

On Research and Innovation Systems

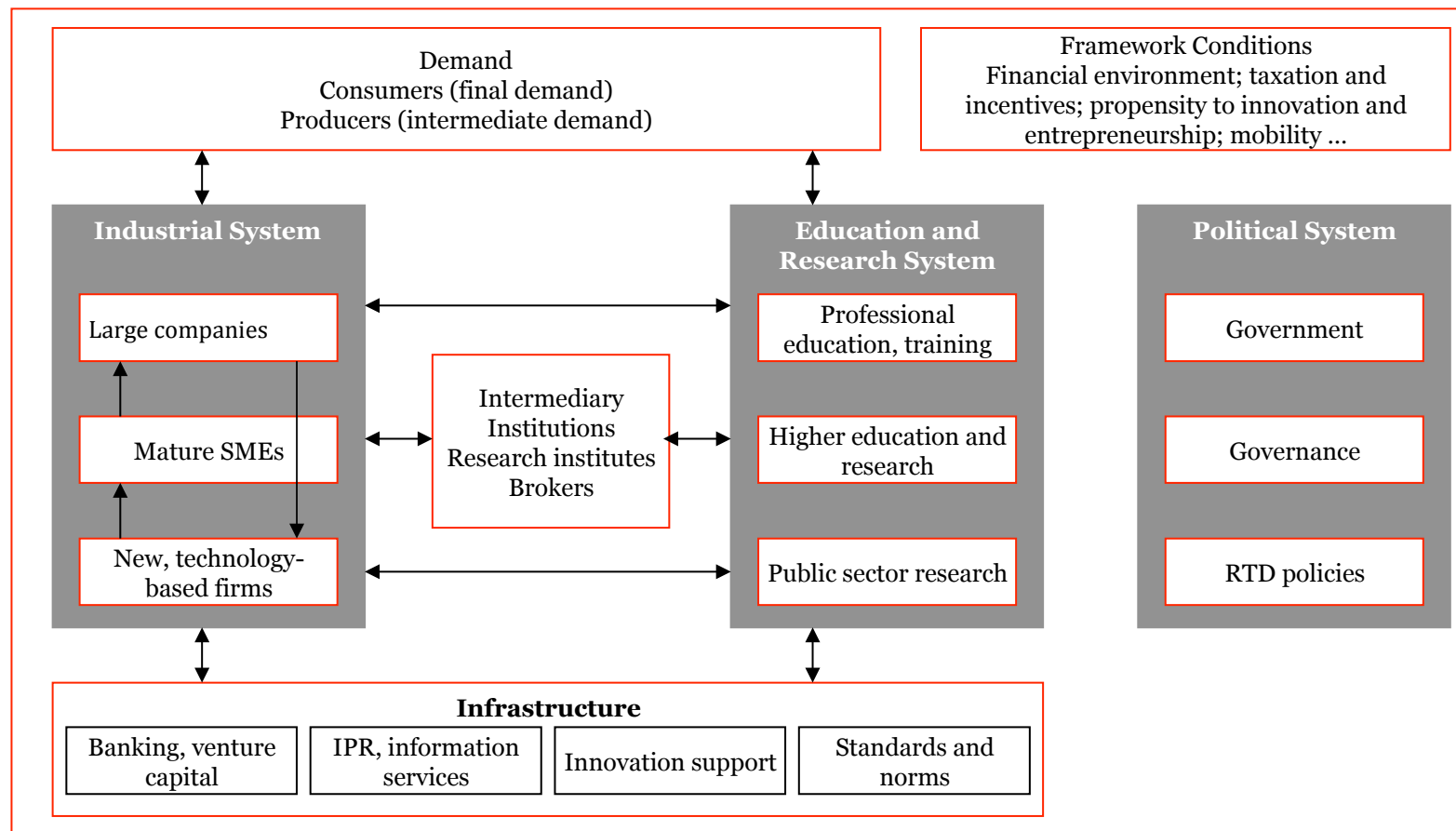
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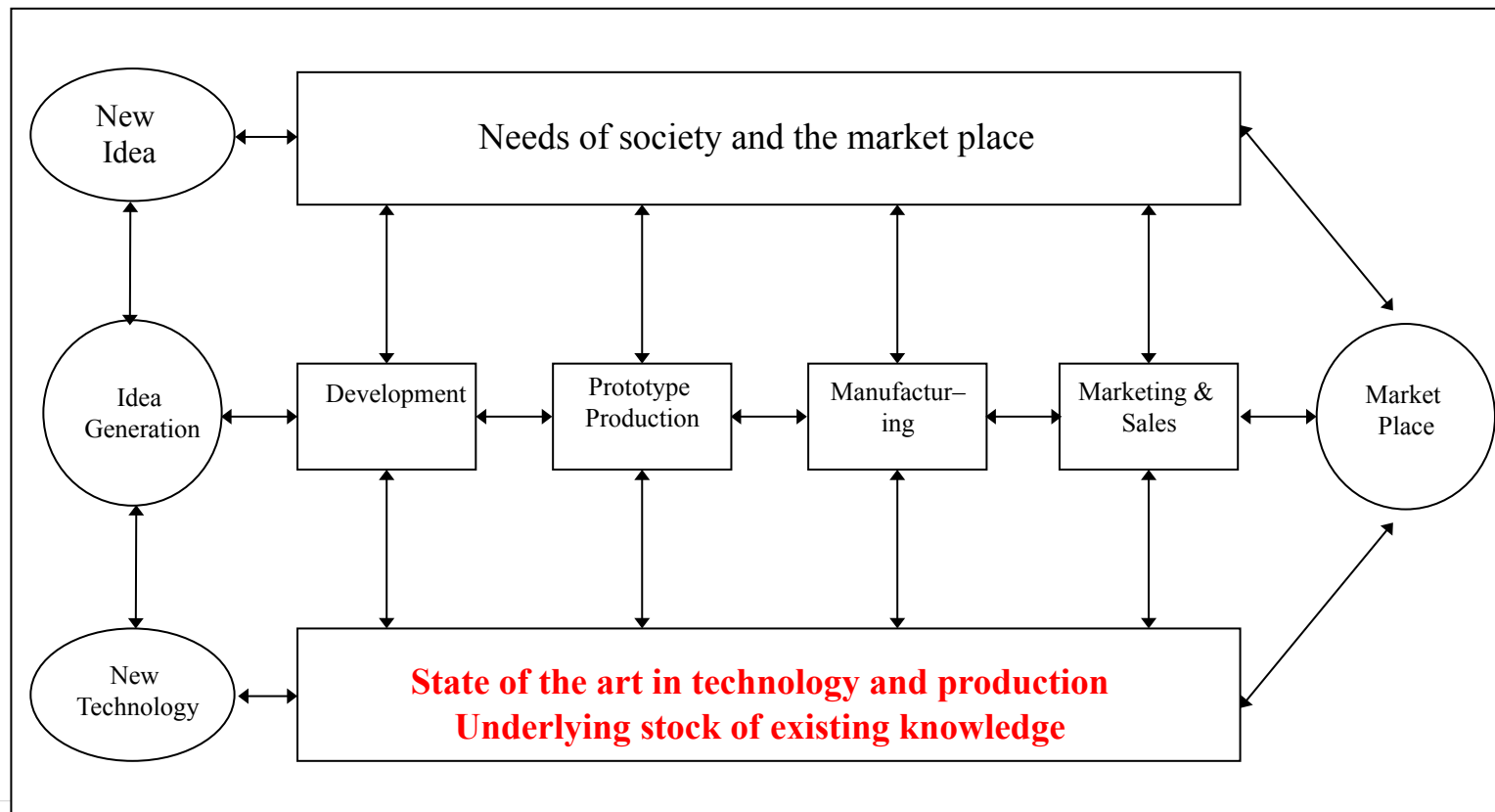
The closer you get to the systems level, the more important context becomes

