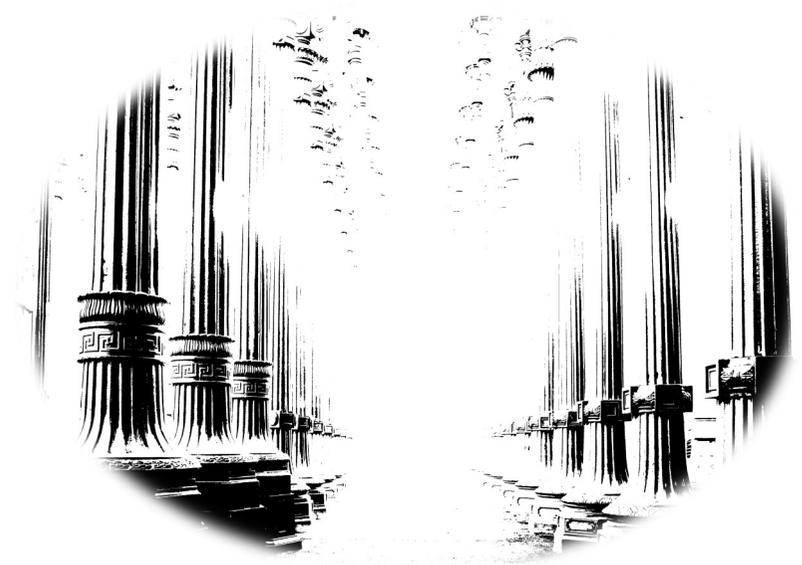


The basic tenets of innovation policy and innovation systems



Two perspectives on innovation and institutions

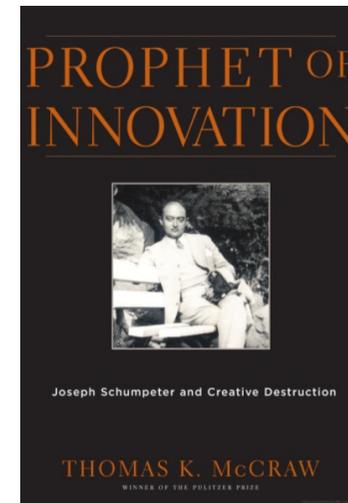
- Understanding the role of institutions and policies on innovation (top down, the big picture)
- Understanding city and regional development as processes of institutional change (deinstitutionalisation and institutionalisation)



Joseph Schumpeter: The Father of Innovation Studies

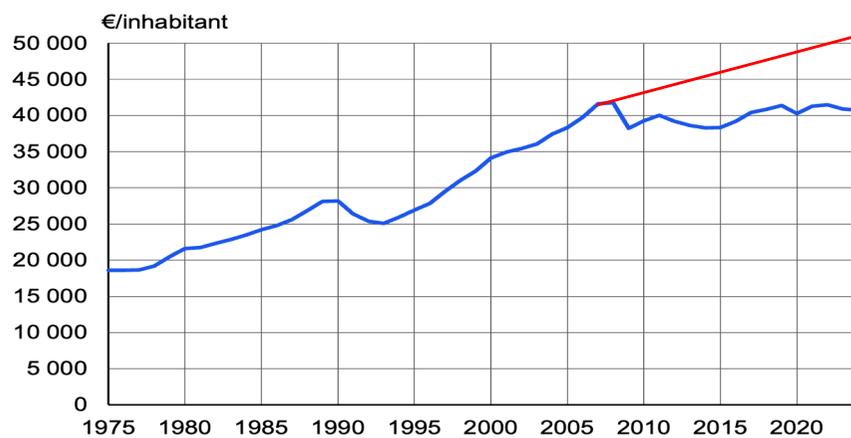
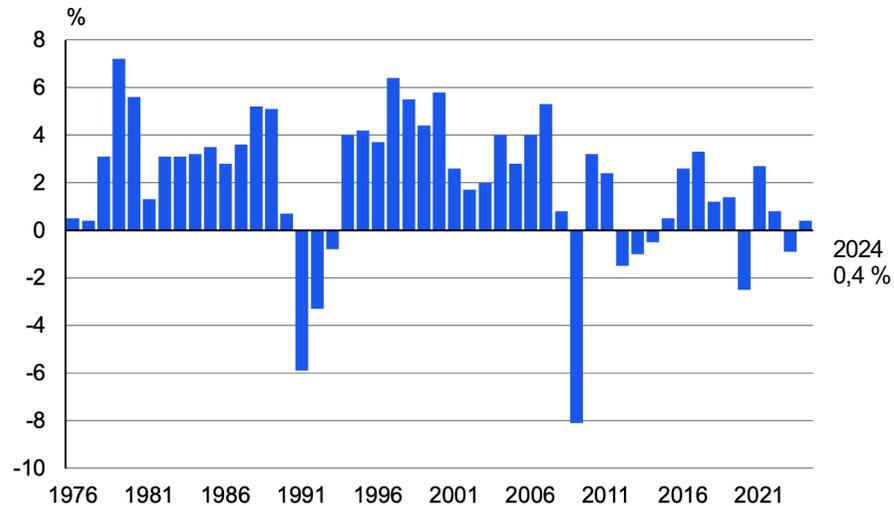
The primary point of his work is that capitalism is to be understood as an **evolutionary process of continuous innovation** and creative destruction

He argued economic change revolves around innovation, entrepreneurial activities, and market power





Annual change in the volume of gross domestic product, 1976–2024*



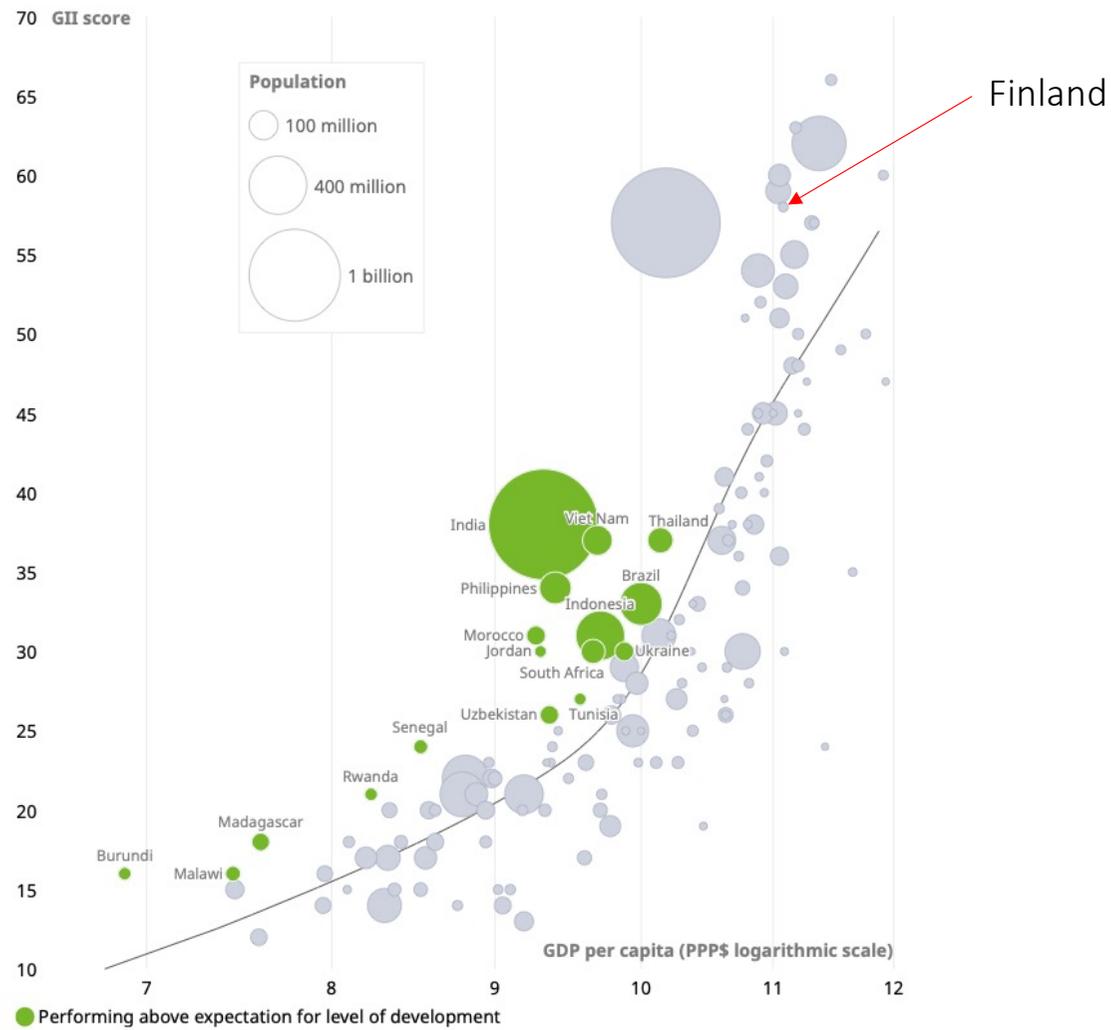
https://stat.fi/tup/suoluk/suoluk_kansantalous_en.html

