Economics and Policy of Innovation

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Dr Claudio Cozza

DEAMS – University of Trieste

Science, Technology and Innovation Policy (Chapter 22)

Technology Policy in History

- New technology cannons produced under Henry VIII
  - Why?
  - Need to fight against the French…
  - … But also thanks to the UK specificities: abundance of iron, attraction of immigrants for political/religious reasons
  - From competition to monopoly

Technology Policy in History (2)

- New technology in dairy processing, in Denmark:
  - In reality, the novel process was developed in Sweden…
  - … But the situation in Denmark made it favourable its diffusion there.
  - The diffusion of this innovation was not strongly led by the Government (as under Henry VIII), but happened in a more "cooperative way".
  - State support was more indirect.

Technology Policy in History (3)

- Modern Innovation Policy is in between. If we look at the US, we find:
  - Strong Policies directly led by the Government (e.g. The programs to develop the atomic bomb or the following programs aimed at fighting the Soviet Union during the cold war).
  - But US policies have been also indirect, as in the case of the upgrading of agricultural activities (through improving in the education and in the diffusion of land universities).

The key role of OECD (oecd.org)

The Organisation for European Economic Cooperation (OEEC) was established in 1948 to run the US-financed Marshall Plan for reconstruction of a continent ravaged by war, in Europe.

Encouraged by its success and the prospect of carrying its work forward on a global stage, Canada and the US joined OEEC members in signing the new OECD Convention on 14 December 1960. The Organisation for Economic Co-operation and Development (OECD) was officially born on 30 September 1961, when the Convention entered into force.

Other countries joined in, starting with Japan in 1964. Today, 34 OECD member countries worldwide regularly turn to one another to identify problems, discuss and analyse them, and promote policies to solve them.

Together with growing economies like the BRICS, the OECD brings around its table today 39 countries that account for 80% of world trade and investment.

The key role of OECD (2)

Key dates:

- 1963: Science policy is finally recognized as crucial, as well as its statistical measurement (first edition of the Frascati Manual).
- 1970: Human and social considerations are brought in the Science Policy discussion.
- 1980: Innovation Policy is discussed, with a broader approach (e.g. focusing on the capacity of society to absorb new technology).
- 1990: the “linear model” for innovation is recognized as being too limited, and innovation is finally defined as an interactive process.
- 2001: with the new century, the focus is strongly moved towards the new economy and the pervasiveness of ICT.

Three different types of policy

- **Science policy**: started in the US during the Second World War → also during the Cold War, the idea was to allocate enough resources to: basic science, government R&D labs, universities.
- Important issues:
  - Wise use of public money;
  - Freedom of science and research (especially in universities);
  - Evaluation of research as a crucial policy tool.

Three different types of policy (2)

- **Technology policy**: started mainly in the 1960s, with a stronger focus on sectors.
- The identification of "strategic technologies" for high-income countries is different for emerging countries.
- The most relevant cases have been the Asian ones (Japan, Korea, Taiwan), where the catching-up process has been sustained by the selection of relevant technologies at the right time.
- However, strategies of promoting "national champions" as in Europe in the 1980s have been unsuccessful.
- Main policy tool: technology forecasting.

Three different types of policy (3)

- **Innovation policy**: is a more recent concept, developed mainly in the 1990s.
- An Innovation policy can be of two types:
  - A first type, where the State does not intervene too much, but it rather focuses on the "framework conditions" (protection of IPR, competition policies, improvement of infrastructures and higher education, etc.);
  - A second type, more in line with the "innovation system" approach, with a strong focus on the review and support of linkages among the parts of the system.

