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Medicine robot services in health care and care: contribution to the green transition

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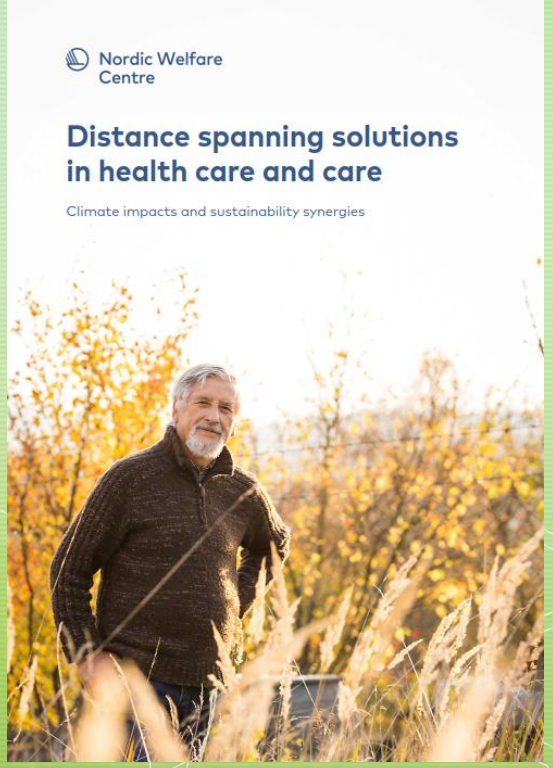

Background

- Digitalisation is generally considered a positive measure for the environment
- Practical methods are needed for assessing diverse impacts of digitalisation, such as climate impacts
  - We introduce a novel methodology to assess the environmental, especially the climate impacts and social impacts of digital healthcare and care services
  - We present the results of a combined quantitative and qualitative assessment concerning the impacts of distance spanning home care services in Finland – focusing on medicine robot services for older people
  - We give practical guidance for future impact assessments
- In recent years, there have been several studies on the carbon footprint of telemedicine (distance spanning solutions)
  - The focus has typically been on benefits, such as avoided patient transfer, and the carbon footprint of the service (for example) has not been assessed
- Conclusions of a recent systematic review on medicine robots (medicine dispensers): research is often focused on hardware and/or software technology; human-centred perspectives are overlooked (yet crucial), and, to date, sustainability and environmental or climate impacts have not been focused on (Gargioni et al., 2024)

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Case region and services

Evondos.fi

Axitare.eu

fi.wikipedia.org

- Data on medicine robot services from home care services of (the current) Wellbeing services county of Päijät-Häme
  - Technologies in use: Evondos (from 2016) and Axitare (from 2020)
  - Clients receive regular medications in a timely manner without a care professional's visit, packed into unit doses
  - Home care professionals fill the robots generally for 1-2 weeks
  - In the event of possible disturbances (such as the medicine not taken), the device makes an alarm to a professional
  - Some of the home visits are replaced, not necessarily all
  - Offered to home care clients (older people) whose functional ability permits meaningful use (15.3% of home care clients in 2022)
- A quantitative and a qualitative impact assessment were conducted
  - A quantitative impact assessment of climate impacts – by Finnish Environment Institute SYKE
  - A qualitative impact assessment of environmental, especially climate impacts and social impacts – by LUT University
- Impacts were identified based on
  - Interviews with the county staff and the two technology suppliers
  - Documents provided by the county (statistics, report on the use and its development)