Cluster policy and innovation system enter Finland

- Deep recession of the early 90's
- High-road targeted - continuing with the old path simply was not an option
- Cluster and innovation system as key focusing devices

Platforms and innovation ecosystems enter Finland

- Lost 15 years (2009/10->)
- Something more dynamic called for
- Platform and innovation ecosystems as key focusing devices



Note: Bubbles are sized according to population. The cubic spline trendline shows the expected level of innovation performance at different levels of GDP per capita for all economies covered in the GII 2025.
 Source: Global Innovation Index Database, WIPO, 2025.



GII rank	Economy	Score	Income group	Region	GII rank	Economy	Score	Income group	Region
1	Switzerland	66.0	1	1	71	Colombia	28.5	18	5
2	Sweden	62.6	2	2	72	Costa Rica	28.4	19	6
3	United States	61.7	3	1	73	Kuwait	28.2	49	13
4	Republic of Korea	60.0	4	1	74	Republic of Moldova	27.4	20	37
5	Singapore	59.9	5	2	75	Seychelles	27.2	50	3
6	United Kingdom	59.1	6	3	76	Tunisia	27.0	6	14
7	Finland	57.7	7	4	77	Argentina	26.8	21	7
8	Netherlands (Kingdom of the)	57.0	8	5	78	Mongolia	26.7	22	13
9	Denmark	56.9	9	6	79	Uzbekistan	26.5	7	3
10	China	56.6	1	3	80	Peru	26.5	23	8
11	Germany	55.5	10	7	81	Kazakhstan	26.3	24	4
12	Japan	53.6	11	4	82	Panama	25.9	51	9
13	France	53.4	12	8	83	Jamaica	25.2	25	10
14	Israel	52.3	13	1	84	Barbados	25.1	52	11
15	Hong Kong, China	51.5	14	5	85	Belarus	25.1	26	38
16	Estonia	51.1	15	9	86	Egypt	24.7	8	15
17	Canada	51.1	16	2	87	Botswana	24.6	27	4
18	Ireland	50.4	17	10	88	Brunei Darussalam	24.5	53	14
19	Austria	50.1	18	11	89	Senegal	23.8	9	5
20	Norway	49.2	19	12	90	Lebanon	23.6	10	16
21	Belgium	48.5	20	13	91	Namibia	23.5	28	6
22	Australia	48.0	21	6	92	Bosnia and Herzegovina	23.4	29	39
23	Luxembourg	47.3	22	14	93	Sri Lanka	22.9	11	5
24	Iceland	47.0	23	15	94	Azerbaijan	22.9	30	17
25	Cyprus	45.5	24	2	95	Cabo Verde	22.6	12	7
26	New Zealand	45.5	25	7	96	Kyrgyzstan	22.6	13	6
27	Malta	45.4	26	16	97	Dominican Republic	22.6	31	12
28	Italy	44.9	27	17	98	El Salvador	22.2	32	13
29	Spain	44.6	28	18	99	Pakistan	22.1	14	7
30	United Arab Emirates	44.2	29	3	100	Cambodia	22.0	15	15
31	Portugal	43.9	30	19	101	Ghana	21.9	16	8
32	Czech Republic	42.0	31	20	102	Kenya	21.4	17	9
33	Lithuania	40.8	32	21	103	Paraguay	21.4	33	18
34	Malaysia	40.6	2	8	104	Rwanda	21.1	1	10
35	Slovenia	40.1	33	22	105	Nigeria	21.1	18	11
36	Hungary	40.0	34	23	106	Bangladesh	21.0	19	8
37	Bulgaria	39.1	35	24	107	Nepal	20.2	20	9
38	India	38.2	1	1	108	Tajikistan	20.2	21	10
39	Poland	37.7	36	25	109	Lao People's Democratic Republic	20.1	22	16
40	Croatia	37.7	37	26	110	Côte d'Ivoire	19.7	23	12
41	Latvia	37.5	38	27	111	Bolivia (Plurinational State of)	19.6	24	15
42	Greece	37.4	39	28	112	Zambia	19.6	25	13
43	Türkiye	37.2	3	4	113	Ecuador	19.5	34	16
44	Viet Nam	37.1	2	9	114	Trinidad and Tobago	19.3	54	17
45	Thailand	36.7	4	10	115	Algeria	18.9	35	18
46	Saudi Arabia	36.0	40	5	116	Cameroon	18.2	26	14
47	Slovakia	35.5	41	29	117	Togo	18.1	2	15
48	Qatar	34.6	42	6	118	Benin	17.8	27	16
49	Romania	34.3	43	30	119	Honduras	17.7	28	18
50	Philippines	33.6	3	11	120	Madagascar	17.6	3	17
51	Chile	33.1	44	1	121	United Republic of Tanzania	17.5	29	18
52	Brazil	32.9	5	2	122	Myanmar	17.3	30	17
53	Mauritius	32.5	6	1	123	Guatemala	17.1	36	19
54	Serbia	31.7	7	31	124	Uganda	17.1	4	19
55	Indonesia	31.3	8	12	125	Malawi	16.0	5	20
56	Georgia	31.2	9	7	126	Burkina Faso	15.9	6	21
57	Morocco	31.1	4	8	127	Burundi	15.8	7	22
58	Mexico	30.5	10	3	128	Mozambique	15.4	8	23
59	Armenia	30.5	11	9	129	Zimbabwe	15.4	31	24
60	Russian Federation	30.3	45	2	130	Nicaragua	15.4	32	25
61	South Africa	30.1	12	2	131	Mauritania	15.4	33	25
62	Bahrain	30.0	46	10	132	Lesotho	14.9	34	26
63	North Macedonia	29.8	13	33	133	Guinea	14.9	35	27
64	Montenegro	29.8	14	34	134	Ethiopia	14.4	9	28
65	Jordan	29.7	5	11	135	Mali	14.0	10	29
66	Ukraine	29.7	15	35	136	Venezuela (Bolivarian Republic of)	13.7		21
67	Albania	29.6	16	36	137	Congo	13.6	36	30
68	Uruguay	28.8	47	4	138	Angola	13.0	37	31
69	Oman	28.7	48	12	139	Niger	11.9	11	32
70	Iran (Islamic Republic of)	28.5	17	2					

Note: The World Bank classified Venezuela (Bolivarian Republic of) as an upper-middle income economy until 2021 and has been unclassified since then due to the unavailability of data.
 Source: Global Innovation Index Database, WIPO, 2025.

