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 opportunites 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

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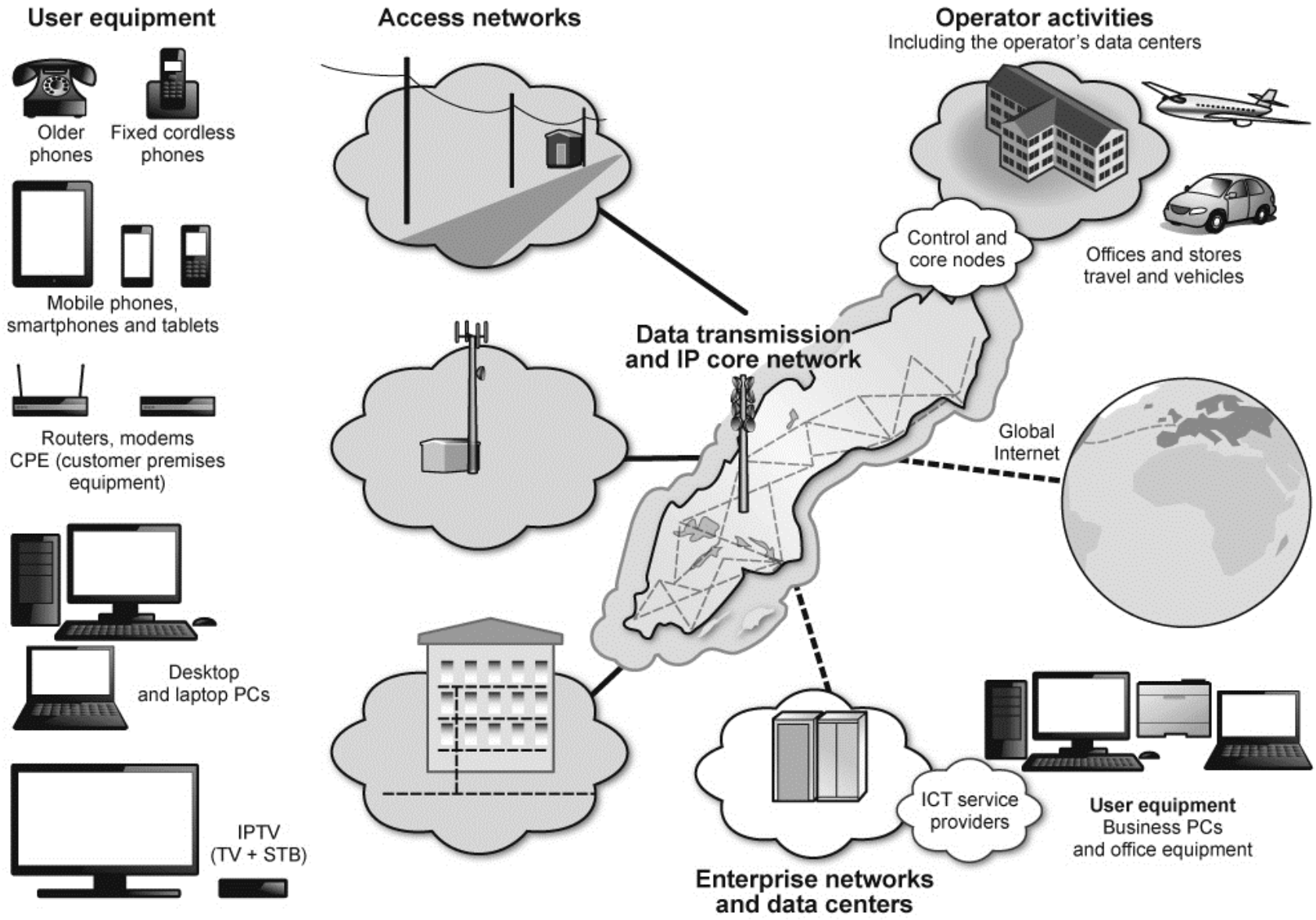
What is ICT?

OECD defintion

- 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)



(Malmodin et al. 2014)

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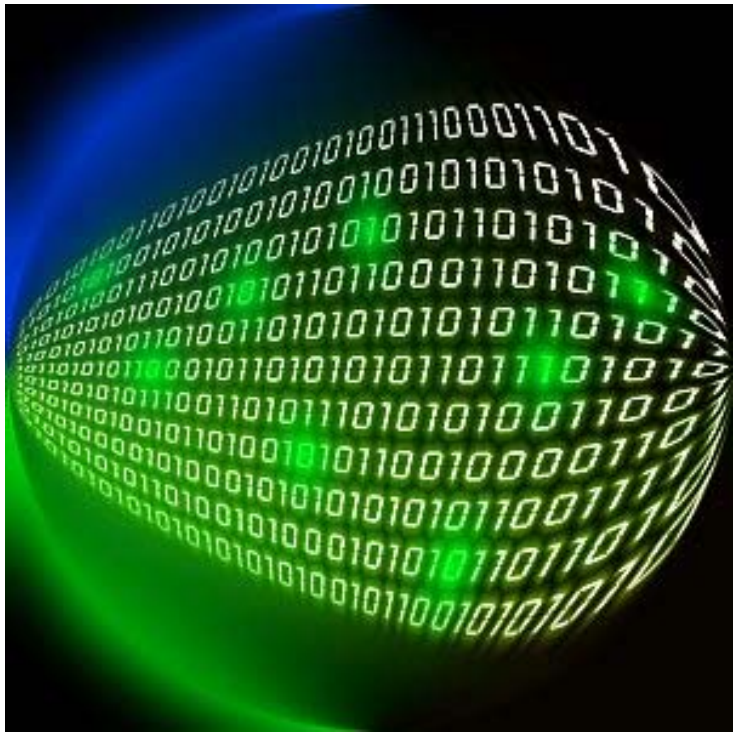
Digitisation?



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)

