

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



Contents

- Background
- OECD NESTI agenda on technology measurement
- Framework for statistics on emerging, enabling and general-purpose technologies
- * A case of nanotechnology statistics in Russia
- Concluding remarks and further steps



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 FFGPT 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 Annual NESTI meeting

NESTI Advisory Board

Conceptualization

EEGPT Task Force Roadmap Revisiting the conceptual framework EEGPT TF Meeting (Moscow)

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

Washington, DC, 27-28 March 2012

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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

Use for general purposes



Enablence



- Wide penetration
- Impact on employment and economic growth
- Competencies for technology support & services
- Integration to national classification systems

Emergence



- Substantial share of R&D expenditure
- Technology transfer flows from academia to industry
- Introduction of applications to the market
- Appearance of new goods & services enabled by new technologies
- Competencies for technology development/processing
- Growth (burst?) of publication/ patent activity
- Emergence of new and development of related S&T disciplines
- Appearance of scientific citations in patents
- Increasing level of R&D intensity



General framework for statistics on EEGPT

Subject & scope of statistical studies

Emergence (early warning)

Bibliometrics & patent analysis (R&D outputs)

Use for general purposes

Enablence

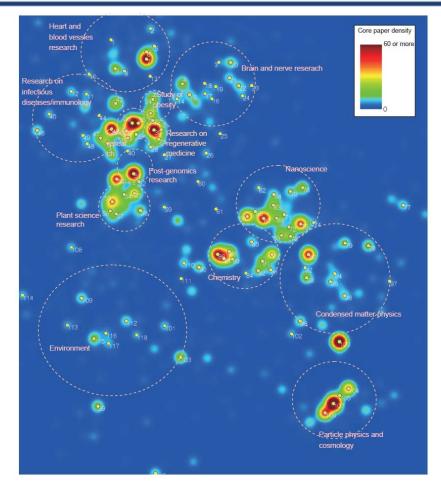
Structural business surveys (impacts, dissemination, utilization etc.)

R&D & technology surveys (R&D inputs & technology transfer)

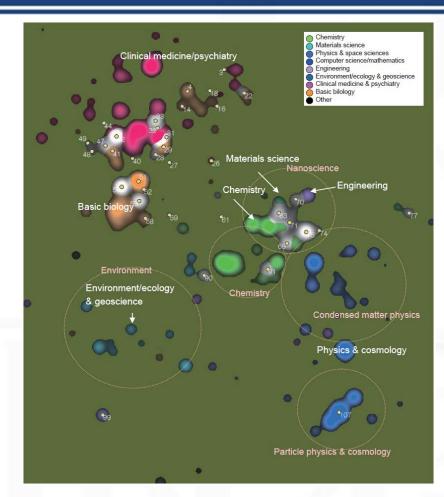
Integration with regular surveys vs. specialized surveys



EEGPT identification: adjusting methodologies – bibliometrics



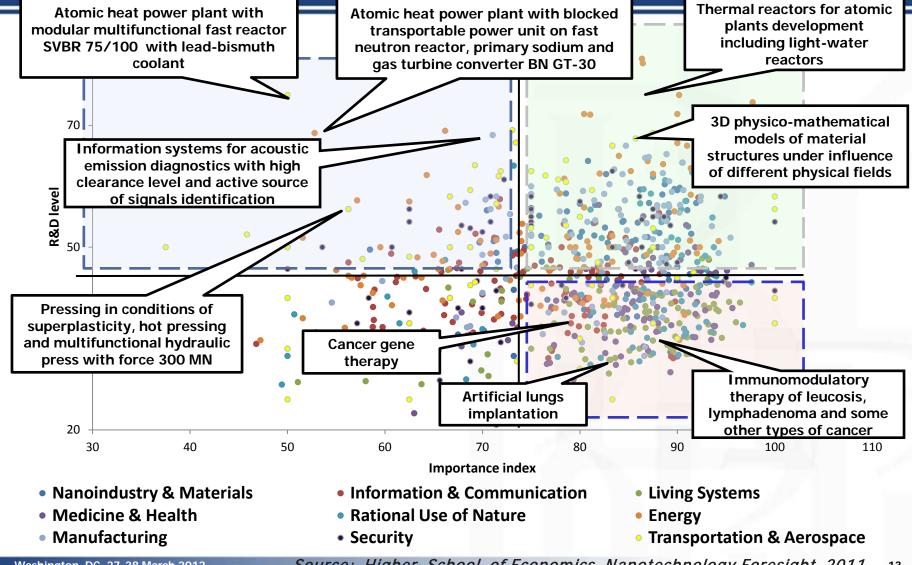
Hot topics: research area correlation map