Intervention + Context = Impact

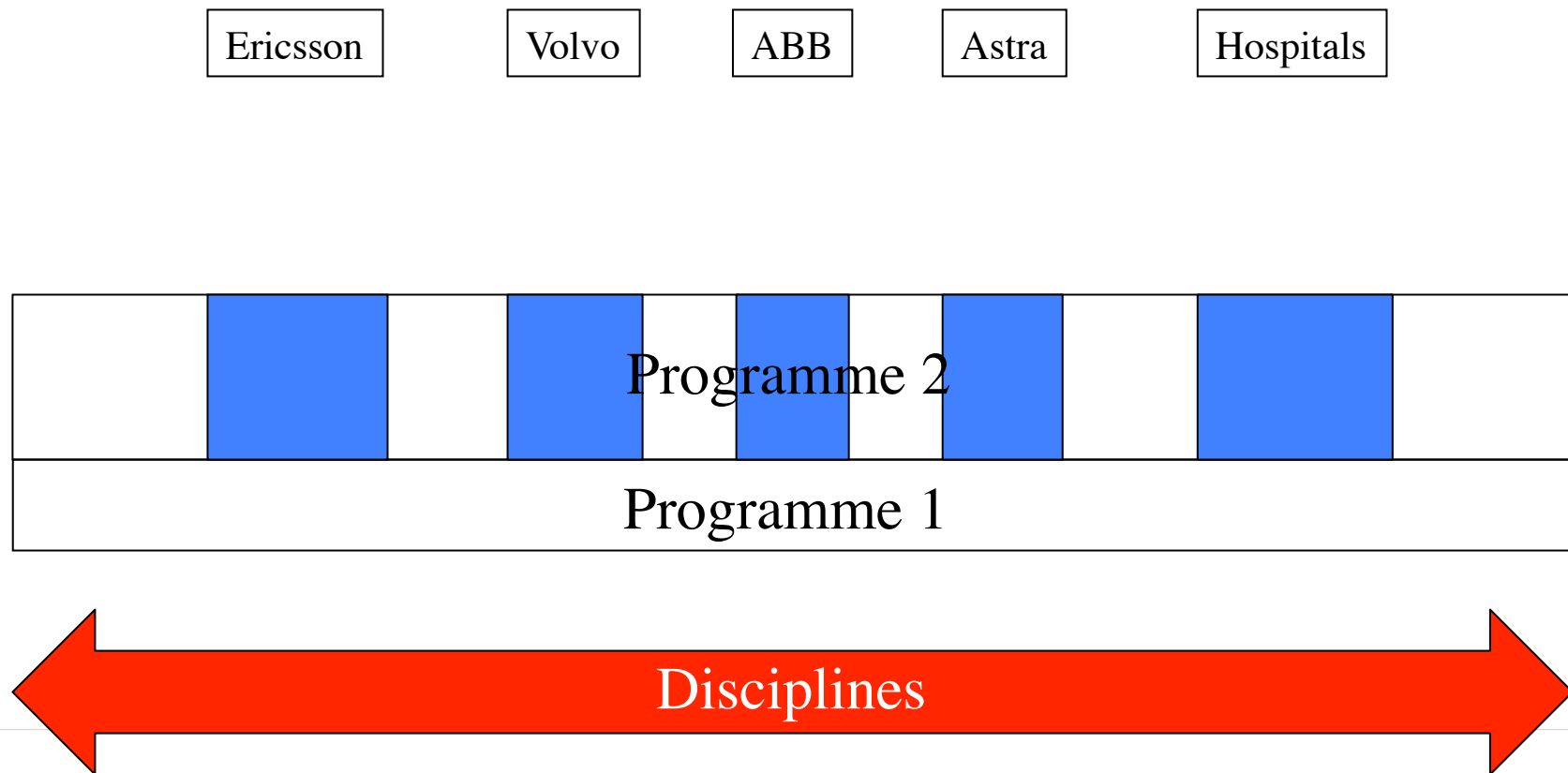
Overall, the Audit is about improving the role of research in the National Research and Innovation System



