ICT as a substitute for transport and travel – sustainability implications with a life cycle perspective

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Lecture outline

The lecture will give an introductory overview about ICT’s own environmental impact and opportunities of ICT to decrease environmental impacts in the transport sector.

- ICT – Information and Communication technology
- Environmental impacts from ICT
- Environmental impacts avoided through ICT
- Short on social impacts
What is ICT?
OECD definition

- A combination of manufacturing and services industries that capture, transmit and display data and information electronically (OECD definition of ICT sector 1998)

- **ICT products** must primarily be intended to fulfil or enable the function of information processing and communication by electronic means, including transmission and display. (OECD 2008)
Digitisation?

Information

Society
Environmental impacts

First order effects – directly related to production and use of ICTs (negative)

Second order effects
• Substitution effects (mainly positive)
• Direct economic rebound effects (mainly negative)
• Other effects that can be both positive and negative

- related to the effect of ICTs on production processes, products, distribution systems, etc
- structural and behavioural changes

(Börjesson Rivera et al. 2014)
Life cycle perspective – from cradle to grave

- Raw material acquisition
- Processes
- Transports
- Manufacture
- Use
- Waste management

EMISSIONS to air, water, ground

RESOURCES, e.g. raw materials, energy, land resources
Discussion

List some major first order effects of ICT products and solutions (2 by 2)
First order impacts - Life cycle perspective

- Modules
- Components
- Raw material
- Waste
- Product
- Content
- Internet
First order impacts - Life cycle perspective
First order impacts - Life cycle perspective
First order impacts - Life cycle perspective
A Life cycle assessment

Environmental impacts of a novel, a printed hardback and an e-book
The studied systems

<table>
<thead>
<tr>
<th>Paper book, trad. bookshop</th>
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<tbody>
<tr>
<td>360 pages</td>
</tr>
<tr>
<td>Woodfree uncoated paper</td>
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<tr>
<td>Maculation 18%</td>
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<tr>
<td>Literary hardback</td>
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<tr>
<td>14% returns from bookshop</td>
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<tr>
<td>One reader</td>
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<td>Car to bookshop, 2 km</td>
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<td>Combustion with energy recovery</td>
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Main Limitations
Uncertain data
- Bookshop (one shop)
- Printing office (efficient process)
- Distribution

Missing data
- Some supply chemicals

Assumptions
- User practice
The studied systems

**E-book**

1.5 MB/e-book

Tablet e-reader with e-ink screen

48 e-books read/e-reader

No other use

75% to waste management
- whereof 48% recycled,
  29% combusted and
  23% landfilled
Potential greenhouse gas emissions

(Modified from Moberg et al. 2011)
Mainly due to production

(Modified from Moberg et al. 2011)
But it matters if you take the car...

(Modified from Borggren et al. 2011)
Swedish ICT sector, 1 year
Greenhouse gas emissions

(Malmodin et al. 2014)
B. Total Sweden (Swedish electricity)

C. Total Sweden (global electricity scenario)

x = Share of total Sweden allocated to TeliaSonera (based on number of subscriptions)

Manufacturing (embodied)  Use (electricity consumption)  Use (other energy)

(Malmodin et al. 2014)
First order impacts

**Manufacturing** and **use** phase have the highest impact in the life cycle.

Varying results in assessments
- Rapid technological development
- Different contexts (e.g. electricity mix)
- Different assumptions on e.g. user practices
- Various materials and substances
- Complex value chain – hard to get data

Climate change impact is mostly assessed

(overview of assessments by Arushanyan et al. 2014)
First order impacts

Manufacturing and use phase have the highest impact in the life cycle.

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Toxicity!

(overview of assessments by Arushanyan et al. 2014)
Discussion

What could be social impacts of ICT substituting transport and travel?

List 3-5 relevant social impacts (2 min)
Social impacts – positive and negative

(makeitfair.org)
A fair phone?

We’re following this road map to a fairer economy

Made with care
Building relationships for better practices, from working conditions to recycling

Precious materials
Conflict-free, fair resources that put people first

Smart design
Open and responsible design for fair electronics

Lasting value
Addressing the entire lifespan of mobile phones

Clear deals
Fair, transparent pricing and production plus an opportunity to support change
ICT FOR SUSTAINABILITY?
ICT FOR SUSTAINABILITY?

Four fundamental ways in which ICT could support more re-source-efficient consumption and reduced environmental impact.

