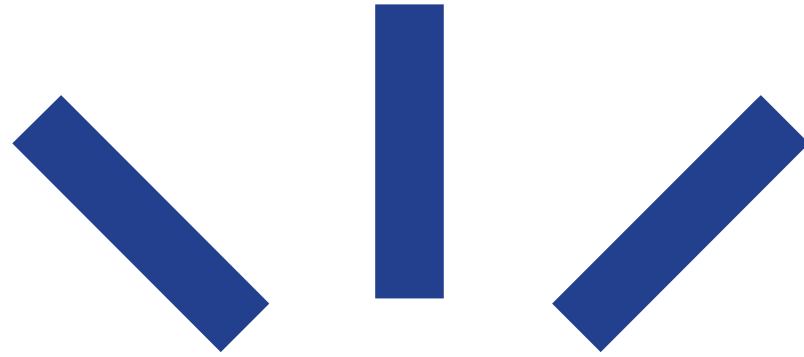




Navigating the 5.0 transitions: Strategic management insights from the HF/E perspective

IEA 2024, session: Sustainable development 2; 27.8.2024, 15-16:30

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Industrial revolutions and the development of technologies and human work



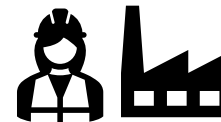
Agriculture, craftsmanship... Mechanized factories... Labor-assisted machinery and mass production... automatization... Smart factories...

18th century

21st century

21st century

- Images created with AI Canva image generator
- European Commission (2021): [What is Industry 5.0?](#)
- Forbes (2022): [What Is Industry 5.0 And How It Will Radically Change Your Business Strategy?](#)
- Business Finland (2021): [From Industry X to Industry 6.0](#)





HF/E and sustainable technology transitions

- Our ERGO2030 research group has focused on (dynamic) organizational capabilities for successful new technology adoption in the manufacturing company context.
- Lately we have been studying:
 - **what kinds of HF/E data manufacturing companies collect and utilize for process development purposes and**
 - **How is HF/E present when selecting organizational Key performance indicators (KPIs)**



Inspired by an old management quotation "**you can't manage what you don't measure**"

- Reiman et al. (2021): [Human factors and ergonomics in manufacturing in the industry 4.0 context – A scoping review](#). Technol. Soc.
- Reiman et al. (2023) [Human Work in the Shift to Industry 4.0: A Road Map to the Management of Technological Changes in Manufacturing](#). Int. J. Prod. Res.



Amounts of accidents/fatalities/first-aid cases/incidents/injuries/illnesses And so on...

Well-being at work surveys

Ergonomics assessments

Work environmental conditions

Safety observations

Employee satisfaction

We know from the organizational management perspective how difficult it is to simultaneously manage well-being at work and labor productivity

Cycle times

Production capacity

Material consumption

Quality ratio

Customer claims/complaints

Number of pieces produced

And so on...

Overall equipment efficiency/effectiveness

Any of those measuring well-being & prod. Simultaneously?