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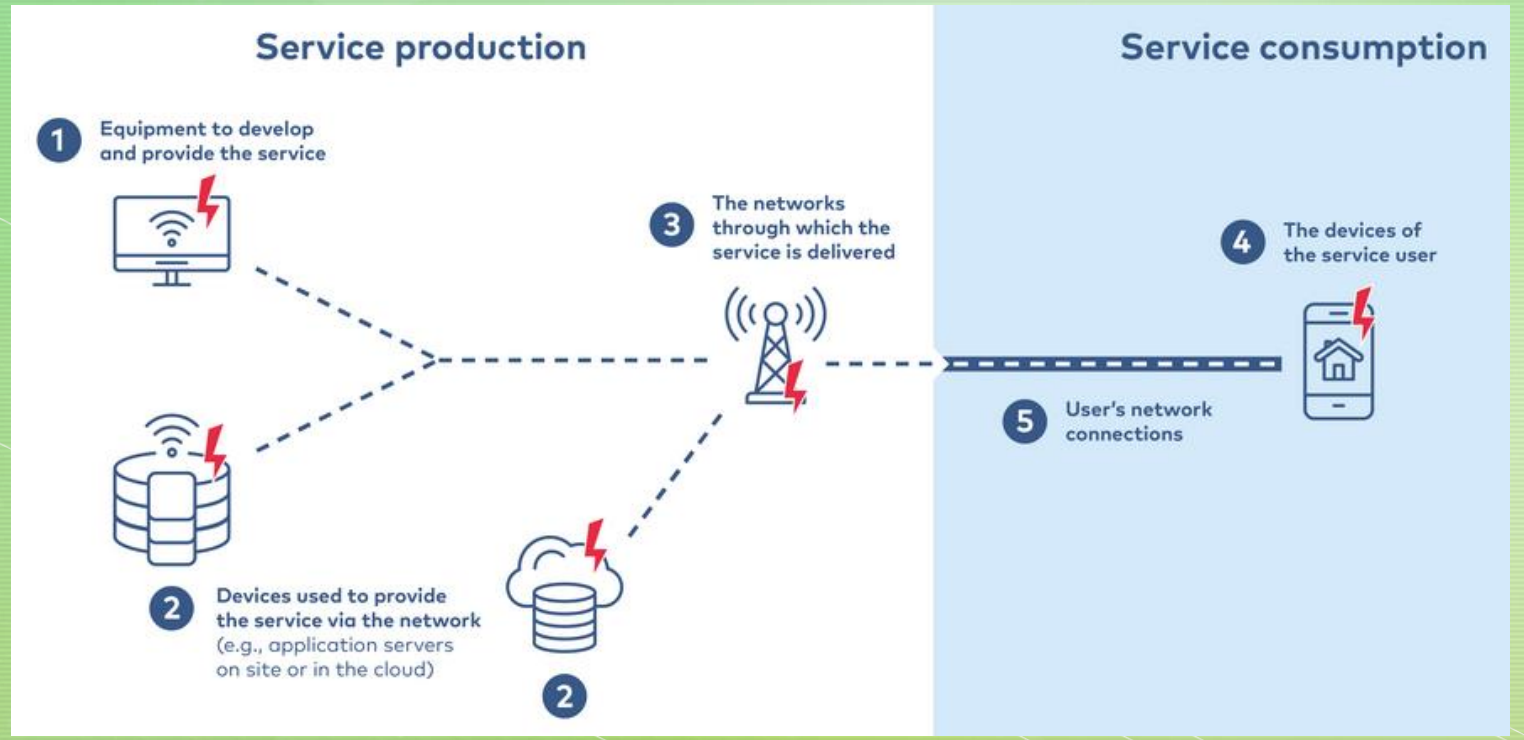
Principles of the impact assessments (1)

Quantitative assessment of climate impacts

- The novel methodology comprises an assessment framework and a calculation model
- The assessment framework is based on life cycle assessment methodology (LCA)
- Challenges of assessing digital services:
  - They typically comprise a high number of components (multiple products and also hidden network components) – an exact assessment of each component is virtually impossible
  - The process of digitalisation is typically gradual

The (simplified) framework for the quantitative assessment of the climate impacts of digital services



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Principles of the impact assessments (2)

Qualitative assessment

- The method for assessing social and climate impacts is based on the principles of human impact assessment (HuIA)
- Impacts assessed using HuIA can be planned or unintended and can be the result of long chains of impacts
- The essence is to holistically identify the positive and negative (and neutral) impacts on the different people and groups of people involved

Categorisation of the qualitative results

Environmental, especially climate impacts: positive and negative

Social impacts: positive and negative

- Impacts on clients/patients
- Impacts on care professionals
- Impacts on service organizations and society

