DISCUSSION FORUM ON LIFE CYCLE ASSESSMENT

Zurich University of Applied Sciences

Life Sciences and Facility Management

Institute of Natural Resource Sciences

Digital media consumption and its environmental impact

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Life Cycle Assessment Research Group

Institute of Natural Resource Sciences (IUNR)
Zurich University of Applied Sciences (ZHAW)

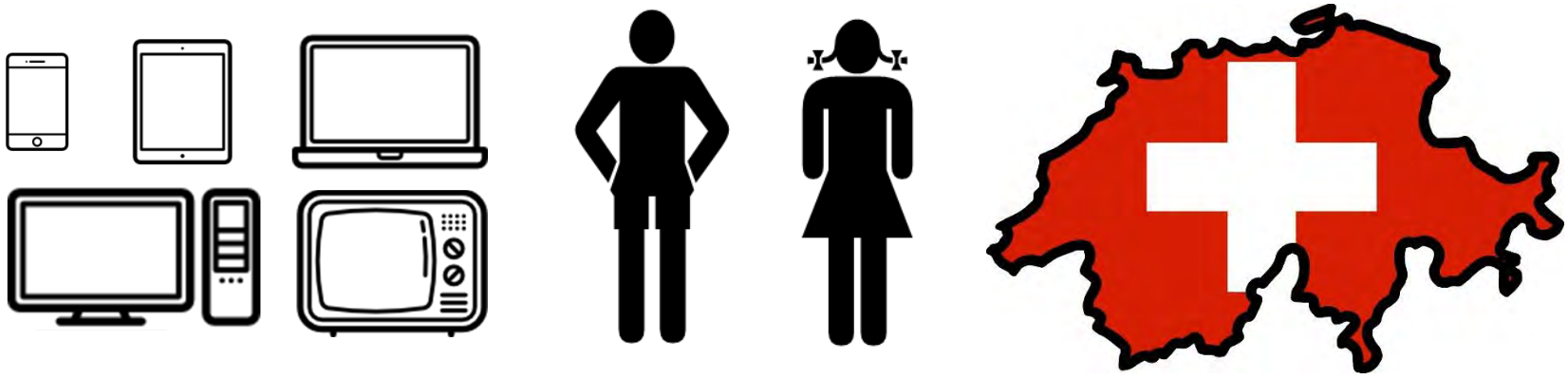
Discussion Forum Nr. 73

21st November 2019, Campus Grüental, Wädenswil, Switzerland

STIFTUNG MERCATOR SCHWEIZ

1. Aim of the study

The aim is to evaluate the environmental impact of **digital media** use by **young people** in Switzerland.



- Which **aspects** of digital media use are environmentally relevant?
- Which environmental **benefits** arise from digital media use?
- Which **recommendations** can be given to young people?

Recommendations from this study were used to promote environmentally-friendly behaviour among young people with a communication campaign.

1. Aim of the study

From an LCA-perspective, the following questions are interesting:

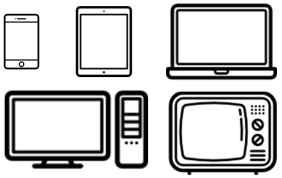
- **Which activities** do young people persue?

  watching videos, e-mailing, chatting, browsing, gaming,

  using social media, listening to music, phoning or watching TV

- **Which devices** do young people use?

  Mobile phones, tablets, laptops, desktops, televisions



- What is the **environmental impact** of their behavior?
- **Which aspects** of their behaviour are relevant?
- Which **recommendations** can be given based on this analysis?

1. Project team: Three ZHAW research groups

Life Cycle Assessment

Regula Keller, Matthias Stucki, René Itten

Sustainability Communication and Environmental Education

Linda Miesler, Urs Müller, Verena Berger

School of Applied Psychology, Section Media Psychology

Lilian Suter, Gregor Waller

A	B	C
3	2	3
4	6	5
5	3	6

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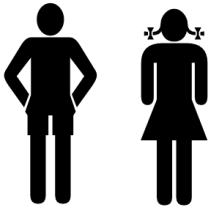
2. Goal and Scope

A	B	C
3	2	3
4	6	5
5	3	6

A	B	C
3	2	3
4	6	5
5	3	6

2. Data sources: Survey on use

- Online questionnaire completed by **800 young people** (12 – 24 years) in 2017, both in school classes and individually.
- Data were adapted to represent the average



Swiss young person taking into account:

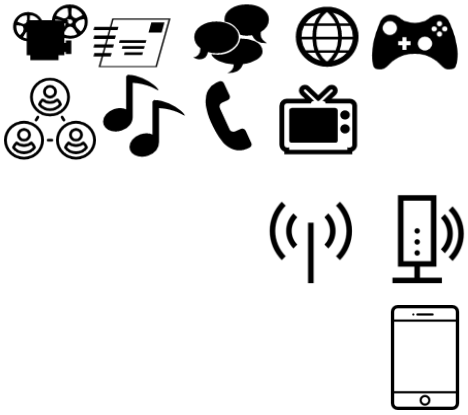
→ age, **sex,** education level and

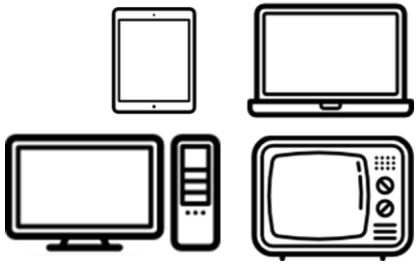
urbanity (suburban areas vs. rural areas)

A	B	C
3	2	3
4	6	5
5	3	6

2. Data sources: Use and ownership

- **From survey:**
  - **Duration** of different activities
  - **Internet connection** (WLAN / mobile network)
  - **Lifespan** of mobile phone (2 years)*
- **Other sources: recent Swiss studies**
  - **Lifespan** of other devices (Thiébaud, 2017)
  - Data on **ownership** of devices (JAMES, 2016)
  - → 99% possess mobile, 30% possess TV





** Swiss average for the mobile phone is 3.3 years (Thiébaud, 2017)*

A	B	C
3	2	3
4	6	5
5	3	6

2. Data sources: Hardware

- **Hardware: End devices**
  - **Router, desktop, screen:** ecoinvent data v. 3.5 from 2018
  - **Mobile phone, tablet, laptop, television:** Data from Green Media Calculator
  - **Mobile phone, tablet, laptop, and router was adapted:** Chinese electricity mix added to correspond to GWP* results published by Apple
  - **Resources** in inventory data corrected: 1kg of Indium has an actual input of 1kg of Indium. Dissipative use assumed, since Indium cannot be industrially retrieved.

A	B	C
3	2	3
4	6	5
5	3	6

2. Data sources: Data transfer

- **Data transfer**
  - Energy use and hardware considered
  - Data based on **Green Media Calculator** (Hischier et al., 2015b; Hischier et al., 2013a)
  - Hardware for data transfer is based on **router** from ecoinvent, adapted: Also Chinese electricity mix added to correspond to GWP* results published by Apple

** GWP = Global Warming Potential*

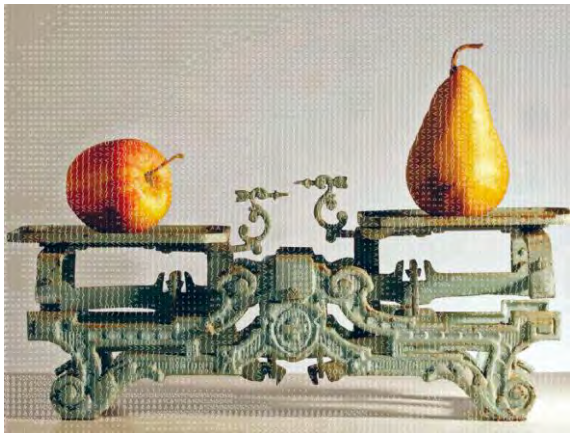
A	B	C
3	2	3
4	6	5
5	3	6

2. Impact assessment methods

- **Ecological scarcity method**

  2013, v.1.06

  (Frischknecht et al., 2013)

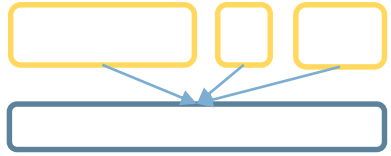


- Results calculated with

  SimaPro, Version 9.0.3.32

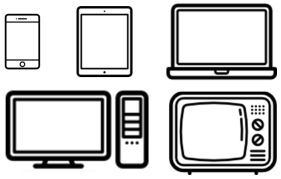
  (PRé Consultants, 2019)

3. Modelling Approach



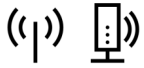
3. General structure of modelling

**Hardware:
End Device**



Usage (incl. data transfer)

Idling (electricity demand modem in stand-by and device)



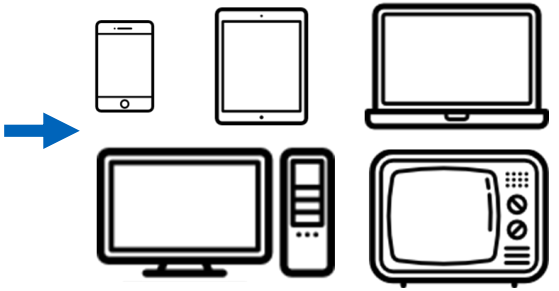
Using background functions (e.g. GPS)

