Management Information Systems (MIS)

37C00100 Spring 2024

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Dept. of Information & Service Management ISM

February 27, 2024

Aalto University
School of Business

Teaching assistant:
Emma Eini

Topics in today's lecture

- My academic background
- Digital era and revolutions; new skills needed from biz students
- ICT use and investments in Finland, government policies, digital barometers
- Digital maturity models
- EU's recent initiatives – twin transition; AI and Data acts
- Future jobs and skills and why should you study MIS?
- Information Systems Science (ISS) - a young discipline
- Practical information about the lectures & assignments
- Wrap up and next steps

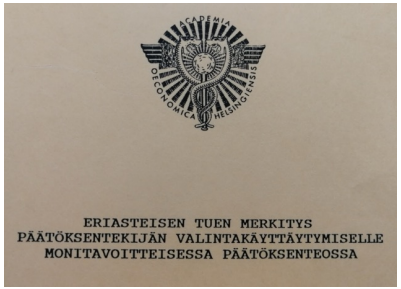
- *Chapters 1 & 2 of the book – see the pre-recorded video lecture in MyCourses* 

My academic background

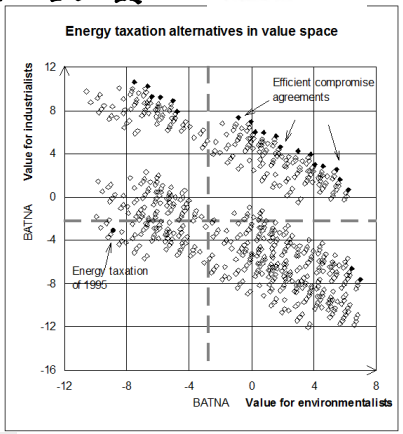
IBM PC 5150

Macintosh 128K

My 1st computers I used at Aalto when studying ISM (IS and OR/MS)



MSc thesis in OR/MS regarding Multiple-Criteria Decision-Making (MCDM)



All Well?

Member of the workgroup that developed Aalto's student wellbeing questionnaire

BIZ Bachelor Program:
Associate Program Director '2020-

Teaching: MIS, BSc thesis seminar, Programming I, Business Process Management for the Digital Era, previously Digitalism Challenge hackathon until '19

Research: Text-mining & science visualization, online collaboration, experiences, digital sustainability

MINISTRY OF TRANSPORT AND COMMUNICATIONS

Big data Strategy for Finland 2014
http://julkaisut.valtioneuvosto.fi/handle/10024/77879

First Principal University Lecturer in Aalto BIZ

https://www.aalto.fi/en/news/the-president-has-appointed-the-first-principal-university-lecturers-at-aalto-university

Computer images: https://en.wikipedia.org/wiki/IBM_Personal_Computer http://www.smashinglists.com/15-unforgettable-mac-computers-old-is-gold/

Digital era and revolutions: New skills needed from business students

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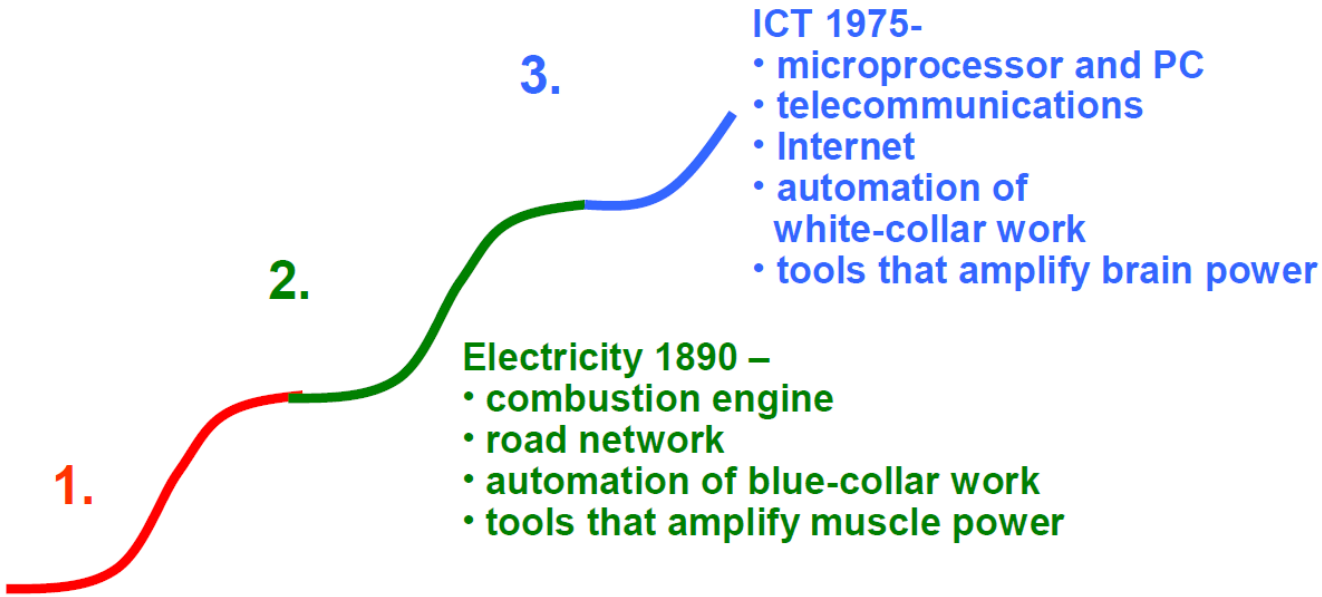
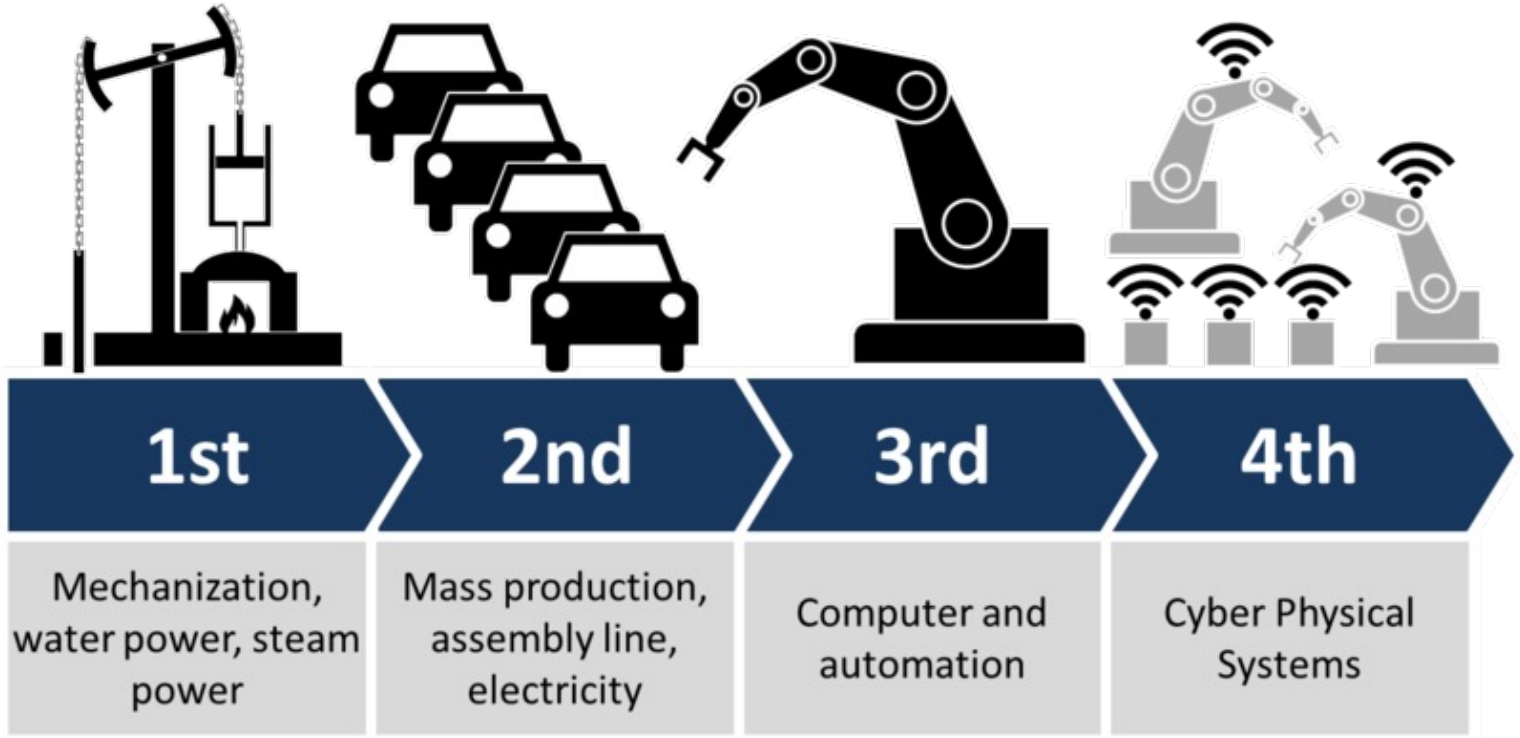
3 industrial revolutions and general purpose technologies



Source: Emeritus Prof. Matti Pohjola, Aalto University ”Increasing Welfare through the Interaction of Productivity and Employment Performance”, Presentation prepared for the Ministry of Labour

4th industrial revolution / Industry 4.0

Built on the digital age, and distinguished by a **ubiquitous and mobile internet**, small powerful **cheap sensors**, artificial intelligence **(AI)** and machine learning **(ML)**.



Source: Shankar, U. (2016), **"Industry 4.0 - The fourth industrial revolution",** https://www.linkedin.com/pulse/industry-40-fourth-industrial-revolution-umang-shankar, Nov 28, 2016.

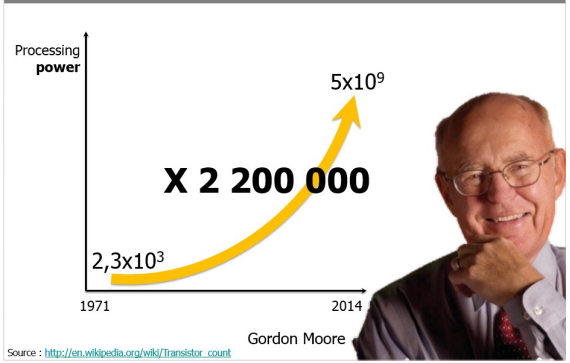
Details of digital revolutions since 1950s

Revolution	Ascension	Enablers	Leverage
Computational Revolution	1950	Electronics + Binary computation	Management Information System
Communications Revolution	1980	Personal computer + Telecommunications	Strategic Information System
Commercial Revolution	1995	The Internet	Business Model
Collaborative Revolution	2010	Social + Mobile + Analytics + Cloud "SMAC"	Platform Ecosystem
Cognitive Revolution	Imminent	Cognitive technologies	Global Brain

Source: Korhonen & Halén (2017) "Enterprise Architecture for Digital Transformation", IEEE 19th conference on Business Informatics, https://ieeexplore.ieee.org/abstract/document/8010739

Enabling trends

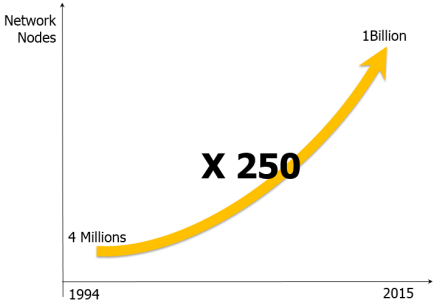
Moore's law



Source : http://en.wikipedia.org/wiki/Transistor_count

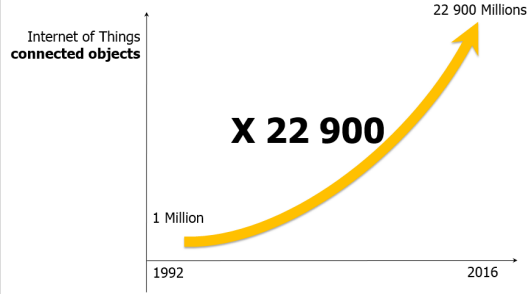
http://celebslists.com/images/gordon-moore-04.jpg

The explosion of the net



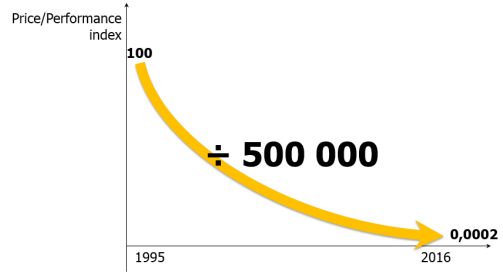
Source : Internet Systems Consortium

The IoT pervasivness



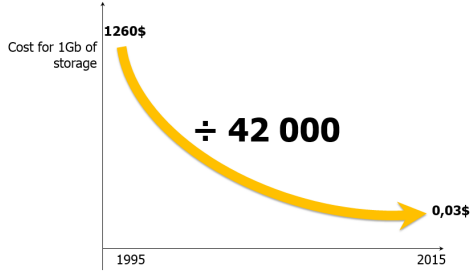
Source https://www.ncta.com/platform/broadband-internet/behind-the-numbers-growth-in-the-internet-of-things/

Dropping prices!



Source : http://www.singularity.com/charts/page62.html

Dropping storage costs



Source : http://www.mkomo.com/cost-per-gigabyte-update

Industry 5.0

I5.0 aims to create a more harmonious and resilient society that respects the environment and human dignity.

Industry 4.0 has been criticized for its overly technical and economic focus, particularly its limited attention to the human side of management.

There is a growing realization that **economic success can yield unsustainable social consequences** and that **firms must leverage advanced technologies to create workplaces that are human-centered, benefit society, and improve quality of life**.

The differentiating feature of I5.0 over its predecessors is that **it aims to reset the economic and social balance through responsible governance**.
It focuses on **enhancing sustainability** and **transitioning towards a digital society.**

Source: Asif, Searcy and Castka (2023), "ESG and Industry 5.0: The role of technologies in enhancing ESG disclosure", Technological Forecasting & Social Change, Vol. 195.
https://www.sciencedirect.com/science/article/pii/S0040162523004912
Image created with Bing Image Creator, Feb 21, 2024.

MIT professors Brynjolfsson and McAfee, book 2017

The latest phase of **computers and the internet** have created **three shifts in how work happens**.

1. The first is **artificial intelligence (AI):** a move from **man to machine** (self-driving cars, online translation, etc.).
2. The second is a shift from **products to platforms** (such as Facebook, Alibaba, Airbnb).
3. The third shift is from the **core to the crowd**. The core refers to centralized institutions (like central banks or the *Encyclopedia Britannica*); the crowd refers to the **decentralized, self-organizing participants**

McAfee and Brynjolfsson (2017), *Machine, Platform, Crowd: Harnessing our Digital Future*. W.W. Norton; 402 p.

https://www.economist.com/news/books-and-arts/21724976-two-experts-mit-analyse-business-implications-our-digital-future-what-will

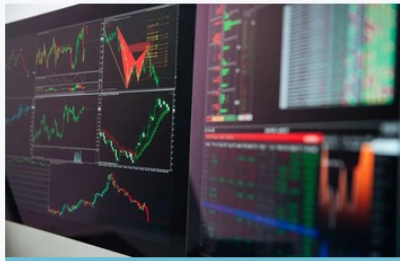
Source: MaCuDE = Management Curriculum for the Digital Era, 100 Business schools' initiative https://macude.org/

MaCuDE's 9 task forces - foundational pillars of business education

Each task force is responsible for identifying necessary changes for business education.

Accounting

Analytics



Finance

Information Systems

Management

Marketing

Strategy, Innovation & Entrepreneurship

Cybersecurity

Future of Learning and Work

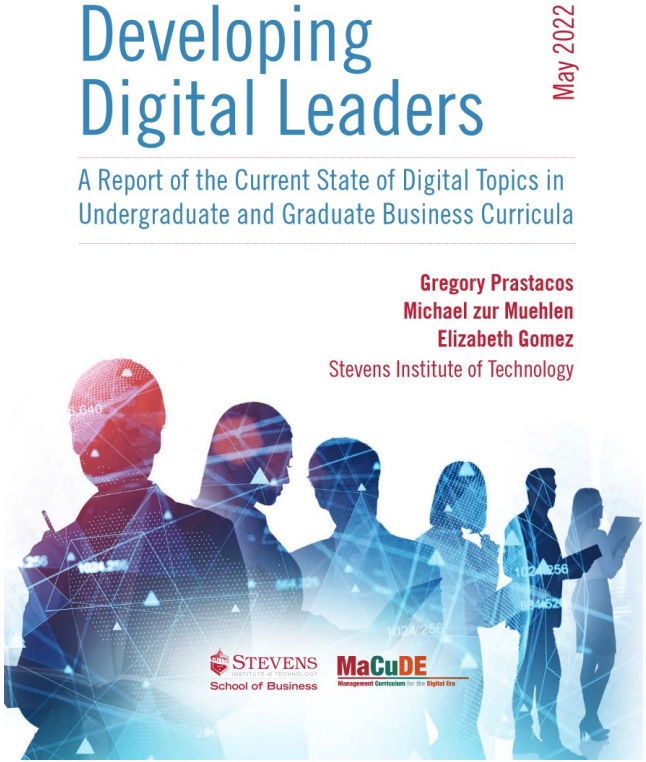
Source: https://macude.org/
MaCuDE = Management Curriculum for the Digital Era

MaCuDE – Phase 1 report

The Digital Era is characterized by five key developments, which are also reflected in the curricula of business schools:

- Data Analytics and Machine Learning
- Programming
- Algorithms and Artificial Intelligence
- Emerging Digital Technologies, and
- Managing Digital Organizations

"Business School students should be exposed to emerging technologies and learn how to assess their utility." (p.8)



Source: MaCuDE: Developing digital leaders (2022) https://macude.org/wp-content/uploads/2022/09/Stevens-MaCuDE-Report-PHASE-1.pdf

MaCuDE – Phase 1 report 2022

To facilitate data-driven decision-making, individuals are expected to be **familiar with the lifecycle of information**, i.e., develop a **sense of data literacy**:

- *Data collection and data integration*

Data literacy transcends disciplinary boundaries and is a requirement of all business school graduates, no matter their major. While many disciplines have specific requirements that align with their specific data formats (e.g., customer data in Marketing, market data in Finance), themes such as the **trustworthiness of data, technical data integration, and information visualization are cross-cutting concerns**.

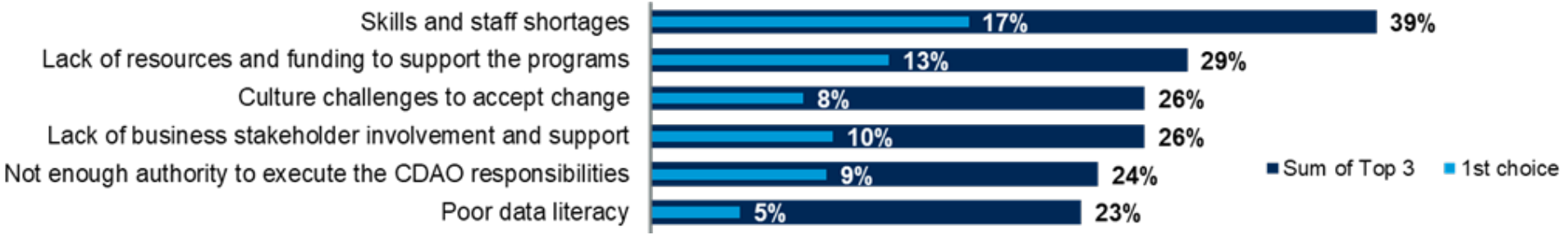
Once a sense of data literacy is established, Business School graduates need to be familiar with techniques for the analysis of these data sources. This includes:

- *Data Interpretation*
- *Data Visualization*
- *Storytelling with Data (presenting data visually in a persuasive way to convince an audience)*
- *Data-driven Decision-Making*

Source: Developing digital leaders (2022) https://macude.org/wp-content/uploads/2022/09/Stevens-MaCuDE-Report-PHASE-1.pdf

Most critical roadblocks in data and analytics

Poor data literacy is among the top roadblocks to the success of data and analytics initiatives



An overwhelming majority of respondents explicitly include **data-driven culture /change management** (75%) and **data literacy/skills training** (67%) within their data and analytics strategies as their top priorities. (Gartner, 2022)

Sources: Graph by Gartner (March, 2023): Gartner Survey Reveals Less Than Half of Data and Analytics Teams Effectively Provide Value to the Organization and Gartner, (December 2022): CDAOs Must Engage Their Stakeholders to Foster Data Literacy and Deliver the Value of Data and Analytics (gartner.com)

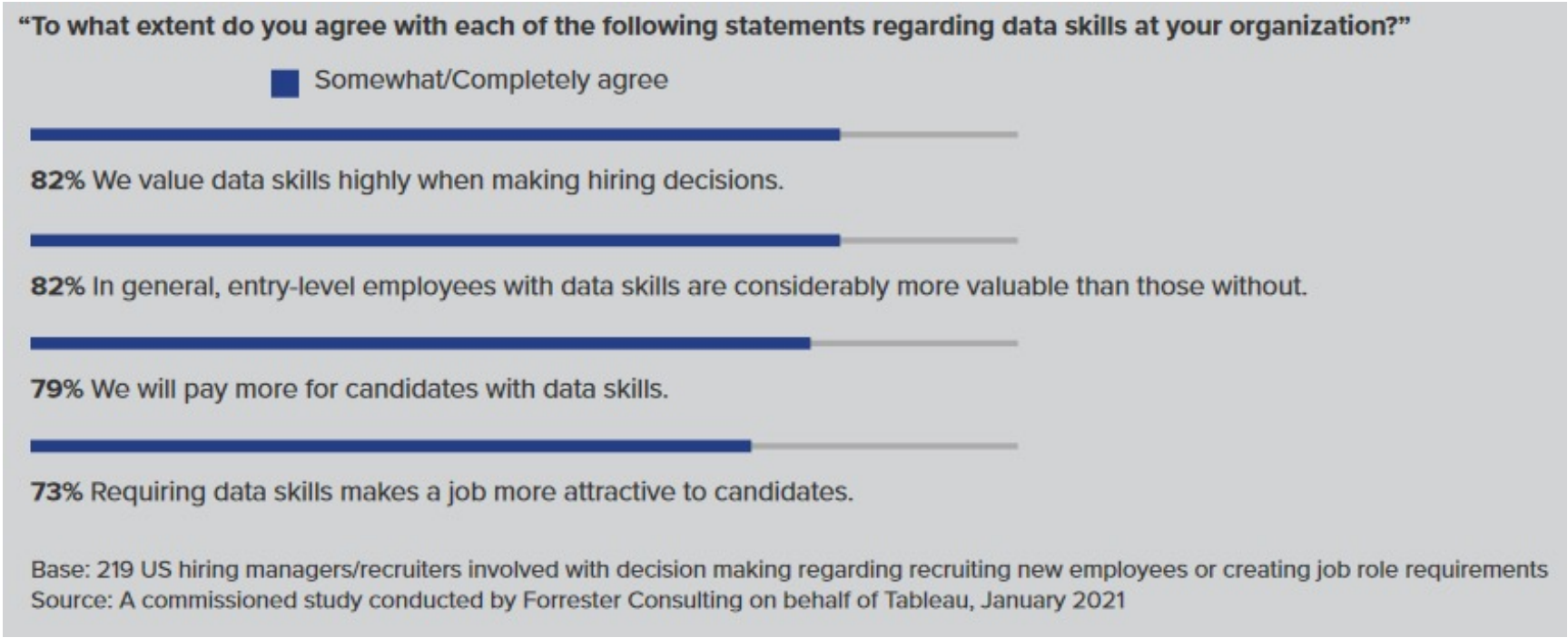
Top-5 skills emphasized by recruiters

	Skills in highest demand	Skills that have increased most in demand over the past 2 years	Skills recruiters anticipate will increase most in importance in the *next* 5 years
1	Data skills/data literacy	Data skills/data literacy	Data skills/data literacy
2	Communication and collaboration skills	Project management skills	Communication and collaboration skills
3	Basic computer skills	Research skills	Research skills
4	Project management skills	Computer programming skills	Project management skills
5	Presentation/public speaking skills	Communication and collaboration skills	Computer programming skills

Base: 219 US hiring managers/recruiters involved with decision making regarding recruiting new employees or creating job role requirements
Note: Showing top 5
Source: A commissioned study conducted by Forrester Consulting on behalf of Tableau, January 2021

Source: Forrester Consulting (2021), "The Great data literacy gap: demand for data skills exceeds supply", https://www.tableau.com/sites/default/files/2021-06/Tableau_Data_Literacy_Report.pdf

Data skills are valued and pay off

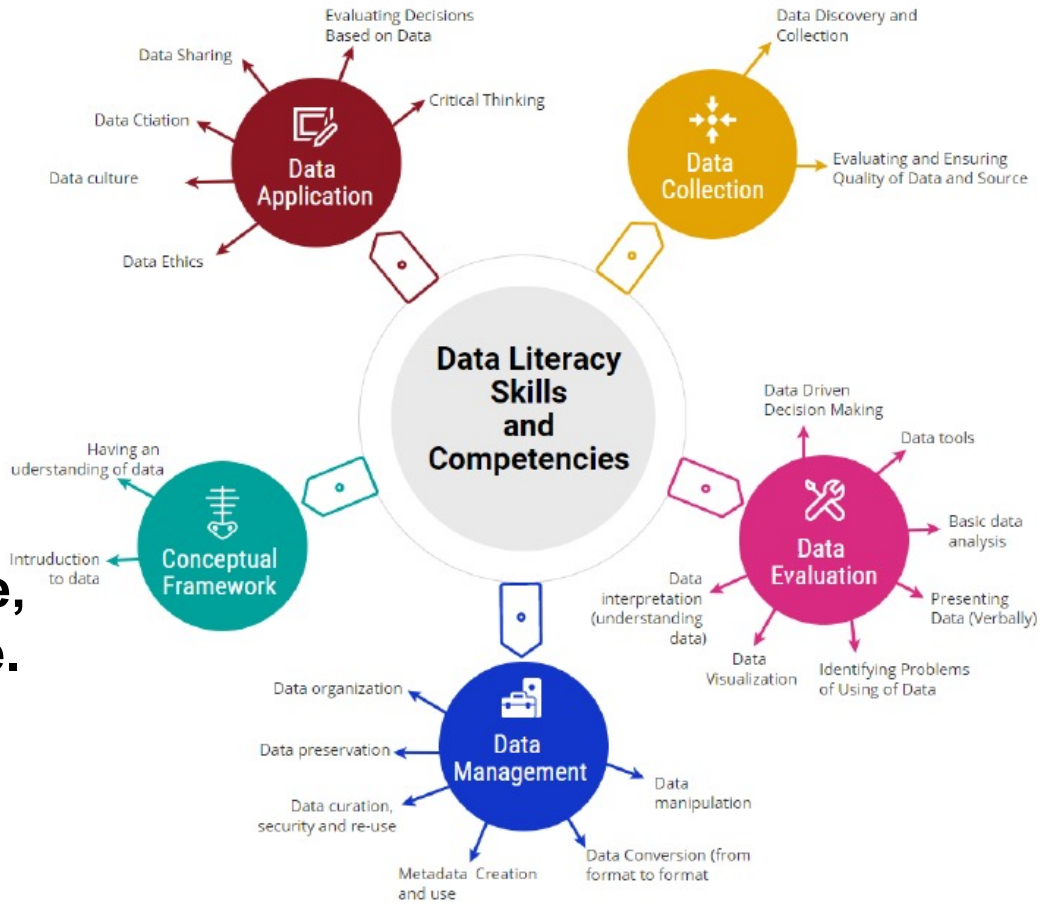


Source: Forrester Consulting (2021), "The Great data literacy gap: demand for data skills exceeds supply", https://www.tableau.com/sites/default/files/2021-06/Tableau_Data_Literacy_Report.pdf

Data literacy

The ability to read, write and communicate data in context, including an understanding of data sources and constructs, analytical methods and techniques applied — and the ability to describe the use case, application and resulting value.

(Gartner, 2019)



Sources: Gartner (2019) , “A Data and Analytics Leader’s Guide to Data Literacy”, , https://www.gartner.com/smarterwithgartner/a-data-and-analytics-leaders-guide-to-data-literacy/
Graphical illustration by Guler (2019) https://www.researchgate.net/figure/Schematic-representation-of-data-literacy-skills-and-competencies-Adapted-from-Ridsdale_fig2_335620777 , adapted from Risdale et al. (2015, p. 38) https://dalspace.library.dal.ca/bitstream/handle/10222/64578/Strategies%20and%20Best%20Practices%20for%20Data%20Literacy%20Education.pdf

Digitalization, ICT and R&D investments in Finland – macroeconomic trends, Government policies and companies' IT use statistics

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Prof. Pohjola's 2014 report to Technology Industries in Finland

*"Regarding the utilization of ICT, we are at the same phase as **how electricity was used in the 1930's**. The greatest productivity gains from electricity accrued from the **new ways of operating** that it enabled."* (cf. *digital transformation, digitaalinen murros*)

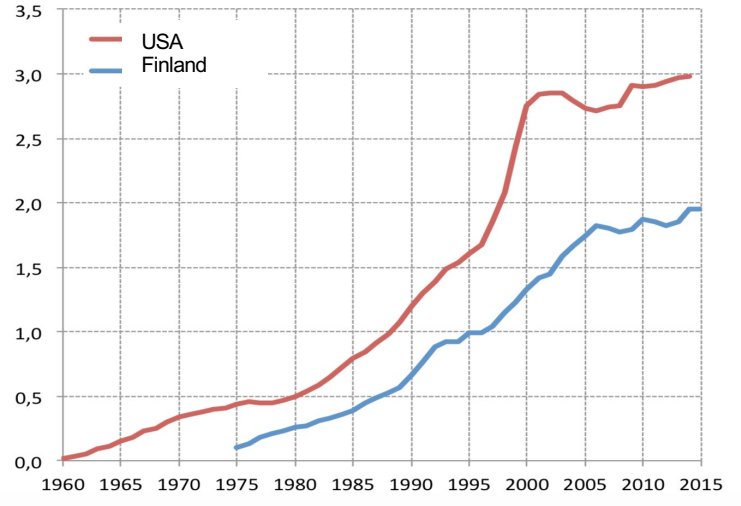
*"**Why ICT would revolutionize the world only now?** Because digital technology is only now **so cheap that everybody can afford it**. The computing power of a tablet is the same as that of a 10-15 year-old supercomputer, which cost millions."*

*"It is though a problem that **only a handful of firms' executives understand the impact and opportunities of digitalization** in combining industrial manufacturing and service production." **

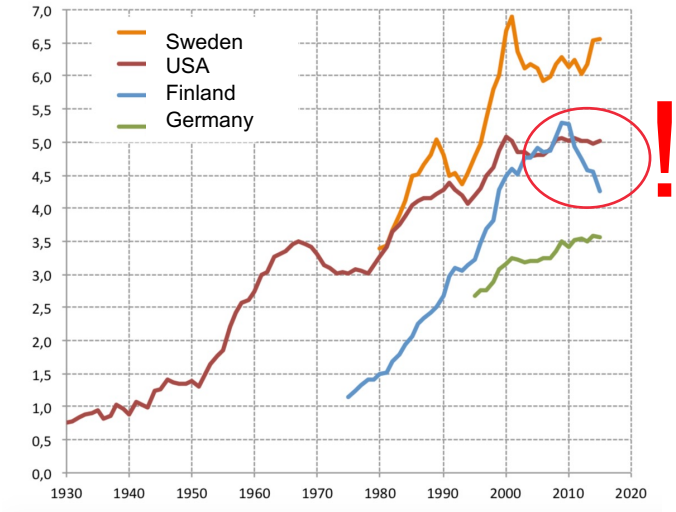
* This is gradually improving, see e.g. SITRA's Situation room: Datatalouden osaamisen kehittäminen – Datatalouden ABC-koulutuksen julkistustilaisuus - Sitra and 24 interesting data economy solutions from Finland - Sitra and Fair data economy roadmap – Sitra, and the Dimecc Ecosystem https://www.dimecc.com, or the **Twin (digital & green) transition** initiatives, e.g. Data4Circularity - towards a data-driven circular economy in Finland, 16 February 2022 - circinnovation, and the innovation ecosystem of the built environment KIRAHub Home - English – KIRAHub

Pohjola, M. (2014), "Finland to a new rise. ICT and digitalization as the sources of productivity and economic growth", available at http://teknologiateollisuus.fi/sites/default/files/file_attachments/pohjola_tuottavuusraportti2014_web_0.pdf

Prof. Pohjola on ICT, productivity and economic growth in 2019



The share of **software and databases** from private sector net capital (excluding apartments,%)



Investments to intellectual property (**software and databases**, **R&D** - in relation to GDP)

"It appears the the digi leap has not been done in Finland yet – and it certainly does not happen by decreasing the ICT and R&D investments!"