Global Innovation Index 2025 rankings

<https://www.wipo.int/web-publications/global-innovation-index-2025/assets/80937/global-innovation-index-2025-en.pdf>

- Institutions (FIN 5th)
- Human capital and research (FIN 5th)
- Infrastructure (FIN 3rd)
- Market sophistication (FIN 11th)
- Business sophistication (FIN 12th)
- Knowledge and technology outputs (FIN 8th)
- Creative outputs (FIN 16 th)

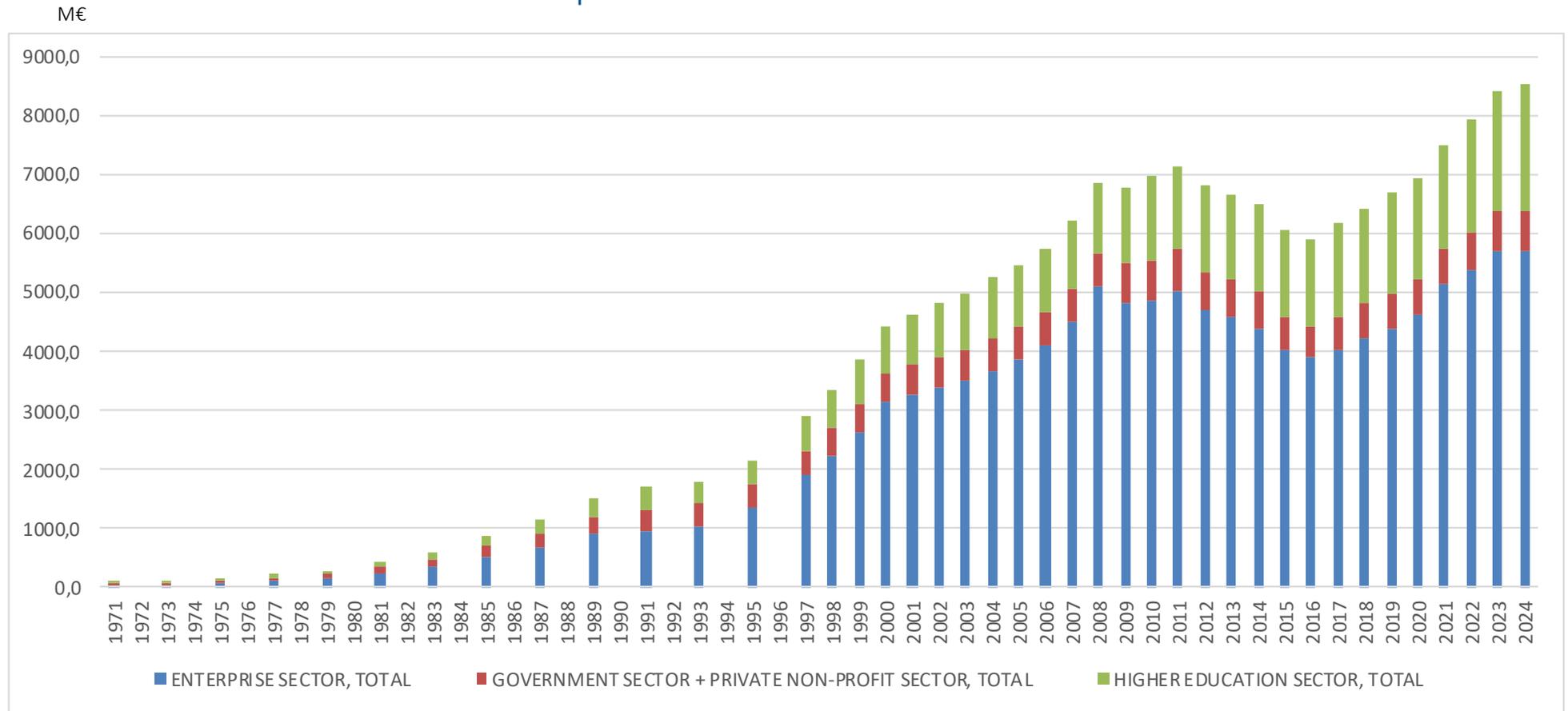
Finland

7

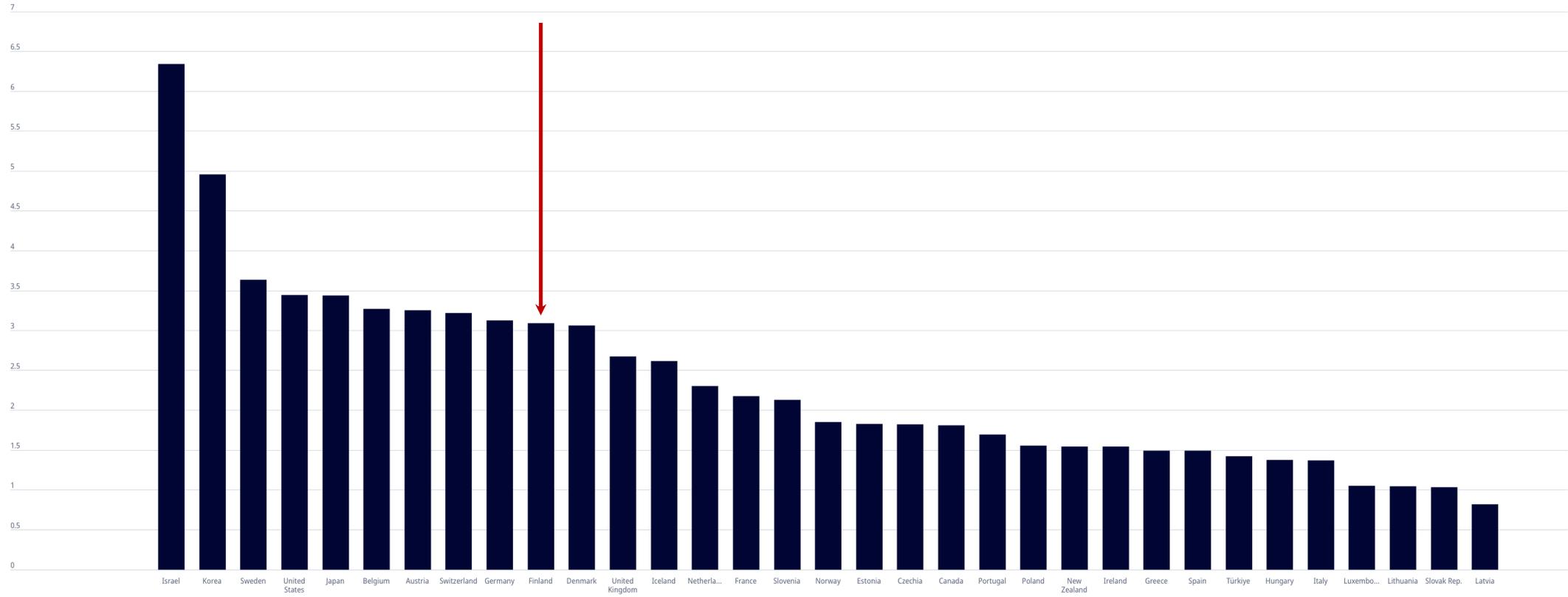
Output rank	Input rank	Income	Region	Population (mn)	GDP, PPP\$ (bn)	GDP per capita, PPP\$
10	5	High	EUR	5.6	361.3	64,657