Figure 22.1 (1)

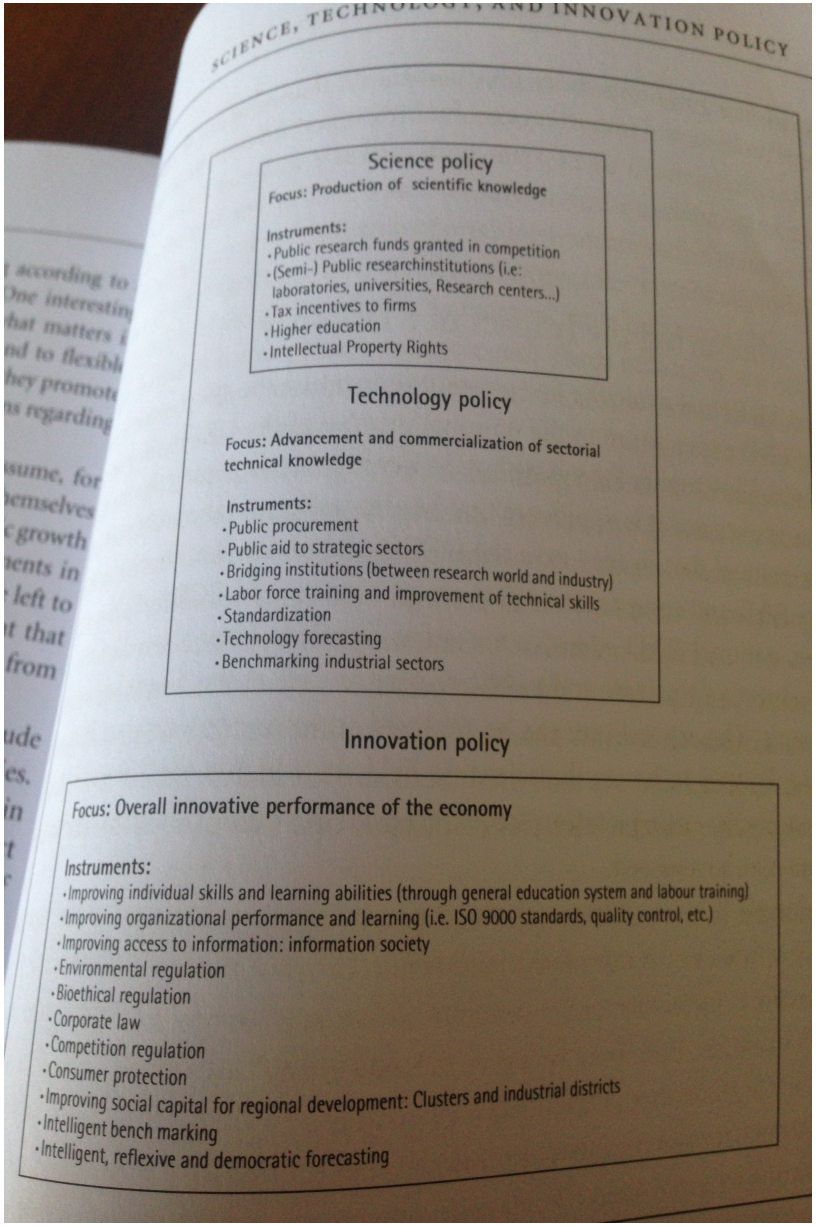