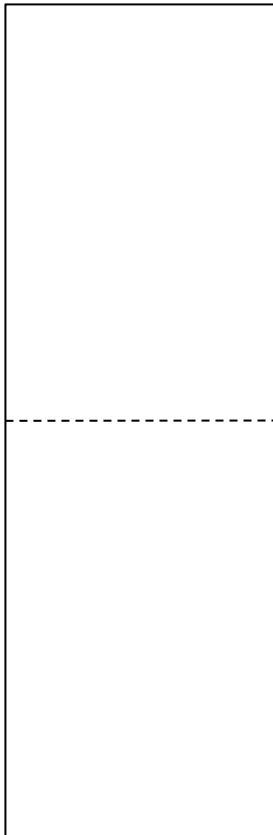
In a catching-up economy, it's especially important to understand how research fits into the innovation process



R&D&I policy is about getting the balance right, not about warfare between the 'basic' and 'applied' tribes

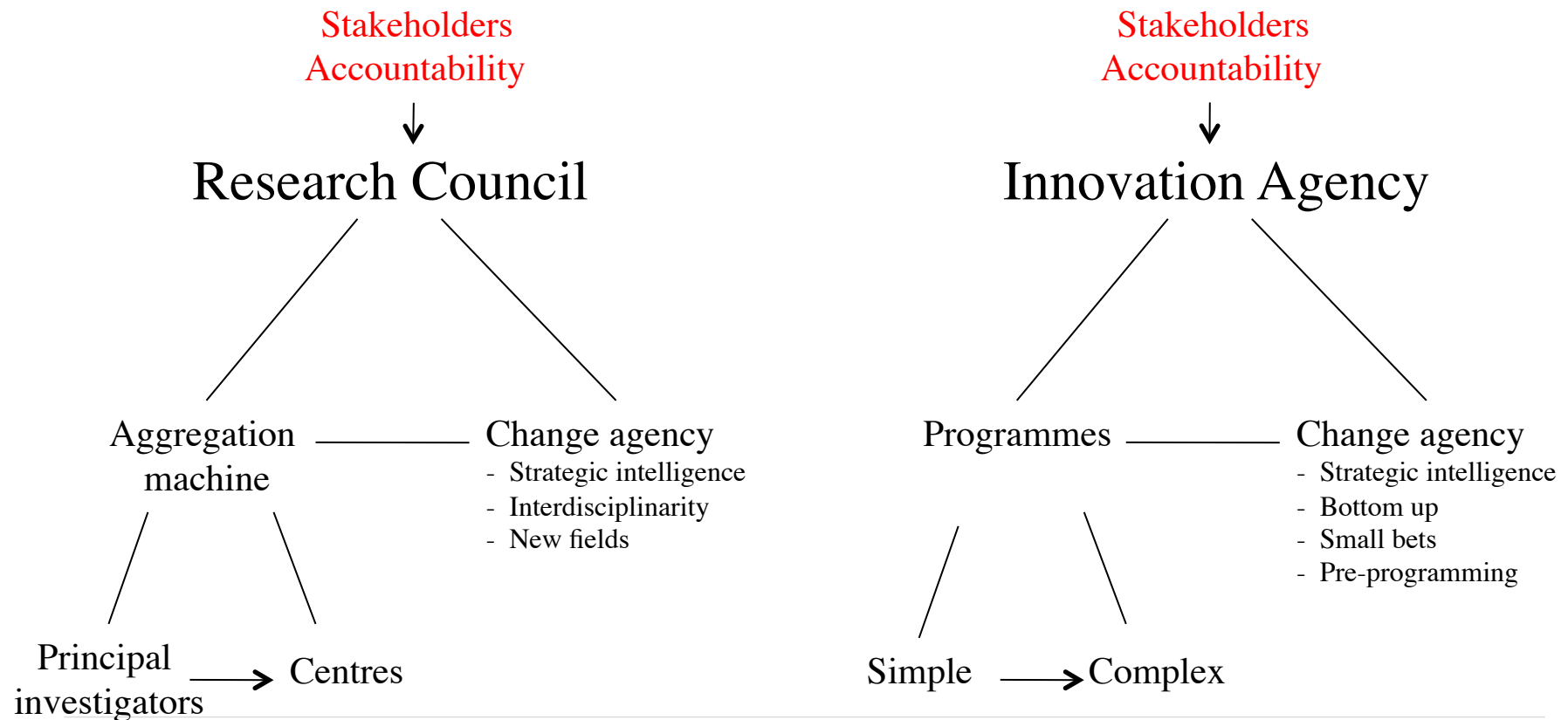


Balance – why we mix institutional and project funding



- Competitive project funding
 - *Short term competition*
 - *Only the already good get it*
 - *Can signal or respond to signals*
 - *Both bottom-up programmed*
 - *Short time constants*
- *Centres of Excellence or Competence*
- Core, block or infrastuctural funding
 - *Stability and planning*
 - *Make sure institutions don't disappear*
 - *Investment and development*
 - *Long time constants*

Ideally, our agencies are active, not passive implementors



Let's pause for an illustration ...