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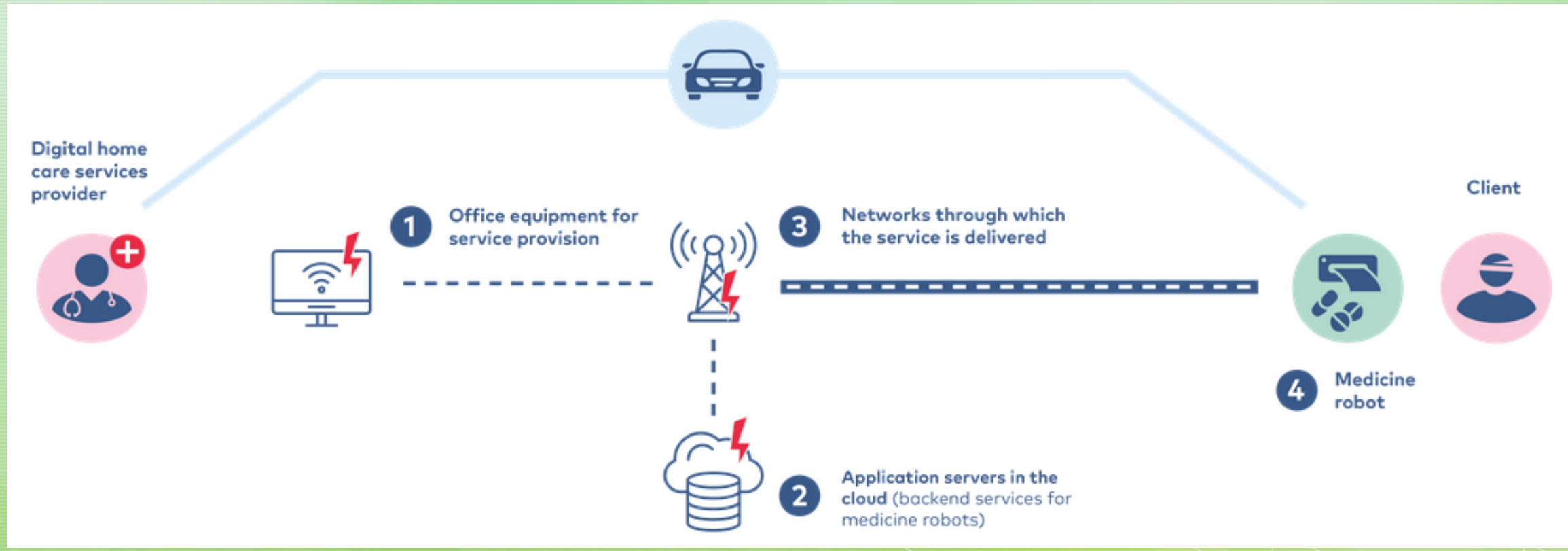
Quantitative assessment of climate impacts: results

Medicine robot service components for the impact assessment



The climate impacts of medicine robot services were calculated for a functional unit based on annual use of a medicine robot by a client who takes medication three times a day