	Score/Value	Rank		Score/Value	Rank
Institutions	83.6	5	Business sophistication	55.3	12
1.1 Institutional environment	84.6	11	5.1 Knowledge workers	59.6	12
1.1.1 Operational stability for businesses*	83.3	14	5.1.1 Knowledge-intensive employment, %	47.8	17
1.1.2 Government effectiveness*	85.8	6	5.1.2 Females employed w/advanced degrees, %	27.0	16
1.2 Regulatory environment	93.7	3	5.1.3 Youth demographic dividend, %	25.7	114
1.2.1 Regulatory quality*	87.5	7	5.1.4 GERD performed by business, % GDP	2.1	10
1.2.2 Rule of law*	100.0	1	5.1.5 GERD financed by business, %	58.1	16
1.3 Business environment	72.4	14	5.2 Innovation linkages	60.2	16
1.3.1 Policy stability for doing business ¹	78.5	9	5.2.1 Public research–industry co-publications, %	4.9	15
1.3.2 Entrepreneurship policies and culture ¹	66.4	17	5.2.2 University–industry R&D collaboration ¹	64.8	14
Human capital and research	60.9	5	5.2.3 University industry and international engagement, top 5 ¹	66.5	28
2.1 Education	70.0	8	5.2.4 State of cluster development ¹	69.7	35
2.1.1 Expenditure on education, % GDP	6.5	11	5.2.5 Patent families/bn PPP\$ GDP	6.7	5
2.1.2 Government funding/pupil, secondary, % GDP/cap	24.8	21	5.3 Knowledge absorption	46.1	11
2.1.3 School life expectancy, years	19.6	4	5.3.1 Intellectual property payments, % total trade	0.9	45
2.1.4 PISA scales in reading, maths and science	495.1	11	5.3.2 High-tech imports, % total trade	7.9	72
2.1.5 Pupil–teacher ratio, secondary	12.6	60	5.3.3 ICT services imports, % total trade	5.3	4
2.2 Tertiary education	50.0	11	5.3.4 FDI net inflows, % GDP	4.2	37
2.2.1 Tertiary enrolment, % gross	108.1	3	5.3.5 Research talent, % in businesses	59.8	15
2.2.2 Graduates in science and engineering, %	29.4	25	Knowledge and technology outputs	52.7	8
2.2.3 Tertiary inbound mobility, %	9.3	32	6.1 Knowledge creation	55.2	9
2.3 Research and development (R&D)	62.6	11	6.1.1 Patents by origin/bn PPP\$ GDP	11.3	6
2.3.1 Researchers, FTE/mn pop.	8,354.3	5	6.1.2 PCT patents by inventor origin/bn PPP\$ GDP	3.9	5
2.3.2 Gross expenditure on R&D, % GDP	3.1	10	6.1.3 Utility models by origin/bn PPP\$ GDP	0.7	25
2.3.3 Global corporate R&D investors, top 3, mn USD	71.0	13	6.1.4 Scientific and technical articles/bn PPP\$ GDP	38.4	6
2.3.4 QS university ranking, top 3*	50.5	24	6.1.5 Citable documents H-index	42.3	20
Infrastructure	67.6	3	6.2 Knowledge impact	51.2	9
3.1 Information and communication technology (ICT)	95.4	7	6.2.1 Labor productivity growth, %	-0.8	117
3.1.1 ICT access*	100.0	5	6.2.2 Unicorn valuation, % GDP	4.7	8
3.1.2 ICT use*	97.2	4	6.2.3 Software spending, % GDP	0.6	14
3.1.3 Government online service*	89.1	19	6.2.4 High-tech manufacturing, %	34.1	33
3.2 General infrastructure	64.3	8	6.3 Knowledge diffusion	51.6	10
3.2.1 Electricity output, GWh/mn pop.	14,513.4	9	6.3.1 Intellectual property receipts, % total trade	2.7	9
3.2.2 Logistics performance*	95.5	2	6.3.2 Production and export complexity	78.8	18
3.2.3 Gross capital formation, % GDP	24.0	64	6.3.3 High-tech exports, % total trade	4.9	43
3.3 Ecological sustainability	43.0	11	6.3.4 ICT services exports, % total trade	9.0	7
3.3.1 GDP/unit of energy use	7.8	96	6.3.5 ISO 9001 quality/bn PPP\$ GDP	8.4	30
3.3.2 Low-carbon energy use, %	60.5	9	Creative outputs	47.8	16
3.3.3 ISO 14001 environment/bn PPP\$ GDP	4.9	18	7.1 Intangible assets	45.7	22
Market sophistication	58.6	11	7.1.1 Intangible asset intensity, top 15, %	67.0	18
4.1 Credit	57.9	15	7.1.2 Trademarks by origin/bn PPP\$ GDP	26.7	76
4.1.1 Finance for startups and scaleups ¹	100.0	1	7.1.3 Global brand value, top 5,000, % GDP	10.3	14
4.1.2 Domestic credit to private sector, % GDP	93.1	24	7.1.4 Industrial designs by origin/bn PPP\$ GDP	2.2	35
4.1.3 Loans from microfinance institutions, % GDP	3.6	10	7.2 Creative goods and services	27.4	42
4.2 Investment	37.4	13	7.2.1 Cultural and creative services exports, % total trade	0.6	50
4.2.1 Market capitalization, % GDP	n/a	n/a	7.2.2 National feature films/mn pop. 15–69	9.0	13
4.2.2 Venture capital (VC) received, deal count/bn PPP\$ GDP	0.8	7	7.2.3 Entertainment and media market/th pop. 15–69	48.4	14
4.2.3 Late-stage VC deal count, % global VC	0.2	22	7.2.4 Creative goods exports, % total trade	0.5	63
4.2.4 VC investors, deal count/bn PPP\$ GDP	0.9	14	7.3 Online creativity	72.4	7
4.2.5 VC investor co-participation/bn PPP\$ GDP	0.5	10	7.3.1 Top-level domains (TLDs)/th pop. 15–69	39.7	22
4.3 Trade, diversification and market scale	80.6	26	7.3.2 GitHub commits/mn pop. 15–69	98.8	3
4.3.1 Applied tariff rate, weighted avg., %	1.3	24	7.3.3 Mobile app creation/bn PPP\$ GDP	78.8	9
4.3.2 Domestic industry diversification	96.4	9			
4.3.3 Domestic market scale, bn PPP\$	361.3	59			

R&D Expenditure in Finland 1971-2024



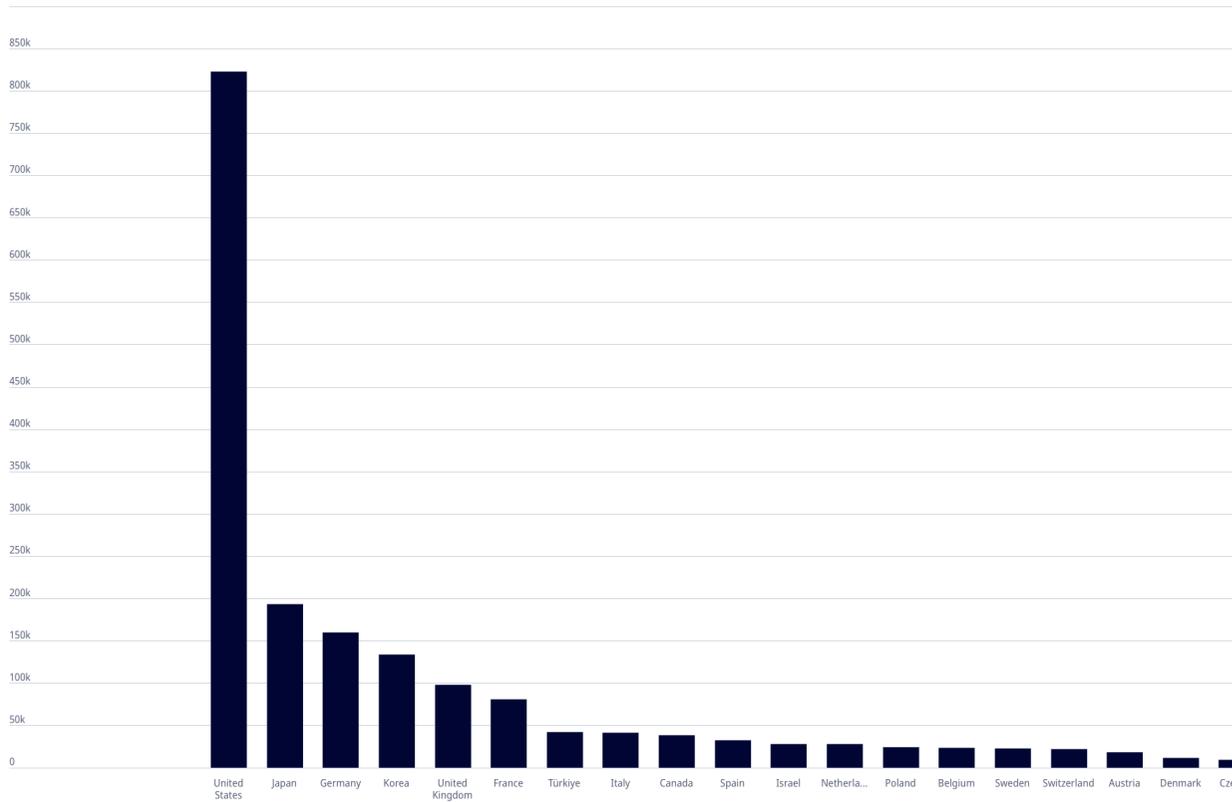
Gross domestic spending on R&D % of GDP, 2023



