



● České fórum pro výzkum, vývoj a inovace 2010

Alokace veřejných prostředků a hodnocení výsledků
vědy, výzkumu a inovací

**Czech Research, Development
and Innovation Forum 2010**

Allocation of public resources and research assessment

Mezinárodní konference organizována Ministerstvem školství, mládeže a tělovýchovy v rámci projektu Mezinárodní audit výzkumu, vývoje a inovací v ČR a implementace jeho výsledků do strategických dokumentů.

● Sborník přednášek

**23.9.2010
Brno**

Místo konání: Hotel International Brno
Husova 16
659 21 Brno



evropský
sociální
fond v ČR



EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání
pro konkurenceschopnost



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

PROJEKT JE SPOLUFINANCOVÁN EVROPSKÝM SOCIÁLNÍM FONDEM
A STÁTNÍM ROZPOČTEM ČESKÉ REPUBLIKY



University of Sussex.

Erik Arnold is Managing Director at Technopolis in the UK and Chairman of the Technopolis Group. He works on: evaluation, science, technology and innovation policy; industry policy; regional and industrial development; benchmarking; and the design and management of policies and programmes. He worked formerly at the Science Policy Research Unit, the University of Sussex, the European Commission and as a management consultant with Booz.Allen & Hamilton. He holds a BA (Hons) in English literature, an MSc in Science & Technology Policy and a DPhil in economics, all from the

Bea Mahieu joined Technopolis in September 2009 as a senior consultant. She works in the field of public policies related to R&D, information society, economic development, and systemic innovation – at European or regional level. Her expertise includes monitoring, evaluation, benchmarking, and ex-post socio-economic impact analyses. Previously she worked in Milano, Italy, where she was head of the international business unit of Databank, a leading market research and competitive intelligence consultancy. She holds a BA (Hons) in Slavic Languages from the University of Gent, Belgium.



Thed van Leeuwen, is senior researcher at CWTS since 1989, after graduating as Msc in Political Science from the University of Amsterdam.

At CWTS he is responsible for the research assessment studies that relate to various levels of evaluation practices, both on country, field, institutional and research group level. Combining the application oriented work within CWTS with academic efforts, he finished his thesis at CWTS in the quantitative studies of science & technology in 2004. Writer of nearly 50 scientific journal papers, his main interest lies in analyses focusing on the use and improvement of bibliometric indicators applied in the evaluation of research entities.

Brigitte Tiefenthaler joined Technopolis in February 2007 as a senior consultant. She mainly works on performance contracts, evaluations, benchmarking and monitoring of national and regional public policy, and strategy development. Before joining Technopolis Brigitte worked for nearly 6 years as an expert for the Austrian Council for Research and Technology Development, which advises the Austrian Government on research, technology and innovation policy. She was involved in the development of strategies and recommendations in fields including sustainable development, nanotechnology, gender issues and the promotion of women in science.

Prior to this Brigitte worked as a head of unit for industrial technologies and transport at the Bureau for International Research and Technology Cooperation in Vienna (now FFG), and as a project leader at the Institute for Polymer Technology at Joanneum Research in Leoben.





Barbara Good joined Technopolis in February 2007, from the Socio-Economic Institute at the University of Zürich, Department of Innovation Economics and Innovation Policy, where she worked as a lecturer and researcher. Her areas of specialisation are innovation policy, economics of innovation and evaluation. She has co-authored several books on the Swiss innovation system and Swiss innovation policy and worked as an evaluator for the Swiss federal government. Barbara also worked as a researcher at the ETH Zürich, at the Department of Environmental Sciences, Institute of Environmental Policy and Economics, and at the Institute of Political Science, at the University of Zürich.

Barbara holds a PhD in Political Science with Economics and an M.A. in Political Science and Economics, both from the University of Zürich. In addition, she has a degree in applied modern languages.

Luke Georgiou B.Sc., Ph.D. is Professor of Science and Technology Policy and Management at Manchester Institute of Innovation Research (formerly PREST) in Manchester Business School at the University of Manchester where he is also Deputy Dean of the Faculty of Humanities. His research interests include evaluation of R&D and innovation policy, foresight, national and international science policy, and management of innovation. He advises several governments and other organisations on these themes.



He recently chaired the Annual Impact Report Panel of the EUREKA Initiative. He was rapporteur of the influential Aho Group report to European Leaders Creating an Innovative Europe and in 2007/8 chaired the EC's Expert Group on ERA Rationales, presented to the European Competitiveness Council of Ministers in July 2008. Most recently he chaired the EU's panel on Gearing Research towards Sustainability and was a member of the panel carrying out the Interim Evaluation of the EU's Joint Technology Initiatives in ICT. He is an elected member of the Board of Governors of the University of Manchester and a member of the Board of Directors of Manchester Science Park Limited.

-Seznam příspěvků-

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- **Governance and Management of the Czech R&D&I system in international comparison (Erik Arnold and Bea Mahieu). str. 11**
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How we are doing the Audit

Erik Arnold
Technopolis

Brno
23 September 2010

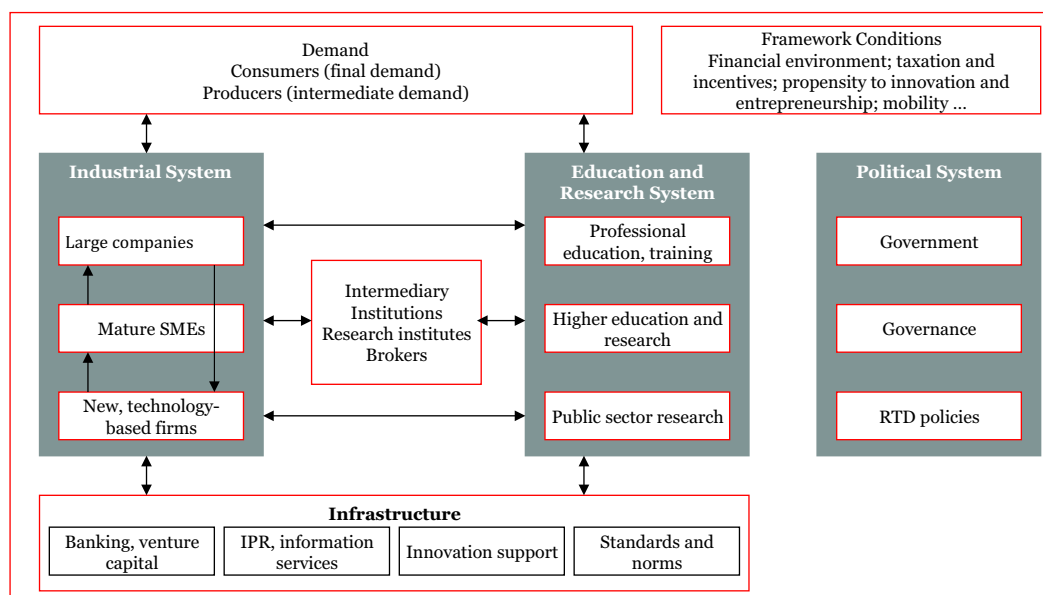
Team conducting the Audit

- CHEPS
 - CWTS
 - Joanneum Research
 - Manchester Institute for Innovation Research
 - Peritus
 - Technopolis
 - Ivo Šanc
-
- Project manager: Technopolis
 - Counterpart: Technology Centre of the Science Academy

Why are we here?

- Reporting the first 3 months' work in an 18-month study
- The First Interim Report has two purposes
 - *Internal purpose: to force the development and sharing of hypotheses/early conclusions*
 - *External purpose: to communicate and create the basis for discussion of our first impressions with key stakeholders in the Czech Republic*
- Important to recognise the preliminary status of this report

Overall, the Audit is about better management of the role of research in the National Innovation System



The NIS perspective has important implications for how we understand performance

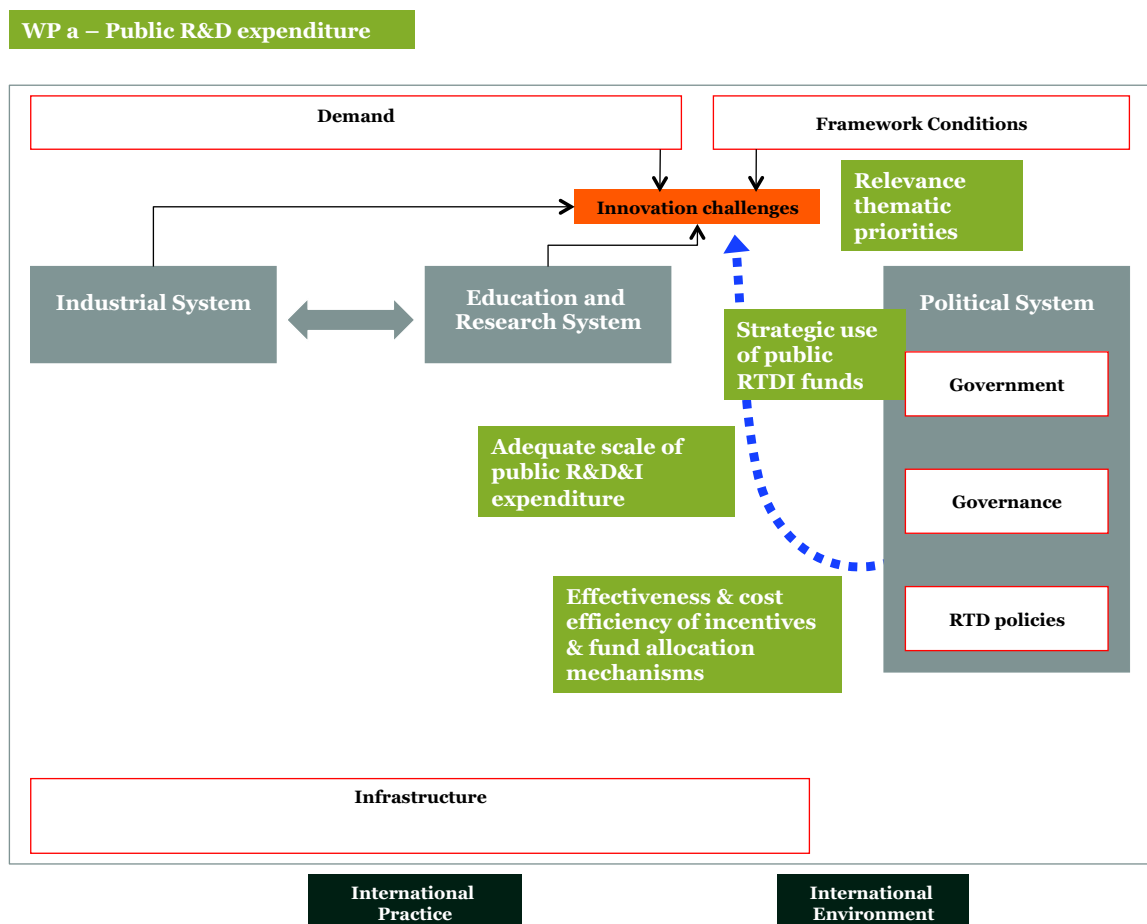
- The bounded rationality of actors has important consequences
 - *Knowledge, learning and institutions are key*
 - *Path dependence*
- Institutions and their environments are inter-dependent – they co-evolve, so institutions are always context dependent
- In many cases, the relevant unit of analysis is not the individual but networks, clusters and institutions
- Governance and other mechanisms that create systemic cohesion are important
- We cannot deal in static optima – we have to understand how to deal with system dynamics