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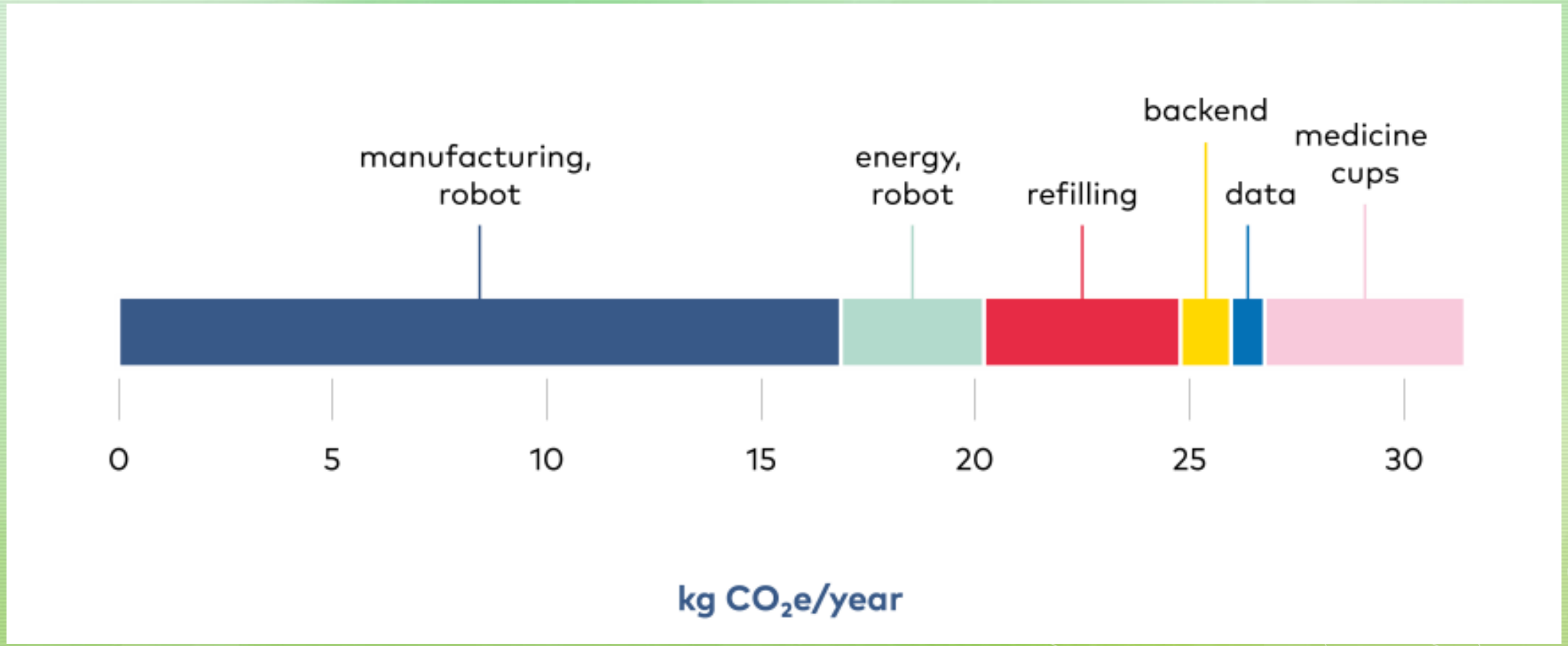
Quantitative assessment of climate impacts: results

Climate impacts of a medicine robot (aggregated)



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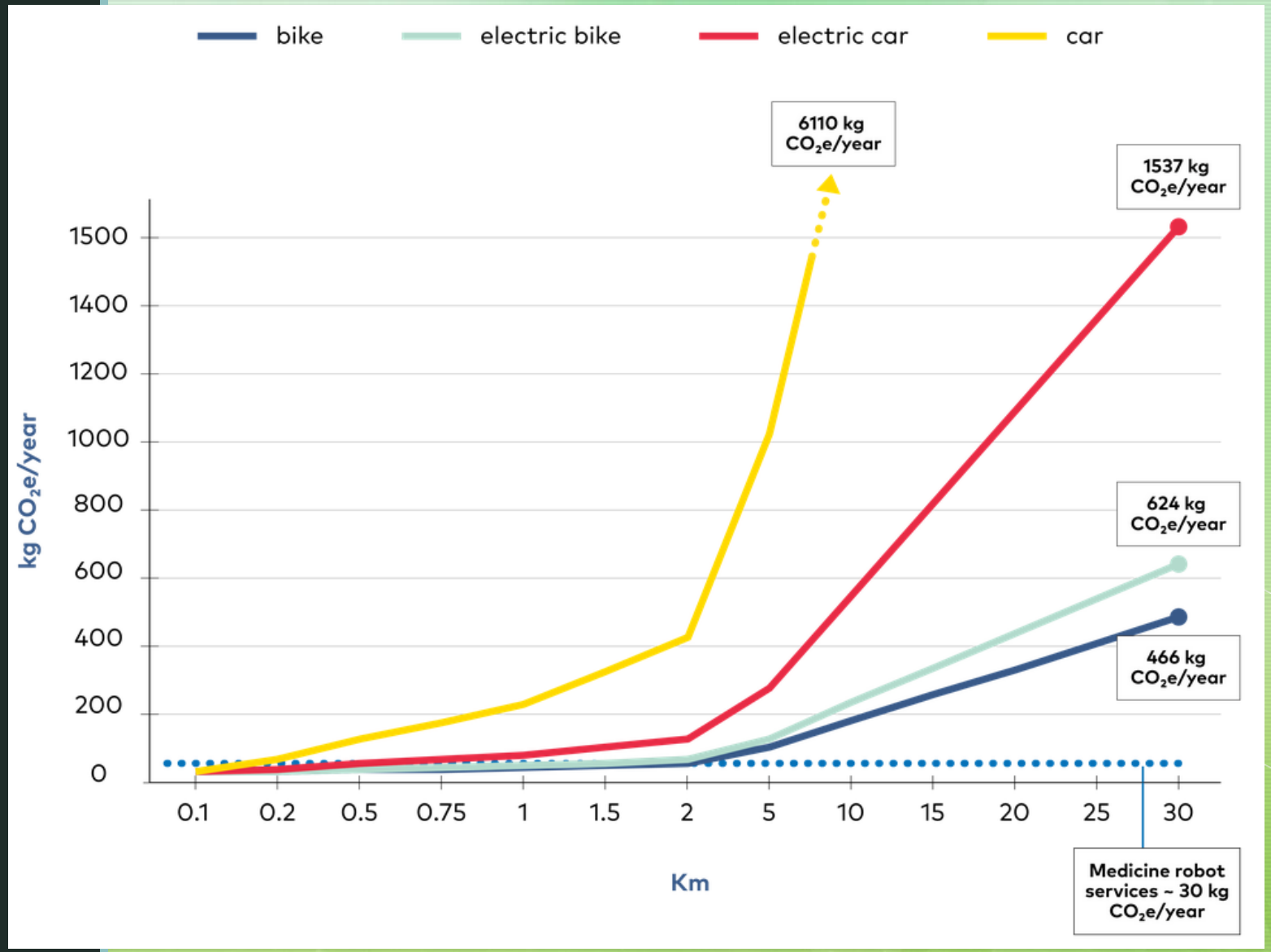
Quantitative assessment of climate impacts: results