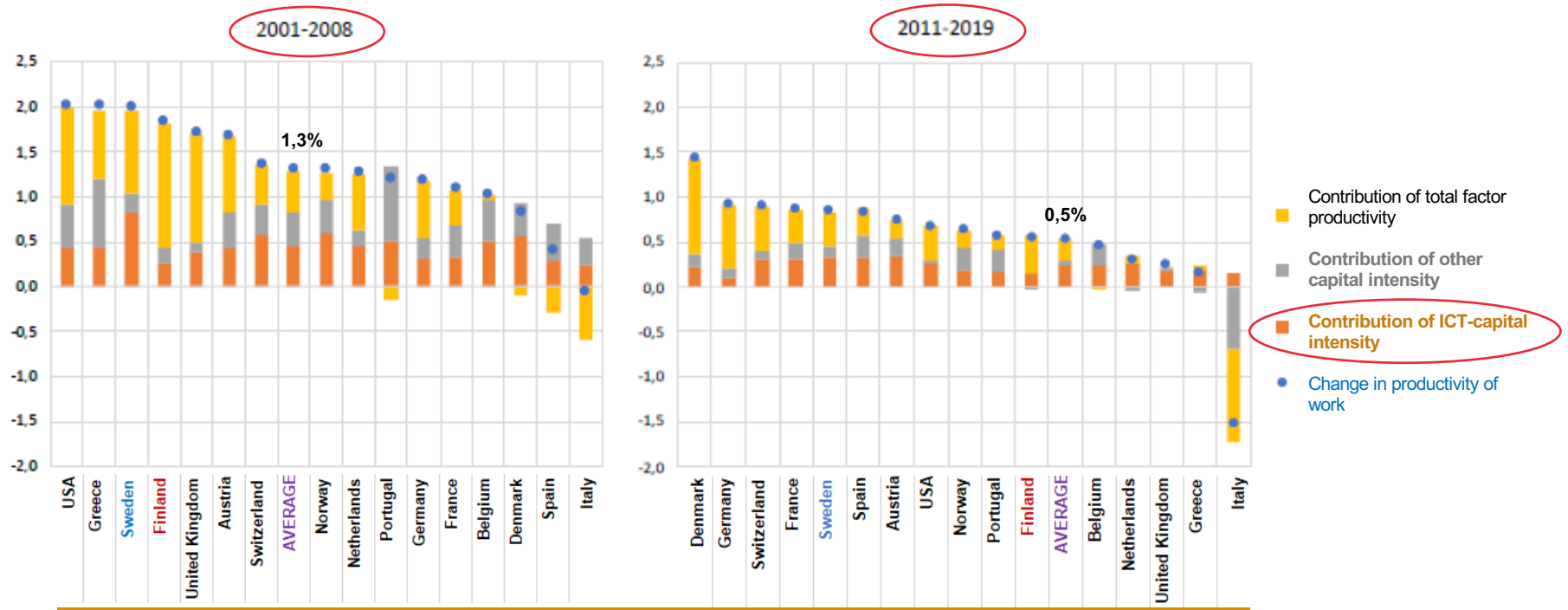
Source: Pohjola (2019): ICT, productivity and economic growth. Economist's view https://ilf.fi/wp-content/uploads/sites/11/2019/12/ILF-IT-tuottavuus-iltapuhde-190131-4-Matti-Pohjola.pdf

See also Pohjola (2020): Teknologia, investoinnit, rakennemuutos ja tuottavuus – Suomi kv vertailussa: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162051/TEM_2020_05.pdf

Prof. Pohjola on productivity, structural change and economic growth in 2021

Average annual change in the productivity of work (%), and contributions of sources to it (%-points)

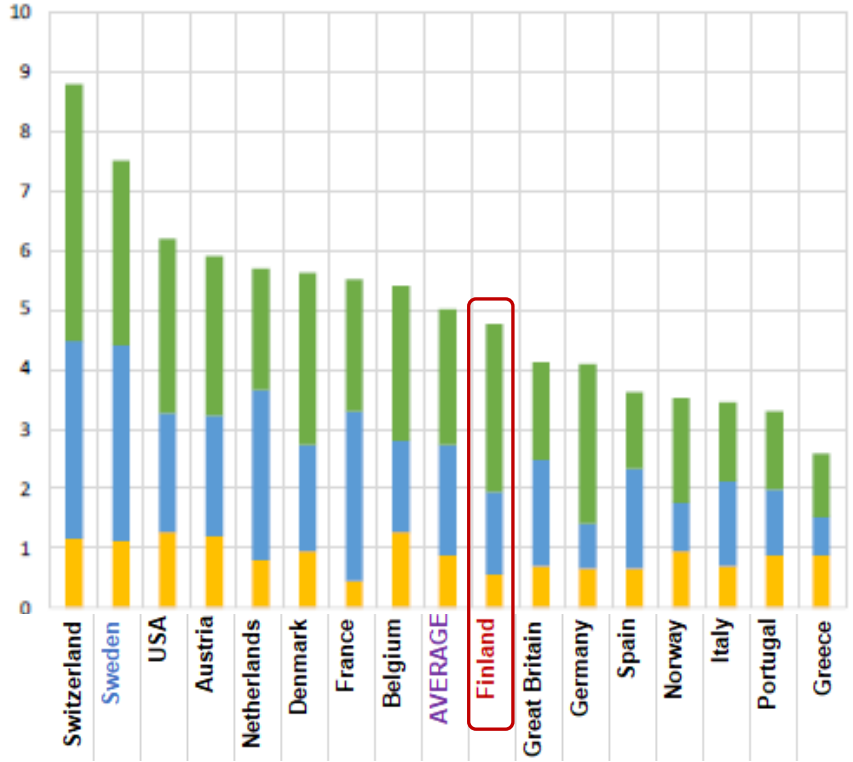
Comparing two 9-year periods (-> growth in productivity of work has on average slowed down from 1,3% to 0,5%):



ICT capital has increased the productivity of work on average more than the other capital together.
In Sweden, ICT capital's contribution has been 2-fold compared to Finland and Germany!

Pohjola (2021): Tuottavuus, rakennemuutos ja talouskasvu, 7.12.2021 https://www.talouspolitiikanarviointineuvosto.fi/wordpress/wp-content/uploads/2022/01/Pohjola-2022.pdf

Prof. Pohjola on productivity, structural change and economic growth in 2021



The share of ICT- and R&D-investments from GDP on average in years 2011-2019, %

- Research and development
- Software and databases
- ICT equipment

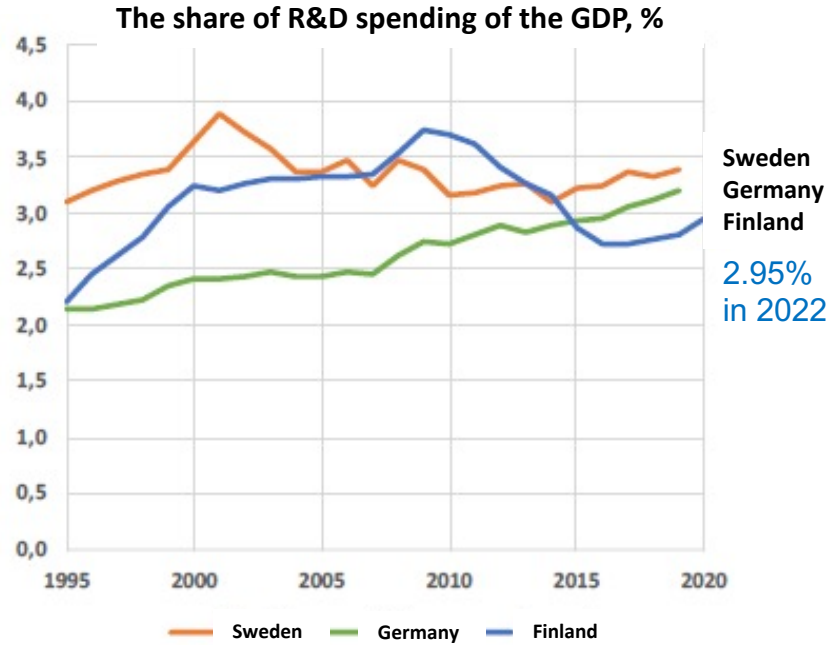
Finland's ICT investments' share of all investments is almost half compared to that of Sweden, and even below the average of 16 OECD countries.

Pohjola (2021): Tuottavuus, rakennemuutos ja talouskasvu, 7.12.2021 https://www.talouspolitiikanarviointineuvosto.fi/wordpress/wp-content/uploads/2022/01/Pohjola-2022.pdf

Prof. Pohjola on productivity, structural change and economic growth in 2021

Also, the **share of R&D spending of the GDP** has fallen smaller in Finland than in Sweden and Germany.

To remedy the situation, PM Sanna Marin's Government decided to turn the **R&D and innovation funding** to a growth path, by outlining **a road map for increasing them to 4% of GDP by 2030** and to develop Finland as the world's best innovation and experimentation environment (R&D funding law since 2023).



Economical research gives solid grounds for the change of direction in innovation policy. **Direct R&D subsidies to companies, indirect subsidies via tax deductions, as well as facilitating the immigration of trained workforce** are effective means in the short term (ca. 5 years), while **increasing education*, especially in the fields of science and technology**, are effective in the long term.

* ***ICT degrees (including ISM) are valued with a coefficient of 1.75x by the Finnish Ministry of Education and Culture***

Source: Pohjola (2021): Tuottavuus, rakennemuutos ja talouskasvu, 7.12.2021 https://www.talouspolitiikanarviointineuvosto.fi/wordpress/wp-content/uploads/2022/01/Pohjola-2022.pdf
State Treasury: https://www.treasuryfinland.fi/investor-relations/sustainability-and-finnish-government-bonds/the-national-plan-to-raise-rd-funding/

Finland's information and technology policy guidelines prepared by the Parliament's Futures committee and Tietopolitiikka.fi group.

Tietopolitiikka.fi (est. 2020) is a collaboration group, which includes information policy actors from all parliamentary parties.

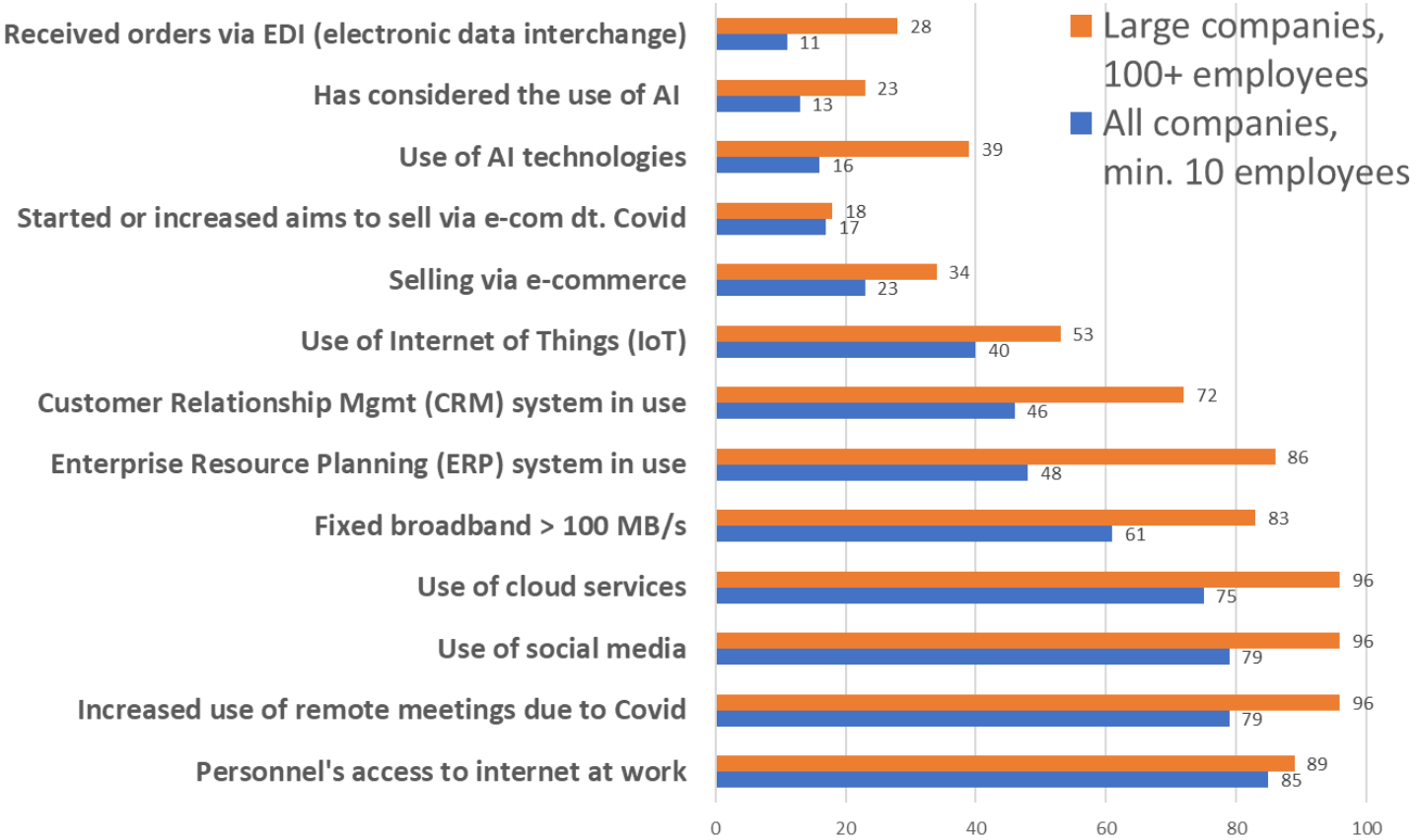
Their 63 action recommendations from March 2023 presented views that the group and also several stakeholders agreed on.

The recommendations impacted the **information and technology policy guidelines for Orpo's Government program**, with which Finland aims to respond to the challenges and opportunities of the digital age.
(See details on Hallitusohjelmakirjaukset tietopolitiikasta - Google Drive)

Contents of report: Management of information and technology policy, human-oriented public services, interoperability of services, digital infra, enabling legislation, public procurement, innovations and digital transition, digital skills, digital security, democracy and participation in the digital era.

Sources: https://tietopolitiikka.fi/ (2023): Information and technology policy: 63 action recommendations
Eduskunnan tulevaisuusvaliokunta (2023): Cross-administrative management of information and technology policy: https://www.eduskunta.fi/FI/naineduskuntatoimii/julkaisut/Documents/TUVJ-5-22.pdf

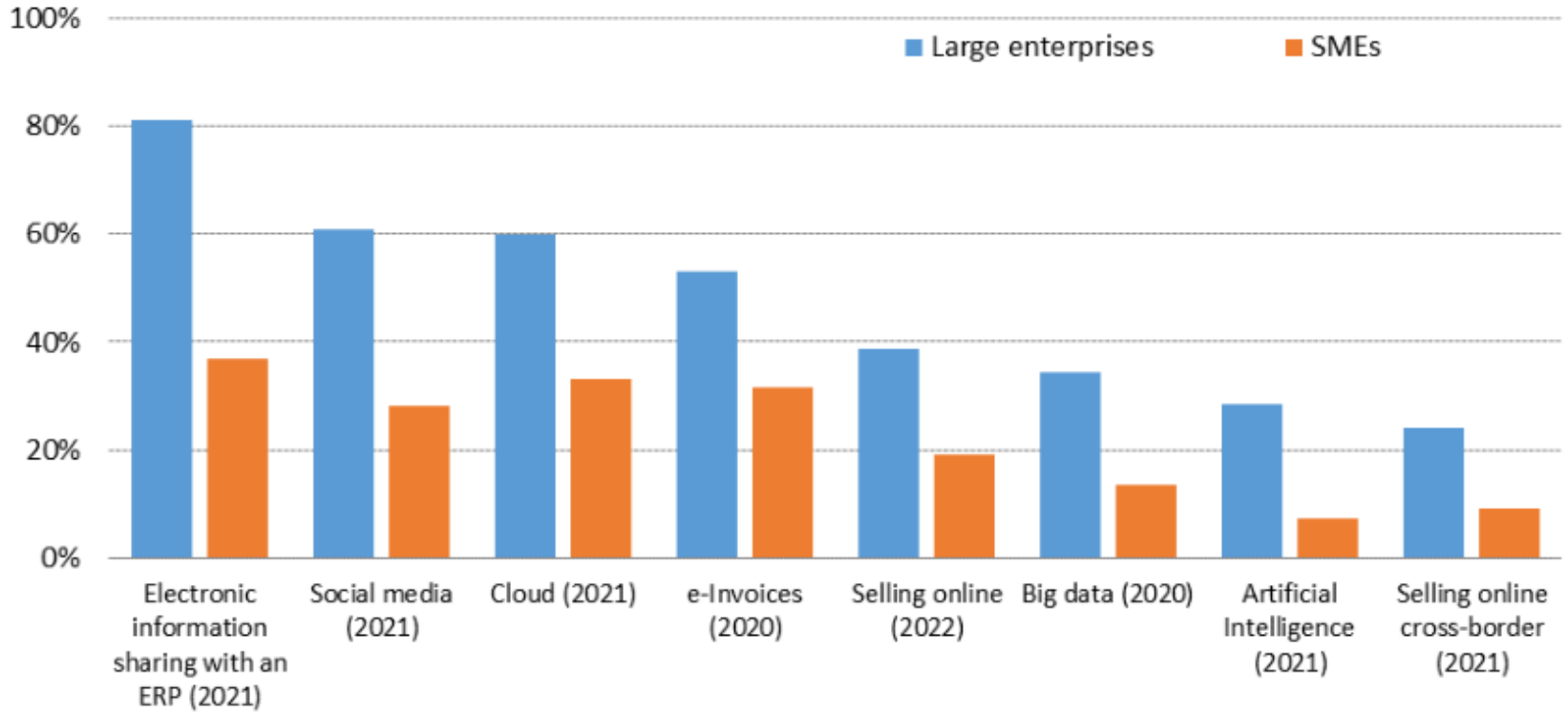
Overview of use of ICT in Finnish companies (min. 10 persons) in 2021, % of all companies



Major potential for improvement!

Data from Statistics Finland (2021) “Use of IT in enterprises”, available at https://www.stat.fi/til/icte/2021/icte_2021_2021-12-03_tie_001_fi.html, 3.12.2021

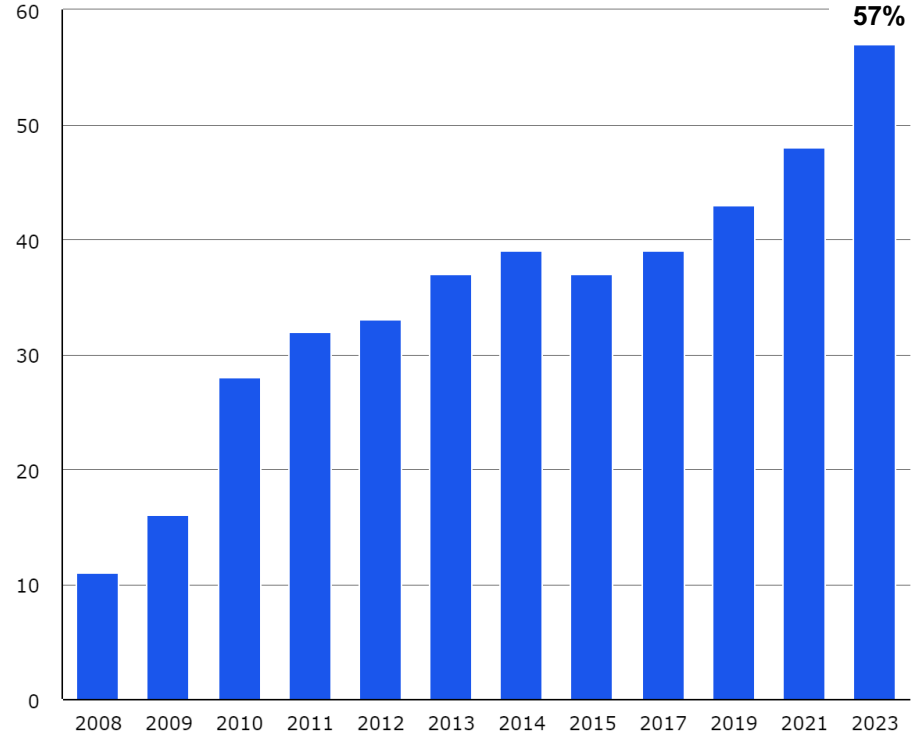
Adoption of digital technologies (% enterprises) in EU countries



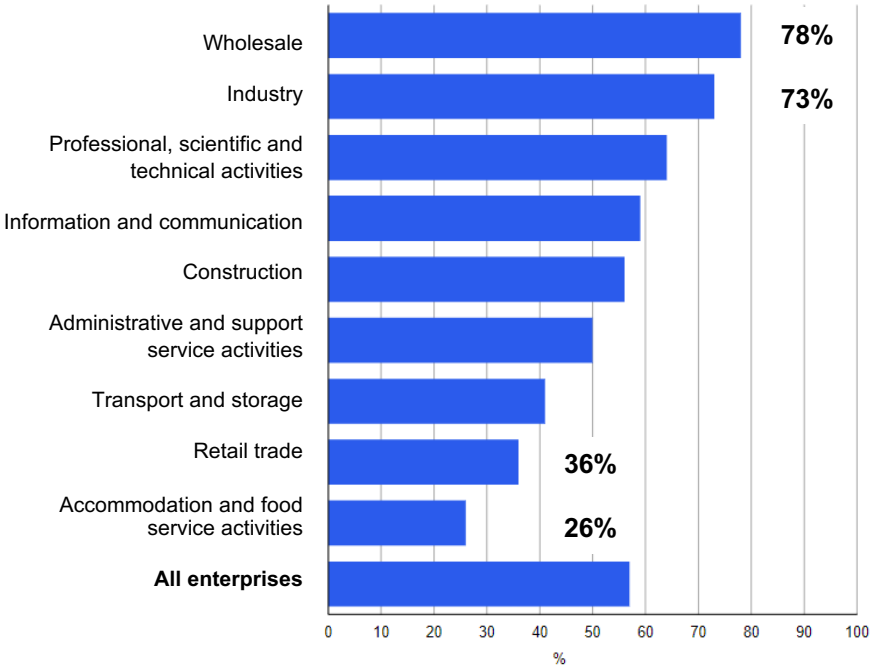
Source: Eurostat, European Union survey on ICT usage and e-commerce in enterprises.

Source: https://digital-strategy.ec.europa.eu/en/library/cardinal-points-digital-decade-report-2023

Use of ERP systems in Finnish companies in 2023 – 57% overall



Company has an ERP system in use in 2023,
share of companies by **industry**

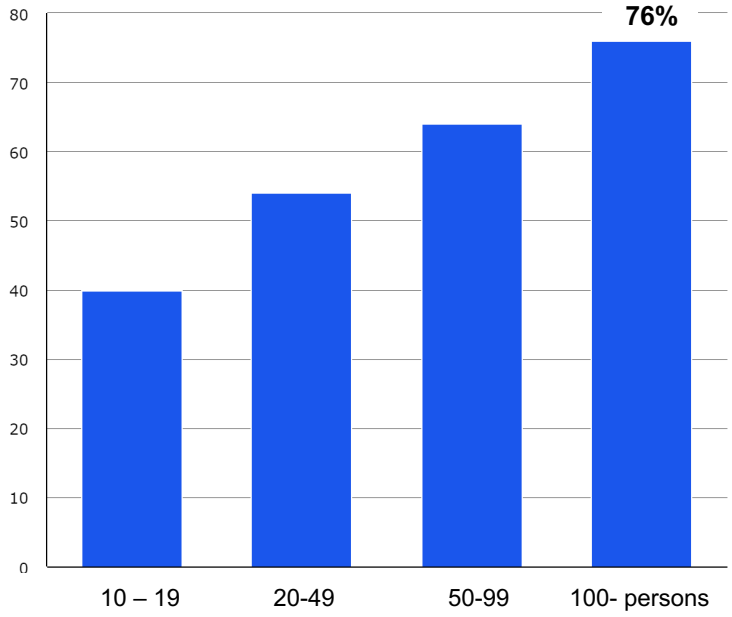


Lähde: Tilastokeskus, tietotekniikan käyttö yrityksissä

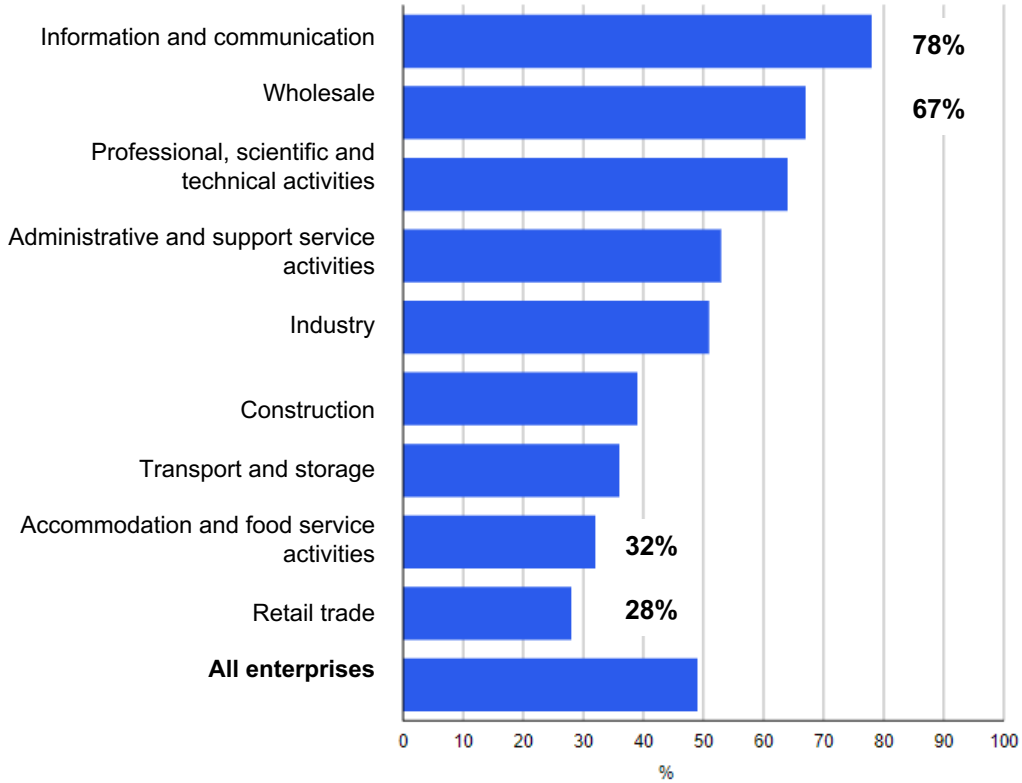
ERP = Enterprise Resource Planning system (toiminnanohjausjärjestelmä)
Source: Statistics Finland (Dec 7, 2023): https://stat.fi/julkaisu/cl8ju4icl85120cvzb2317b7z and https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

Use of CRM systems in Finnish firms in 2023 – 49% overall

Company has a CRM system in use in 2023,
share of companies by **size**

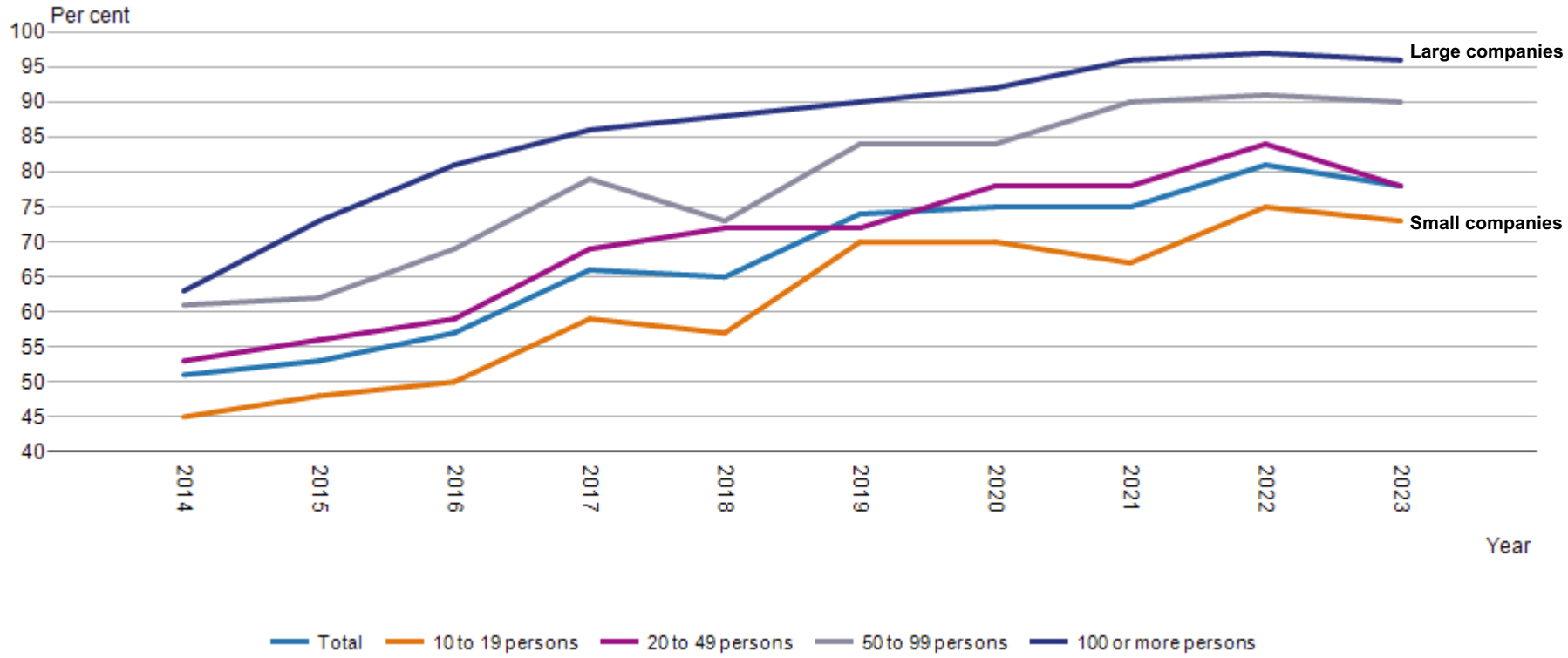


Company has a CRM system in use in 2023,
share of companies by **industry**



CRM = Customer Relationship Management system (asiakkuudenhallintajärjestelmä)
Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

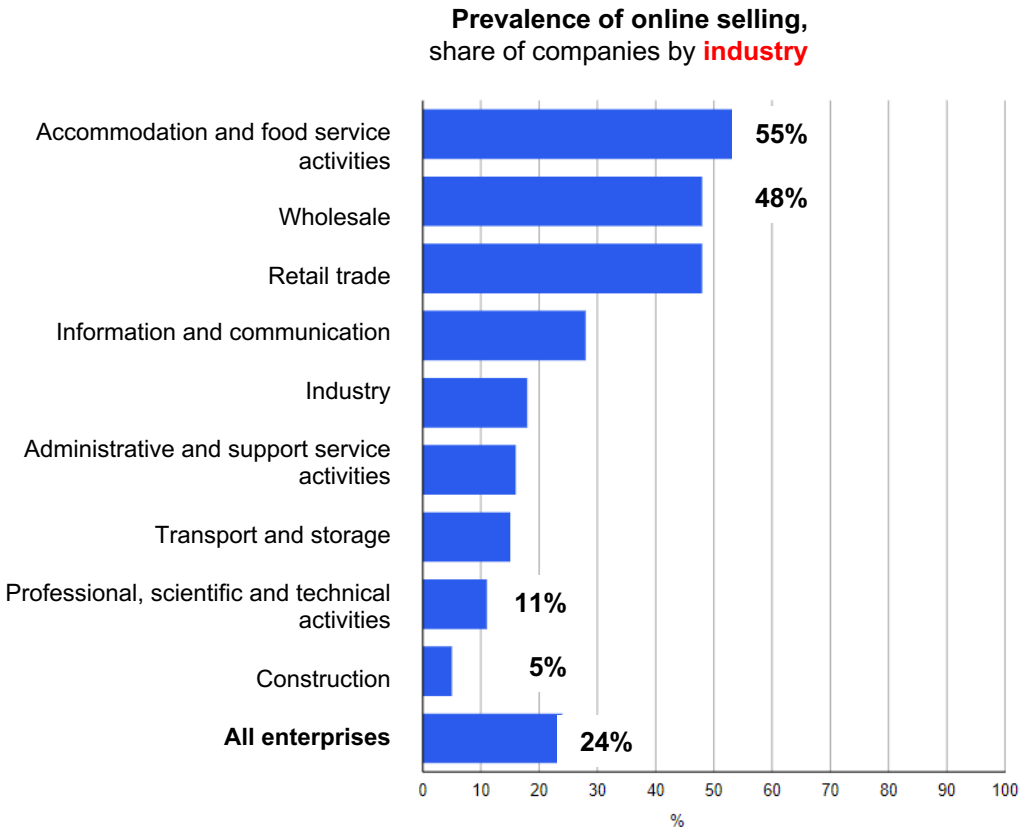
Use of cloud services in Finnish companies – 78% overall



Source: Use of information technology in enterprises by Size category of personnel and Year. Use cloud services, % of enterprises.. PxWeb (stat.fi)

Use of Online selling in Finnish firms in 2022 – 24% overall

Online selling means orders for products or services received by the company, which have been made on the company's own website or electronic marketplace.



