VINNOVA and its role in the Swedish Innovation System - Accomplishments since the start in 2001 and ambitions forward

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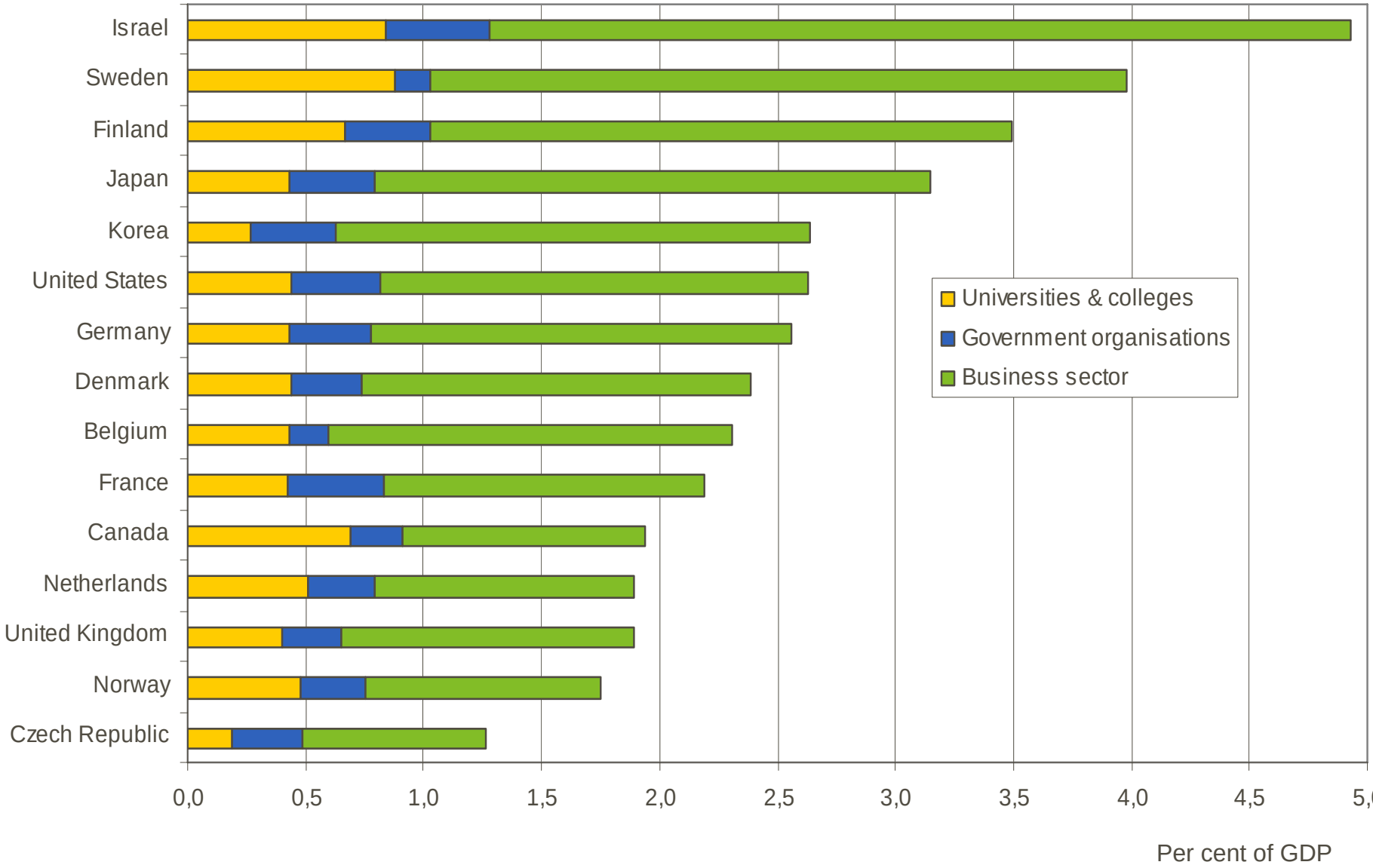
VINNOVA and its role in the Swedish Innovation System

- Some basic facts about VINNOVA
- Critical steps in the Evolution of VINNOVA's portfolio of programs
- Some challenges ahead

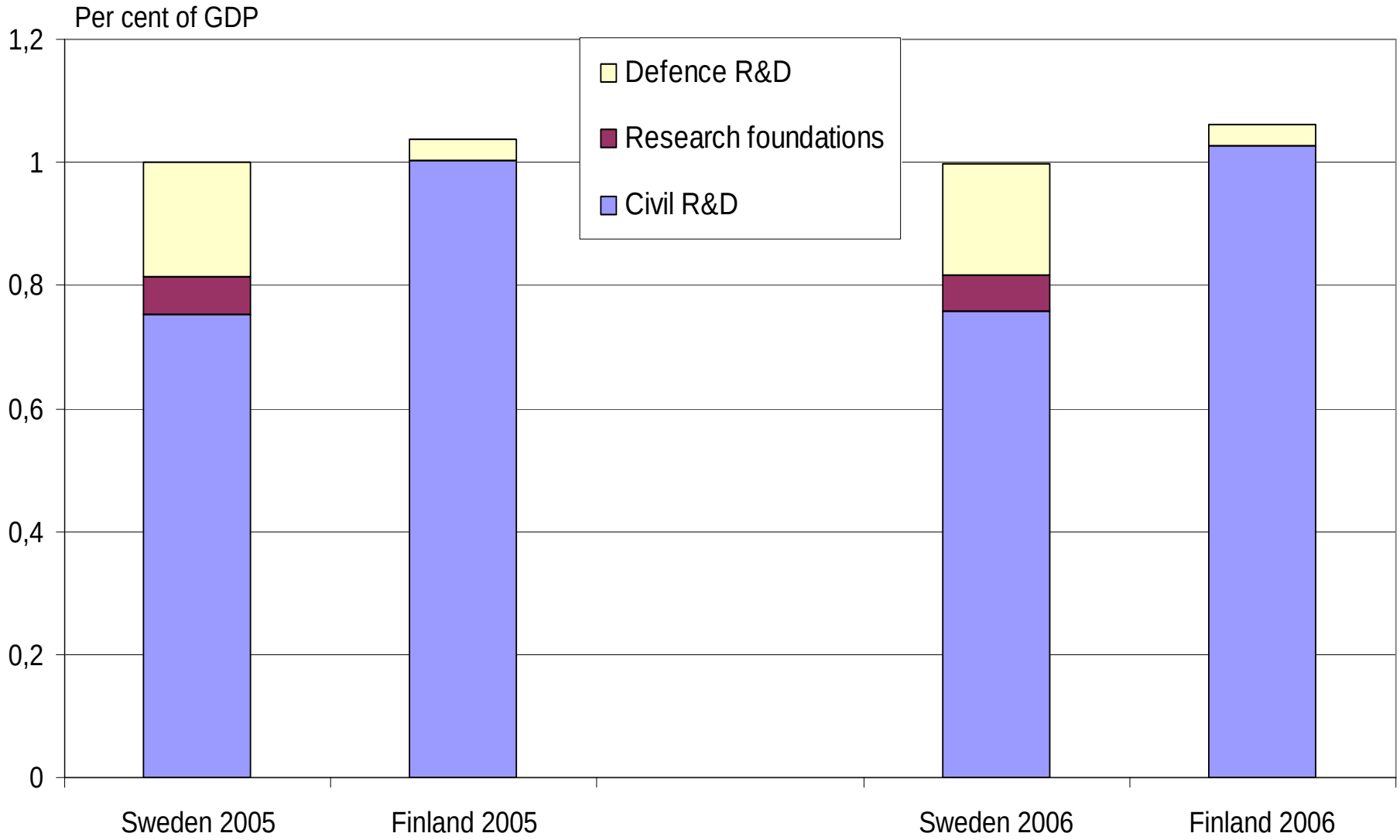
For reference: Some additional facts about the Swedish Research and Innovation System

R&D expenditure in relation to GDP 2003



Source: OECD MSTI, 2005

Governmental financing of R&D in 2005 and 2006 in percent of GDP



Källa: SCB 2005; OECD MSTI 2005

Swedish National Innovation System Characteristics:

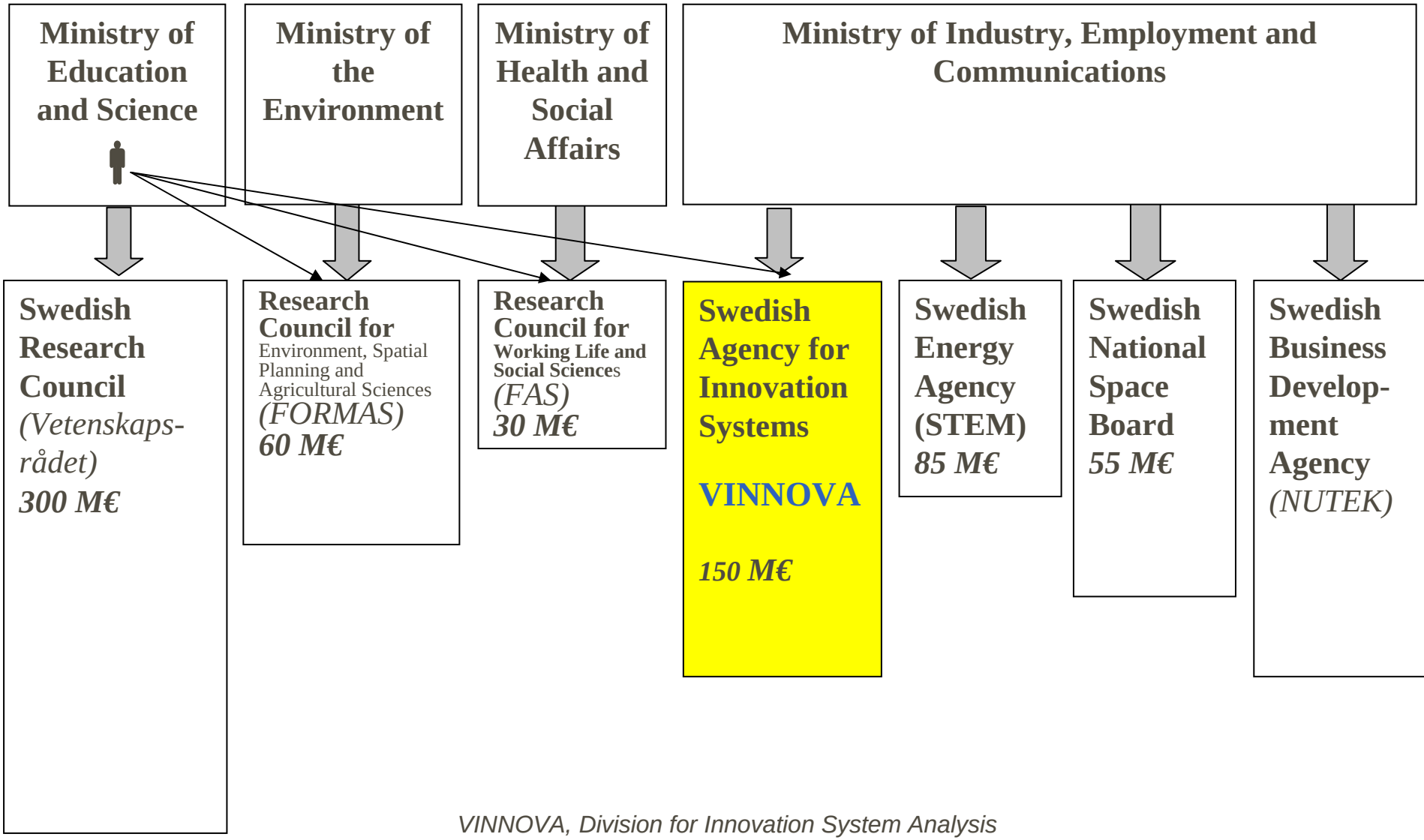
- The economy strongly internationally linked