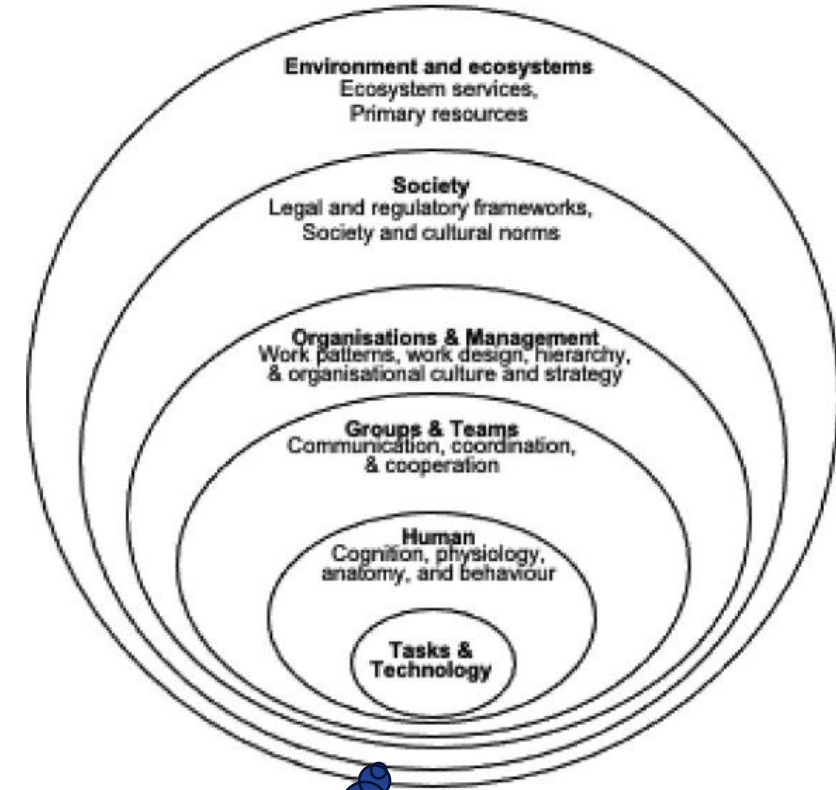
Various indicators/KPIs available... **Finding a suitable mix of leading & lagging indicators is a managerial challenge**

- More on HF/E indicators from the company perspective, see: Reiman et al. Human work in strategic technology transitions in manufacturing. International Journal of Human Factors and Ergonomics. In press.



...can we go forward with sociotechnical systems' thinking?

How do we define systems?



See more discussion on the definitions of sociotechnical systems, e.g., at:

- Trist, E.L. 1981. The Evolution of Socio-Technical Systems: A Conceptual Framework and an Action Research Program. Ontario Ministry of Labour, Ontario Quality of Working Life Centre
- Kleiner, B.M. 2006. Macroergonomics: Analysis and design of work systems, Applied Ergonomics 37 (1), 81-89.
- Moray, N. 2000. "Culture, Politics and Ergonomics." Ergonomics 43, 858-868.
- Richardson, M. & Thatcher, A. (2023) State of science: refitting the human to nature, Ergonomics.

Inspired by these considerations, we have initiated an additional "pop-up study" where we consider HF/E data and KPIs from the country perspective.



**Consider Finland as a nation as
a sociotechnical system entity**

**Can such a large system
be examined from the
HF/E perspective? (and of
course should it be...)**

**Of course one might also
ask that why should it
be...**

1ST

HAPPIEST COUNTRY

For the fifth time in a row, Finland ranked the happiest nation in the UN World Happiness Report.

The UN World Happiness Report is a survey of the state of global happiness that ranks 156 countries by how happy their citizens perceive themselves to be.

