Adaptive Foresight: From analysis to policy

Conceptuals foundations and insights from R&D investment in the New Member States

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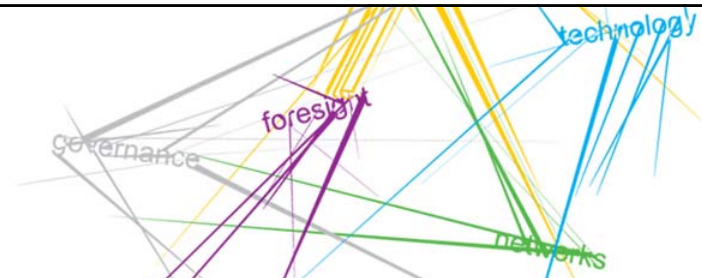
Overview

- Adaptive Foresight in Innovation Policy
- R&D Investment in the New Member States
  - Approach and Overview
  - Automotive Sector
  - Pharmaceutical Sector
  - Policy Issues



Adaptive Foresight in Innovation Policy

The guiding interest and inspiration

- When is Foresight effective? The impact on decision-making matters!
  - Informing debates
  - Guiding strategy formation
  - Facilitating implementation
- A gap between informing debate and facilitating implementation by foresight

Typical requirements of foresight for policy

- Coping with uncertainty
  - explore multiple settings, framework scenarios
- Coping with the limited ability to shape of the future
  - What's the room for manoeuvre: within the confines of different framing scenarios?
- Coping with adjustments in a fast-changing environment
  - continuous monitoring and learning
  - „portfolio approach" vs. „success scenario"!
- Coping with the normative dimension
  - long-term objectives vs. short-term actions
  - risks and opportunities rather than ex-ante impact assessment
- Coping with the needs of a specific „policy client"
  - targetting specific *individual* strategies and (hidden) agendas
- Coping with coordination in implementation
  - Participation and coherent actions by different actors

The critical questions…

- How to bridge the gap between foresight processes and concrete actions by policy and other actors
- Beyond collective channels of impact: how to „tap" foresight for individual strategies and measures „back home"?
- How to overcome the limitations of participatory processes and draw also on the „hidden agendas"? Could customer-oriented forward-looking processes be an option?
- How to avoid „naive" pursuit of unachievable visions and accept the limitations to „shaping the future"?

Positioning AF in the policy context

- AF as a framework developed to position and under-stand the role of foresight in the RTI policy context
- The Austrian context
  - „Foresight“ is not a very popular term, strong reliance on informal networking, expert advice and planning, but at the same time increasing demand to provide forward-looking support to policy
  - The „room for manoeuver“ for a small country is rather limited: trend-taker rather than trend-setter; need to concentrate on selected areas
  - A turn towards „strategy“ in policy-making: re-organisation of RTI-policy and re-thinking of the role of government in governance
  - Demands from policy to get strategic and forward-looking support, beyond the „provision of information“

Requirements for „Adaptive Foresight“

- Foresight to help actors navigate complex decision landscapes
  - Multiple options
  - Interaction and strategic behaviour in a multi-actor setting
  - Well-known difficulties of anticipation
- AF as a framework to position foresight in a *policy* context – requirements:
  - Appropriate understanding of innovation and strategic decision-making
  - Contribute to mobilisation and co-ordination
  - Insights on how to change course, give new impulses, and upset agendas

The roots of Adaptive Foresight

- Three constitutive roots of Adaptive Foresight…
  - New models of innovation
  - Foresight
  - Adaptive Planning
- … with some common features
  - Dealing with complexity & uncertainty
  - Abandoning the illusion to predict the future

Developments in Foresight

- From technology forecasting to a consideration of market and social aspects: innovation as a systemic and path-dependent process
- Recognition of need for interaction and participation: innovation as a distributed process
- Emphasis on open participatory processes: innovation as a collectively shaped process
- BUT:
  - Need to make foresight effective for decision-making: innovation as a strategic activity with open *and* closed processes
  - Underestimation of the need to adapt and to be cautious: innovation as a contingent and uncertain process
  - Need to strengthen the scientific basis: towards a systematic and fact-based foundation
- Adaptive Planning could be of help!

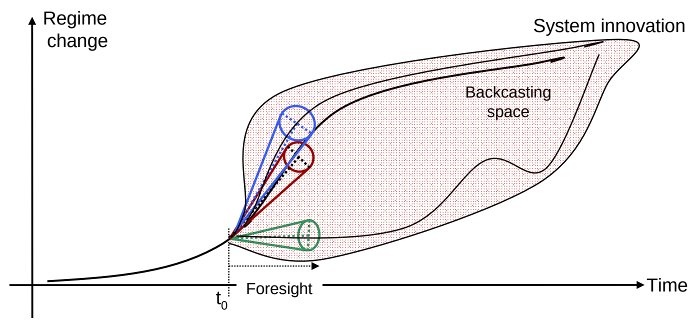
Adaptive Planning

- One-stage decision-making
  - Robust options (individually or at portfolio level)
  - Flexible options
- Sequential decision-making
  - Adding adaptive options
- Adaptive Planning then
  - Is strategic planning that handles uncertainty by considering robustness, flexibility, and adaptivity within a common framework.
  - Proposes a package of decision options resulting from an AP exercise will typically consist of both robust (fixed and flexible) and adaptable parts.
- Analysis at portfolio level
- The commitment vs. opportunism issue