Positioning of inter/ multidisciplinary research areas



EEGPT identification: adjusting methodologies - Foresight





Operational definition of nanotechnology in Russia

Important requirements

International literature/ practices

Innovation potential

Qualitative characteristics

Expert team

Nanotechnologies – a set of technologies related to control of the matter and processes on the nanoscale level (100 nm or less by one or several dimensions) and providing new properties of the matter to create improved materials, devices or systems which utilize those new properties.

Russian initiatives:

- Programme for Nanoindustry Development until 2015
- Federal Goal-oriented Programme "Nanotechnology infrastructure development in the Russian Federation for 2007-2010"

Field of study

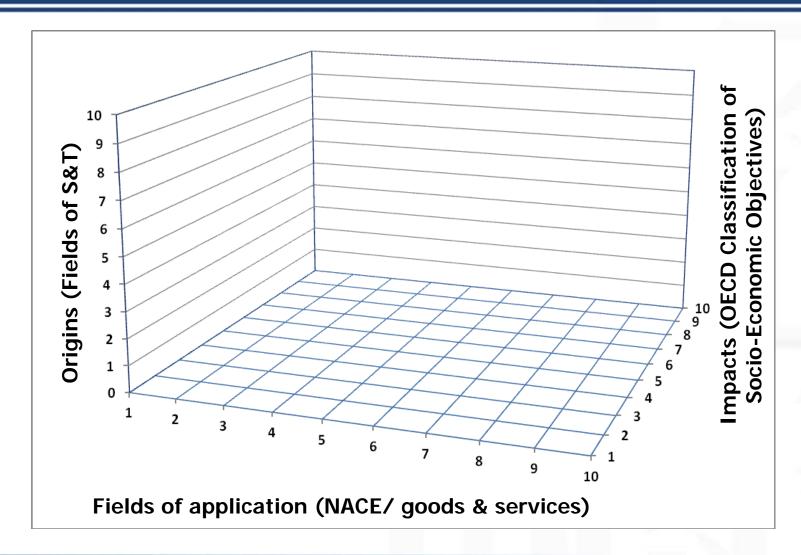
Precision level

International organisations: ISO, OECD, EPO, EC/FP7

Areas of application

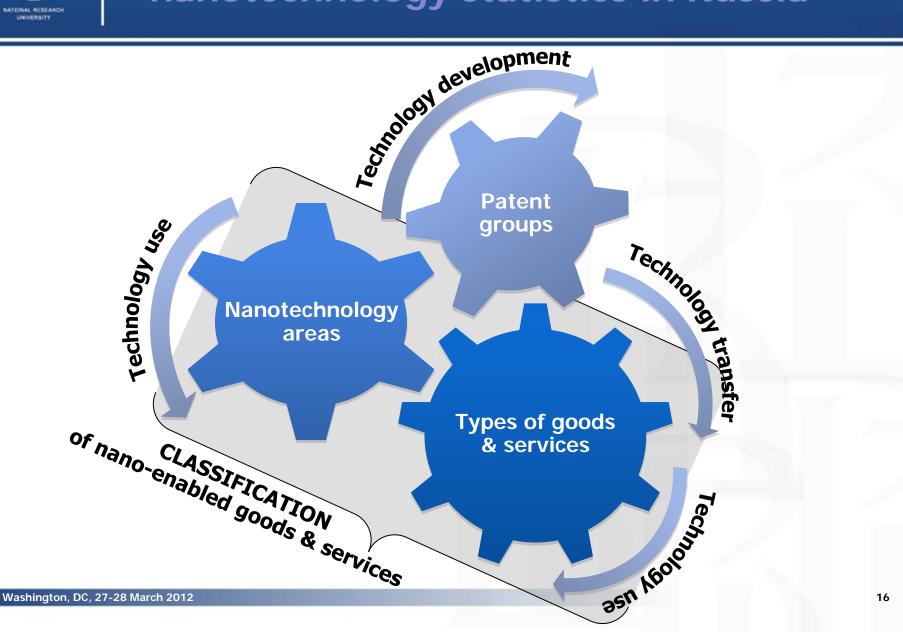


A 3-D classification approach





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 nanoenabled goods & services



