

Supplementary material to the article “Assessing the environmental performance of ICT-based services: does user behaviour make all the difference?” (Journal Sustainable Production and Consumption)

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Supplementary material contains a summary of LCA studies which investigate the interplay of user behaviour and environmental assessment of products and services (Table S1), as well as detailed results of SHS composition (Table S2), and environmental impact for GWP and MDP (Table S3).

Tab S1: Summary of LCA studies which investigate the interplay of user behaviour and environmental assessment of products and services

Study	Product interaction	Functional unit	Product system	Information on user behaviour
Achachlouei and Moberg (2015)	Duration	One reader’s use of one copy of Sköna Hem	print edition of a magazine and electronic edition read on a tablet device	No additional data; assumption on average use, sensitivity analysis for relevance
Amasawa et al. (2018)	Choice of products, duration	book reading activities per person and per person-book	books (both paper and e-book) purchased or acquired, and electronic device to read e-books	Primary data; information on reading patterns through a web survey in the USA and a 3-month social experiment involving e-readers in the USA to observe the changes in reading patterns upon e-reader adoption within the same population
Bossek et al. (2021)	Choice of products, duration, frequency of use	Reporting unit instead of FU “life of Dirk”	Human being	Primary data: collection of all the products and possessions consumed by the person up to the present time, and additional information on user behaviour, e.g. average life span or user ratio
O’Brien et al. (2009)	Frequency of use	Not clearly stated; only time period was specified: “environmental indicators of nappy system over the first 2.5 years of a child’s life”	Two types of nappies: disposable/ reusable	No additional data; categorization of user behaviour (frequency of nappy changing) based on assumptions

Pohl et al. (2021)	Choice of products, duration, frequency of use	110 m ² apartment space in Germany managed (monitored and controlled) for 5 years	typical SHS that encompasses heating in Germany	Primary data; information on the average SHS in Germany (components, number of devices, heating behaviour) and information on housing from a survey among 375 SHS users in Germany
Ross and Cheah (2017)	Choice of product setting, duration	lifetime of a 2.5-kW rated inverter air-conditioning system used to cool a single office	2.5-kW rated inverter air-conditioning system	Primary data; Inclusion of variances in air conditioning usage patterns in offices by measuring and analysing data such as room temperature, humidity or noise over a period of 5 months; data were collected using integrated sensor units
Samaras and Meisterling (2008)	Duration	1 km of vehicle travel in the United States.	Five types of vehicles: conventional vehicle with internal combustion, hybrid electric vehicle, 3 different plug-in hybrids	Partly primary data; assumption on frequency of charging, survey on driving distances
Schien et al. (2021)	Choice of products, duration, frequency of use	delivery and viewing of one year's worth of BBC television to the population of the UK	Viewing devices (e.g. mobile device, Smart TV), Internet and broadcast distribution	Primary data; survey data from broadcast provider on viewing behaviour
Shahmohammadi et al. (2017)	Choice of products, duration	One wash cycle	doing laundry including use of detergents and electricity consumption of washing machine (depending on load size, wash duration, temperature profile, efficiency)	Secondary data; regionally disaggregated data for 23 European countries, such as product related environmental data, data on background electricity mixes as well as data from a European consumer survey on product usage and washing habits.
Shahmohammadi et al. (2019)	Choice of products, duration	one shower event	Showering including water consumption (depending on duration and water flow rate) and electricity consumption (depending on type of water heater) and number, type and dosage of shower products, e.g. gel, shampoo, hair conditioner	Secondary data; User behaviour based on measured data from other research
Solli et al. (2009)	Product handling	1 kWh of heat delivered in a household	Two types of wood stoves	Secondary data; assumptions on user behaviour based on previous research

Tab. S2: Description of the SHS composition per resident, number of devices (mean, standard deviation, maximal & minimal number, share of newly purchased devices per component)

Component	M	SD	MAX	MIN	Share newly purchased devices
Radiator thermostat	2.405	1.445	7	0.345	0.816
Humidity sensor	0.838	1.453	7	0	0.824
Door/window sensor	0.508	0.936	7	0	0.848
Motion sensor	0.635	0.945	6	0	0.798
(Security) Camera	0.399	0.656	4	0	0.847
Smoke detector	0.929	1.282	7	0	0.721
Wireless intercom system	0.217	0.372	3.5	0	0.697
Smart plug	0.819	1.207	7	0	0.792
Switch	0.282	0.609	5	0	0.779
Control unit	0.487	0.383	2.667	0	0.858
<i>SHS total</i>	7.519	5.271	34	0.4	0.811

Tab S3: Split - environmental performance SHS on average

	GWP [kg CO2 eq per capita]				MDP [kg CU eq per capita]			
	MEAN	SD	MIN	MAX	MEAN	SD	MIN	MAX
Overall environmental impact	-35.1	239,9	-991.4	804.0	0.97	0.8	-0.1	4.79
Smart heating component	41.9	23.5	2.6	150.8	0.43	0.3	0.005	1.41
Other components	37.8	41.0	0	249.3	0.57	0.7	0	3.78
Optimisation effect	-103.9	42.9	-332.4	-6.7	-0.03	0.03	0.21	-0.004
Heating behaviour	-10.9	236.5	-870.6	877.8	-0.001	0.09	-0.74	0.5

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