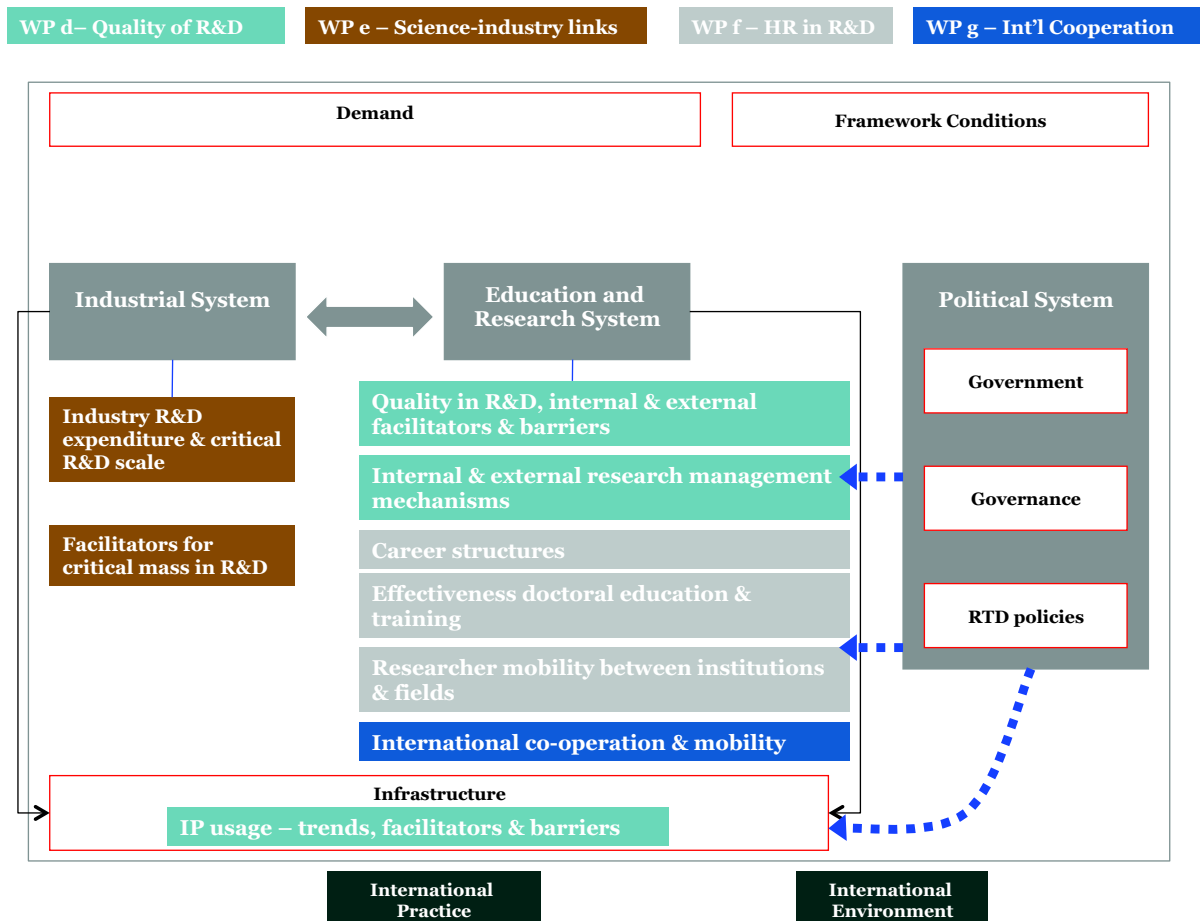
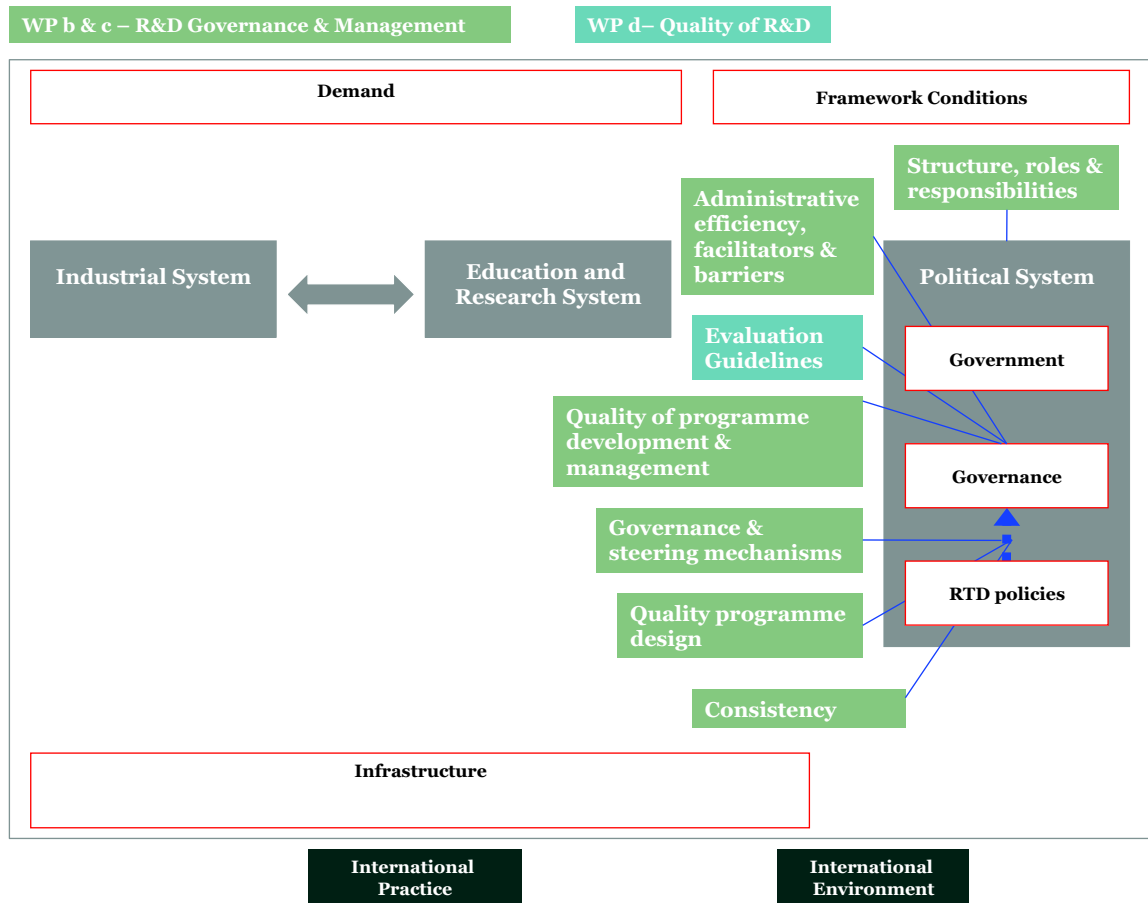
The NIS perspective also helps us understand the relationship between research and social effects

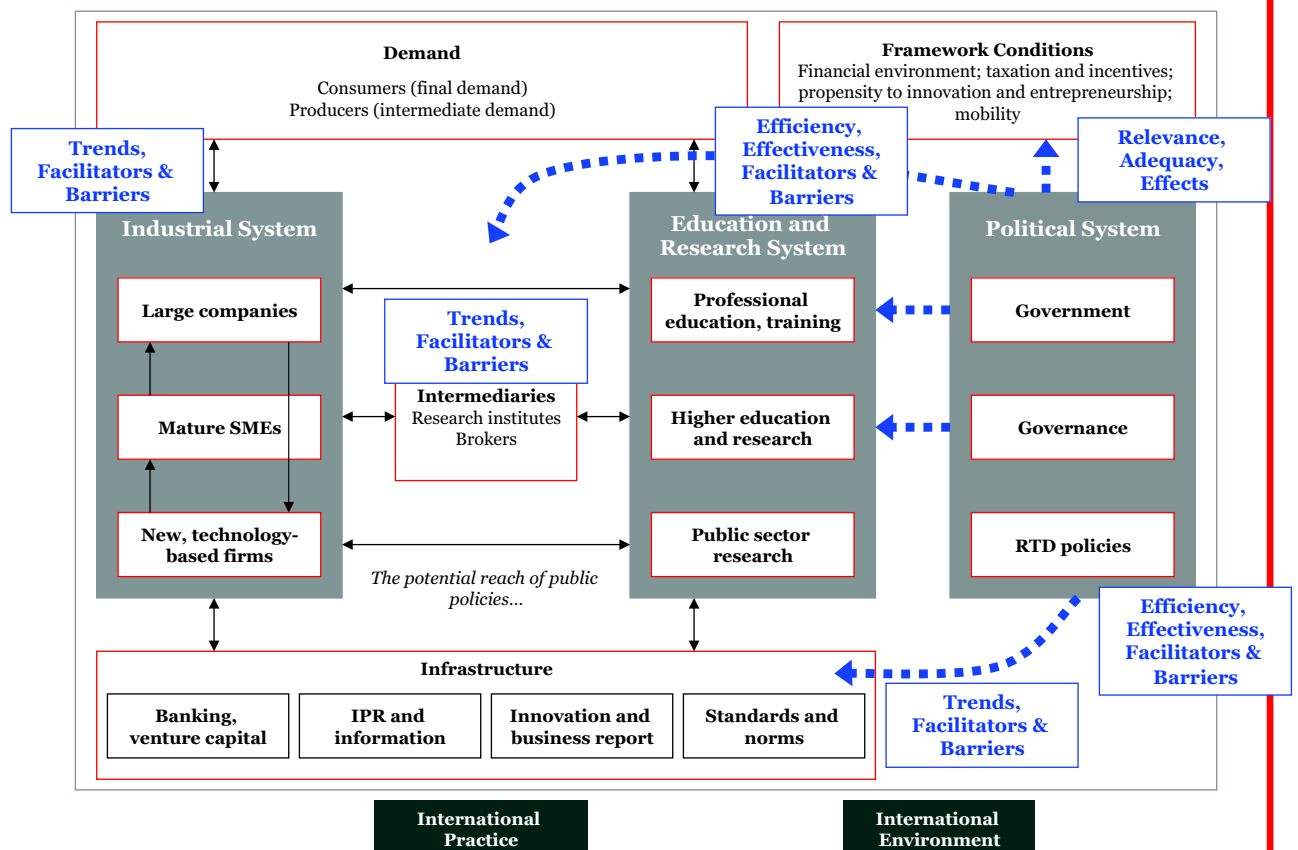
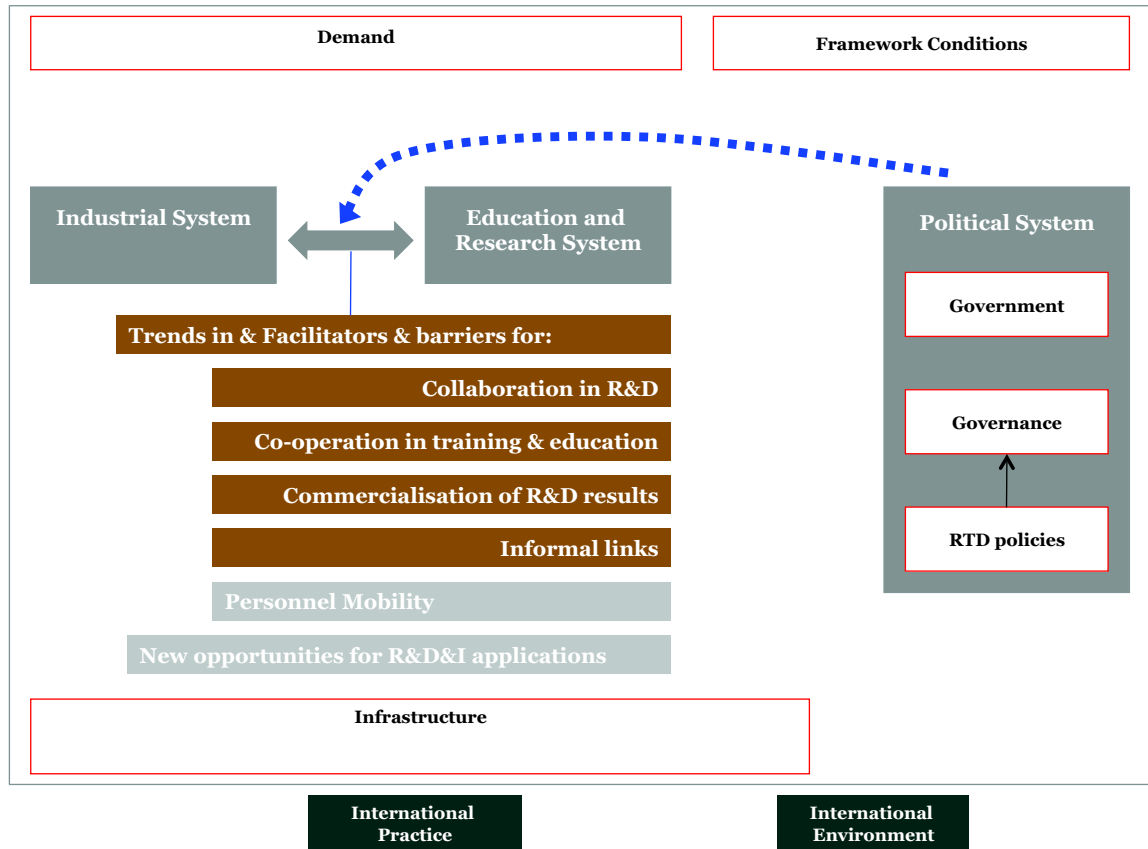
- Interconnection and interdependence are at the heart of the innovation system concept
 - *The research-innovation relationship is non-linear*
- Business enterprises are central actors in the system
- Demand, not just supply, drives innovation systems
- Innovation activities are much more than R&D
 - *Design, engineering and management play key roles in innovation systems*
 - *Innovation functions do not map 'tidily' on to organisations*
- National systems are internationally open
- In policy, balance – or 'mix' – is key

How do we audit?

- Benchmarking performance
- Comparing processes, institutions and structures
- Understanding both internal logic and context
- Gap analysis between actual performance, desired performance and foreign performance
- Searching for ‘transportable’ ways to improve
- What we do **NOT** do is
 - *Judgement by opinion survey*
 - *Uncritically accepting the views of high-status interviewees*
 - *Bringing a set of standard solutions, as if they applied in all contexts*







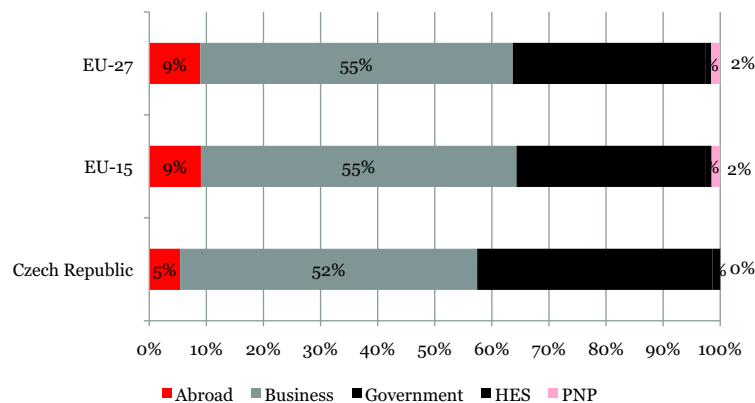
R&D Inputs

*Joanneum Research – Policies
Centre for Economic & Innovation Research*

Significant achievements in R&D Intensity

- Continuous growth of R&D investments in the last decade.
 - *Since 1999 total R&D expenditures have more than tripled.*
- Both Enterprise and Government Sector increased R&D investment
 - *Business Sector: 330% increase of R&D funding since 1999*
 - *Government Sector: 328% increase of R&D funding since 1999*
- Due to strong efforts of both public and private sector, the Czech Republic...
 - *Has considerably narrowed the gap in R&D intensity compared to EU-27*
 - *Is among group of countries with highest growth levels in R&D intensity despite high growth rates of GDP*
 - *Is among the group of New Member States with highest level of R&D intensities*
 - *Shows higher R&D intensities than most of South European Countries*

R&D funding structure resembles the EU-15/27 one



- A lively business enterprise sector
 - accounts for approx. 55% of total R&D funding
- Funding from abroad is comparatively low
 - despite high rates of FDI in the Czech Republic

Science-industry links appear weaker than desirable

Funding structure of the Higher Education Sector

- Predominantly funded via government sources (91%)
- Funding from Enterprise Sector: 1%
 - Lowest share of higher education R&D from Business Enterprise Sector within EU-27 (EU-average 6%)
 - Poor growth dynamics in the past decade

Funding structure of the Government R&D Sector

- Increase in funding from Enterprise Sector: from 7% in 1999 to 11% in 2008 (14% in 2007)
 - Higher funding levels from Business Enterprises than the EU-15 average (9%).
- Caution: Government R&D Sector varies strongly between member countries in terms of size and type of institutions
 - In CR includes all public research institutions, i.e. Academy of Science, sector-focused institutions under competence of ministries, etc.