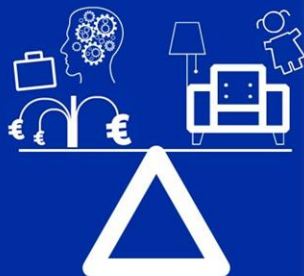


3RD

WORK-LIFE BALANCE

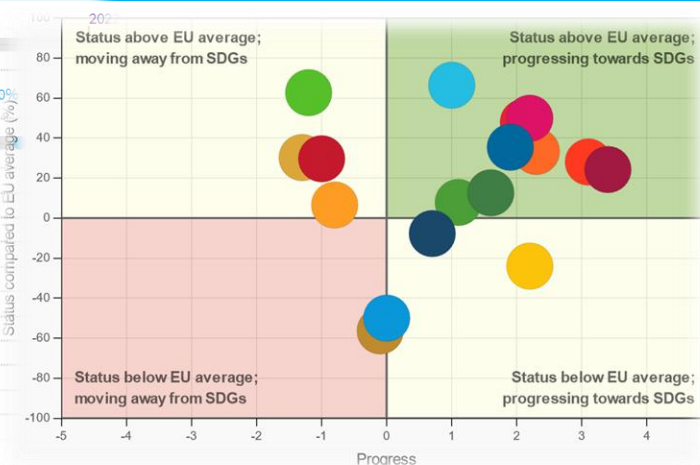
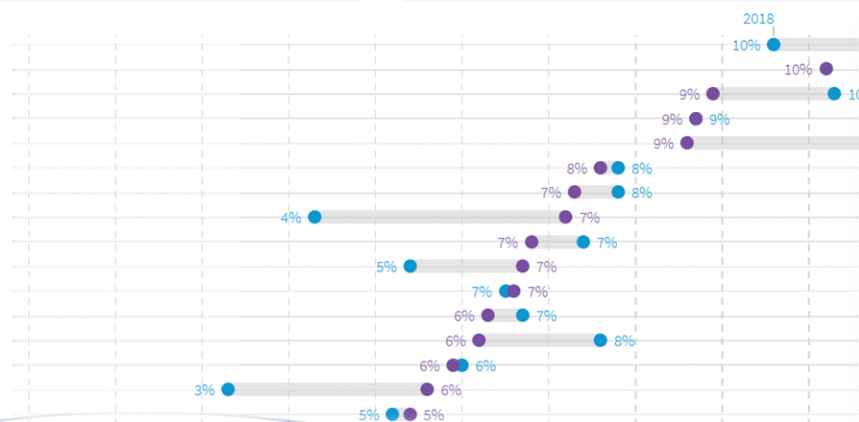
Helsinki, Finland is among the best places for work-life balance when comparing data on work intensity, institutional support, legislation, and livability. The index measures 20 factors determining the work-life balance of 40 cities worldwide.

Source: Kisi Work-Life Balance Index 2022



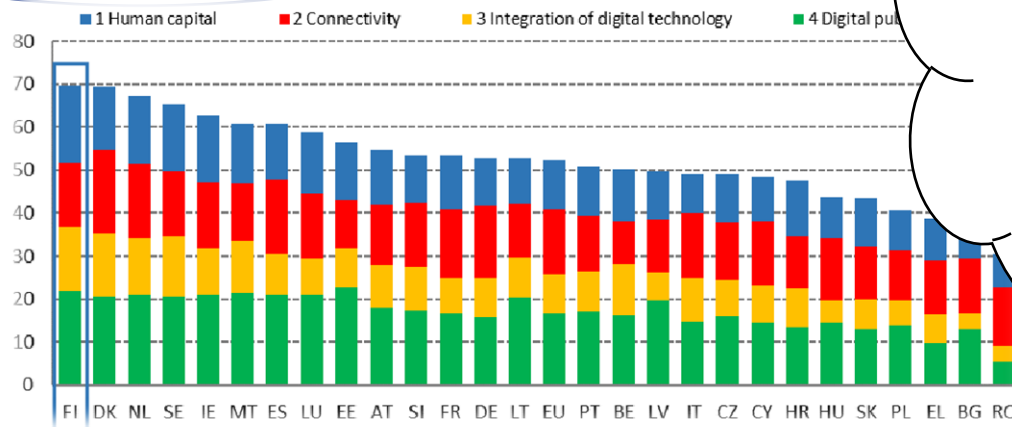
Share of enterprises using industrial or service robots in the EU, 2018-2022 (%)

Denmark
Belgium
Finland
Italy
Spain
Portugal
France
Malta
Sweden
Slovakia
Slovenia
EU27
Netherlands
Czechia
Estonia
Austria