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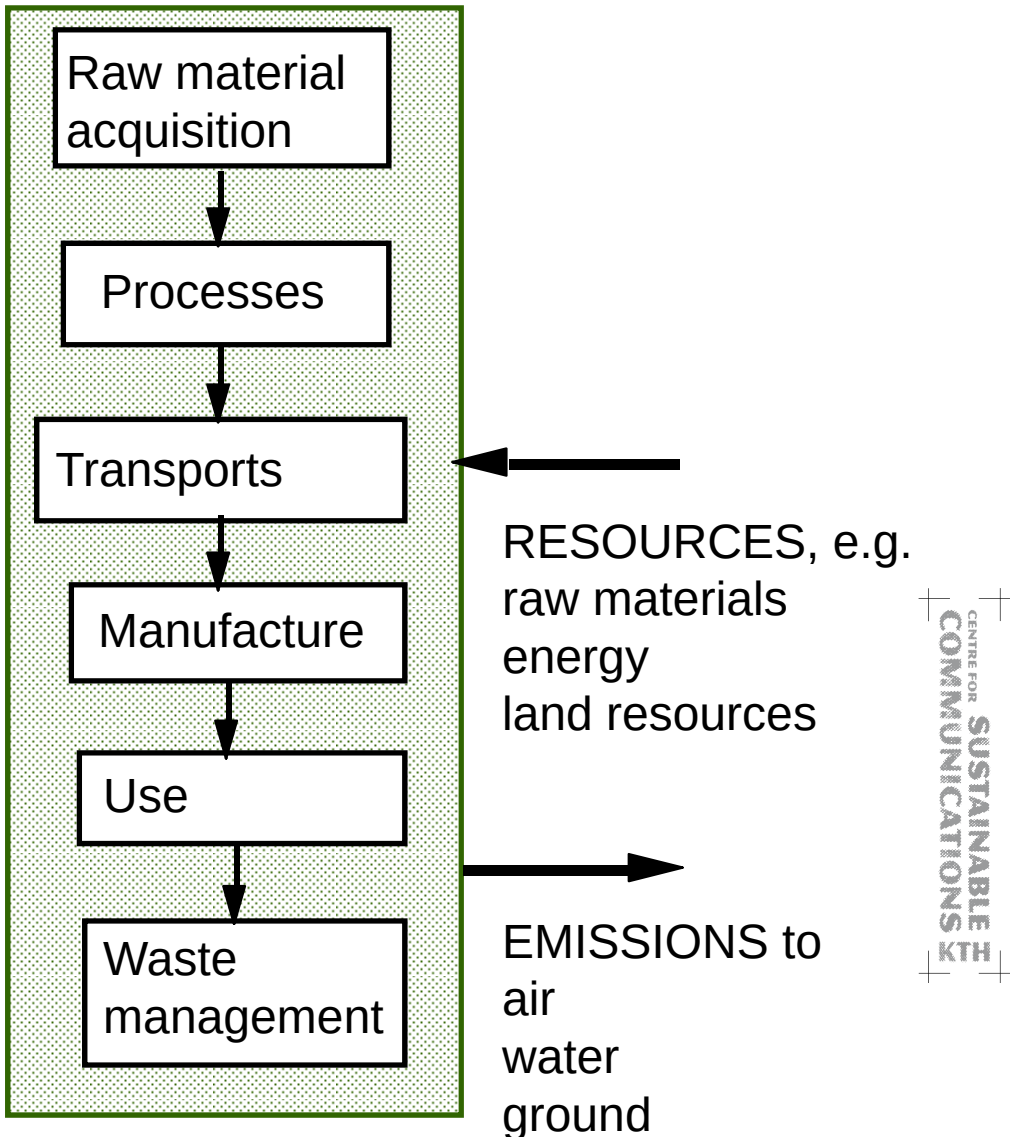
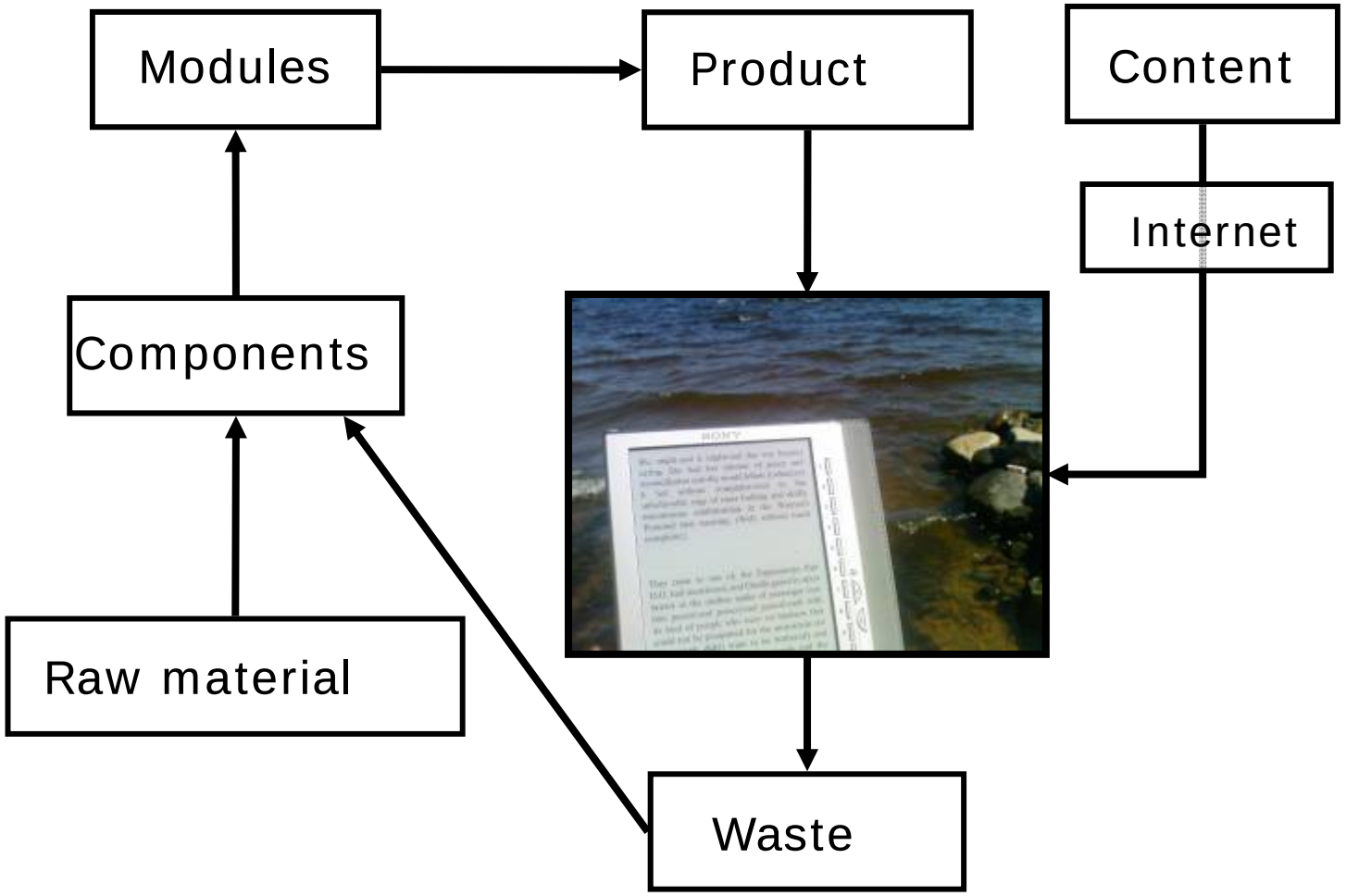
Life cycle perspective – from cradle to grave



Discussion

List some major first order effects of ICT products and solutions (2 by 2)

