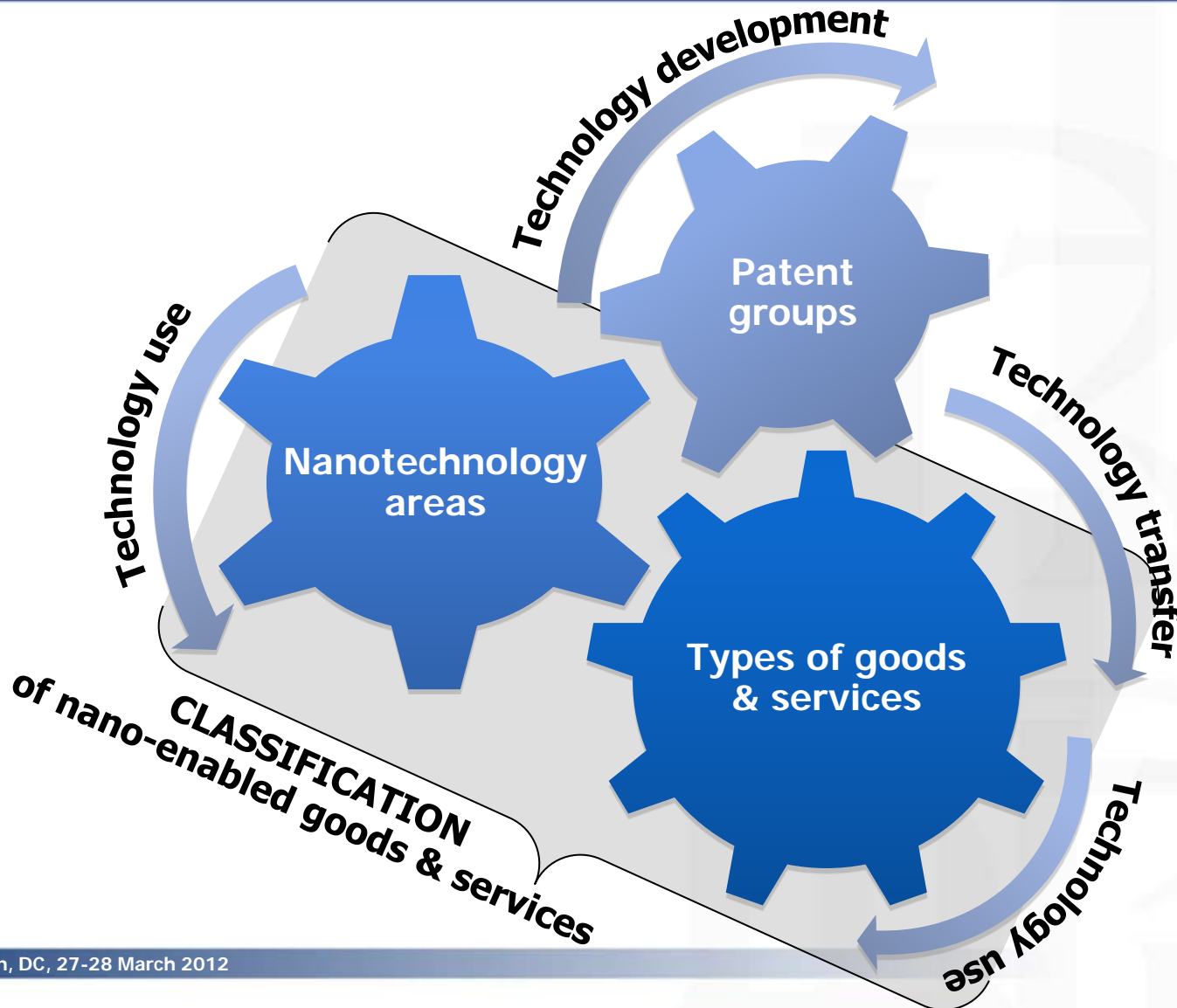
# Operational definition of nanotechnology in Russia