Adaptive Foresight

- Adaptive in three respects:
  - Balance between the ability to shape and the need to adapt
  - Iterative monitoring, visioning, goal-formulation and learning at several levels: society, policy strategy, programmes, etc.
  - Balance between participatory and internal processes of anticipation to enhance the impact on strategy and decision-making
- Help decision-makers develop strategies
  - Working closely with a client, acting on behalf of an addressee
  - Highly sensitive to political settings
  - Degree of participation depends on phase of the process: Debates on strategic positioning may be inappropriate in a public setting
  - Need for actor-specific and targeted forward-looking exercises to „translate“ participatory foresight into individual actor strategies („strategic counselling“)

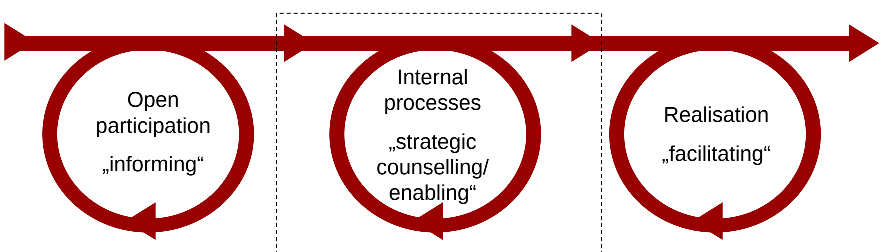
Foresight and Backcasting in Transition Management



➡ Within each scenario, the room for shaping the future is quite limited!

Adding a process cycle to foresight …

- A „second cycle“ of interaction between „informing“ and „facilitating“ cycles, targeted at individual actor strategies
- Embedded in the full policy cycle and its iterations („policy proces improving“)



- Discourse
- Joint visions/scenarios
- Mobilisation

- Interpretation
- Individual strategies

- Concrete follow up
- Collective actions
- Coordination

Building blocks of an archetypical AF process

- Initial analysis and review
  - System analysis and identification of the focal issue
- Drafting of exploratory framework scenarios
  - Analyse the scenario space
- Specification of exploratory framework scenarios
  - Rationalising creativity
- Formulation of collective visions and objectives
  - Developing a sense of direction
- Identification of challenges associated with each framework scenario
  - Opportunities and threats

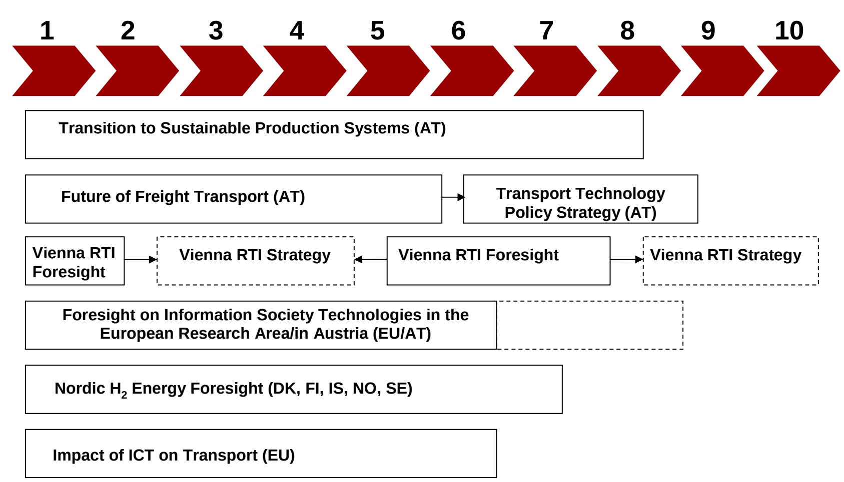
Building blocks of archetypical AF process

- Identification of collective pathways
  - Multiple backcasting
- Identification of collective strategies
  - A portfolio of robust and adaptive options across scenarios
- Identification of individual objectives, roles and options
  - Targeting scenarios to individual actors
- Identification of individual strategies
  - Portfolios of options for individual client organisations
- Realisation and coordination
  - Policy implementation and learning among autonomous and strategic actors

Fitting AF into the development process of innovation policy

- Monitoring and data gathering quite well established
- Multi-level, multi-actor – horizontal and vertical policy coordination
  - Overarching participatory part can be followed by actor-specific phases at different levels: ministries, agencies, programmes, but also firms and universities
  - Process at both levels of collective visions/scenarios and individual strategies
- Multi-phase or continuous approach inherent to AF
  - Coordination in time and sequential decision-making
  - Regular „assessment“ of progress and need for adjustment as part of a continuous process
- Leadership of the process
  - Process ownership by ministries and/or councils