- *replace* products/surfaces/travel/transport
- *intensify* the use of products/surfaces/travel/transport
- make processes and activities more *efficient*
- *inform* of changed consumption choices

(Höjer et al. 2015)
ICT FOR SUSTAINABILITY?

Informe

- Replace

- Intensify

- Make more efficient
But...

• What do we do with the information?

• What does the efficiency gains lead to?

• What is the effect of replacing?

• Does intensifying mean dematerialisation?
ICT FOR SUSTAINABILITY?

Inform - Easy to shop?

Efficiency - Money saved?

Intensify – Increased use?

Replace – Complement?

With your Smartphone...

...you get in and drive off
But...

- What do we do with the information?
- What does the efficiency gains lead to?
- What is the effect of demobilisation?
- Does dematerialisation really occur?

In order to reach the potentials action and measures are needed!
What about the long-term potential?

New solutions….new structures and new practices?

- Education
- Health
- Banking
- Postal services

- Where do we live?
- Where do we work?
- Etc
What about the long-term potential?

How can ICT be used for sustainable development?

New solutions....new structures and new practices?

- Education
- Health
- Banking
- Postal services

- Where do we live?
- Where do we work?
- Etc
Different ways and reasons to meet at a distance

“Open door”

TelePresence  www.cisco.com

“Everyday-Skype”
One conference - in Switzerland and in Japan
between discovery and use
(Coroama et al. 2012)
Participants

kg CO₂/participant

0 100 200 300 400 500 600 700 800

kg CO₂

participants

Nagoya-only conference 189 t CO₂

Davos-only conference 235 t CO₂

two-site conference 119 t CO₂

Travel CO₂

Davos only Davos + Nagoya Nagoya only

235 119 189 525 224 794

Total tons Kg / attendee

(Coroama et al. 2012)
APPs
sharing economy - share rides
Intelligent travel systems – ITS
Trafiken.nu
"Så kan köerna försvinna – utan dyra vägbyggen"

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Ny rapport. Lösningen på storstädernas trafikkaos är inte gigantiska nyinvesteringar, utan bättre resursutnyttjande. Med en interaktiv reseplanerare som låter alla trafikanter välja bästa vägen – med

ANNONS:
Vidareutbildningar IT
Vi utbildar för smartrare företag. Kurser, Program & Konferenser.
www.dffkompetens.se
The relevance of ICTs for environmental sustainability – A prospective simulation study

(Hilty et al. 2006)

Scenarios for Europe 2020
Direct, indirect and structural & behavioural impacts

ICT application types
- E-business
- Virtual mobility
- Virtual goods
- ICT in waste management
- Intelligent transport systems
- ICT in energy supply
- ICT in facility management
- ICT in production process management
Results: ICT and transport.....

(Hilty et al. 2006)

**Freight transport**
- Decreasing through:
  - Supply chain management
  - Virtual goods
  - Production process management

- Increasing through:
  - ITS

**Passenger transport**
- Decreasing through:
  - Virtual mobility

- Increasing through:
  - ITS
  - Time utilization during transport

Public transportation increases by ICT and private car transport growth decreases
The prospective study for the European Union with a time-horizon until 2020 revealed...

...great potential for ICT-supported energy management and for a structural change towards a less material-intensive economy, **but** strong rebound effects in the transport sector whenever ICT applications lead to time or cost savings for transport.
Some overall results…..

(Hilty et al. 2006)

Low overall impact as positive and negative impacts cancel each other out.

There is no general ICT policy for environmental sustainability.

ICT is not the key factor that could stabilize freight transport.
Discussion

How could planning and policies facilitate ICT solutions for sustainable practices?

Which are key issues to address?
Summing up

**ICT**’s environmental impact should be assessed using a life cycle perspective and considering different types of environmental impacts.

**ICT** gives rise to direct environmental impact which should be minimised.

**ICT** has the potential to decrease environmental impacts in other sectors and for different practices, but can also increase them.

Second order, more complex impacts need to be taken into account.

**ICT** for sustainability needs to be supported in order to achieve potential benefits.
Thanks,

Questions?

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ICT as a substitute for transport and travel – sustainability implications

“ICTs do not necessarily lead to a more environmentally-sound future, but they offer new opportunities to develop more sustainable solutions”

(Berkhout & Hertin, 2004)
One minute – on a paper

About the lecture

• One thing you learnt
• What was good?
• What could be improved?