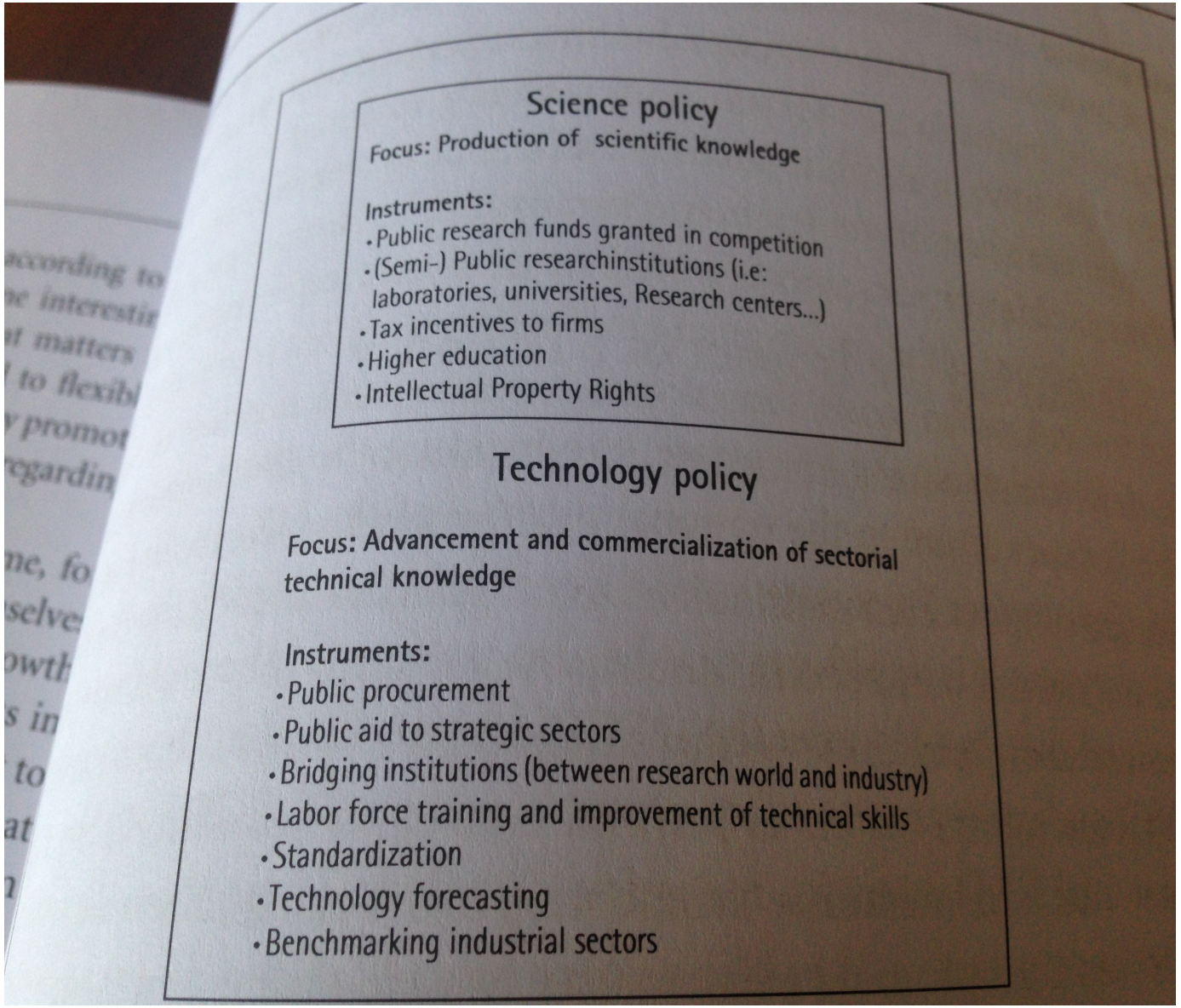