- The big international companies dominates the R&D-system
- SME invest very little in R&D

- Universities dominates the public R&D-system and they have a third task, to cooperate with companies and society
- Small sector of Research-institutes

- Government invests very little R&D-money in companies outside the military sector

Major public R&D-funding organizations in Sweden and their budgets 2006

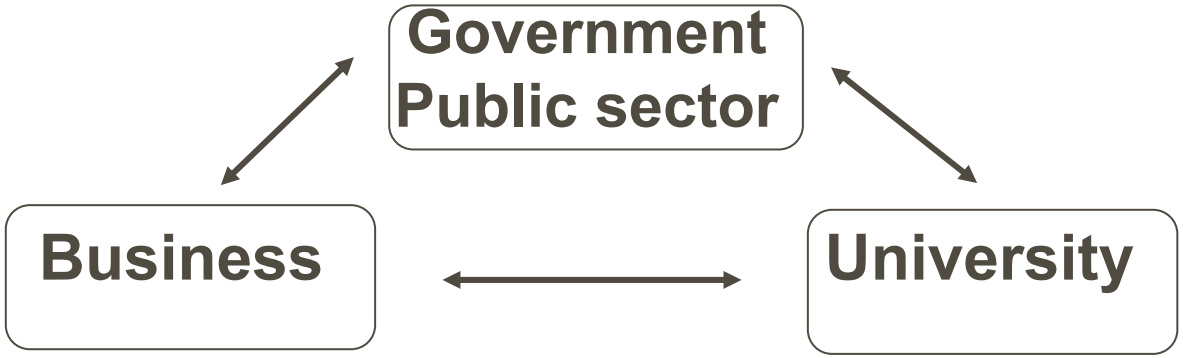


Some basic facts about VINNOVA

VINNOVA (Swedish Governmental Agency for Innovation Systems)

- Established in 2001
- Budget 2006: 150 M€ (excl. adm. expenses)
- Staff: 176 of whom 49 PhDs
- Leading government agency in the field of innovation under the Ministry of Industry, Employment and Communication
- Mission: “Promote sustainable economic growth by financing needs-driven R&D and by developing innovation systems”
- Focus: Strengthening research cooperation between academia, companies and politics/public sector in the Swedish innovation system

Triple Helix

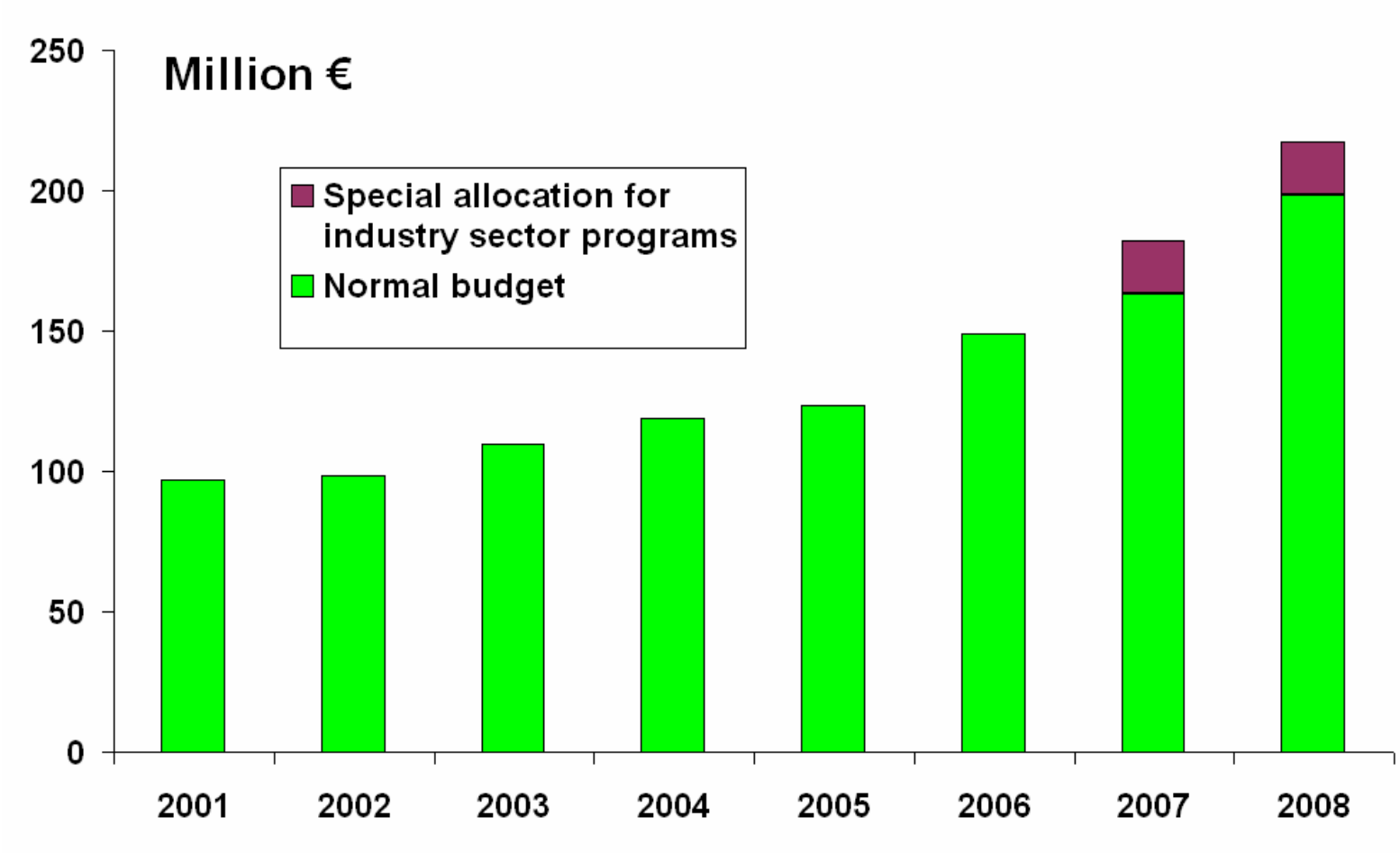


Depending Actor Groups
"Learning by fighting"

Knowledge based economy

From PPP, Public Private Partnership,
To Public Private Univ. Partnership,
i.e. Triple Helix

VINNOVA Budget development 2001-2008 (excl. adm. expenses)



VINNOVA's main areas of activity (1)

- Development of research and innovation strategies for specific fields and sectors in close dialogue with actors in Swedish innovation systems
- Strategic R&D-programs in six major fields usually involving cooperation between universities and companies and other actors
- Support the building up of strong research and innovation environments
  - VINN Excellence Centers and other COEs at universities
  - Regional Innovation Systems (VINN Growth program)

VINNOVA's main areas of activity (2)

- Strengthening of the functions for commercialization of research at universities
- Development of the institute sector in Sweden
- Support for R&D aiming at radical innovations in SMEs
- Supporting international cooperation
- Knowledge and research about innovation systems
- Informing the broader public about research and innovation

Distribution of VINNOVA's funding among different types of organizations

• Universities	≈ 40 percent
• Research Institutes	≈ 30 percent
• Companies	≈ 20 percent
• Others	≈ 10 percent

Distribution of VINNOVA's funding among different types of technical fields

- Information & Communication Technologies ≈ 20 percent
- Services and IT implementation ≈ 10 percent
- Biotechnology, Life sciences ≈ 20 percent
- Manufacturing and Materials ≈ 20 percent
- Transport systems, Automotive ≈ 20 percent
- Working Life Science ≈ 10 percent

Technology fields covered by VINNOVA (1)

- **Information and Communication Technologies**
  - Communication Systems
  - Software-intensive Systems
  - Micro- and Nanosystems
  - Vehicle IT and Telematics
  - Network-based Software Technology
- **Services and IT implementation**
  - E-services in Public Administration
  - IT in Home Healthcare
  - ICT Implementation
- **Biotechnology**
  - Biotechnology
  - Pharmaceuticals and Diagnostics
  - Medical Technology
  - Innovative Foods
  - BioNanoIT

Technology fields covered by VINNOVA (2)

- **Manufacturing and Materials**
  - Efficient Product Realization
  - Manufacturing Engineering
  - Complex Assembled Products
  - Wood Manufacturing
  - Light Materials from Lightweight Design
  - Use of Materials in Engineering Industry Products
  - Wood Materials Science and Engineering
  - Green Materials from Renewable Resources
- **Transportation**
  - Innovative Vehicles for Different Transport Modes
  - Aviation Engineering
  - Innovative Logistics and Freight Transport
  - Infrastructure and Efficient Transport Systems
  - Maritime Safety
- **Working Life**

Framework for VINNOVA's activities

- Government Research Bill presented to the parliament in March 2005 and approved in June 2005. Sets the budget frame for the period 2006-08
- "Innovative Sweden – A Strategy for Growth through Renewal" presented jointly by Ministry of Industry, Employment and Communication and Ministry of Education, Research and Culture in June 2004
- Annual instruction to VINNOVA from Ministry of Industry
- Reports from strategic dialogues between Ministry of Industry and representatives of industry in six fields
- Additional ad hoc tasks given VINNOVA by Ministry of Industry during the budget year, e g resulting from industrial dialogue

Critical steps in the Evolution of VINNOVA's portfolio of programs

Creation of VINNOVA part of comprehensive reform of Swedish research councils and industrial policy agencies in 2001

- Fewer and larger research councils and agencies
- Swedish Research Council and VINNOVA two main pillars in the new system
- Needs-driven research and Innovation recognized as a legitimate and significant area of government policy
- Innovation system perspective endorsed