Some specific characteristics of R&D funding and expenditures – to be further investigated

- Majority of Business R&D expenditures are funded by own, national enterprise sources (80%)
- Highly concentrated in some specific sectors
 - *More than half in the Manufacturing Sector (59%)*
- Government funding accounts for 13% of BERD
 - *Relatively high at international level: 6% above EU-27 and EU-15 averages*
 - *Highly concentrated on Services sector (62%) – especially Research Services*
 - *Manufacturing sector receives 35% of GOVERD while accounting for 59% of BERD*

Our presentations today

- Governance & Management of the R&D&I System
- R&D Outputs
- The Research Evaluation Guidelines
- What Research Assessment Means for a Leading UK University
- Conclusions & rationale for our recommendations

Thank you

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Governance & management of the Czech R&D&I system in international comparison

*Erik Arnold & Bea Mahieu
Technopolis*

Brno, 23 September 2010

Focus of our analysis in these first 3 months

- Historical background: 1990 - 2008
- The 2008 Reform Plan – perceived failures, vision & main objectives
- The envisaged R&D&I Governance structure
- The R&D&I support management processes

Key findings – R&D&I Governance

1. Over the past 2 decades – and especially after 2000: significant reform efforts to tackle the problems of transition, modernisation & accession to the EU
2. After 2000: growing perception of the role of R&D for economic development, leading to increasing focus towards innovation & applied research
3. Key systemic failures perceived as persistent
4. Growing recognition of the need for coordination & integration, leading to significant progress in governance
5. The concept of a logical consistency across the programme cycle has been applied, but a crucial component of strategic intelligence is missing: the ex-post evaluation of policies, programmes & institutions

1. Movement towards a W European model

- The old R&D&I system had major problems
 - *Unhealthy separation Higher Education – Research*
 - *Separation of industrially-oriented R&D from industry*
 - *Lack of effective mechanisms to encourage relevance and ensure quality within the research-performing system*
- A key modernising intervention is to create a ‘binary’ research funding system, distinguishing between
 - *Institutional funding, intended to sustain the research activities of universities & institutes*
 - *Targeted funding*
 - High leverage over the wider research activities (cover marginal costs)
 - Subject to quality control
 - Can be programmed towards societal objectives

2. Increasing focus on innovation & applied research

Increasing use of targeted funding as

- ‘Focusing’ device, drawing effort towards societal/industrial problems
- Mechanism for co-development & knowledge transfer between industry & research

Shift in funding focus:

- From institutional to targeted funding
 - *In 2004: 54% institutional funding – In 2012: 54% targeted funding*
- Constant increase in share of targeted funding for the Ministry of Industry & Trade
 - *In 2004: 23% → 2008: 26% → envisaged for 2012: 32%*
- Considerable change in institutional funding distribution between Higher Education & Academy (ongoing trend – *intended?*):
 - *In 2004: both 40% → In 2012: Higher Education 60% - Academy 23%*

3. Interventions responding to persistent failures

- Persistent systemic failures:
 - *Shortcomings in R&D&I support management*
 - *R&D capacity building*
 - *Unsatisfactory science-industry collaboration*

The 2008 Reform Plan & the National Policy for R&D&I 2009-2015:

- Programmatic interventions
 - *Policy-mix supporting R&D collaboration, capacity-building & innovation*
- Systemic interventions
 - *Structural coordination of the R&D&I Governance system*
 - *Structural integration of research & innovation*
 - *Improved co-ordination of R&D&I policies & linkages with other policies*
 - *Coordination of R&D&I support planning & management*

4. Significant reforms in governance

- Reduction of number of ministries with responsibility for R&D
- Establishment of the R&D&I Council as
 - *An arena for discussion on research & innovation*
 - *An opportunity to develop holistic research & innovation policies*
- Two central agencies
 - *Strengthening of the role of the Grant Agency/Science Foundation*
 - *Creation of the Technology Agency*

Two ‘special’ features of the envisaged R&D&I governance structure:

- The role of the R&D&I Council
- The role of the Technology Agency

4a -The role of the R&D&I Council

- Among OECD countries, three main models:
 - *Joint planning model (Japan)*
 - *Co-ordination model (Finland, Netherlands)*
 - *Advice model*
- In the CR: almost a virtual science ministry
 - *Coordinates R&D&I policies top-down*
 - *Has a strong say in budgeting*
- Questions:
 - *Limits to time & analytic efforts?*
 - *Lack of contacts with sectors of society and the R&D&I system that are normally maintained by the ministries and their agencies*
 - *Degree of potential policy influence at government level?*

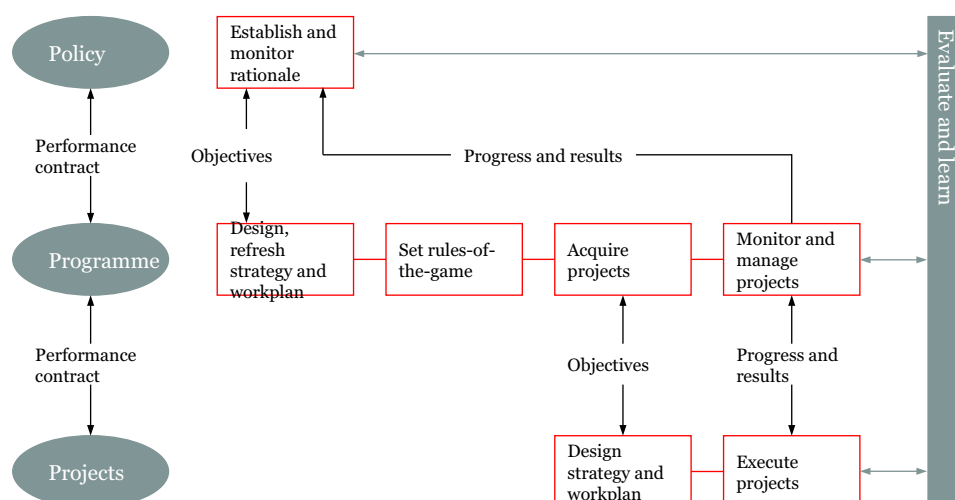
4b - The role of the Technology Agency

Fulfills a double role, operating both at the policy-making level (ministry) and as agency

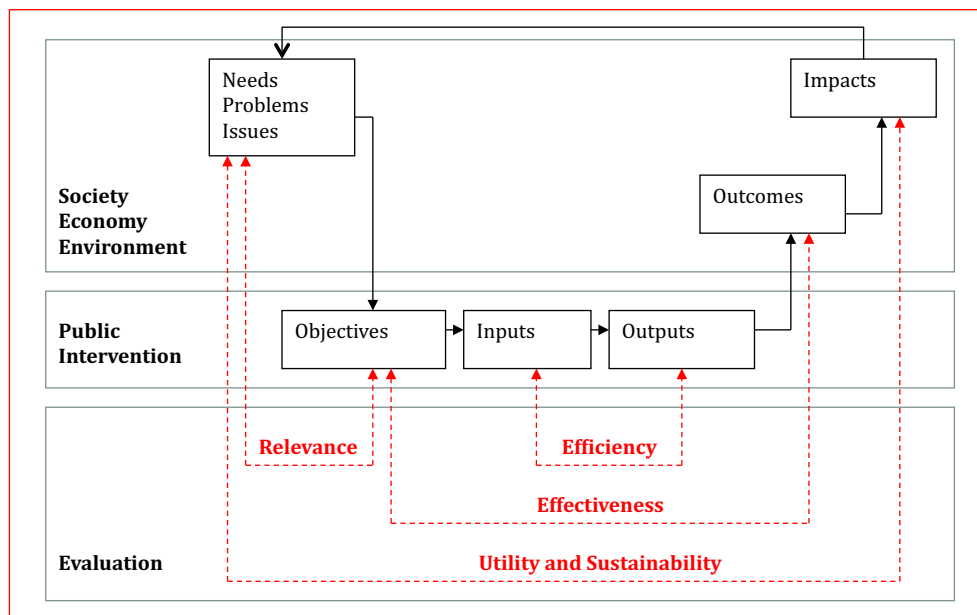
- Multi-principal intermediate research funder, acting as an executive agency for the ministries with competence for R&D&I
 - *BUT: only for those programmes that “do not strictly belong to the ministries’ cross-sectoral & sectoral fields of competence”*
- Mono-principal intermediary, acting on the national priorities for (applied) research & responding directly to the R&D&I Council
 - *BUT: lack of contacts with sectors of society and the R&D&I system that are normally maintained by the ministries and their agencies*

5a. Ex-post evaluation as a component of the policy cycle

Logical consistency across the programme cycle maximises the chances that interventions reach their objectives



5b. Ex-post evaluation key for strategic intelligence



Next steps

- Questionnaire to understand the users' perspective
- Collection of detailed information on
 - *The operation of the governance structures*
 - *Budgeting, priority-setting in practice*
 - *Programme management and implementation – reality vs regulation*
- Deepening the international comparisons

Thank you



R&D Outputs in the Czech Republic

Bibliometric research performance indicators: An overview

Rodrigo Costas Comesaña & Thed van Leeuwen

Conference related to the Audit of the Czech R&D system

Brno, September 23rd, 2010



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Contents of the presentation

- Summary of the main findings.
- Methodology of bibliometric studies.
- Bibliometric database and data collection.
- Bibliometric indicators produced by CWTS.
- International comparison of the Czech Republic's performance
- Results on meso-level.



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Summary of the main findings

- Growth of output and impact of the Czech Republic
- Changed composition of the output in terms of scientific cooperation → more **internal** cooperation
- Change in the research profile of the Czech Republic
- Growth of fields in the social sciences & humanities
- Productivity per capita & international impact increased
- Growth on sector/institutional level:
 - Universities have taken the lead
 - The CR Academy of Sciences remains a ‘Powerhouse’!



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Methodology of Bibliometric Studies



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Functions of applying bibliometrics

Using bibliometrics as a diagnostic tool, we can distinguish two main functions:

- Mainly **descriptive** (e.g., The Dutch Observatory on Science & Technology, on German medical sciences, but also CWTS benchmark studies).
- Mainly **evaluative** (e.g., studies for VSNU, the Dutch Association of Universities).



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Goals of applying bibliometrics

Using bibliometrics to measure output and impact, we can distinguish two main goals:

- Gaining insight in the **research potential** of entities or a complete organization.
- Gaining insight in the **past performance** of entities or a complete organization.



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Choices and consequences

The final choice for a certain approach or type of study is mainly 'customer driven'.

Depending on the goals one wants to achieve (evaluation of research (groups), description of the scientific profile of an institute or university, etc.), specific approaches fit the raised questions.



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Models of bibliometric analysis

- In our analyses, we can roughly distinguish between two different types of models:

- **Top-Down approach**

- **Bottom-Up approach**

In the next section, we will further explain these two different approaches.



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Building blocks of an organization

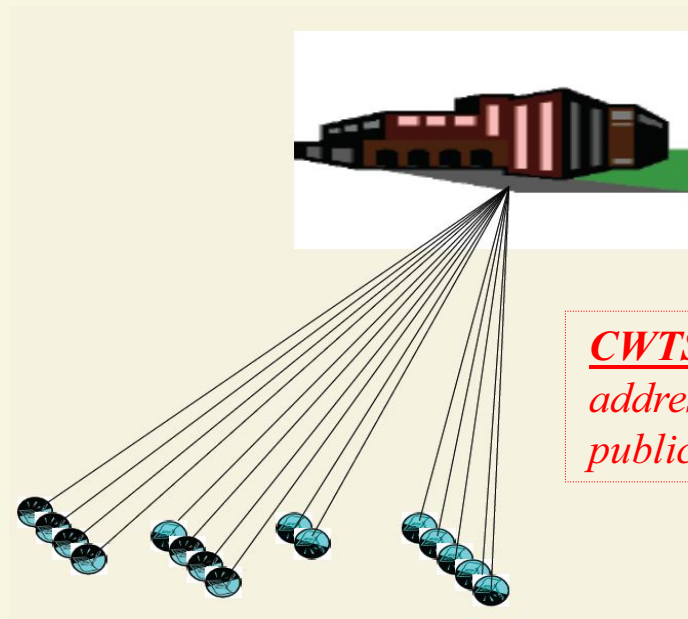
- University
- Laboratories / research groups
- Researchers (in these laboratories)
- Scientific publications