SCIENCE, TECHNOLOGY AND INNOVATION POLICY
Science policy
Focus: Production of scientific knowledge
Instruments:
• Public research funds granted in competition
• (Semi-) Public researchinstitutions (i.e: laboratories, universities, Research centers...)
• Tax incentives to firms
• Higher education
• Intellectual Property Rights
Technology policy
Focus: Advancement and commercialization of sectorial technical knowledge
Instruments:
• Public procurement
• Public aid to strategic sectors
• Bridging institutions (between research world and industry)
• Labor force training and improvement of technical skills
• Standardization
• Technology forecasting
• Benchmarking industrial sectors
Innovation policy
Focus: Overall innovative performance of the economy
Instruments:
• Improving individual skills and learning abilities (through general education system and labour training)
• Improving organizational performance and learning (i.e. ISO 9000 standards, quality control, etc.)
• Improving access to information: information society
• Environmental regulation
• Bioethical regulation
• Corporate law
• Competition regulation
• Consumer protection
• Improving social capital for regional development: Clusters and industrial districts
• Intelligent bench marking
• Intelligent, reflexive and democratic forecasting

Figure 22.1 (2)



Science policy

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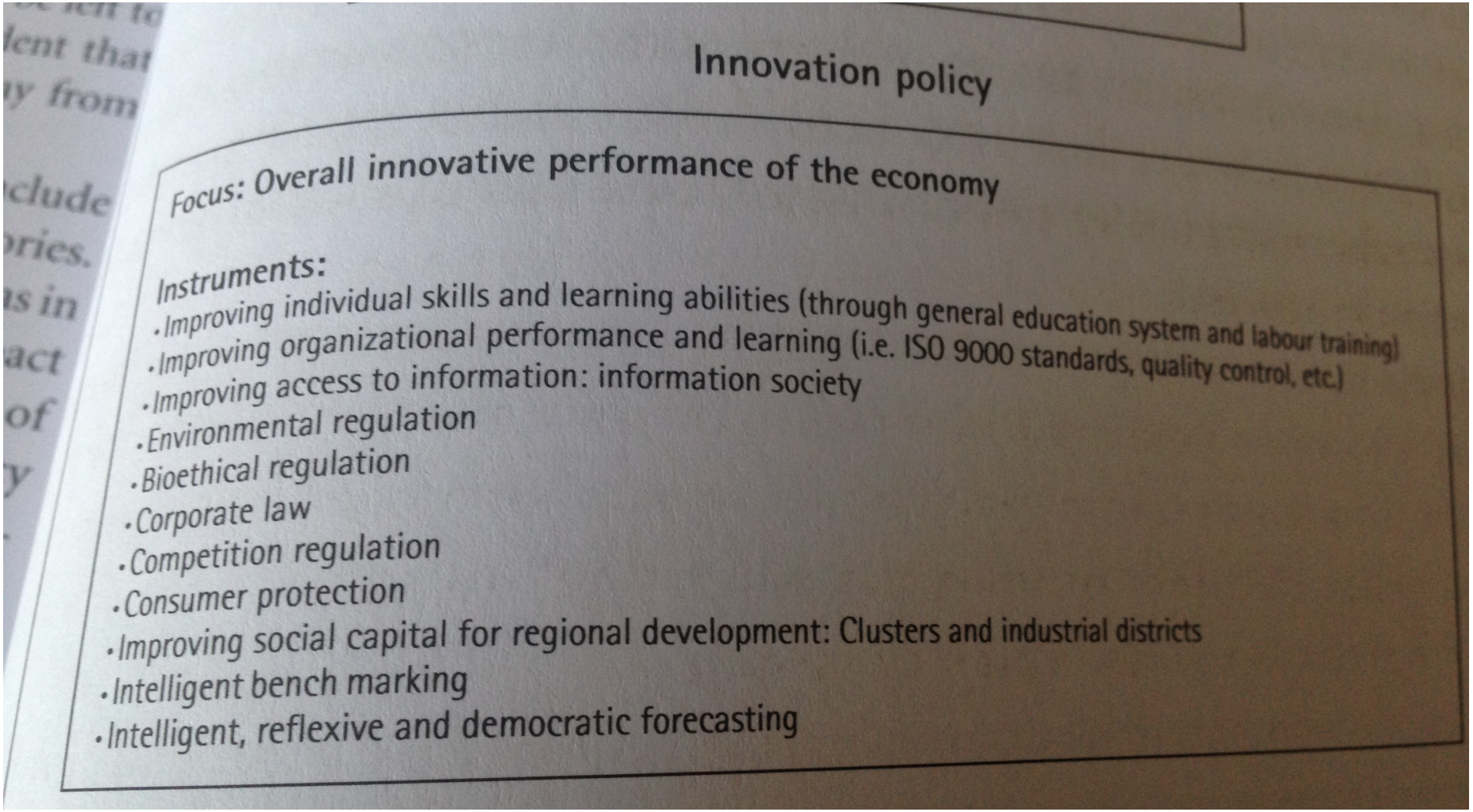

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Innovation policy in the neoclassical perspective

- The State should intervene only if a market failure has happened.
- In innovation, the typical market failure is a lack of investments in knowledge → therefore incentives should be developed to increase such investments.
- However, some neoclassical assumptions are in contrast with the overall view of innovation:
  - The representative (average) firm is perfectly rational;
  - Markets are competitive.
- We know instead that high-tech and innovative markets are highly concentrated (few top firms, as in Schumpeter Mark II) and always characterised by high uncertainty (also for market leaders).

Science, Technology and Innovation Policy in reality

- In reality, no country can focus on just one type of policy above mentioned (Science, Technology, Innovation).
- It is always used a "mix" of them → not by chance, in EU official documents on Innovation, the "policy mix" is often recalled.
- However, the same policy tools/measures have been selected and used in different ways in the world, leading to different "policy designs".