First order impacts - Life cycle perspective



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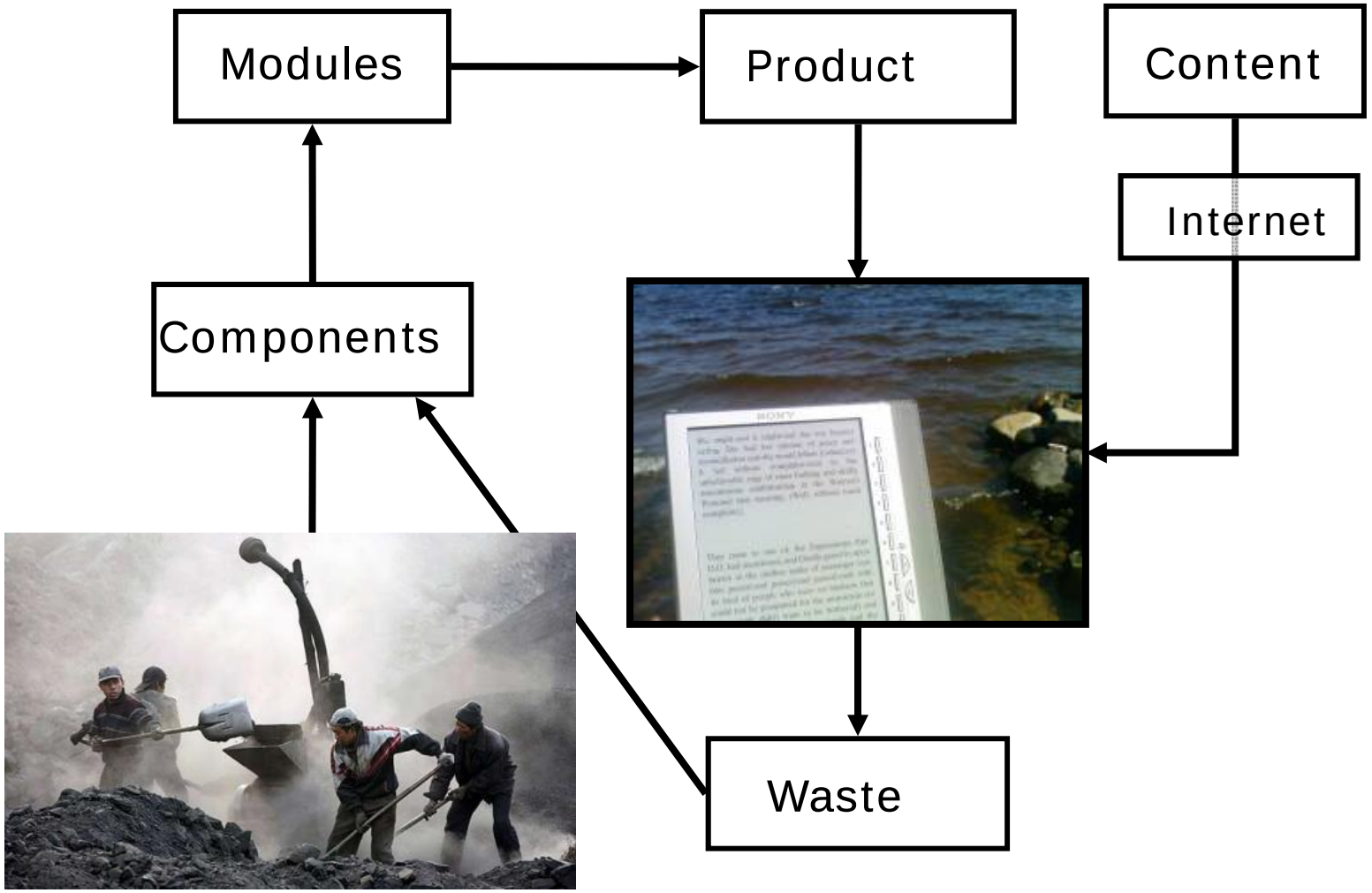
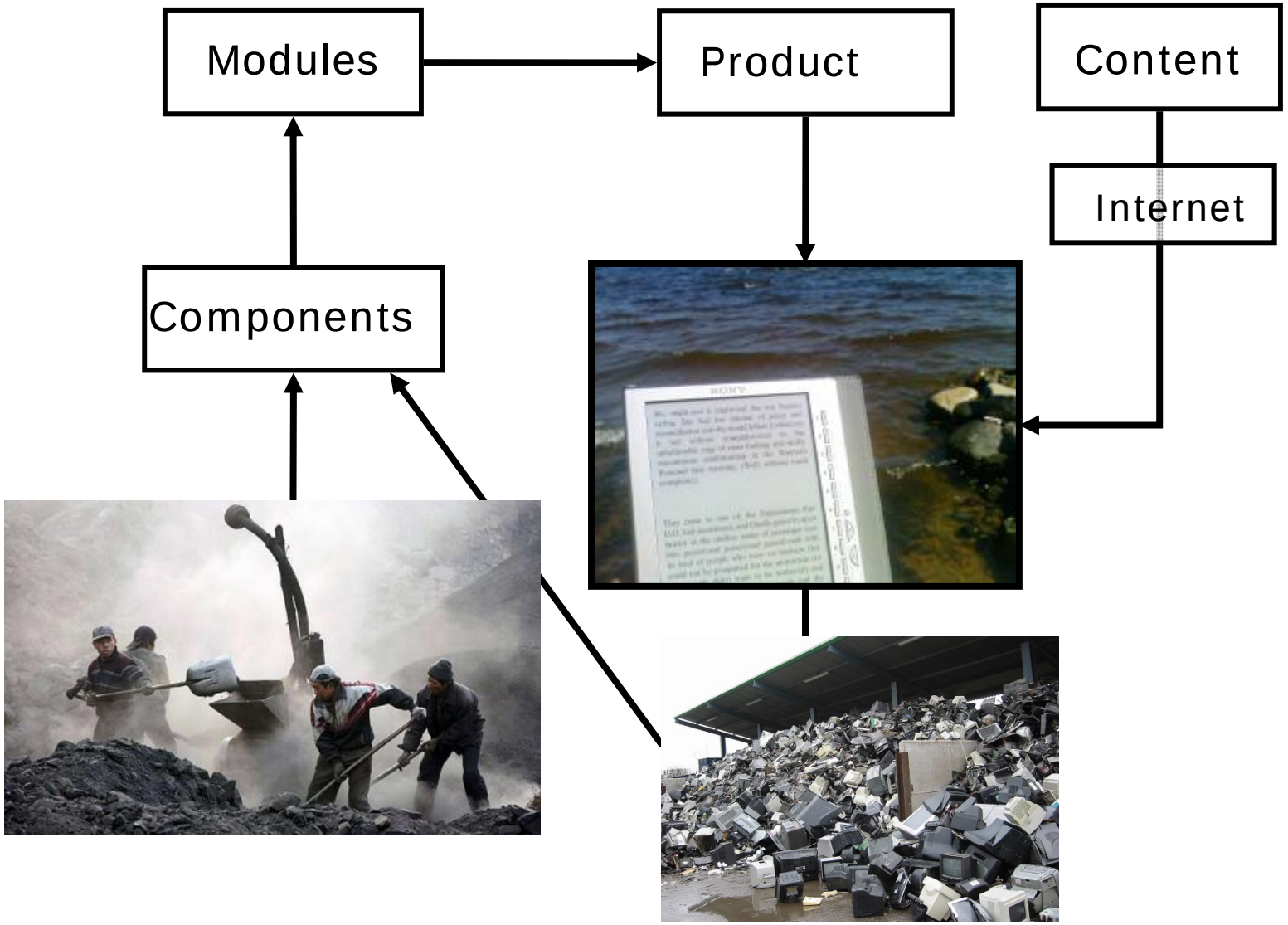
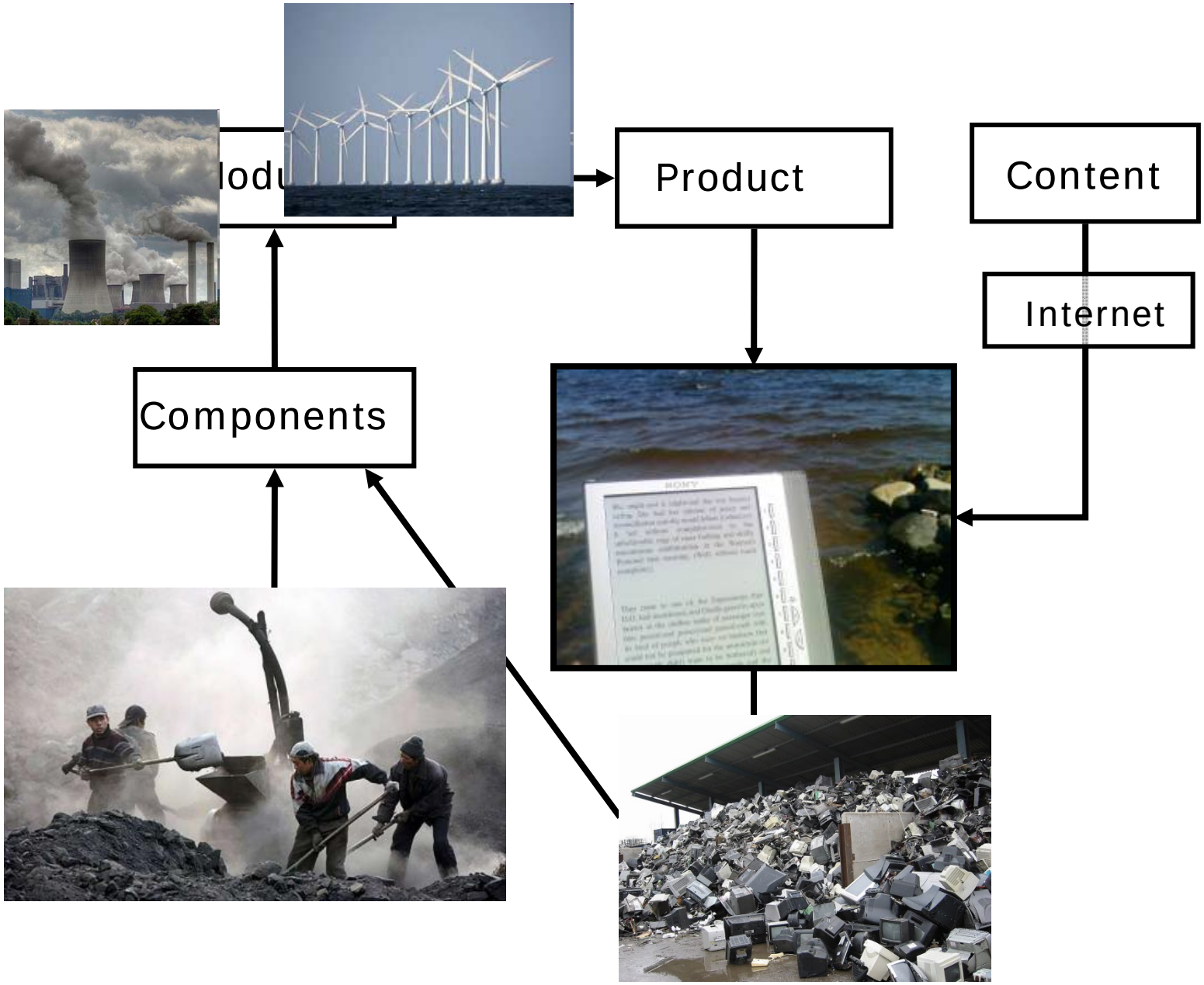
First order impacts - Life cycle perspective