Usage of devices (data, direct electricity demand)

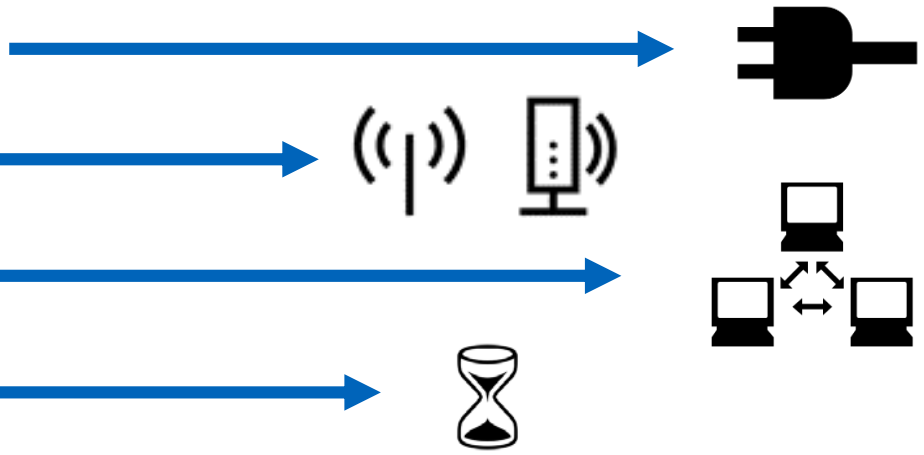
Environmental impact of digital media use

3. Modelling of devices and usage

- **Which devices were analyzed?**
  - Focus on **common** devices with multiple functions
  - Mobile phone, tablet, laptop, desktop and television
  - No other devices taken into account



- **Which aspects of usage were analyzed?**
  - Direct **electricity** demand devices
  - **Data** (WLAN or mobile network; data transfer; data centres)
  - **Duration** of activities



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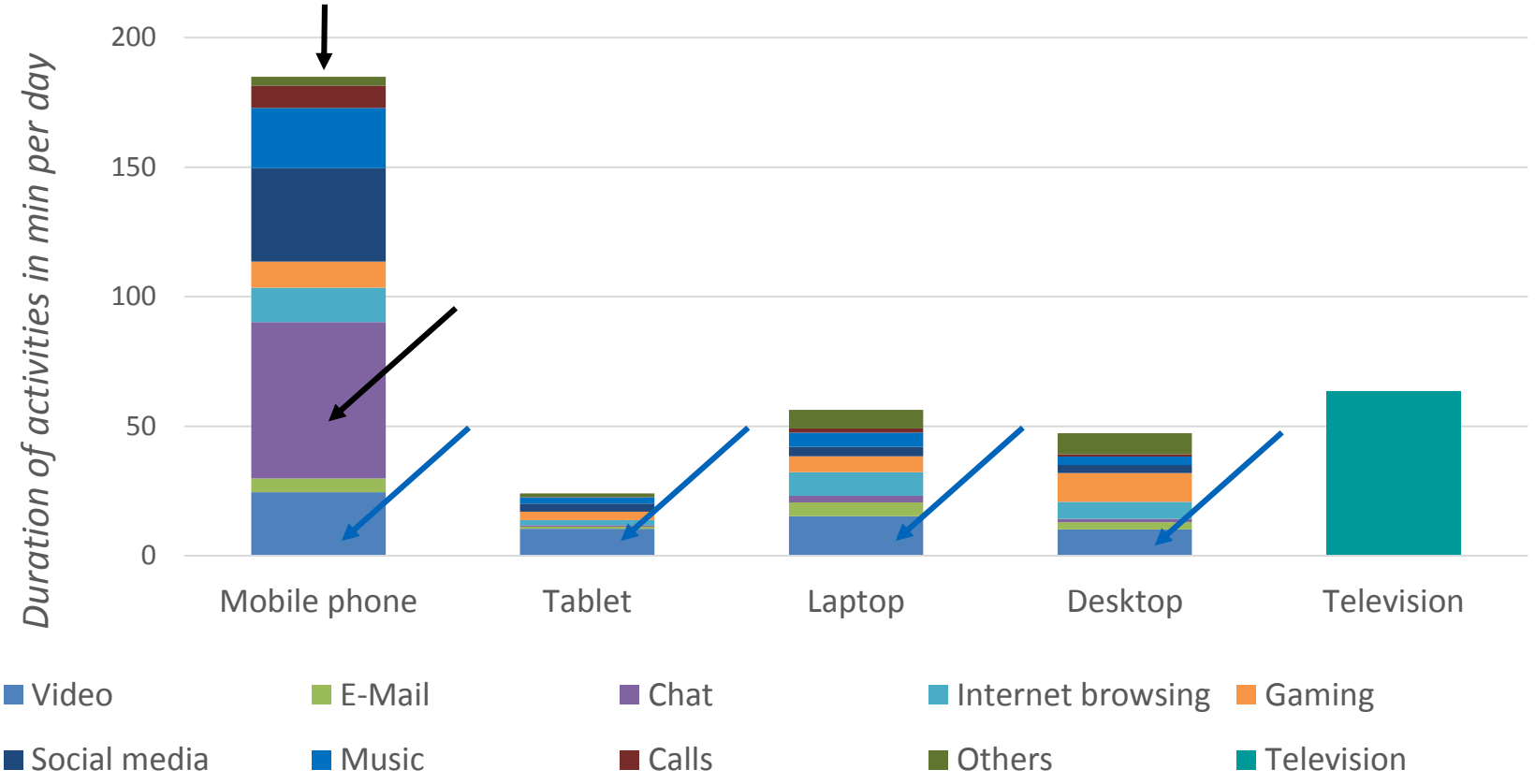
4. Inventory data