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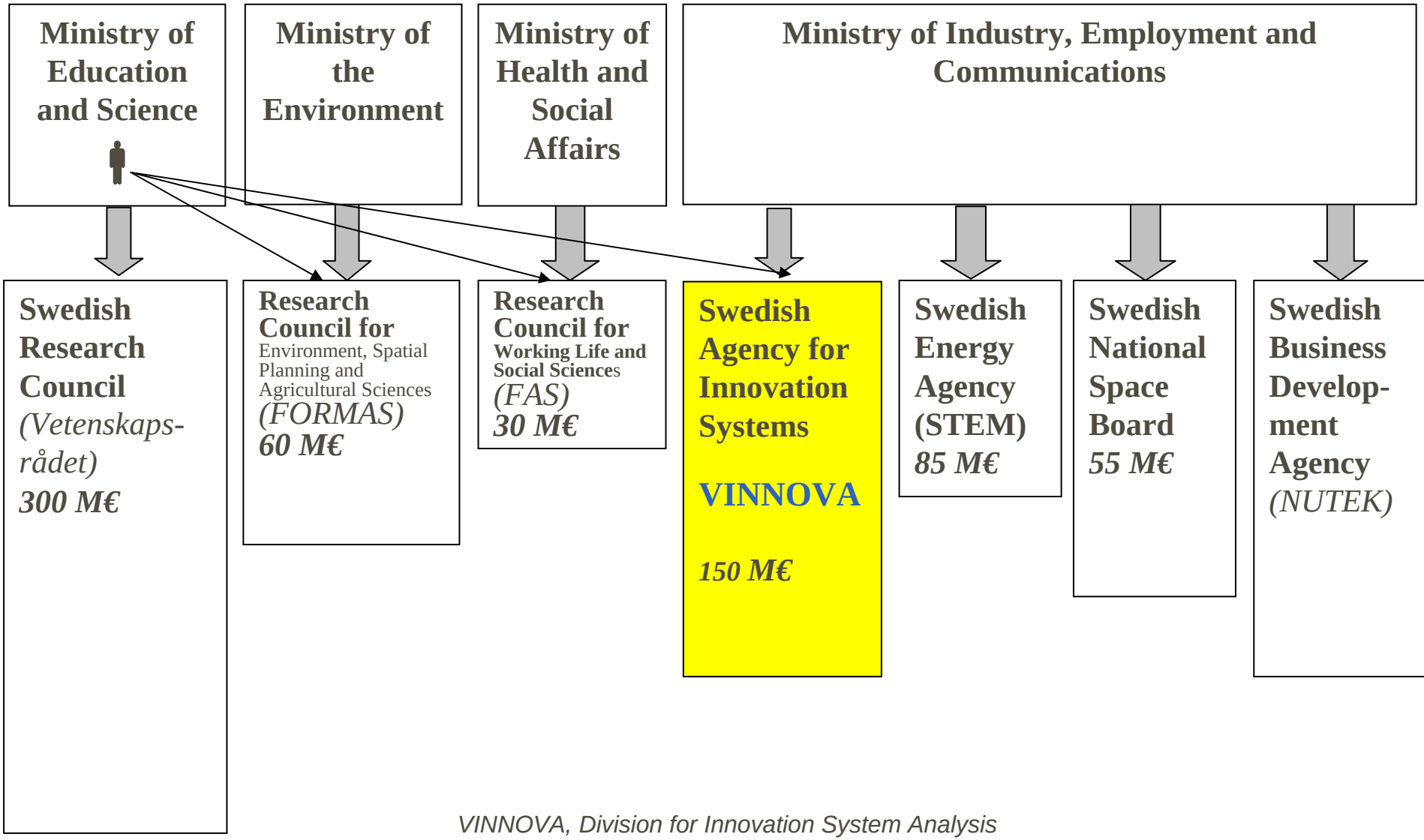

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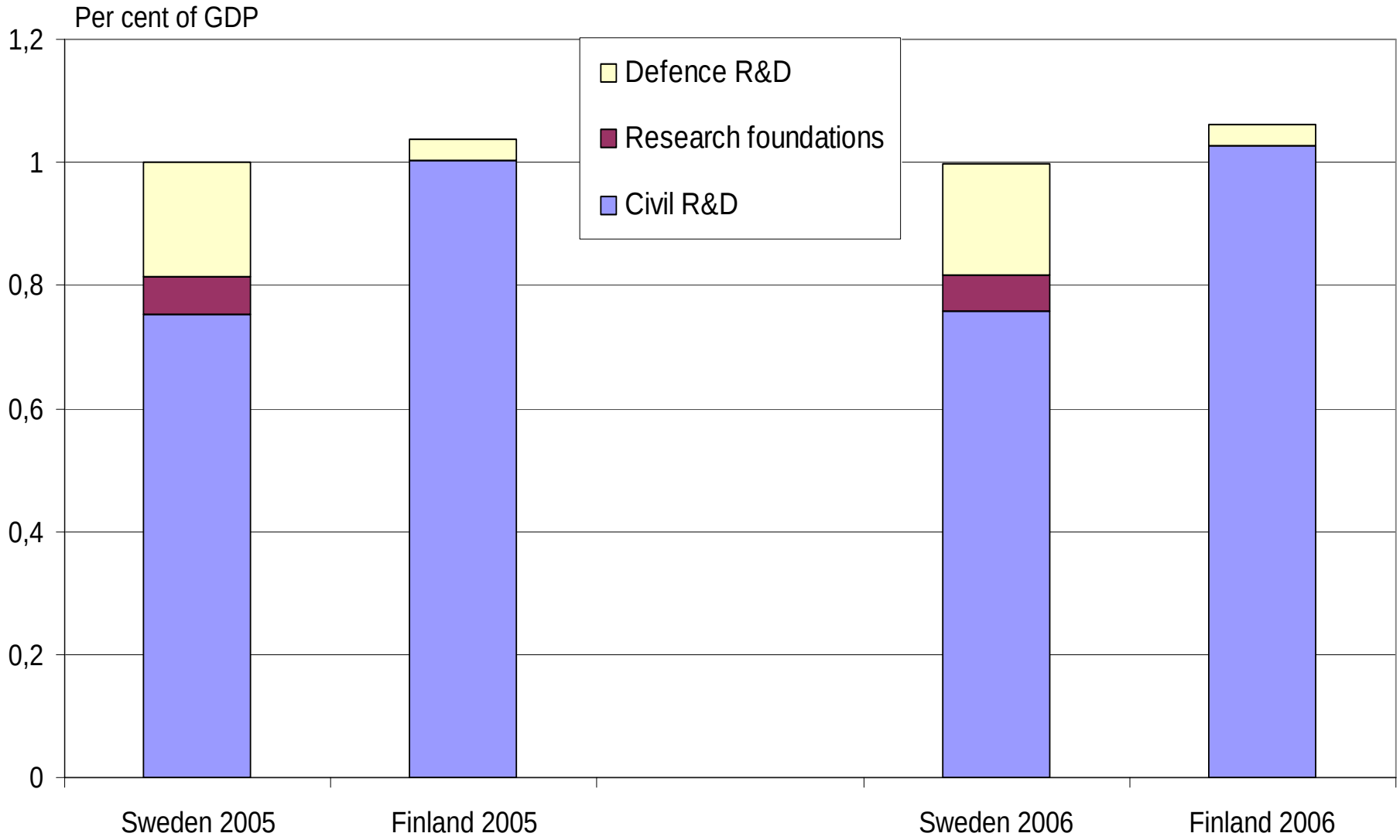


Källa: SCB 2005; OECD MSTI 2005

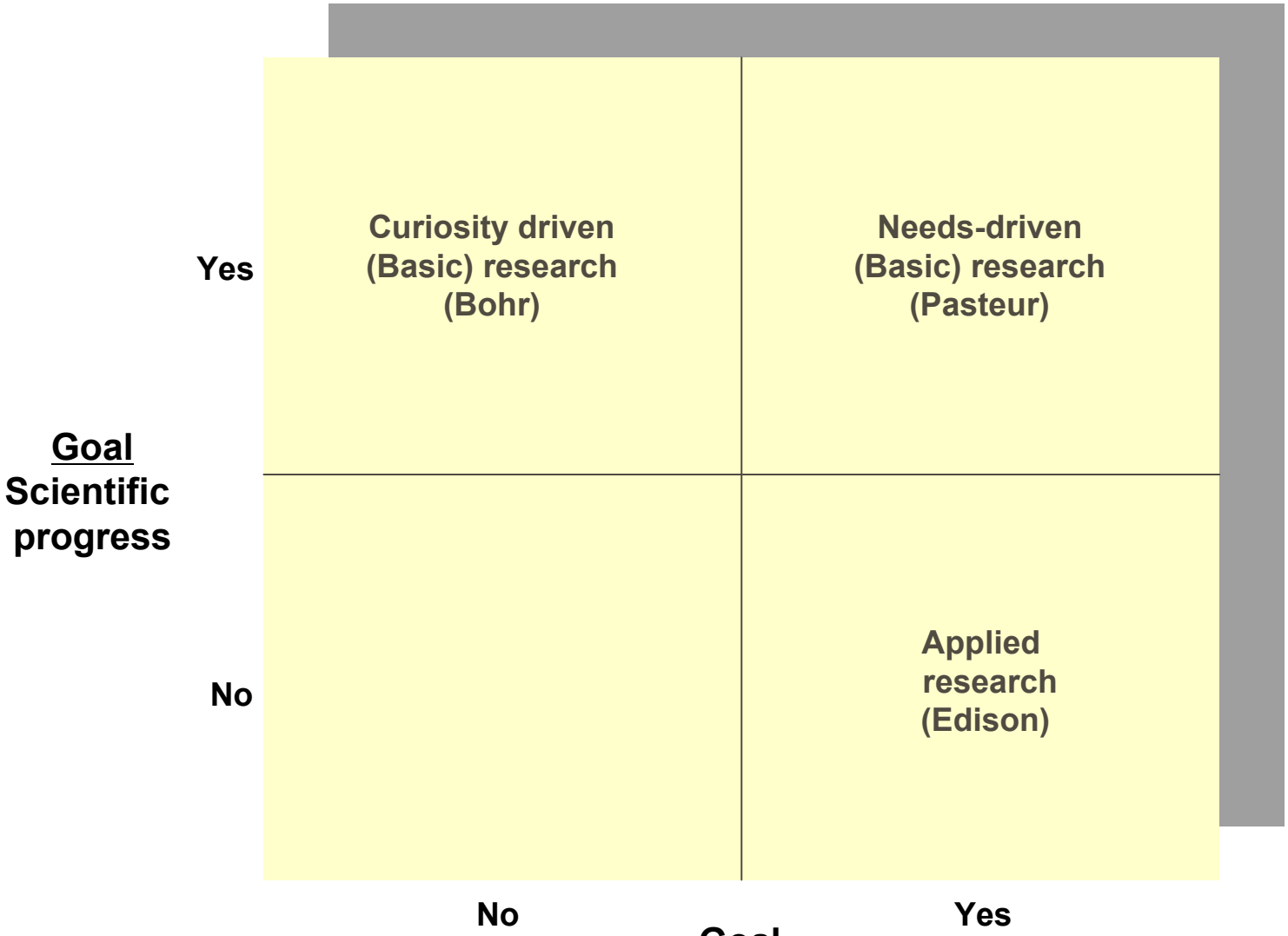
Critical steps in the evolution of VINNOVA during its first five years (1)