First order impacts - Life cycle perspective

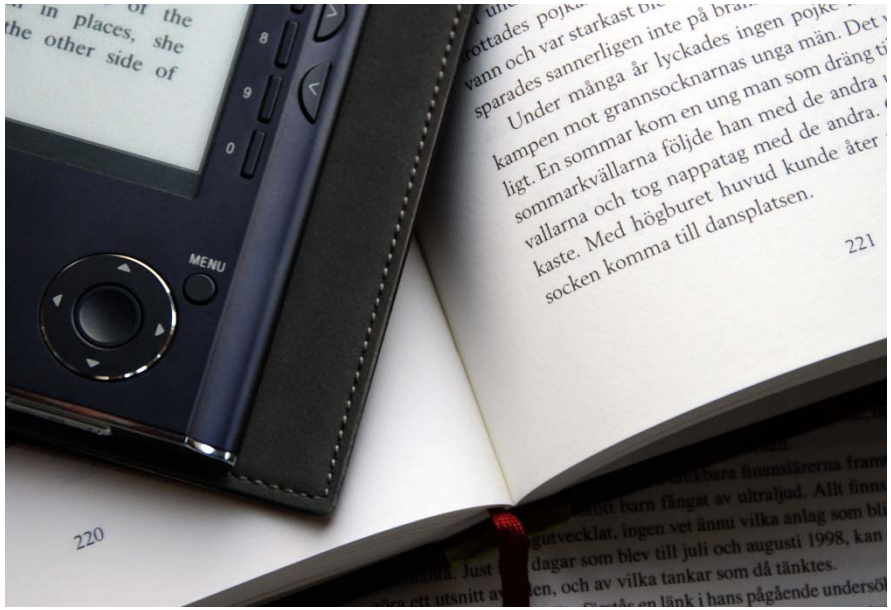


First order impacts - Life cycle perspective



A Life cycle assessment

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



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The studied systems

Paper book, trad. bookshop	Paper book, internet bookshop
360 pages	360 pages
Woodfree uncoated paper	Woodfree uncoated paper
Maculation 18%	Maculation 18%
Literary hardback	Literary hardback
14% returns from bookshop	0.5% returns from bookshop
One reader	One reader
Car to bookshop, 2 km	Car to bookshop, 2 km
Combustion with energy recovery	Combustion with energy recovery

