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Environmental impacts of AI and digital technologies

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Direct climate impacts of digital technologies…?

In the global context currently not that large…

- The global ICT sector caused roughly 1% of global GHG emissions in 2024 (Malmodin et al., 2026)
- Energy use of AI is only a small share of global electricity use (de Vries, 2023; Luers et al, 2024).

…but still significant…

- Example: US data center electricity consumption more than doubled between 2017 and 2023: Mainly due to increased use of AI (Shehabi et al, 2024).

…and challenges might be huge locally…

- Example: Data centers responsible for 23% of Ireland's electricity consumption in 2025 (Central Statistics Office Ireland)

Not only energy use and climate impacts…
Water use, resource impacts, toxicity impacts..etc.

Malmodin et al., (2026) ICT4S conference
de Vries (2023) Joule 7(10)
Luers et al (2024) Nature 628: 718 -720
Shehabi et al (2024) 2024 United States Data Center Energy Usage Report
Central Statistics Office Ireland (2025) "Data Centres Metered Electricity Consumption 2025"

ICT=Information and communication technology

Net effects of AI and digital technologies…?

Direct effects of producing, using and disposal of digital technologies (cause increased impacts)

Indirect effects of digital technologies (can cause increased and reduced impacts)

- Example: Energy systems control and planning



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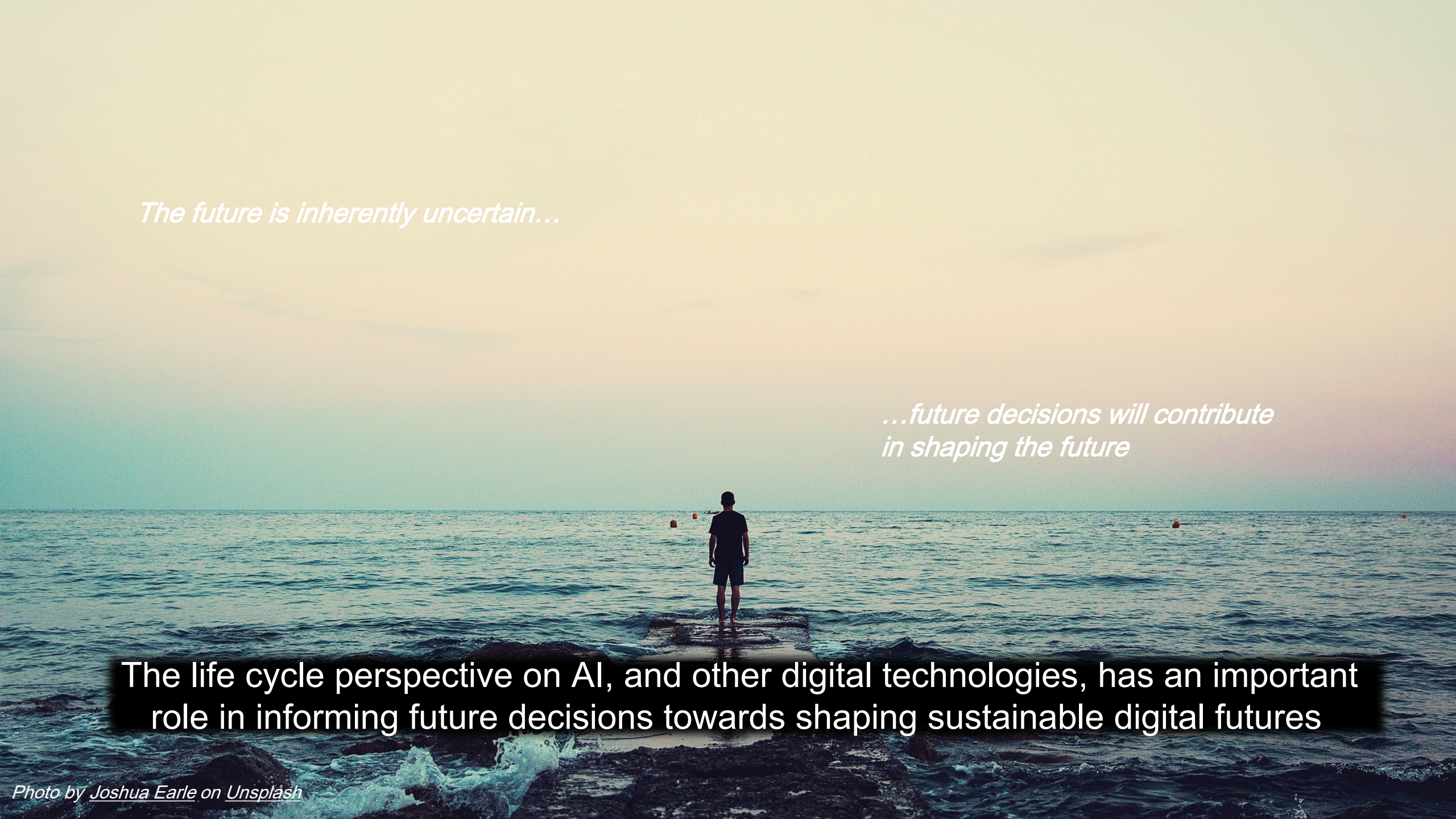