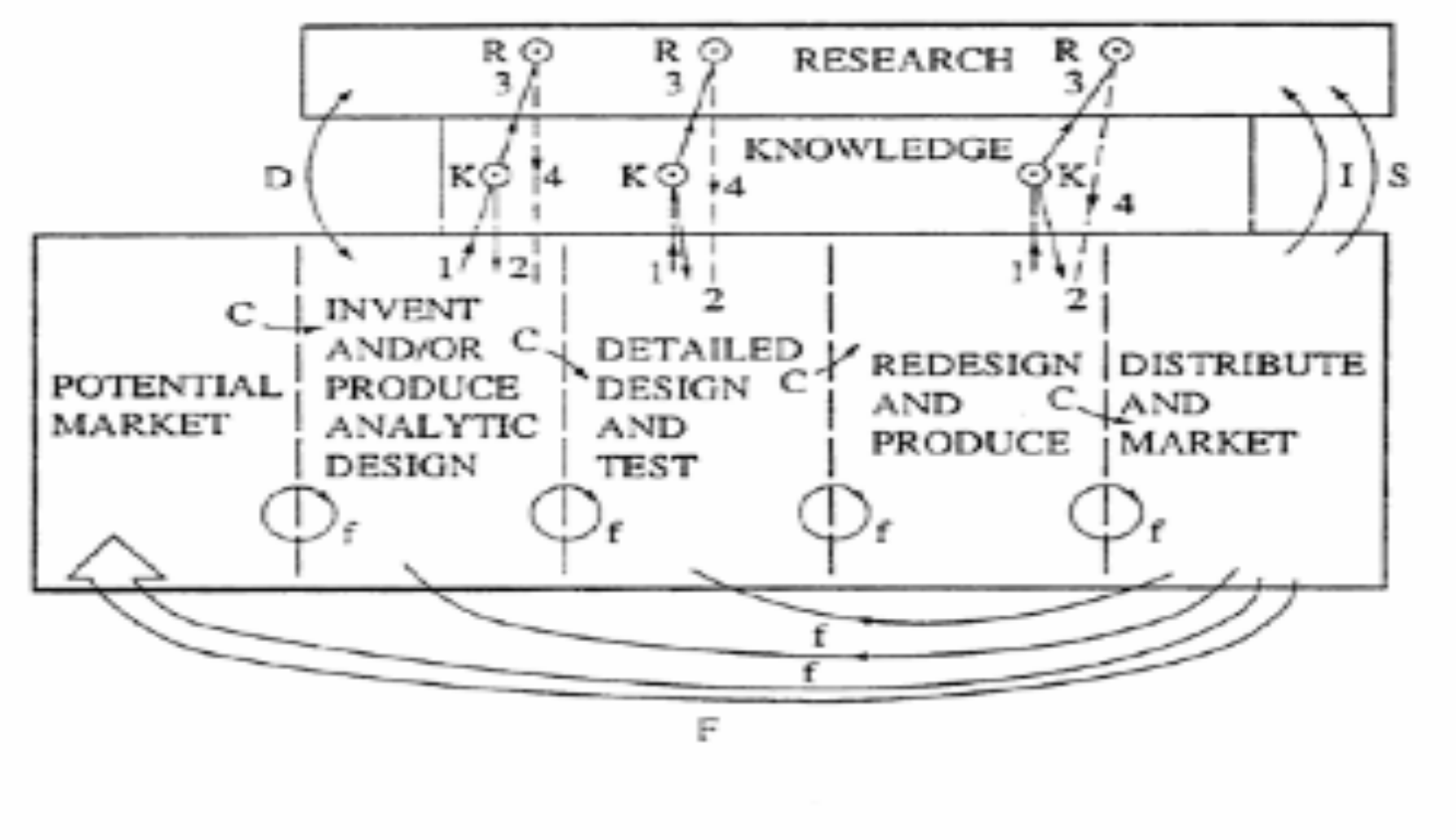
Science, Technology and Innovation Policy in the US

- In the US, the first policy document was the report by Vannevar Bush, published in 1945.
- He was suggesting a unique coordinating authority (that became then the National Science Foundation).
- However, in the US some leading sectors have been stronger than this authority itself: nuclear, defence, space and health.
- These sectors lead the technologies of some *industrial complexes* vertically organised (more or less like a value chain).