Source: [Main Science and Technology Indicators \(MSTI database\)](#)
© OECD

<https://www.oecd.org/en/data/indicators/gross-domestic-spending-on-r-d.html>

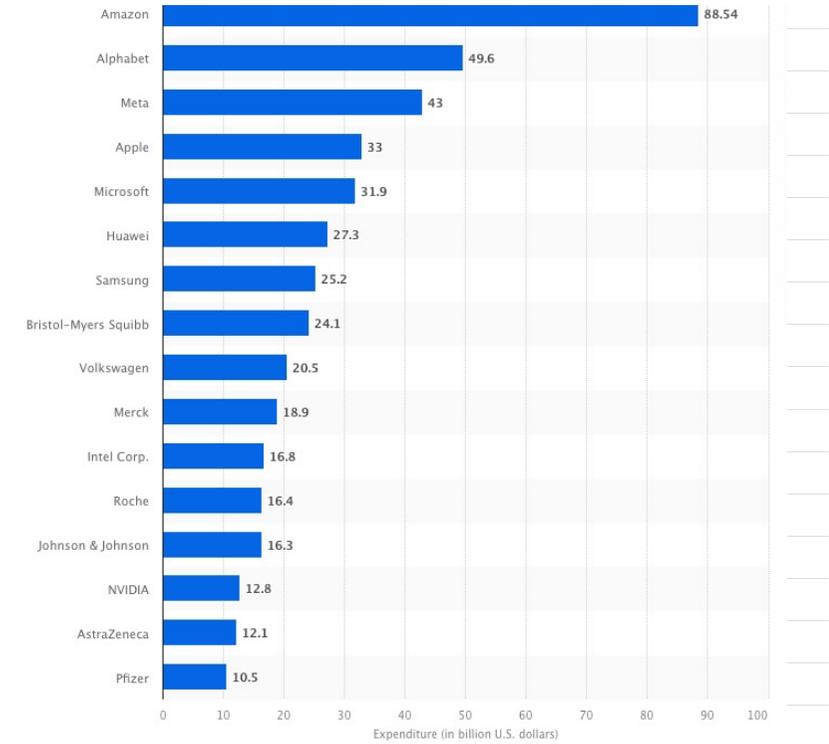
Gross domestic spending on R&D, million US Dollars (2023)



Source: [Main Science and Technology Indicators \(MSTI database\)](#)
© OECD

Economy & Politics › Economy

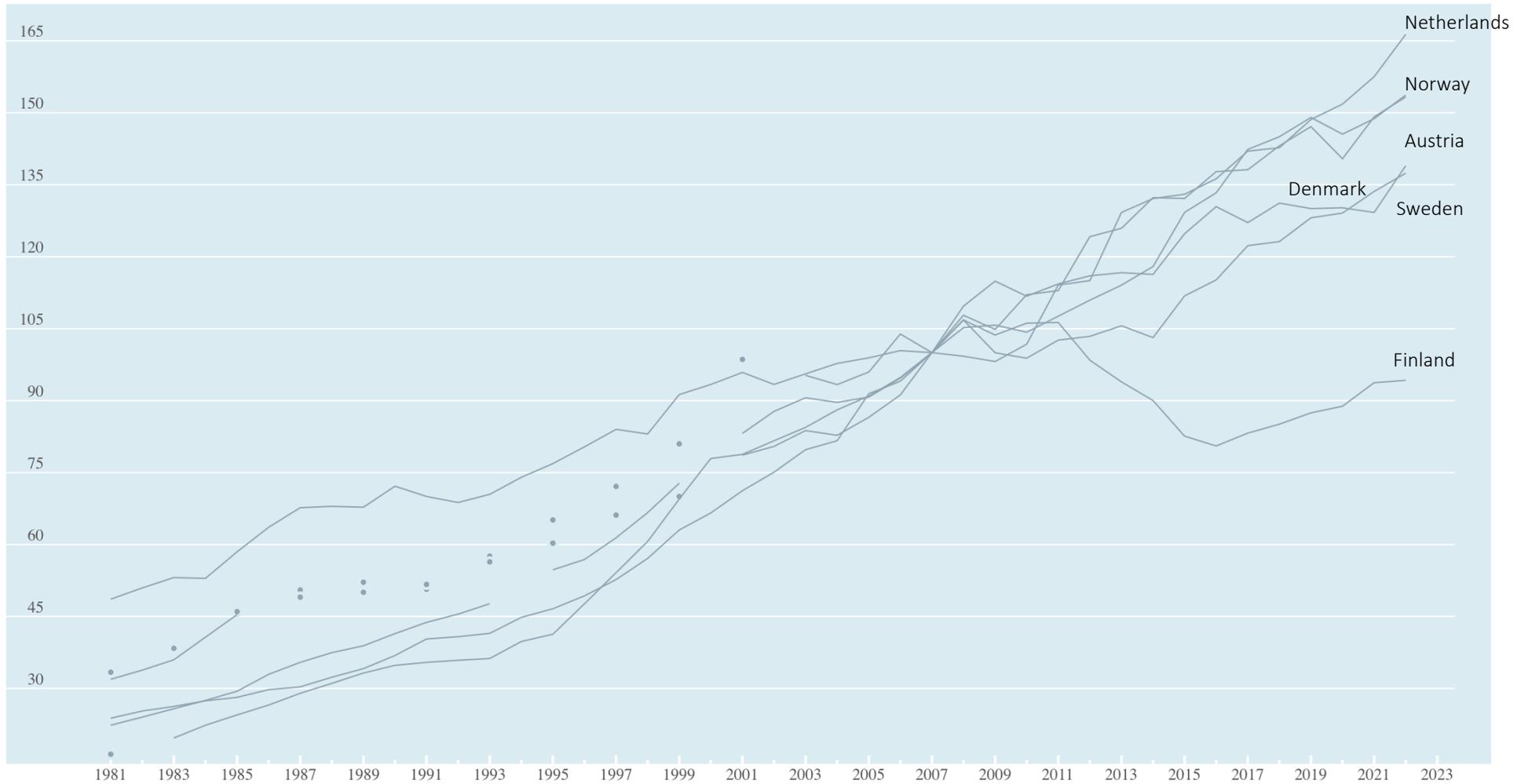
Ranking of the companies with the highest spending on research and development worldwide in 2024 (in billion U.S. dollars) (Statista)



Main Science and Technology Indicators (MSTI database)

Measure: Gross Domestic Expenditure on R&D (GERD)