- How to become a world-beater in mobile telephone systems ...
- The GSM Story (from a Swedish perspective)

You can download the full GSM Story from

[http://www.technopolis-group.com/resources/downloads/
820_The_GSM_story.pdf](http://www.technopolis-group.com/resources/downloads/820_The_GSM_story.pdf)

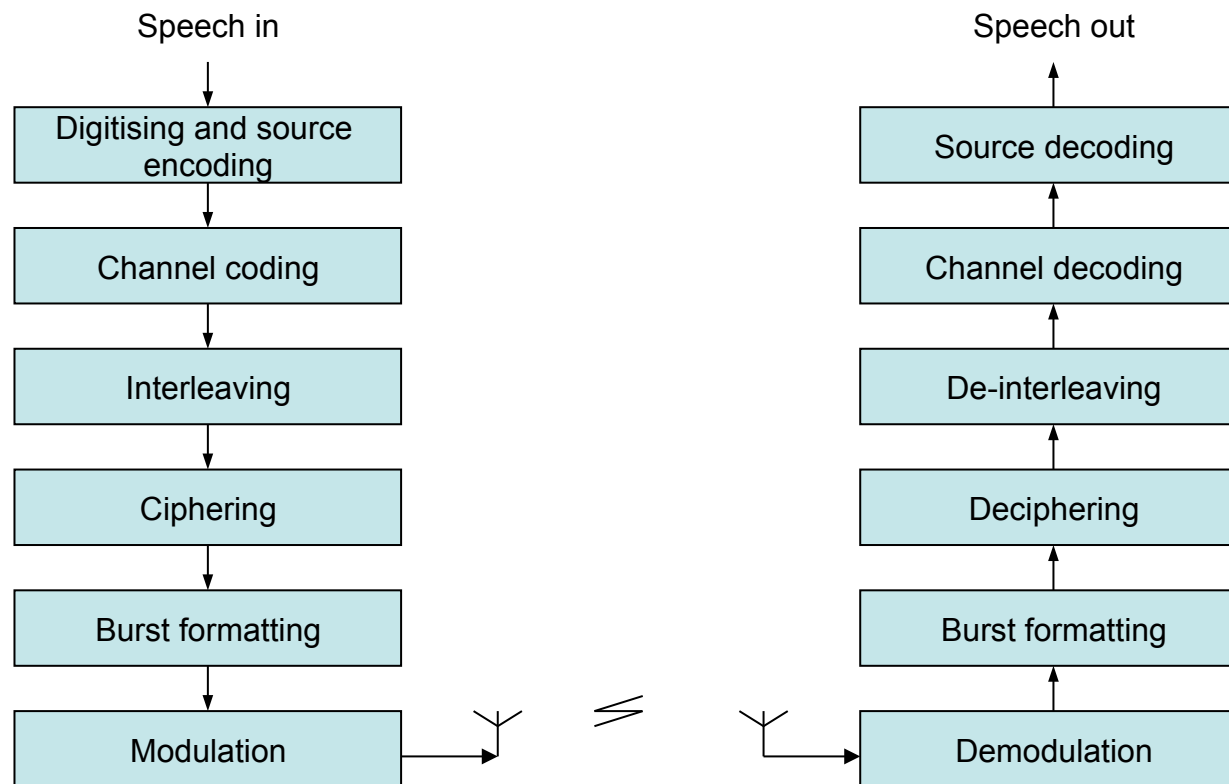
Or

<http://www.vinnova.se/upload/EPiStorePDF/va-08-04.pdf>

Developing GSM depended on solving 6 problems in the radio access link

1. How to convert and code speech into digital form, using as little bandwidth as possible while maintaining acceptable speech quality
2. Coding multiple conversations into a single channel
3. How to protect the coded signal from fading and noise in the radio channel
4. How to modulate the resulting digital signal over radio waves while maintaining high bit rates
5. A particular problem was ‘inter-symbol interference’
6. How to implement the solutions to these problems in electronic components

(By the way, this was the answer ...)



Mobilising research to help solve the problems

- Building on SRA capabilities developed to serve military needs
- Sven-Olof Öhrvik engages the research community through the 'radio club': Lund, Linköping, CTH, (KTH)
- STU supports the work via bottom-up project funding
- Universities launch new research agendas
- SRA runs internal problem-solving R&D projects that link with but do not wholly depend on university projects
- SRA moves Öhrvik to LTH; builds factories outside the university gates