4. Duration of activities



→ **Mobile phone** is used most; mainly used for chatting

→ Watching **videos** accounts for a lot of use on all devices

Source: Suter, L., & Waller, G. (2017b).

4. End devices: Lifetime and ownership

Life time end devices

(Sources: Mobile phone from the study «JAMES» from Waller et al., 2016. Others from Thiébaud et al., 2016)

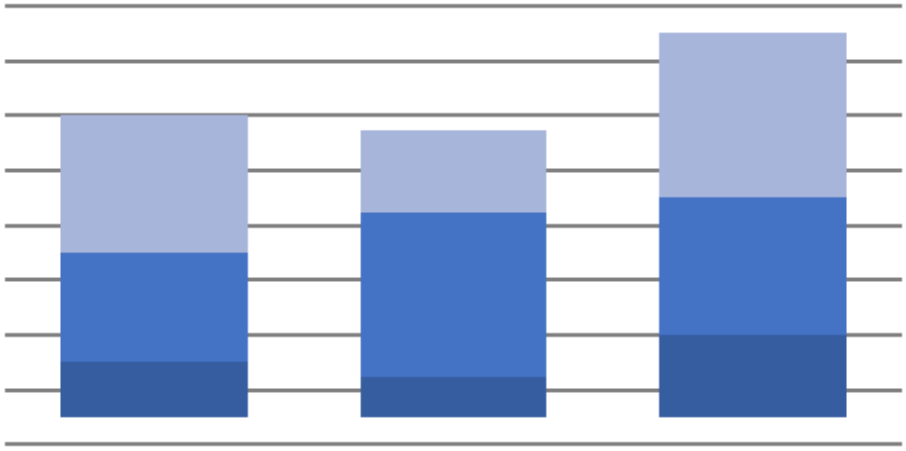
	Mobile phone	***Tablet***	***Laptop***	***Desktop***	***Television***
Service life time in years	2.0	5.6	5.3	5.6	9.2

End devices per young person

(Source: Study «JAMES» from Waller et al.)