Science, Technology and Innovation Policy in the US (2)

- Such an approach presents disadvantages:
  - Lack of coordination → competition among these large leading sectors;
  - → bias in favour of military and space expenditure;
  - → despite being a "competitive economy", a lot of public money goes to few industries dominated by few large firms.
- And advantages:
  - Economies of scale are very strong;
  - The diversity of research efforts is very high and leads to positive feedbacks for the whole system (chain-linked model of innovation).

Figure 1: Chain linked innovation model



Source: Kline and Rosenberg 1986, adapted

Science, Technology and Innovation Policy in Japan

- Differently from the US, the Japanese technology policy has been very explicit;
- It means that Japan ministries (especially the MITI, Ministry of Technology) officially promoted some specific industries and sectors;
- That was done also with the support of some private firms (monopolistic as in the case of the telecom company NTT) that coordinated the technological development of other private firms (e.g. Hitachi and NEC);
- Paradoxically, money spent in subsidies by the Japanese Government was less than in the US…

The Innovation Union

- The **Innovation Union** is the European Union **strategy** to create an innovation-friendly environment that makes it easier for great ideas to be turned into products and services that will bring our economy growth and jobs.
- The Innovation Union is **one of the seven flagship initiatives** of the Europe 2020 strategy for smart, sustainable and inclusive growth.

The Innovation Union (2)

Smart growth

- Digital agenda for Europe
- Innovation Union
- Youth on the move

Sustainable growth

- Resource efficient Europe
- An industrial policy for the globalisation era

Inclusive growth

- An agenda for new skills and jobs
- European platform against poverty

The Innovation Union (3)

- The Innovation Union plan contains **over thirty actions points, with the aim to do three things:**

1. make Europe into a **world-class science performer**;
2. remove **obstacles to innovation** – like expensive patenting, market fragmentation, slow standard-setting and skills shortages – which currently prevent ideas getting quickly to market; and
3. revolutionise the way **public and private sectors work together**, notably through Innovation Partnerships between the European institutions, national and regional authorities and business.

The Innovation Union (4)

- Promoting excellence in education and skills development
- Delivering the European Research Area
- Focusing EU funding instruments on Innovation Union priorities
- Promoting the European Institute of Innovation and Technology (EIT) as a model of innovation governance in Europe
- Enhancing access to finance for innovative companies
- Creating a single innovation market
- Promoting openness and capitalising on Europe's creative potential
- Spreading the benefits of innovation across the Union
- Increasing social benefits
- Pooling forces to achieve breakthroughs: European Innovation Partnerships
- Leveraging our policies externally
- Reforming research and innovation systems
- Measuring Progress

Many policy tools

Appendix C Typology of policy instruments

Innovation system element and policy objective	**Policy instrument**	**Description**
Policies enhancing skills for innovation	Support to human resources for R&D	Measures that support the development of human resources for research such as doctoral grants to support research in a specific field or encourage the involvement of a specific group in research, support to further professionalization of research staff, post-doc programmes, supporting researchers to participate in international networks, etc.
	Innovation related skills education	Support to developing innovation and entrepreneurship skills of researchers, business managers, students, support to vocational training with an innovation/research dimension, support to innovation management trainings of staff in enterprises/universities.

Many policy tools (2)

Policies to support investment in research and technologies	Competitive funding of research (e.g. universities and public research organisations)	Competitive grants provided to academic research institutions, universities, and public and private non-profit research institutions. The focus is on conducting basic research projects or research projects addressing a societal challenge and less on involving companies or industry.
	Direct business R&D support	Competitive grants provided to enterprises to engage them in pre-competitive, industrial research.
	R&D infrastructure	Support to the development of national research infrastructures (both general or tied to a specific programme) and to ESFRI - European Strategy for Research Infrastructure plans
	Centres of Excellence	A centre of excellence is a structure where research and technology development (RTD) is performed of world standard, in terms of measurable scientific production (including training) and/or technological innovation. (Erawatch, 2007)