Initially, the interaction involves only a handful of key university researchers

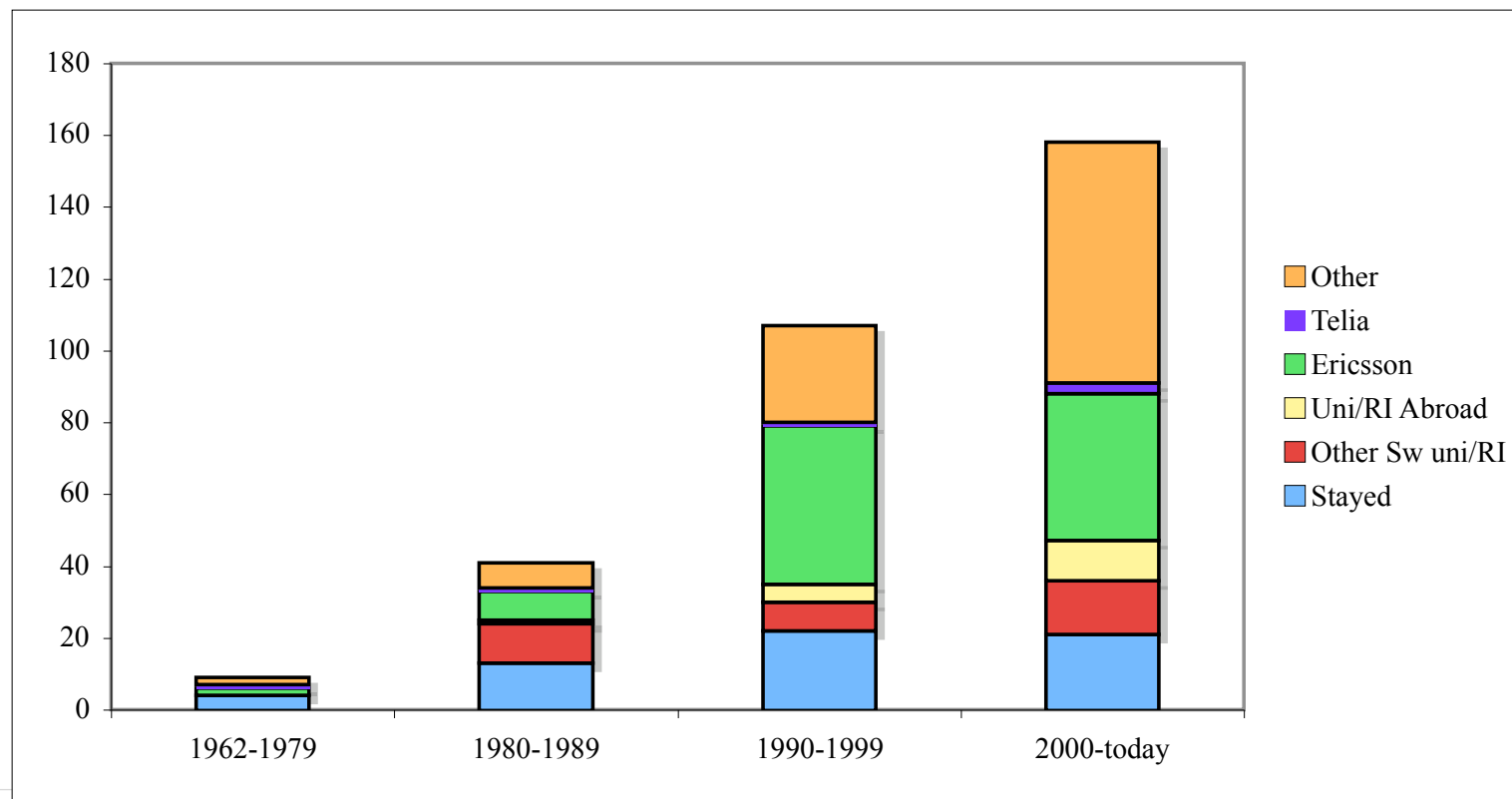
	Speech coding	Channel coding	Modulation	Propagation, equalisation	Components
Per Hedelin	X				
Lars Zetterberg	X	X			
Tomas Ericsson		X			
Rolf Johannesson		X			
S-O Öhrvik		X			X
Jens Zander		X		X	
Lars Ahlin		X		X	
Björn Gudmundsson				X	
Carl-Erik Sundberg			X		
Tor Aulin			X		
Arne Svensson			X		
Mats Torkelsson					X
Sven Mattisson					X
Claes Hammar					X
Lars Wanhammar					X