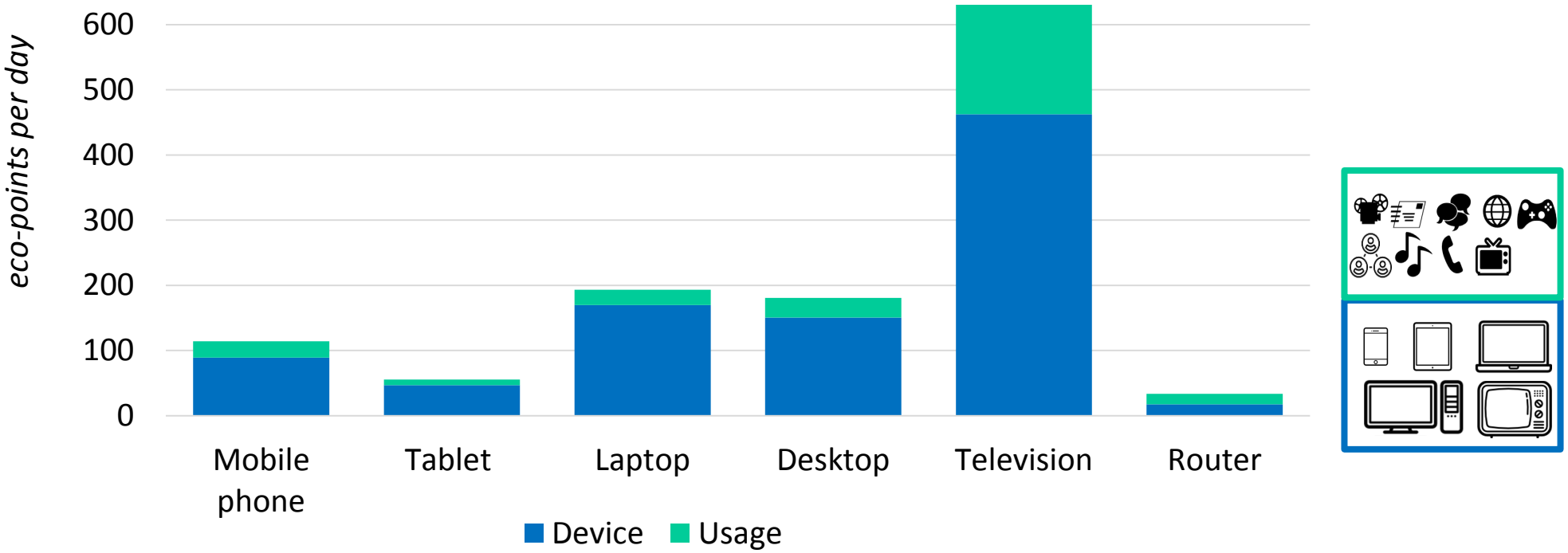
	unit	***Mobile phone***	***Tablet***	***Laptop***	***Desktop***	***Tele-vision***	***source***
Proportion with their ***own device***	%	*99*	*39*	57	19	30	*(Waller et al., 2016)*
Proportion with ***device in household***	%	*100*	*83*	74	25	96	*(Waller et al., 2016)*
Devices per person *(personal & share of household devices)*	[p]	*0.99*	*0.51*	0.62	0.21	0.47	*calculated*

4. Results



4. Usage of digital devices per day (eco-points)

calculated with user data from survey



→ Devices have highest impact (personal & shared in household): 78% of total impact
→ Follow-up project «Lifesaving» aims at extending the lifespan of hardware

→ Television has a high share of use (27%): data provision in data centres (23%), direct electricity demand (3%), data transfer (< 0.1%)

→ Television is most relevant in terms of impact (> 50% from total)

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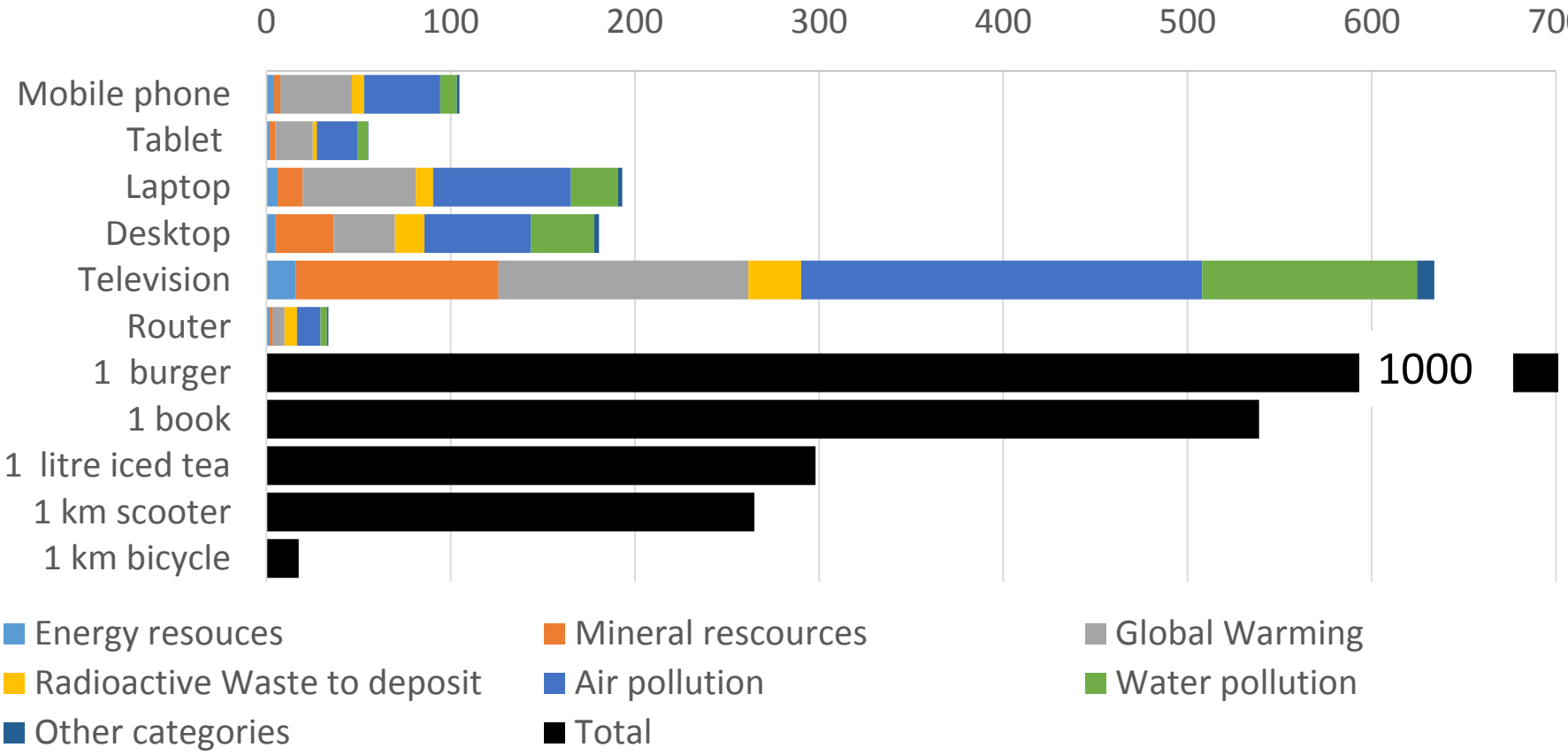
4. Usage of digital devices per day (eco-points per day)