Comparing the climate impacts of medicine robot services to the climate impacts of avoided travel

The studied medicine robots are a climate-friendly option when the distance to a client by car (even an electric car) is more than one kilometre (two kilometres by bike)

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Qualitative assessment of climate impacts: results

Positive climate impacts

- Decrease from even 60 home visits per month per client -> 2 visits (for filling the robot) – but usually, only part of the visits are replaced
- Decrease in medicine wastage; savings on care professionals' protective equipment (disinfectants, gloves, masks)

Negative climate impacts

- Error messages/alarms may require extra home visits
- When the device is brought to the client, guidance is always given – but with better planning and by ensuring the care professionals' technical expertise, unnecessary driving could be avoided

"I personally find these [medicine dispensers] useful. These have been well received in the work community. Suitable clients are suggested from the field. It's frustrating to drive 50 minutes to give the morning medicine." (A care professional)

"Thorough training and support produces [positive] environmental impacts by ensuring that the device is not left unused or that there is no return to giving the medicine on site." (A technology supplier)

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Qualitative assessment of social impacts: results

Impacts on…	Positive impacts	Negative impacts
Clients/ patients	Savings on service fees, improved accuracy in the timing of medication and care visits, less medication errors, maintaining a sense of independence and autonomy	Not suitable for everyone (e.g. a client potentially being suspicious); perceived suitability of the devices (size, appearance) in the home environment
Employees	Reduction in the time required for travelling and technical tasks, easier planning of time use (more time for actual care work rather than, for example, changing protective equipment and disinfecting between client visits)	Change of work, new tasks (e.g. responsibility for technology, assessment of service needs) Change requires learning, which can be overwhelming No reduction in total workload because the number of clients keeps increasing; easy visits have decreased, while challenging visits remain
Service organisations and society	More rational allocation of resources (face-to-face visits for those clients who really need them), possible increase in general appreciation and attractiveness of care work	Challenges related to work culture and in incorporating the technology into service processes Management challenges and complexity; new and old ways of working collide (e.g. engaging and assisting care personnel, procurement expertise, support services)