Main Limitations

Uncertain data

- Bookshop (one shop)
- Printing office (efficient process)
- Distribution

Missing data

- Some supply chemicals

Assumptions

- User practice

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The studied systems

E-book

1.5 MB/e-book

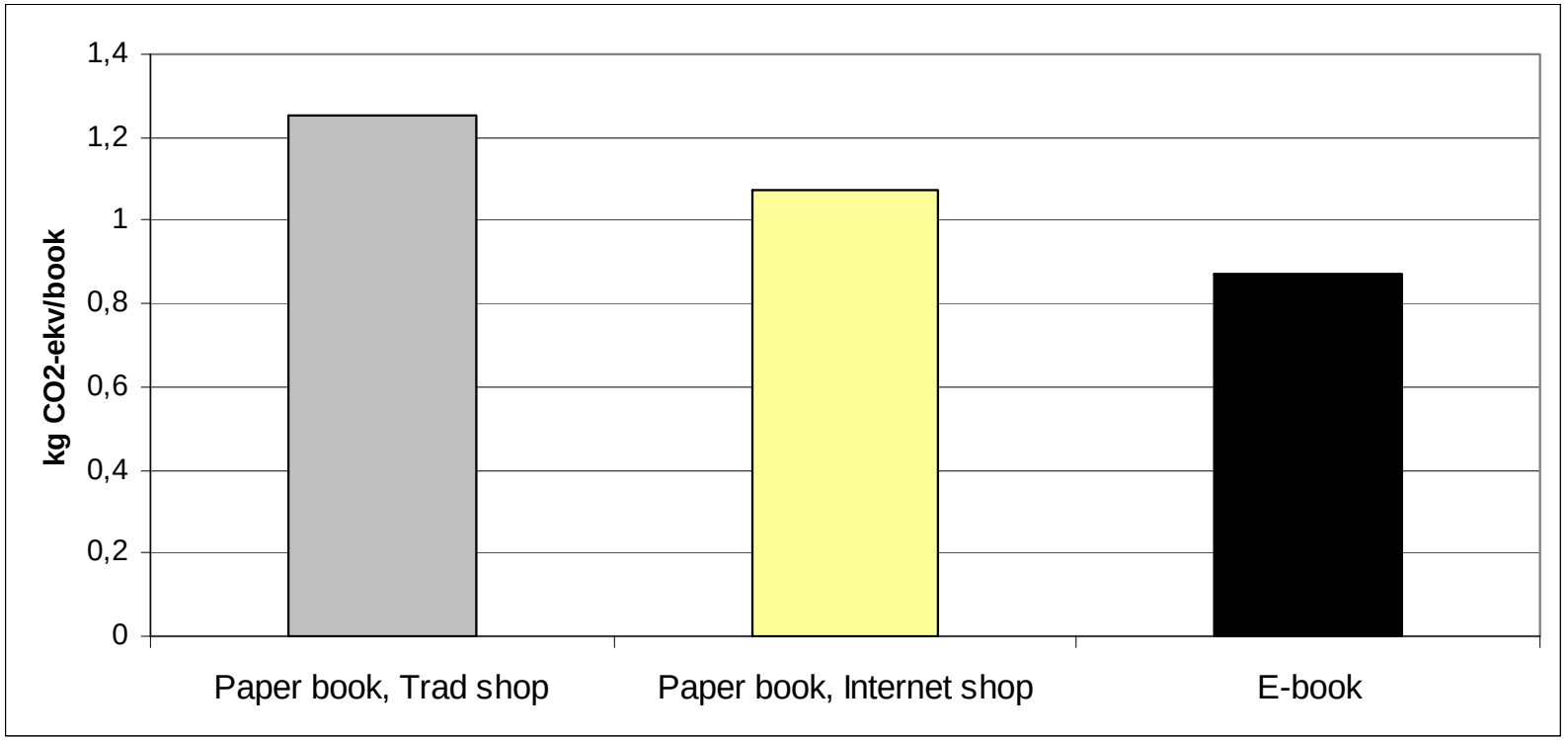
Tablet e-reader with e-ink screen

48 e-books read/e-reader

No other use

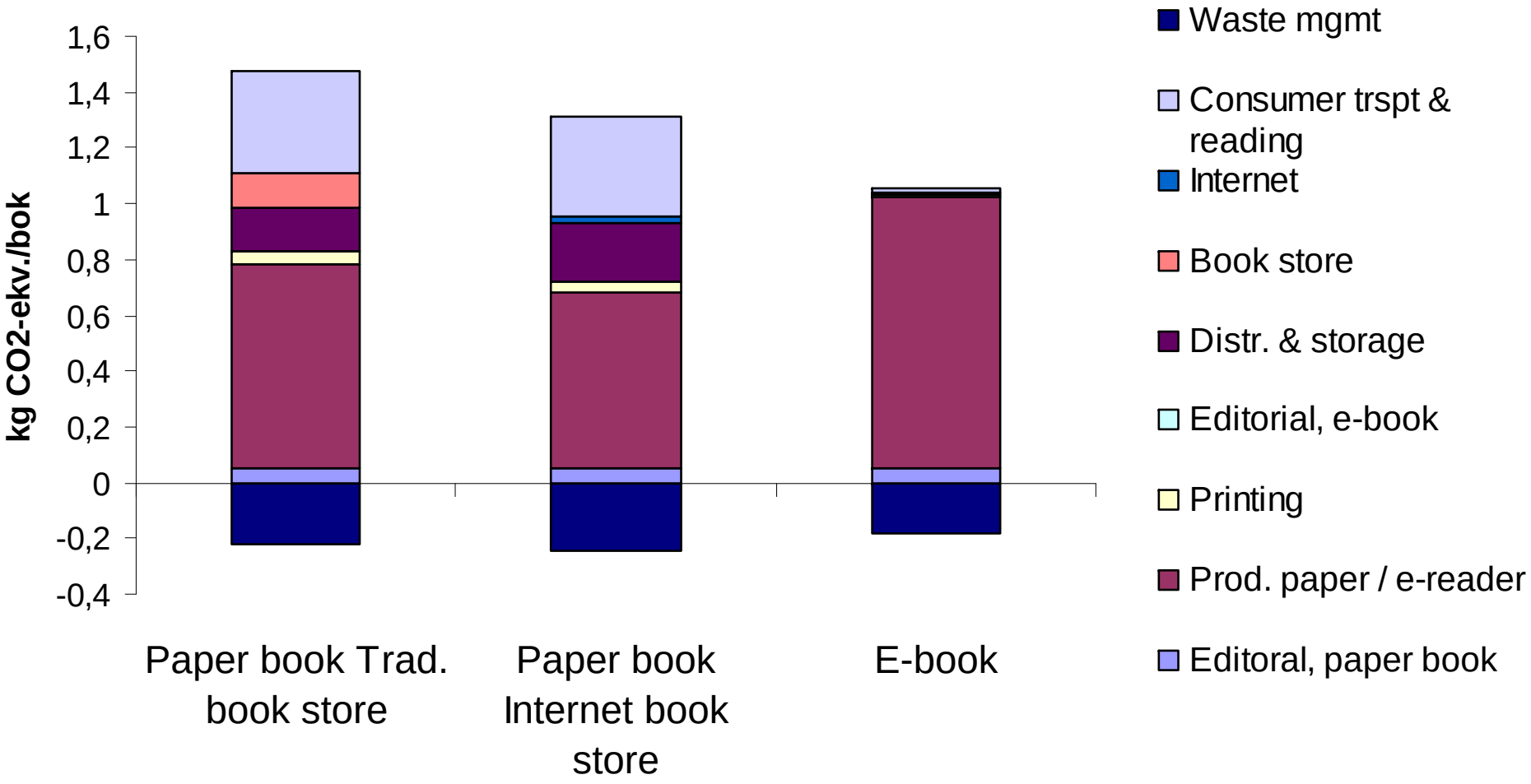
75% to waste management
- whereof 48% recycled,
29% combusted and
23% landfilled