- Establishing the legitimacy of support for needs-driven research
- Integration of three former funding agencies and building an organization for more than traditional R&D-funding
  - Actor-oriented perspective as a complement to traditional focus on technological fields
  - Recognition of the need for a stronger analytical basis for policy
- Gaining trust among other actors. Combining funds to reach critical mass. Creating common visions (e g National Technology Foresight project)
- Establishing the ”Triple Helix” model through the VINN Growth program (regional innovation systems) based on experience from Telecom City. Strengthened VINNOVA’s image nationwide
- Triple Helix composed decision boards
- Following up on successful programs from the predecessor: Competence Centers followed by VINN Excellence Centers

Critical steps in the evolution of VINNOVA during its first five years (2)

- National Incubation Program and the creation of The Innovation Bridge. VINNOVA focusing on verification and universities' own infrastructure for commercialization
- R&D-programs as main result of high level strategic dialogue between government and key export industries. The crisis at Saab Automobiles opens the door for a more activist innovation policy.
- Reversing the decline in government basic funding for the Research Institute sector
- Breaking with tradition with new program for direct support of company-led R&D in SMEs
- Knowledge about Innovation Systems

Curiosity driven and needs-driven research



Pasteur's Quadrant borrowed from Daniel Stokes

Research and Innovation

Research: Money transformation to Knowledge & Competence

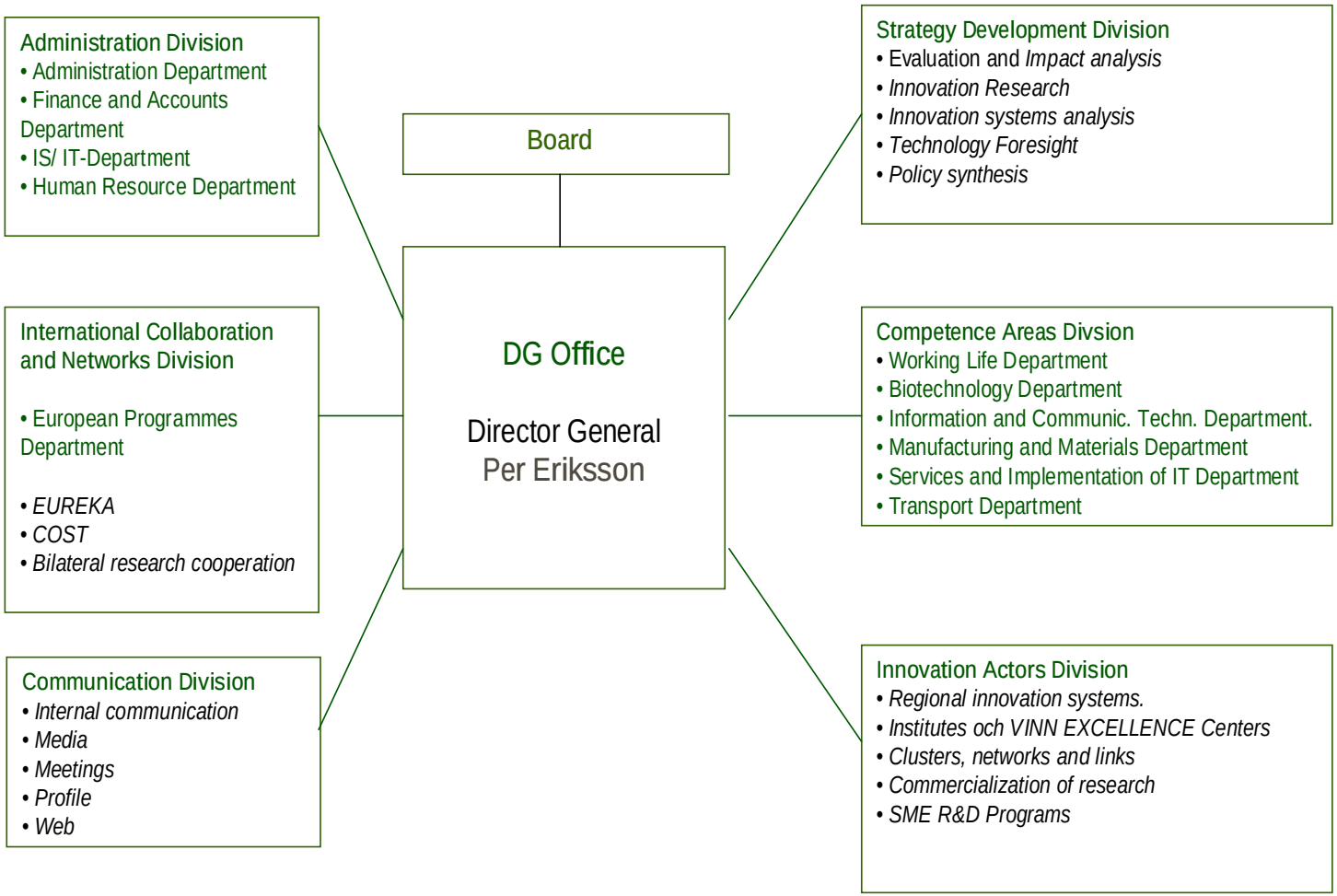
Innovation: Knowledge & Competence transformation to Money

Developing innovation system is to make the above efficient, i.e. to make investment in R&D profitable. Identify bottlenecks and possibilities.

Sectorial R&D-programs continue long tradition in predecessor organizations

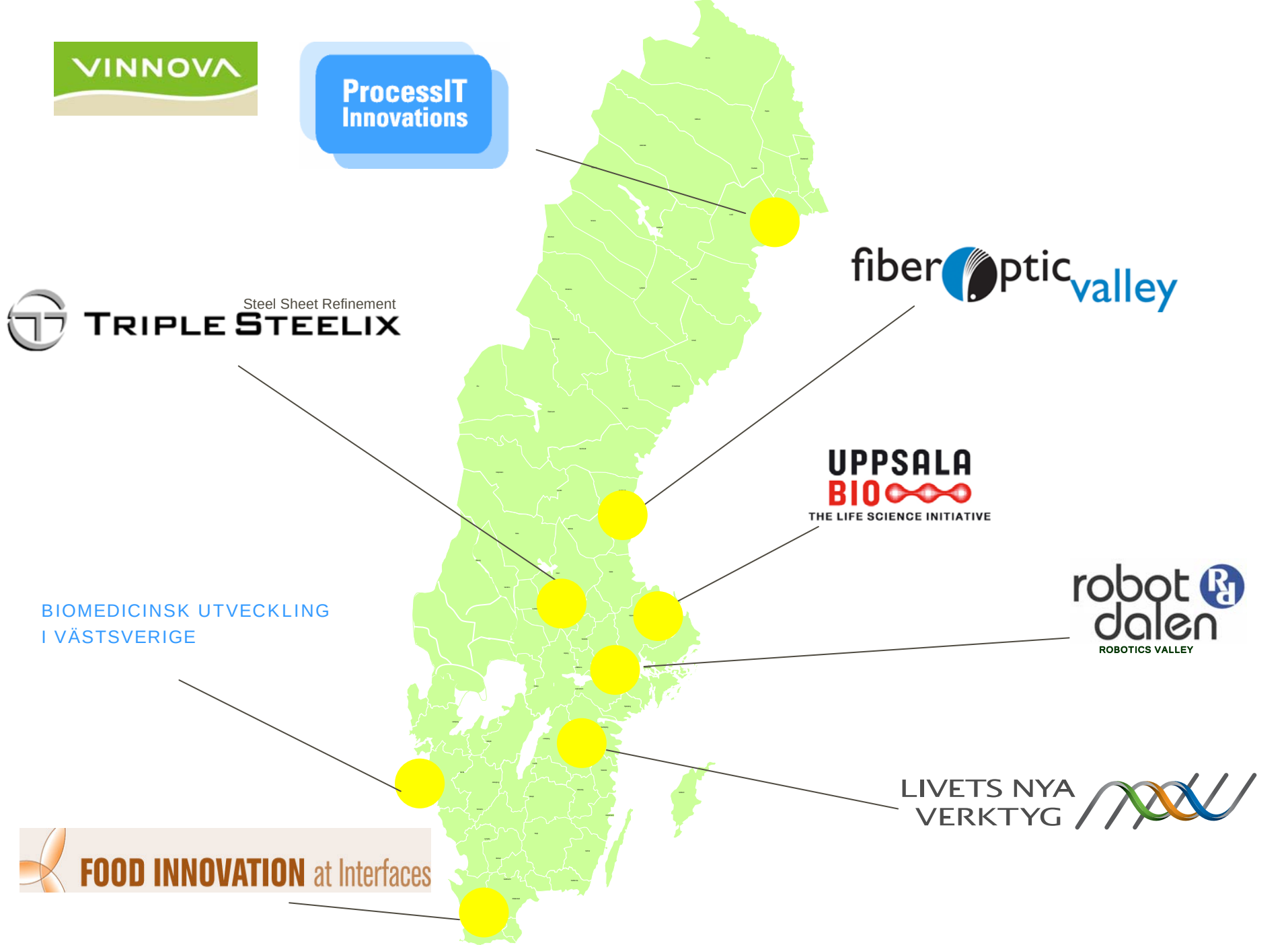
- A major part of VINNOVA's funding is channeled through R&D-programs for specific technical or industrial fields
- Each program has a Triple-Helix-composed Program Council; additional outside experts consulted when needed
- Co-financing from industry usually required for grants to universities or research institutes
- Technical expertise of program officers also utilized in evaluation of proposals under programs, which are not sector-specific
- Continuous work of analyzing innovation systems in various fields in order to identify opportunities, bottlenecks, etc. as a basis for launching of new programs. Occasionally special requests from ministry.

VINNOVA's Organisation



VINNVÄXT – Implementing “Triple Helix” on the regional level

- Triple Helix: Bringing together Business, Academia and the Public sector/Political world
- Own experience from the successful revitalization of the city of Karlskrona through the development of “Telecom City” in the 1990s
- VINNVÄXT (VINN Growth) is a competition among regions for the development of internationally competitive research and innovation environments in specific growth fields.
- 8 winners so far in two competitions
- 14-22 M€ over 10 years for each winner. Half from VINNOVA and half from companies and regional governments.