calculated with user data from survey



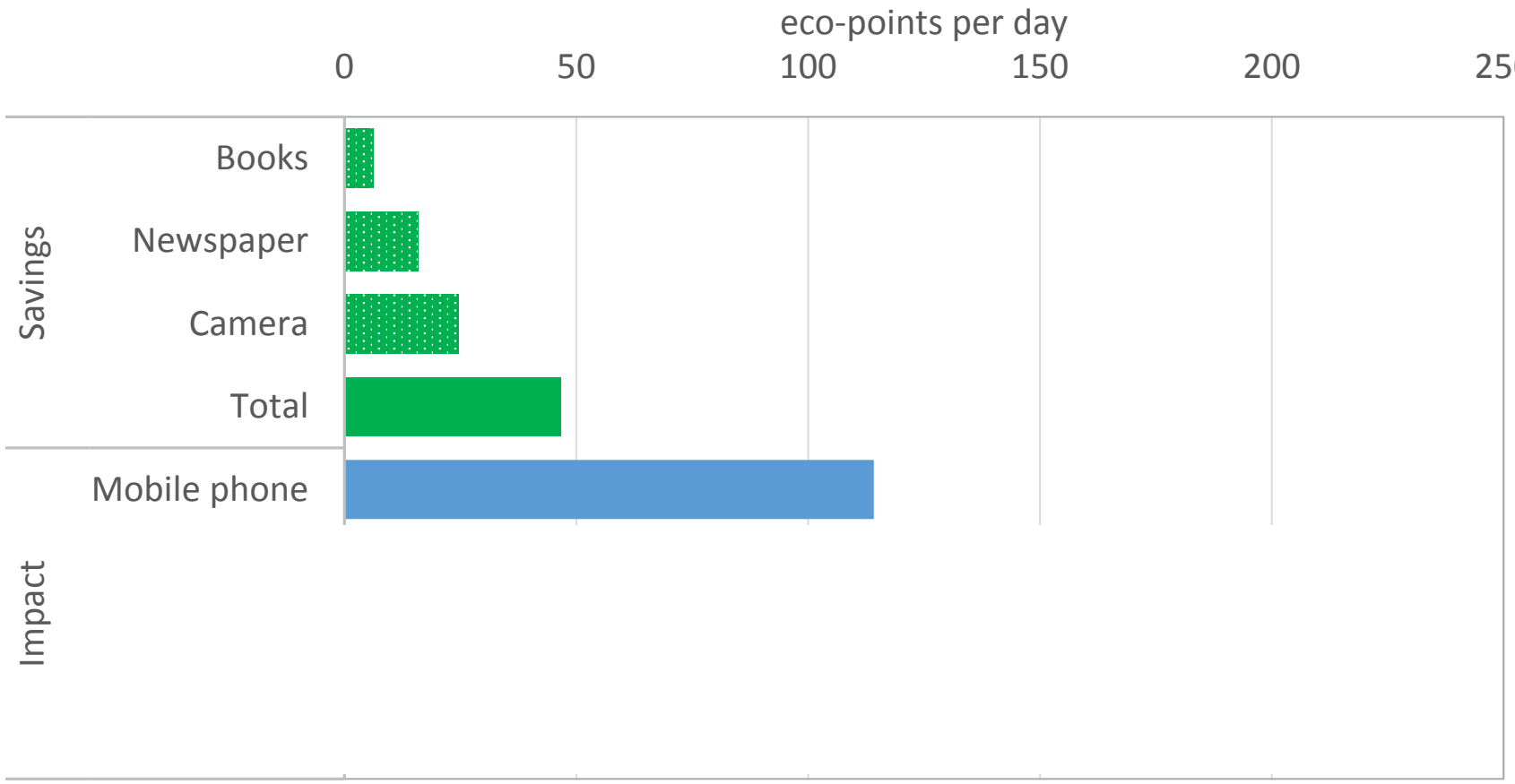
→ Relevant impact categories are: Mineral resources, climate change, air & water pollution