Many policy tools (3)

Policies to strengthen linkages within innovation systems	Collaborative R&D programmes	Measures to support R&D projects conducted in some kind of a co-operation between public/academic/not-for-profit sector research institutions and enterprises (including specific schemes to encourage the business sector to fund research in research institutions).
	Cluster programmes	*All policy initiatives aimed at specifically promoting cluster development and support to cluster management at national or regional levels. This includes all state aid measures classified as aid for innovation clusters in the Community Guidelines for State Aids for R&D and Innovation*
	Mobility between academia and business	Support provided to encourage the recruitment of researchers by enterprises; 'industrial resident schemes' where industry staff enrols in academia, including recruitment of skilled personnel in enterprises.
	Technology transfer	Support given to establish structures and mechanisms to encourage the transfer of know-how and technology from research to business: funding of technology transfer offices and other knowledge transfer structures between academia and industry, SME-academia networks and other research commercialisation support structures, matching SMEs with an appropriate "technology provider" in order to ad dress similar technological problems, relay projects between academia and business.
	Competence centres	Competence Centres are investments by Member States made to encourage greater efficiency in the interaction between researchers, industry, and the public sector, in research topics that promote economic growth by their direct relevance to industry agendas. They can be considered as public-private partnerships, aimed at enabling research which might not otherwise take place, and facilitate better interaction with industry towards producing tangible economic benefits (CREST, 2008).

An example: the PACINNO project

The goal of PACINNO is to **establish a platform** for **cooperation** in research and innovation covering the whole **Adriatic region** (8 countries: Italy, Slovenia, Croatia, Bosnia-Hercegovina, Serbia, Montenegro, Albania and Greece).

Main targets:

- Researchers
- Start-Ups and "would-be" entrepreneurs
- SMEs and Pocket Multinationals
- ***Policymakers***

ACTIVITIES for Policymakers

Effective **policies** on innovation are necessarily grounded on a profound **knowledge** of how innovation is taking place at the **macro** and **micro** level.

A major activity of PACINNO is the analysis of the **Innovation systems** and processes within the Adriatic Region and the development of:

- Detailed Innovation Maps and Indicators
- Regional Innovation Policy Measures
- Case studies of best Innovation Policy practices

Innovation Policies: how to compare countries?

- Existing taxonomies of Research and Innovation (R&I) Policies are always a bit problematic → which are the "borders" of R&I? which are main categories to be analysed?
- Even more when dealing with heterogeneous areas (like the Adriatic one).

Our approach

We decided that our taxonomy had to be **simple** but **comprehensive** → PACINNO aims at full comparability of Adriatic countries.

How?

1. Identification of **few** macro-categories
2. Distinction between **direct vs. indirect** governmental support for all categories (usually it regards only R&D tax credit)

PACINNO novel taxonomy

1	R&D	1a	Direct support
		1b	Indirect support
2	Human resources	2a	Direct support
		2b	Indirect support
3	Collaboration	3a	Direct support
		3b	Indirect support
4	Innovation capabilities	4a	Direct support
		4b	Indirect support

PACINNO novel taxonomy (2)

Examples:

- 1 a: R&D grants, subsidies and all money from Government to R&D performers
- 1 b: tax credit and all other fiscal incentives to R&D performers

PACINNO novel taxonomy (3)

Examples:

- 2 a: grants and other policies to directly support the development of Human Resources
- 2 b: bank loans to students, tax incentives to lifelong learning (also of researchers) etc.