VINNOVA
ProcessIT Innovations
fiber optic valley
Steel Sheet Refinement
TRIPLE STEELIX
UPPSALA BIO
THE LIFE SCIENCE INITIATIVE
robot dalen
ROBOTICS VALLEY
BIOMEDICINSK UTVECKLING
I VÄSTSVERIGE
LIVETS NYA VERKTYG
FOOD INNOVATION at Interfaces

VINNVÄXT

What is the money used for?

- **At least 50 percent to R&D**
- **Development organisation and process management**
- **Mobilisation**
- **Competence supply**
- **Brand creation**
- **Strategic work**
- **Follow-up**

What does it take to win?

- **Good growth potential**
- **Common strategic idea**
- **Regional strength and leadership**
- **Strong R&D environment**
- **Renewal in focus**
- **All parties must contribute – Triple Helix**

Effects

- **Helps regions to go from words to action**
- **Competition format forces regions to prioritise**
- **Strategic research on companies' terms**
- **Clear coordination effect**
- **Strong role for regional politicians**
- **Growth in focus**
- **Gives credibility**
- **Builds brands**

Internationally attractive Research Centers of Excellence crucial in era of globalization

- Major theme in both National Innovation Strategy and in Research Bill
- Competence Centers program started by NUTEK in 1994 (predecessor of VINNOVA) considered a success
- VINNOVA started similar new program VINN Excellence Centers with requirement of active involvement of industry and public sector organizations
- Other COE programs funded by Swedish Research Council, Formas and Foundation for Strategic Research

VINN Excellence Centers

- Provide an arena for research collaboration between universities, industry and public sector
- Research centers must be internationally competitive
- 19 of planned 25 already established
- 10 years
- 2.2 M€ per Center and year
  - 1/3 from VINNOVA
  - 1/3 from industrial and other partners (in kind and cash)
  - 1/3 from host university (commitment of institutional funds)
- 10-15 partners per Center, both large and small innovative firms
- Call for proposals in two steps; first resulting in planning grants
- Highly competitive process
- Review of scientific excellence by international experts

19 VINN Excellence Centers already selected

Broad field	Research focus	University
Biotechnology and Wood Fiber/Paper Technologies	Ubiquitous Intelligence in Paper and Packaging	Royal Institute of Technology
	Biofiber Materials	Royal Institute of Technology
	Supramolecular Biomaterials - structure dynamics and properties	Chalmers University of Technology
	Biomaterials and Cell Therapy	Göteborg University
	Protein Technology	Royal Institute of Technology
	Antidiabetic Foods targeting the Insulin Resistance Syndrome	Lund University
Information and Communication Technologies	Antenna Systems	Chalmers University of Technology
	GigaHertz Microwave Technology	Chalmers University of Technology
	Sustainable Communications (communication that can serve as alternative to physical travel and transportation)	Royal Institute of Technology
	Mobile Services and Ubiquitous Computing	Stockholm University
	Wireless Sensor Networks	Uppsala University
Industrial & Materials Technology	Hierarchic Engineering of Industrial Materials (quantum mechanics in materials engineering)	Royal Institute of Technology
	Functional Nanoscale Materials - High-Impact Surface Engineering Solutions for Industry	Linköping University
	Efficient Product Realization (fast, flexible, and highly customized global product and production development processes)	Chalmers University of Technology
	Functional Product Innovation (incl. facilitating 3R)	Luleå Technical University
Transport	Tools for future vehicle design	Royal Institute of Technology
	Next Generation Innovative Logistics	Lund University
	Sustainable development of passenger transportation services	Karlstad University
Working Life	Managing Mobility for Learning, Health and Innovation	Linköpings universitet

Need to strengthen small but important Research Institute sector

- Industrial Research Institutes receive ca 60 % of their funding from industry
- The Industrial Research Institutes must be able to compete internationally in order to survive; some already have significant funding from EU and foreign companies
- The decline in the government share of funding reached a critical point where the sustainability of the institutes was at stake. Recently the government decided to double its basic funding from current level of 9 percent of total turnover
- Most of the Industrial Research Institutes have recently been consolidated into four large groups. A further consolidation is being discussed.

8 Institute Excellence Centres selected

VINNOVA, The Foundation for Strategic Research and the Knowledge Foundation jointly arranged a competition among all Research Institutes for “Institute Excellence Centre” grants. Each grant amounts to 4.3 M€ over six years, with the same amount from industry.

Broad field	Research focus	Institute
Drug Delivery	Controlled Delivery and Release	YKI (Institute for Surface Chemistry)
Wood	Center for Eco-efficient and Durable Wood-based Materials	SP/Trätek (Swedish Institute for Wood Technology)
Information and Communication Technologies	Center for Networked Systems	SICS (Swedish Institute of Computer Science)
	Fiber Optic Center	Acreo (contract research in electronics, optics and communication technology)
	Imaging Integrated Components	
	Center for Advanced Sensors, Multisensors, and Sensor Networks	FOI (Swedish Defence Research Agency)
Metals	Casting Innovation Center	SweCast (Swedish Institute of Casting Technology)
	Center for Process Integration in Steelmaking	MEFOS (Metallurgical Research Institute)

Commercialization of university research

- The infrastructure for supporting commercialization of university research has been too fragmented and lacking in resources
- The Innovation Bridge was established as a new strong player in 2005 providing seed financing (220 M€ in capital) and operating a National Incubation Program developed by VINNOVA
- VINNOVA is currently working with Swedish universities to help develop their overall strategies and organization for interacting with industry and commercializing their research (Key Actor Program)
- VINNOVA is also providing support for ”verification research”
- Support for a large number of joint university-research projects under VINNOVA’s regular R&D-programs

New Strategic R&D-programs in partnership with six key export industries (1)

- National Innovation Strategy jointly announced by Ministry of Industry and Ministry of Education in June 2004
- Strategic dialogue between Minister of Industry and six industries followed by development of R&D-strategies:
  - Motor Vehicles
  - IT and Telecom
  - Aerospace
  - Pharmaceuticals, Biotechnology and Medical technology
  - Forest Products
  - Metals

New Strategic R&D-programs in partnership with six key export industries (2)

- R&D-programs for Motor Vehicles and Aerospace Industries started already in 1990s.
- Threat of close-down of Saab factury owned by GM triggered large increase in joint government-industry R&D-progam in manufacturing technology and vehicle telematics. VINNOVA charged with defining programs together with industry.
- At the request of the Ministry of Industry VINNOVA developed a research and innovation strategy for Biotechnology in cooperation with industry
- Development of innovation strategies and R&D-programs spread to other industries. VINNOVA asked by government to develop R&D-programs with industry.
- Government provides 110 M € over five years in new funding for R&D-programs to be matched by industry

“Do Research and Grow!” for stimulating radical innovation in SMEs (1)

- Government support of R&D in companies traditionally very small in Sweden, except R&D related to military procurement or via European Space Agency
- VINNOVA proposed Swedish version of the American SBIR
- Initially government included small program (1.1 M€ per year) in Research Bill
- Expanded to´11 M€ for 2006 and later the same amount for 2007.
- Following strong response from industry, VINNOVA is aiming at continuing and expanding the program further
- Possible future introduction of tax incentives for R&D may compete with, or complement, the program

“Do Research and Grow!” for stimulating radical innovation in SMEs (2)

- Product-related R&D-projects, which add a significant element of new knowledge, in firms with fewer than 250 employees,
- Criteria: “shall strengthen the company’s capacity to compete on the global market and thereby contribute to the generation of economic growth and new jobs in Sweden” (of course difficult to evaluate)
- 33 funded R&D-projects of 316 applications (first half year of program)
- 300 000 € per project/6-18 months from VINNOVA matched by firm
- Also support for feasibility studies
- VINNOVA seeking to increase the budget from current 11 M € per year

“Do Research and Grow!” for stimulating radical innovation in SMEs (3)

- Funded companies
  - 10 without significant links to universities
  - 6 established independently of universities but today joint research with Swedish univ. important
  - 3 found original ideas abroad but for 2 of them joint research with Swedish univ. and companies was crucial for commercializing the original idea
  - 14 were established based on unique knowledge or technology from Swedish univ. and almost all continue close coop. with Swedish univ.
- Still to early to judge exactly how representative the selected companies are of innovative Swedish SMEs

Knowledge and Research about Innovation Systems

- Our knowledge about Innovation Systems is still insufficient for developing well balanced and really effective policies
- Especially we need a deeper understanding of the meaning and implications of the recent movement towards globalization and of the relative future importance of leading-edge science as an input in innovation processes, as well as methods for evaluating the impact of innovation policies.
- VINNOVA is funding research on innovation systems at four Swedish universities. It is also commissioning many innovation studies as part of its operational activities in addition to its in-house analytical work.

Some of the challenges ahead for VINNOVA

- Make sure that Sweden is sufficiently attractive in at least some fields also for foreign companies. What is required of internationally competitive ”research and innovation environments”?
- Strategy and partnership building for effective support of international R&D-cooperation, which can strengthen the Swedish innovation system. Complementing current focus on EU with a stronger global orientation
- Better balance between science and technology push and market pull. Expanding funding to and through companies.
- Closer interaction industry, especially with SMEs
- Innovation in service industries
- Integrating environment and energy considerations more vigorously
- Development of reliable methods for policy impact analysis, which can meet political requirments in spite of long lead times

Innovation in global networks of companies and researchers

- Government organizations must respond to globalization
- Positioning Sweden in the restructuring that takes place in the European Research Area is crucial
- Being competitive in Europé increasingly requires of both companies and researchers to be competitive and active globally
- VINNOVA is already heavily involved in promoting R&D-cooperation in Europé
- VINNOVA aims at significantly increasing its cooperation with organizations in countries outside Europé, including and not least in Japan

Conclusions

- The importance of R&D for competitiveness today emphasized by both the government (political level) and industrial leaders
- VINNOVA has established itself as a credible actor and, as testified by budget growth, is seen by the government as useful for developing and implementing policies
- Interaction with industry needs to be deepened further
- Development and implementation of a global strategy is a big challenge
- Timing has proven to be crucial
- Preparedness makes it possible to respond to opportunities opening up in unpredictable political processes

For reference:

Some additional facts about the Swedish Research and Innovation System

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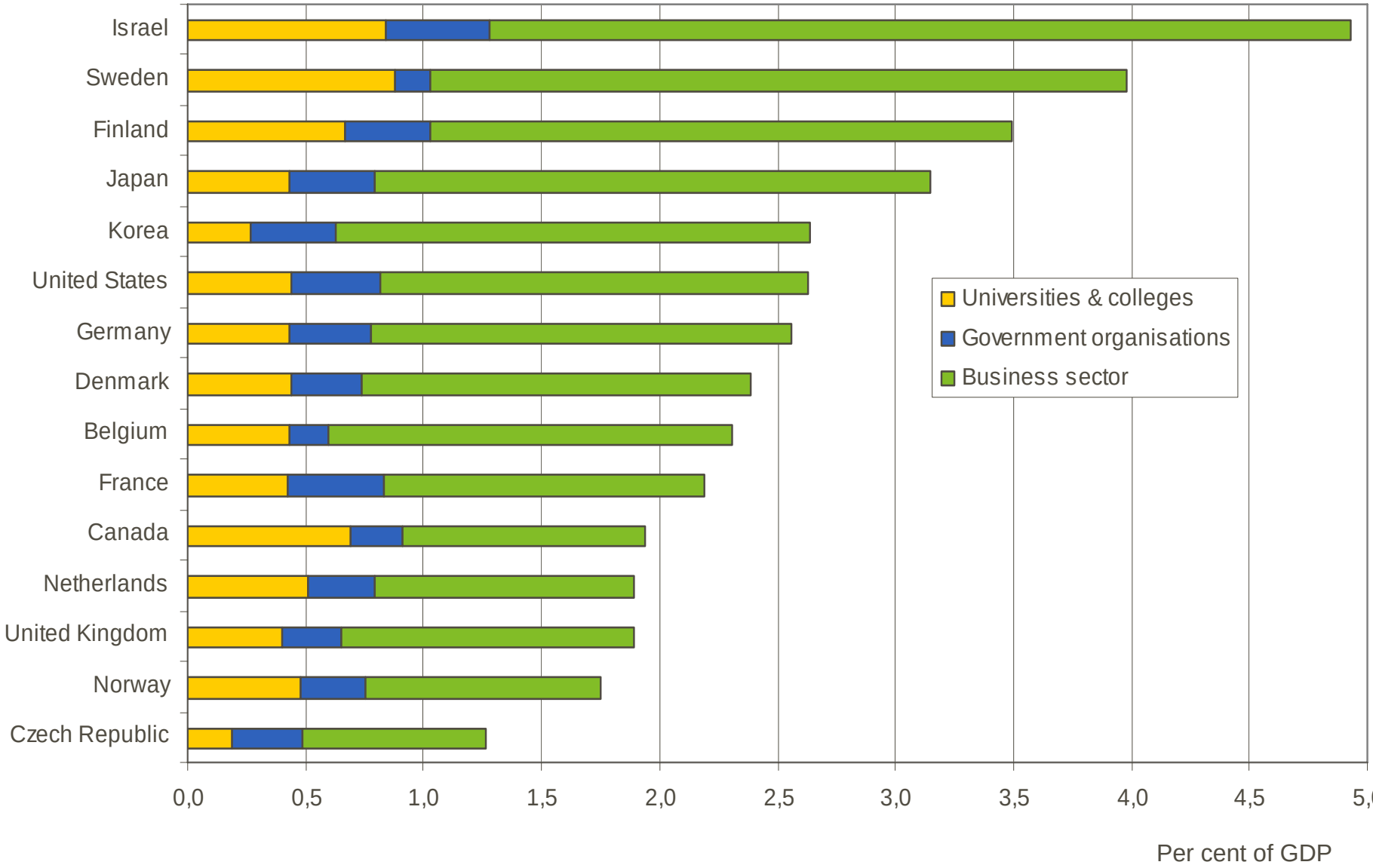
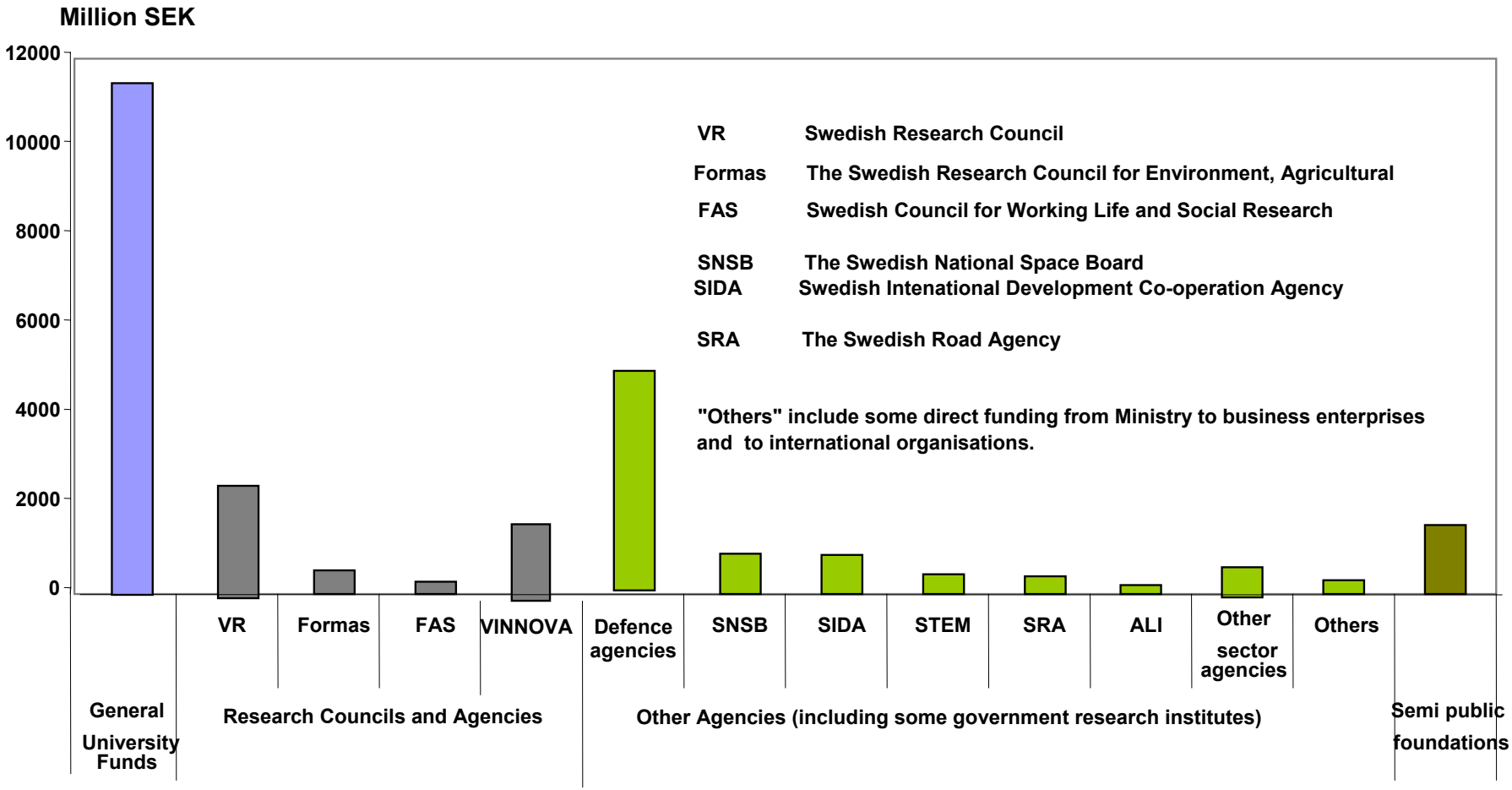


Source: OECD MSTI, 2005

Main features of Swedish Innovation System

- High spending on R&D as percent of R&D
- Internationally oriented industrial firms and universities are dominating players
- Starting in 1988 a large part of the R&D-intensive major companies have merged with or been acquired by foreign firms
- Government funding of R&D has been concentrated to universities and the defense sector
- Public research institutes play a minor role except in the area of defense
- So called industrial research institutes are funded jointly by industry and the government (ca 60 percent from industry)
- University teachers have the right to their inventions unless other agreement has been made. Transfer of the rights to the respective universities is under consideration.

Swedish Government funding of R&D 2005 by agency



Source: Statistics Sweden, Government Budget Appropriations or outlays for research and development 2005.

Recent Developments in Research and Innovation Policy (1)

- New Research Bill for period 2006-2008
- New overall Innovation Strategy and strategies for specific fields
- R&D-programs in cooperation with six industrial sectors
  - Pharmaceutical/biotech/medical eq.; Telecom; Aerospace; Motor Vehicles; Forest products; Metals
- Large increase in funding of COEs at universities and research institutes through a highly competitive process
- Strengthening of cooperation among Swedish R&D-funding org.
  - Swedish Brain Power, Security-related research, etc
- Consolidation of Industrial Research Institutes into four major groups and reversal of earlier trend of decrease in government basic funding

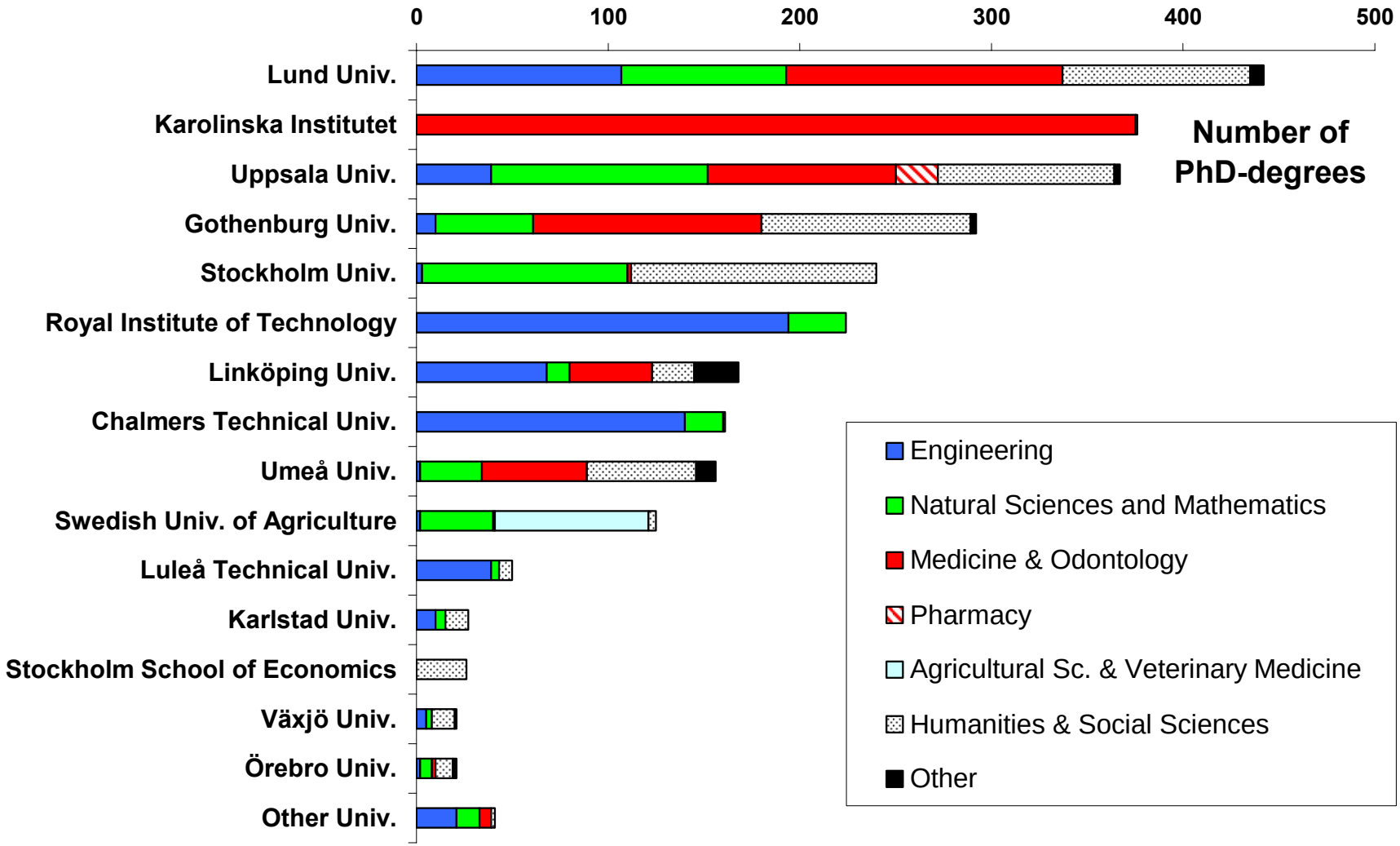
Recent Developments in Research and Innovation Policy (2)