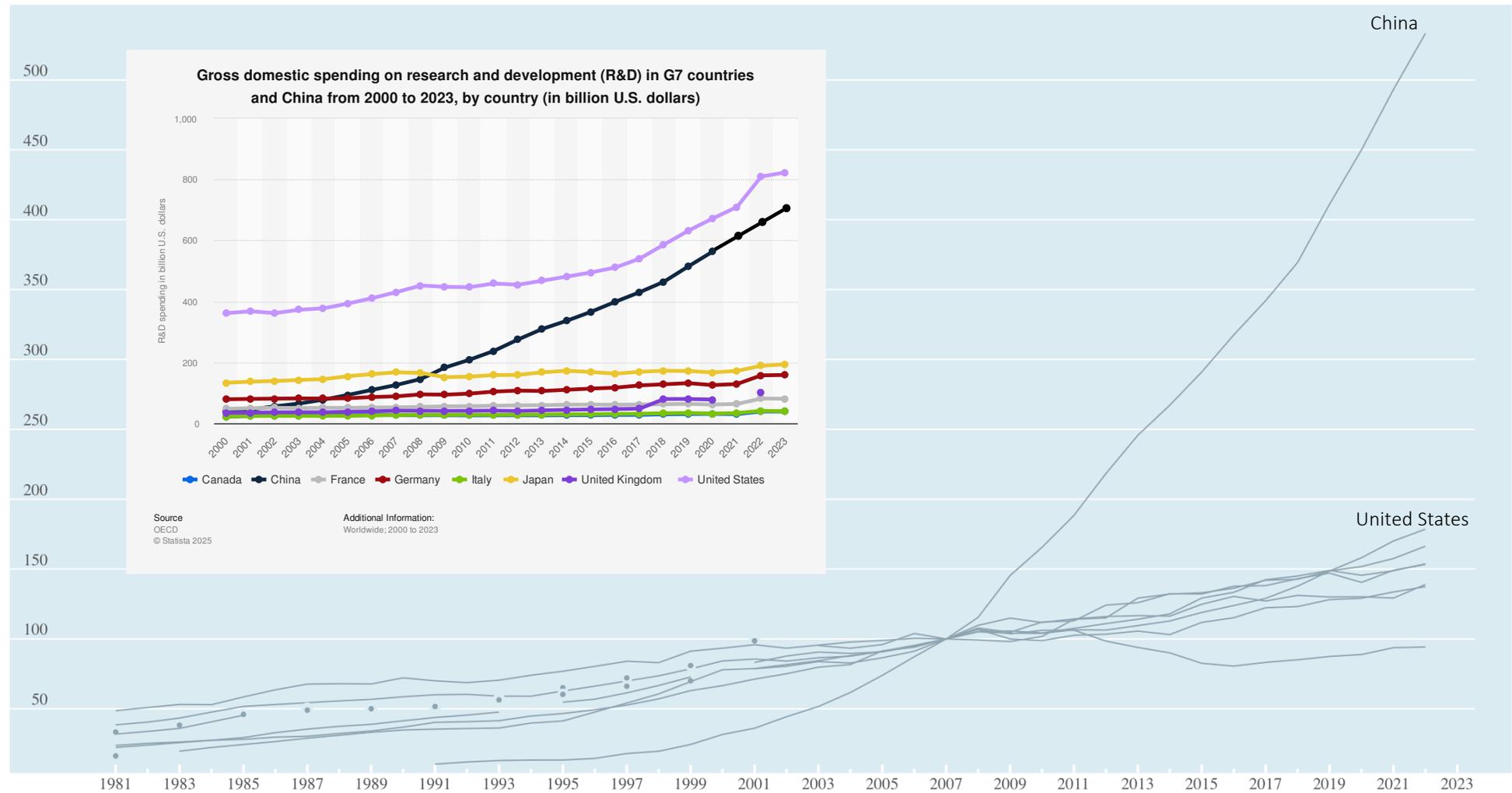
Combined unit of measure: US dollars, PPP converted, Constant prices, Index, 2007



Main Science and Technology Indicators (MSTI database) i

Measure: Gross Domestic Expenditure on R&D (GERD)

Combined unit of measure: US dollars, PPP converted, Constant prices, Index, 2007



Very basics

Innovation = something new + implemented
+ value added (Stähle & Sotarauta 2003; Schumpeterian view)

Innovation policy is actions by public organisations
that influence innovation processes (Edquist 2008)

Innovation system consists of interacting private
and public firms, universities, and government
agencies aiming at the production of new
knowledge and exploitation of it (Freeman 1989)

Innovation seeks to reorder society



Photo by Ramón Salinero on Unsplash

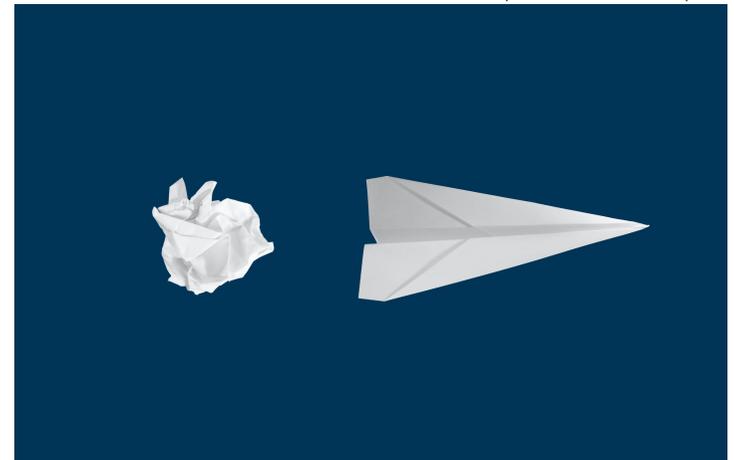


Photo by Matt Ridley on Unsplash

Innovation and related studies tell us about

- Big ideas underpinning regional development
- The social side of various production systems
- Learning, interactions and regional cultures
- Evolutionary dynamics of regional development and related innovation systems
- Knowledge foundations of (regional) cultures

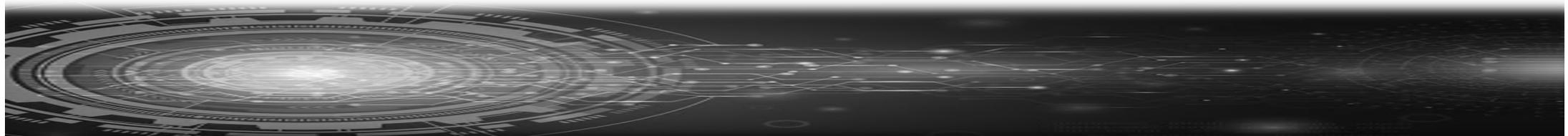
Joseph Schumpeter primarily developed his ideas to apply to private-sector entrepreneurs but the use of his theory and ideas have expanded.

An innovation displaces older products, services or processes and thus leads to creative destruction.

Generations of innovation policy (framings)

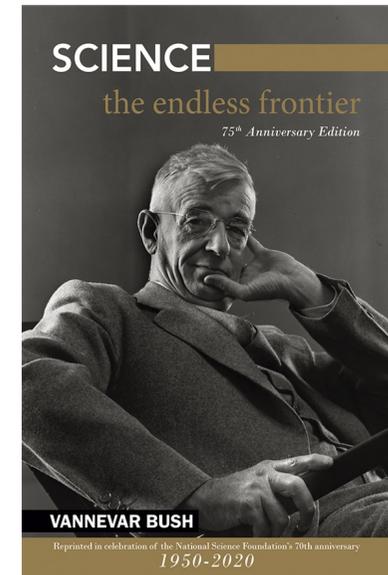
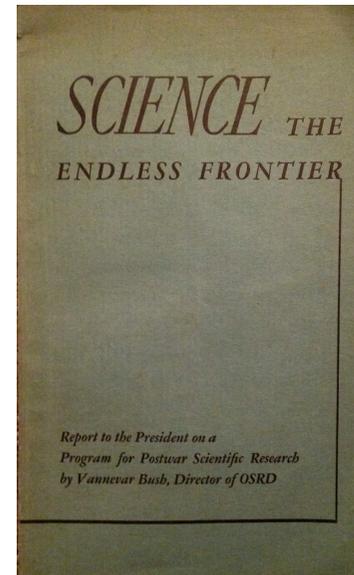
1. R&D & Regulation, technology push (1950s ->)
2. National systems of innovation (1990 ->)
3. Transformative innovation policy (mission-oriented) (emerging)

Schot, J. & Steinmueller, W.E. (2018) Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47, 1554-1567



1. Technology push policy (1950->)

- Research and development >>> innovation >>> economic growth
- Focus on scientific breakthroughs, technology development and commercialization of new technologies
- Key actors: Universities, research institutes, companies



R&D

DESIGN &
ENGINEERING

MANU-
FACTURING

MARKETING

SALES

Technology push policy

- **Rationale for innovation policy: correct market failures**
- Suboptimal investment levels in research and development
 - Financing public research
 - R&D subsidy – directly or through tax deductions
 - Establishment of IPR system

Technology-push policies aim to enhance the supply of technologies by providing incentives that reduce the costs of their development (e.g., through direct subsidies to research and development efforts).