PACINNO novel taxonomy (4)

Examples:

- 3 a&b: all policies favouring R&I collaboration, including Technology Transfer ones
- 4 a&b: all policies regarding embodied technological change, purchase of machineries, regulation of standards, IPR, etc.
- Same distinction direct/indirect

Some numbers in percentage

(caveat: absolute numbers can be very different across Adriatic countries)

Policy category	1a	1b	2a	2b	3a	3b	4a	4b
Albania			17%		**83%**			
BiH	**31%**		19%		13%		**31%**	6%
Croatia	13%	1%	27%		27%		**31%**	
Greece	23%		21%		**49%**	5%		2%
Italy	**25%**	15%	5%		8%	8%	23%	18%
Montenegro	**25%**	17%	17%	17%	17%	8%		
Serbia	16%		24%	4%	16%		**28%**	12%
Slovenia	**30%**	4%	13%		22%		24%	7%
Adriatic area	**22%**	**4%**	**18%**	**1%**	**25%**	**2%**	**21%**	**6%**

Smart Specialisation

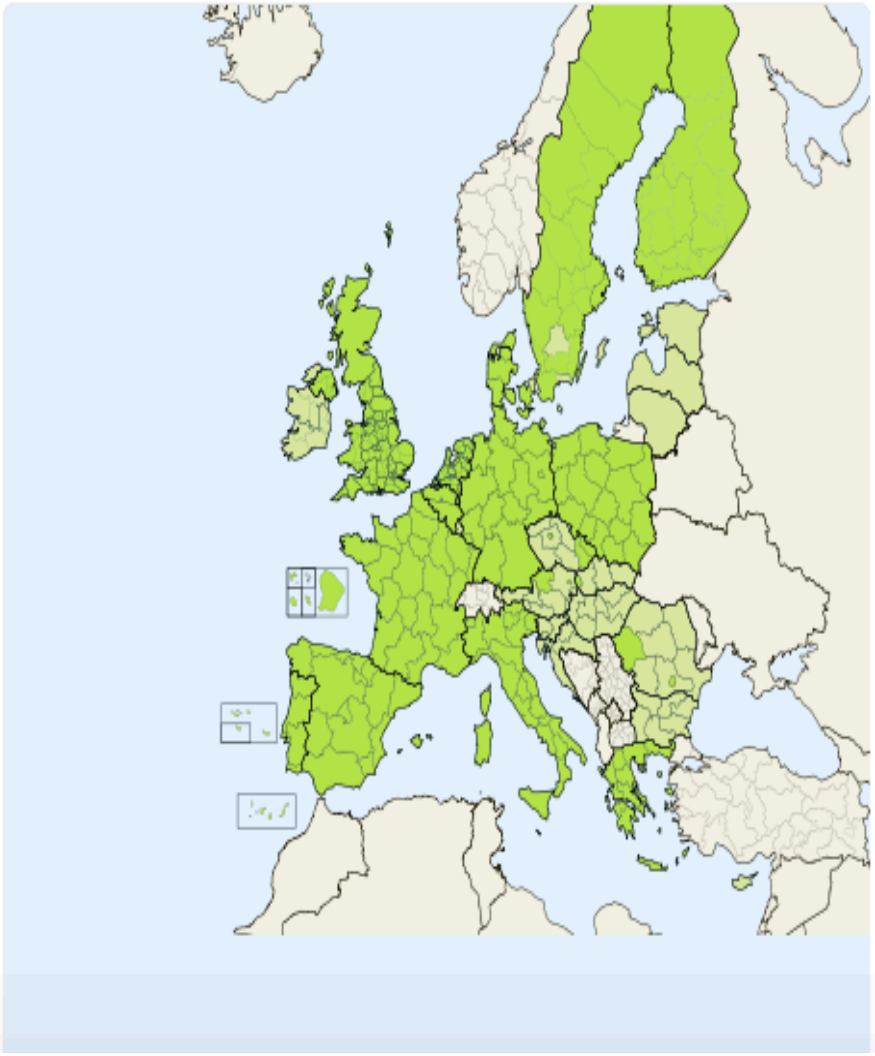
- The Smart specialisation' approach combines industrial, educational and innovation policies to suggest that countries or regions identify and select a limited number of priority areas for knowledge-based investments, focusing on their strengths and comparative advantages.

- Eye@RIS3

EYE@RIS3

Select Region Refresh

Match All of the following fields:



Research & Innovation Capabilities

Select

Business Areas & Target Market

Select

EU Priority

Select

Research & Innovation Capabilities (Subcategory)

Select

Business Areas & Target Market (Subcategory)

Select

EU Priority (Subcategory)

Select

Region/Country Name

NUTS ID

Description of Priority

Refined Search

Approximated Search