Recent examples of „Adaptive Foresight“-inspired exercises in the public sector



Assessment and future methodological challenges

- Some strong points
  - More realistic policy strategies
  - Defensive („adaptive“) and offensive („exerting options“) at the same time
  - Enhancing effectiveness of forward-thinking by moving from collective to single-actor process stages
  - Strategic thinking about portfolios of options
- Some lessons learnt
  - Need to work also „side by side“ with policy-makers on policy strategies, in support of individual actors/organisations
  - Degree of participation can vary; some phases are open and participatory, others could be internal, depending on political cultures & contexts!
  - The ability to shape the future can be very limited, even for well-mobilised stakeholder communities. Foresight-based policy advice needs to take into account the need to adapt, not only the ability to shape

Assessment and future methodological challenges

- … and some further work ahead
  - From small industrialised countries to large countries and developing countries
  - Build learning explicitly into a „rolling“ AF process - get away from impressionism and strengthen the scientific basis of AF
  - Combine with recent advances in computer assistance and complex systems modelling
  - Bring real options fully to bear

Priority setting in Austrian RTD policy

- Strategy of Council for Research and Technology Development, but also individual programmes
- How to justify the setting of priorities in an as rational way as possible?
  - What lines of argumentation can be used/are regarded as legitimate to justify functional and thematic priorities („scientifically sound")
  - Clear limitations to a „rationalist" approach, to be complemented by a participatory process („process backing")
  - Inherent elemetn of political judgement („political primacy")
- Phase 1 exercise, but outlining a process for Phases 2 and 3

- → now followed by a new project on thematic priority-setting using a participatory foresight-type process

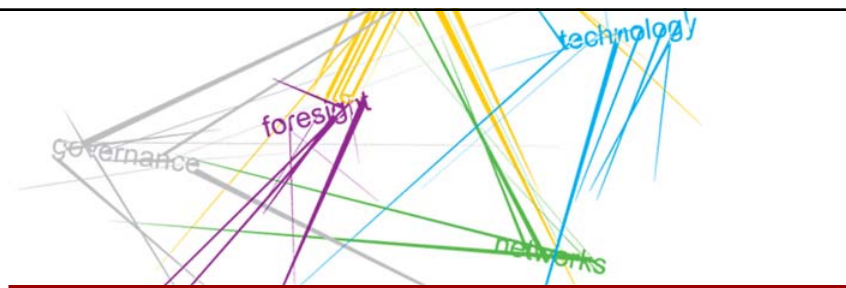
Transition to sustainable production systems

- Exploring scenarios and strategy options for different actors in a participatory process
- Strong industrial participation + research + policy
- Focusing on „transition fields" in order to inform specific programme level
- Exploring the remaining „room for manoeuvre" within the confines of largely externally defined scenarios
- Covering phases 1, 2 and partly 3, outlining phase 4
- Not going into much depth of strategy development for policy, but looking at individual strategies of different actors

- Foresight Brief at www.efmn.info

Mid-term strategy for Austrian research, technology and innovation policy

- Defining policy strategy from the perspective of a single ministry…
- … taking into account matters of positioning in the political system...
- emphasis on 2nd and 3rd phase
- building mainly on existing material on current situation and future trends (tech, socio-econ, institutional)
- Definition of vision, objectives and main lines of initiatives for the coming five years
- Timing: preparing for new budgetary framework, synchronisation with FP 7



R&D Investment in the New Member States

ETEPS NET
European Techno-Economic Policy Support Network

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www.eteps.net

Background and policy interest

- R&D and industrial „shake out“ followed by significant increase in FDI, more in production than in R&D
- Structural impacts and structural risks unclear
- Refocussing of R&D activities
- New constellations emerging, new roles for different types of actors; but the benefits/risks are unclear

➡ What‘s the role of policy to improve and consolidate private R&D investment in the NMS and thus help move towards knowledge-intensive upgrading of the economy?

Objectives

- Overcome two major shortcomings
  - lack of data at macro, sectoral and in particular at micro level
  - lack of understanding of what is currently happening
- Give some first indications to policy

- Exploratory study to improve the knowledge base on (private) R&D investment in the NMS
- Laying the foundations for what might turn into a forward-looking activity in the future

Approach

- Focus on
  - Determinants of private sector R&D
  - Impacts of private sector R&D
- Three layers of analysis
  - National frameworks
  - Four sector studies per country + Comparative analysis for Automotive and pharmaceutical/chemical industry
  - Few company case-studies in the sectors selected
- + screening the availability of statistical material

Selection of industries

- For each of the NMS, 4 sectors were selected for
- Most sectors analysed at NACE two-digit level, some at three-digit level
- Selection of sectors on the basis of
  - their R&D intensities (R&D/GDP),
  - the recent rise in these figures and
  - the contributions to GDP of the sectors.