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Top Down approach



*CWTS compilation of
address-based
publication set*

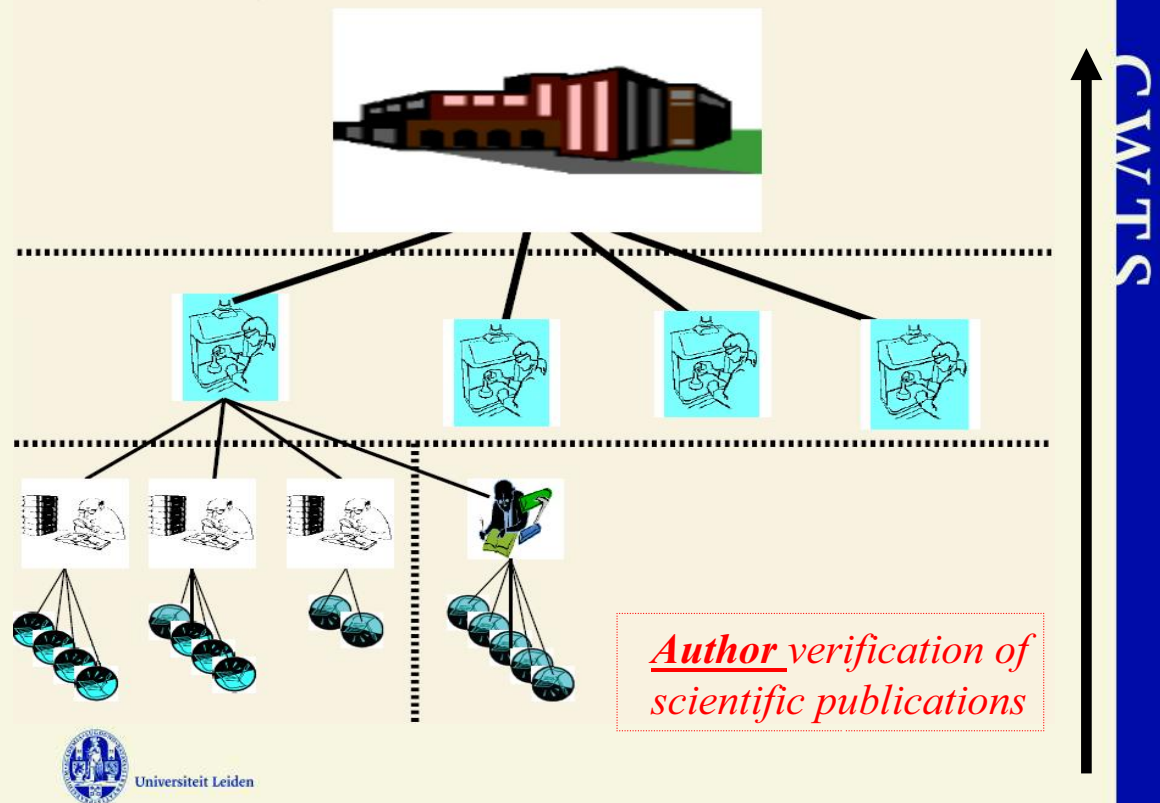


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Bottom Up approach



Combining Approach with Goals

	Top-Down	Bottom-Up
Past performance	Yes	Yes
Research potential	No / Yes (?)	Yes

Combining Approach with Functions

	Top-Down	Bottom-Up
<i>Descriptive</i>	Yes	Yes
<i>Evaluative</i>	No	Yes



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Typology of studies

- We distinguish various levels of analysis:
 - *Macro-level*, e.g. country comparison for the EU, Dutch Observatory of S&T;
 - *Meso-level*, e.g. analysis of universities, research institutes or fields;
 - *Micro-level*, e.g. analysis of programmes, groups, or individual researchers.



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Bibliometric database and data collection



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CWTS data system

- CWTS has a full bibliometric license from Thomson Reuters to conduct evaluation studies using the Web of Science.
- Our bibliometric database covers the period 1981-2009.
- Some characteristics:
 - Over 31.000.000 publications.
 - Over 500.000.000 citation relations between source papers.
 - 100.000.000 authors (incl. variations), 15.000.000 'unique' names.
 - Over 60.000.000 addresses, some 90% cleaned up over the last 10 years.
 - Contains reference sets for journal and field citation data.



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Data collection

- Roughly, we can distinguish three methods for the collection of a set of publications
 - **Based on a list of names of researchers**
(verification through a website creates a valid dataset)
 - **Based on a list of publications of a unit**
(the supplied lists forms the authorized/verified dataset)
 - **Based on the address of a country or an institution.**
(this approach does not allow lower level insights)

For research assessment methods, one wants to work with both the first and the second method.

For descriptive studies, the last method is appropriate.



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Bibliometric indicators produced by CWTS



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Some basic indicators are ...

- ***P***: number of publications in journals processed for the Web of Science.
- ***C***: number of received citations, excl. self-citations.
- ***CPP***: mean number of citations per publication, excl. self-citations
- ***Pnc***: percentage of the publications not cited (within a certain time-frame !!!)
- **% *SC***: percentage self-citations related to an output set.



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Important indicators are...

- ***CPP/JCSm***: ratio between real, actual impact, and mean journal impact.
- ***CPP/FCSm***: ratio between real, actual impact, and mean field impact.
- ***JCSm/FCSm***: ratio between journal impact, and field impact, indicative for the ‘quality’ of the journal package in the field.
- *These indicators are currently ‘under construction’*



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Field classification

- The field classification applied in the study is a modified version of the field classification schedule used in other observatories (NOWT, the Dutch observatory).
- This current schedule fits the Czech Republic's R&D&I system better.
- Main differences relate to physics and its' relation to mechanical engineering, and mathematics and statistics, as an integrated field.



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Input data combined with bibliometrics.

- Normally, input data supplied by the OECD are used for linking to bibliometric data.
- These data are considered as unreliable for this purpose, as:
 - Not all countries use similar definitions for R&D personnel;
 - Not all countries supply information to the OECD on a regular basis;
 - How is input related to output, what about throughput, particularly across countries and fields;
 - Local culture and development level of R&D personnel in relation to WoS based bibliometric indicators: what does it mean ?
- This explains our choice for the numbers of inhabitants, as that is a clear number, which is not easily manipulated.



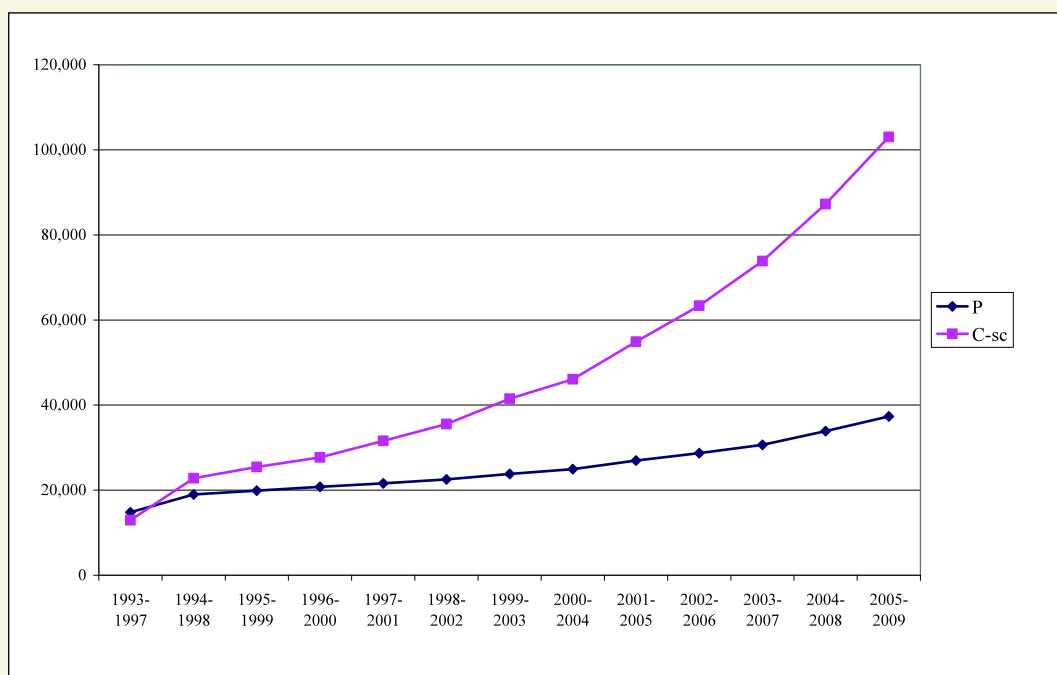
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International comparison of the Czech Republic's performance



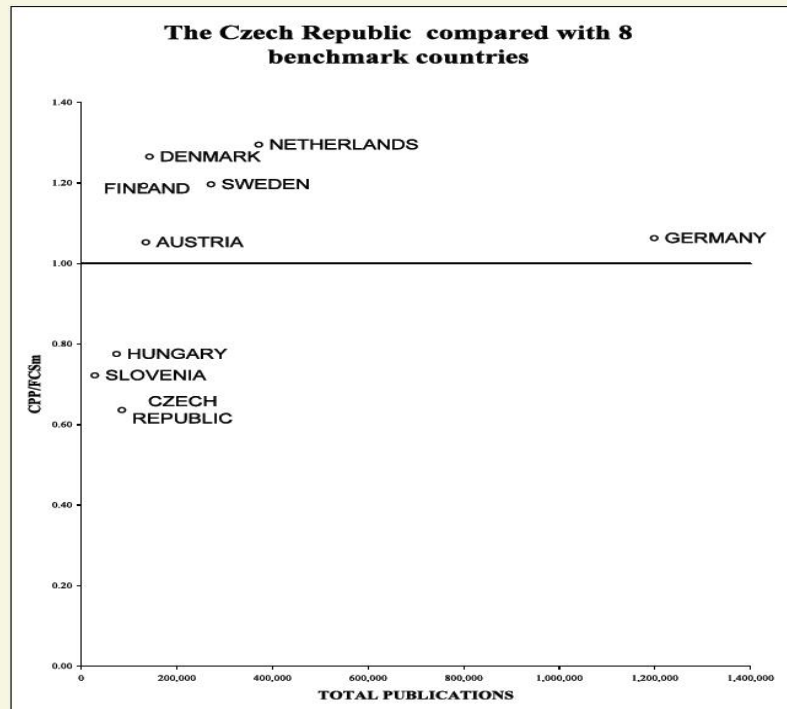
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Growth of output and impact of the Czech Republic



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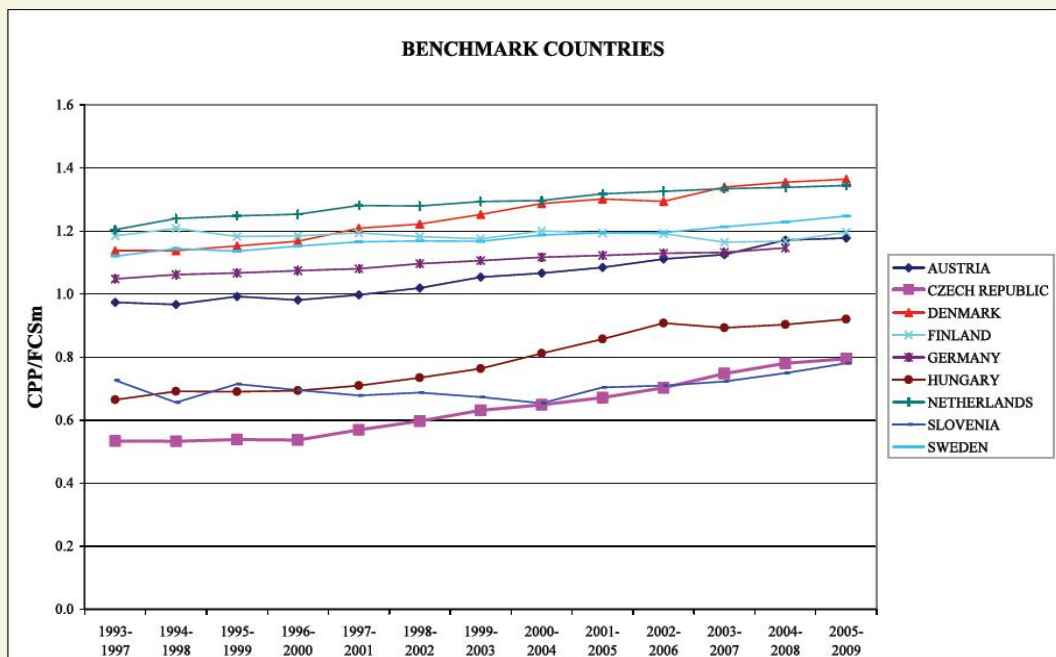
International comparison, in time



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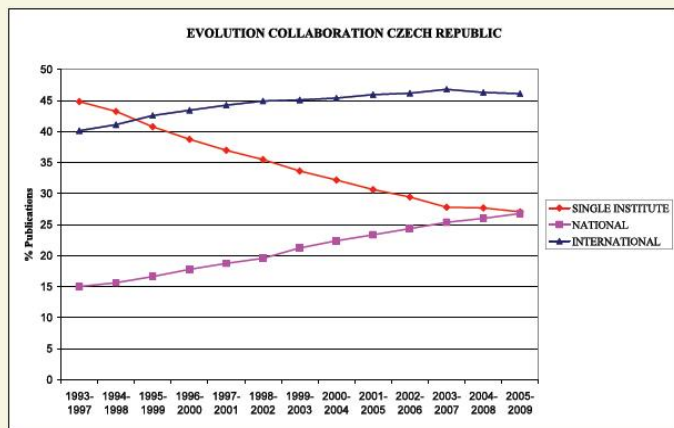
International comparison, in time



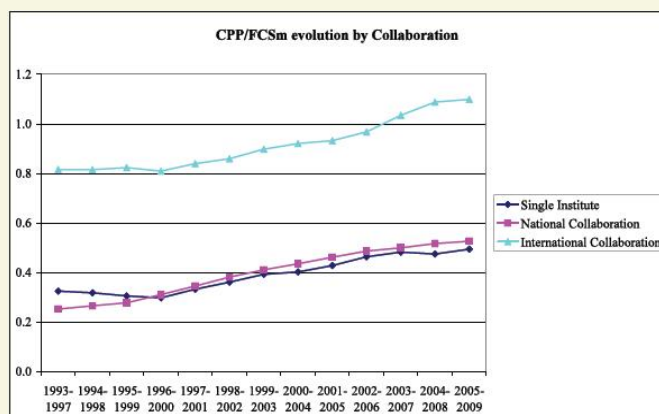
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The role of cooperation relations



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Profile of the Czech R&D system, 93-09 vs 06-09

Most fields in the profile have low impact scores.