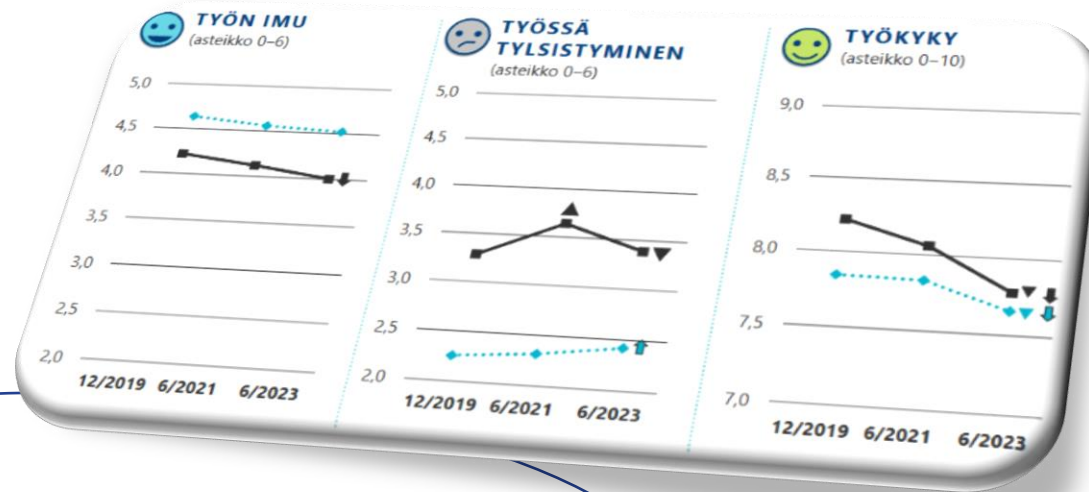
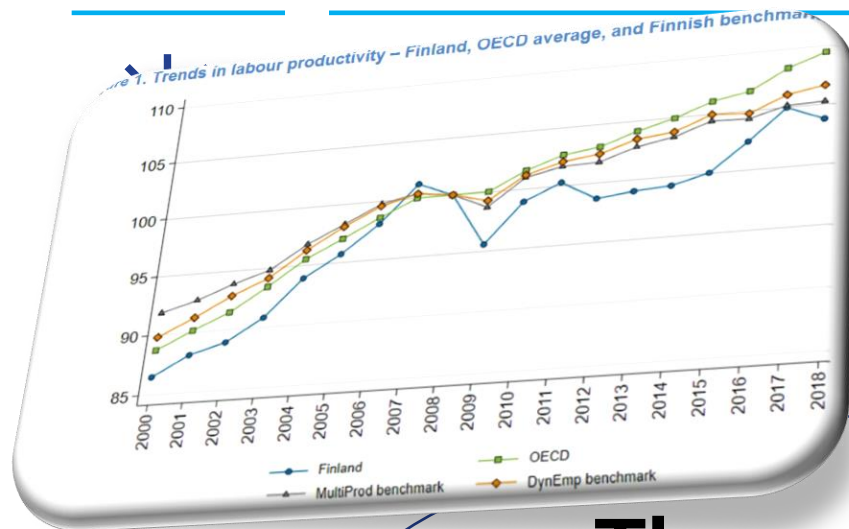