The transition involved no fundamental research

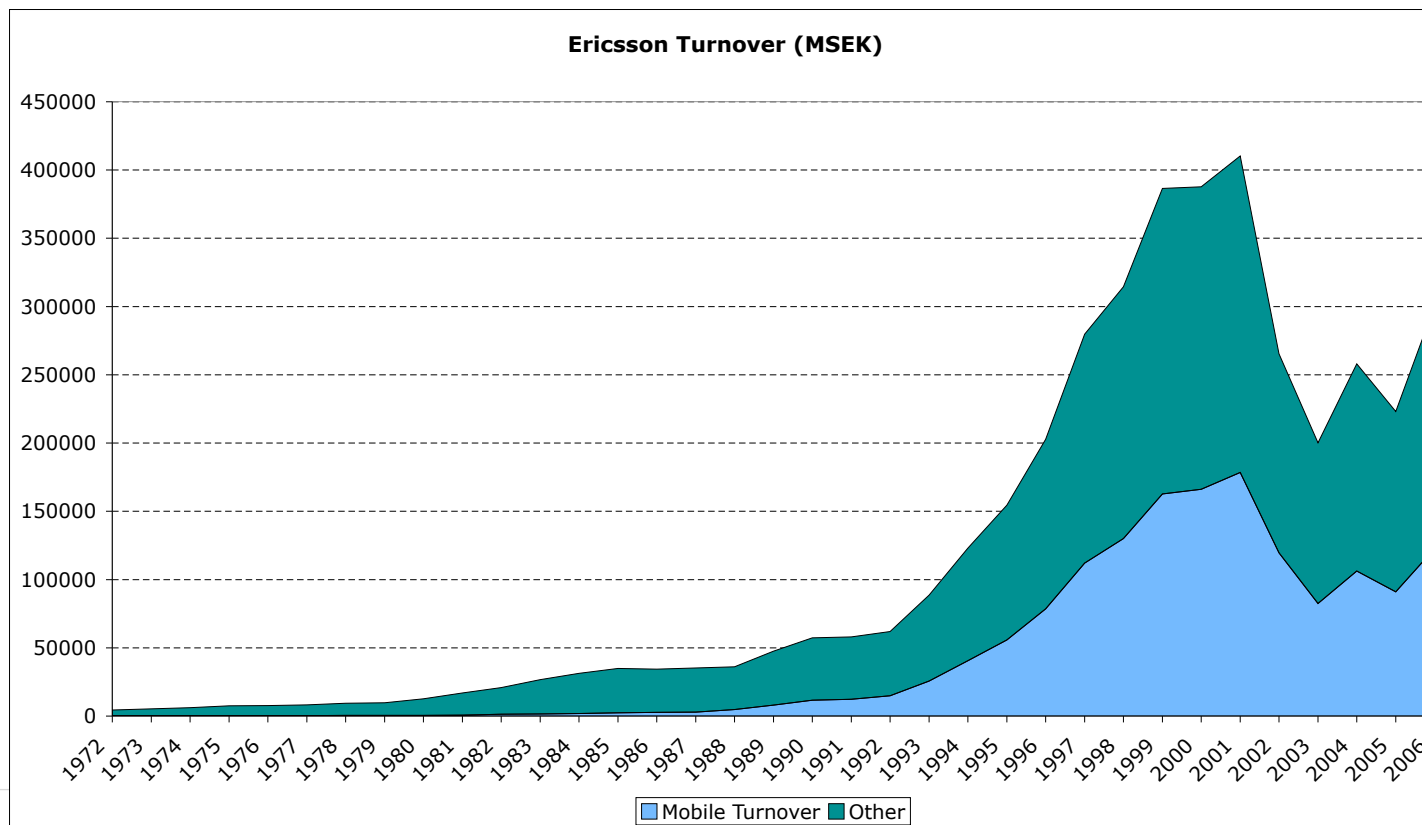
- Our study found not a single case of ‘linear model’ ideas transfer. The developments all depended on refining the stock of existing knowledge
- David Roessner has the same result for the 1G-> 2G transition in the USA: the NSF played no role at all

Scaling up human capital production to meet system needs underpinned Ericsson's success

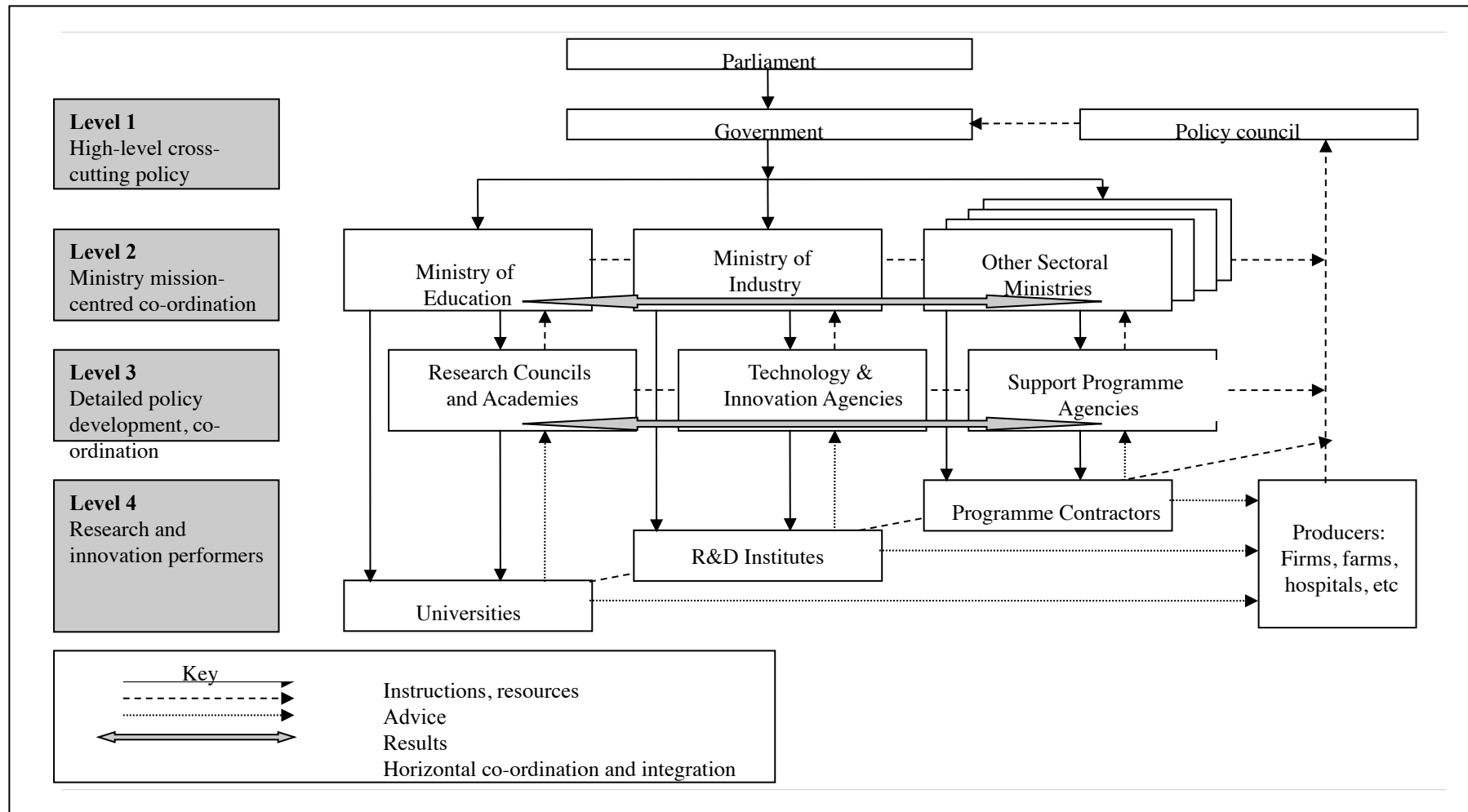
(PhD, lic)