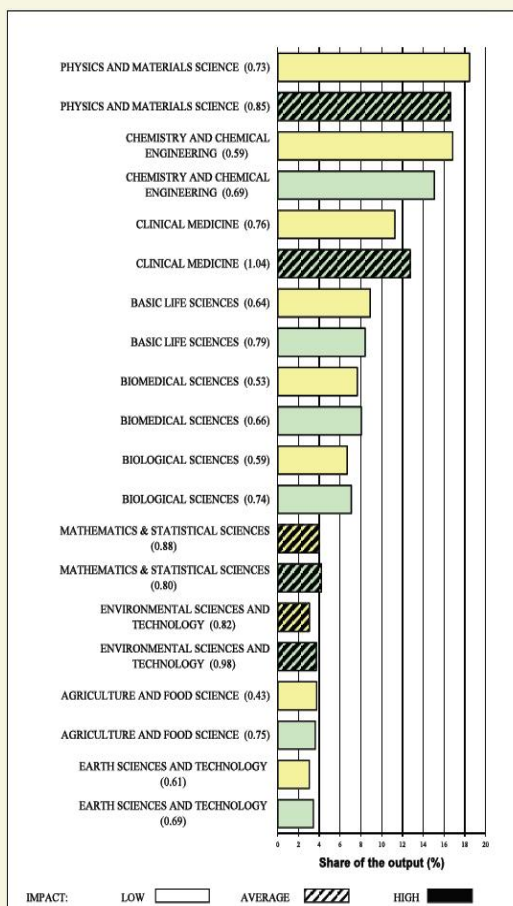
We notice a strong focus on the natural sciences, giving the Czech Republic a 'European continental profile'.

More fields in the profile now show average impact scores.

We notice a shift in the focus towards the medical sciences, giving the Czech Republic a somewhat more 'Anglo-Saxon profile'.



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Combining demographic data to the bibliometric scores of the Czech Republic on output and impact

	Productivity 93-09	CPP/FCSm 93-09	Productivity 05-09	CPP/FCSm 05-09	Delta P	Delta I
AUSTRIA	0.0010	1.05	0.0012	1.18	27.07	11.91
CZECH REPUBLIC	0.0005	0.64	0.0007	0.79	47.95	24.94
DENMARK	0.0016	1.27	0.0019	1.36	20.36	7.86
FINLAND	0.0015	1.19	0.0018	1.20	19.03	0.32
GERMANY	0.0009	1.06	0.0010	1.16	18.56	9.50
HUNGARY	0.0005	0.78	0.0007	0.92	58.03	18.77
NETHERLANDS	0.0014	1.30	0.0017	1.34	22.58	3.83
SLOVENIA	0.0008	0.72	0.0013	0.78	58.97	8.10
SWEDEN	0.0018	1.20	0.0020	1.25	14.11	4.29



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Results on the meso-level



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Institutional bibliometric analysis - Methodology

Collection of bibliographic data for the main-institutional sectors:

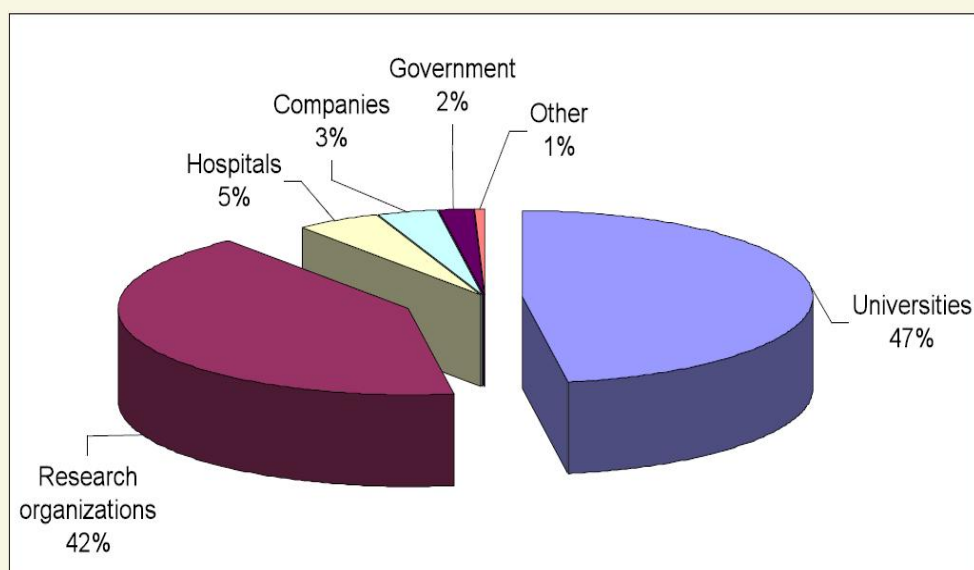
- Universities
- Hospitals
- Academy of Sciences
 - + Institutes
- Research organizations, companies, and others

Consultancy with several experts from the Czech Republic

- Support in detecting problems
- Criteria in standardization procedures
- Discussion of some of the indicators

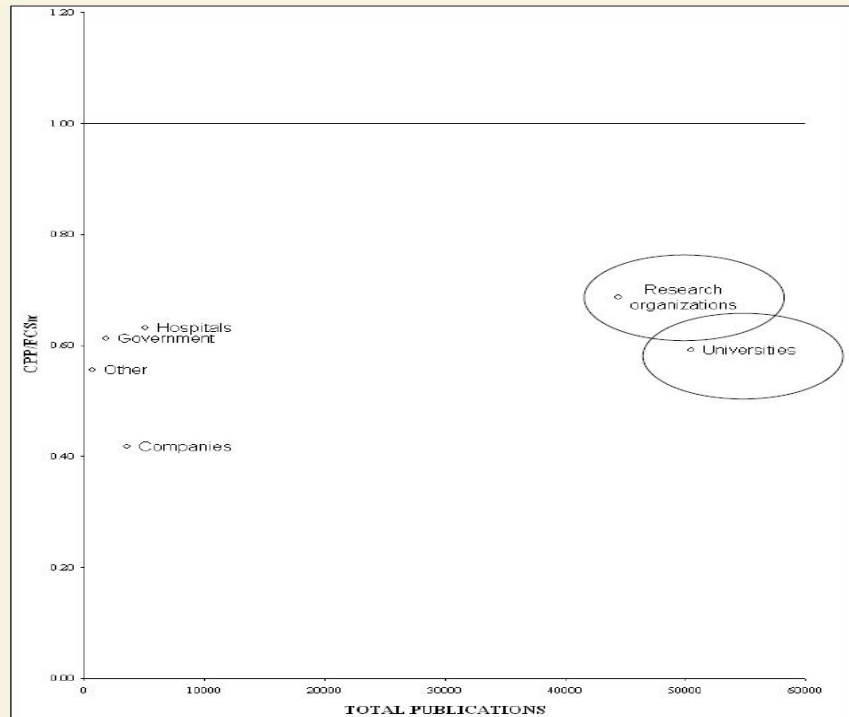


Distribution of WOS production by institutional sectors



Performance

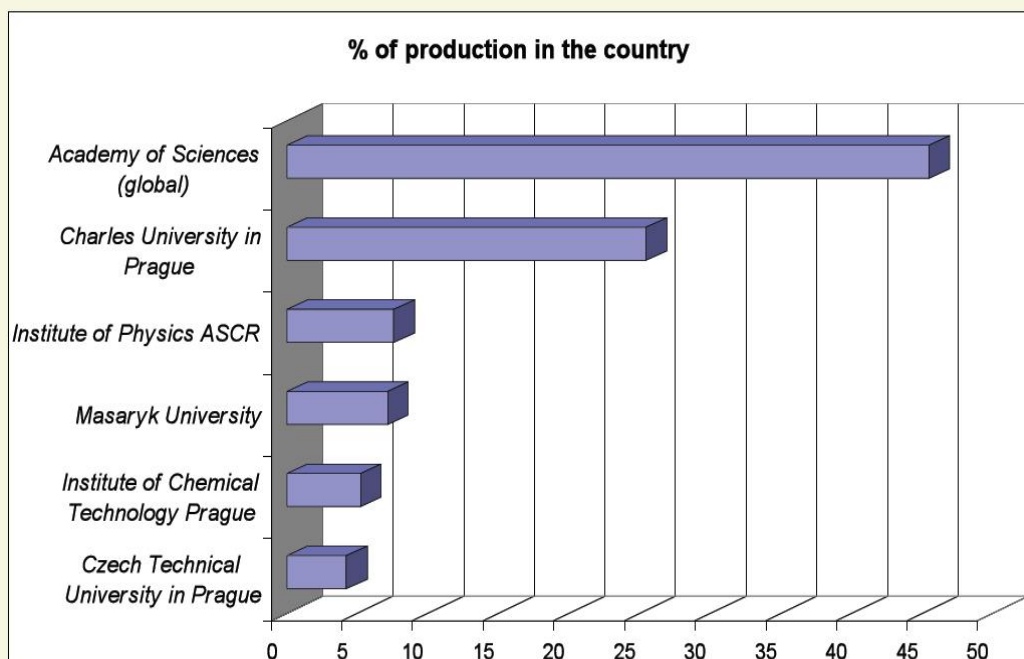
Main sectors:



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Main institutions



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Main institutions

Important actors (with more than 2000 publications):

Several **Institutes of the Academy of Sciences**

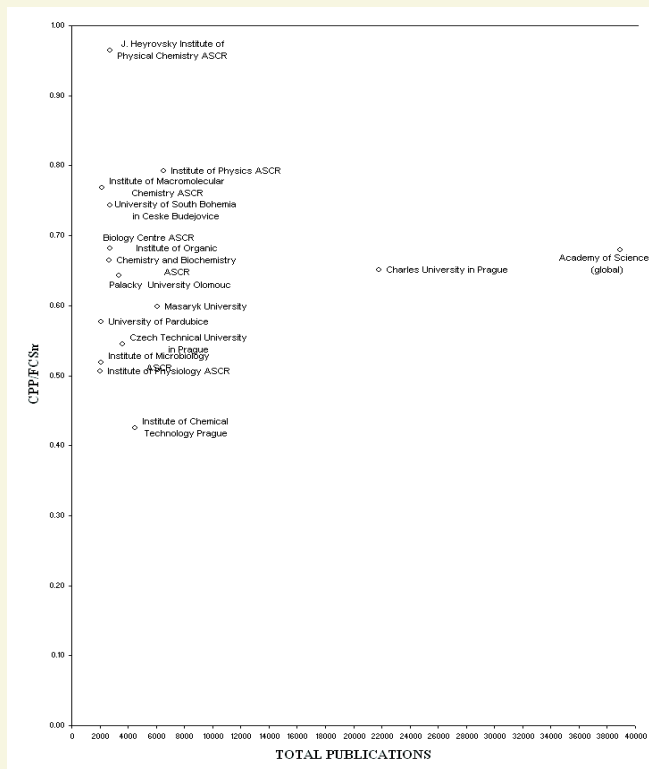
Several Universities:

- **Charles University,**
- **Univ. South Bohemia**
- **Masaryk University,**
- **Czech Technical Univ.,**
- **University of Pardubice**

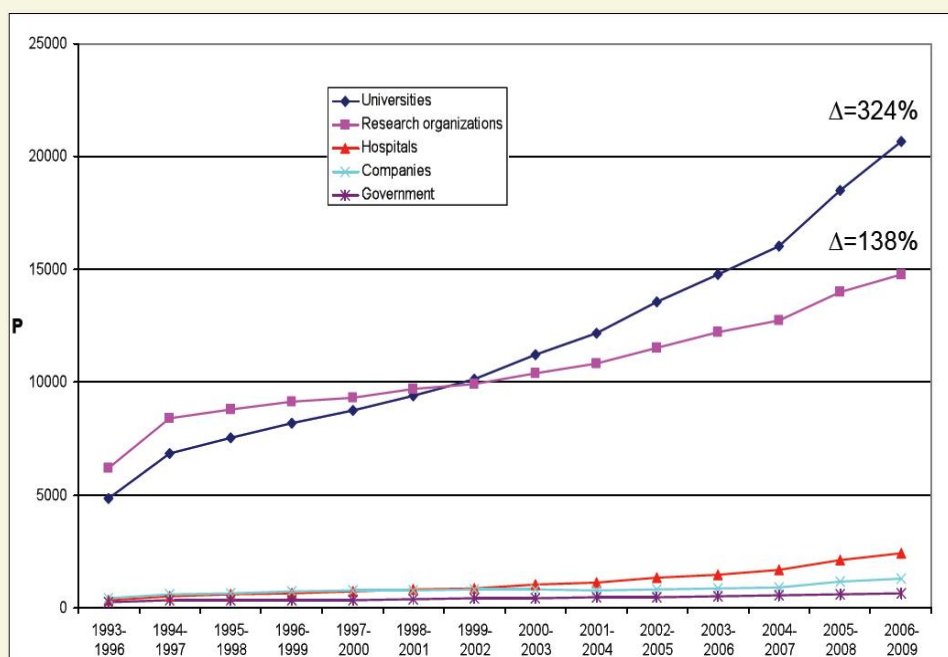
... and the **Institute of Chemical Technology.**