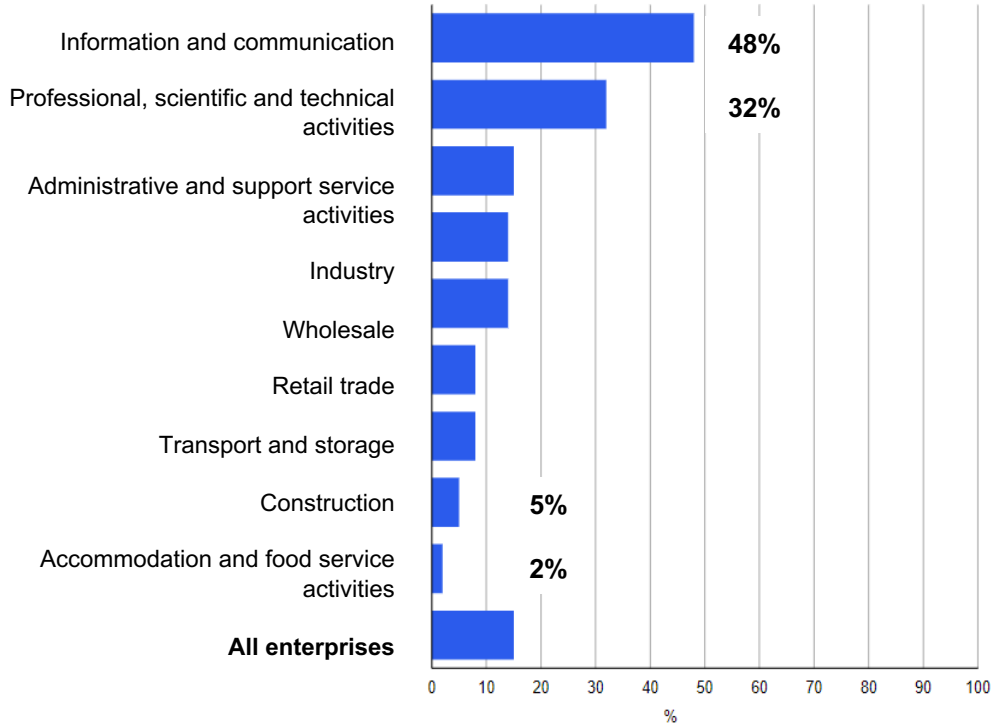
Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

Use of Artificial intelligence in Finnish firms in 2023 – 15% overall

AI technologies were used by 15% of companies. **42% of the largest companies (at least 100 employees)** and 10% of the smallest companies (10–19 employees) used AI technologies.

By industry, AI technologies were clearly **most commonly used in the information and communication (48%)** and professional, scientific and technical activities (32%) industries.

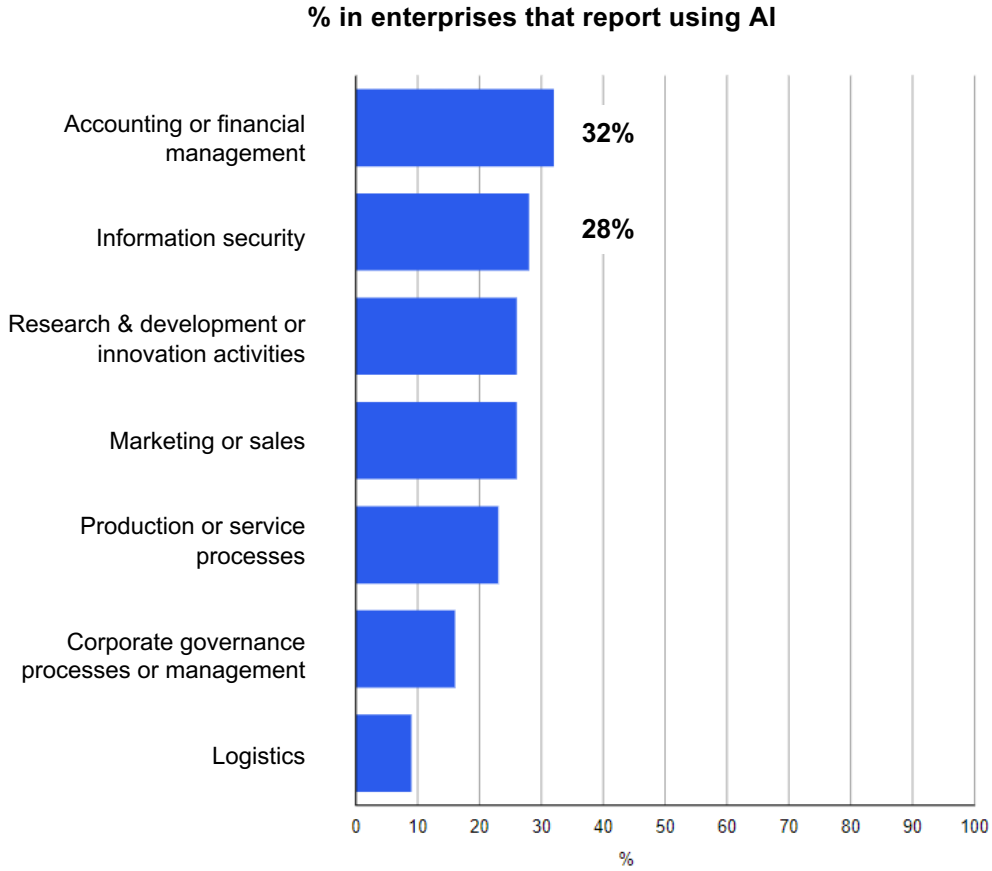
Company has AI technologies in use in 2023,
share of companies by **industry**



Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

Use purposes of AI in Finnish companies in 2023

AI is most commonly used for accounting and financial management (32%), representing 5% of all companies. Next in information security (28%) or in R&D and innovation (26%).

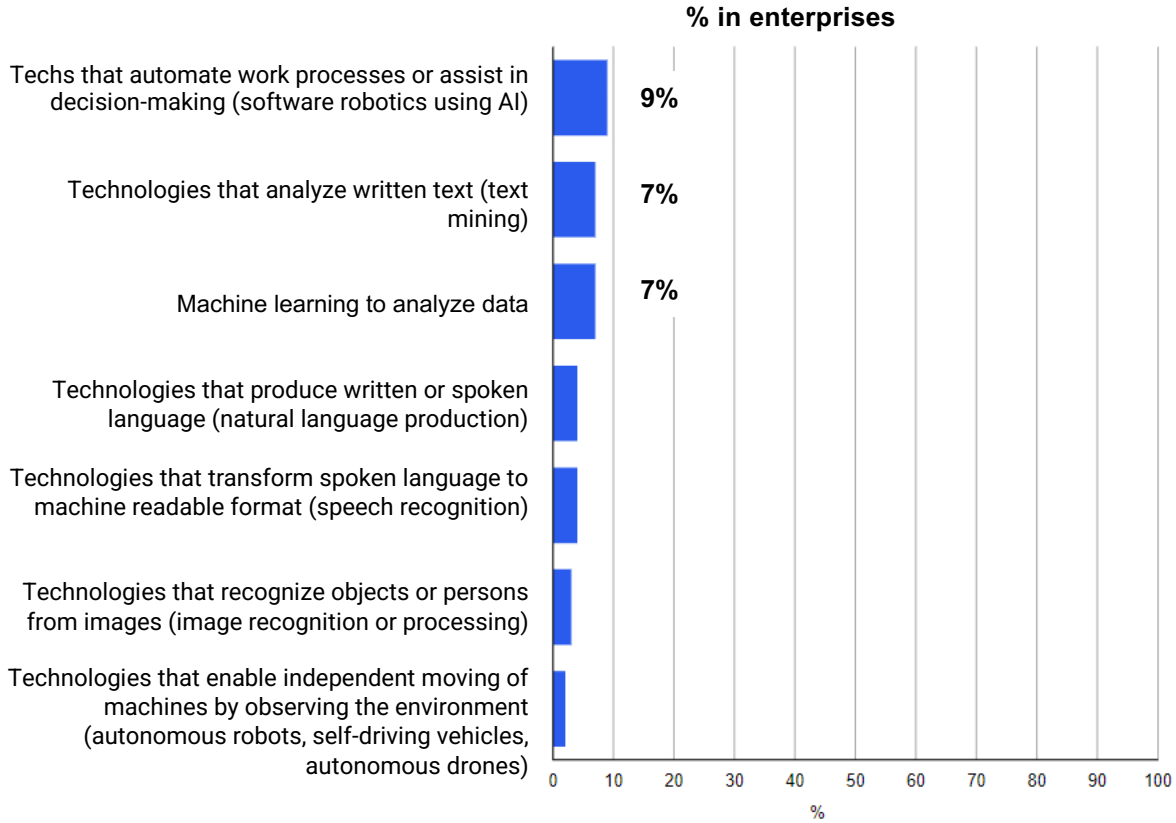


Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

AI technologies used in Finnish companies in 2023

The most commonly used AI technologies **automate work processes or assist in decision-making (software robotics using AI**), which were used by 9% of companies.

Technologies that **analyze written text (7%) and machine learning to analyze data (7%)** were the next most common AI technologies.

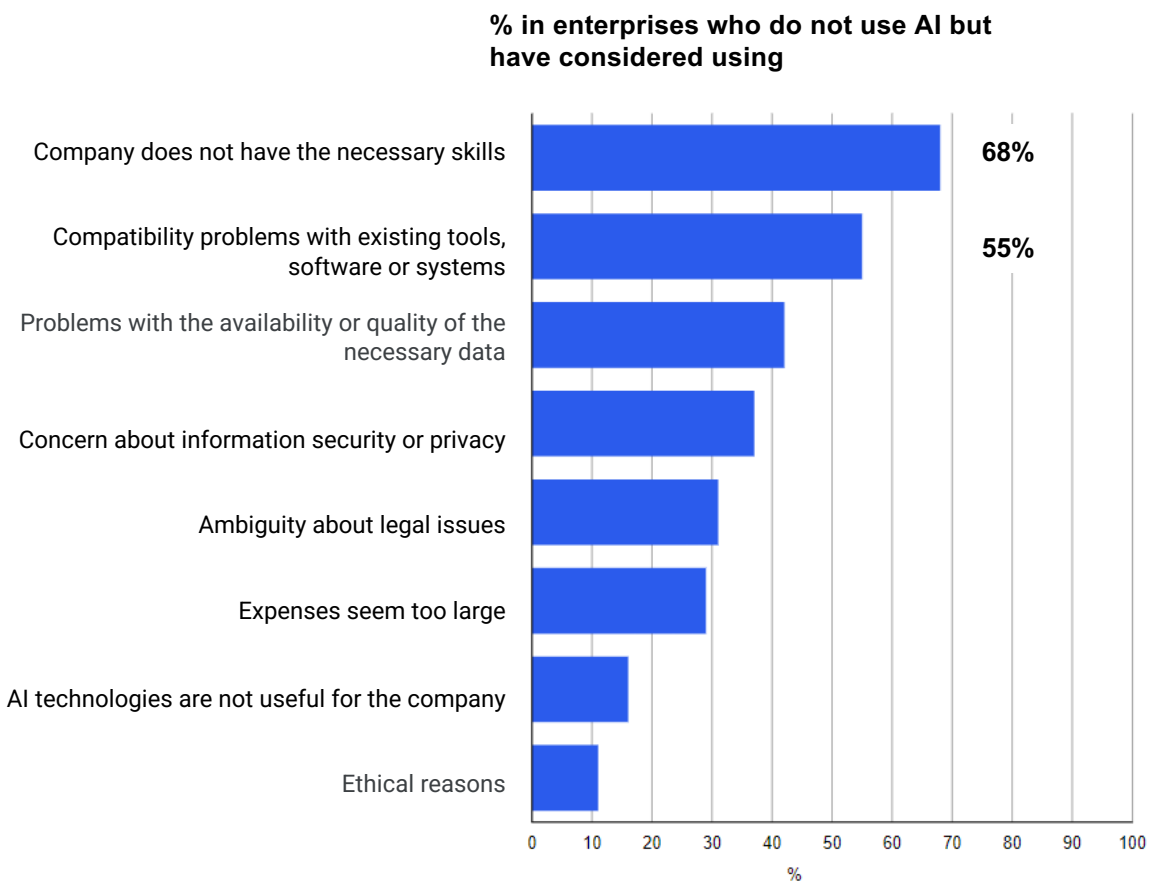


Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

Reasons for not using AI technologies in Finnish companies in 2023

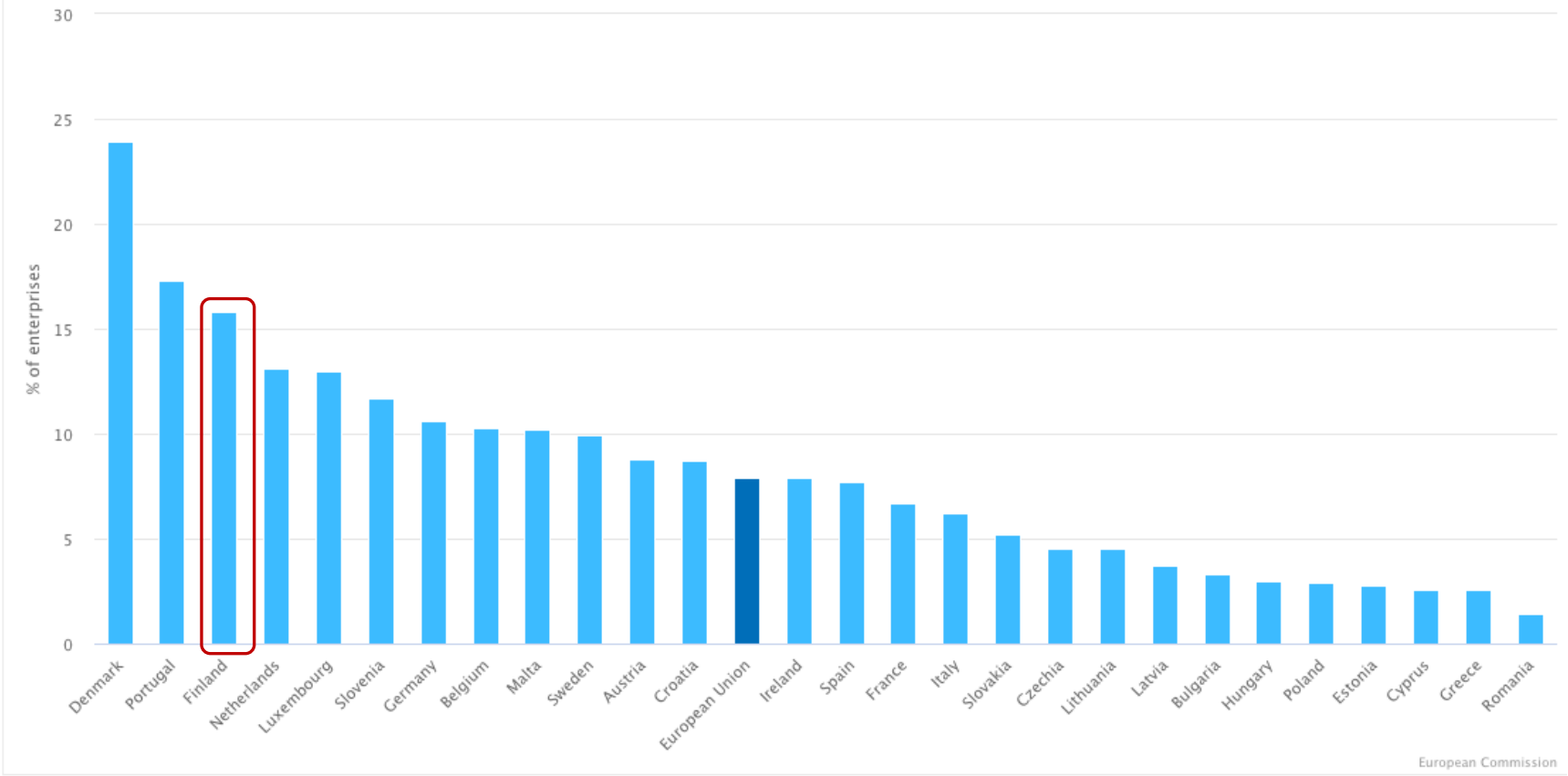
The most common reason for the company not using AI technologies (of those who do not use AI technologies but have considered it) was a **lack of skills** (68%).

Common reasons were also **compatibility problems** with existing tools, software or systems (55%) and problems with the **availability and quality of the necessary data** (42%).



Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2

Comparison to other EU countries – AI tech used in enterprises in EU countries in 2021



Source: DESI 2023 dashboard for the Digital Decade - Digital Decade DESI visualisation tool (europa.eu)

Use of Automatic data transmission in Finnish firms in 2023 – 13% overall

Sales via **automatic data transfer**, i.e. orders placed by customers via **EDI** (Electronic Data Interchange), also automatic demand-driven orders created by system & orders that are received directly into ERP.

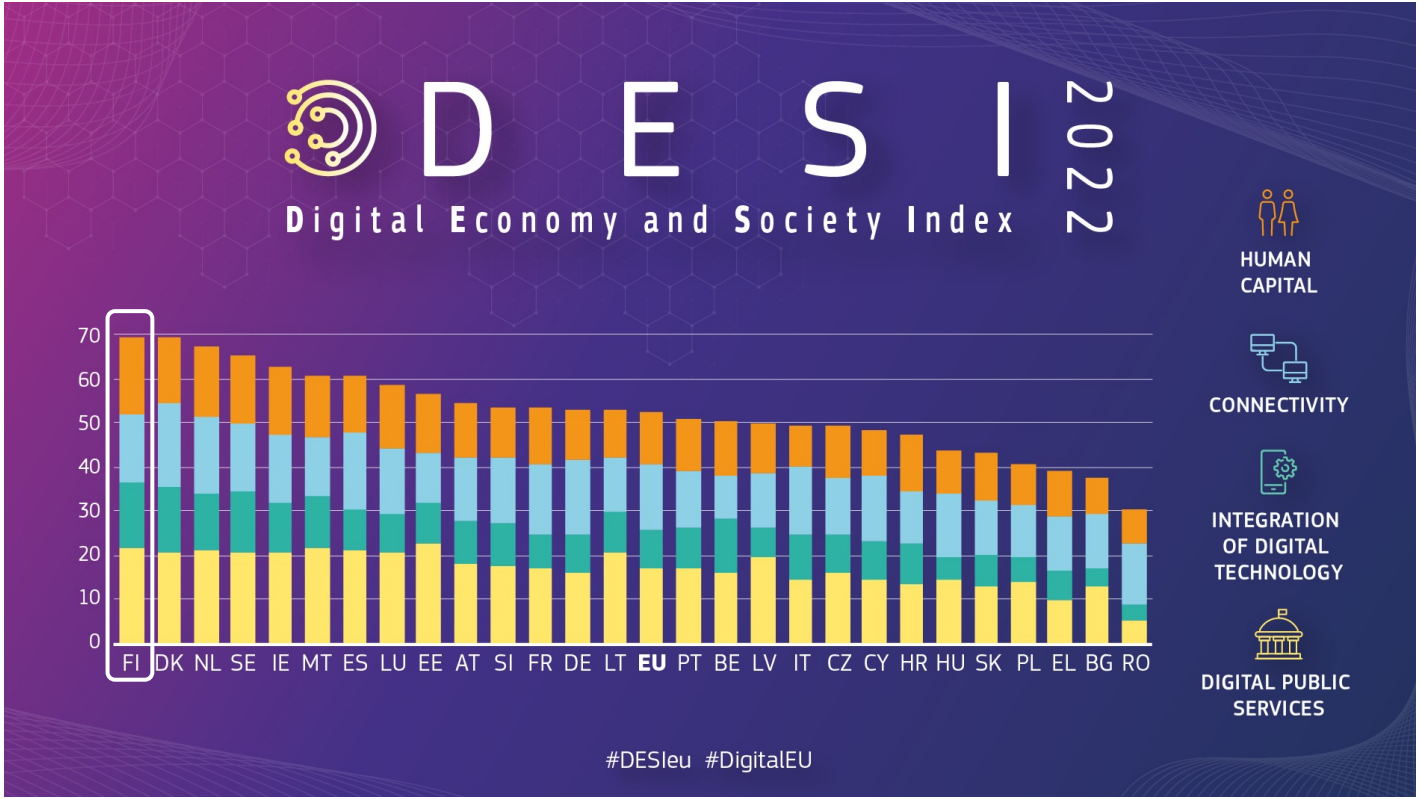
EDI is a procedure in which a data flow is produced from the information located in the company's IS, which is transmitted electronically to the receiving organization and can be automatically further processed there. The term EDI/OVT (organisaatioiden välinen tiedonsiirto) is often used. Examples of EDI are EDIFACT (UN's message standard), ODETTE, XML/EDI.

13% of the companies used automatic data transmission for receiving sales orders. The use of automatic data transfer for receiving orders was most common among industries in **wholesale (28%) and industry (22%).** By size, the frequency of receiving orders with automatic data transfer was strongly focused on the **largest companies (28%)**. In 2022, the value of sales made with automatic data transfer in all companies (min 10 employees) was ca. 75 billion euros - corresponding to 18.4% of the companies' combined turnover.

Source: Statistics Finland (Dec 7, 2023), ICT use in enterprises, https://stat.fi/julkaisu/cl8junjuw8i2g0cw15veu2sl2
See also: Real time economy - Real time economy (yrityksendigitalous.fi),
eFTI front page | eFTI, Pan-European Public Procurement Online About – OpenPeppol
Follow prof. Tomi Dahlberg (emeritus) in LinkedIn if interested in this area!

Digital indexes and barometers

Finland 1st in EU's Digital Economy and Society Index DESI 2022

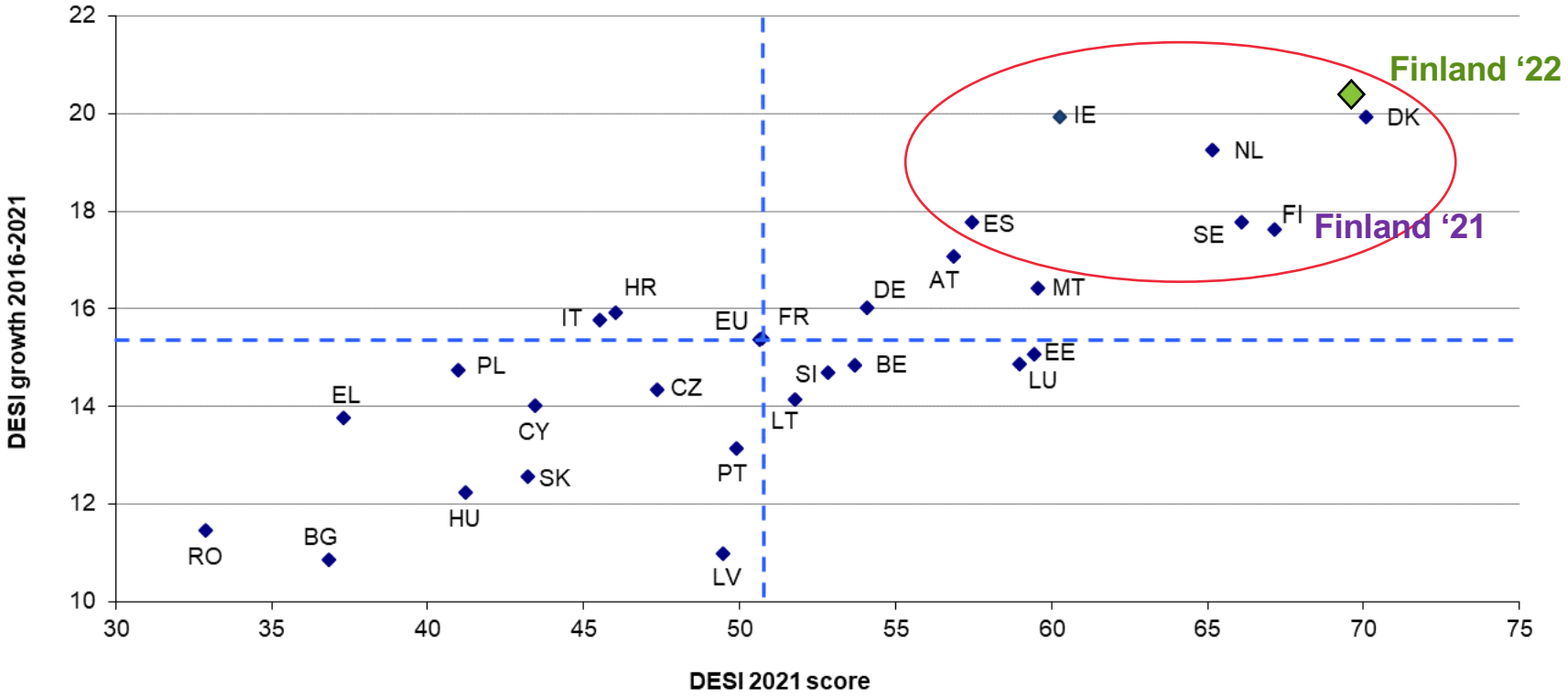


Source: https://ec.europa.eu/digital-single-market/en/desi, 2022. From 2014 to 2022, DESI summarised indicators on Europe's digital performance and tracked the progress of EU countries.

As of 2023, and in line with the **Digital Decade Policy Programme 2030**, DESI is now integrated into the State of the Digital Decade report and used to **monitor progress towards the digital targets.**

DESI Progression from 2016 vs. score in 2021

The most significant progression was noted in Ireland and Denmark, followed by the Netherlands, Spain, Sweden & Finland. These countries also perform well above the EU DESI average based on their scores in DESI 2021.



Source: https://ec.europa.eu/digital-single-market/en/desi, 2021.
In 2022, Finland's score is 69.6 (was 67.1 in 2021) and Denmark's 69.3 (was 70.1 in 2021), while the EU average is 52.3 in 2022 (was 50.7 in 2021).

Overview of 4 DESI dimensions 2022

DESI Dimension	Indicators related to the Path to the Digital Decade proposal
1 Human capital	At least basic digital skills ICT specialists Female ICT specialists
2 Connectivity	Gigabit for everyone (Fixed very high capacity network coverage) 5G coverage
3 Integration of digital technology	SMEs with a basic level of digital intensity AI Cloud Big data
4 Digital public services	Digital public services for citizens Digital public services for businesses

Source: European Commission

Source: https://ec.europa.eu/digital-single-market/en/desi, 2022. Report: https://ec.europa.eu/newsroom/dae/redirection/document/88764

Details on DESI dimensions 1(2)

Dimension	Sub-dimension	Indicator
1 Human capital	1a Internet user skills	1a1 At least basic digital skills
		1a2 Above basic digital skills
		1a3 At least basic digital content creation skills
	1b Advanced skills and development	1b1 ICT specialists
		1b2 Female ICT specialists
		1b3 Enterprises providing ICT training
		1b4 ICT graduates
2 Connectivity	2a Fixed broadband take-up	2a1 Overall fixed broadband take-up
		2a2 At least 100 Mbps fixed broadband take-up
		2a3 At least 1 Gbps take-up
	2b Fixed broadband coverage	2b1 Fast broadband (NGA) coverage
		2b2 Fixed Very High Capacity Network (VHCN) coverage
	2c Mobile broadband	2c1 5G spectrum
		2c2 5G coverage
		2c3 Mobile broadband take-up
	2d Broadband prices	2d1 Broadband price index

Source: https://ec.europa.eu/digital-single-market/en/desi, 2022.