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Selection of industries: CY, CZ, EE

Country	Nace code	Sector
Cyprus	45	Construction
	24	Manufacture of Chemicals and Chemical Products
	29	Manufacture of Machinery and Equipment
	65	Financial intermediation except insurance and pension funding
Czech Republic	34	Manufacture of motor vehicles, trailers and semi-trailers
	24	Manufacture of chemicals and chemical products
	25	Manufacture of rubber and plastic products
	31	Manufacture of electrical machinery and apparatus n.e.c.
Estonia	65-67	Financial intermediation
	15	Food and beverages
	27-29	Metal products, machinery
	36-37	Furniture, recycling

Selection of industries: HU, LV, LT

Country	Nace code	Sector
Hungary	24.4	Manufacture of pharmaceutics, medicinal chemicals and botanic products
	34.3	Manufacture of parts and accessories for motor vehicles and their engines
	33.1	Manufacture of medical instruments
	31.6	Manufacture of other electric equipment
Latvia	24	Manufacture of chemicals and chemical products
	74	Other business services
	17	Manufacture of textiles
	28	Manufacture of fabricated metal products
Lithuania	24	Manufacture of chemicals and chemical products
	33	Manufacture of medical, precision and optical instruments, watches and clocks
	29	Manufacture of machinery and equipment
	15	Manufacture of food products and beverages

Selection of industries: MT, PL

Country	Nace code	Sector
Malta	67.2, 66.1	Financial intermediation
	29	Manufacture of machinery and equipment
	15	Food & Beverages
	22	Printing
Poland	29	Manufacture of machinery and equipment
	24.4	Manufacture of pharmaceutics, medicinal chemicals and botanic products
	35.3	Manufacture of other transport equipment (aircraft and)
	34	Manufacture of transport equipment (motor vehicles, trailers and semi-trailers)

Selection of industries: SK, SI

Country	Nace code	Sector
Slovakia	27+ 28	M. of base metals, fabricated metal products
	34	M. of motor vehicles and transport equipment
	25	M. of rubber and plastic products
	24	M. of chemicals, chemical products and man-made fibres
Slovenia	31	Manufacture of electrical machinery and apparatus
	24.4	Manufacture of Pharmaceuticals
	29	Manufacture of machinery and equipment
	33	Manufacture of medicine, precision and optical instruments

Data sources

- Data sources:
  - National statistical offices
  - Eurostat
  - OECD not included as data only available for CZ, PL
- Surveys
  - R&D survey acc. to Frascati Manual
  - CIS acc. to Oslo Manual
- Reliability
  - No difference to other EU-countries in terms of methodology
  - Problem of small scale of some countries (confidentiality)
  - Different understanding of innovation

Automotive and related Industries

- The NACE sector 34, Manufacture of motor vehicles, trailers and semi-trailers (or a sub-sector) was studied in Czech Republic, Poland, Hungary, and Slovakia.
- The NACE sector 31, Manufacture of electrical machinery and apparatus n.e.c was studied in Czech Republic and Hungary.
- The NACE sector 35, Manufacture of other transport equipment (aircraft and ...) was studied in Poland
- The NACE sector 25, Manufacture of rubber and plastic products was studied in the Czech Republic

Country	Nace code	Sector	R&D intensity private R&D investment as percentage of sectoral GDP (2003 or 2004)	increase in R&D intensity (%)	Sectoral GDP as % of national GDP (2003 or 2004)
CZ	34	Manufacture of motor vehicles, trailers and semi-trailers	9.8%	0% (stable) (2001-2004)	2.6%
	31	Manufacture of electrical machinery and apparatus n.e.c.	1.6%	90% (2001-2004)	1.9%
	25	Manufacture of rubber and plastic products	0.8%	80% (2001-2004)	1.7%
HU	34.3	Manufacture of parts and accessories for motor vehicles and their engines	2.88%	114.21% (2001-2003)	0.81%
	31	Manufacture of other electric equipment	3.48%	54.05% (2001-2003)	0.26%
PL	34	Manufacture of transport equipment (motor vehicles, trailers and semi-trailers)	1.3%	55.40% (2003-2004)	1.30%
	35.3	Manufacture of other transport equipment (aircraft and ...)	2.0%	77.50% (2003-2004)	0.40%
SK	34	M. of motor vehicles and transport equipment	1.66%	n.a.	2.20%

The Importance of FDI

- FDI: brown-field and green-field investments
  - Cz: VW- Skoda; takeover
  - H: Suzuki, GM, Audi; all green-field
  - PL: Fiat (FSM), Daewoo (FSC, fighting GM for FSO!); takeover
  - GM green-field (1998) & taking over Daewoo (2002)
- Suppliers in all CE countries
- Motivations: push & pull factors

Competitive Pressures, Strategic Options (push factors for FDI)

- Finding new markets (new customers, less intense competition)
- Cutting costs (keep existing markets via lower prices)
- Introducing new features, new functions (e.g. safety, comfort, GPS), improving reliability and fuel economy
- Creating new market segments in mature markets
  sports models, four-wheel-drive cars, light trucks, minivans
- Introducing organisational innovations to improve flexibility, shorten lead and delivery times
- Customising mass-produced models (buyers ‘design’ their own car, using a set of standardised components)