→ Indium is responsible for 65% of the impact in the category mineral resource use (of which TV: 50%)

4. Assumptions for daily substitution

Substituted product	amount	unit	Comment
Book	0.011	Pieces per day	Replaced by audiobooks and digital books
Newspaper	0.26	Pieces per day	5 newspapers per week minus digitally read newspaper = 1.8 per week
Camera	$2.2 * 10^{-4}$	Pieces per day	50% don't have a camera; 75% because of mobile phone. lifetime: 5.3 years

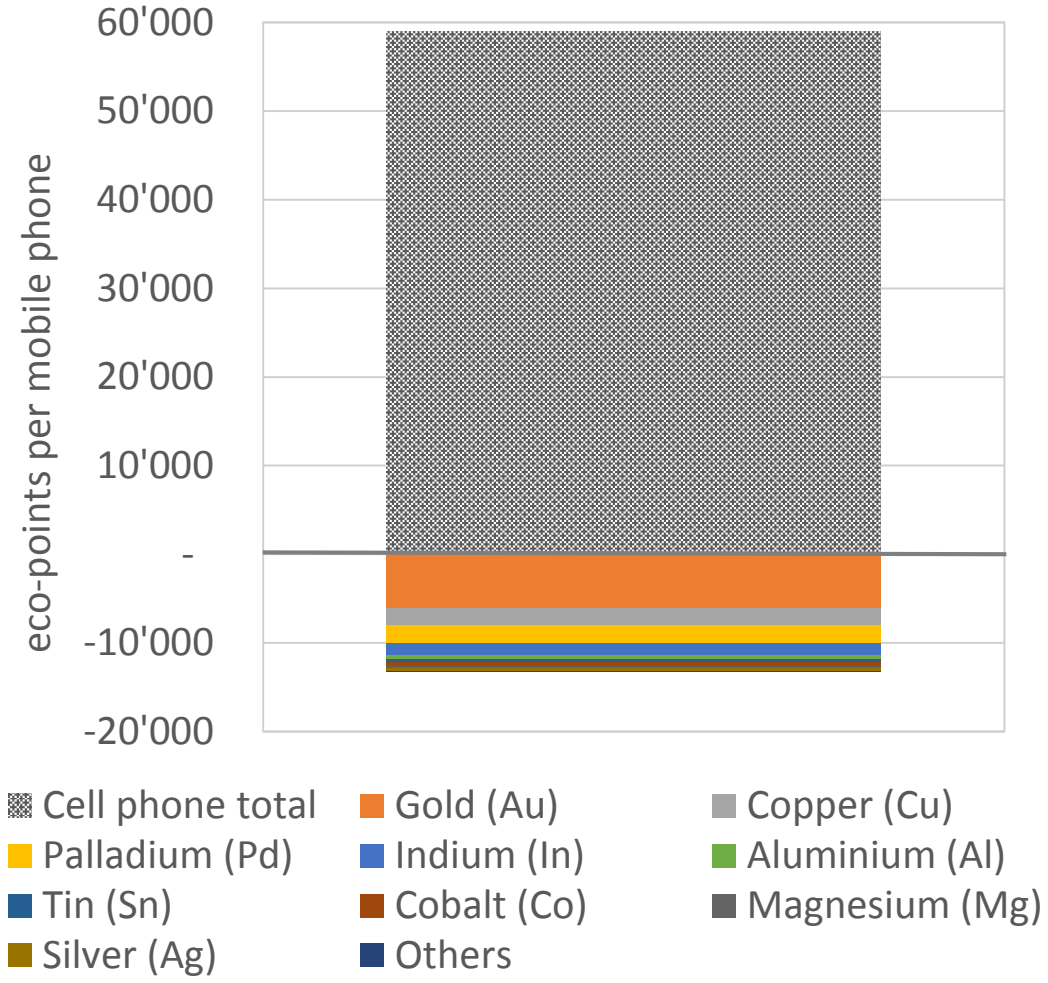
4. Savings due to substitution (eco-points)