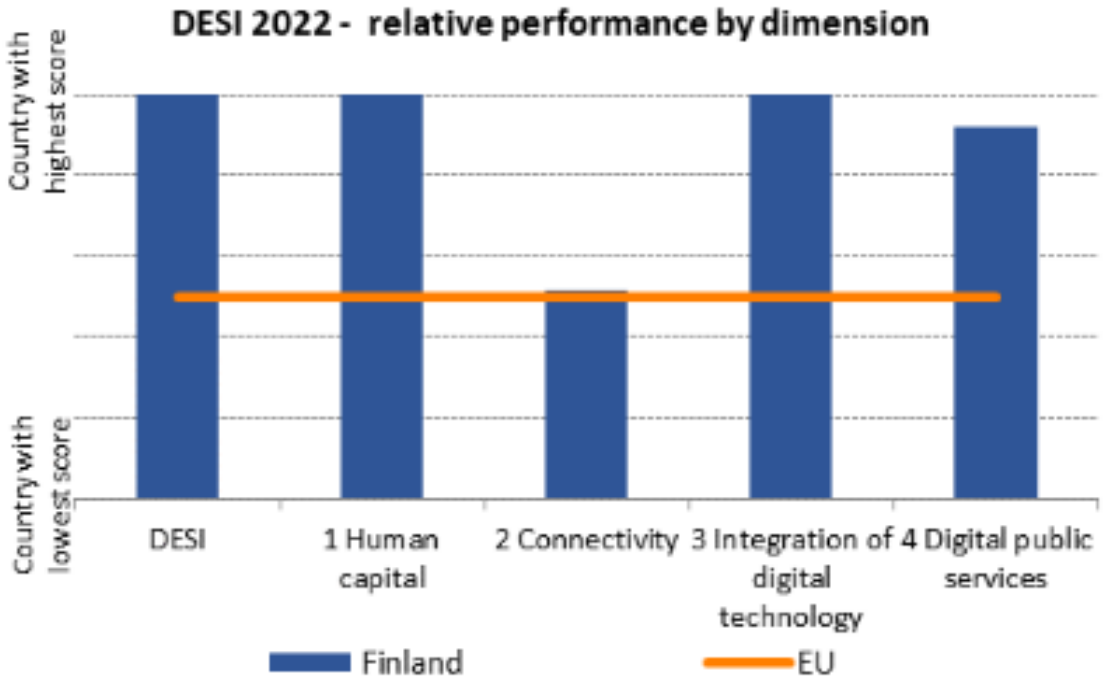
Details on DESI dimensions 2(2)

3 Integration of digital technology	3a Digital intensity	3a1 SMEs with at least a basic level of digital intensity
	3b Digital technologies for businesses	3b1 Electronic information sharing
		3b2 Social media
		3b3 Big data
		3b4 Cloud
		3b5 AI
		3b6 ICT for environmental sustainability
		3b7 e-Invoices
	3c e-Commerce	3c1 SMEs selling online
		3c2 e-Commerce turnover
		3c3 Selling online cross-border
4 Digital public services	4a e-Government	4a1 e-Government users
		4a2 Pre-filled forms
		4a3 Digital public services for citizens
		4a4 Digital public services for businesses
		4a5 Open data

Source: https://ec.europa.eu/digital-single-market/en/desi, 2022.

Finland's DESI performance by dimension in 2022

Rank	**1.**	**1.**	**8.***	**1.**	**2.**



* Connectivity: Many sparsely populated areas still do not have any VHCN (very high capacity network) availability or are served by only one VHCN.

Although Finland's rate of fixed VHCN coverage is close to the EU average (68% vs. 70%), it **scores low (12.4%) in rural areas.**

The rank improved from 13th (in 2021) to 8th (in 2022).

Source: https://ec.europa.eu/digital-single-market/en/desi , 2022. Finland's report: https://ec.europa.eu/newsroom/dae/redirection/document/88700

Finland's Digital public services indicators in DESI 2021

Finland ranks **2nd** in the digital public services, after Estonia, followed by Malta and the Netherlands.

	DESI 2020	Finland DESI 2021	Finland DESI 2022	EU DESI 2022
4a1 e-Government users	**91%**	**91%**	**92%**	**65%**
% internet users	2019	2020	2021	2021
4a2 Pre-filled forms	**NA**	**NA**	**90**	**64**
Score (0 to 100)			2021	2021
4a3 Digital public services for citizens	**NA**	**NA**	**90**	**75**
Score (0 to 100)			2021	2021
4a4 Digital public services for businesses	**NA**	**NA**	**93**	**82**
Score (0 to 100)			2021	2021
4a5 Open data	**NA**	**NA**	**86%**	**81%**
% maximum score			2021	2021

"Finland scores well above the EU average. Online interaction between government authorities and the public is approaching the maximum level with 92% of Finnish internet users using e-government services. Finland performs very well on pre-filled forms (90%), and on providing online services for both individuals and businesses. Finland scores above the EU average on open data, too."

Source: https://ec.europa.eu/digital-single-market/en/desi, 2022.

Aalto students have contributed also!

ISM has organized the Public service hackathon aka Digitalism Challenge course 5 times with Accenture and Fjord.

The course was about solving real challenges related to digitalization at the public sector.

Last time, the client was **Nordic Smart Government** project (PRH, State Treasury and Tax). Also 3 SME's from the food chain were invited as case companies (Fat Lizard brewery, Tapola farm, Organic Association)

Ca. 100 students from **5 Aalto Schools** in 20 teams.

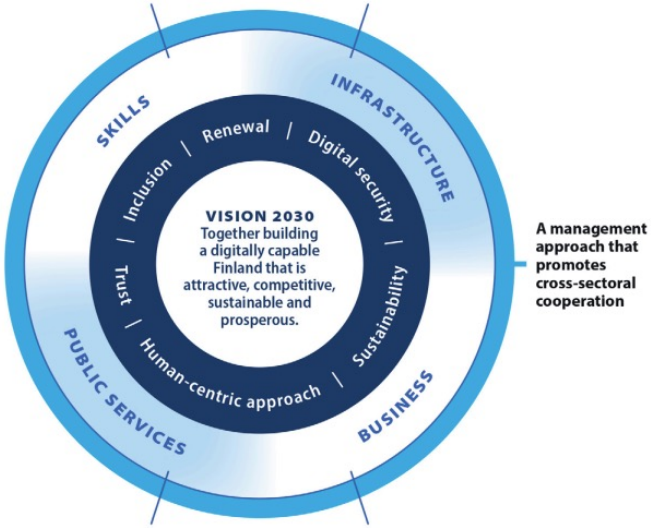
Previous clients: HUS, Population Register Centre, Finnish Customs, Finnish Defence Forces, National Police Board, Finnish Border Guard, Ministry of the Interior, Government Shared Services Centre for Finance and HR, the Apotti Project, City of Helsinki's Disability Services, Eteva, Helsinki's Family Centres and Nordea with Tax Admin.

https://www.whatif.aalto.fi/pshack

https://www.aalto.fi/en/news/solutions-innovated-during-the-digitalism-challenge-course-are-put-into-practice

DESI now in Digital Decade Report

As of 2023, in line with the EU's Digital Decade Policy Programme 2030, DESI is now integrated into the **State of the Digital Decade report** and used to monitor progress towards the digital targets.



Sources: https://digital-strategy.ec.europa.eu/en/policies/desi
Interactive stats: DESI 2023 dashboard for the Digital Decade - Digital Decade DESI visualisation tool (europa.eu)
Government report: Digital Compass (valtioneuvosto.fi)

Digital Decade Country Report 2023: Finland

Finland has been at the forefront of the digital transformation for many years, expected to make a very strong contribution to the collective efforts to achieve the EU's Digital Decade targets. It has rolled out comprehensive digital policies with early adoption of 5G, has well-developed e-Government services, and has a highly skilled workforce coupled with good coordination and programming. Further measures are needed to reach the gigabit connectivity target. To guide its digital transformation over the coming years, Finland submitted its own Digital Compass in 2022, which is well aligned with the Digital Decade Policy Programme.

Finland is collaborating with other Member States in exploring the possibility to set up **European Digital Infrastructure Consortia (EDICs)** on: (i) Genome, to enable the effective and secure cross-border access to repositories of personal genomic datasets; (ii) Copyright Infrastructure, to release the potential of EU's creative sectors; (iii) Mobility And Logistics Data, to enable access, sharing and reuse of data in these areas; and (iv) Innovative Massive Public Administration inter-Connected Transformation Service, to develop a new generation of advanced cross-border services.

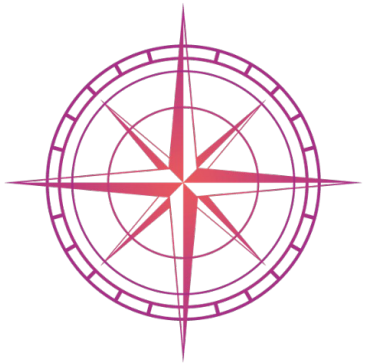
EU's Digital Decade policy programme

The programme sets out digital ambitions for the next decade in the form of concrete targets. The main goals are:

1. A digitally skilled population and highly skilled digital professionals
2. Secure and sustainable digital infrastructures
3. Digital transformation of businesses
4. Digitalisation of public services

Skills

20 million employed **ICT specialists**, more graduates + gender balance
80% of adults can **use tech** for everyday tasks



Government

Key Public Services - 100% online
Everyone can **access health records online**
Everyone can use **eID**

Infrastructure

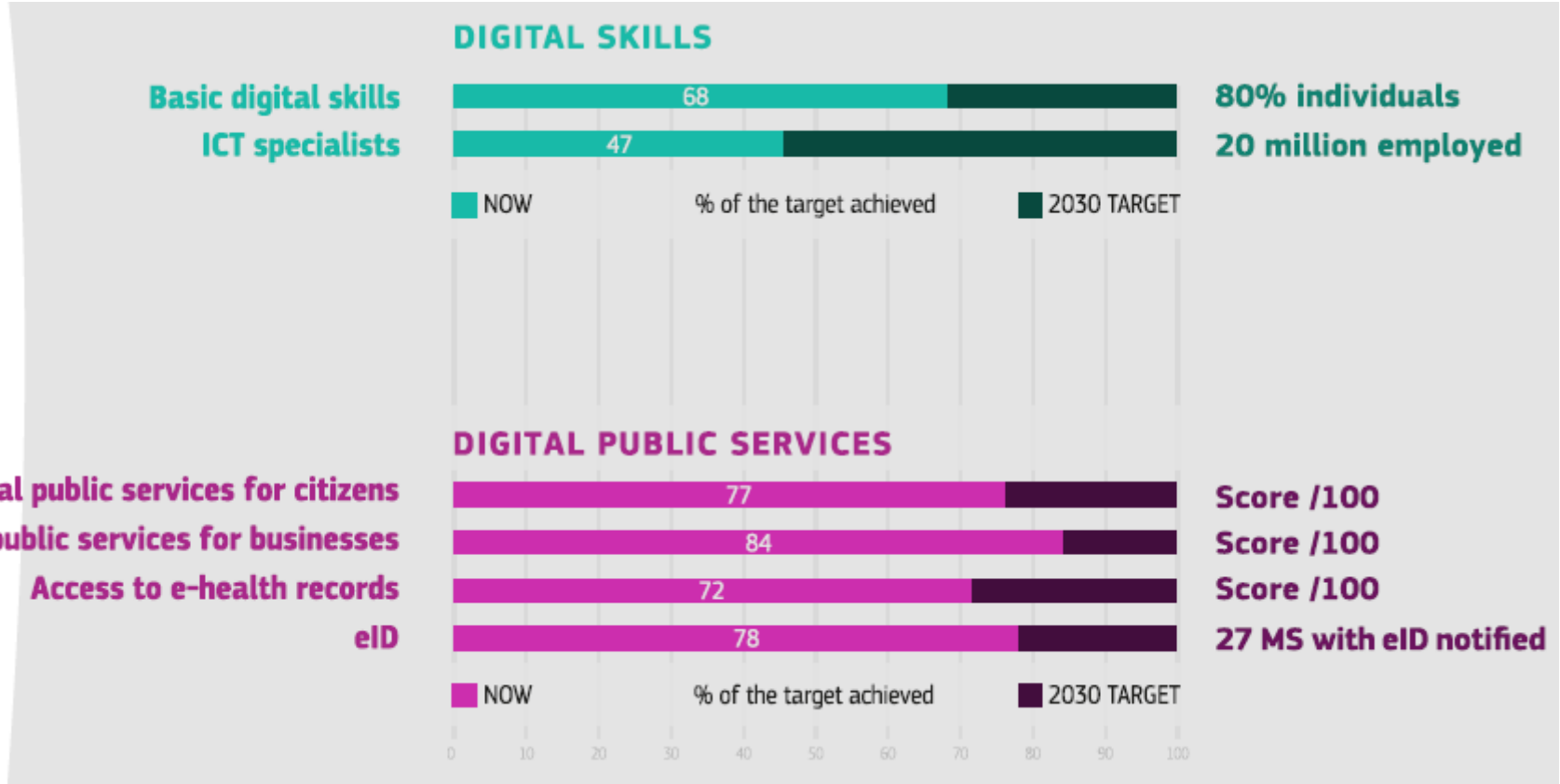
Gigabit connectivity for everyone, **high-speed mobile coverage** (at least 5G) everywhere
EU produces 20% of world's **semiconductors**
10 000 **cloud edge nodes** = fast data access
EU **quantum computing** by 2025

Business

75% of companies using **Cloud, AI or Big Data**
Double the number of **unicorn startups**
90% of **SMEs taking up tech**

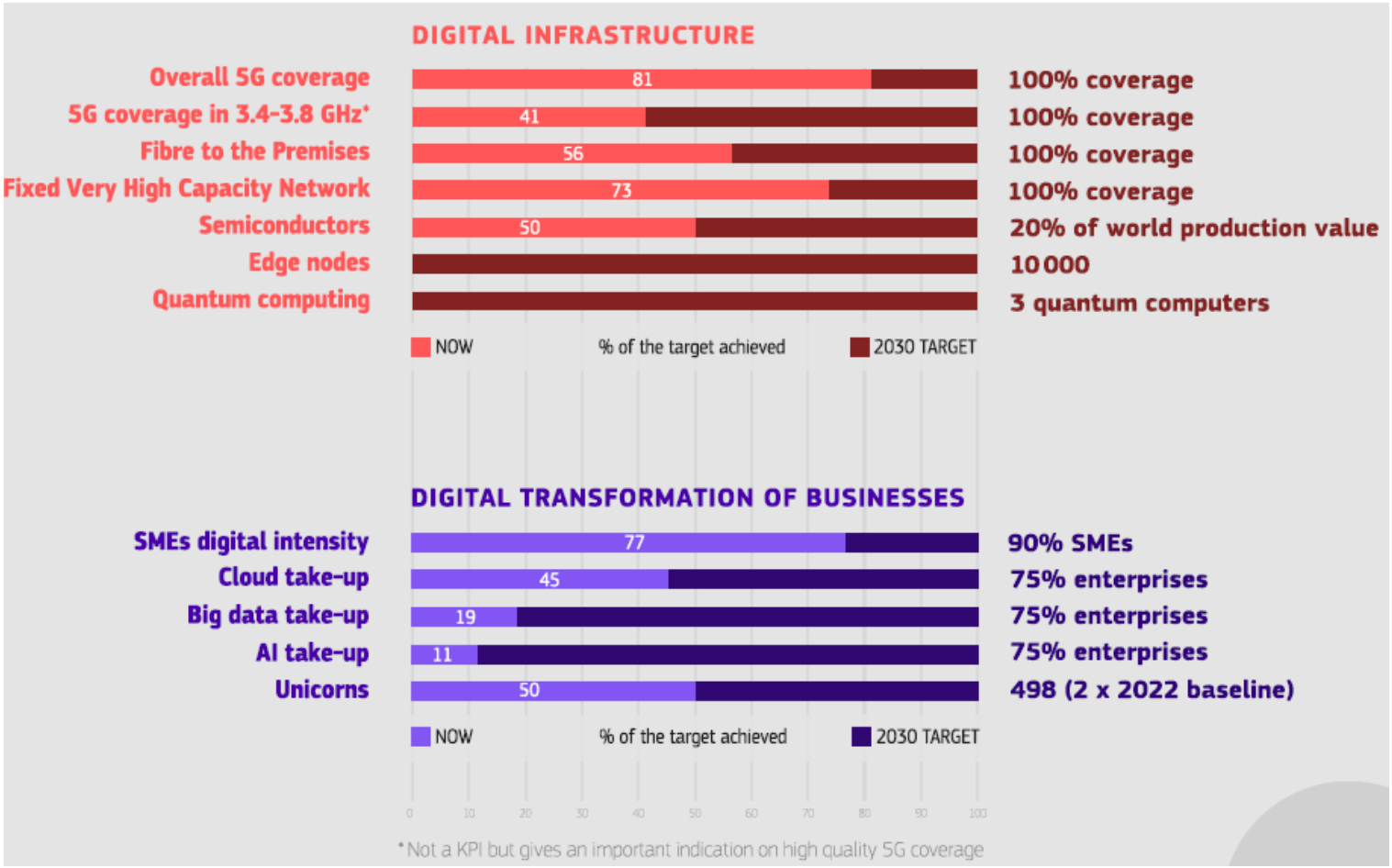
https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#tab_1

Digital Decade policy programme – EU targets for 2030 (1/2)



https://digital-strategy.ec.europa.eu/en/library?topic=201

Digital Decade policy programme – EU targets for 2030 (2/2)



https://digital-strategy.ec.europa.eu/en/library?topic=201

Finland in EU's Digital Decade Country Report 2023

Finland should continue implementing its policies in the area of digital skills. Notably, it should implement the announced policies to further increase the number of ICT specialists.

Finland should continue implementing its policies in the area of digital infrastructure. It should pay even more attention to very high-capacity network coverage, delivering broadband to the rural areas, including fibre to the premises throughout the country.

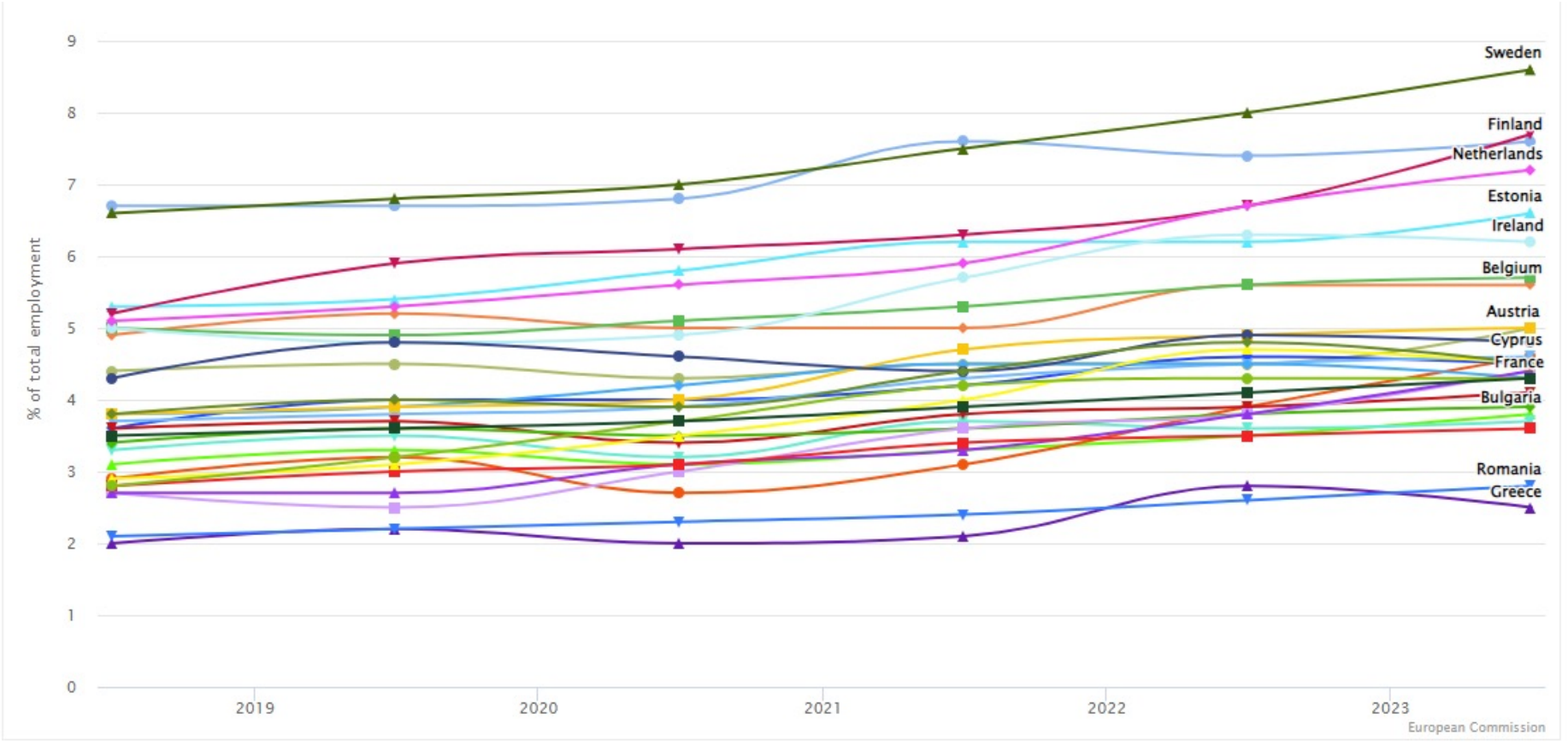
Measures taken by Finland in the field of semiconductors and quantum computing should continue in order to help the EU to become a strong market player in these areas.

Finland should continue implementing its policies in the area of digitalisation of businesses. In particular, it should continue boosting the take up of advanced digital technologies by businesses, particularly in the area of AI and big data, by providing incentives for investment.

Finland should continue implementing its policies to digitalise public services. In particular, cybersecurity should stay at the forefront of governmental policies.

Source: European Commission 2023 Report on the state of the Digital Decade | Shaping Europe's digital future (europa.eu), Country report of Finland, 2023.

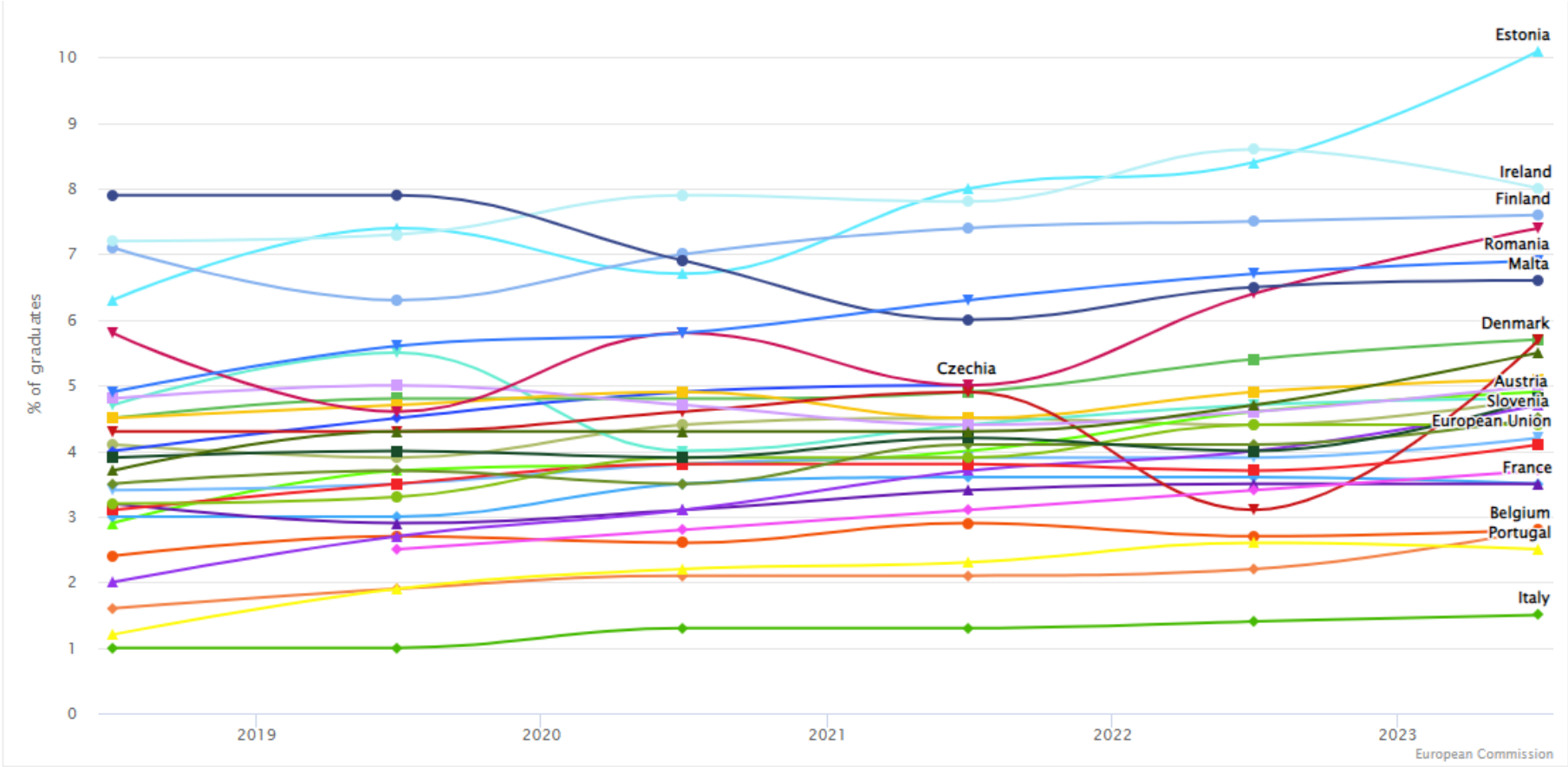
Selected DESI stats – ICT specialists (as % of total employment)



Source: European Commission DESI 2023 - Compare countries progress - Digital Decade DESI visualisation tool (europa.eu) , 2023.

Explore the visualization tool for further insights on various items!

Selected DESI stats – ICT graduates (as % of graduates)



Source: European Commission DESI 2023 - Compare countries progress - Digital Decade DESI visualisation tool (europa.eu) , 2023.

NEW: Cyber citizen skills and their development in EU

News

Finland creates common model for EU member states for teaching cybersecurity skills to citizens

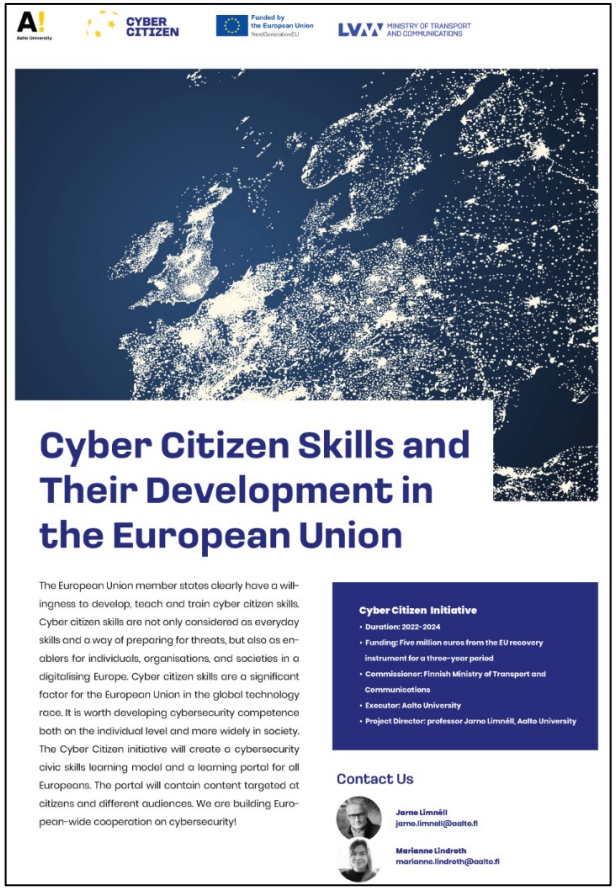
Published: 17.2.2023

The Cyber Citizen Project will create a model for teaching cybersecurity skills to citizens and a related learning portal.

Aalto University and the Ministry of Transport and Communications are implementing the extensive Cyber Citizen Project to create a common model for teaching cybersecurity skills to citizens in the EU Member States. As part of the project, on 17 February 2023 Aalto University published a comprehensive report on the current state of teaching cybersecurity skills to citizens throughout the European Union. Finland has been awarded EUR 5 million for this project from the EU Recovery and Resilience Facility for a three-year period.

Finland / Aalto University creates an educational package to make cybersecurity a civic skill across the EU.

A participatory cyber game is created during the project.



CYBER CITIZEN

Funded by the European Union NextGenerationEU

MINISTRY OF TRANSPORT AND COMMUNICATIONS

Cyber Citizen Skills and Their Development in the European Union

The European Union member states clearly have a willingness to develop, teach and train cyber citizen skills. Cyber citizen skills are not only considered as everyday skills and a way of preparing for threats, but also as enablers for individuals, organisations, and societies in a digitalising Europe. Cyber citizen skills are a significant factor for the European Union in the global technology race. It is worth developing cybersecurity competence both on the individual level and more widely in society. The Cyber Citizen initiative will create a cybersecurity civic skills learning model and a learning portal for all Europeans. The portal will contain content targeted at citizens and different audiences. We are building European-wide cooperation on cybersecurity!