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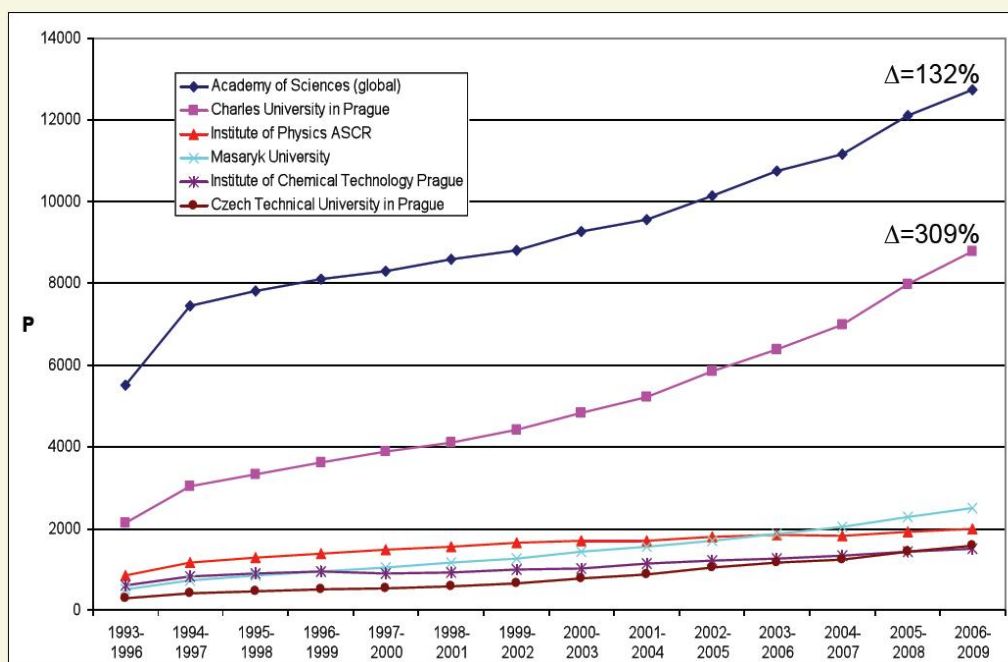


Evolution of production by main sectors



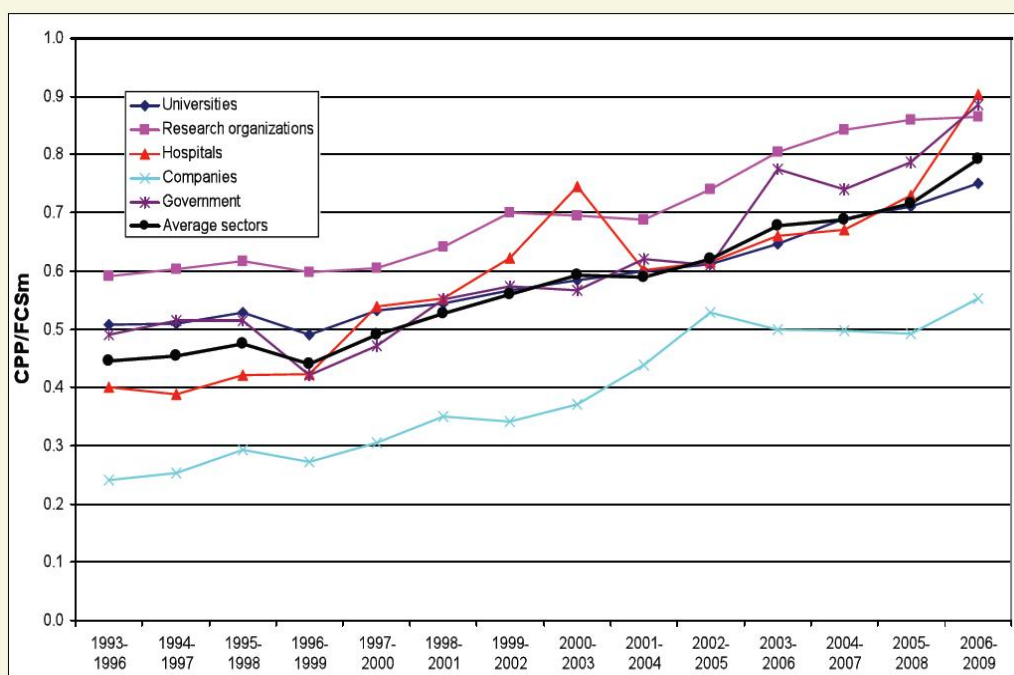
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Evolution of production by main institutions



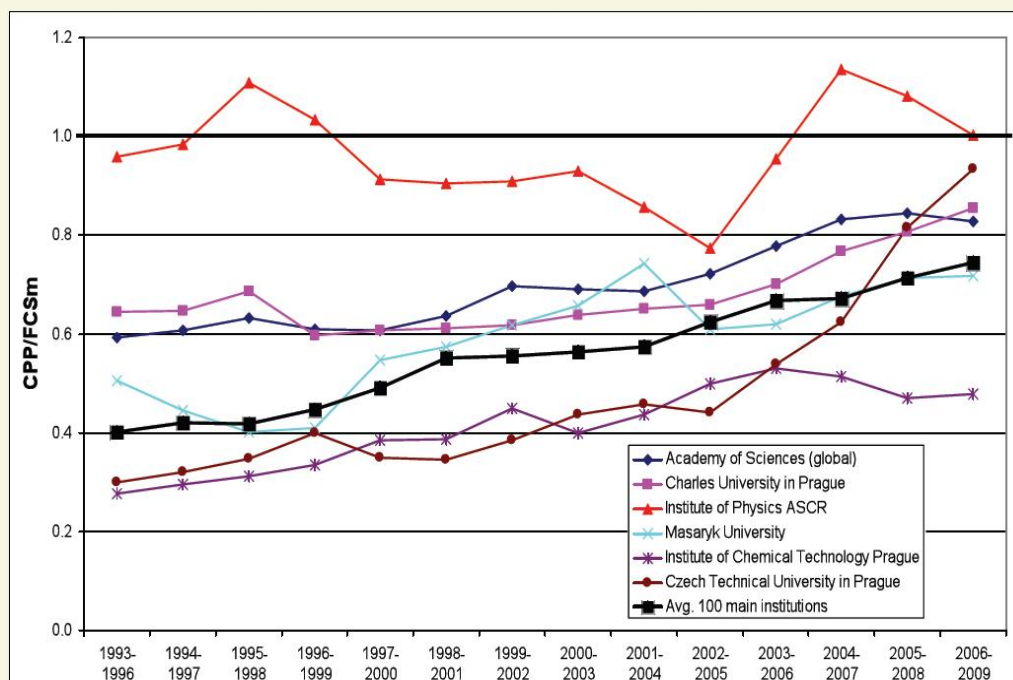
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Evolution of normalized-impact by main sectors



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Evolution of normalized-impact by main institutions



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Institutions by fields

- The main Czech institutions have been studied for the 34 main fields
- All institutions with at least 5 publications in each field have been considered and presented in the report
- In almost all the fields the first institutions are:
 - The Academy of Science as a whole (global) or its institutes
 - The Charles University in Prague
- Some exceptions are:
 - “Economics & Business”, “Political Science & Public Administration”, “Energy Science & Technology”, “Instruments & Instrumentation” and “Mechanical Engineering & Aerospace” (the latter with a remarkable role of the Czech Technical University in Prague)



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Some conclusions

Increasing pattern of Production and Impact over time for most of the institutions

The field-normalized impact (CPP/FCSm) is also increasing but still below international level for most of the institutions

The Academy of Sciences and the Charles University in Prague are the main actors:

- In the whole production
- Among the different main fields

The collaboration (especially the international) has increased over time for most of the institutions



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Thank you for your attention



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The Research Evaluation Guidelines in International Perspective

Brigitte Tiefenthaler & Barbara Good
technopolis |group| Austria

Contents of the presentation

- Key messages
- Basics for our assessment of the Evaluation Methodology (EM)
- The transformation of the EM 2004-2010
- The EM as a tool for research evaluation
 - *Evaluation practices abroad: conclusions from international cases*
 - *Critical issues with the CZ EM*
- The EM as a basis for the allocation of funding
 - *Performance-based Research Funding Systems (PRFS)*
 - *Characteristics of PRFS, critical issues and their situation in the CZ system*
 - *Lessons learned*

Key Messages

- The Evaluation Methodology needs further refinement in order to reach international good practice in evaluating quality of research
- Using the Evaluation Methodology as a basis for allocating institutional funding introduces significant risks and is likely to cause discontinuities

Basis for our assessment of the Evaluation Guidelines

- In-depth analysis of the Evaluation Methodologies 2004 and 2009 (available in English)
- Preliminary analysis of the Evaluation Methodology 2010 (was approved only recently)
- International case studies (UK, NL, FR, AT, AUS, NO)
- Interviews
- Analysis of (policy) documents
- Next steps:
 - *Complete international case studies*
 - *In-depth analysis of the mechanisms for the allocation of institutional funding*
 - *Development of recommendations: what is to be done?*

The transformation of the EM (1): The double role of the EM

- EM 2004
 - *Concept of a metrics-based quantitative results evaluation*
 - *Tool for improving the quality of research performance*
- EM 2009
 - *Adopts the metrics-based evaluation of R&D results as a Performance-based Research Funding System (PRFS)*
 - *To be applied at the level of funding bodies (budget chapters)*
- EM 2010
 - *Goes one step further from 2009 and extends the use to the level of research institutions*
- Close link at the practical level:
 - *EM defines eligible results, collection & conversion into point values*
 - *Provides the basis to allocate institutional funding*

The transformation of the EM (2): The changing scope

- EM 2004
 - *Broadly outlined, comprehensive approach covering different layers of the research system*
 - R&D programmes
 - Projects, research intentions and other R&D activities
 - Research organisations
 - *Different approaches for different layers*
- EM 2009 and EM 2010
 - *Exclusive focus on research organisations and research programmes*
 - Research organisations
 - RTDI programmes

The transformation of the EM (3): The restriction of scope

- EM 2004
 - *Stresses the importance of evaluating (socio-economic) results and effects of research programmes based on their self-set objectives*
 - *“... puts great emphasis in... taking into account the specificities of the different types of research...” (EM 2004, [23])*
 - *“...the whole range of societal functions and effects of research on the economy, society, education, knowledge...” (EM2004, II, 2.)*
- EM 2009 and EM 2010
 - *Measures research outputs exclusively*
 - *Impacts and their ex-post analysis are never mentioned*
 - *No differentiation: “...disregarding the type of research carried out.” (EM 2010, II, 2.2)*
 - *“... evaluation of efficiency is not carried out.” (EM2010, Introduction)*

How the CZ EM differs from international practice (1)

- Czech EM is purely metrics-based and almost unique:
 - *UK RAE uses a number of qualitative and quantitative indicators but these are subordinate to peer judgement*
 - *AUS & NO rely more on quantitative indicators, but not as radically as CZ*
- Formative approaches: Evaluation is about learning & improving, not just about accountability
 - *French AERES: formative approach underline “self-reflection”*
 - *Dutch SEP: from “jury” model to “coach” model*
- Larger scope: Evaluation systems go beyond research outputs
 - *UK RAE: includes e.g. research strategy, staff development, research students and studentships, research income etc.*
 - *French AERES: looks at governance, strategy and the “life” at research units*
 - *Dutch SEP: looks at research management, policy, research facilities, PhD training and societal relevance of research*

How the CZ EM differs from international practice (2)

- Societal relevance & impact: Research evaluation increasingly meets the challenge of assessing the role of research in society
 - *Dutch SEP: since 2009, assessment of societal impact (ERiC system)*
 - *UK REF assessment of wider impact of research (→ pilot exercise to test and develop method)*
- Retrospective vs. prospective
 - *Dutch SEP assesses past performance and future plans*
- An instrument for steering universities
 - *Dutch SEP: universities are subject to quality assurance in exchange for autonomy*
 - *AT: universities are fully autonomous in the evaluation of research – but legally obliged to do so*

How the CZ EM differs from international practice (3)

- Research evaluation and allocation of institutional funding: Not necessarily a (direct) linked
- Dutch SEP: no link
- French AERES: indirect link
 - *Evaluations regarded as “objective negotiation tools” for negotiating performance contracts*
- AT: indirect link
 - *Universities have to report to the Science Ministry about the setting up of evaluation systems (but not about the results of evaluation)*
- UK Research Assessment Exercise: direct link
 - *Inform the distribution of funds by the UK higher education funding bodies, i.e. results are used in the quality related funding formula*
- NO: direct link, but affects a very small part of overall resources

The Czech EM: Critical issues (1)

- Different types of institutions are assessed in the same way
→ their very different missions, tasks, activities, and funding situations are ignored
- Differences between disciplines are not taken into account adequately
 - *different types of research results are not equally important across disciplines and modes of research*
 - *not all types of results are equally achievable for all scientific disciplines*
 - *scientific disciplines differ in their publication cultures & patterns*
- EM focuses exclusively on countable research outputs
 - *might encourage gaming the system, e.g. “salami tactics”*

The Czech EM: Critical issues (2)

- EM does not consider input factors
 - *different starting points of institutions are ignored*
 - EM excludes anything beyond outputs
 - *research quality, research management, post-graduate-training, etc.*
 - EM is set at too high a level of aggregation compared to the level at which research is taking place
 - EM has no formative element, being retrospective and purely metrics-based
 - *it creates no opportunities for researchers, research managers and research institutions to learn and improve quality*
- Note: these issues are valid for of the EM both as an evaluation tool and as a basis for funding decisions!