Potential greenhouse gas emissions



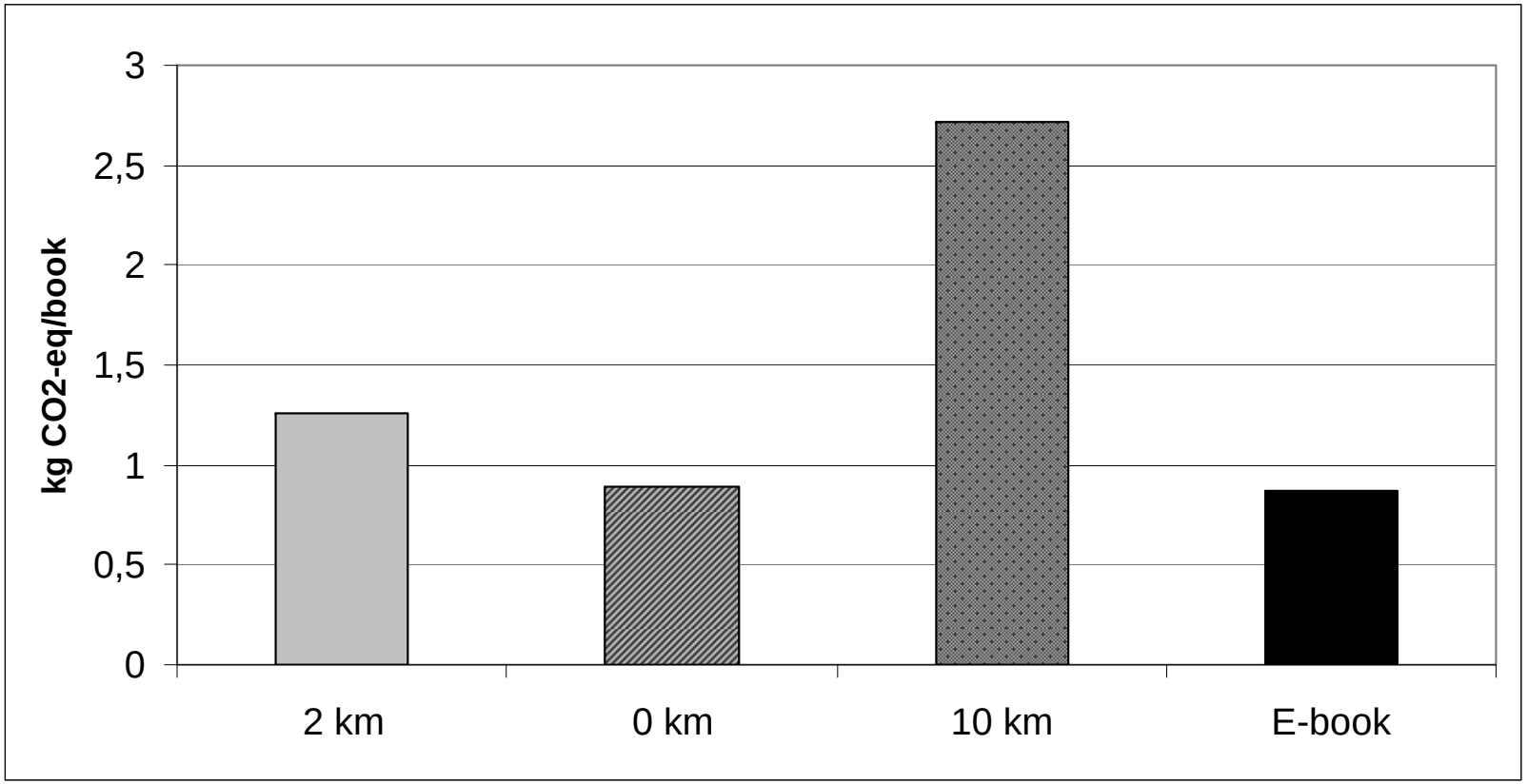
(Modified from Moberg et al. 2011)

Mainly due to production

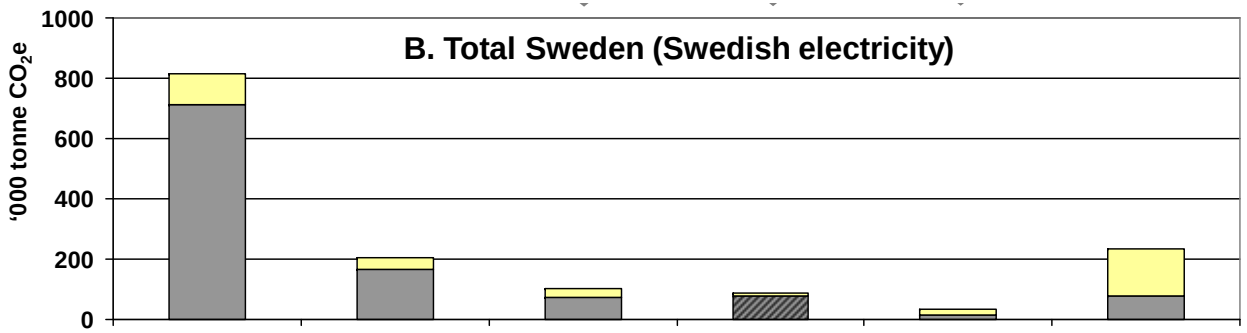


(Modified from Moberg et al. 2011)

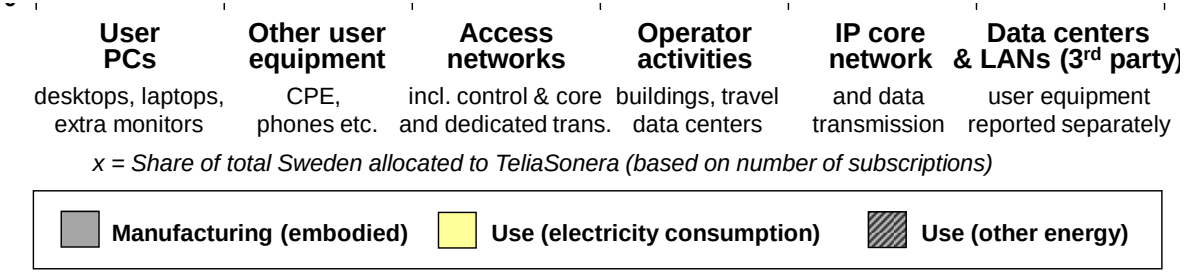
But it matters if you take the car…



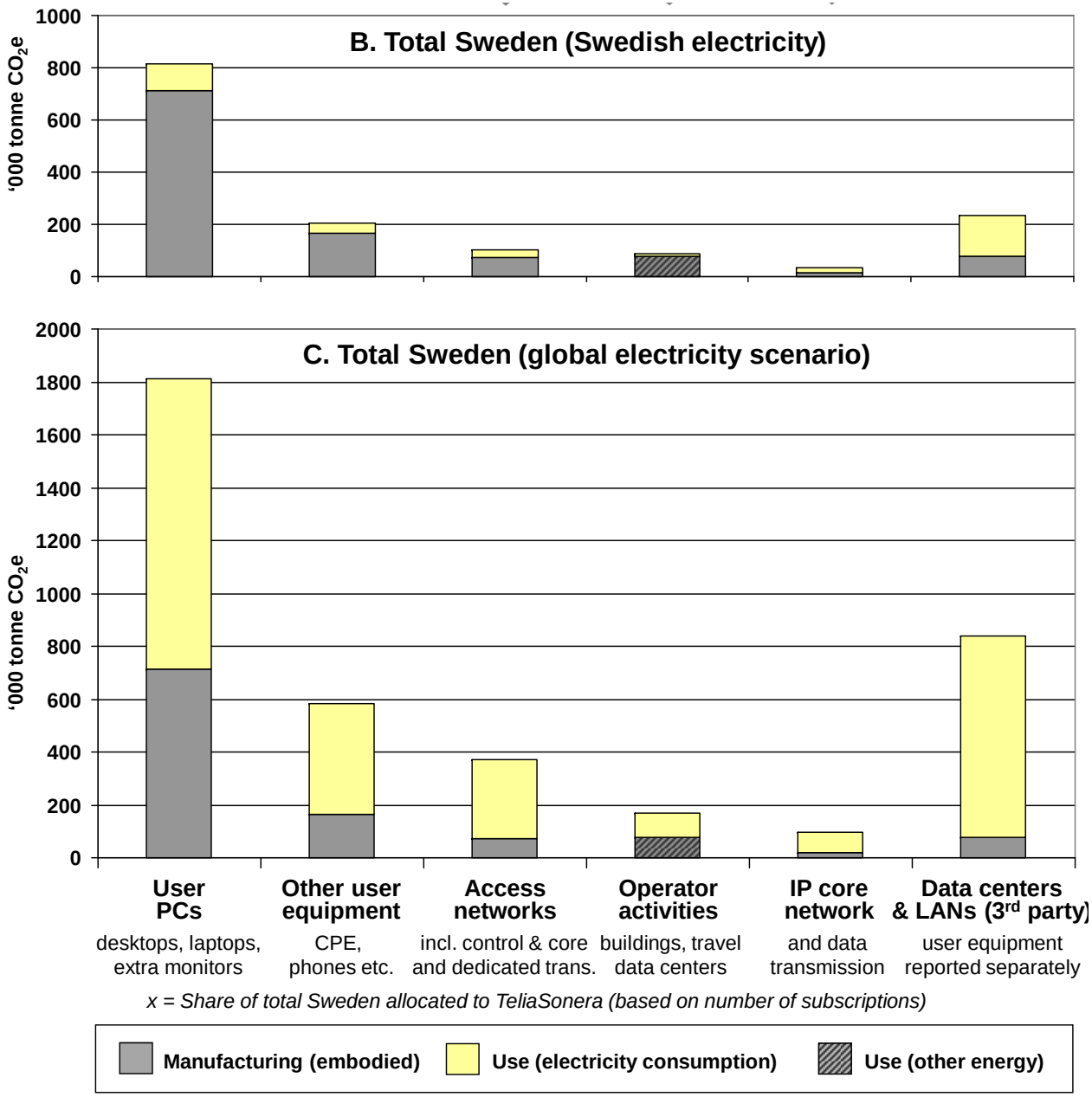
(Modified from Borggren et al. 2011)