Cyber Citizen Initiative

- Duration: 2022- 2024
- Funding: Five million euros from the EU recovery instrument for a three-year period
- Commissioner: Finnish Ministry of Transport and Communications
- Executor: Aalto University
- Project Director: professor Jarno Limnéll, Aalto University

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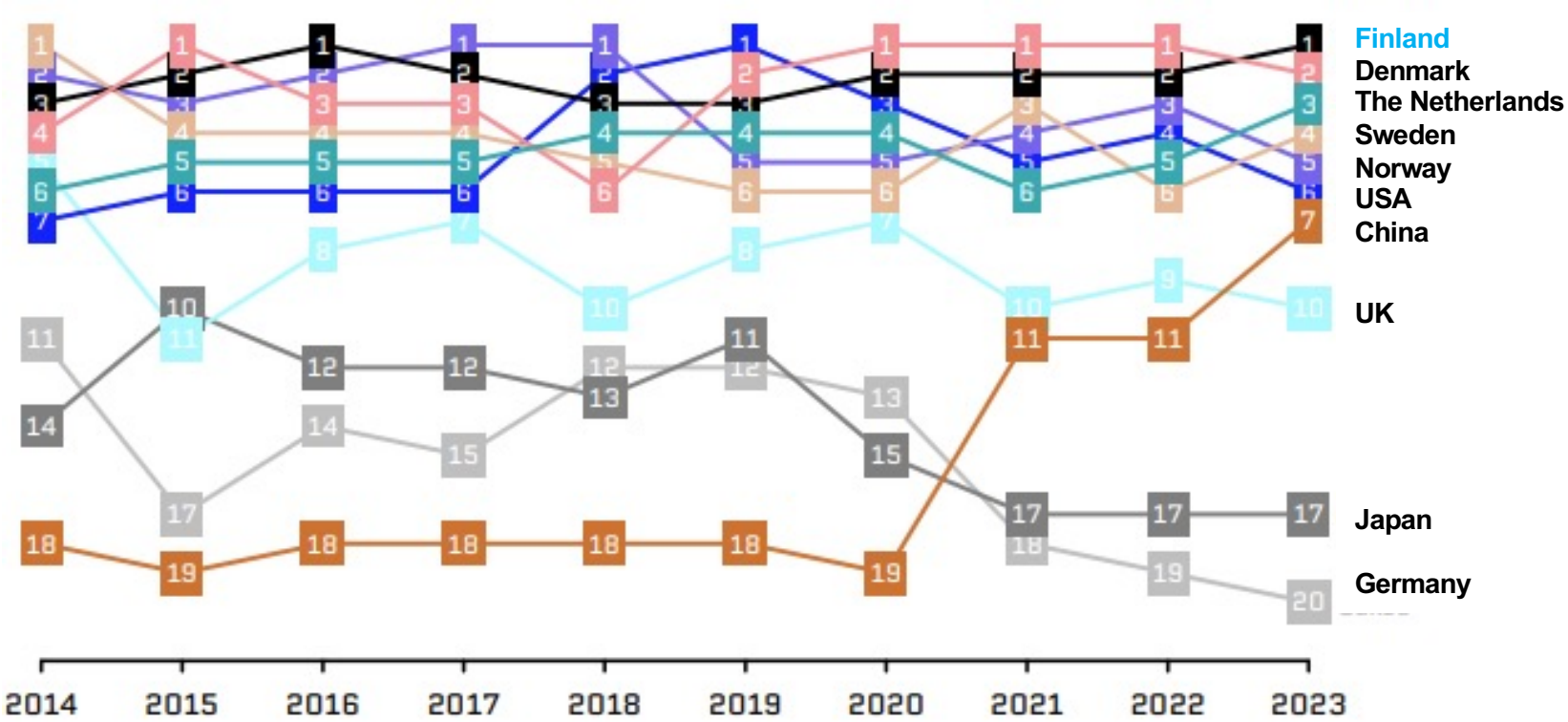
https://www.aalto.fi/en/news/finland-creates-common-model-for-eu-member-states-for-teaching-cybersecurity-skills-to-citizens , 17.2.2023, https://cyber-citizen.eu/en/cyber-citizen-initiative/ https://cyber-citizen.eu/en/aineisto/report/, 17.2.2023 https://cyber-citizen.eu/en/antti-orasvuo-will-be-responsible-for-the-production-of-the-participatory-cyber-game/ 14.2.2023

Digi barometer 2023, Finland is 1st overall

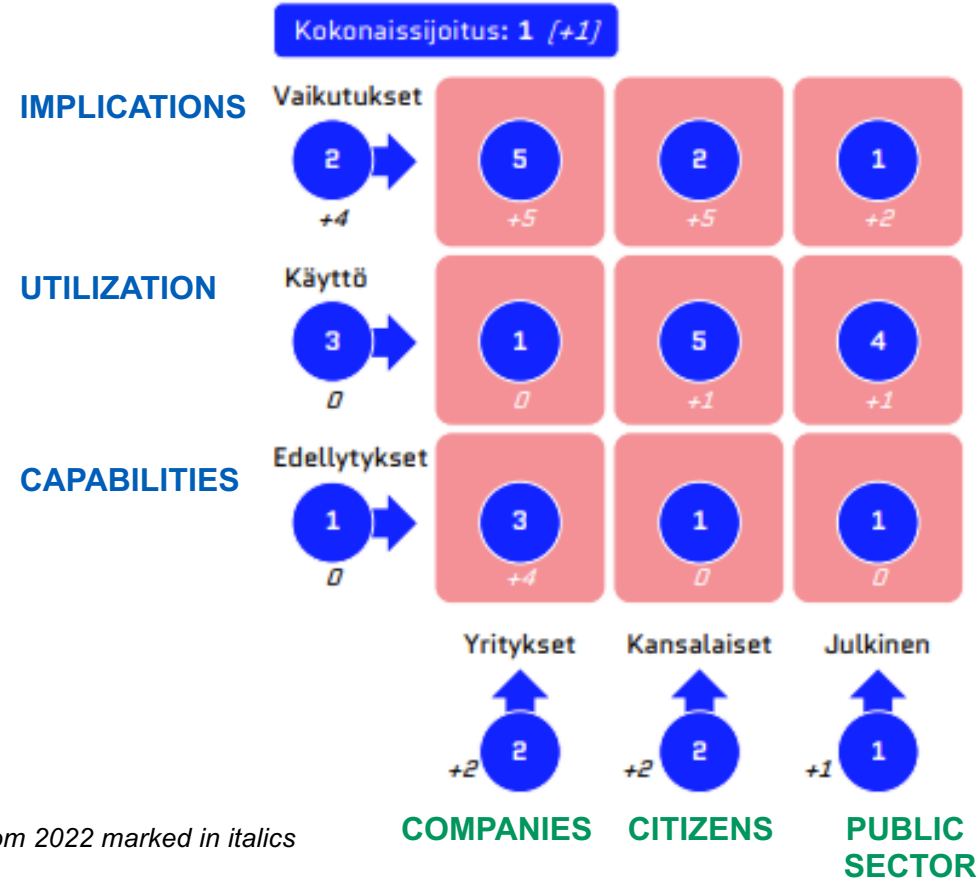


The barometer measures the **utilization of digital capabilities** in 22 countries (also outside EU) with a composite index of **36 variables**. The measurement is done on **three levels** (capabilities, utilization, and implications) and across **three sectors** (company, civic, and public).
Source: https://www.etla.fi/julkaisut/muut-julkaisut/digibarometri-2023-data-tekoaly-ja-talouskasvu/ Etlatieto Oy

Digi barometer 2023

DIGIBAROMETER measures the utilization of digitalization on **three levels** (**capabilities** to utilize digitalization, actual **utilization**, and **implications**) and in **three sectors** (companies, citizens and public sector).

Finland fares very well in the capabilities (1st) and in actual utilization (3rd). **In the implications Finland has improved the most** from 2022 (from 6th to 2nd). In the sectors, Finland is 1st in the public sector and 2nd both in companies and civic sector.



Changes from 2022 marked in italics

Source: https://www.etla.fi/julkaisut/muut-julkaisut/digibarometri-2023-data-tekoaly-ja-talouskasvu/ Etlatieto Oy

Previous results compared to Pohjola's studies on ICT investments

Finland fares much worse in Pohjola's *ICT investment comparisons* than in DESI and other similar indexes regarding the digital economy and society. In 2022, the Desi Index ranked Finland 1st and Sweden 4th of EU countries.

WHY the discrepancy??

"*DESI and other similar indexes* ***measure the readiness and ability of citizens, businesses and other communities in utilizing and producing digital services****. They* ***do not evaluate how ICT and digital services increase both labour productivity and the demand for work****, and thereby accelerating economic growth*."

Source: Pohjola (2021): Tuottavuus, rakennemuutos ja talouskasvu, 7.12.2021 https://www.talouspolitiikanarviointineuvosto.fi/wordpress/wp-content/uploads/2022/01/Pohjola-2022.pdf

Digital maturity of companies at the global level

Digital maturity and DM models

Digital Maturity reflects "the status of a company's digital transformation" – thus it describes **"what a company has already achieved with regard to transformation efforts"** (Chanias and Hess, 2016; Thordsen and Bick, 2023)

Digital maturity **comprises a technological and a managerial aspect** and therefore can be seen as a holistic concept. Organizations reach the highest level of maturity when they have **both a strong digital foundation and a good understanding of how to leverage this foundation for a strategic business advantage.** Moreover, digital maturity is not a static concept because the digital landscape is continuously changing. (Teichert 2019, p. 1675)

Digital transformation: *"An organizational change process that **improves an organization through digital technologies** and may lead to profound changes in value creation and the organizations' identity."* (Christmann et al., 2024)

Chanias, S., & Hess, T. (2016). How digital are we? Maturity models for the assessment of a company's status in the digital transformation. Management Report/Institut für Wirtschaftsinformatik und Neue Medien, (2), 1-14.

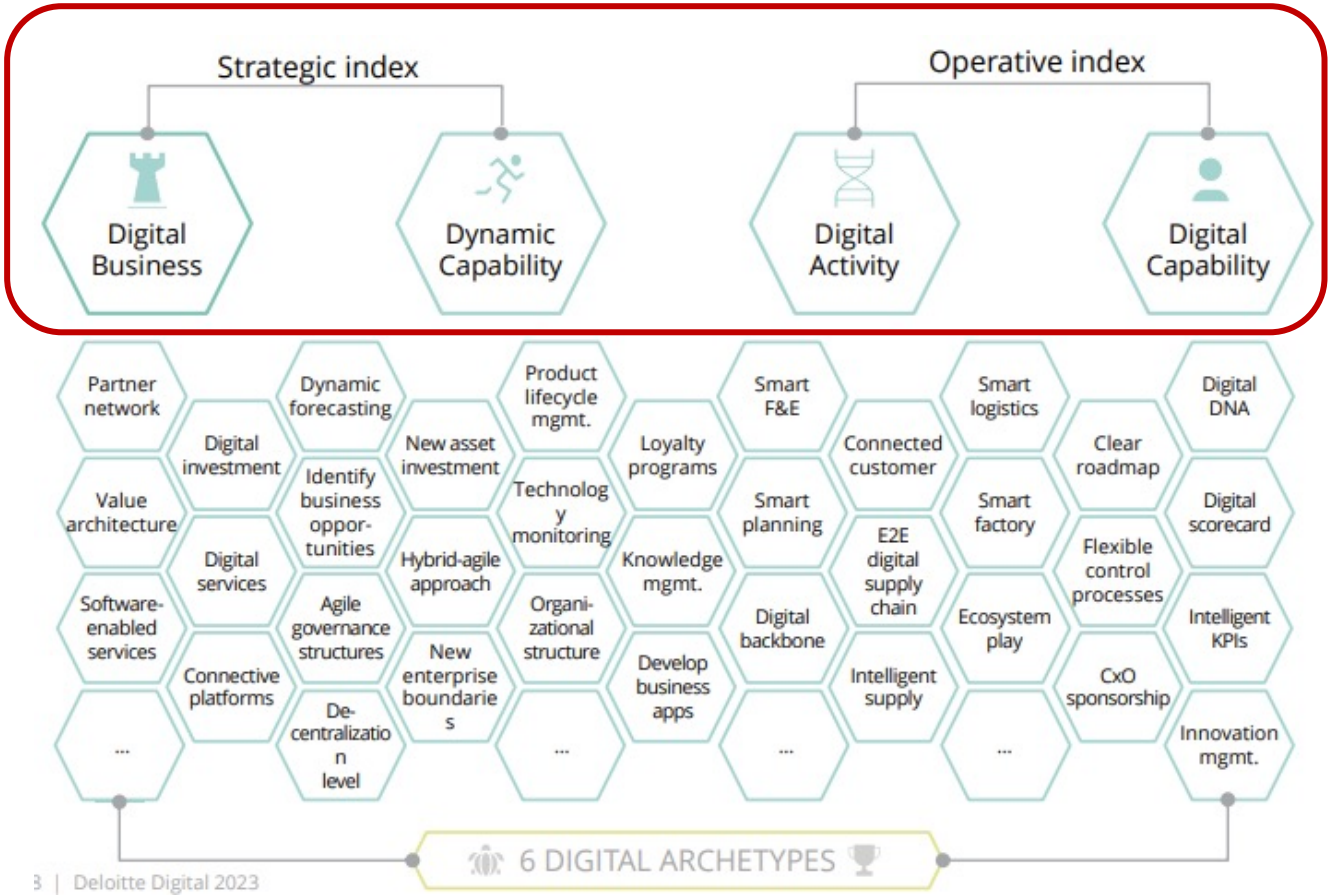
Teichert, R. (2019). Digital transformation maturity: A systematic review of literature. Acta universitatis agriculturae et silviculturae mendelianae brunensis. https://repozitar.mendelu.cz/xmlui/bitstream/handle/20.500.12698/1308/J-Teichert-ActaUnivAgricSilvicMendelBrun-6-2019.pdf

Thordsen, T., & Bick, M. (2023). A decade of digital maturity models: much ado about nothing?. Information Systems and e-Business Management, 21(4), 947-976. https://link.springer.com/article/10.1007/s10257-023-00656-w

Christmann et al. (2024) The **twin transformation** butterfly https://link.springer.com/article/10.1007/s12599-023-00847-2

Example DM model: Deloitte's Digital Maturity Index consisting of 4 holistic indices

with 90+ operational and strategic parameters



Deloitte Digital 2023: Digital Maturity Index Survey 2023, Enabling business growth through digitalization, https://www2.deloitte.com/content/dam/Deloitte/de/Documents/industry-operations/Deloitte-Digital-Maturity-Index-Survey-2023.pdf

Focus on Germany, Japan, UK and US, over 800 C-level and business unit leaders interviewed across four manufacturing sectors, primary focus on industrial products and automotive, to analyze how companies are shaping their digital futures.

Six digital archetypes evolving based on these

Digital archetypes

CHAMPIONS combine consistent digital strategy with operational excellence to achieve a flexibility advantage

POTENTIALS focus on developing their digital strategy hand in hand with operational excellence to achieve cost advantages

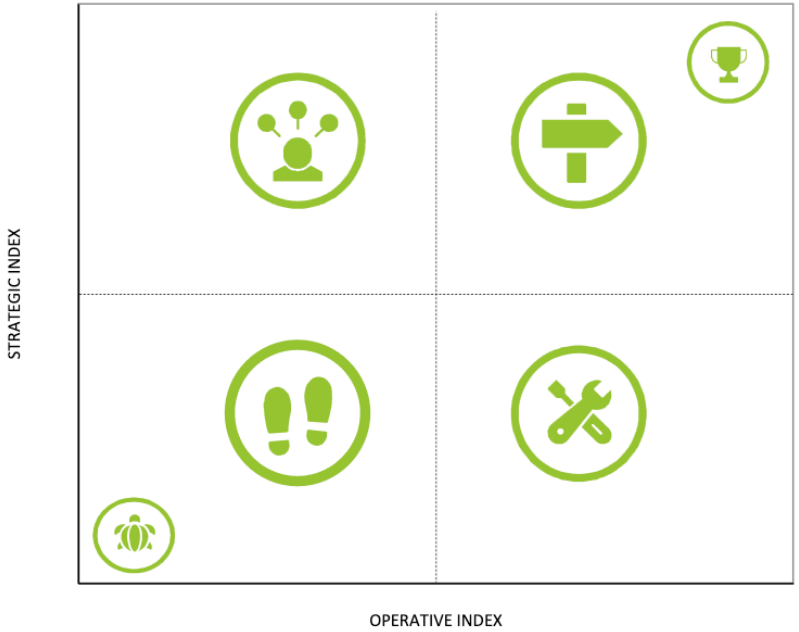
INNOVATORS show distinct advances in digital business through an innovative portfolio but average operational success

OPERATORS focus on digitalizing their core value chain, founding their success upon flexibility through innovative solutions

FOLLOWERS seek to consistently advance digital skills in both index dimensions. Connecting initiatives is essential to improve

LAGGARDS lack digital skills in both index dimensions using digitalization to improve overall efficiency

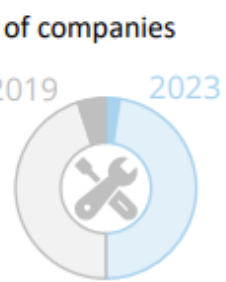
Strategic and operative maturity

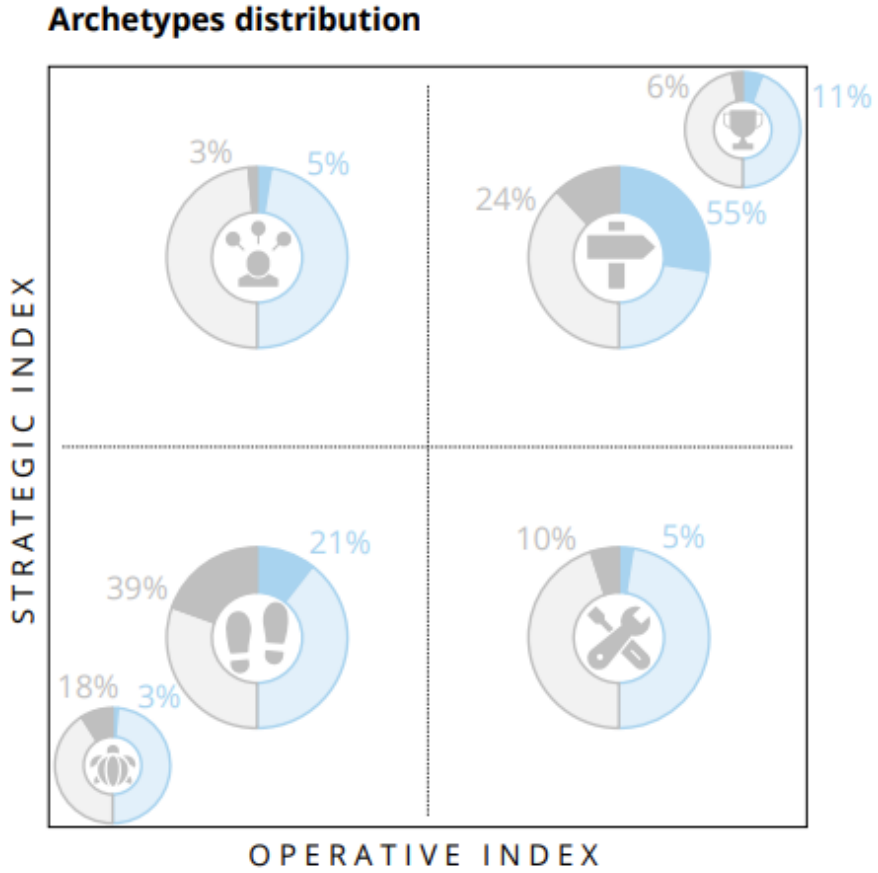


Deloitte Digital 2023: Digital Maturity Index Survey 2023, Enabling business growth through digitalization, https://www2.deloitte.com/content/dam/Deloitte/de/Documents/industry-operations/Deloitte-Digital-Maturity-Index-Survey-2023.pdf

Deloitte's latest digital maturity index survey 2023

Archetypes distribution from 2019 to 2023

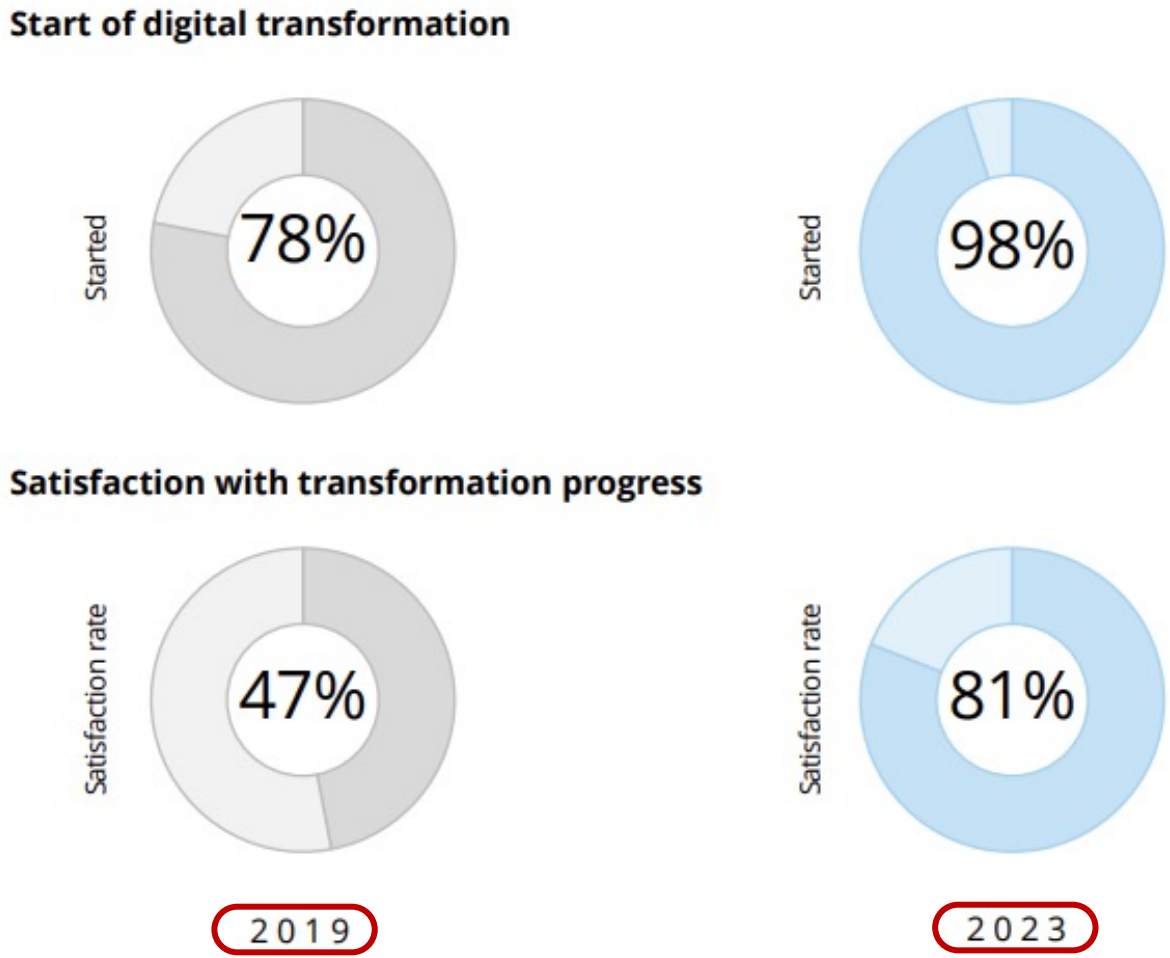




Deloitte Digital 2023: Digital Maturity Index Survey 2023, Enabling business growth through digitalization, https://www2.deloitte.com/content/dam/Deloitte/de/Documents/industry-operations/Deloitte-Digital-Maturity-Index-Survey-2023.pdf

Deloitte digital maturity index survey 2023

Development of digital transformation



Deloitte Digital 2023: Digital Maturity Index Survey 2023, Enabling business growth through digitalization, https://www2.deloitte.com/content/dam/Deloitte/de/Documents/industry-operations/Deloitte-Digital-Maturity-Index-Survey-2023.pdf

Deloitte digital maturity survey 2023 – key findings

1. Since 2019, companies have become more digitally mature, with **16% of companies experiencing increases in digital maturity**.

2. **Higher digital maturity** translates into **higher EBIT and revenue**, supporting a trend that was already underway in 2019.

3. Adopting an **ecosystem approach** can help companies accelerate their digital maturity and reap the benefits faster.

4. **Additional investment** **is needed** to drive future progress.

EBIT = Earnings before interest and taxes

Deloitte Digital 2023: Digital Maturity Index Survey 2023, Enabling business growth through digitalization, https://www2.deloitte.com/content/dam/Deloitte/de/Documents/industry-operations/Deloitte-Digital-Maturity-Index-Survey-2023.pdf

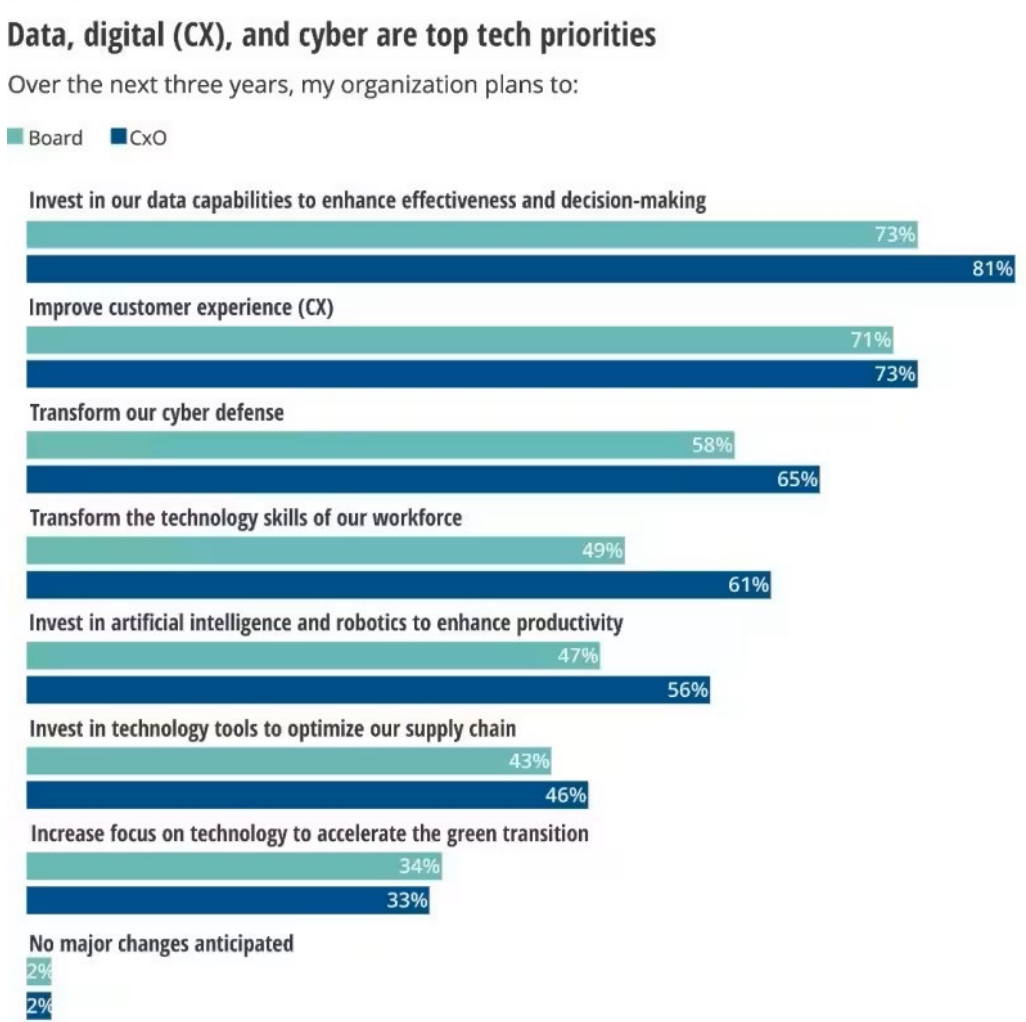
Global Boardroom Program survey ‘22

Tech investment and improvement priorities

Deloitte Global Boardroom Program surveyed in 2022 over 550 directors and C-suite executives (CxOs) from companies based in 55 countries to understand the **degree of board engagement in technology** today.

The survey revealed underinvestment in technology and uncovered gaps in board understanding and engagement on digital transformation!

Note: this was a multiple-choice question



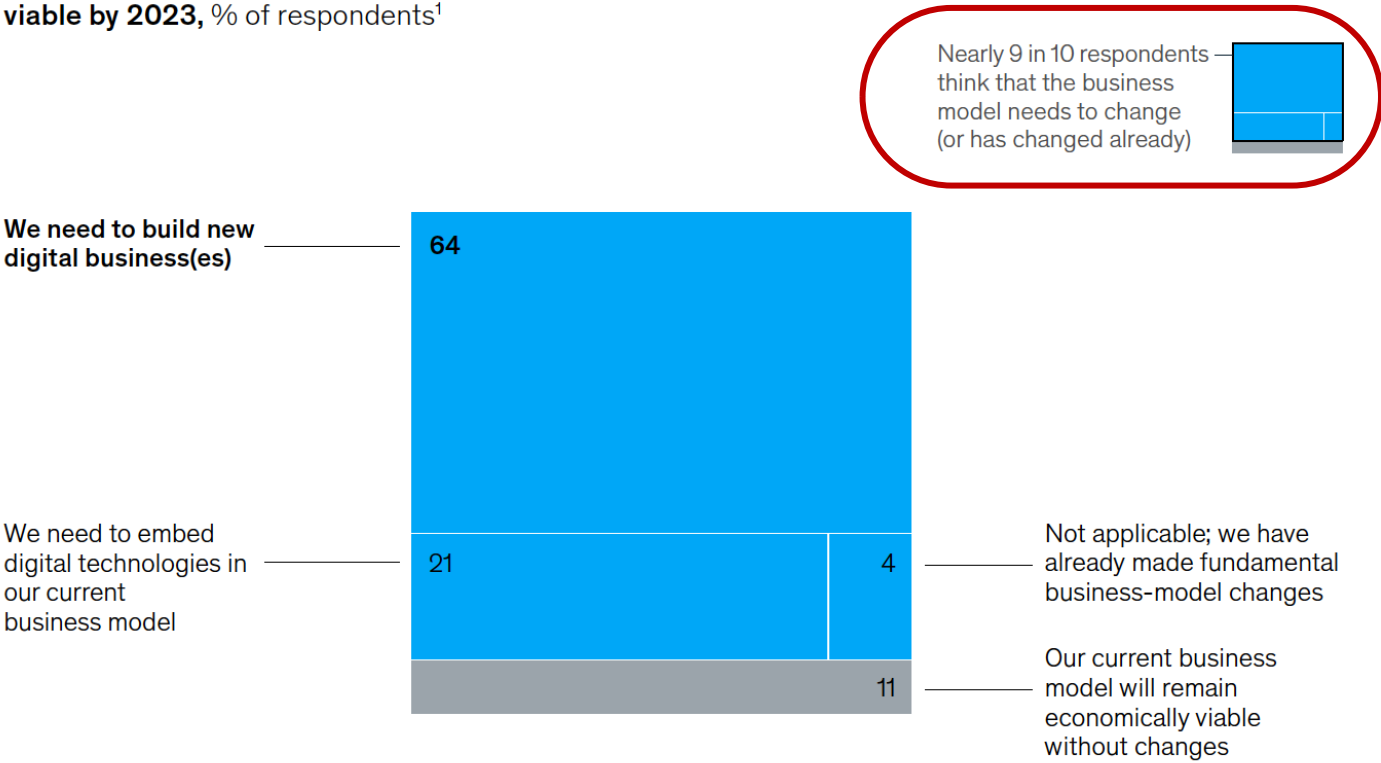
Source: Touche et al. (2022) Digital frontier: A technology deficit in the boardroom
https://www2.deloitte.com/us/en/insights/topics/leadership/digital-transformation-topics-for-corporate-technology-leadership.html

McKinsey Global Survey

Need to change business model / build new digital businesses

Looking toward 2023, most companies will need to build new digital businesses to stay economically viable.

Changes needed to make company's business model economically viable by 2023, % of respondents[1]



[1]Respondents who answered "don't know" are not shown; n = 1,140.

Source: McKinsey Global Surveys, 2021: A year in review, Dec. 2021 https://www.mckinsey.com/featured-insights/mckinsey-global-surveys

Digital transformation ambitions range a lot!

Source: Deloitte Global CEO Program and Center for Integrated Research analysis, 2022.