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Net effects of AI and digital technologies…?

"AI is one of the most disruptive technologies of our time"
(Luers et al., 2024)

Luers et al (2024) Nature 628: 718 - 720



The future is inherently uncertain…

…future decisions will contribute in shaping the future

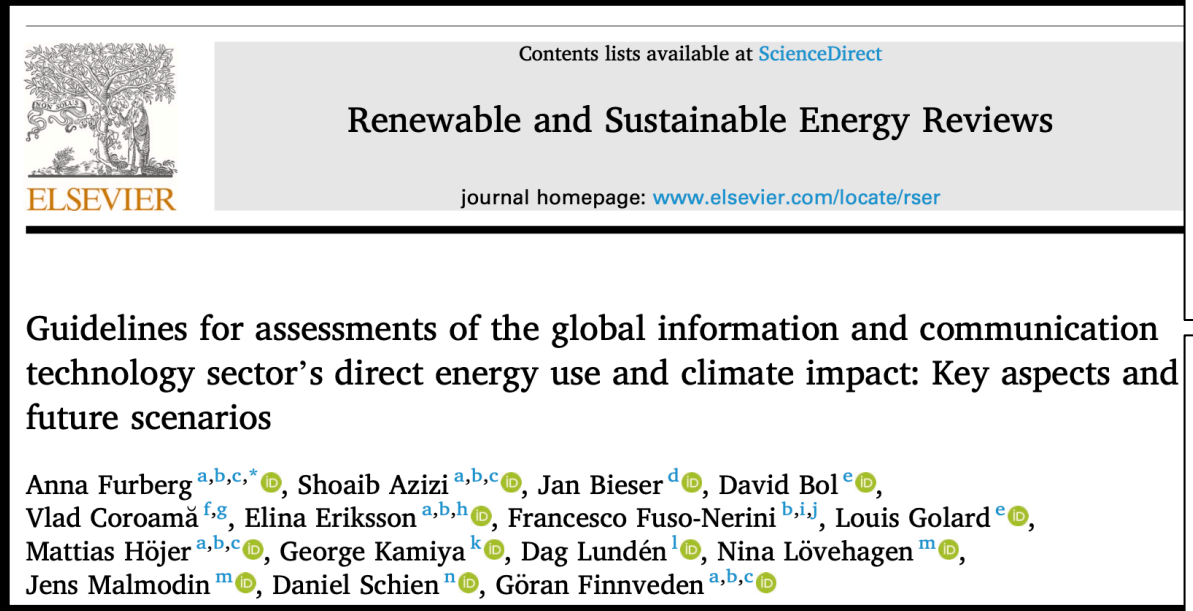
The life cycle perspective on AI, and other digital technologies, has an important role in informing future decisions towards shaping sustainable digital futures

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The type of research that we do…

- Assess environmental impacts of Information and communication technology (ICT) applying Life cycle assessment (LCA) and life cycle thinking
- Investigate opportunities and challenges of digitalization for sustainability

Examples of articles published during 2026:



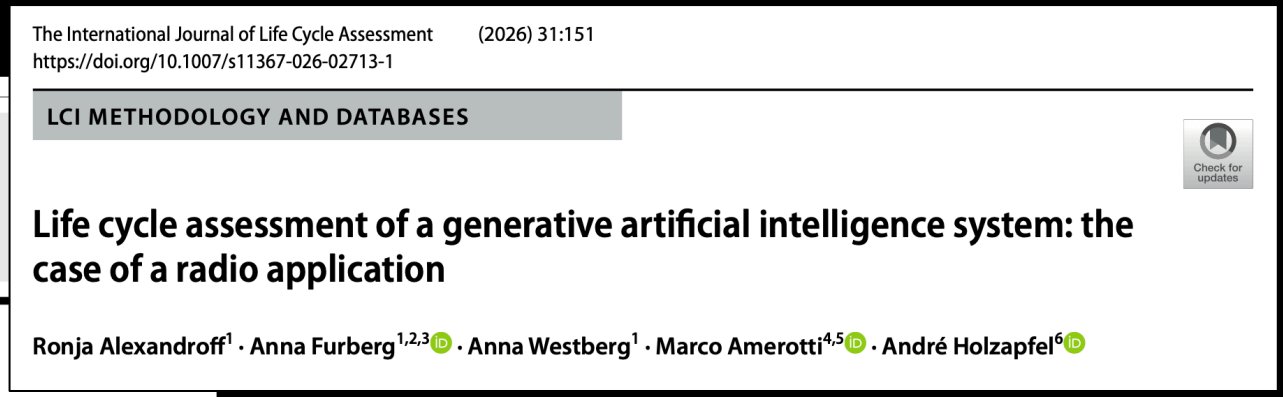
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Renewable and Sustainable Energy Reviews

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Guidelines for assessments of the global information and communication technology sector's direct energy use and climate impact: Key aspects and future scenarios

Anna Furberg [a,b,c,*], Shoaib Azizi [a,b,c], Jan Bieser [d], David Bol [e], Vlad Coroamă [f,g], Elina Eriksson [a,b,h], Francesco Fuso-Nerini [b,i,j], Louis Golard [e], Mattias Höjer [a,b,c], George Kamiya [k], Dag Lundén [l], Nina Lövehagen [m], Jens Malmodin [m], Daniel Schien [n], Göran Finnveden [a,b,c]

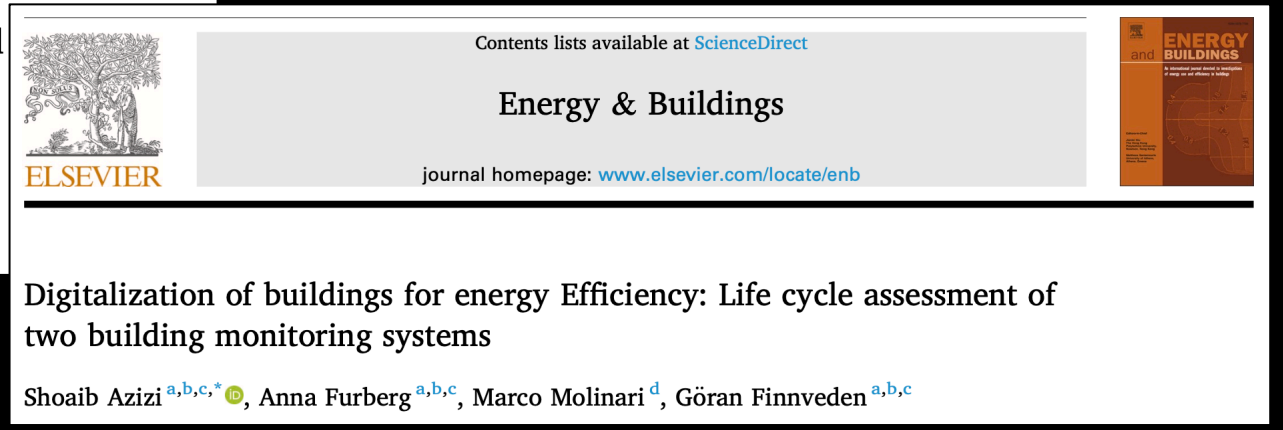


The International Journal of Life Cycle Assessment (2026) 31:151
https://doi.org/10.1007/s11367-026-02713-1

LCI METHODOLOGY AND DATABASES

Life cycle assessment of a generative artificial intelligence system: the case of a radio application

Ronja Alexandroff[1] · Anna Furberg[1,2,3] · Anna Westberg[1] · Marco Amerotti[4,5] · André Holzapfel[6]



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Shoaib Azizi [a,b,c,*], Anna Furberg [a,b,c], Marco Molinari [d], Göran Finnveden [a,b,c]