Analysis

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

Expanding NCP with new nanoenabled 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

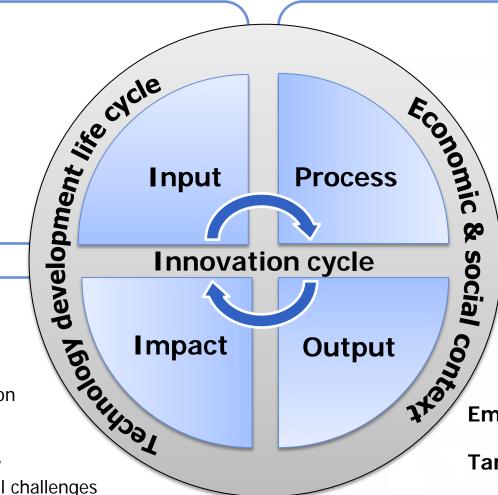
- Venture capital
- Budget funding

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

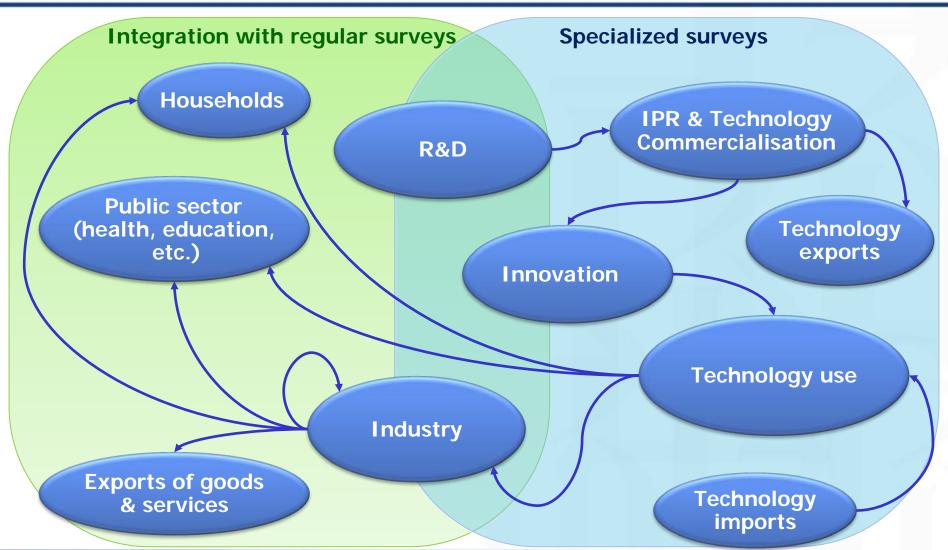
IPRs

Tangible assets

- goods & services
- innovations



EEGPT statistics: coverage & survey strategies





Nanotechnology indicators included into national statistical surveys

R&D Survey

Innovation Survey

Structural Business Survey

Survey on Advanced Manufacturing Technologies Survey on Demand for Professionals (biennially)

Nanotech R&D personnel

Innovative nanoenabled goods & services Sales of nanoenabled goods & services

Number of developed nanotechnologies

Nanotech R&D expenditure

Earmarked nanotechnology survey (2010)

Module for manufacturing and sales of nano-enabled goods & services (quarterly since 2010)