Source: Smith et al. (2022), "How to lead digital transformation from the top" https://www2.deloitte.com/us/en/insights/topics/strategy/how-to-lead-digital-transformation.html

McKinsey Global survey - State of AI 2023: GenAI's breakout year

AI has risen from a topic relegated to tech employees to a **focus of company leaders**: nearly 25% of surveyed C-suite executives say they are personally using genAI tools for work, and 28% of respondents from companies using AI say genAI is already on their boards' agendas.

What's more, **40 % of respondents say their organizations will increase their investment in AI overall because of advances in genAI**.

Expectations for genAI's impact are high: **75% of all respondents expect genAI to cause significant or disruptive change in the nature of their industry's competition** in the next 3 years. Tech and financial serv. expect most disruption.

Source:McKinsey Global survey - State of AI 2023: Gen AI's breakout year (2023) https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-AIs-breakout-year Online survey April 11-21, 2023, 1684 respondents from all regions, industries, company sizes, functions. 913 respondents said their org had adopted AI.

McKinsey Global survey

Most regularly reported genAI use cases within function

Most regularly reported generative AI use cases within function, % of respondents

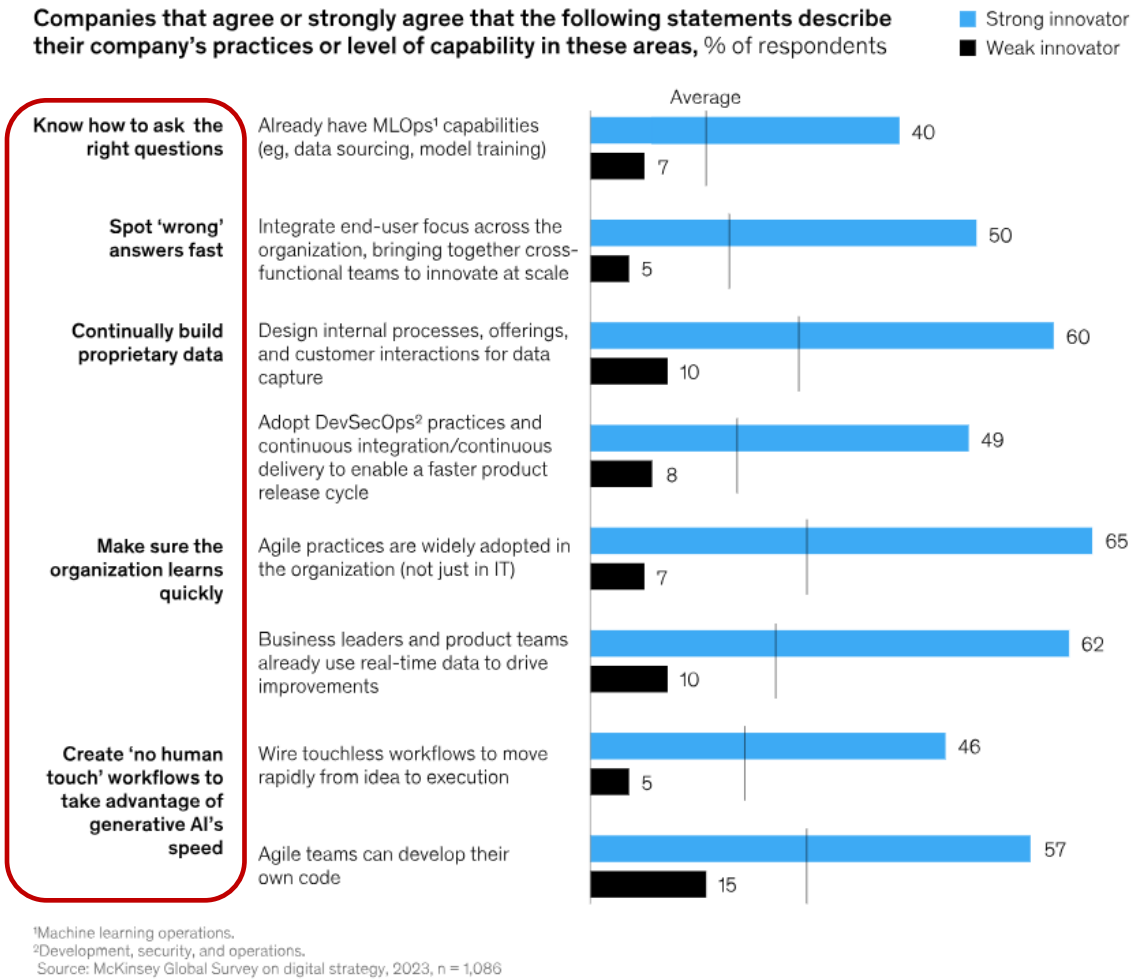
Marketing and sales		Product and/or service development		Service operations	
Crafting first drafts of text documents	9	Identifying trends in customer needs	7	Use of chatbots (eg, for customer service)	6
Personalized marketing	8	Drafting technical documents	5	Forecasting service trends or anomalies	5
Summarizing text documents	8	Creating new product designs	4	Creating first drafts of documents	5

[1]Questions were asked of respondents who said their organizations have adopted AI in at least 1 business function. The data shown were rebased to represent all respondents.
Source: McKinsey Global Survey on AI, 1,684 participants at all levels of the organization, April 11–21, 2023

Source:McKinsey Global survey - State of AI 2023: Gen AI's breakout year (2023) https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-AIs-breakout-year

McKinsey Global Survey 2023

Top innovators pursue 5 actions that capture more value from generative AI, creating strategic distance from their peers.



Source: McKinsey Global Surveys, Companies with innovative cultures have a big edge with generative AI, August 2023: https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/companies-with-innovative-cultures-have-a-big-edge-with-generative-ai

Recent EU initiatives regarding digital sustainability and EU's strategy for data

EU's twin transition* initiative
(in Finnish kaksoissiirtymä / digivihreä siirtymä/kehitys)

Successfully managing the green and digital 'twin' transitions is the cornerstone for delivering a sustainable, fair, and competitive future.

This study examines how the European Union can ensure that the green and the digital transitions mutually reinforce each other. This study analyses how current and future digital technologies could become key enablers for the green transition by 2050, which is when the European Union aims to be climate neutral. It also examines tension points between the twin transitions, such as how digital technologies might bring additional environmental burdens with them. It assesses how economic, social, and political factors will impact the twin transitions. The study takes a closer look at five economic sectors that are among the highest greenhouse gas emitters in the EU: 1) agriculture, 2) buildings and construction, 3) energy, 4) energy-intensive industries, and 5) transport and mobility. On this basis, the study derives key requirements for a successful management of the twin transitions.

European Commission – Muensch et al. 2022: **Towards a green and digital future**, Key requirements for successful twin transitions in the European Union, https://publications.jrc.ec.europa.eu/repository/handle/JRC129319

* **Note that politicians and the academic literature use various terms related to twin transition, most notably twin/dual transformation.**

Illustration of the interplays between digital transformation (DT) and sustainability transformation (ST)

DT def: *"An organizational change process that **improves an organization through digital technologies** and may lead to profound changes in value creation and the organizations' identity."*

ST def: *"An organizational change process that is multilayered, complex, and relates simultaneously to **environmental, societal, governmental, regulatory, and individual factors**."*

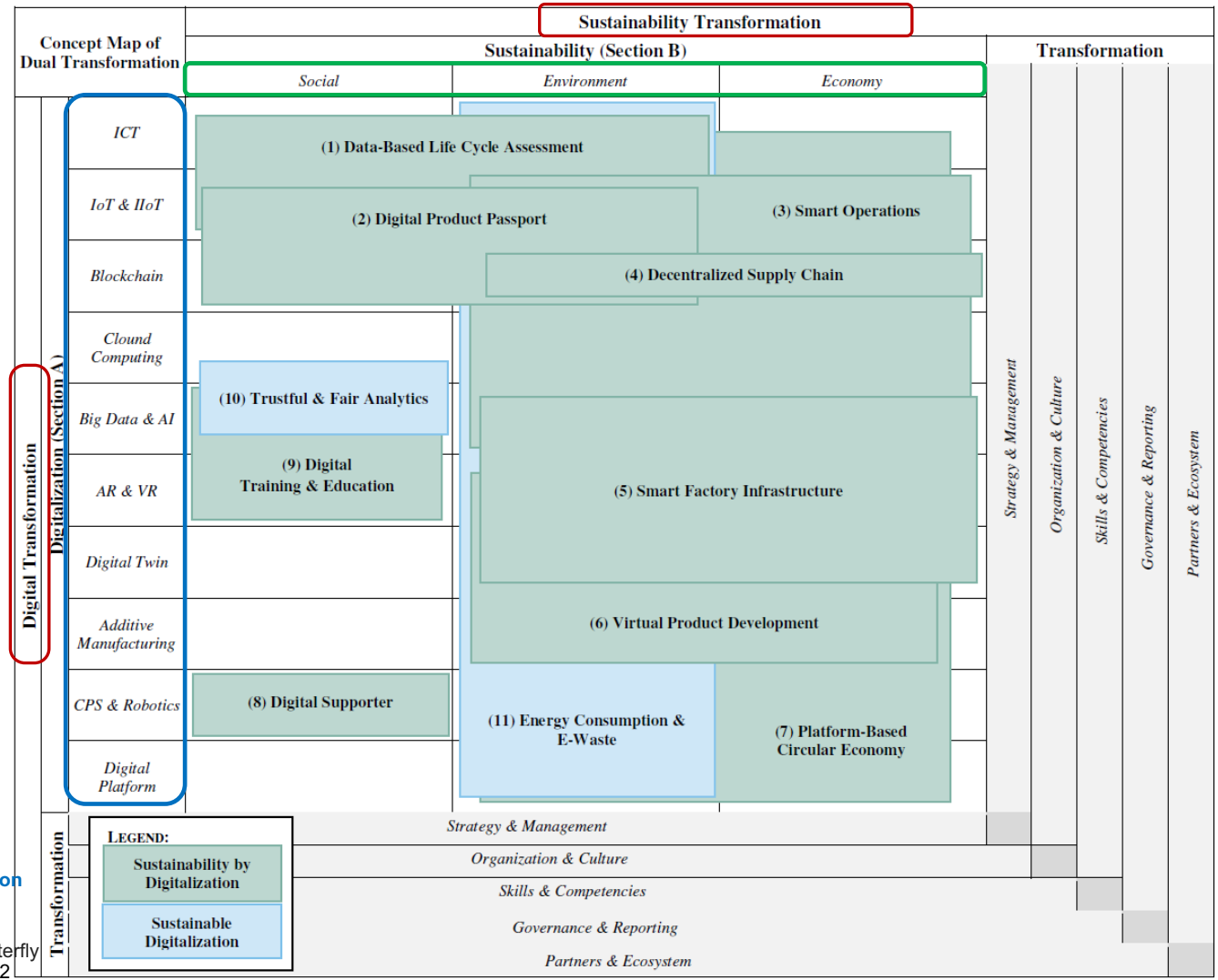
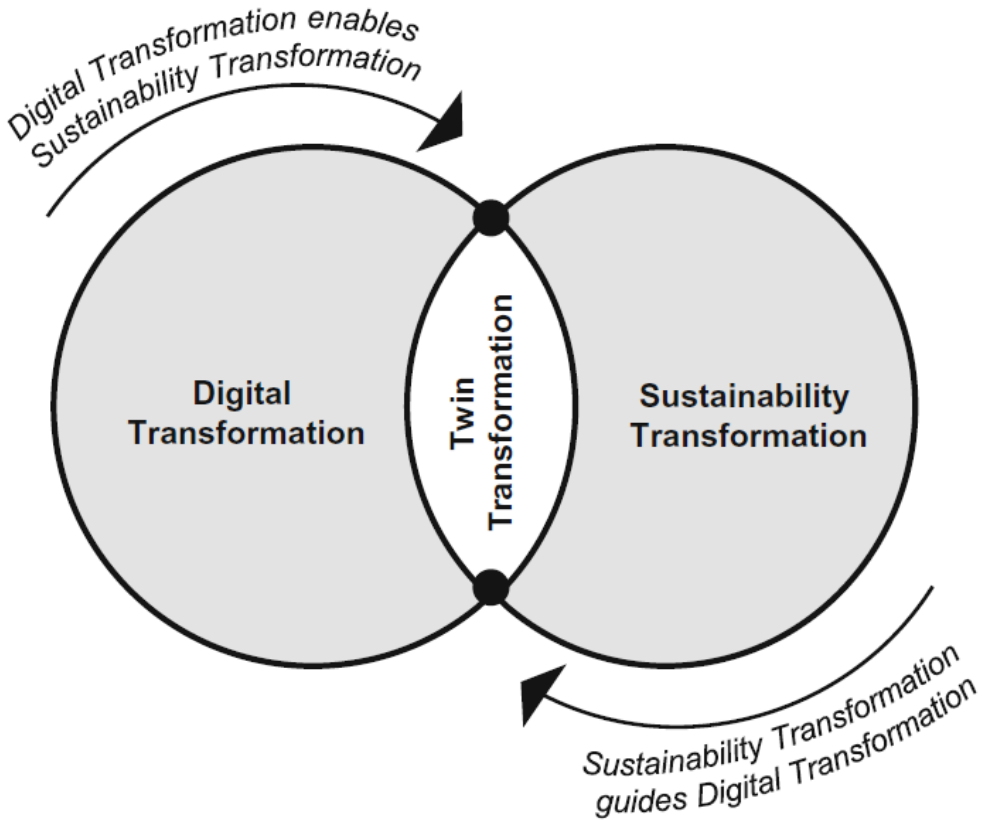


Fig: Kürpick et al. (2023) Framework for **Dual Transformation**
https://ieeexplore.ieee.org/abstract/document/10129630

Defs:Christmann et al. (2024) The **twin transformation** butterfly
https://link.springer.com/article/10.1007/s12599-023-00847-2

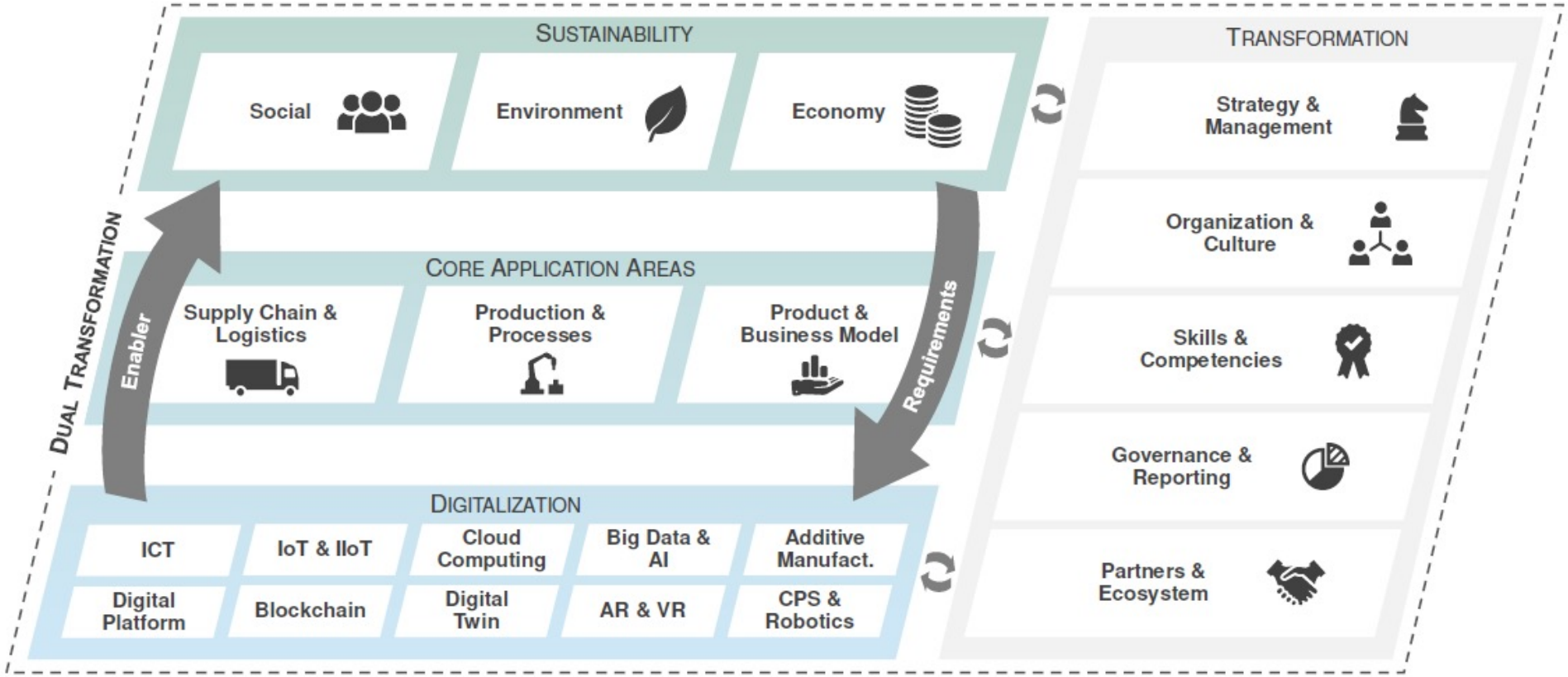
Twin transformation

“A twin transformation refers to a value-adding interplay between digital and sustainability transformation efforts that improve an organization by leveraging digital technologies for enabling sustainability and leveraging sustainability for guiding digital progress.”



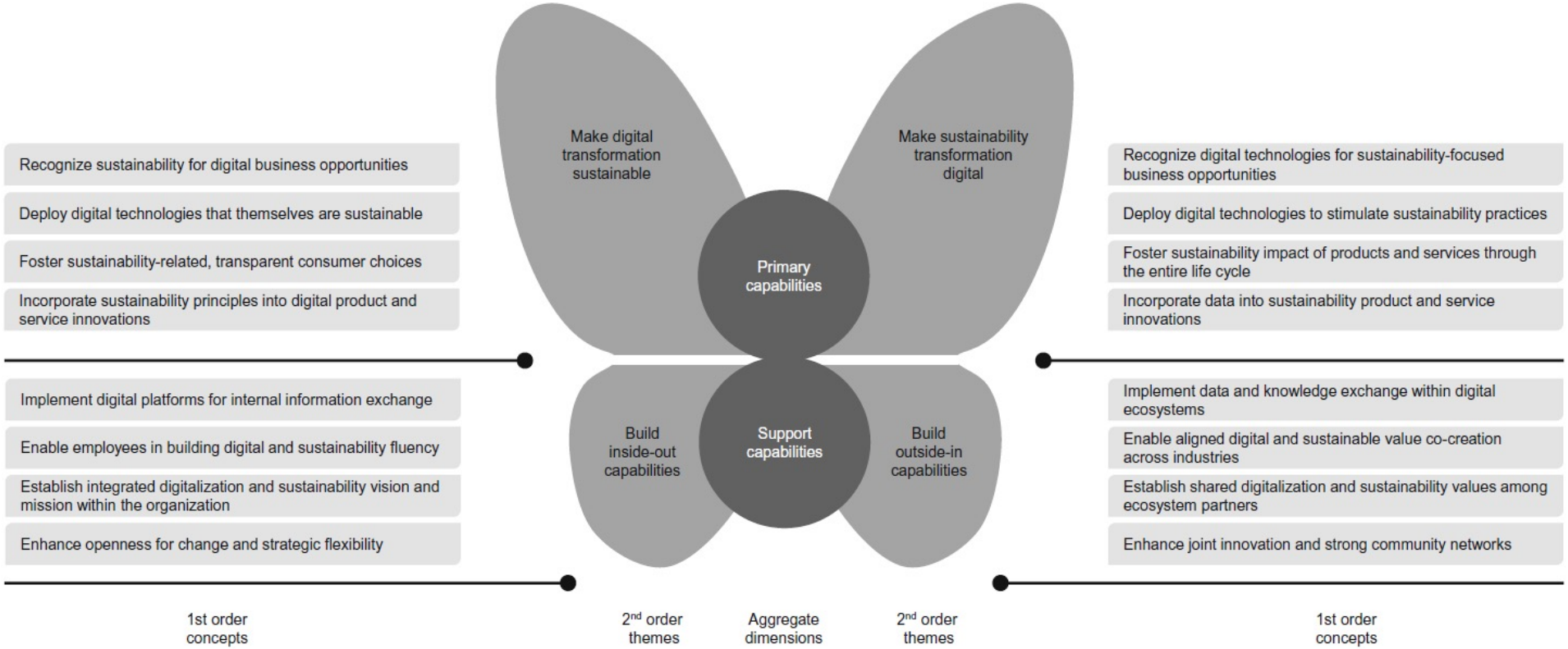
Source: Christmann, A. S., Crome, C., Graf-Drasch, V., Oberländer, A. M., & Schmidt, L. (2024). The Twin Transformation Butterfly: Capabilities for an Integrated Digital and Sustainability Transformation. *Business & Information Systems Engineering*, 1-17. https://link.springer.com/article/10.1007/s12599-023-00847-2

Literature-based framework for Twin/dual transformation



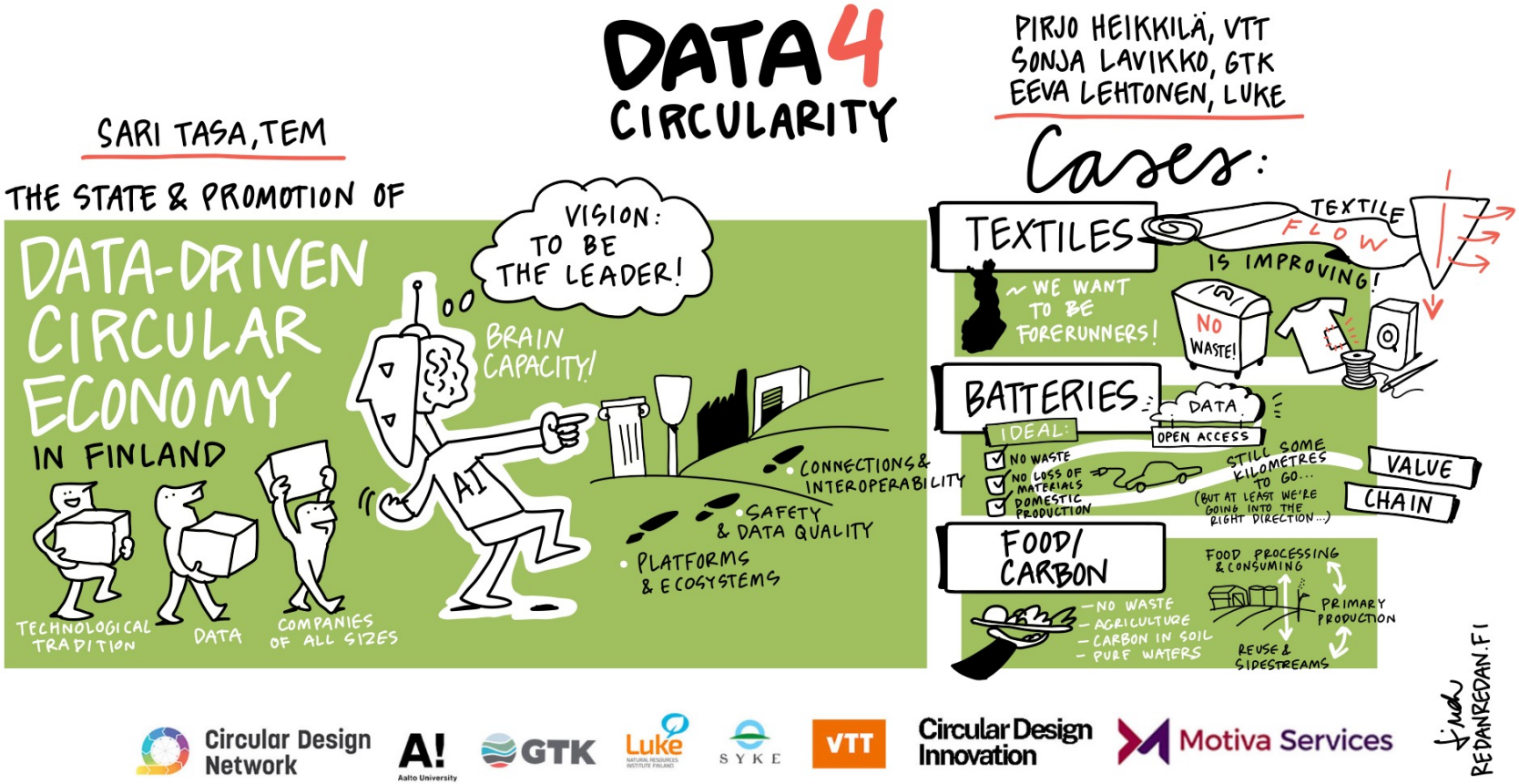
Source: Kürpick, C., Kühn, A., Olszewski, L., & Dumitrescu, R. (2023, April). Framework for Dual Transformation: A Systematic Literature Review on the Interplays between Digitalization and Sustainability. In *IEEE Conference on Technologies for Sustainability (SusTech)* (pp. 175-182). Available at: https://ieeexplore.ieee.org/abstract/document/10129630

Twin transformation capability framework based on Teece's dynamic capabilities theory



Source: Christmann, A. S., Crome, C., Graf-Drasch, V., Oberländer, A. M., & Schmidt, L. (2024). The Twin Transformation Butterfly: Capabilities for an Integrated Digital and Sustainability Transformation. *Business & Information Systems Engineering*, 1-17. https://link.springer.com/article/10.1007/s12599-023-00847-2

Finland aims to be a forerunner in data-driven circular economy



Source Data4Circularity – Towards a data-driven circular economy in Finland, https://event.prospectumlive.com/data4circularity/lobby, February 16, 2022.

Finland’s CO2 DataHub ecosystem for built environment

CO2 DataHub ecosystem is an innovation and data network designed for the needs of organizations in the **real estate and construction industry**, intended for the collection and reliable sharing of real emission data.

The goal of the network's activities is:

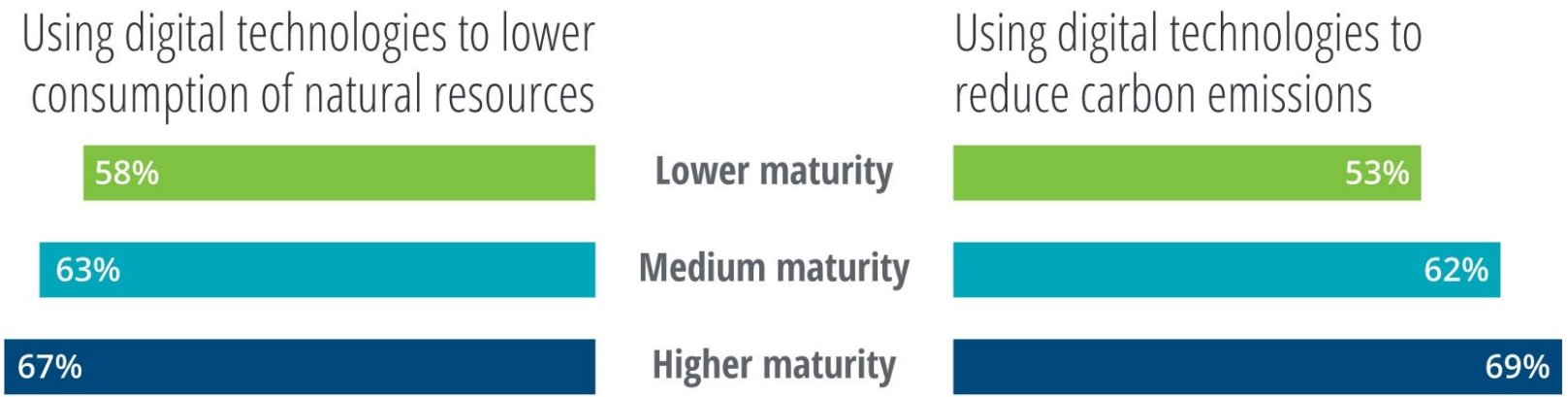
1) To help understand the overall picture of the emissions in the built environment.
2) To use data to lead the implementation of solutions that reduce the carbon footprint.
3) To produce a financially significant responsibility advantage for the participating organizations.

Source https://kirahub.org/co2-datahub-ekosysteemi/, see also 2023 https://co2datahub.vastuugroup.fi/hankeseminaari

Deloitte's digital maturity survey

In **all digital maturity levels**, most companies are already **using digital technologies** to address **environmental sustainability**!

Percentage of respondents using digital technologies to improve environmental sustainability, by digital maturity level



Source: Gurumurthy et al. (2020) https://www2.deloitte.com/us/en/insights/topics/digital-transformation/digital-transformation-survey.html

Fortune/Deloitte CEO survey from fall 2023

Source: Fall 2023 Fortune/Deloitte CEO Survey Insights
https://www2.deloitte.com/us/en/pages/chief-executive-officer/articles/ceo-survey.html

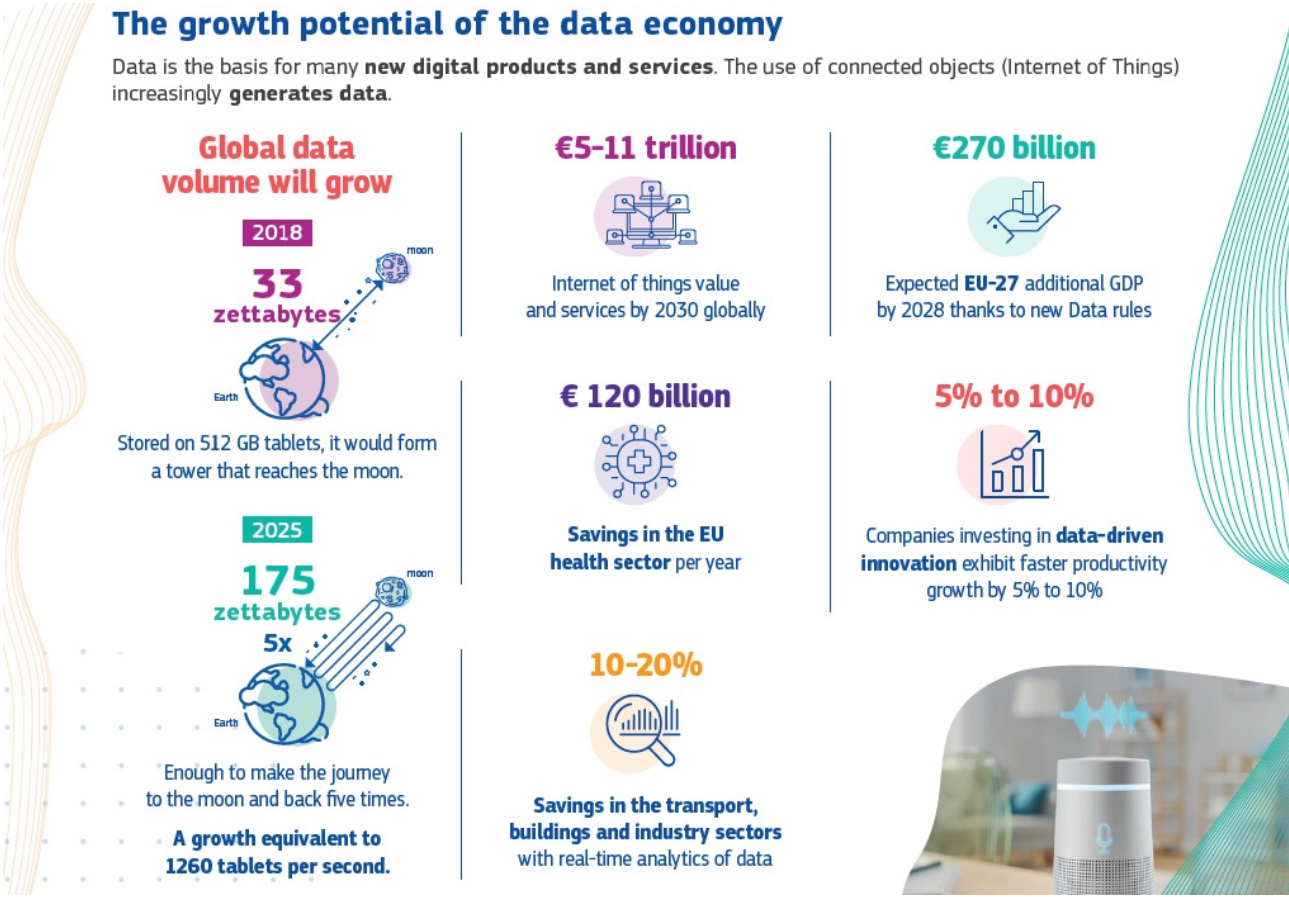
See also: Asif et al. (2023), "ESG and Industry 5.0: The role of technologies in enhancing ESG disclosure", Technological Forecasting & Social Change, Vol. 195.
https://www.sciencedirect.com/science/article/pii/S0040162523004912

How companies should prepare for the new EU Corporate Sustainability Reporting Directive (CSRD) (hankensse.fi)

EU's Data Act (Jan 2024)

The Data Act aims to make more data available for use. It sets up rules on who can use and access what data for which purposes across all economic sectors in EU.