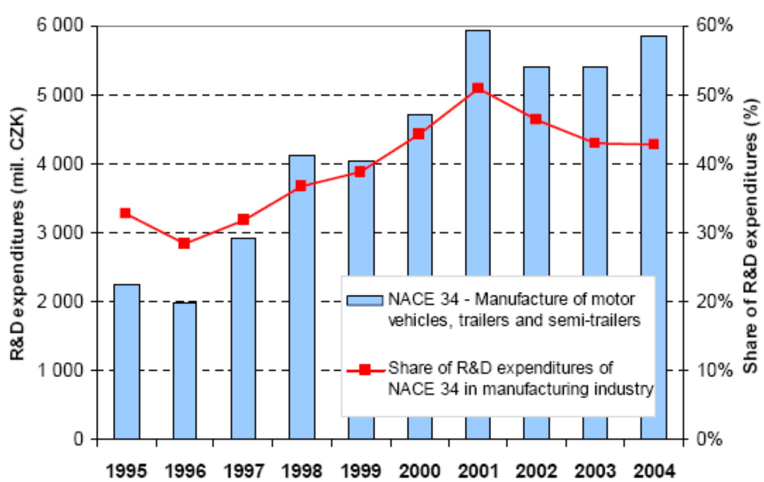
Advantages of CE („pull” factors)

- Emerging markets, „hungry” customers
- Wage differences (7-8-fold)
- Geographic proximity
- Low wages, flexibility: specialty models
- Investment grants, tax holidays
- Source / „test-bed” for organisational innovations
- Increasing production and sales

The Czech Automotive Industry

- Long-established tradition
-     1897: Tatra President, produced on an assembly line
- A leading sector in the Czech economy
- Turnover: CZK361.6 bn (~€12 bn) (2004)
- > 93,000 direct jobs (~7% of total mfg jobs)
- Export share: 85% (2002)
- Share in total Czech exports: 21% (2002)

BERD: NACE 34



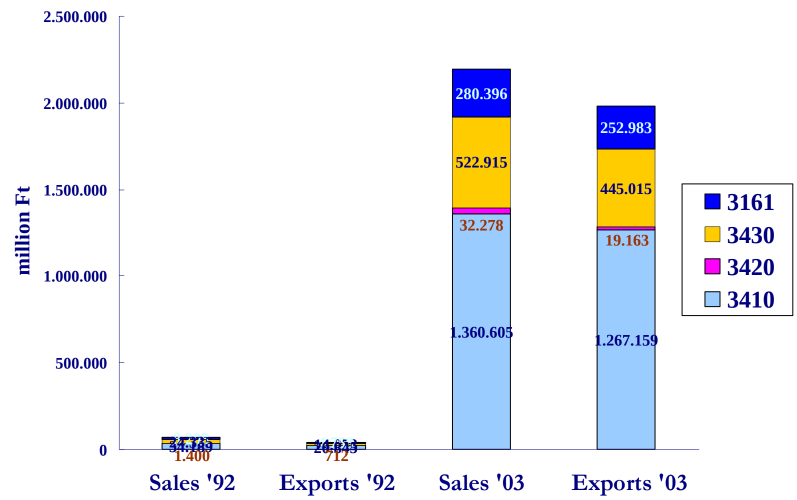
Skoda/VW

- Components (2.8% of total revenues):
  4-valve, 3-cylinder engines (2003: 48.1% to VW)
  MQ200 gearboxes (2003: 26.8% to VW)
  pressing equipment and other tools
- Organisational innovations: e.g. modular manufacturing; component systems integrators supply modules directly to the assembly line (first Octavia, then Fabia and Superb)
- Investments abroad:
  Skoda Auto India Private Ltd. Aurangabad, India 99.99%
  Skoda Auto BH d.o.o., Sarajevo-Vogošèa, Bosnia and Herzegovina, 100%
  Zao Skoda Auto Udmurtija, Iževsk, Russian Federation, 75.1%
  Skoda Auto assembly plant in Solomonovo, Ukraine

The Hungarian Automotive Industry

- Small-scale car production before 1945
- Some important R&D results in the 1880s-1890s (carburator, improved combustion engines)
- Council of Mutual Economic Assistance (CMEA) since 1964 division of labour between CE countries:
  - a large bus manufacturing firm;
  - components for commercial vehicles and CMEA carmakers;
  - no car production in Hungary
- FDI in the early 1990s: cars, components

Automotive Sub-sectors, 1992 vs. 2003



Plus dozens of other firms classified as plastic, rubber, engineering, etc.!

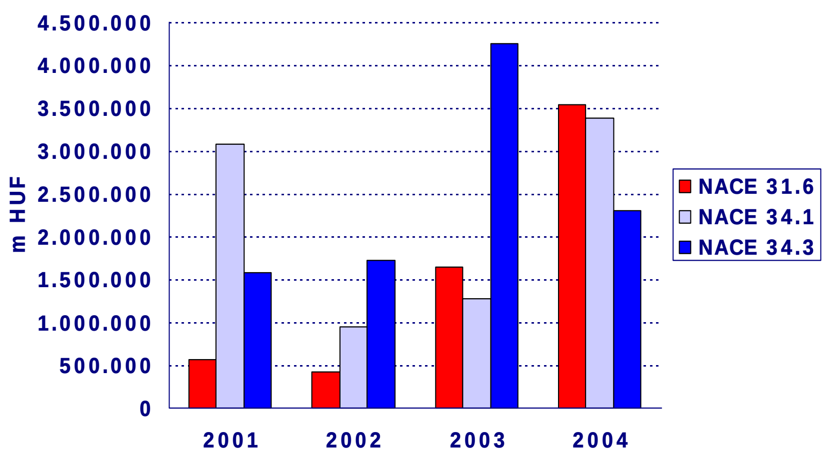
Automotive Sub-sectors Hungary

- Policy consideration should be based on revised data, taking into account actual activities of firms: car assembly vs. components manufacturing
- A large company: engines + cars
- NACE 34.30 (manufacture of parts) is very significant in Hungary