- Strengthening of infrastructure and funding of commercialization of innovation seeds originating in universities
  - Creation of Innovation Bridge (seed financing and incubators)
  - National incubator program
  - Other programs at VINNOVA
- New program for direct funding of R&D in SMEs through open competition
- Preparation of 7th European Framework program
- Intensified cooperation between European R&D-funding org. Through ERA-Nets
- New government agreements for cooperation in S&T with China, India and USA and expansion of cooperation with Japan under existing agreement.

Increase in the annual government R&D budget allocations from 2005 to 2008 as proposed in Research Bill of autumn 2005

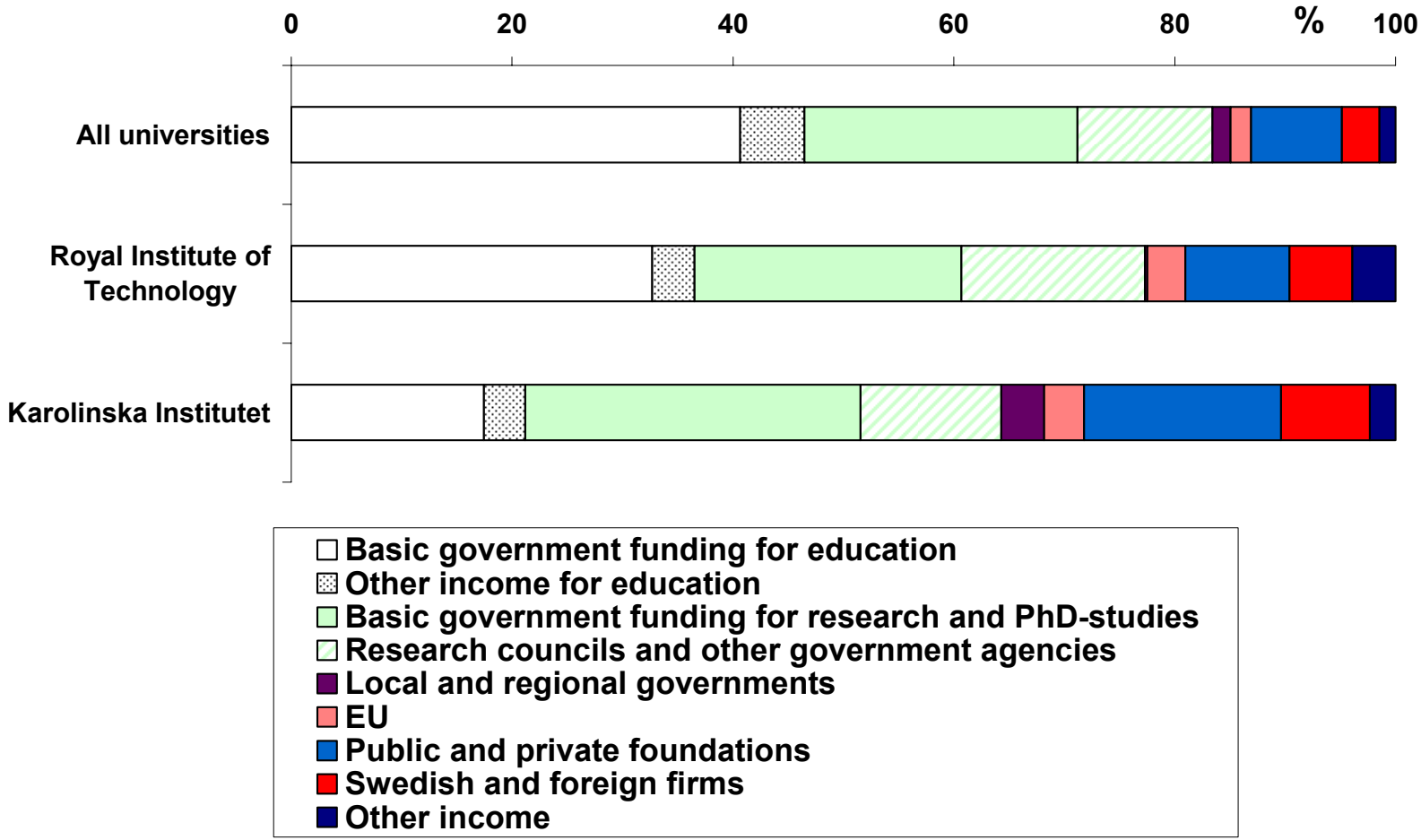
	VR	VINNOVA	FAS	Formas	Univ	Other	Total	Capital allocation
Strong Resarch Environments ("COEs")	210	60	10	20			**300**	
Priority fields								
* Medicine	380		20				**400**	
* Engineering	160	180				10	**350**	
* Sustainable Development	50	20		140			**210**	
Research Schools	60	25	5	10			**100**	
Positions for young scientists	85	50	5	10			**150**	
Institutional funds to Universities					520		**520**	
Univ Holding companies								60
Industrial Research Institutes		110					**110**	
Univ-Ind cooperation programs		120					**120**	
SME Program		10					**10**	
Research Infrastructure	42						**42**	
SLBA						5	**5**	20
Gender research	12				1		**13**	
Educational science	10						**10**	
Total increase 2005-2008	**1009**	**575**	**40**	**180**	**521**	**15**	**2340**	
Budget allocation in 2005	**2523**	**1122**	**291**	**531**				
Proposed budget allocation in 2008	**3532**	**1697**	**331**	**711**				

PhD-degrees conferred at Swedish universities in 2005



Source: Högskoleverket Årsrapport 2006

Funding structure for Swedish universities



Source: Högskoleverket Årsrapport 2006

Research Institutes represent a small part of the Swedish Innovation System

- Since the establishment of the Technical Research Council (one of the predecessors of VINNOVA) in the 1940s, government policy has been to concentrate public research funding in universities
- Main exception is in the defense area, where most of the research is done at the Defense Reseach Agency
- The National Testing and Research Institute (SP), which is wholly government-owned, is the largest Industrial Research Institute
- Most other Industrial Research Institutes are today jointly owned by industrial associations and the government. They receive on average 60 percent of their funding from industry, 30 percent from the government and the rest from the EU.

  (During the late 1990s this group of institutes changed their legal form from foundations to limited-liability companies partly owned by the industry)

Different types of research institutes in Sweden

- **Swedish Defense Research Agency (FOI) ≈ 1250 employees**

- **Industrial Research Institutes ≈ 2100 employees**
  - Institutes jointly owned by government and industrial associations 1400
  (60 % of funding from industry; 31 % from government mainly through VINNOVA; 9 % from EU)
  - National Testing and Research Institute (SP) (government-owned) 700

- **Other Government Research Inst. & Agencies ≈ 430 R&D FTEs**
  - Swedish Institute for Infectious Disease Control (SMI)
  - The National Institute for Working Life (ALI)
  - Swedish National Road and Transport Research Institute (VTI)
  - etc..

(Note: FTEs = Full Time Equivalents)

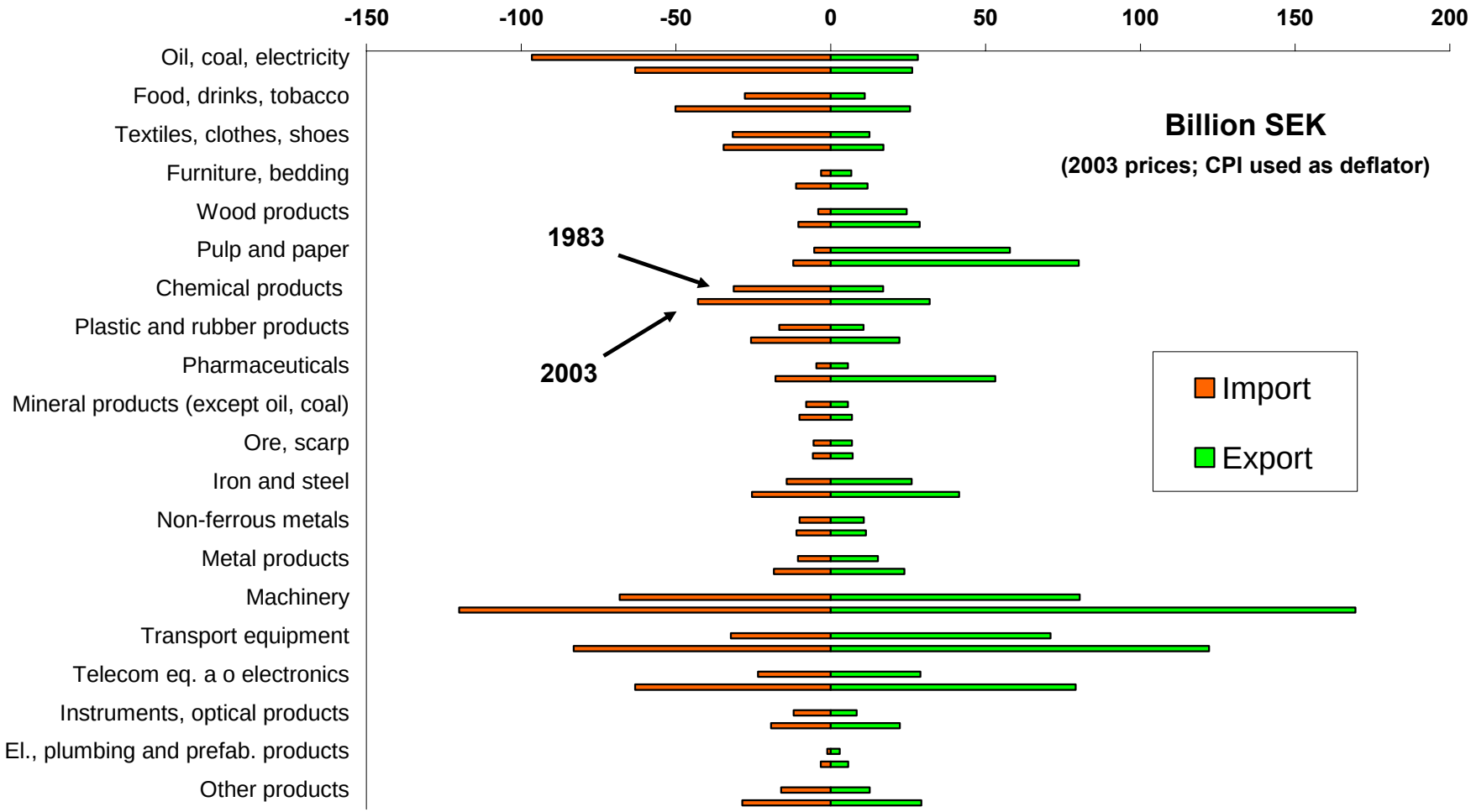
Industrial structure (1)