Performance-based Research Funding System (PRFS)

Policy Context in the Czech Republic

- Search for objective criteria for the allocation of institutional funding
- Increasing focus on concrete R&D results
- Shift towards greater autonomy of institutions by replacing research intentions with a PRFS

Key characteristics of PRFS (1)

- Applied in many countries
 - *Austria, Australia, Denmark, Finland, Flanders, France, Hong Kong, Italy, New Zealand, Norway, Poland, Slovak Republic, Spain, Sweden, UK*
- Used in different ways
 - *A competitive source of discretionary income*
 - *A reward for quality and / or volume of output*
 - *An instrument of policy*
 - *Or a mix of these (UK: all three)*
- Used at different levels
 - *Individual performance (Spain)*
 - *“Units of assessment”, e.g. department, research group (UK, Hong Kong)*
 - *Institutions (most systems)*

Key characteristics of PRFS (2)

- Typical output measures applied
 - *Volume*
 - *Quality*
 - *Impact*
 - *Utility*
- Trend: from peer-review to indicator-based systems
 - *To de-politicise and to de-personalise (esp. CR)*
 - *To cut costs and to simplify*
- Intervals between successive allocations & period assessed vary
 - *CR: annual decisions, based on number of results of past five years*
 - *AT: decisions every three years, based on the differences between the past two funding periods*
- Percentage of funding moved in one allocation round (→)

How much money is moved by a PRFS?

- International practice: modest amounts of money are moved, compared to total institutional funding
 - *NO: reallocation is limited to 2% of university income*
 - *AUS, NZ: 10% of national university funding governed by PRFS*
 - *AT: formula based funding rules 18% of national “block” funding for universities and the max. annual reduction is limited by law to 2% p.a.*
- The situation in the Czech Republic
 - *Implementation of the new system in various phases and with differences between institutions*
 - *By 2011, for most research institutions, 2/3 of institutional funding will be determined by the PRFS – for others even 100%*
 - *Rough estimate: 30% of universities’ and 80% of the Academy’s total national public funding affected*

Effects of PRFS

- PRFS are intended to affect performance
- PRFS are relatively new, hence, there is a limited amount of evidence about their effects
- UK: quality of university research has clearly increased
- The effects on collective behaviour can be surprisingly large
 - *Potential funding change*
 - *Role of rankings & grades as indicators of esteem*
- ... and not all effects might have been intended
 - *See the example of AUS*
- Care needs to be taken to avoid such unintended, perverse effects
- Critical factor: inter-field differences (→)

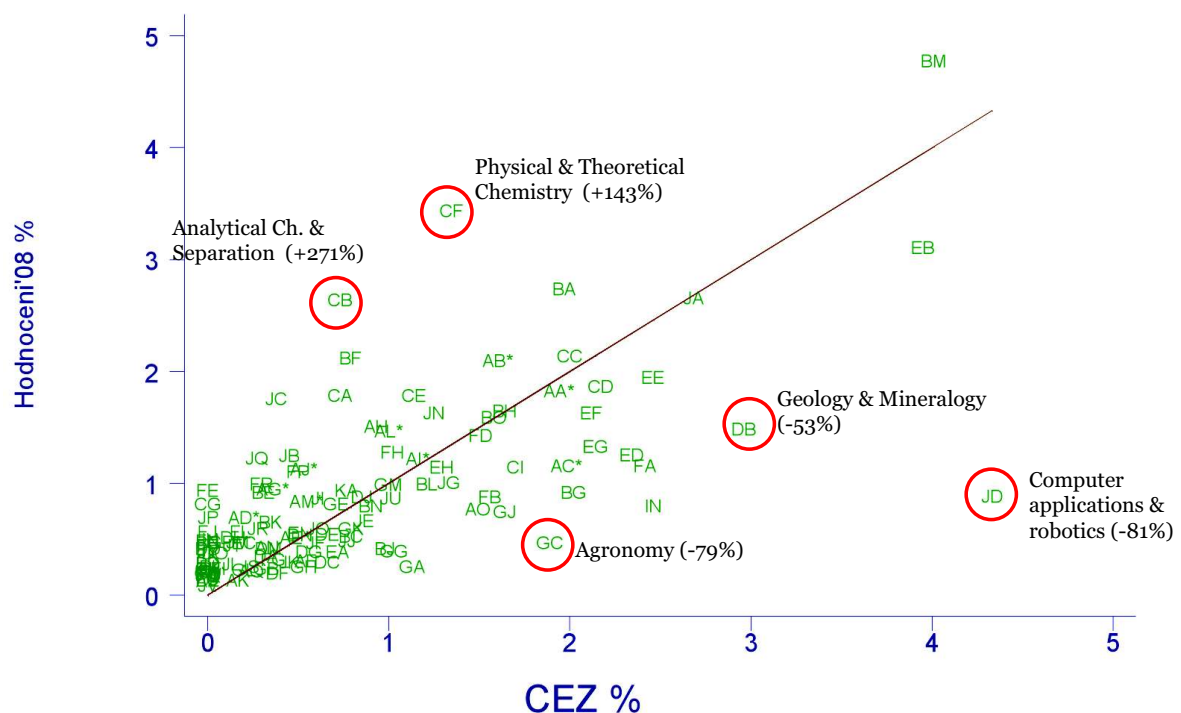
How to tackle inter-field differences in PRFS?

- Differences between scientific fields are large and need to be taken into account (see above)
- Approach 1: use methods for field normalisation
 - *Either in calculating indicators*
 - *Or in the translation of indicators into the allocation of money*
 - *NO considered field normalisation but decided it was too hard*
- Approach 2: avoid putting fields in competition with each other
 - *Requires separate decisions on the allocation of money among fields*
 - *UK uses approx. 60, Sweden 34 disciplinary categories*
 - *CZ EM 2010 is an attempt in this direction, but with only 10 categories → still inter-field competition*

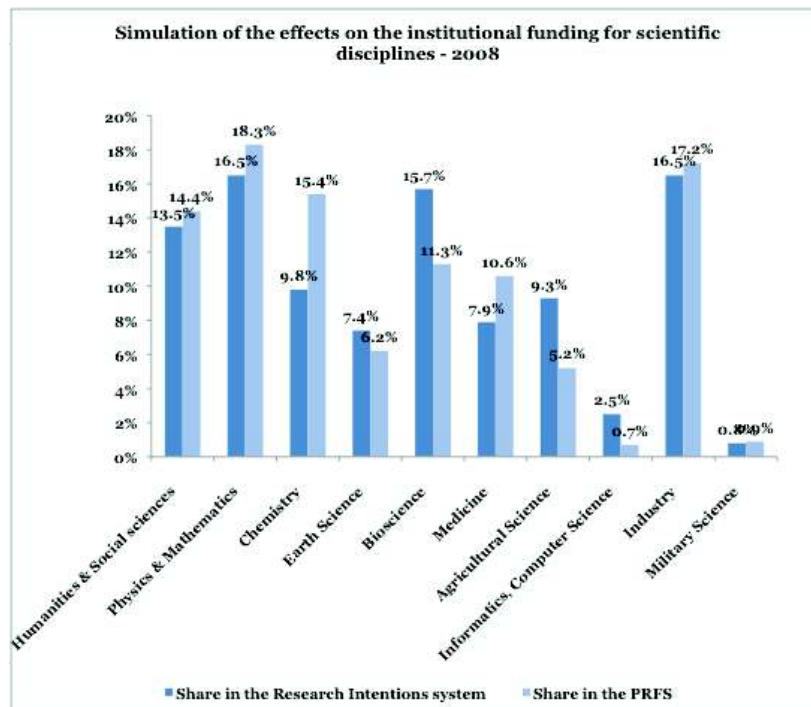
Inter-field differences in the Czech EM?

- How would the Czech EM affect different fields?
- Simulation based on the EM 2008 - *Project for the preparation of the Methodology to evaluate the results of research institutions and of programmes finished in 2010*, Secretariat to the R&D&I Council, 2010
- Major conclusions valid for EM 2010:
 - *differences within the ten fields defined by the new EM remain large (e.g. history vs. economics within 'Humanities and Social Sciences')*
 - *J_{imp} are excluded from the 'damping', but they account for the lion's share of point values (65% in 2009!)*

Field specific shares (in %) of institutional funds allocation by Research Intentions and by the PRFS



Shift in focus of institutional funding for research



Source: "Project for the preparation of the Methodology to evaluate the results of research institutions and of programmes finished in 2010" Secretariat of the Board of the R&D&I Council, 2010

Main preliminary findings from the simulation of the CZ system

- Expected shifts in the focus of institutional funding
- “Winners”:
 - *Chemistry: inorganic c., analytical c. & separation, physical & theoretical c.*
 - *Medicine: traumatology & orthopedics, psychiatry, pharmacology etc.*
 - *Physics & mathematics: Theoretical ph., elementary particles & high energy ph., general mathematics*
 - *Humanities & Soc. Sci.: Politology, Legal Sci., Letters*
- “Losers”:
 - *Bioscience: (all but immunology), among them **genetics & molecular biology***
 - ***Agricultural sciences:** (all but plant pathology)*
 - ***Informatics & computer sciences***
 - ***Industry: computer application and robotics***
- Some PRFS results would contradict the thematic priority set in the National Priorities for Applied R&D&I 2009 -2011 (highlighted cases)

Key lessons about PRFS

- Move slowly
The research community takes time to respond to changed incentives
- Take small steps
Moving small amounts of money has big effects on behaviour
- Explicitly tackle field differences
- Do not use solely indicator-based approaches
Combine them with other allocation principles

Thank you

What research assessment means for a leading university: How the University of Manchester tackles research assessment

Luke Georghiou

*Manchester Institute of Innovation Research
Manchester Business School
University of Manchester*

Outline

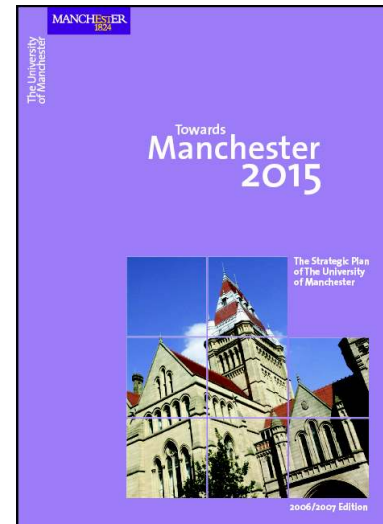
- University of Manchester and its Key Performance indicators
- UK Research Assessment Exercise
- Constructing and deconstructing ranking tables
- Research Excellence Framework
- Manchester's Research Profiling Exercise
- Implications for incentives

The “new” University of Manchester

- Victoria University of Manchester and UMIST merged in October 2004 to form UK’s largest university
- The 2015 Vision of the new institution – overall objective set out in Vision Document **Manchester 2015**

To make the University of Manchester, already an internationally distinguished centre of research, innovation learning and scholarly inquiry, one of the leading universities in the world by 2015.

- Aiming for distinctive identity that equalled but did not emulate the UK’s “Golden Triangle” or the US Ivy League



2015 Vision

- Initially drafted in 2004 with strong leadership from a new President and Vice-Chancellor
- Consultative process with all staff
- Reviewed annually by Board of Governors and senior staff and some changes made in light of experience

Strategy Encapsulated in 9 Goals

1 High International Standing

- To establish the University of Manchester as a world renowned centre of scholarship and research by 2015. To match the leading universities in the world in attracting and retaining teachers, researchers and 'critical mass' research teams of the highest quality. To be a higher education brand synonymous with the finest international standards of academic excellence with pioneering, influential and exciting research and scholarship.

2 World Class Research

- To establish the University of Manchester by 2015 among the 25 strongest research universities in the world on commonly accepted criteria of research excellence and performance.

3 Exemplary Knowledge and Technology Transfer

4 Excellent Teaching and Learning

5 Widening Participation

6 Empowering Collegiality

7 Efficient, Effective Management

9 More Effective Community Service

2015 Agenda – Key Goals and Key Performance Indicators (KPIs)

Goal 1 High International Standing

Present KPIs

- Clear evidence of improvement in standing as measured by reputable international higher education rankings
- Appointing a number of 'iconic' scholars: 5 Nobel Laureates on staff by 2015, 3 by 2008

2015 Agenda

Goal Two: World Class Research

Initial KPIs

- 50% staff international quality 2008; 70% 2015
- Doubling real research income by 2015
- Doubling postgraduate research students and postdocs by 2015

Present modified KPIs

- Annual increase in share of high impact research publications
- Doubling real external grant income by 2015
- Treble research expenditure by 2015
- Double no of PGR students successfully completing and no of postdocs by 2015

Progress to Date – Achievements

- Two Nobel laureates signed (one paid for by large donation) plus another iconic appointment, several more in pipeline
- Research income growth ahead of schedule TARE rose 45% in 3 years
- Most popular in terms of student applications – growing when others falling
- External recognition – Times Higher and Sunday Times University of the Year in successive years
- Biggest mover up the rankings but not enough



Nobel Laureate, Professor Joseph E. Stiglitz has been appointed to chair the University's new Brooks World Poverty Institute.