Clusters in Hungary:
Major Players and Markets

- Transmission cluster (~ 2 mill. engines + gearboxes, clutches)
  - Audi, Opel, ZF — mainly 'followers' (incl. suppliers' parks)
    some endogenous suppliers
- Assemblers in Hungary (cars, commercial vehicles)
  - Suzuki, Audi mainly T2,'direct' endogenous suppliers, too
    foreign-owned suppliers (incl. Hun plants)
  - Ikarus, Rába (?) — very small market (buses, trucks)
    mainly T2, 'direct' endogenous suppliers, too
- Other T1 suppliers: in HU or abroad (PC, CV)
  - Denso, etc. — T2, T3 endogenous suppliers
- CV manufacturers abroad — Rába (axles), its suppliers

BERD in three sub-sectors producing automotive products, Hungary, 2001-2004



Source: CSO

Impacts of R&D and Innovation in Hungary

- Intensity of in-house R&D is well below the EU15 average
- Intense innovation activities
  - New products, processes
  - New markets
- Significantly improved performance
- Sources of innovation
  - Know-how, licences from parent companies/ buyers
  - In-house non-R&D and R&D activities

Central Europe's Role

- Low-end, high volume models for various markets
- High-end, low volume models for the EU/ US markets
- Components manufacturing for exports
- A living laboratory for organisational innovations
- Asian firms: entry to the EU markets through Central Europe

Challenges and Opportunities for Indigenous CE Automotive Suppliers

- Loss of former markets, entry of major foreign players
- Strong competition, exacting demand
- Access to new markets, innovation, mgmt, finance
- Global restructuring, platform strategies, international production networks, new roles, responsibilities for T1 suppliers
- Technological changes => blurring boundaries between industries (e.g. automotive - electronics)
- EU membership

Impacts of Automotive FDI

- Macroeconomic impacts: employment, exports - imports, tax, demonstration effect → more FDI
- General microeconomic impacts:
  diffusion of new mgmt, organisational techniques, culture
- Re-structuring supplier networks
  - local suppliers replaced or acquired
  - Asian firms: strong incentives to promote local suppliers
  - intra-regional division of labour and FDI
  - competence building or destroying

Threats/ opportunities of FDI and international production networks

- '*Foot-loose*': low-tech, low-value added activities, low paid jobs, ready to leave for even cheaper sites
- '*Anchored*': knowledge-intensive, high-value added activities, highly paid jobs, close contacts with local R&D and HE, strong local supplier base
- *Integrated* into international sectoral systems of innovation
- *Left out* (marginalised as a low-cost production site)
- Strong National Innovation System, clear strategic goals, conscious policy implementation to take advantage
- Co-ordinated investment, industrial, STI, education, regional development, competition policies

Policy Implications

- No complacency: informed, continuously renewed, concerted policies are needed (industrial, investment, reg. dev., trade, innovation, education, etc.)
- Short-term vs. long-term 'pull' factors:
  low wages, tax incentives, grants for one-off projects
  vs. attractive, favourable environment for innovation-based, continuously improved competitiveness
- The importance of components manufacturing
- Suppliers are different ⇒ policies must be tailored: 'one size doesn't fit all'

Pharmaceutical industry: Coverage and overview

- The **pharmaceutical sector (24.4)** studied in **Poland, Hungary, and Slovenia**. The **chemical sector** has been studied in **Latvia, Lithuania** and **Slovakia**
- the **sector has grown in total size (sales, value added)**, **R&D expenditures and R&D employees** in the last 10 years.
  - Though, during the transformation, which was characterised by privatisation, often by **foreign investors** and MNC, the number of firms has not changed significantly (e.g. fallen in Poland and, slightly grown in Slovakia).
  - Some restructuring with the R&D labs has been carried out, partly with concentration tendencies as for instance in Hungary. A general decline can be observed in Slovakia (only chemical sector data available).

Country	Nace code	Sector	R&D intensity private R&D investment as percentage of sectoral GDP (2003 or 2004)	increase in R&D intensity (%)	Sectoral GDP as % of national GDP (2003 or 2004)
CY	24	Manufacture of Chemicals and Chemical Products	3.82%	113% (2001-2003)	0.50%
CZ	24	Manufacture of chemicals and chemical products	3.8%	55% (2001-2004)	1.5%
HU	24.4	Manufacture of pharmaceutics, medicinal chemicals and botanic products	19.27%	-4.7% (2001-2003)	0.51%
LV	24	Manufacture of chemicals and chemical products	1.90%	50.00% (2001-2003)	0.63%
LT	24	Manufacture of chemicals and chemical products	5.33%	974% (2002-2003)	1.02%
PL	24.4	Manufacture of pharmaceutics, medicinal chemicals and botanic products	n.a.	39.10% (2003-2004)	n.a.
SK	24	M. of chemicals, chemical products and man-made fibres	1.12%	confidential	0.80%
SI	24.4	Manufacture of Pharmaceuticals	8.84%	19.40% (2001-2003)	3.33%

Slovenia’s pharmaceutical sectors

- most striking growth of R&D.
  - The R&D expenditures have almost increased 700% between 1992 and 2004.
- only two firms perform R&D, namely Krka and Lek, part of MNC.
- Both companies are engaged in the development and production of generic products
- hardly linked to the national research infrastructure, e.g. via co-operations with universities.