# A 3-D classification approach



# Classification system for nanotechnology statistics in Russia





# Classification of nano-enabled goods & services

**Objective:** identification, systematisation & presentation in a unified format

## CLASSIFICATION of nano-enabled goods & services

**National Classification of Goods & Services (NCP) by Type of Economic Activity (NACE/CPC-compatible):**  
*Identification of existing nano-enabled goods & services*

### Analysis

- Market segmentation
- Catalogues
- Data bases
- Open information sources:

*Expanding NCP with new nano-enabled goods & services*

### Local classifications

#### Nanotechnology areas:

- Nanomaterials
- Nanoelectronics
- Nanophotonics
- Nanobiotechnology
- Nanomedicine
- Nanoinstruments
- Specialised technological equipment

#### Types of goods & services:

- Elementary nanoproducts
- Conventional goods containing nanocomponents
- Conventional goods & services manufactured with the use of nano-enabled processes
- Machinery & equipment for nanotechnology

# Indicators

## Sources

- financial
- personnel
- knowledge
- technological

## Investments

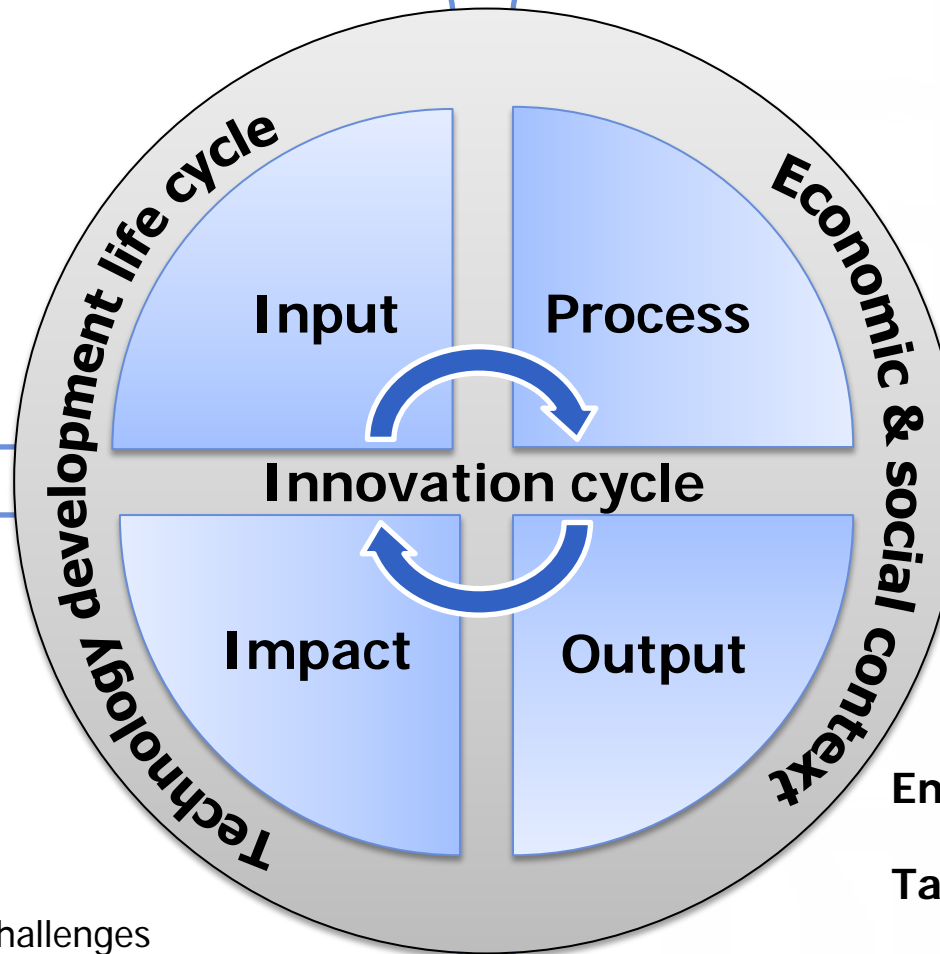
- Venture capital
- Budget funding

## Direct

- sales
- employment
- market shares
- final user adoption

## Indirect

- CO2 savings
- energy efficiency
- respond to global challenges



## Precompetitive development

- collaboration
- partnership
- mobility & skills