Anyway, we did
that. So, Finland –
as a sociotechnical system
entity

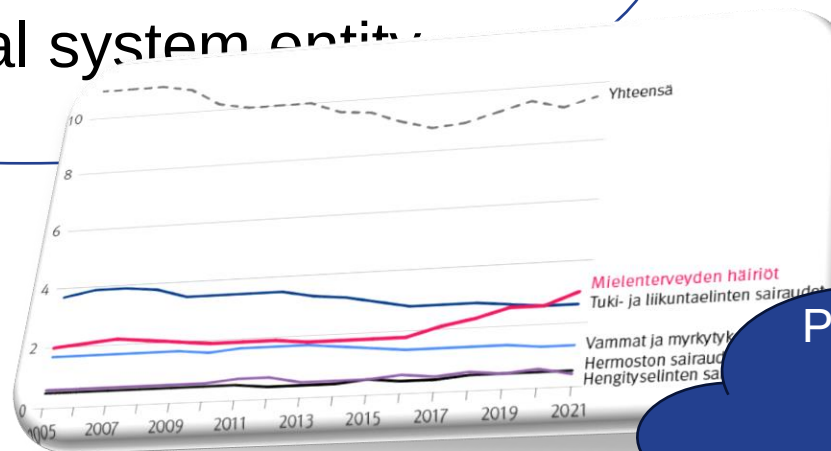
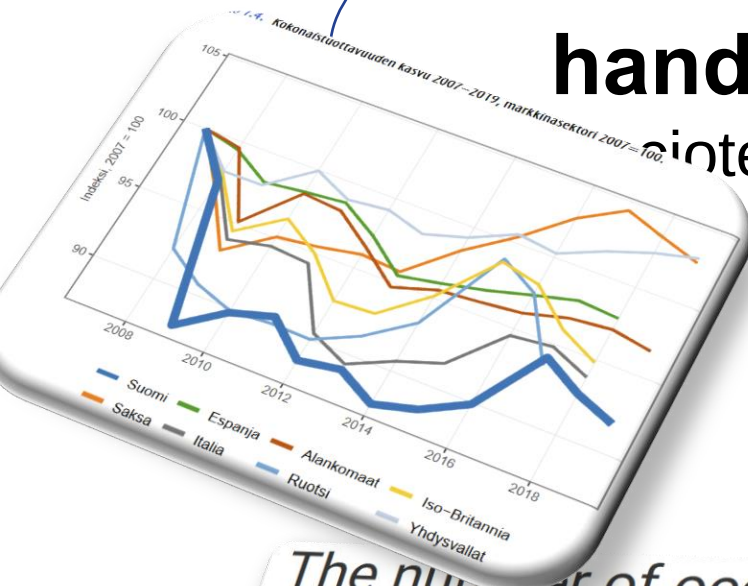
Digital Economy and Society Index (DESI) 2022 ranking



Based on global
evaluations, our
system must be in a
perfect balance
(when examined
from the HF/E
perspective)?



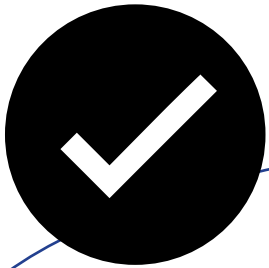
Then, on the other hand... Finland – as a
biotechnical system entity



The number of occupational accidents rose more in 2022 than expected

...there might be something to be balanced?

Policy programmes surely take stand with these issues and steer us towards an optimized system?



Finland – our new government program targets for significant productivity developments through digitalization and better working quality

HF/E is also very interested in these issues... Wouldn't there be a perfect fit for Finland and HF/E?

"you can't manage what you don't measure"
How do we follow the development?

		OECD	World Bank	IMF	EUROSTAT	ILO	EU OSHA
Productivity indicators	GDP per hour worked	X	X	X		X	
	Employment/ unemployment rate	X	X	X	X	X	
	Annual hours worked per employee	X			X	X	X
	Labour force participation rate	X	X		X		
	Labour productivity - volume of output produced per unit of labor input	X			X	X	
	Labour costs					X	
	Total factor productivity	X					
	Multifactor productivity	X					
	Educational attainment level	X	X			X	
	Occupational accident and injuries*	X			X	X	X
Well-being indicators	Occupational diseases	X			X	X	
	Inspectors per 10 000 employed persons/Inspector visits					X	X
	Time pressure						X
	Vibrations, loud noise and temperature						X
	Exposure to dangerous substances						X
	Ergonomics risks						X

* This is purposely a wide term, including a variety of lagging indicators describing occupational accidents by total numbers, frequencies, days lost and cases per different variables (like sex, age, economics activity).

To avoid measuring too much or wrong issues, the KPIs should be selected wisely fitting the strategic purposes

- Is HF/E present in these?
- Should it be?
- What would then be the indicators?
- Who should choose them?



...The new industrial strategy would need to be based on totally new targets and indicators for business performance and sustainability in business models rather than the rather “classical” headline indicators of competitiveness...*

Is there room (should there be) for HF/E experts in this discussion?

...Industry 5.0 should orient towards the optimization of more appropriate measures that reflect contemporary economic thinking, such as ... and valuing human and natural capital...*

...Policy and measurement of economic activity need to place greater emphasis on the material/real economy over financial metrics and short-term profiteering...*

***As discussed in the EU Industry 5.0, a transformative vision for Europe publication.**

Arto Reiman/ University of Oulu