→ Highest savings due to no need for a camera with multifunctional mobile phones

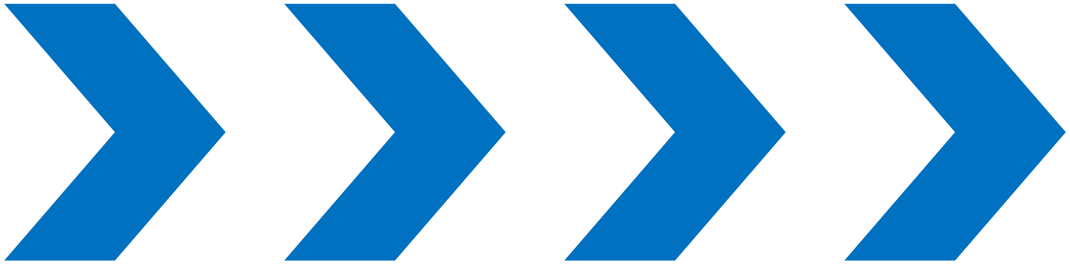
→ Relevant savings for newspaper and books

4. Savings due to recycling mobile phone (eco-points)



- → Assumption: All metals can be recycled and replace primary production
- → Metal content of mobile phones based on **Manhart et al**. (2016)
- → Max of **22**% of environmental impact of the production of a mobile phone can be reduced if metals of a mobile phone can be fully recuperated.

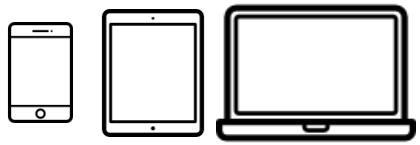
5. Conclusions

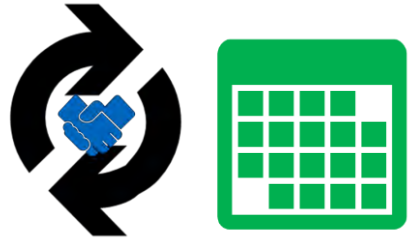


5. Conclusions

Devices – improvement options

- Fewer devices = fewer impacts
- **Smaller devices** have lower environmental impact
- Sharing devices instead of buying new ones
- Maximise lifetime, reduce number of devices

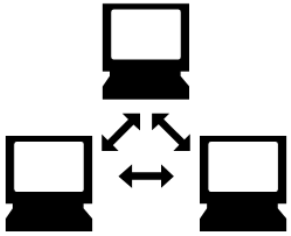




Usage – improvement options

- Electricity demand is lower for smaller / portable devices
- Data transfer is not relevant;
- **Data provision** is only relevant for data-intensive use like high resolution TV.

Multifunctionality can reduce environmental impacts



5. Use of insights for communication campaign

Communication campaign was developed by the research group sustainability communication and environmental education in collaboration with myblueplanet.

Aim: ***Motivate young people to use their mobile phone longer****, because*
→ *Hardware and its lifetime are crucial*
→ *99% of all young people own a mobile phone*

If you want to know more, visit www.ugphone.ch.

Questions?

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Appendix: Duration of activities as table

Duration of usage in min/day	**Mobile phone**	***Tablet***	***Laptop***	***Desktop***	***Television***
Video	24.5	*10.4*	15.3	10.2	-
E-Mail	5.4	*0.9*	5.3	*2.8*	-
Chat	60.3	*0.5*	2.5	*1.2*	-
Internet browsing	13.3	*2.0*	9.1	*6.7*	-
Gaming	10.0	*3.2*	6.2	*11.1*	-
Social media	36.1	*3.2*	3.7	*3.1*	-
Music	23.3	*2.4*	5.5	*3.2*	-
Calls	8.5	*0.1*	1.6	*0.9*	-
Others	3.5	*1.5*	7.2	*8.0*	-
Television	-	-	-	-	63.4
Total	**184.9**	***24.1***	**56.4**	***47.3***	**63.4**

Appendix: Access network via mobile data per megabyte data transfer

	Dataset	Amount and unit	Comment
Output	Access Network, UMTS, 2010	1 MB	
Input	Electricity, medium voltage {CH}| market for	0.293 Wh / MB	(Schien, et al., 2013)

Appendix: Access network via home wlan router per megabyte data transfer

	Dataset	Amount and unit	Comment
Output	**Access Network, home WLAN, basis**	**1 d**	
Input	Electricity, low voltage {CH}| market for	61.9 Wh	9.8 W stand-by, 24 h per day, divided by number of users
	router, internet {GLO}| market for_corrected	0.000144 p	1 piece per household, lifetime 5 years, divided by number of users

	Dataset	Amount and unit	Comment
Output	**Use, W-LAN Router**	**1 h**	
Input	Electricity, low voltage {CH}| market for	0.816 Wh	Difference of electricity demand between active and stand-by-mode (12.9 – 9.8 Wh), divided by 3.8 users