- technology transfer

## Research infrastructure

- equipment

## Tacit knowledge

- graduates
- diplomas
- publications
- know-how

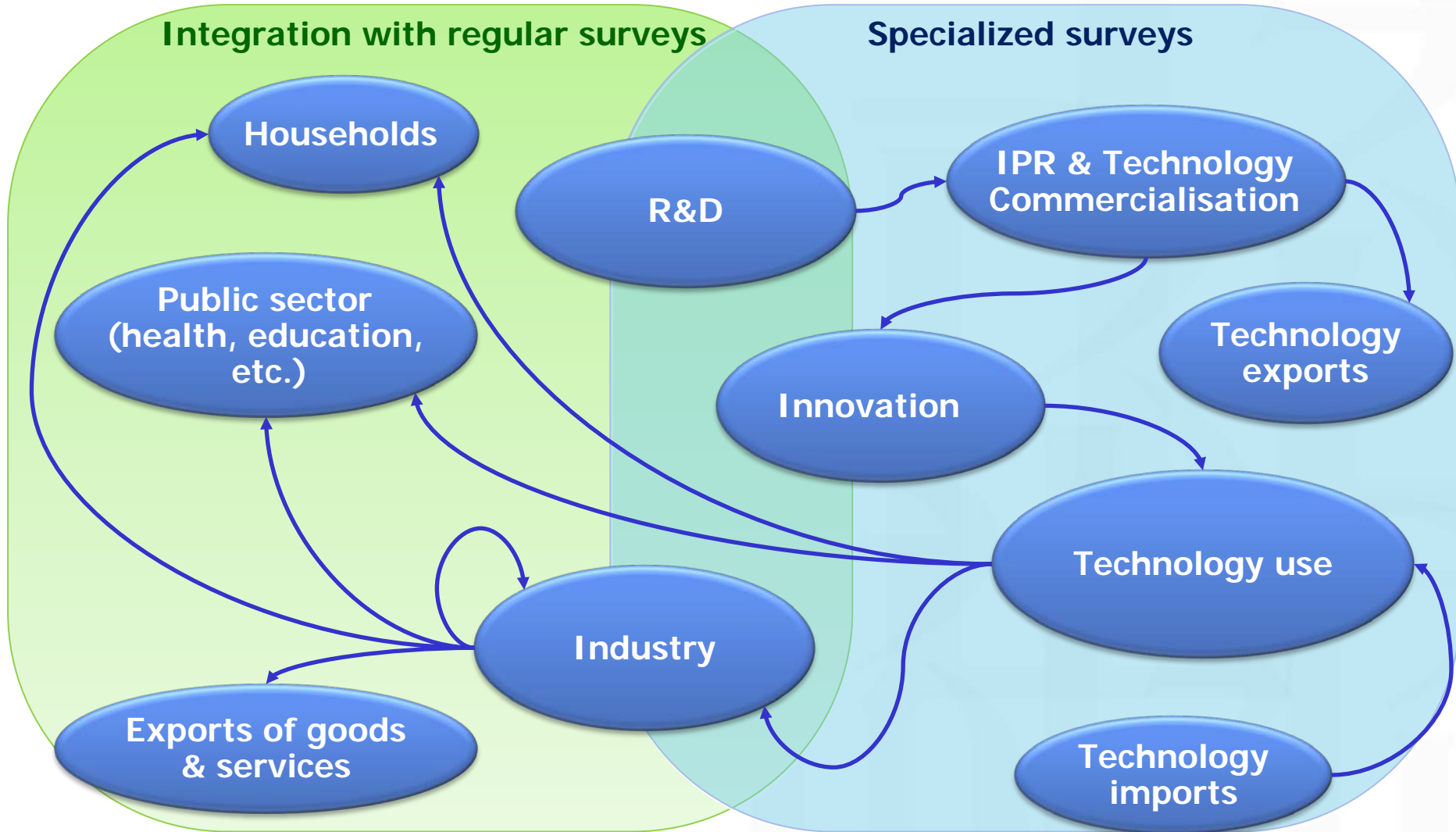
## Embodied knowledge

- IPRs

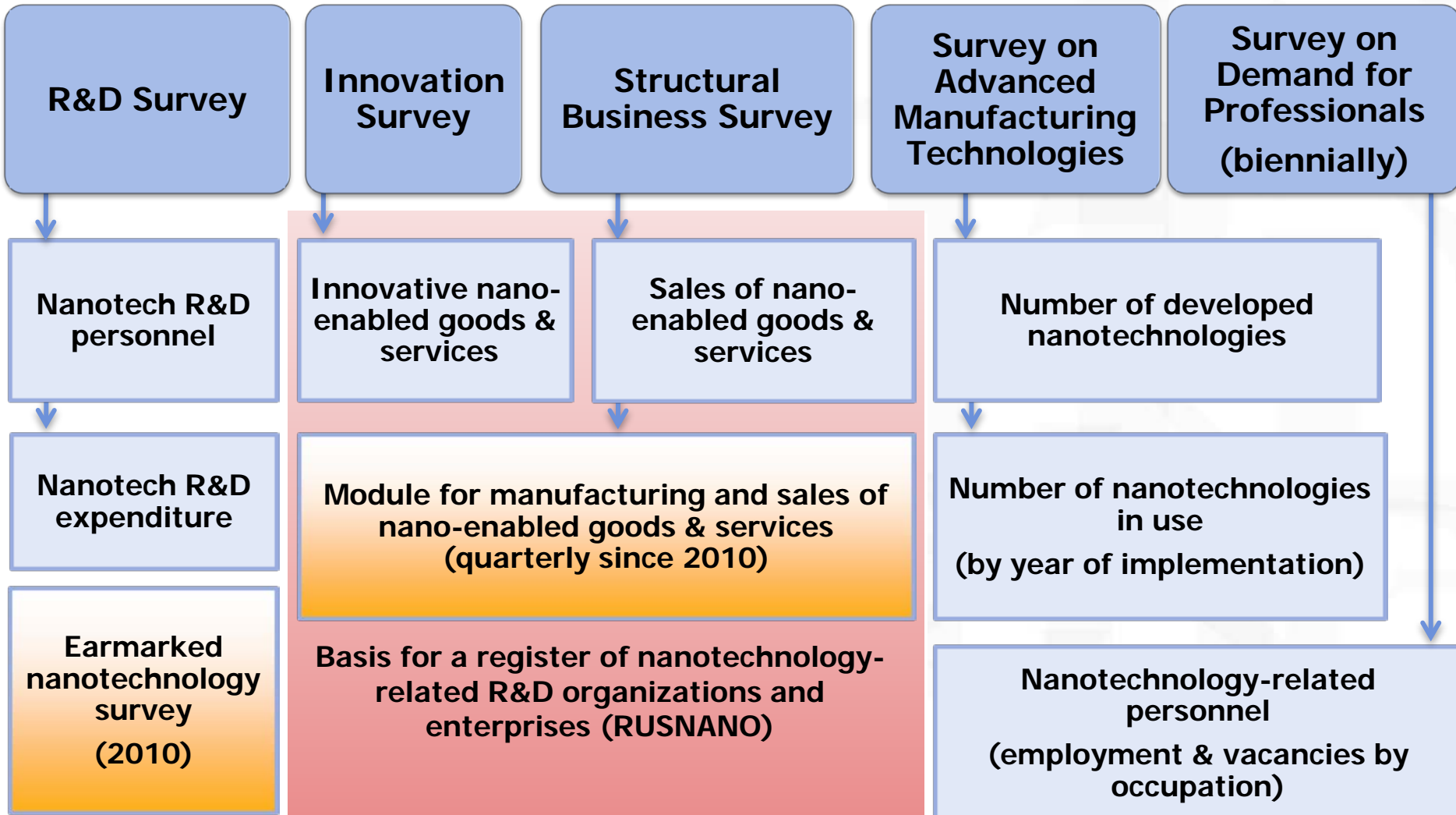
## Tangible assets

- goods & services
- innovations

# EEGPT statistics: coverage & survey strategies



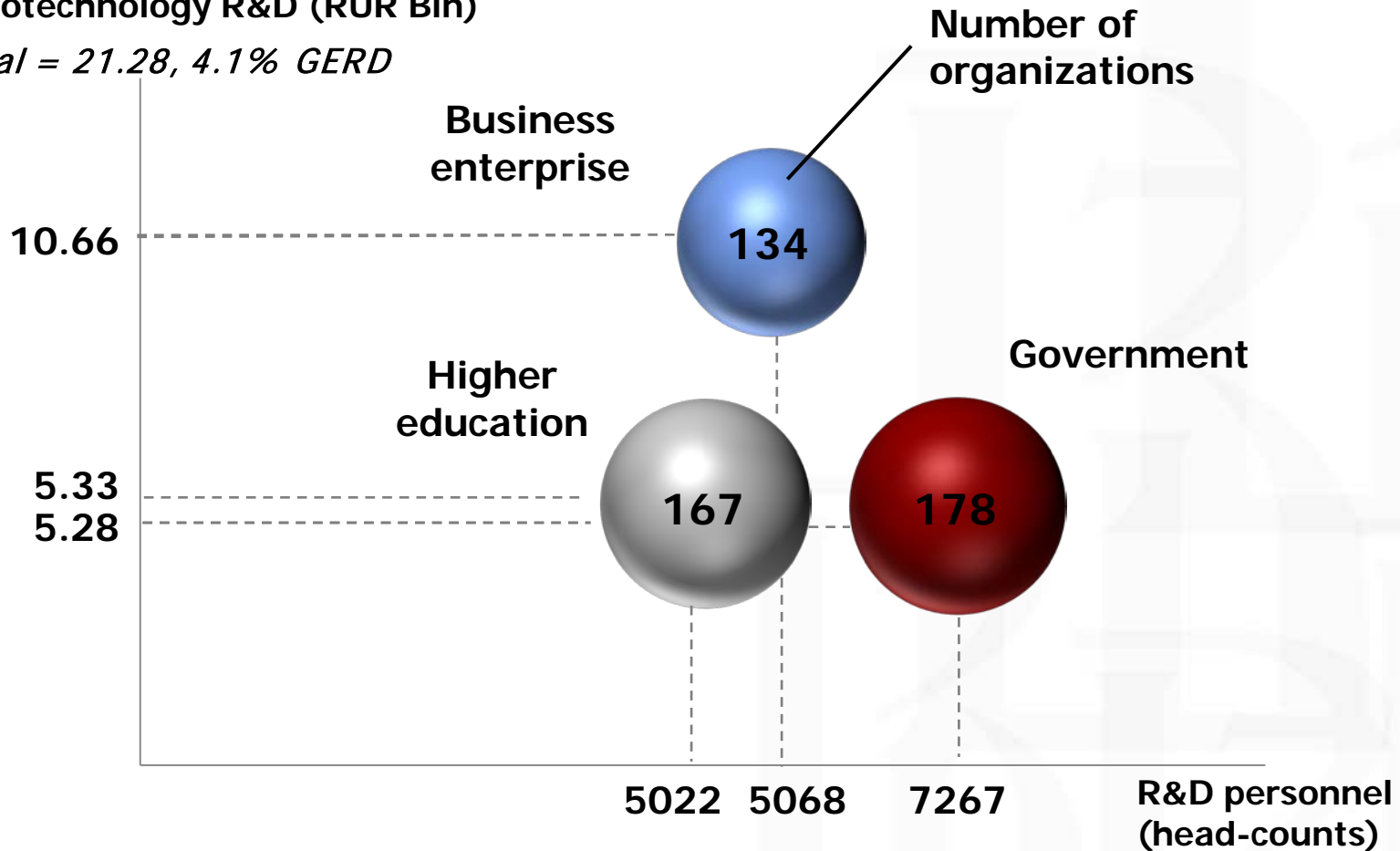
# Nanotechnology indicators included into national statistical surveys