Swedish ICT sector, 1 year
Greenhouse gas emissions



(Malmodin et al. 2014)



(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)

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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

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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

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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?

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!

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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"

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One conference
- in Switzerland and in Japan

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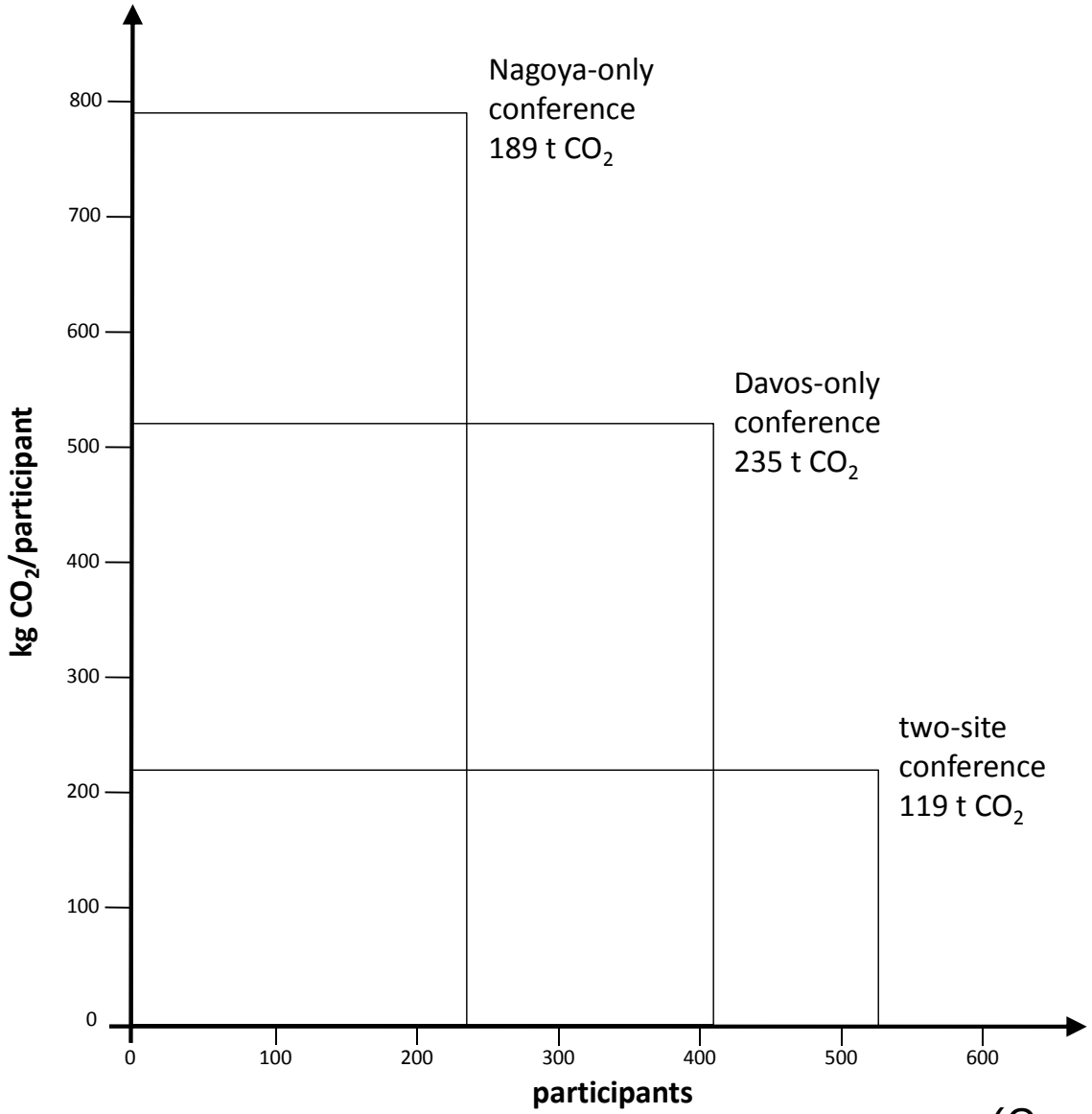
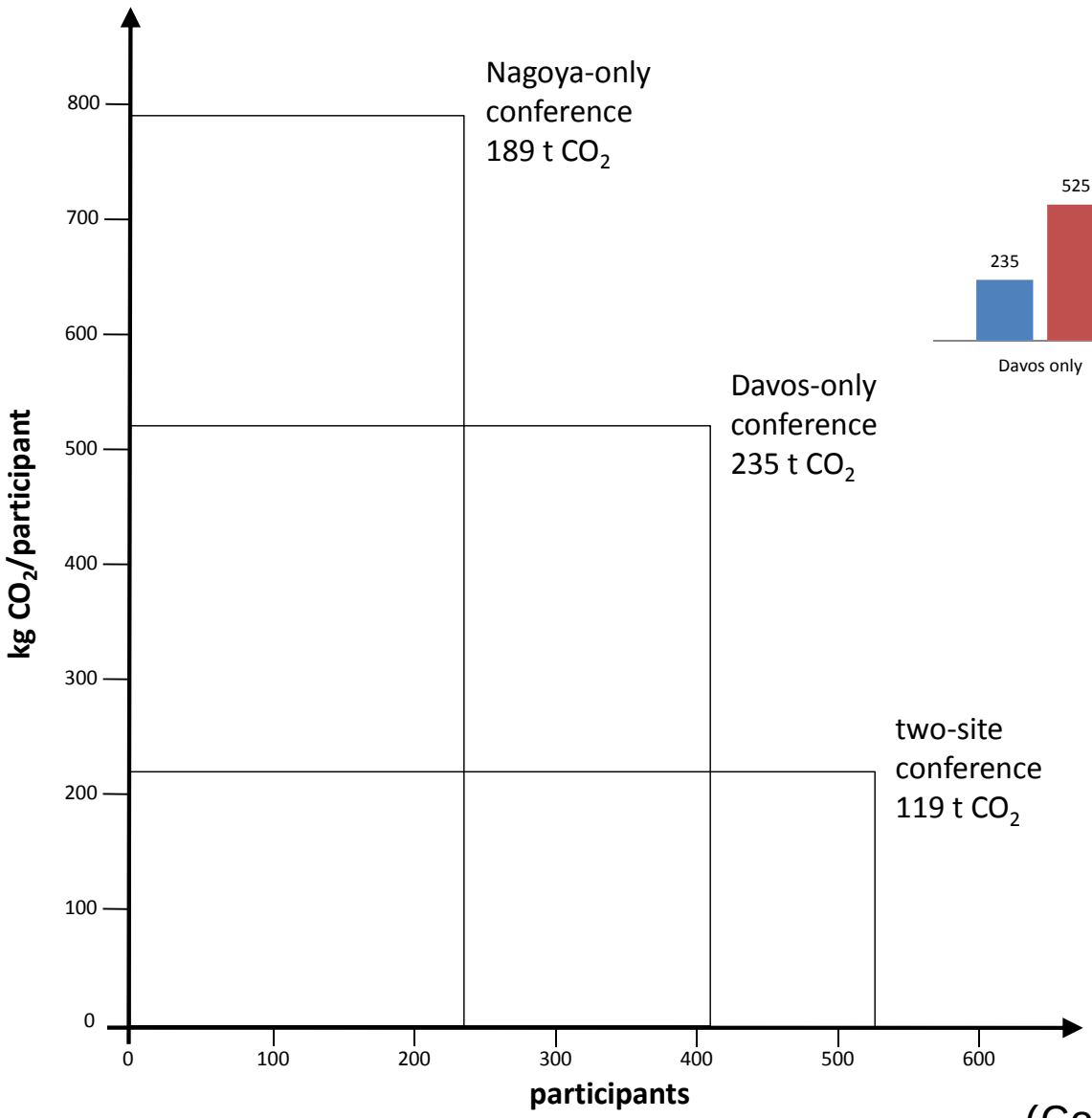
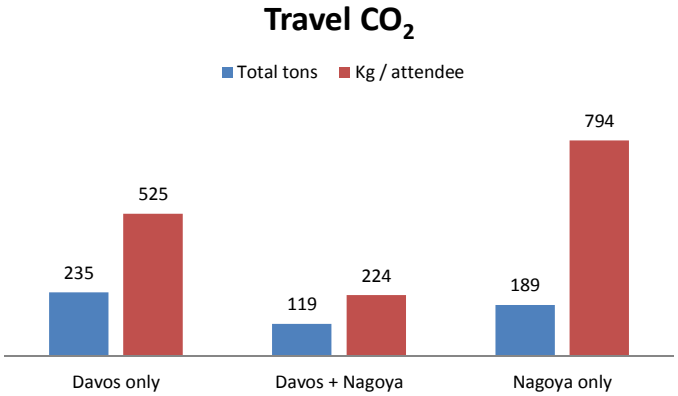
between discovery and use
GROWING DEFICIT
Between Discovery & Consumption
1960 1965 1970 1975 1980 1985 1990 1995
15
Gap between discovery and use
EMPA
Materials Science & Technology
Gap between discovery and use