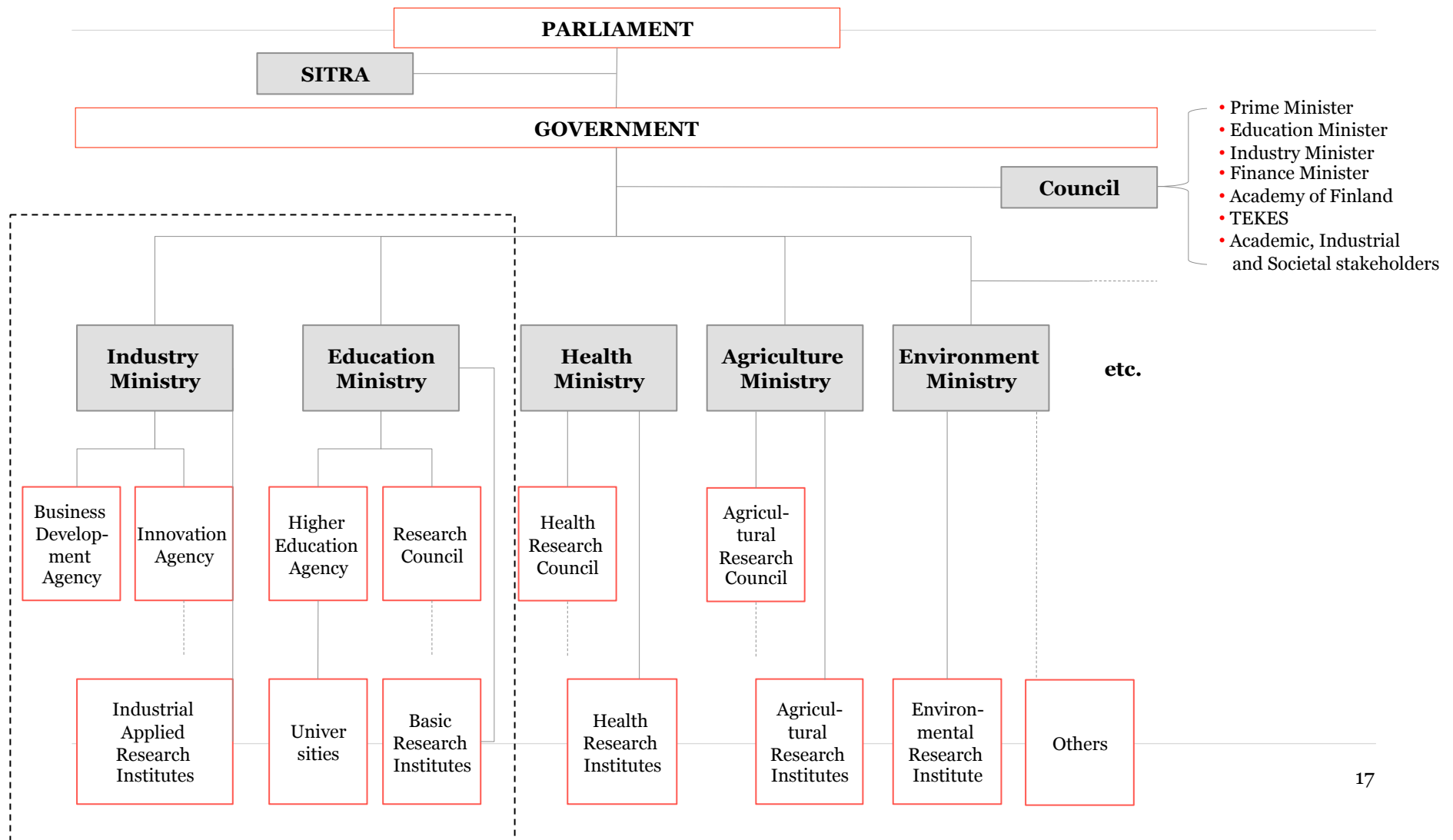
GSM transformed Ericsson from a small player to global dominance in digital mobile systems