# Nanotechnology R&D expenditure and personnel in Russia by sector of performance: 2010

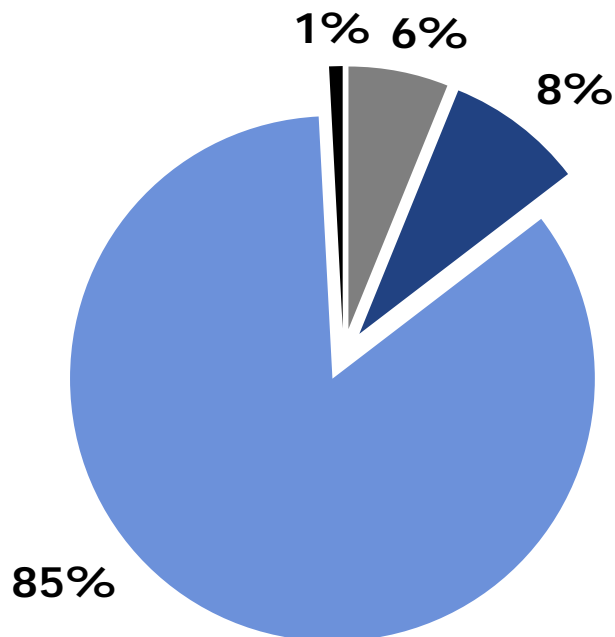
Gross domestic expenditure on nanotechnology R&D (RUR Bln)