Part of EU's Strategy for Data - "Big five" proposals: Data Act, Data Governance Act, Digital Markets Act, Digital Services Act, AI Act



European data strategy - European Commission (europa.eu), Data Act | Shaping Europe's digital future (europa.eu)

EU’s AI Act (tekoälysäädös in Finnish)

A provisional agreement was just reached on harmonised rules on AI, the so-called **AI act**.

The regulation aims to ensure that **AI systems** placed on the European market and used in the EU **are safe and respect fundamental rights and EU values**. This landmark proposal also aims to stimulate investment and innovation on AI in Europe.

1. Rules on **high-impact general-purpose AI models** that can cause systemic risk in the future, as well as on high-risk **AI systems**
2. A revised system of **governance** with some enforcement powers at EU level
3. Extension of the list of **prohibitions** but with the possibility to use **remote biometric identification** by law enforcement authorities in public spaces, subject to safeguards
4. Better protection of rights through the obligation for deployers of high-risk AI systems to conduct a **fundamental rights impact assessment** prior to putting an AI system into use.

European data strategy - European Commission (europa.eu),
Artificial intelligence act: Council and Parliament strike a deal on the first rules for AI in the world - Consilium (europa.eu)
EU:n historiallinen tekoälyasetus nytkähti eteenpäin – tutustu Teknologiateollisuuden koontiin | Teknologiateollisuus

SITRA launched in 2023 a new website and PowerBI dashboard for Roadmap for Fair Data Economy

“Datatalouden kansallinen tiekartta”

https://datatalouden tiekartta.fi/

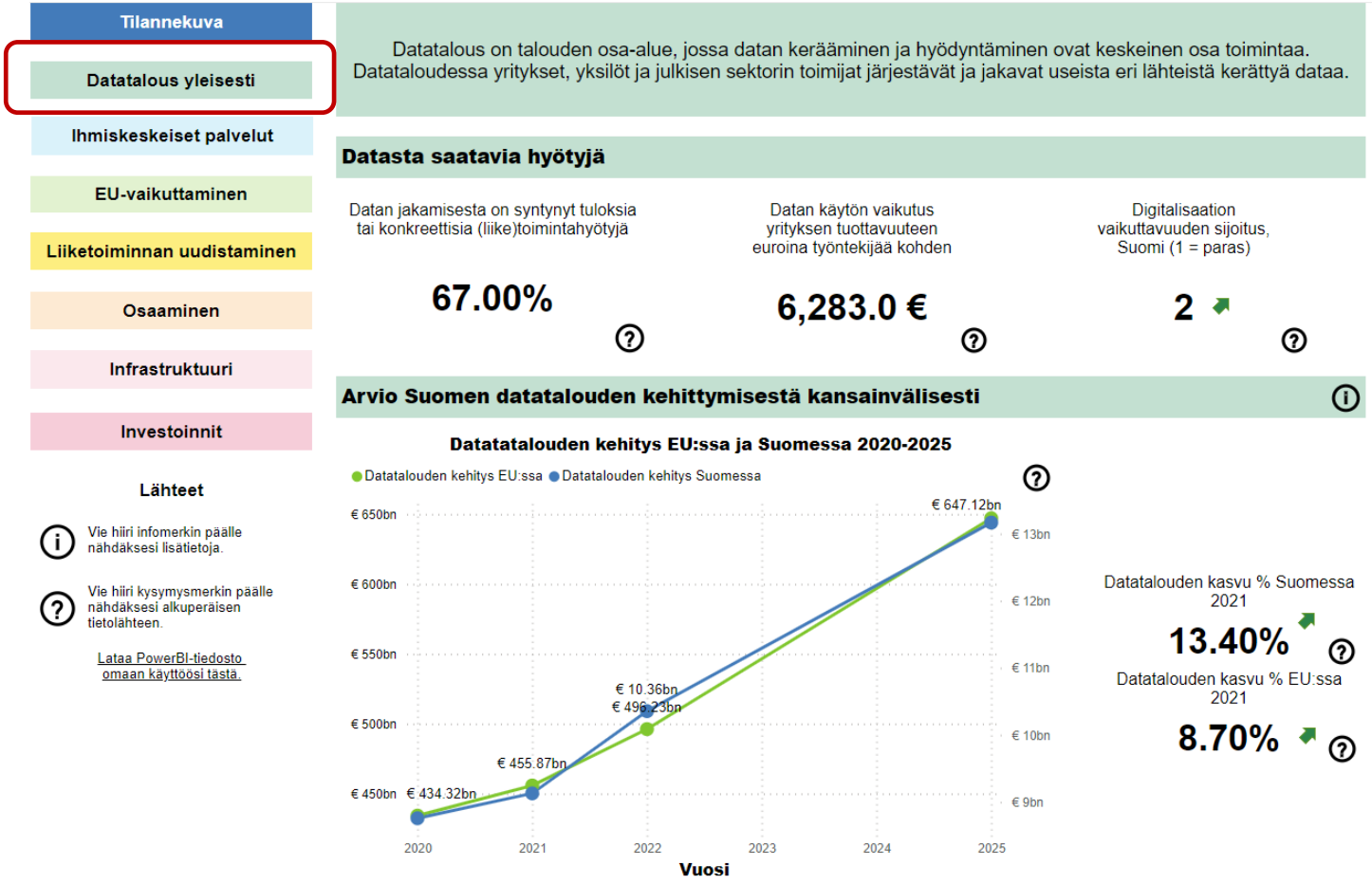
Source: Presentation by Toni Luhti/Mindmote Oy, Datatalouden tilannehuone webinar, January 17, 2023. https://www.sitra.fi/tapahtumat/datatalouden-tilannehuone/

PowerBI dashboard for Fair Data Economy, 7 areas

“Datatalouden tilannekuva”

PowerBI llink:

Microsoft Power BI

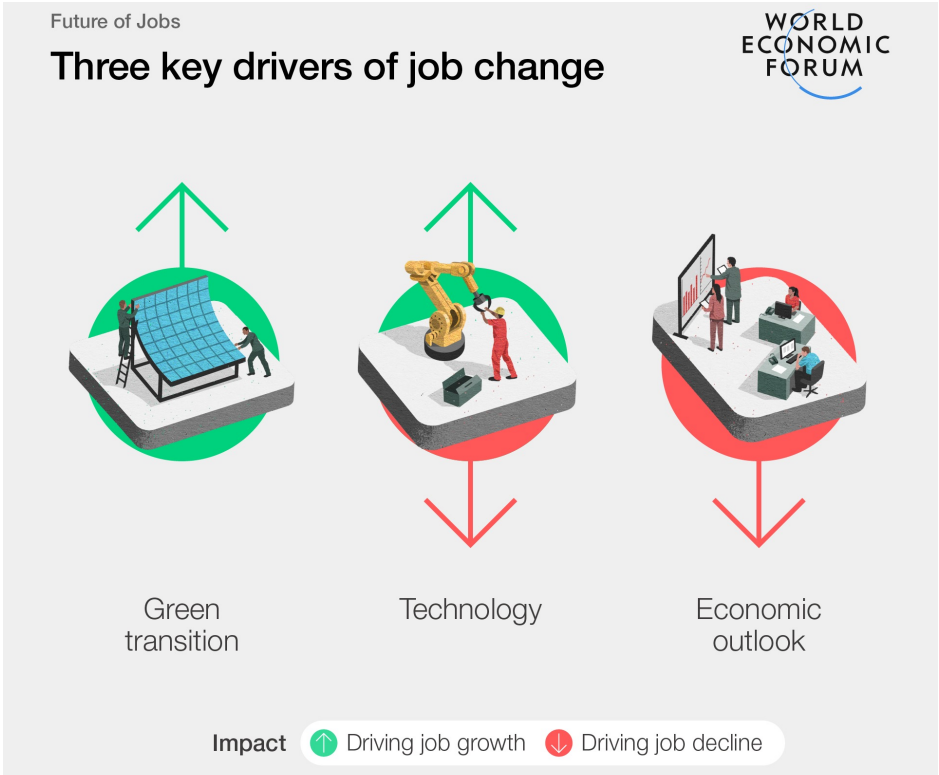


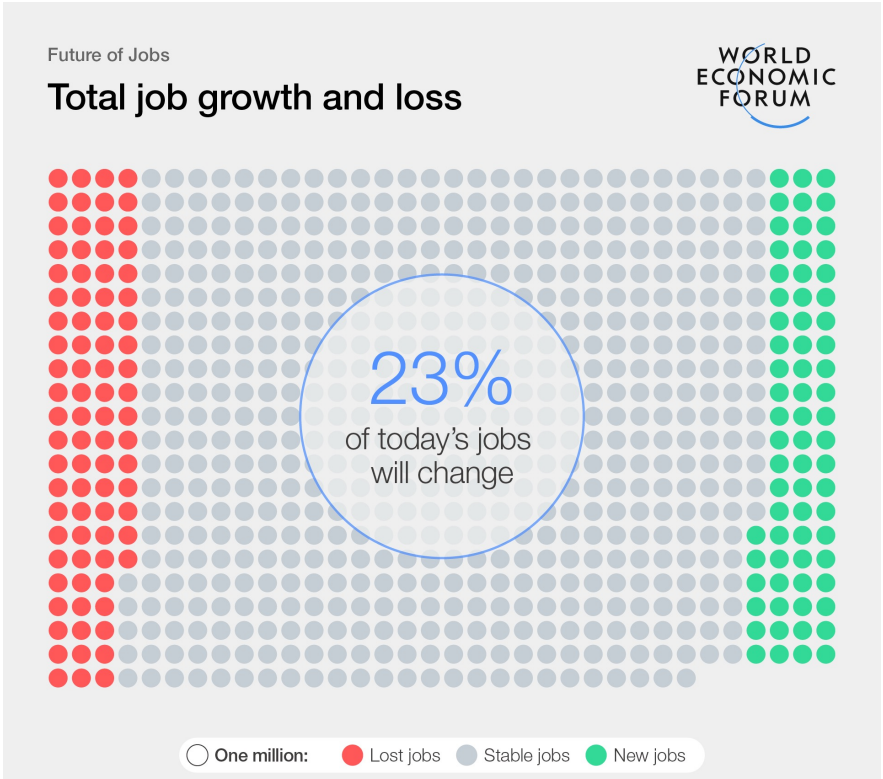
Source: Presentation by Toni Luhti/Mindmote Oy, Datatalouden tilannehuone webinar, January 17, 2023.

Future jobs and skills…

and why you should study MIS

World Economic Forum: the Future of Jobs





Source: World Economic Forum, Future of Jobs Report 2023, available https://www.weforum.org/publications/the-future-of-jobs-report-2023/infographics-2128e451e0/

The Future of Jobs

Fastest growing vs. fastest declining jobs

WORLD ECONOMIC FORUM

Top 10 fastest growing jobs

1.	AI and Machine Learning Specialists
2.	Sustainability Specialists
3.	Business Intelligence Analysts
4.	Information Security Analysts
5.	Fintech Engineers
6.	Data Analysts and Scientists
7.	Robotics Engineers
8.	Big Data Specialists
9.	Agricultural Equipment Operators
10.	Digital Transformation Specialists

Top 10 fastest declining jobs

1.	Bank Tellers and Related Clerks
2.	Postal Service Clerks
3.	Cashiers and ticket Clerks
4.	Data Entry Clerks
5.	Administrative and Executive Secretaries
6.	Material-Recording and Stock-Keeping Clerks
7.	Accounting, Bookkeeping and Payroll Clerks
8.	Legislators and Officials
9.	Statistical, Finance and Insurance Clerks
10.	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers

Source
World Economic Forum, Future of Jobs Report 2023.

Note
The jobs which survey respondents expect to grow most quickly from 2023 to 2027 as a fraction of present employment figures

Source: https://www.weforum.org/publications/the-future-of-jobs-report-2023/infographics-2128e451e0/

The Future of Jobs

Businesses' top 10 skill priorities for 2027

WORLD ECONOMIC FORUM

1. Analytical thinking	6. Curiosity and lifelong learning
2. Creative thinking	7. Technological literacy
3. AI and big data	8. Design and user experience
4. Leadership and social influence	9. Motivation and self-awareness
5. Resilience, flexibility and agility	10. Empathy and active listening

Type of skill

Cognitive skills · Self-efficacy · Technology skills · Working with others

Source
World Economic Forum, Future of Jobs Report 2023.

Note
The skills which organizations will prioritize in workforce development initiatives from 2023 to 2027

Source: https://www.weforum.org/publications/the-future-of-jobs-report-2023/infographics-2128e451e0/

Working in future (article in HS 22.1.2021)

*"**Artificial intelligence is already partially replacing** doctors, journalists, lawyers, therapists and even writers and artists. It will continue to be a data crunching power assistant.*

*The ever-faster development of technology means that the **society must adapt faster**.*

According to Risto Linturi, future experts should be taught skills that teachers themselves do not know or master properly. They become like coaches, and they learn at the same time as the students.

***WHAT SKILLS** does a new kind of working life require?*

*Elina Hiltunen and Linturi highlight **creativity, critical thinking**, **good technology skills**, **interaction and teamwork skills**, as well as **learning to learn**.*

*Hiltunen also mentions **media literacy, presentation skills, cultural competence, empathy, self-knowledge** and **entrepreneurial skills**.*

'Robots, artificial intelligence, and the virtual world should be more familiar than pen and paper.' "

Source: Vainio (2021) Tulevaisuuden töissä. Millainen työelämä on 2040-luvulla ja millaisia taitoja silloin tarvitaan? Asiantuntijat ennakoivat. HS, 22.1.2021
https://www.hs.fi/elama/art-2000007754561.html

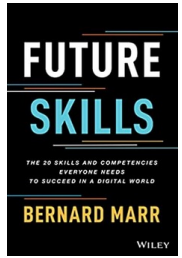
AI is a tool that can revolutionize the way we learn

*"In the working life of the future, one of the biggest changes is the ability to **work together with AI**. To achieve this skill, you need to know what kind of **questions and prompts** produce the right results. And asking the right questions, in turn, requires **expertise in the subject area**. However, expertise alone is not enough. Individuals must learn when and how to ask the right questions, which requires an understanding of why certain questions are being asked and what problems are being attempted to be solved.*

*AI is not just a tool for cheating, but **a tool that can revolutionize the way we learn**. Its correct use and understanding promotes critical, creative and informed thinking. We should therefore focus on clarifying this difference and **guide learners to understand the true potential of AI and the responsibility of applying it in learning**."*

Source: Patjas, Elina (2024). HS Mielipide, 17.2.2024, https://www.hs.fi/mielipide/art-2000010221819.html

Futurist Bernard Marr on future skills



"But far from detaching us from our humanity, I believe this wave of new technologies ***will make work more human****, not less. What can be automated will be automated,* ***leaving humans to do the work that we're ultimately better suited to—tasks that rely on distinctly human skills like complex decision-making, creativity, empathy and emotional intelligence, critical thinking, and communication****. These are the sorts of skills where humans outperform even the most intelligent machine. This is where we excel. And it's where the future of work lies. In more human, more fulfilling work."* (p. 2)

"In a world that's constantly changing, digital skills will quickly grow stale and need refreshing. ***Continual learning will become the norm****. And in this ever-shifting landscape, a* ***positive mindset****—by which I mean excitement about the possibilities that new technologies bring, and a* ***willingness to learn*** *about them—is what will separate the successful from the not-so-successful."* (p. 5)

Marr (2022), Future skills. The 20 skills and competencies everyone needs to succeed in a digital world, https://bernardmarr.com/wp-content/uploads/2022/09/Future-Skills-ESampler.pdf

Motivation to study MIS - Why do we need to manage information in organizations?

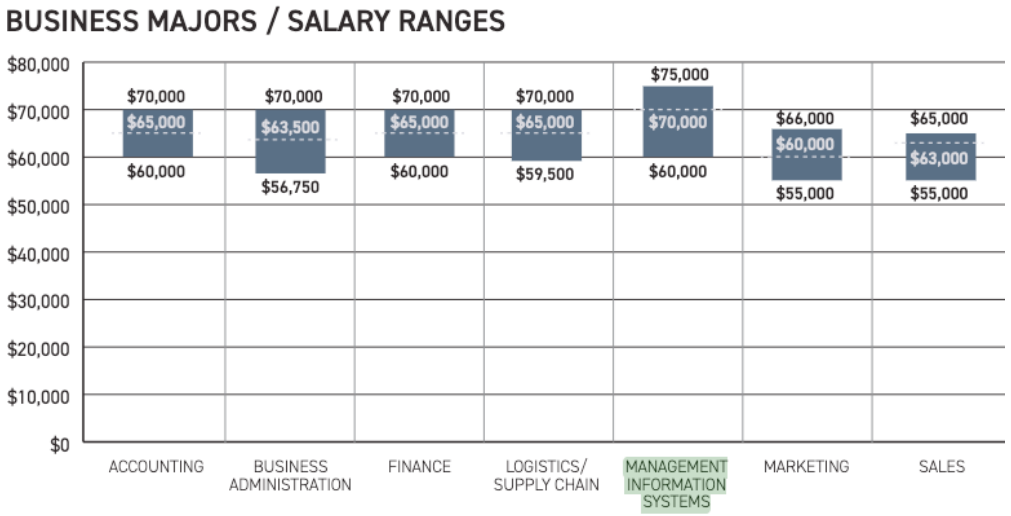
Effective management of information and related IT is **critically important to the survival and success** of an organization due to:

- *increasing **dependence** on information and information systems,*
- *increasing **vulnerabilities** and a wide spectrum of **cyber threats**,*
- *increasing amounts of information causing **information overload**,*
- ***scale and cost** of the current and future **investments** in information and information systems,*
- *potential for technologies to dramatically **change organizations and business practices, create new opportunities and reduce costs**.*

Sources: COBIT (2000) IT Governance framework, Chaffey and Wood (2005)

National Association of Colleges and Employers (NACE):
MIS degree is the best paid business major at the BSc level

BUSINESS MAJORS	
Accounting	$64,092
Actuarial Science	$69,677
Business Administration/Management	$62,856
Finance	$64,887
Hospitality Management	$57,150
Human Resources	$60,423
International Business	$62,988
Logistics/Supply Chain	$64,538
Management Information Systems	$73,695
Marketing	$60,462
Sales	$60,696



Business graduates from the Class of 2024 have an average salary projection that is 3% higher, lifting it to $63,907 from 2023 projection of $62,069. Within the specific business disciplines, **Management Information Systems shows the largest growth;** their average projection of $73,695 is up 7.5% from $68,557 last year.

Source: NACE: Starting salary projections for Class of 2024 new college graduates by academic major, Winter 2024 survey, data reported by employers, available at: https://uwosh.edu/career/wp-content/uploads/sites/38/2024/01/Winter-2024-Salary-Survey-Report.pdf

Top Degrees for the Highest-Paying Business Careers

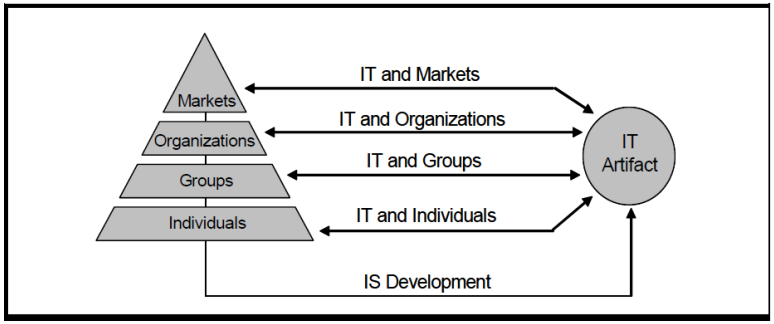
1. **Master of Business Administration (MBA)**
2. **Bachelor's in MIS (IS Management)**

   "Some of the highest-paying jobs in the business world revolve around technology. A degree in computer science or information science can help prepare students for technological roles. These play an important part in the success of modern businesses. **If you want one of the most profitable positions in the business world**, **you will need more than just computer knowledge**. **You must develop** a **background in business theory and practices**. **You can then apply that computer knowledge to help your company achieve its goals.** A bachelor's degree in Management Information Systems (MIS) is a great choice. It combines *business classes* with the mathematics, software development and computer programming courses of a computer science program. By the time you graduate from an undergraduate MIS degree program, you will understand how computer coding and technology works. You will also learn to use computer technology to solve an organization's problems."

3. **Bachelor's in Marketing**
4. **Master's in Finance**
5. **Bachelor's in Supply Management**

Source: Dodge (2023), 15 Top Highest-Paying Business Degrees, https://www.degreequery.com/15-top-degrees-highest-paying-business-careers/

Discipline behind MIS is Information Systems Science (ISS), which is a relatively young business school discipline (ca. 60 years).



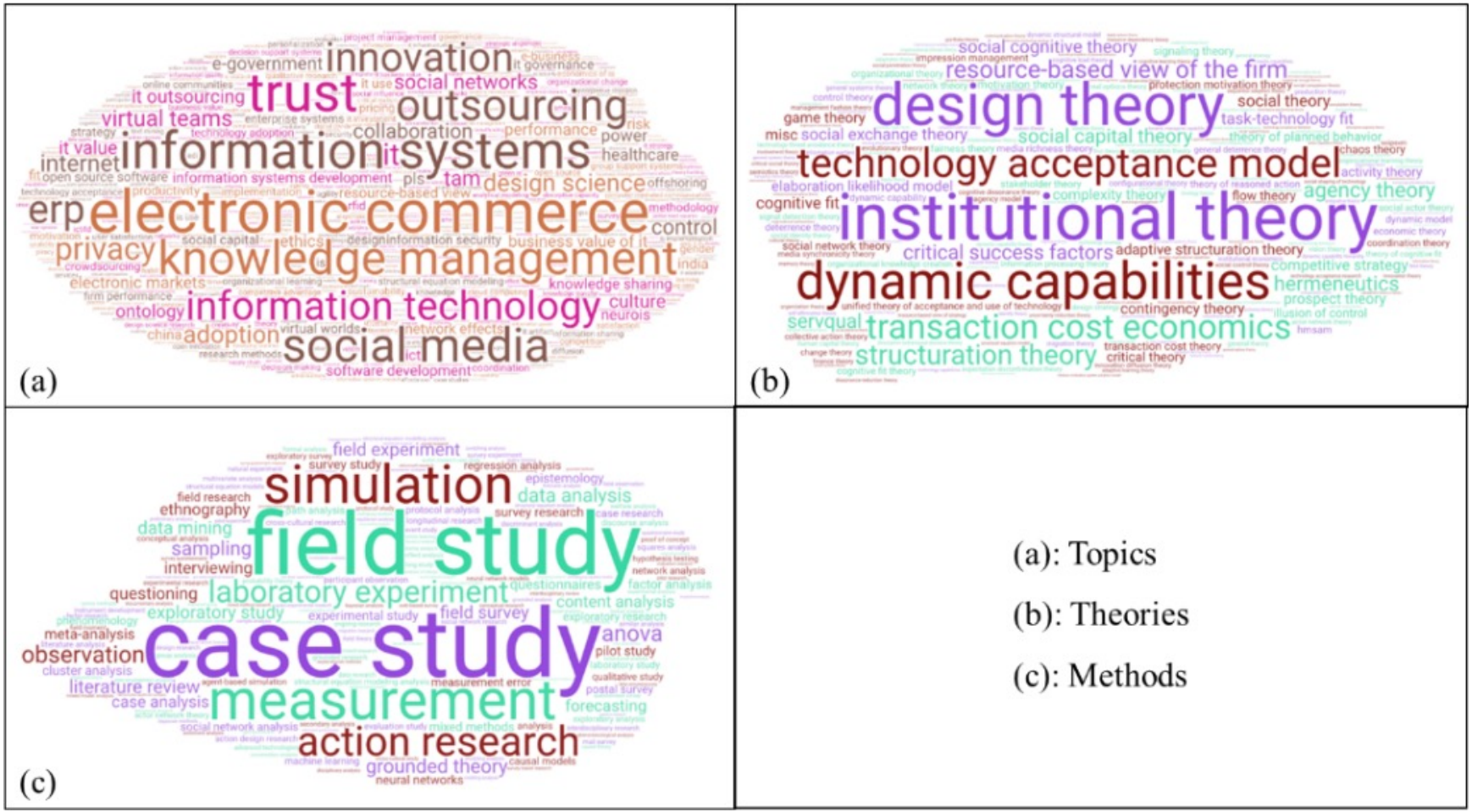
Main research themes in ISS:

Table A1. High-Loading Terms for the 5-Factor Solution

F5.#	F5 Label	Top 30 Terms
F5.1	IT and Organizations	plan, strateg, busi, firm, organiz, execut, competit, issu, organ, resourc, success, invest, industri, chang, project, system, coordin, role, implement, innov, integr, advantag, technologi, compani, knowledg, inform, corpor, factor, capabl, valu
F5.2	IS Development	dss, decision, design, system, problem, approach, method, requir, databas, techniqu, methodologi, expert, applic, analysi, tool, support, gener, framework, propos, prototyp, base, knowledg, evalu, structur, softwar, object, solv, maker, environ, plan
F5.3	IT and Individuals	instrum, valid, measur, construct, perceiv, satisfac, usag, accept, reliabl, user, factor, eas, influenc, test, job, variabl, survei, comput, behavior, empir, success, individu, inten, attitud, scale, adop, train, relationship, determin, find
F5.4	IT and Markets	price, market, consum, product, seller, custom, buyer, onlin, cost, invest, electron, servic, supplier, firm, trade, network, valu, transac, trust, profit, internet, commerc, econom, optim, strategi, industri, vendor, increas, offer, reduc
F5.5	IT and Groups	gss, team, meet, task, commun, collabor, outcom, gdss, trust, facilit, work, particip, social, experi, support, interac, instrum, electron, learn, virtual, influenc, comput, individu, behavior, idea, perceiv, affect, em, structur, mediat

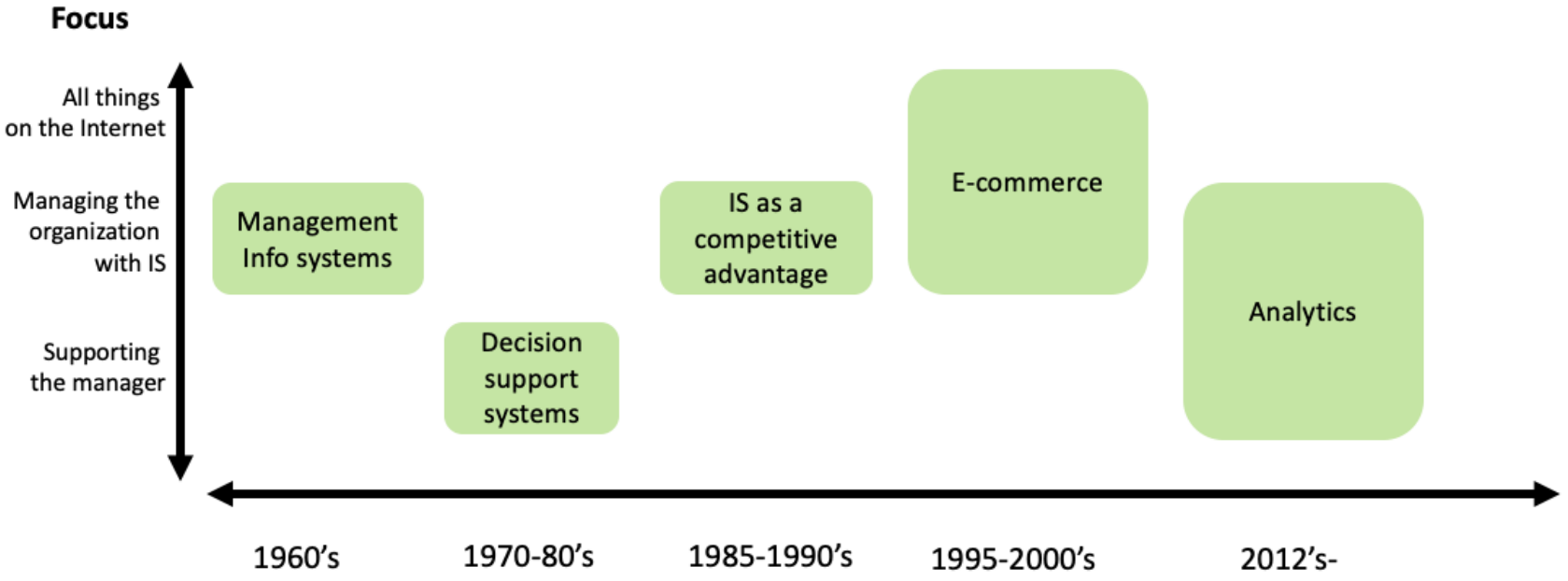
Source: Sidorova et al. (2008), "Uncovering the Intellectual Core of the IS Discipline", *MIS Quarterly*, 32(3), 467-482.