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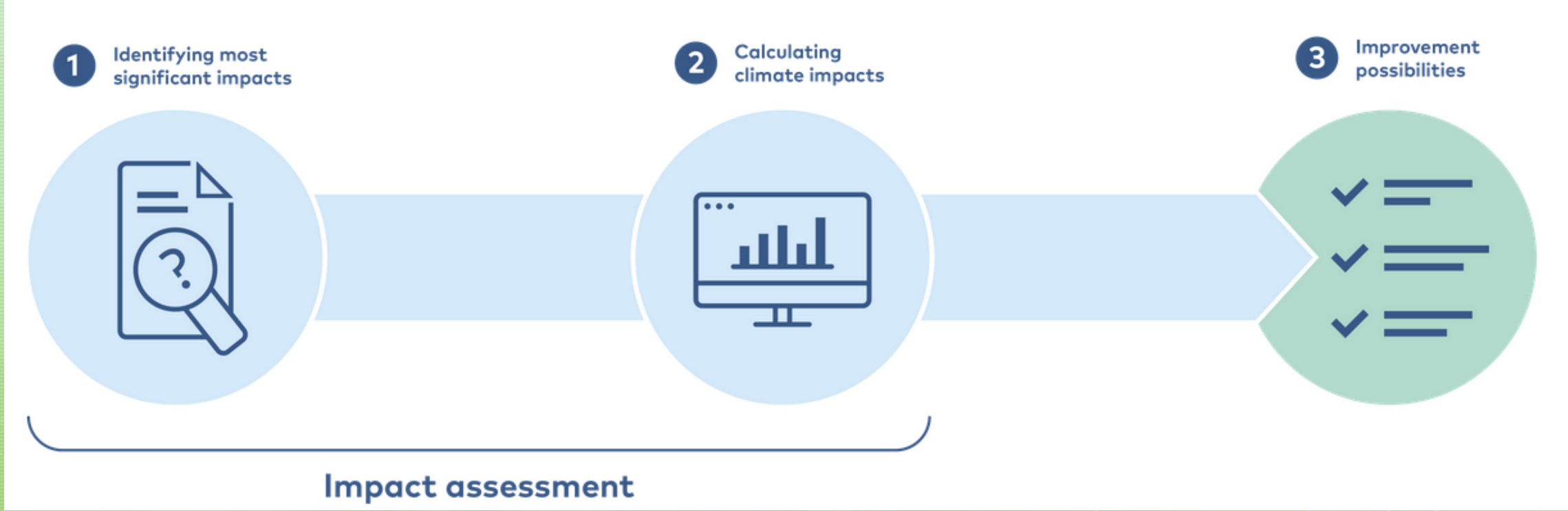
Practical guidance for future impact assessments

- A full life-cycle assessment, for example, is quite a heavy process – to facilitate easier yet adequately accurate assessments, a simple assessment method was developed along with an online service (https://laskurit.hiilineutraalisuomi.fi/verkkopalvelu/english/)
- The assessment method is based on both qualitative and quantitative assessments