Hungary’s pharmaceutical sector

- has grown faster in comparison to the entire chemical sector in the last years.
  - It is the most R&D intensive sector in Hungary. Between 2001 and 2003 R&D expenditures have grown about 20% annually.
- Total sales and value added has grown fast between 1997 and 2004. Though, the number of employees decreased in this period.
  - FDI became a major determinant of R&D in Hungary. About 80% of the industry
  - restructured the R&D system, decreased personnel, reduced the product range and number of R&D projects.
- Trend to specialise in certain fields
  - limits the co-operation with domestic universities which are now performed mainly in the field of analytical testing.

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Poland's pharmaceutical sector

- invested increasingly in R&D between 1999 and 2004,
  - in contrast to the general trend in the whole enterprise sector.
- The number of employees has also grown, though the number of R&D units decreased in the past.
- In contrast to other sectors, the privatisation has gone slower in the past.
- Like in other countries the companies' prime strategy was the development of generic drugs.
- In general, the companies have problems with quality management (safety) and keeping EU standards.
- Thus, most products are sold to Eastern Europe, Middle East and other countries.

Latvia, the chemical sector

- has recovered after a decline about 1999. The turnover in 2003 was about the same as in 1997.
- Half of the turnover comes from the pharmaceutical branch.
- The R&D expenditures has been grown in the last years faster as the turnover,
- the R&D ratio is now 1,9% (2003).
- The sector and the R&D activities are dominated by a few large companies.

Lithunia, the chemical sector

- Chemical industry - 30% of total BERD
- 77 researchers
- Privatisation - 4 Spin-offs from state research institute with 2 in pharmaceutical industry

Slovakia, the chemical sector

- decreasing value added, R&D expenditures and R&D employees.
- R&D activities are carried out by 14 companies.
- REACH is a big challenge for the whole sector
- Among the 10 largest chemical firms only one pharmaceutical firm is represented.
- **Zentiva** Hlohovec R&D ratio of 4,1 %; 240 researchers
  - biggest Central and Eastern Europe producer of pharmaceuticals.
- R&D now transferred to the headquarter in Prague.
- The company developed new products (new generic molecules) and built up R&D, manufacturing and marketing capabilities.

FDI and research infrastructure

- The role of **FDI** is not very important in most countries
  - Exception: The Hungarian sector, is now nearly totally influenced by foreign MNC.
- The **research infrastructure**
  - In general, the R&D infrastructure is not very favourable for pharmaceutical companies.
  - Citation from the Slovak report : “R&D infrastructure in many Slovak industries reminded of technical museums rather than modern research facilities.”
  - FDI firms seem to be better off
  - universities and research organisations play a minor role

Human resources

- seem to be the most critical hampering factors for the further development of the sector in all NMS.
- Interviews in several firms reveal that the lack of qualified scientists hinders the further expansion of R&D activities.
- Potential candidates are often insufficiently qualified. Many qualified scientists go abroad (brain drain).
  - Citation from a Hungarian company case study: “The company needs to have the best brains and not technicians”.

Regulations

- Standards for registration of new drugs, is important factors for the pharmaceutical sector.
- Related is the aspect of quality management.
  - Many Polish companies could not cope with the new conditions
  - Zentiva (CZ and SK) is an example of a company which used successfully the EU's Mutual Recognition Procedure (MRP) in order to gain market registration for key products.
- In general, recently introduced environmental protection regulations (REACH) are of influence.

Policy measures

- **Policy measures** (mainly financial support) are not regarded as very influential by the companies as either fostering or hampering factor in general.
- Even though drugs are mostly developed for large or global markets **specific national market demand conditions**, e.g. by close co-operations with Hospitals, universities, key scientists, etc. could cerate some niche markets. However, this could not be observed as important of fostering factor in the pharmaceutical sector in the studied countries.

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Key firms and Start-ups

- The list of **key firms** in each country confirms the strong concentration of the sectors in the different countries.
  - In several countries the largest firms are now subsidiaries of foreign MNC.
- **Start-up activities** have been very weak in general even though the data sources are very limited. In all countries the pharmaceutical sector is dominated by a few large (foreign) firms.

The R&D strategy

- mainly based on the production of generic products in the last century.
- The production of new drugs and the ability to develop or discover new molecules becomes therefore increasingly important ➔ rise in R&D
- Zentiva and the case study firm 'HU' not only succeed in process but also mastered the product innovation challenge.
- Firm HU (8,6% R&D intensity) was privatised in 90ies (mainly FDI) and is a highly successful company which develops original drug molecules and generic products. Main owner is a foreign investor. In this company about 750 people are working in the R&D department

Impacts of R&D and Future development

- The assessment of the **impacts of R&D** is generally difficult.
  - Increasing R&D investments helped firms to grow and to keep competitive in many cases. Thereby, international investors played the central role.
  - Domestic firms mainly stay in their traditional markets.
  - Newly established firms, spin-offs and start-up play hardly any role in the studies countries.
- Even though, the pharmaceutical sector has increased competitiveness in the past, in general the **future development perspectives** seems not to be very favourable and it is doubtful if the companies and the sectors are able to grow in the future, their main challenge will be to develop new molecules.