(Stefano, Gambardella & Verona, 2012)

2. Innovation systems approach

- Innovation as key for competitiveness
- High-road strategy of innovation vs. low-road strategy of cost competition
- From linear to interactive model
- Innovation comes in many shapes involving variegated types of actors and networks
- Open system – local & global – interdependencies
- A focusing device
- New language in the 90's

National innovation system is a network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse new knowledge (technologies)

Freeman 1987

Also, regional and sectoral systems of innovation

Origins of the innovation system approach

OECD work in 1982 ('Science, Technology and Competitiveness')

- A dynamic perspective on innovation and learning in the promotion of economic growth with an active role of government



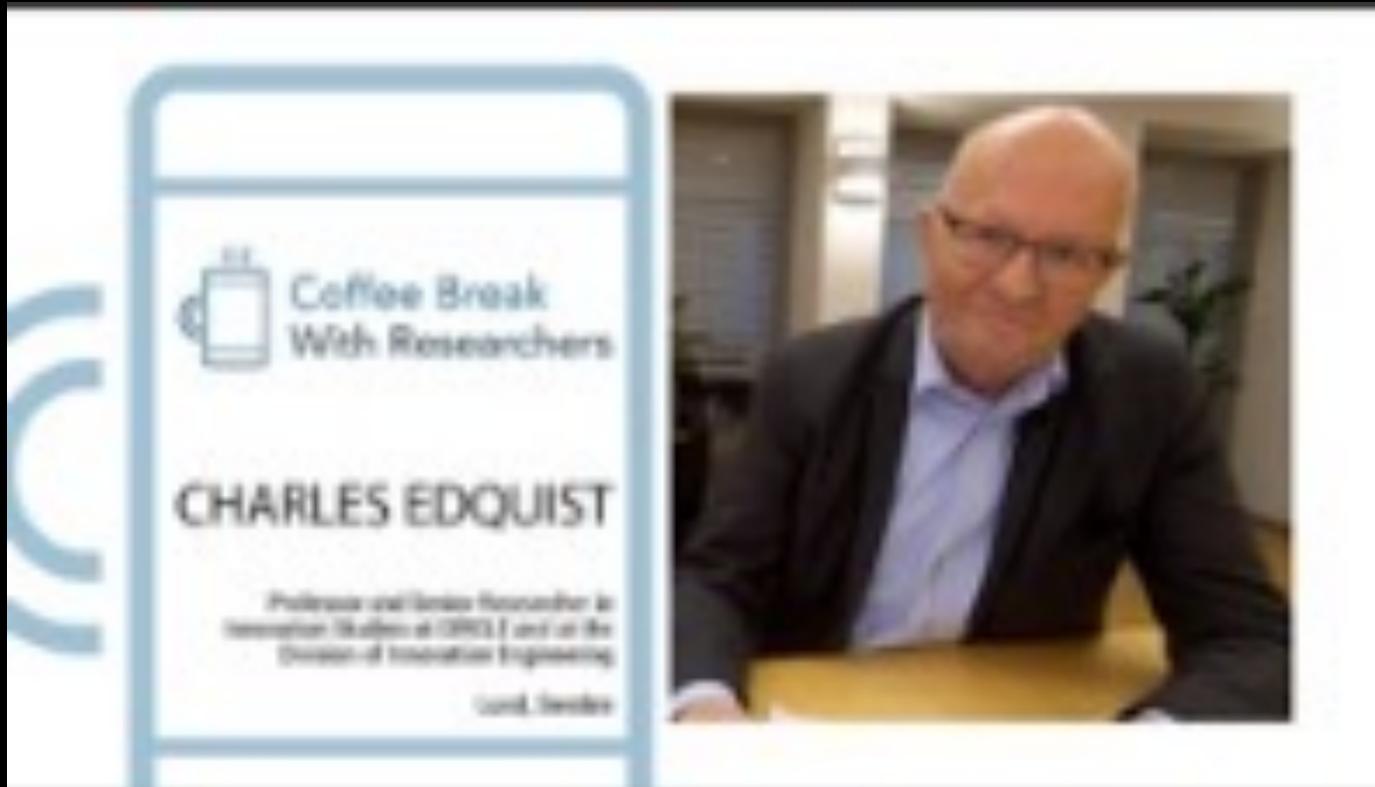
Freeman (1987): Technology policy and Economic Performance: Lessons from Japan

Lundvall (ed.) (1992): National Systems of Innovation: Towards a theory of innovation and interactive learning

Nelson (ed.) (1993) National Innovation Systems: A Comparative Analysis

Edquist (ed.) (1997) Systems of Innovation: Technologies, Institutions and Organizations