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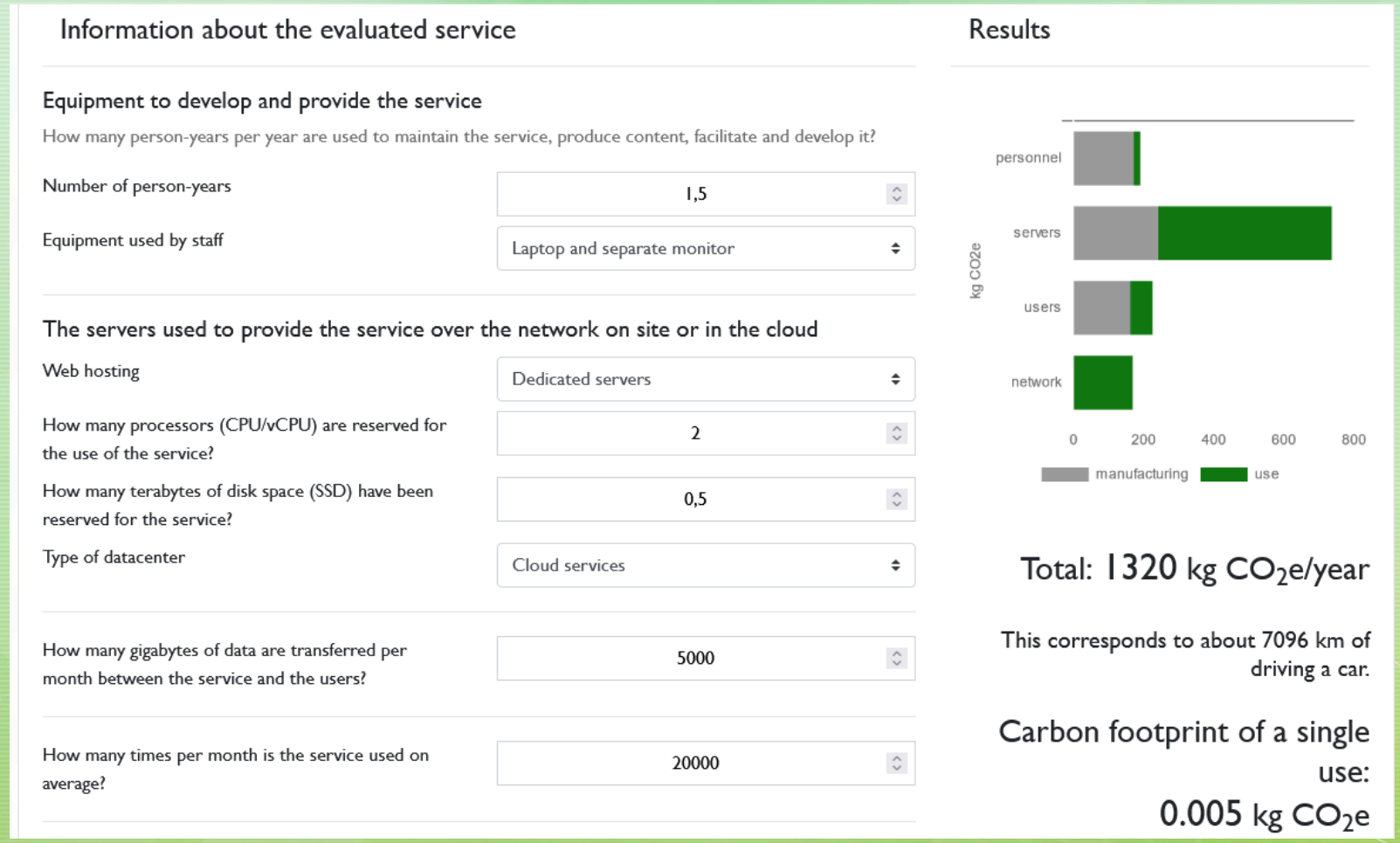
Online service for climate impact assessment of simple digital services



- Check lists
  - identifying most significant impacts
  - improvement possibilities (e.g., energy consumption during use)
- Online carbon footprint calculator for simple services (distance spanning services such as remote healthcare appointments)

Illustrative online service:
https://laskurit.hiilineutraalisuomi.fi/verkkopalvelu/english/

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Integration of the qualitative assessment: an example of **intertwined and multidirectional** impacts

- It is important to adequately **assess the suitability** of the distance spanning service, or the technology it uses, for the client/patient before its implementation and to **carefully familiarise all parties involved** so that it can be safely and successfully used
- This will contribute to the planning and foresight of the work and thus **the functionality of the whole services**, thereby increasing the possibility of achieving positive climate impacts