Cross-cutting issues in all sectors and countries

- Overwhelming importance of FDI, at least in some sectors (automotive)
- Domestic competencies, quality of HR-base in combination with labour costs and access to local markets are key determinants of foreign investment in R&D
- Need to keep up with international standards/regulations
- Home markets tend to contribute to the local embedding of R&D (e.g. IT services in Estonia, health system for pharma) → „localised R&D/FDI" vs. „footlose R&D/FDI"
- Impacts: Integration in and dependence on research strategies of multi-nationals has double-edged consequences for the R&D base
  - Upgrading of knowledge and managerial/organisational competencies by way of FDI (overall and/or R&D)
  - Problematic division of labour

Cross-cutting issues in all sectors and countries

- In some countries, perception of a growing scarcity of qualified HR to satisfy foreign and domestic investors needs → a critical issues for the future
- National-sectoral „R&D- industrial history“ matters („path-dependency“)
- Distinguish types of companies and R&D-strategies
  - „A“ companies → autonomous players (intermediaries in ES, biotech niche players??)
  - „B“ companies → embedded in global R&D networks (automotive, some pharma)
  - „C“ companies → adaptation-oriented R&D for local market needs (e.g. telecom equipment)
  - „D“ companies → invisible R&D (services, SMEs)

Review of methodological and data issues

- Eurostat
  - usually 1 year behind, time series since about 1997/98 (except CY, MT, LV)
  - For most sectors addressed R&D expenditure and employment data available for 1996-2003, exceptions for confidentiality reasons
  - Availability of other indicators only sporadic or at higher aggregation level
- What indicators are missing?
- Reliability problems: R&D personnel vs. expenditures/innovative firms
- Limits to comparability
  - High specificity of national *and* sectoral characteristics
  - „holes“ in sectoral sample (e.g. financial services)
  - Coverage of „A“, „B“, „C“ and „D“ companies
- Hardly any studies on impact and determinants of private sector R&D could be identified

Future research needs

- Data are incomplete and require additional efforts from statistical offices
  - What are the most important gaps?
  - How could they be overcome? Problems of definition (services)
- Deepening of sectoral studies; additional sectoral studies especially in services
- Perspectives for human resources for private sector R&D
- Little information on impacts of private sector R&D; can only be understood in the context of company strategies
  - Little information on local spill-over effects, cluster, ties with universities and research infrastructure
  - Impact of FDI on development of competence base
  - Distinction of types of companies (e.g. MNC and local niche players)

Future research needs

- Need for further and deeper company case-studies
  - e.g. in service sectors
- Role and impact of policy
  - Education and qualification
  - Innovation infrastructures
  - The long-term impact of tax and other investment incentives
  - Upgrading of innovation system rather than specific incentives (basic research, innovation-friendly environment, etc.)
- Improve comparability
  - Take into account high specificity of national and sectoral characteristics
  - „patching gaps“ in sectoral sample (e.g. financial services)
  - coverage of „A“, „B“, „C“ and „D“ companies

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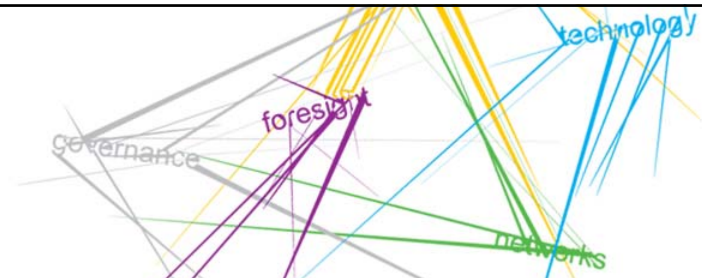

Wien denkt Zukunft

RTI-policy strategy development process

Objective of the process

- For the first time, bringing together the major research and innovation actors and policy actors together to formulate a joint strategy for RTI-policy of the City
- Overcome the existing differentiation and „mushrooming“ of institutions since the late 90ies
- Define priority areas for action for the coming ten years
- Bring RTI to the forefront of public and policy attention

The specific context

- The pineapple model
  - Vienna in the middle of Lower Austria
- The federal system
  - Vienna and the nation state
- The „new“ neighbours
  - Major potential to join forces with Eastern neighbours (Centrope-Region)
  - … but difficult to realise effective collaboration
- Vienna moves towards being a post-industrial services city, with manufacturing industries disappearing or moving out

The specific context

- Significant scientific capacity (9 universities, Austrian Academy of Sciences, non-university research sector)
- Some areas of strength
  - Life science – much research for foreign-owned firms, few domestic firms with production
  - ICT – dominated by Siemens, otherwise heterogeneous
  - Automotive – little research, some development, much production
  - Creative Industries – the recent success story
  - Social sciences & humanities – large capacity, but very scattered

The process