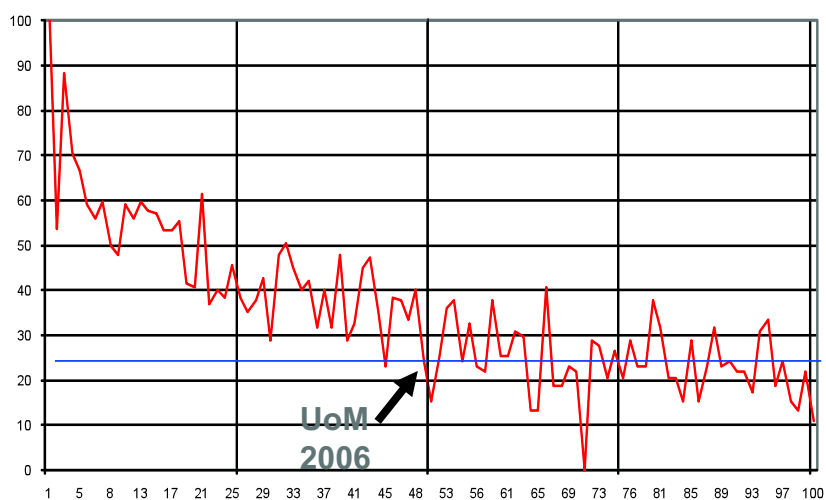
Tracking the ARWU

	World ranking	European ranking	UK ranking
2010	44 (40)	9 (7)	5
2009	41	7	5
2008	40	6	5
2007	48	9	5
2006	50	9	5
2005	53	12	6
2004*	78*	24*	9*

* VUM only

Highly Cited Researchers

Score on HiCi 24.3



Progress towards and within top 25 becomes exponential challenge

Recent Challenges

- Financial
 - *Large operating deficit in 2006 (£30m on £601m turnover) had to be eliminated – now back in surplus*
 - *Driven by larger than expected national salary settlements, growth of staff numbers by 2,800, investment ahead of RAE and structural deficit through duplication*
 - *Early retirement and voluntary severance scheme reduced staff (mainly admin) by 630*
 - *Highlights marginal nature of academic finances and vulnerability to shocks meaning must maintain drive for productivity gain and growth of high revenue areas*
- Balancing teaching and research
 - *Initial push for research gave students impression of neglect*
 - *University now launched challenging initiative to re-personalise undergraduate education while gaining efficiency through e-learning and Graduate Teaching Assistants*
 - *Promotion tracks available for teaching and knowledge transfer specialist as well as conventional careers*
- Trade off between indicators has to be managed

Growth of rankings industry stretching credibility

- Academic Ranking of World Universities
- QS Rankings
- Taiwan Rankings
- Leiden Rankings
- Webometrics
- Highimpactuniversities.com
- EU Umultirank
- Times Higher Education (THE)
- THE attracting derision for its citation approach which ranks Egypt's Alexandria University higher than Stanford largely because of a single highly cited individual whose work is considered by many to be fraudulent

National Rankings – the Research Assessment Exercise

- Means of allocating university block grant for research
- 6 iterations since 1986
- Basically a form of peer-review carried out by disciplinary panels covering all submitted areas of activity (Units of Assessment) in each university
- Substantial change in methodology between 2001 and 2008
 - *Replacing overall grades for each submission with profiles*

Quality profiles

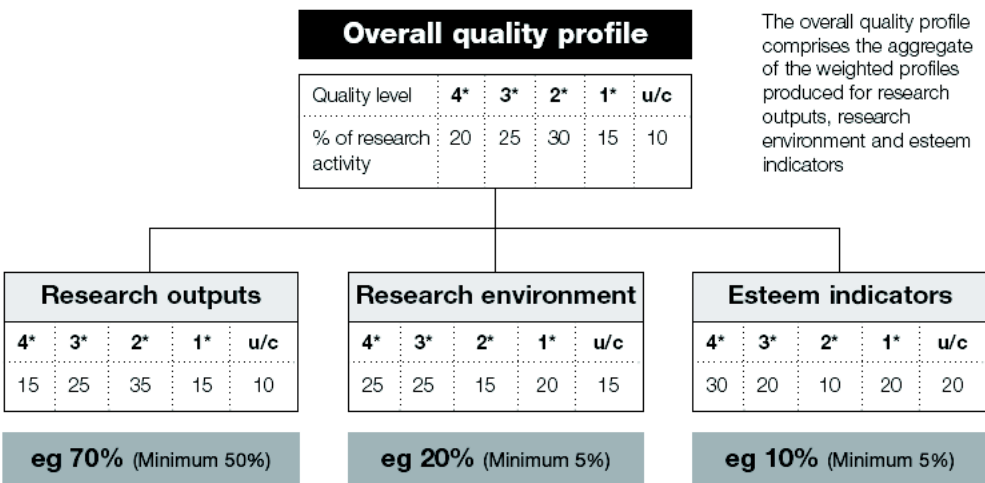
- Replace 7 point scale of ratings which corresponded to proportion of staff at “international” and “national” quality levels
- 3 overarching elements
 - *Research outputs – normally 4, publications, materials, IP, performances etc*
 - *Research environment – eg strategies for promoting and developing researchers, equipment, facilities, income, PhD numbers and completions*
 - *Esteem indicators – eg prizes, committee memberships, advisory posts, editorial boards*
- Some variation of weightings and factors to be considered across Main Panels and Sub-panels

Definitions of quality levels

- Four star
 - *Quality that is world-leading in terms of originality, significance and rigour.*
- Three star
 - *Quality that is internationally excellent in terms of originality, significance and rigour but which nonetheless falls short of the highest standards of excellence.*
- Two star
 - *Quality that is recognised internationally in terms of originality, significance and rigour.*
- One star
 - *Quality that is recognised nationally in terms of originality, significance and rigour.*
- Unclassified
 - *Quality that falls below the standard of nationally recognised work. Or work which does not meet the published definition of research for the purposes of this assessment.*

Building a quality profile

Figure 1 Building a quality profile



How to convert this into University rankings

Two main approaches

- 1) Grade Point Average – assumes that the categories are numeric scale and averages the score
 - *a measure of the average quality of those entered*
- 2) Research Power – includes the number of those achieving the quality levels
 - *can be normalised version of GPA x FTE returned*
 - *can be “medals table” – number of 4* or number of 4*+3**
 - *Measure of the concentration of quality in an institution*

Different results for Manchester

	GPA excluding specialist institutions	GPAXFTE	4* medals	4*+3* medals
1.	Cambridge	Cambridge	Cambridge	Cambridge
2.	Oxford	Oxford	Oxford	Oxford
3.	LSE	Manchester	UCL	Manchester
4.	Imperial College		Manchester	
5.	UCL			
6.	Manchester			

How much game playing?

- Pre-results controversy with campaign by universities who believed they had submitted higher proportions of staff to have publish this data but ambiguity in definitions pointed out by Russell Group universities prevented this
- Staff with at least 20% contracts could be included – many universities hired leading international stars part-time
 - *But if it was real presence this was a benefit*

Converting assessment to funding distribution

- Switch from banded funding which excluded those below a threshold to “supporting excellence wherever it is found” i.e. funding anyone with 2* or above
 - *So-called “pockets of excellence” gaining £45 million*
- 150 of the 159 HEIs that took part in RAE2008 demonstrated at least 5% world-leading quality research in one or more of their submissions
 - *Effectively a major shift in market share away from research intensive universities*
- Whether this is best use of public money depends upon the nature of critical mass in research
 - *Research tends to show quite low threshold for research groups*
 - *Much more significant for interdisciplinary configuration and doctoral training*
- Is it good for a nation to run all universities on a single system of incentives?
- For UK financial crisis means this decision will be revisited
 - *More concentration likely*

Research Excellence Framework Replacing RAE as Instrument for Allocation of QR Block funding

- Initial government proposals driven by Treasury were to use research income as driver
- Immediate evidence that this would produce distortions (for example towards equipment-intensive fields) led to this being extended to include citations
- Arguments against citation element as automatic driver of funding well set out in Technopolis report but more key arguments
 - *Every attempt to use formula driven approaches has resulted in substantial litigation because of the high likelihood of errors – Australian system withdrawn*
 - *All leading bibliometric experts insist that their findings should be interpreted and moderated by peer review*
 - *Incentive effect is towards monodisciplinary journals which divert researchers away from interdisciplinary socioeconomic challenges*

Current proposed Research Excellence Framework

- Slightly simplified submissions but outputs remain at core of judgement
 - *supplemented by citation data where relevant*
- Research environment assessed through grant income and PhD numbers
 - *Plus critical mass?*
- New element of research impact
 - *Case-study based but must derive from excellent research*

How does a University Respond?

- Clear evidence that universities individually or through associations work to influence the presentation of rankings in order to favour their own interests
- Less clear in what way the rankings and evaluations influence behaviour
- Current thinking affected by impending budget cuts
- More difficult for them to know what to do about failures
 - *For past RAEs have had spectrum from withdrawal from area to major corrective action if it is a core subject*

Getting down to individual staff level – Research Profiling

- RAE does not tell you which staff are contributing to research performance
- Since 2008/9 Manchester carrying out profiling of all staff (2,172)
- Holistic judgement by internal panels based upon:
 - *Publication profiles*
 - *Grant income over 3 years benchmarked for field*
 - *PhD supervision*
 - *Impact*
- Used for REF preparation, for supporting staff development
- In hard economic times similar evidence could be used to tell us which areas and which individuals we should prioritise to retain

Impact

- *Impact (statement using suggested categories and evidence of economic, social or cultural impact)*
 - Operating as an expert in various non-academic domains where research pedigree confers expert status
 - Trialing, introducing, modifying or developing clinical practice
 - Consulting for commercial, government or NGO's
 - Receiving industrial or other non-public funding
 - Licensing technology out
 - Involvement in a spin-out company
 - Media coverage
 - Other

Outcome

- Staff assigned one of 4 categories
 - a. *Internationally leading; 23%*
 - b. *Internationally recognised; 34%*
 - c. *Nationally recognised; 27%*
 - d. *Not achieving the standards of national or international recognition 15%*

Problems we faced

- Ensuring transparent, fair and open process
- Collecting data – publications through a University electronic repository but interface struggled with high levels of input around deadline
- Acceptance – staff trade unions had to be assured about use to be made of data but still threatened boycott
 - *Did not materialise*
- Interpreting data
 - *Co-authorship in subjects such as high energy physics*
 - *Co-grantholding*
 - *Standing of articles/books in subjects without clear journal hierarchy*
- Changes made for this year's iteration to deal with these

Living with Rankings and Assessments

- Citations present interesting dilemma
 - *ARWU incentivising maximum publication in measured journals*
 - *REF incentivising citations per paper so unless some options to choose what is assessed as with RAE strong disincentive to publish more speculative work eg with students*
- Message from RAE has been that peak performance is more important than average performance
 - *Should universities institute quality control (internal peer review) on publications before they go to journals?*
 - *Main internal levers PDRs and promotions to align individual incentives with institutional goals*
- Our research is increasingly organised on a thematic and interdisciplinary basis but both RAE and REF remain grounded in teaching-based disciplinary structures
- Our own system insists on holistic peer judgement informed by indicators
- In the final cut we will operate in terms of our own strategies and KPIs and treat the external exercises as hurdles we must confront from time to time

References

- Georghiou L, *Strategy to Join the Elite: Merger and the 2015 Agenda at the University of Manchester*, in McKelvey M and Holmen M (eds) **Learning To Compete In European Universities - From Social Institution to Knowledge Business** Edward Elgar 2009
-

Findings & Recommendations

*Erik Arnold
Technopolis*

Brno, 23 September 2010

Key findings

- Strong improvements in R&D effort by both business and the state
- Issues to be resolved about apparently weak industry-science links and possible mismatches between the state and industrial systems
- Dramatic recovery in bibliometric performance
- Movement towards a binary funding system and reforms in governance
- Refocusing of institutional evaluation to become an indicators-driven performance-based research funding funding system
- Programme evaluation practices could be broadened, to provide policymakers with better information

Evaluation Guidelines

- The implementation of the Research Evaluation Guidelines this year linked to reallocation of up to two thirds of institutional funding appears to represent a significant risk to the health of the R&D&I system.
 - *In particular through discontinuous, unintended changes to funding for particular fields and institutions*
- It should be replaced by a more field-differentiated and robust system, whose likely effects are better understood. (This is actually foreseen in the Guidelines 2010-12.)
- An option is to extend the existing division of institutional resources (based on Law 130) until such time as a more robust system can be implemented.

Premise

There were significant improvements in R&D inputs & outputs since 1990s, but there is no basis for complacency

- Continued efforts to increase the amount and quality of R&D inputs and outputs are fully justified
- Valid intention of the Performance-based Research Funding System (PRFS) to allocate resources towards those who perform best

BUT: the scope and method need significantly to be refined

Why?

Large changes in research funding priorities lead to disproportionately large & disruptive changes in research capacity (losses, but also inability to absorb new resources)

While

- The adequacy of the evaluation methodology to provide an *account of performance* is questionable (e.g. propensity to publish)
- Its results systematically disadvantage of some research areas, including some considered of *high strategic importance* in national research policy
- There appears to have been *no 'testing'* of the Evaluation methodology in terms of relationship between its results & the results of other more conventional methods

→ **The effects are uncertain**

The precautionary principle

- The current allocation of resources is no doubt flawed BUT: it is an accomplished fact with which the research performing institutions have been able to live.
- Moving from this via the Evaluation Methodology to what would almost certainly be **another sub-optimum** is likely to do damage to capacities.
- The right thing to do is to refine the method as quickly as proper analysis permits before making another leap. (This is what the UK has done with the RAE/REF, based on extensive piloting)

How?

Key lessons from international experience:

- Move slowly enough to let the system respond to the changed incentives
- Take small steps – moving small amounts of money has big effects on behaviour
- Explicitly tackle field differences
- Do not use solely indicator-based approaches but combine these with other allocation principles

This recommendation is a way to ask some questions

- To the new government: is the Evaluation Methodology consistent with policy objectives?
- To the R&D&I Council: are the investments and disinvestments triggered by the Evaluation Methodology the desired ones or are they unintended and potentially undesirable effects?
 - *Eg, disinvestment in agriculture*
- To the Evaluation Methodology developers: how can we refine the methodology to minimise unintended consequences and incorporate learning and better incentives for performance improvement?

Evaluation more broadly

Ex-post evaluation capacities and practices should be introduced in connection with the funding of R&D&I policies, institutions and programmes.

These should be based upon evaluation conducted by people external to the funding bodies involved and should in many cases include an international dimension.

Why?

Ex-post evaluation is a critical component of ‘strategic intelligence’ for policy & programme design

- Producing outputs is only the first – and often least important – part of the journey towards reaching policy goals
- Ex-post evaluation provides an opportunity to understand relationship between
 - *Diagnosis of problems & goals in a programme*
 - *Achievement of the goals & the solution of the problem*
- It explains factors enabling or hindering the success of policy interventions & programmes to take into account in future actions

Thank you

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