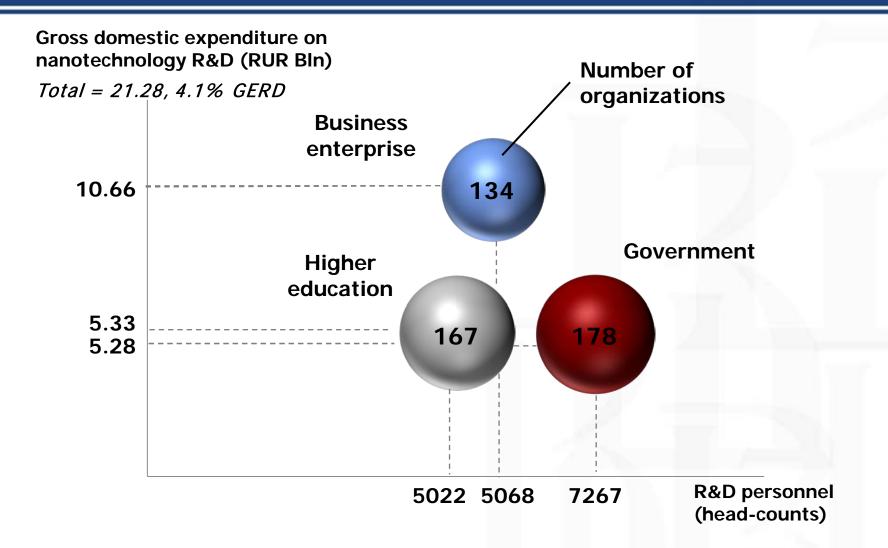
Basis for a register of nanotechnologyrelated R&D organizations and enterprises (RUSNANO) Number of nanotechnologies in use (by year of implementation)

Nanotechnology-related personnel employment & vacancies by

(employment & vacancies by occupation)

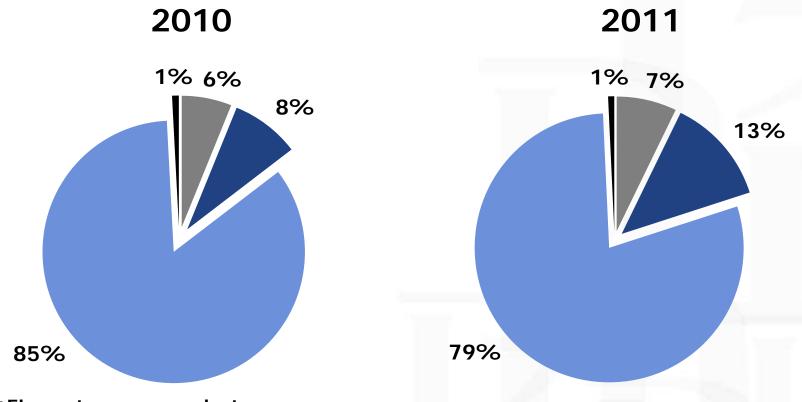


Nanotechnology R&D expenditure and personnel in Russia by sector of performance: 2010





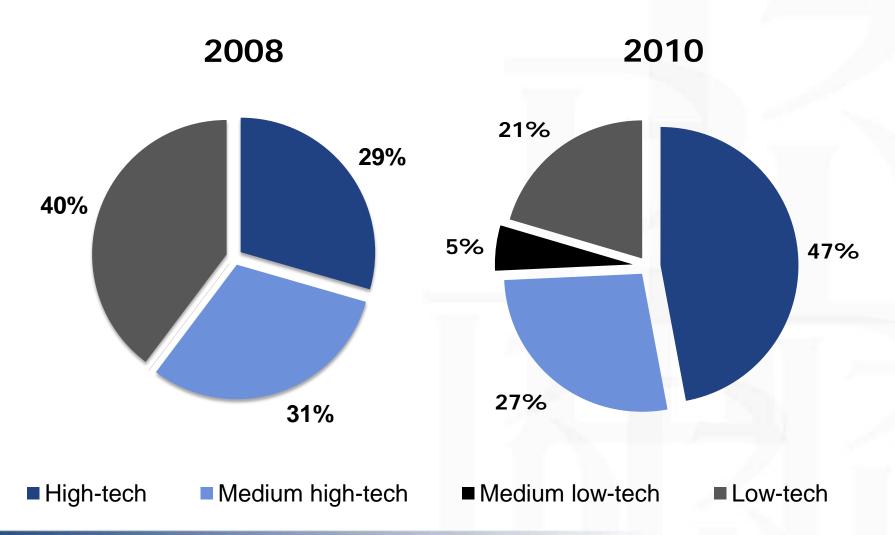
Sales of nano-enabled goods & services



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



Sales of innovative nano-enabled goods & services





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 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)



Thank you for your attention!

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