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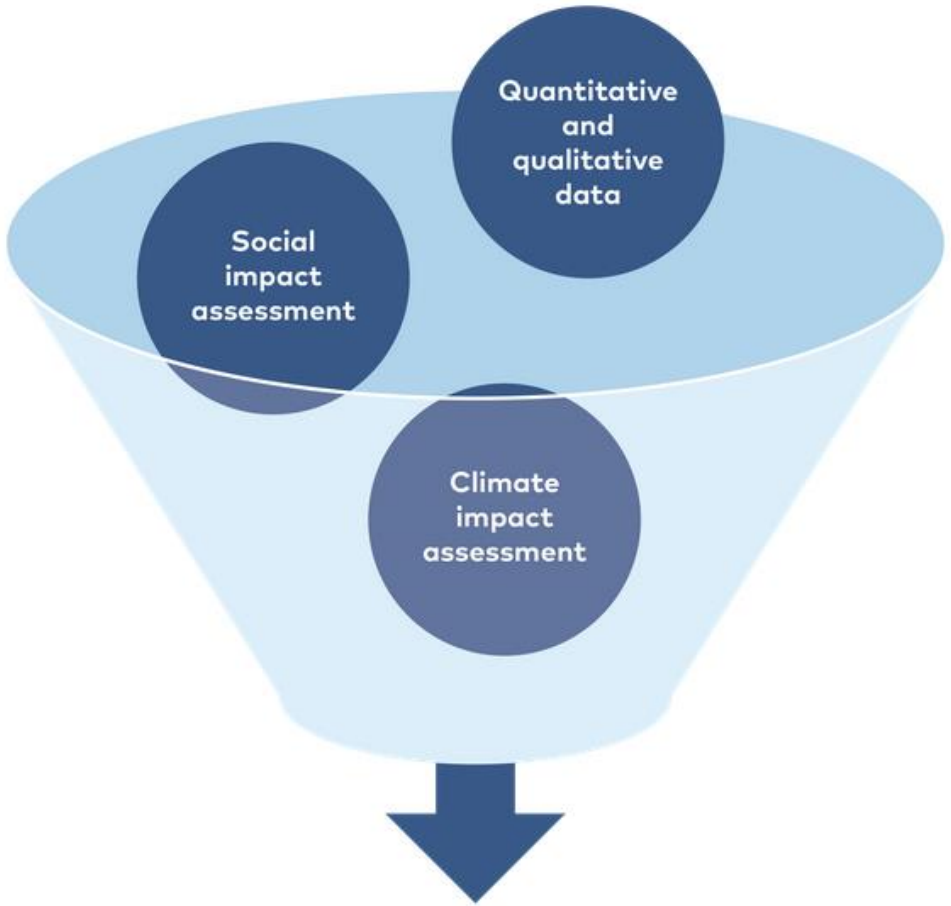
Conclusions: Towards a balance of impacts

Finding the right balance requires careful and informed planning – the main priority being to provide good health care and care



- **A well-planned and well-implemented digital service is likely to be a climate-friendly option**, but at least some **negative climate impacts result from every digitalisation action**
- The design, architecture and practical implementation of digital services **greatly affect** their climate and social impacts
- **Multi-perspective and multi-method impact assessments** are important to advance the green transition
- **A systemic understanding** of the service context in which everything affects everything is essential
- **In addition to quantitative assessment** – and to help interpret its results – a **qualitative understanding is needed**, especially when access to numerical data is limited
- Qualitative assessment **gives an in-depth contextual understanding related to people**'s ways of working and using services, which the service organisation and system are able to affect in their development activities

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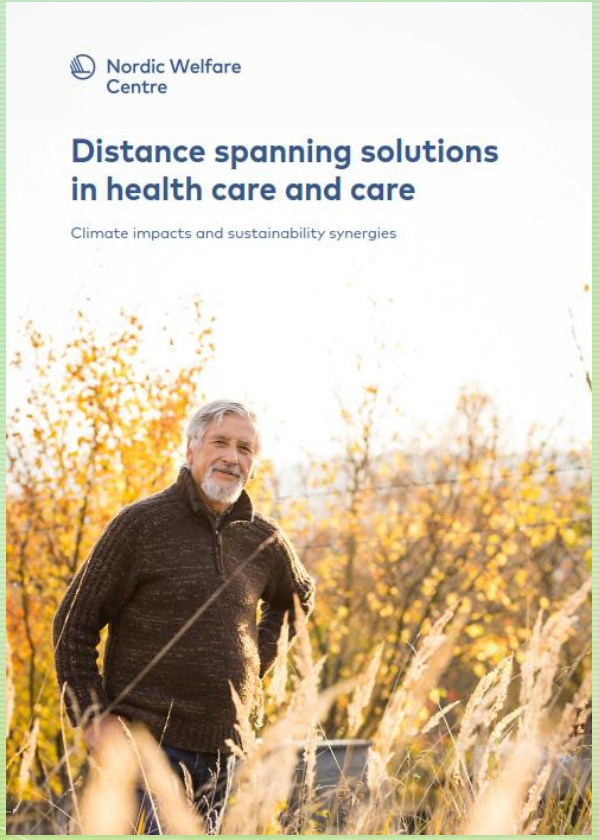
Thank you!

Further information:

- Our webinar “Wakeup call! Environmentally friendly e-health” (2023): https://www.youtube.com/watch?v=0-diozBjF4E
- A project report in Finnish and policy briefs: https://tietokayttoon.fi/julkaisut/raportti?pubid=URN:ISBN:978-952-383-256-5
- A journal manuscript in review
- helina.melkas@lut.fi



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