*Total = 21.28, 4.1% GERD*

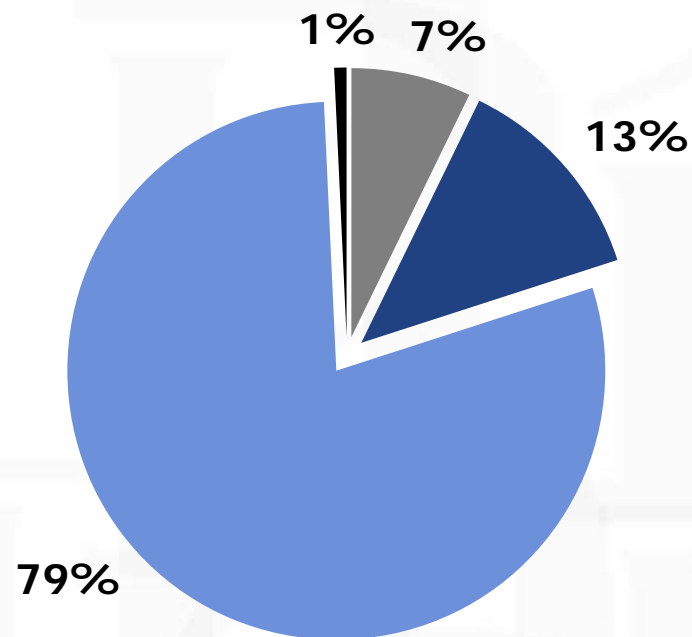


# Sales of nano-enabled goods & services

2010



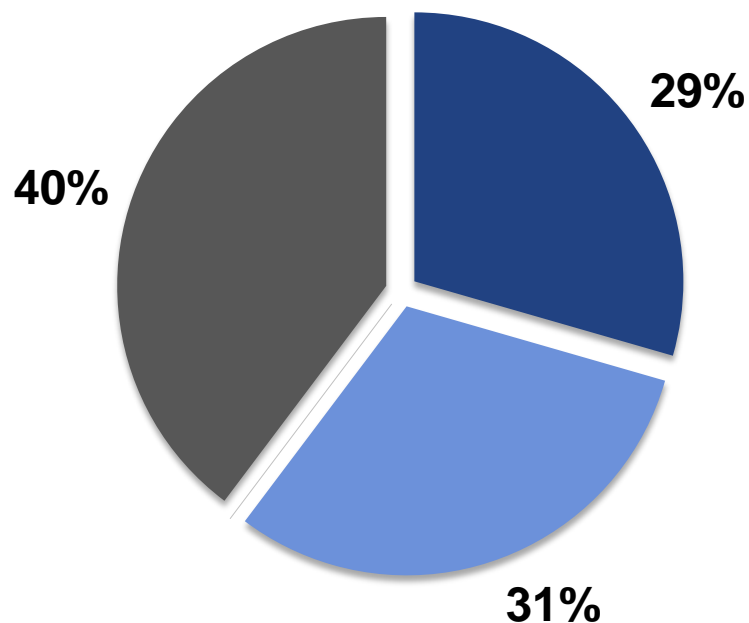
2011



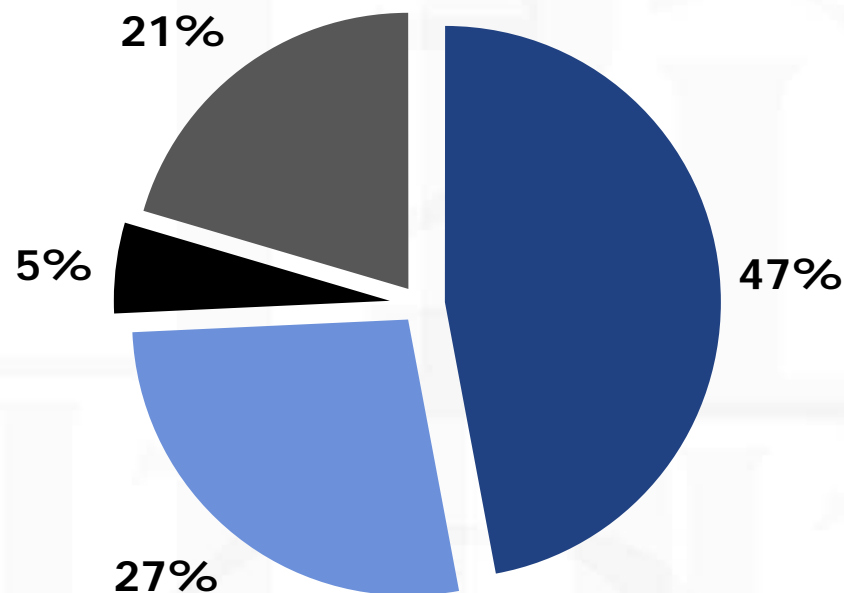
- Elementary nanoproducts
- Conventional goods containing nanocomponents
- Conventional goods & services manufactured with the use of nano-enabled processes
- Machinery & equipment for nanotechnology

# Sales of innovative nano-enabled goods & services

2008



2010



■ High-tech

■ Medium high-tech

■ Medium low-tech

■ Low-tech

# Concluding remarks and further steps

- **Development of operational definitions of EEGPT for statistical purposes**
- **Identification of statistical units and data sources on EEGPT**
- **Elaboration of approaches for detection and criteria for statistical classification of EEGPT**
- **Comparative analysis of the approaches used to measure phenomena associated with EEGTP**
- **Development of of key indicators on technology development, application and impacts**
- **Identification of strategies for data collection with references to measurement issues**
- **Development of Guidelines for Measuring EEGPT (a draft to be discussed at NESTI, June 2012)**





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# Thank you for your attention!

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