- In relation to the size of its economy Sweden has a broad industrial structure with world-leading companies in e g the following industries:
  - Infrastructure for mobile communication (Ericsson)
  - Pharmaceuticals (AstraZeneca)
  - Heavy trucks (Volvo, Scania)
  - Industrial robots (ABB)
  - Ball bearings (SKF)
  - Household Appliances (Electrolux)
  - Electric power transmission (ABB)
  - Paper, packaging and wood products (many companies)
  - Cemented carbide and specialty steels (Sandvik, etc)
  - Many fields of specialized machinery and equipment (many companies of different size)
- Two manufacturers of high-end passenger cars (Volvo Cars, Saab Automobile) and Autoliv leading in safety.

Industrial structure (2)

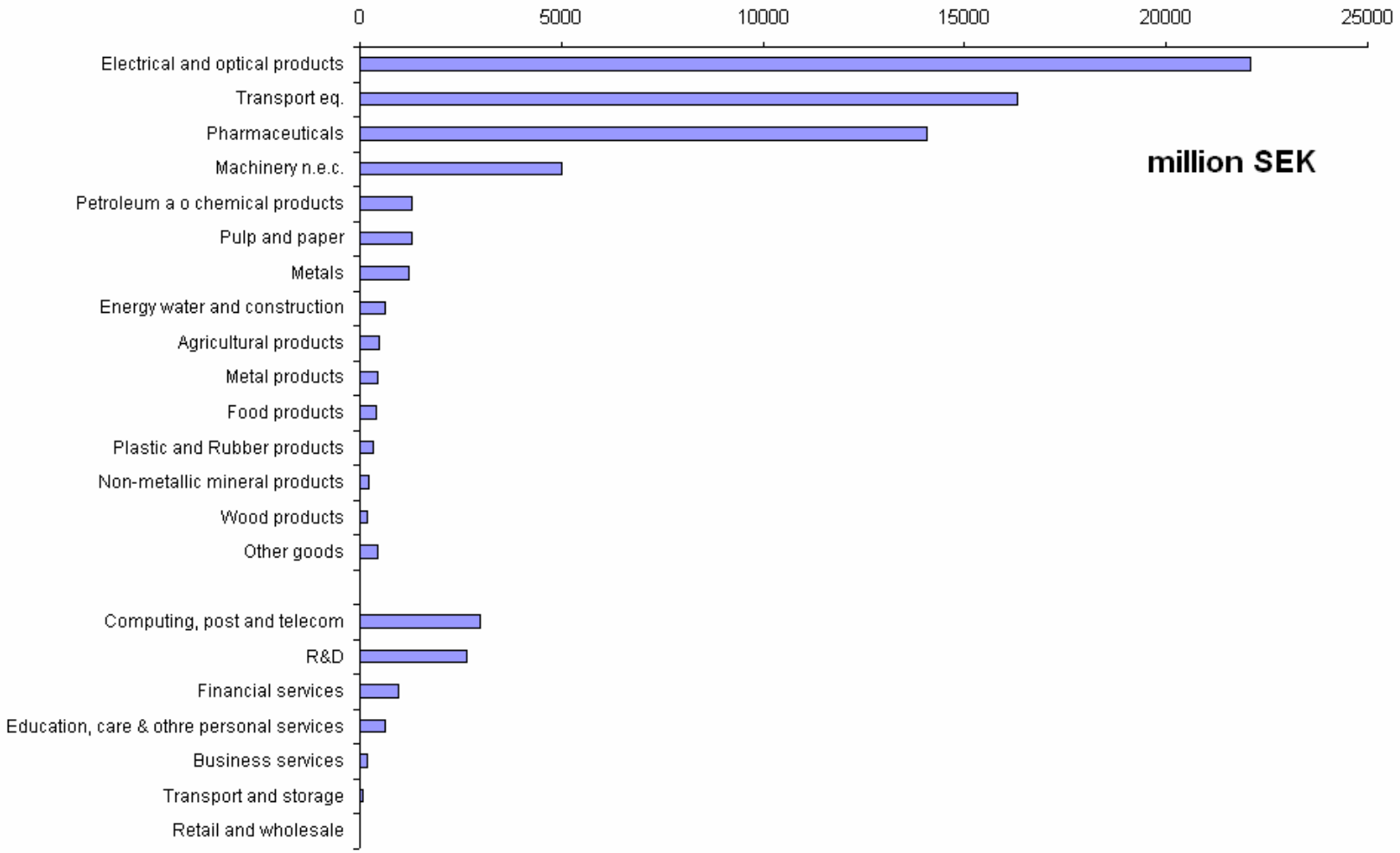
- Sweden also has internationally competitive companies offering niche products in other high tech fields
  - Aerospace and defense electronics (Saab etc)
  - Electronics
  - Business software
  - Biotech tools, medical equipment and biomaterials (GE Health, Gambro, Nobel Pharma, etc)
- Sweden has a high quality software services industry, “embedded systems” being one area of particular strength. Systems integration general strength of Swedish industry.
- Many small innovative biotech firms most of which are not yet profitable
- High standards of environmental management
- Biomass Energy

Sweden's export och import 1983 och 2003

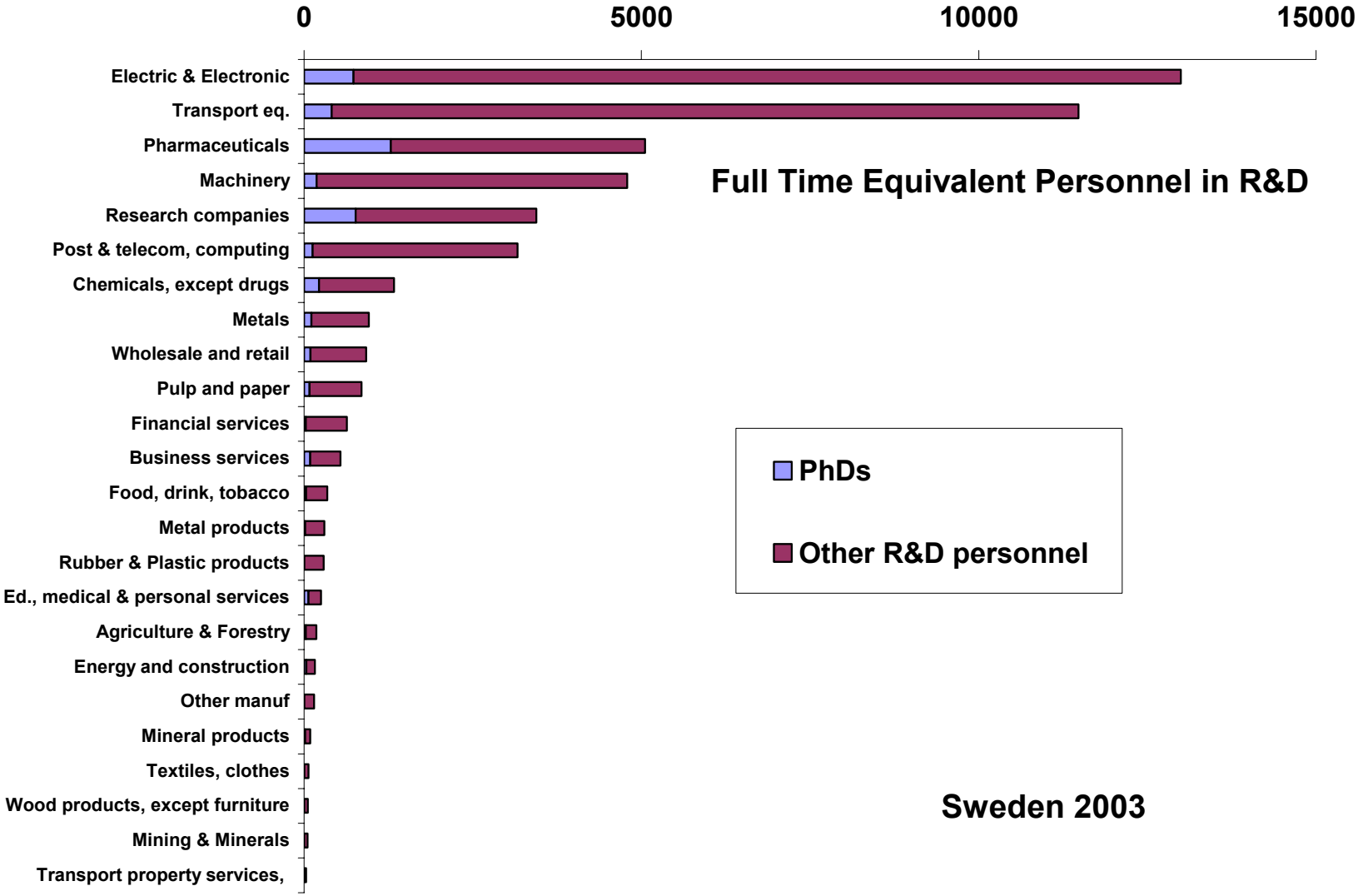


Source: Statistics Sweden

R&D in Swedish industry 2003 by product field



R&D personell in Swedish industry by sector and level of qualification



Source: Statistics Sweden