(Coroama et al. 2012)





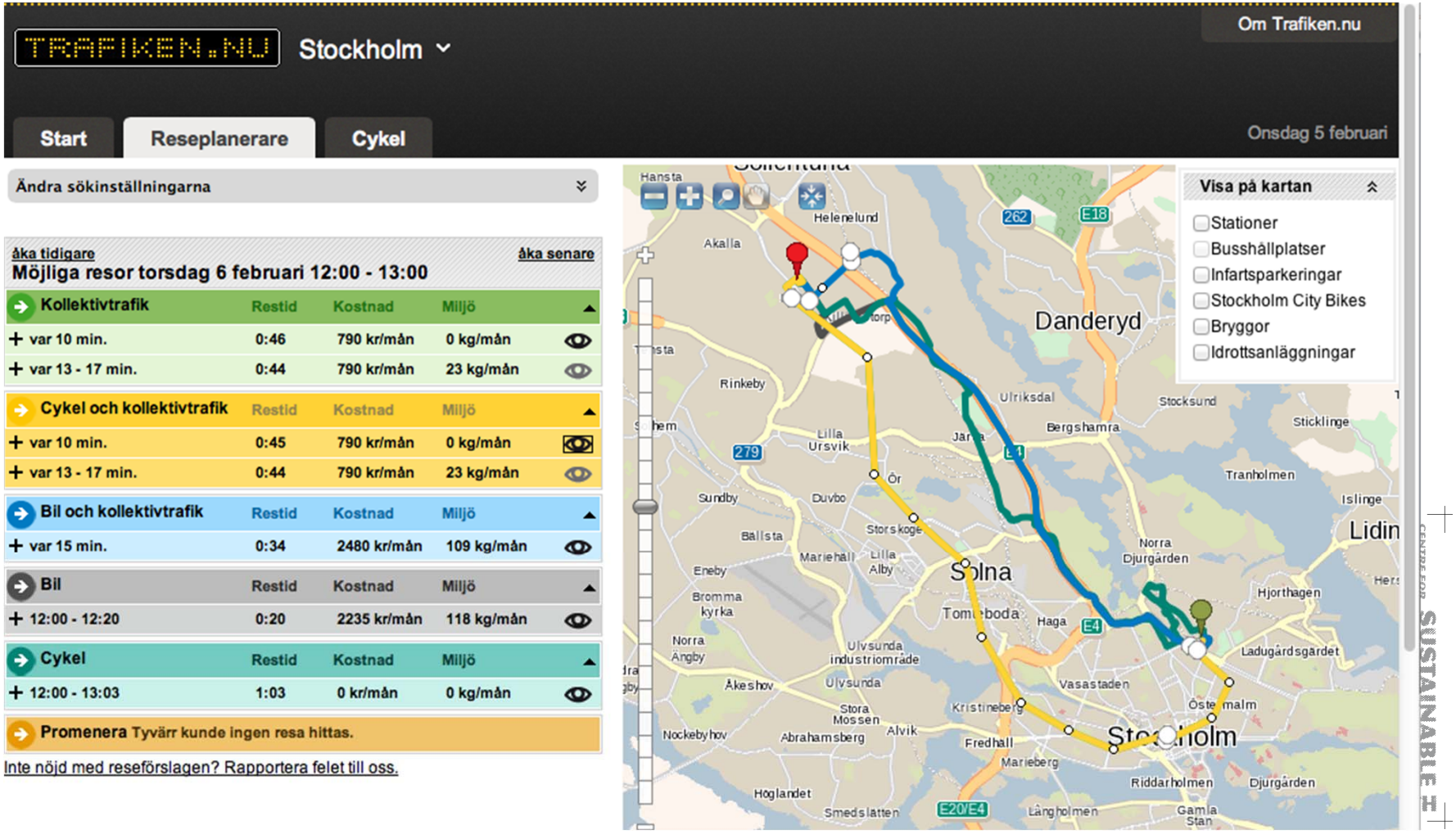
(Coroama et al. 2012)

APPs

sharing eonomy - share rides

Piggy Baggy

Intelligent travel systems – ITS
Trafiken.nu



”Så kan köerna försvinna – utan dyra vägbyggen”

Publicerad 2015-04-12 00:00

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

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

Less important:

- E-shopping

Passenger transport

Decreasing through:

- Virtual mobility

Increasing through:

- ITS
- Time utilization during transport

Public transportation increases by ICT and private car transport growth decreases

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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 adress?

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 potenital 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

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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)

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One minute – on a paper

About the lecture

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