Charles Edquist: Towards a holistic innovation policy



<https://www.youtube.com/watch?v=HWyAyqXUGH0>

Composition of the Research and Innovation Council of Finland

Ministerial members

Prime Minister **Petteri Orpo**, Chair

Minister of Finance **Riikka Purra**

Minister of Science and Culture **Sari Multala**, 1st Vice-Chair

Minister of Economic Affairs **Wille Rydman**

Minister of Education **Anders Adlercreutz**

Minister of Agriculture and Forestry **Sari Essayah**

Other members

Riikka Heikinheimo, Director, Confederation of Finnish Industries

Ilkka Kivimäki, Partner, Maki.vc

Markku Kulmala, Academy Professor, University of Helsinki

Sari Lindblom, Rector, University of Helsinki, 2nd Vice-Chair

Vesa Taatila, Rector, Turku University of Applied Sciences

Antti Vasara, President & CEO, VTT Technical Research Centre of Finland

Kai Öistämö, President & CEO, 3rd Vice-Chair

Permanent experts

Timo Lankinen, Permanent State Under-Secretary, Prime Minister's Office

Olli Kärkkäinen, Strategy and Research Director, Ministry of Finance

Sirkku Linna, Director General, Ministry of Education and Culture

Juhapekka Ristola, Director General, Ministry of Economic Affairs and Employment

Paula Eerola, President, Academy of Finland

Lassi Noponen, Director General, Business Finland

Secretariat

Johanna Moisio, Secretary-General, Prime Minister's Office

Antti Pelkonen, Chief Specialist, Prime Minister's Office

Harri Lämsipuro, Chief Specialist, Ministry of Economic Affairs and Employment

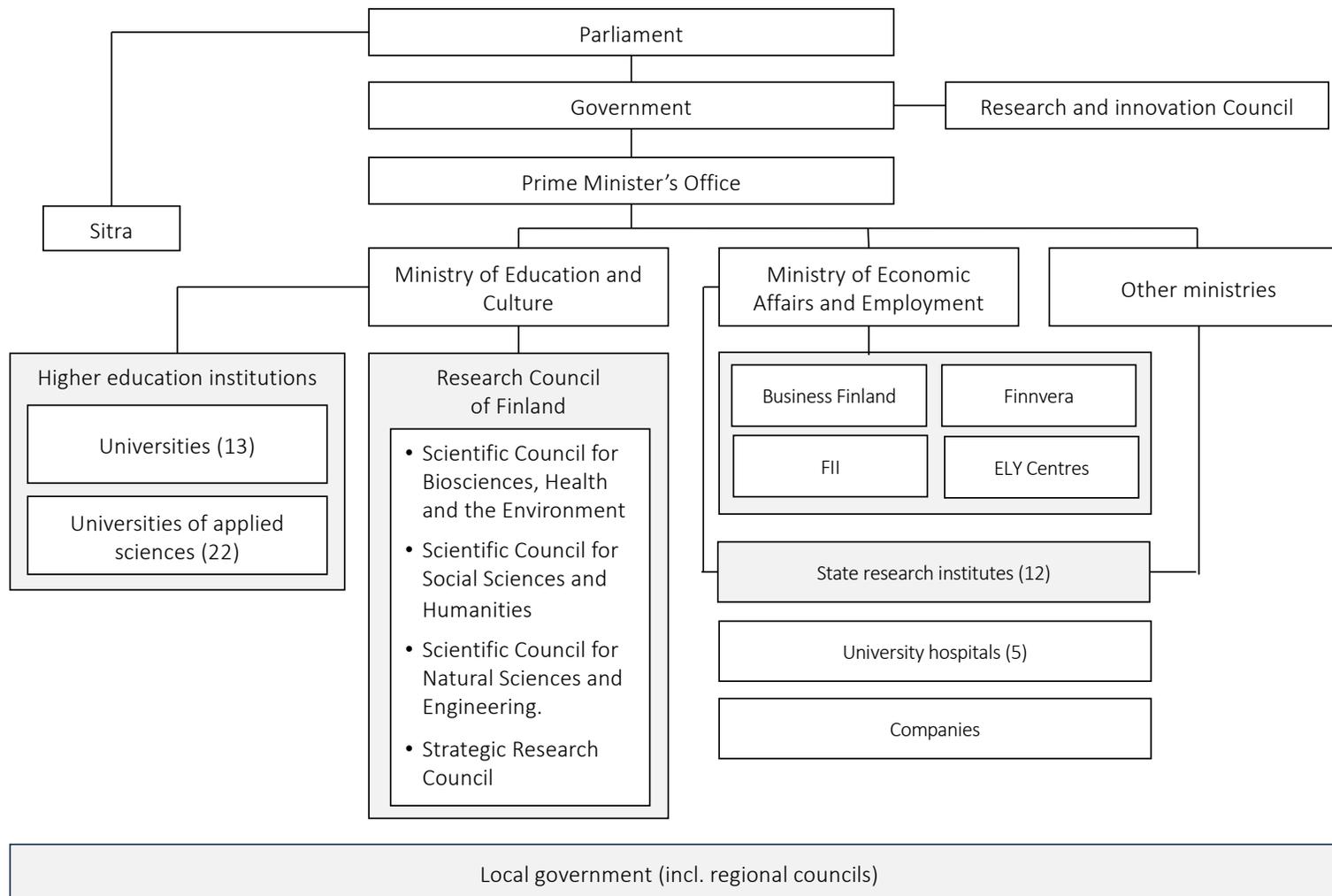
Jussi Alho, Chief Specialist, Ministry of Education and Culture

Finland:

Science Council (1963->1987)

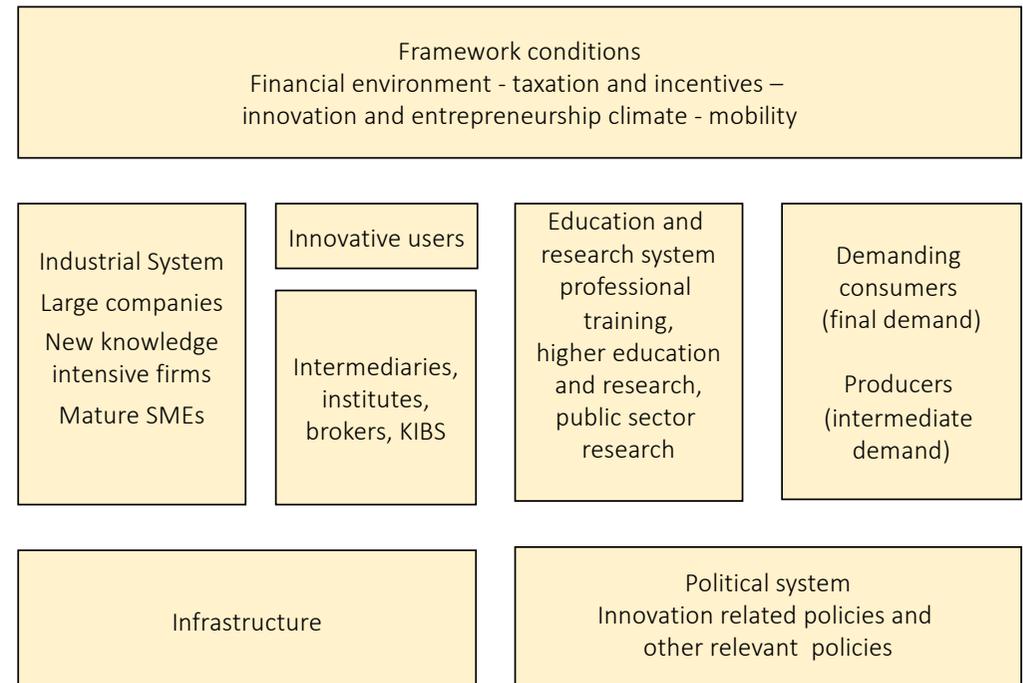
Science and Technology Council (1987-2008)

Research and Innovation Council (2009->)



Innovation systems approach

- Innovation as a systemic process – collaboration and interaction
- Actors - networks - institutions
- Key actors
 - Universities / research institutes/ firms
 - Users
 - Intermediaries
 - Public organizations
 - Educational organizations
- Science push & demand pull



(Modified from Autio 1998, den Hertog 2000; Smits & Kuhlman 2004; Kautonen)

Innovation system policy

Rationale: correct innovation system failures

- **Infrastructure failures**

- Insufficient infrastructures – ICT, transport, research etc.

- **Capability failures**

- Lack of appropriate competencies, especially relating to emerging technologies

- **Institutional failures**

- Formal institutions hindering innovation
- Informal institutions hindering innovation (e.g. lack of risk-taking behaviour)

- **Network failures**

- Weak network failure: limited interaction > poor exploitation of complementary sources of knowledge and processes of interactive learning
- Strong network failure: Cooperation in closely tied networks leads to lock-in into established trajectories and a lack of infusion of new ideas, inward-looking behaviour

Positive impacts of the innovation system approach

(Björn Asheim)

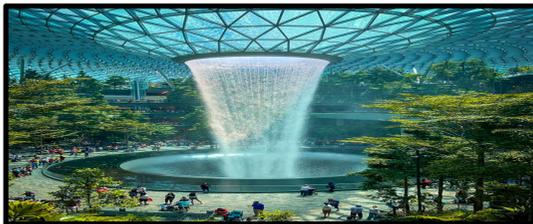
New view on what constitutes international competitiveness

- From relative wages (low road or weak competition) to non-price competitiveness national policies of promoting innovation and learning (high road or strong competition)

The 'system' dimension moved attention from linear to interactive thinking of innovation

- from science and technology policies to innovation policy

From fountain to forum



Innovation ecosystem

‘Network of interconnected organizations, **connected to a focal firm or a platform**, that incorporates both production and use side participants and created as appropriates new value through innovation.’

(Autio & Thomas 2014)

Type of system	Entrepreneurial regional innovation ecosystem (ERIEs)	Institutional regional innovation system (IRIS)
<i>Image of the market</i>	Ambiguous - opportunity and collaborative space	Uncertain, risky competitive space
<i>Innovation process</i>	Action-oriented, experimentation, learning	Planning-orientated, need to monitor, control and minimise risk
<i>Strategies</i>	Emergent, processual	Planned
<i>Time</i>	Emergence, splatter visions combined with continuous learning	Clear vision combined with long-term planning
<i>Organisational structure</i>	Organic (loosely coupled)	Mechanistic, contractual

Type of system	Entrepreneurial regional innovation system (ERIS)	Institutional regional innovation system (IRIS)
<i>Critical assets</i>	Entrepreneurial skills Venture capital	Management skills Institutional capacity
<i>Decision logic</i>	Effectuation: Acting on available/accessible resources	Causation: Planning for and controlling the future
<i>Cooperation</i>	Ad hoc, intermittent both weak and strong ties, swift trust	Planned and long-term, strong ties, social capital
<i>Critical actors</i>	Individuals who forms teams of complementary competences	Representatives of different sectors of society