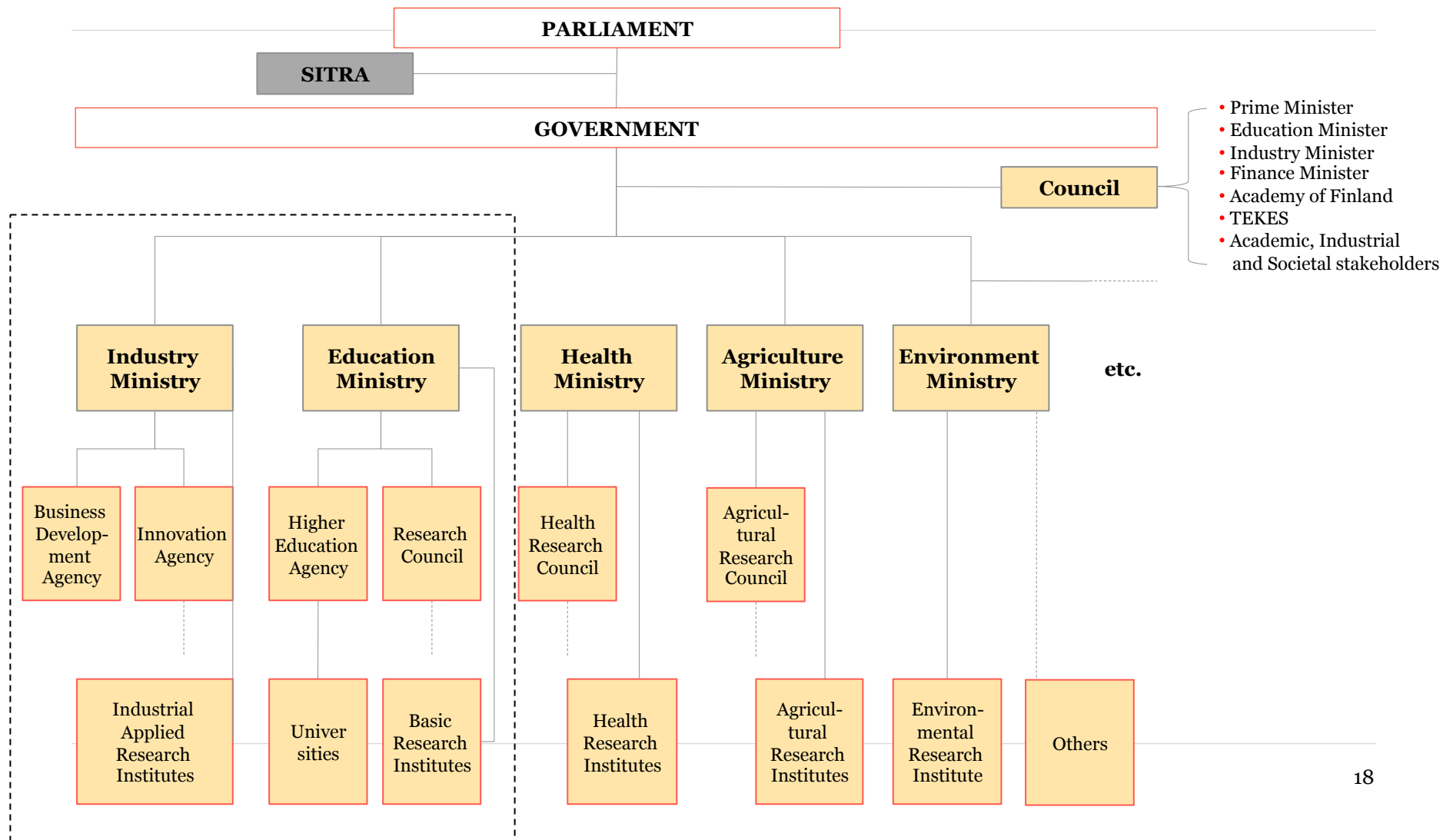
All countries struggle to govern the state's role in the NIS



The 'two pillar' model in Finland is highly effective



Where's the strategic intelligence in Finland?



Emerging ideas on running a good NRIS

- Since innovation, applied and basic research are interdependent, all three need to be healthy and interlinkages among them and the institutions that perform and fund them must be strong
 - Scientific performance must converge towards global levels and exceed this in selected areas of national or industrial importance
 - Since a lot of important innovation involves adapting and using existing knowledge, there must be strong capabilities for accessing global knowledge, including through FDI, connecting MNCs to domestic supply chains, reverse engineering and ‘unbundling’
 - It is important to have broad capabilities in basic research in order to keep university teaching up to date, ensure there is scientific capability available in most fields to meet policy and societal knowledge needs and to provide a point of growth when it turns out that increased capacity is needed
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- A significant proportion of basic and applied research should be directed towards areas of national and industrial priority – not only to make knowledge but also educated and trained people
- Links between industry and the research and higher education system (including the applied research institutes) are important both for ‘advanced’ and less advanced companies, though the type of link and the right counterpart will depend upon the absorptive capacities of the individual firms
- NRIS governance needs to include a transparent ‘arena’ in which stakeholders and decision-makers can debate and establish broad R&D&I priorities, leaving the budget to the government and the details of implementation to others
- Members of the arena should act as experts and not as representatives, and should not be incentivised by the process to represent their own or other organisations

- The strategic intelligence needed should be created and analysed in a distributed way across the institutions of the NRIS
- Evaluation is a key component of strategic intelligence and requires the same ‘intervention logic’ at its heart as programme design. The overriding purpose of evaluation is to understand the degree to which interventions tackle and solve societal problems. Evaluation of outputs alone has limited value
- R&D&I policy should be implemented according to the principle of subsidiarity: decisions should be made as low down as possible in the hierarchy of organisations involved
- The organisations involved, not least those responsible for funding R&D&I, need appropriately skilled and experienced people and should use transparent, efficient and rational programming practices that take account both of national priorities and the needs of stakeholders

- Mechanisms are needed to articulate demand for technology and research, not only supply. The knowledge and experience of stakeholders is needed in order to do this effectively
- The state's role in governing the parts of the NRIS under its control must include the ability to act as a 'change agent' – overcoming lock-ins where these have a negative effect on the NRIS. It needs to be able to tackle systemic failures as well as the traditional market failures involved in funding research
- More broadly, the state must have the capacity to do 'bottleneck analysis' in the NRIS, generating strategic intelligence about performance, problems and opportunities for change
- The NRIS must be internationally open, both in industry and in the research and higher education system, linking the Czech communities to global sources of knowledge and to the quality demands of the global science and technology systems

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Thank you

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