Word Clouds of Topics, Theories, and Methods in ISS research (1999-2018)



Source Deng et al. (2020), "Analysis of topics, theories, and methods of information systems research in the past two decades: A knowledge graph approach", PACIS conference, https://web.archive.org/web/20220921111036id_/https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1002&context=pacis2020

Development of central themes in ISS (i.e. MIS) discipline based on Distinguished Prof. Emeritus Joey George



Based on: George, Joey F. and Hadidi, Rassule (2023) **"What's in a Name? Central Themes in MIS Since the Field's Founding**," *Journal of the Midwest Association for Information Systems,* Iss. 1, Article 1, Available at: https://aisel.aisnet.org/jmwais/vol2023/iss1/1

Practical issues of the course

Practical issues

Lectures

- On Tuesdays and Thursdays (on campus in Otakaari 1 Hall U8 or in Zoom) at 13:15 – 14:45
- **NOTE: 2 of the lectures are extra and held on Mon or Wed at 10-12 o'clock at BI course (Ekonominaukio 1, V001-2)**
- Most of the live lectures will also be recorded (depending on guest lecturers' preferences)

Course book

- **Information Systems for Managers (without cases),** Piccoli & Pigni, 2021, Ed. 5 or 4
- https://www.prospectpressvt.com/textbooks/piccoli-information-systems-for-managers-5-0
- Availability in library:
  https://primo.aalto.fi/discovery/search?query=any,contains,37C00100&tab=Everything&search_scope=MyInst_and_CI&vid=358AALTO_INST:VU1&offset=0

Final grade

- Assignments = **60**% (60 points)
- Exam = **40** % (40 points)
  - Scheduled exams: April 18 (9-12 o'clock) and re-take in June 5 (13-16 o'clock)
  - **Minimum of 50% of BOTH assignments (30 p) AND exam (20 p) required!**
  - *Possibility to earn 8 bonus points by being present in guest lectures! (= other than Bragge's lectures)*

Course website: https://mycourses.aalto.fi/course/view.php?id=40794

*News of the course are sent via MyCourses **Announcements** (> notifications to your email)*

*Also **Zulip chat** is used in peer-to-peer communications! Register in https://mis2024.zulip.aalto.fi/*

Contents of the course book, Ed. 5.0

https://www.prospectpressvt.com/textbooks/piccoli-information-systems-for-managers-5-0

2023 lecture plan

Note that last-minute changes (e.g. lectures moved to Zoom) might be announced in case of sickness!

Follow the MyCourses announcement notifications in your email!!

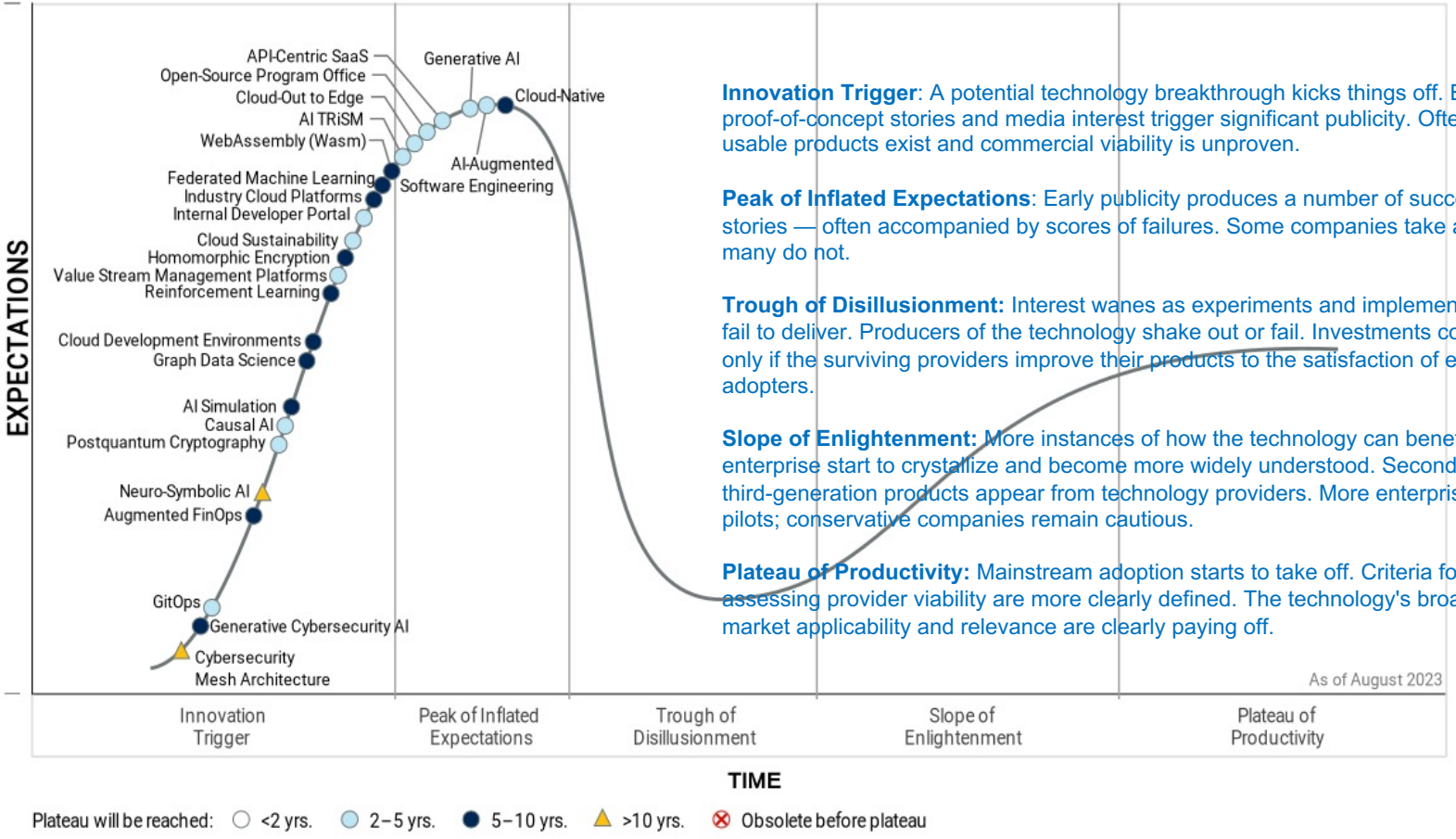
Earn bonus points from being present at 8 guest lectures!

1	27.2. Tue	**Introduction to the MIS course & Chapters 1-2 (IS and the role of general and function managers; IS defined)** / Bragge
2	29.2. Thu	**Collaborative IS and groupware technologies** / Bragge
3	5.3 Tue	**Organizational change in the digitalization era–how to bring myth to life?** / Modern Work Lead Karoliina Kettukari, Meltlake (part of Futurice)
4	7.3. Thu	**Service design and human-centred design methods in healthcare** Assistant Prof. Johanna Viitanen and Post-doc Kaisa Savolainen, Aalto SCI and Aalto ARTS
5	12.3. Tue	**Responsible and strategic use of data & AI** Iiris Lahti, Head of services and customer success, Saidot
6	14.3. Thu	**Information systems development, agile development** / PhD Antti Salovaara, Senior University Lecturer, Aalto ARTS, Department of Design
7	19.3. Tue	**Data, text and web-mining & bibliometric literature reviews** / Bragge
8	21.3. Thu	**Beyond ERP–digital innovation driving sustainability transformation** / Glen Koskela, Portfolio Strategy & Alliance, Uvance CX, Fujitsu
9	26.3. Tue	**Challenges with big data analytics** / Doctoral researcher Sampsa Suvivuo, ISM/Information Systems Science, Aalto BIZ
Extra	27.3. Wed at 10-12, BI course	**Why Tableau? demo** / Janne Lind, Lead Solutions Engineer, Tableau, a Salesforce company, *Joint lecture with our Business Intelligence course.*
		EASTER BREAK 28.3. - 3.4.
10	4.4. Thu	**Data visualization and storytelling** / Post-doc researcher Philipp Back, ISM/Business Analytics, Aalto BIZ
Extra	8.4. Mon at 10-12 BI course	**State of Business Analytics** / Juha Teljo, Vice President of Solution Engineering in EMEA, Tableau, a Salesforce company.
11	9.4. Tue	**IT Security and Privacy** / Mikko Karikytö, Chief Product Security Officer, and Dario Casella, Head of Product Privacy Office, Ericsson Finland.
12	11.4. Thu	**Course wrap-up and hints for the exam** / Bragge

About the assignments

- Instructions are provided at MyCourses Instructions for Assignments tab & to be returned to Assignment Submissions
  - Some text-based assignments are automatically scanned via Turnitin plagiarism detection software - you are able to see the originality reports and resubmit* if needed.
  - **Points are deducted from late assignments (grace period 2 days)**: ***-1p***
- The first, ”**2024 Tech trends**” assignment to be returned by **March 1**:
  - Read blogs and reports on current technology trends or future skills needs, and answer the six questions for Assignment 1 (provided at MyCourses)
- Remember proper citing conventions (no copy-pasting, mention the sources).

Gartner's hype cycle for Emerging technologies 2023



Innovation Trigger: A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist and commercial viability is unproven.

Peak of Inflated Expectations: Early publicity produces a number of success stories — often accompanied by scores of failures. Some companies take action; many do not.

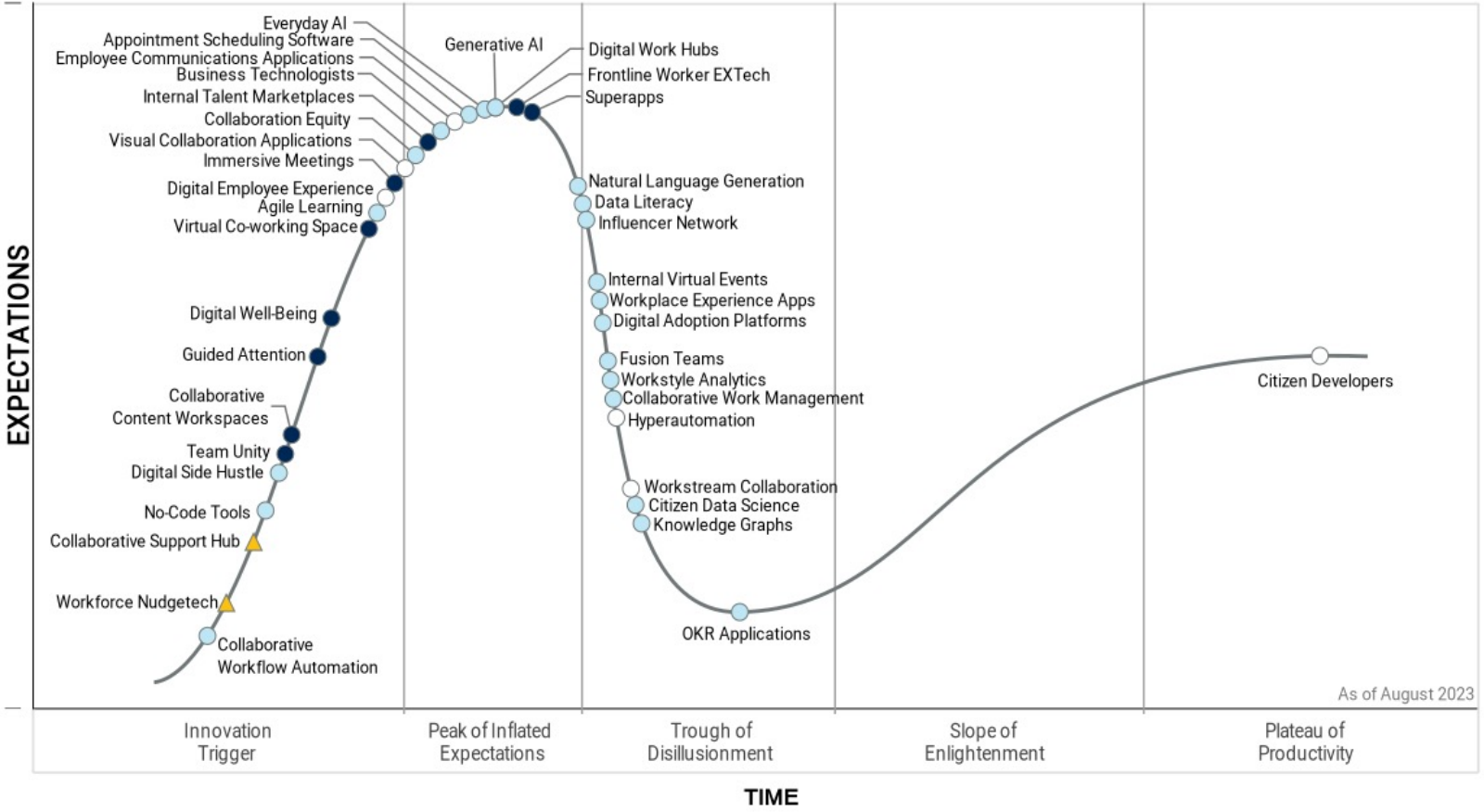
Trough of Disillusionment: Interest wanes as experiments and implementations fail to deliver. Producers of the technology shake out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters.

Slope of Enlightenment: More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious.

Plateau of Productivity: Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off.

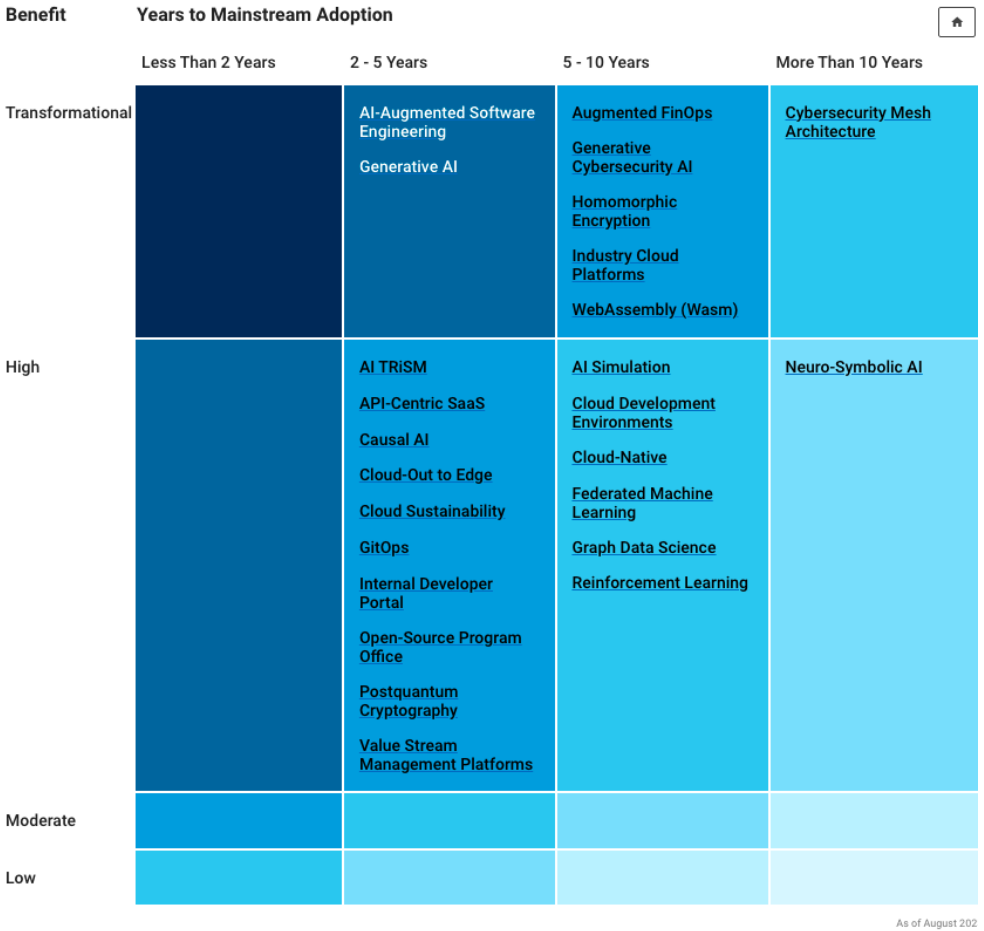
https://www.gartner.com/en/information-technology/research/hype-cycle *NOTE: Gartner's research reports are available at http://gartner.aalto.fi*

Gartner's hype cycle for Digital workplace apps 2023



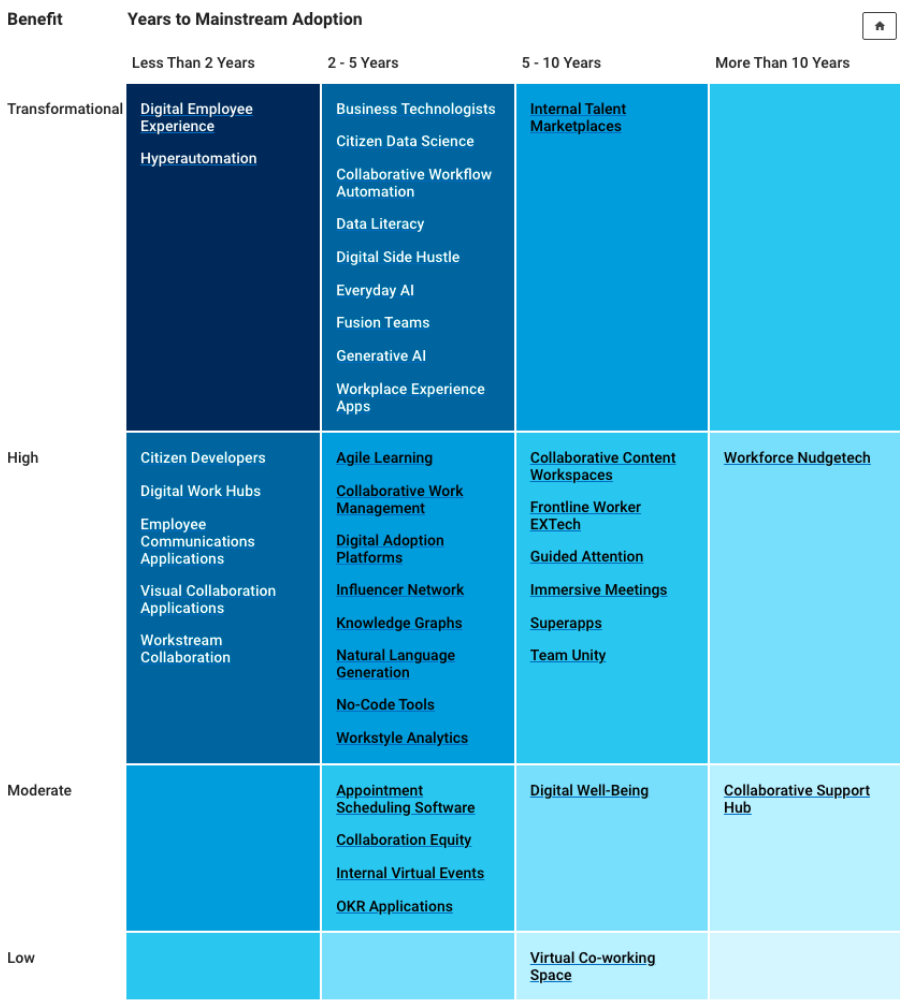
https://www.gartner.com/en/information-technology/research/hype-cycle *NOTE: Gartner's research reports are available at http://gartner.aalto.fi*

Gartner's priority matrix for Emerging technologies 2023



https://www.gartner.com/en/information-technology/research/hype-cycle *NOTE: Gartner's research reports are available at http://gartner.aalto.fi*

Gartner's priority matrix for Digital workplace 2023



https://www.gartner.com/en/information-technology/research/hype-cycle *NOTE: Gartner's research reports are available at http://gartner.aalto.fi*

Schedule & points for assignments

Nr.	Assignment	Deadlines	Max points
1	Business technology trend reports 2024	Fri 1.3.	8
2	Python programming starters	Fri 8.3.	8
3	SQL data management language for querying databases	Fri 15.3.	8
4	Prompt Engineering MOOC (IBM Watsonx)	Fri 22.3.	8
5	Practical AI – What everyone should know of AI (Microsoft Copilot , Bing Image creator)	Wed 27.3.	8
6	Exploring and visualizing data with Tableau Online	Fri 5.4.	10
7	Research profiling with Scopus and Text-mining with Leximancer	Fri 12.4.	10
Extra	Answering to Aalto's course feedback survey	Thu 25.4.	2
	Above assignments and feedback survey in total		62
Bonus	Points from being present at guest lectures at campus, (or in zoom in case the live lecture is shifted to zoom. 1 bonus point / guest lecture at the MIS course	Thu 11.4.	8

	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Course summary
Lecture schedule *Lectures on **Tuesdays & Thursdays at 13-15**, except two extra BI lectures on Mon or Wed at **10-12***	**L1:** Tue 27.2. Introduction to course & book's chapters 1-2 **L2:** Thu 29.2. Collaborative IS and groupware technologies	**L3:** Tue 5.3. Organizational change in digitalization era **L4:** Thu 7.3. Service Design and Human-centered methods in healthcare	**L5:** Tue 12.3. Responsible and strategic use of data & AI **L6:** Thu 14.3. Information systems development, agile methods	**L7:** Tue 19.3. Data, text and web-mining, bibliometrics **L8:** Thu 21.3. Beyond ERP - digital innovation driving sustainability transformation	**L9:** Tue 26.3. Challenges with Big Data Analytics **Ext1:** Wed 27.3. Why Tableau? Demo **EASTER BREAK** Thu 28.3. –	**EASTER BREAK** until Wed 3.4. **L10:** Thu 4.4. Data visualization and story telling	**Ext2:** Mon 8.4. State of Business Analytics **L11:** Tue 9.4. IT Security and Privacy **L12:** Thu 11.4. Course wrap-up and hints for the exam	**12 MIS + 2 extra BI lectures** *The 2 extra lectures are arranged jointly with our BI course on Mon or Wed at 10-12 o'clock in Ekonominaukio 1, hall V001-002*
Presence in classes	*Gather bonus*	*points from*	*being present*	*in the guest*	*lectures!*			Possibility to gather 8 bonus points
Assignments 60% of grade (deadlines) *Gather at least 30/60 points*	**A1 (8 p):** Business Technology trend reports (Fri 1.3.) *NOTE that this assignment is compulsory!*	**A2 (8 p):** Python programming starters (programming-24.mooc.fi) (Fri 8.3.)	**A3 (8 p):** SQL data management language for querying databases (codecademy.com /learn/learn-sql) (Fri 15.3.)	**A4 (8 p):** Prompt Engineering with IBM's WatsonX, (cognitiveclass.ai /courses/prompt-engineering-for-everyone) (Fri 22.3.)	**A5 (8 p):** Practical AI (cs.edukamu.fi/ practical-ai) (WED 27.3.)	**A6 (10 p):** Data exploration & visualization with Tableau Online (online.tableau.com/) (Fri 5.4.)	**A7 (10 p):** Text-mining research from Scopus.com with Leximancer (Fri 12.4.)	**A1-A7 assignments + Diary:** Gather at least 30/60 pts **Extra: Course Feedback survey** (24.4.) (worth 2 pts)
Exam 40% *Gain at least 20/40 points*								**Exam in MyCourses on 18.4. at 9-12**

Course feedback from previous years and impacts

80% of the students have praised the **hands-on assignments** and the tools introduced in them

- *”The assignments were excellent. They were challenging but still relatively easy to do so that learning was actually happening.”*
- *”For the first time assignments on the course were interesting.”*
- *“The assignments felt actually useful and the topics felt relevant to my studies and my future.”*
- *“The assignments were great because I learned many new tools and techniques that will hopefully be useful for me in the future.”*

Assignments will be **published early on** for students to better allocate time for them

- **New software** in assignments (this year WatsonX, Microsoft Copilot, Bing Image creator)
- **Assignments now account for 60%** of the course grade (previously 40%), based on course feedback

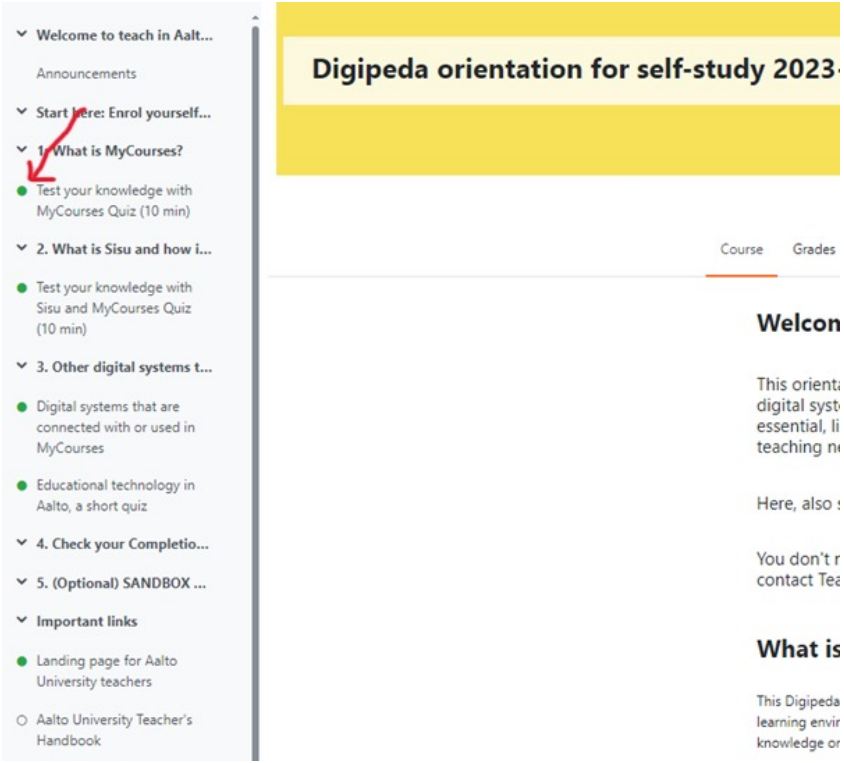
50% have complimented the **variety and high quality** of **guest lectures** > keeping the concept, but adding lectures by main teacher and Aalto faculty

- *“Some of the lecturers were amazingly interesting and inspiring.”*
- *”Overall, the course had the best guest lectures I have seen in Aalto and I think this is the only way to arrange such an extensive course.”*

Students appreciate **flexibility in studying**

- All **lectures were recorded** already in 2019 and provided for students as an alternative to campus lectures.
  - As students appreciated the flexibility in watching according to their own schedule, the practice has continued since
- Possibility to **submit assignments late**, to enable working on them during the weekends (as some students wish so)

Completion progress in use



Activity completion is activated in MyCourses: it follows your progress on the course.

Some items are marked <u>automatically</u> done (green dot) when submitting an assignment.

In some cases you must <u>manually mark</u> the assignment as done

Wrap up

Course goal 1: SEE THE BIG PICTURE !


Course goal 2: KNOWING IS RELAXING.
”T-SHAPED PEOPLE” ARE WANTED!
• J. Bragge 2010

Lots of technology issues and ”ABC” acronyms!

Also managers and other business people have to study these on a ”need to know” basis

- *Only selected topics will be discussed during the classes –*
  others are left to be independently read and studied from the course book.

Where to follow technology developments relevant for organizations?

CIO.com, TechCrunch.com, ZDNet.com, Mashable.com, TIVI.fi, itewiki.fi Digitoday.fi, Tech twitterers and bloggers…

Next steps in the course

Watch the latter part of this intro lecture from the pre-recorded Panopto video 
(Chapters 1 & 2 of the book)

Join the MIS 2024 Spring discussion board at Zulip!

Use your aalto email, and register to Zulip when logging in first time:

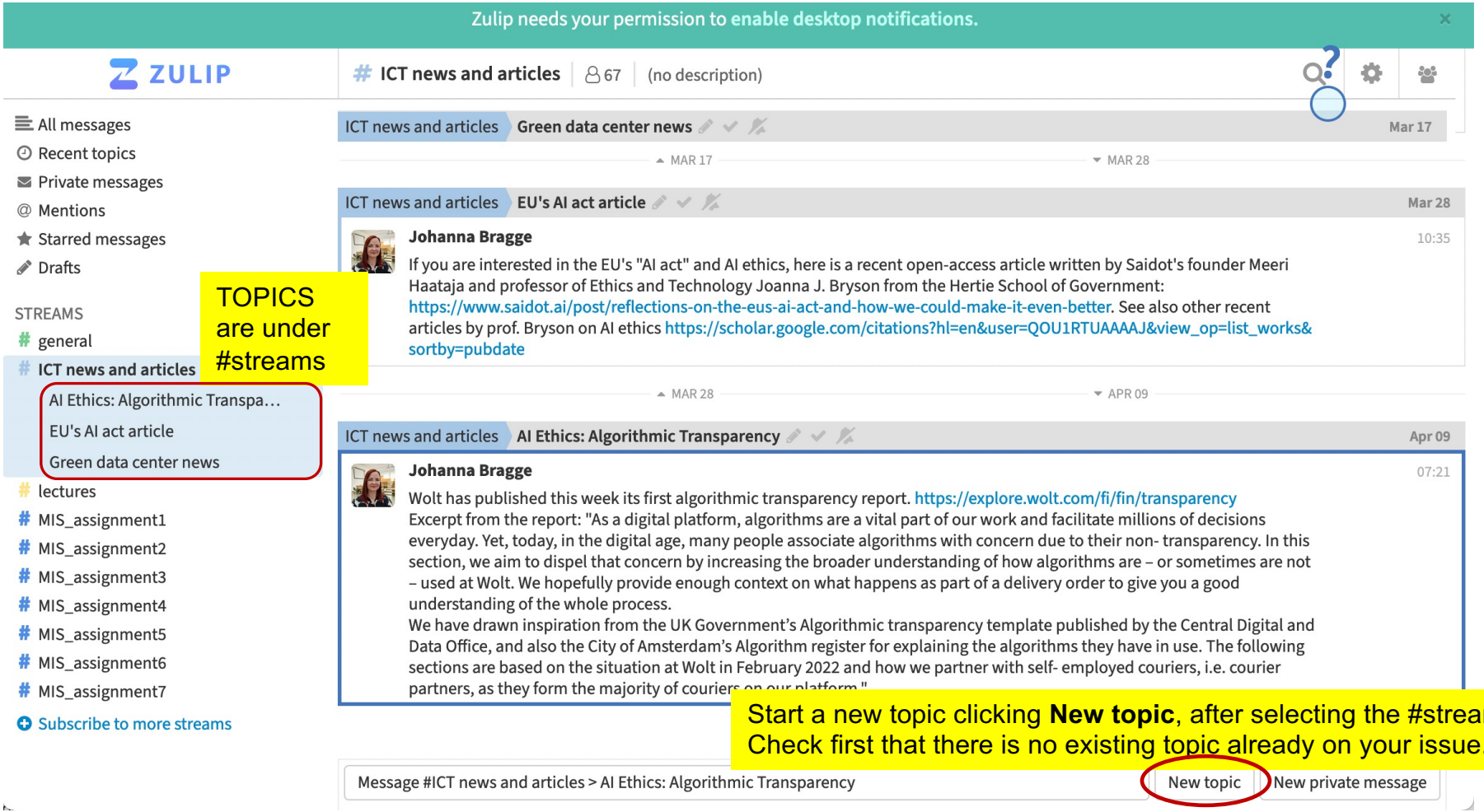
https://mis2024.zulip.aalto.fi

Start conducting Assignment 1 (deadline Friday March 1 midnight) and the others according to their deadlines.
Note: the assignment deadlines are flexible by a penalty of -1 point (2 days)

Attend the lectures OR start watching the lecture videos regularly!
2 lectures weekly, (exceptions on Easter weeks).
Earn bonus points from presence.

Discuss issues in assignments & tools or insights from lectures, or recent ICT news in Zulip during the course!

Give anonymous feedback via Presemo.



More instructions on how to use Zulip at https://scicomp.aalto.fi/aalto/zulip/