ICT TASK force study

Second Stakeholders Meeting – 15th of September 2022

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The Joint Research Centre

- The Joint Research Centre (JRC) is the Commission's science and knowledge service.
- Provide independent scientific advice and support to EU policy.
- Based in 5 countries, with more than 5,000 employees
- The Product Bureau team is based in Seville (Spain)

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The Product Bureau team in Sevilla

- The European Product Bureau is part of the Circular Economy and Industrial Leadership Unit of Directorate B - Growth and Innovation.
- It’s main aim is to support the implementation of European sustainable product policies

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Study Objectives

- Determine the best policy approach for improving their energy efficiency and wider circular economy aspects.

- Provide policy recommendations on the inclusion of Ecodesign criteria and beyond (i.e. systems) based on material and energy efficiency improvement potential, and considering user behaviour and lifecycle costing aspects.

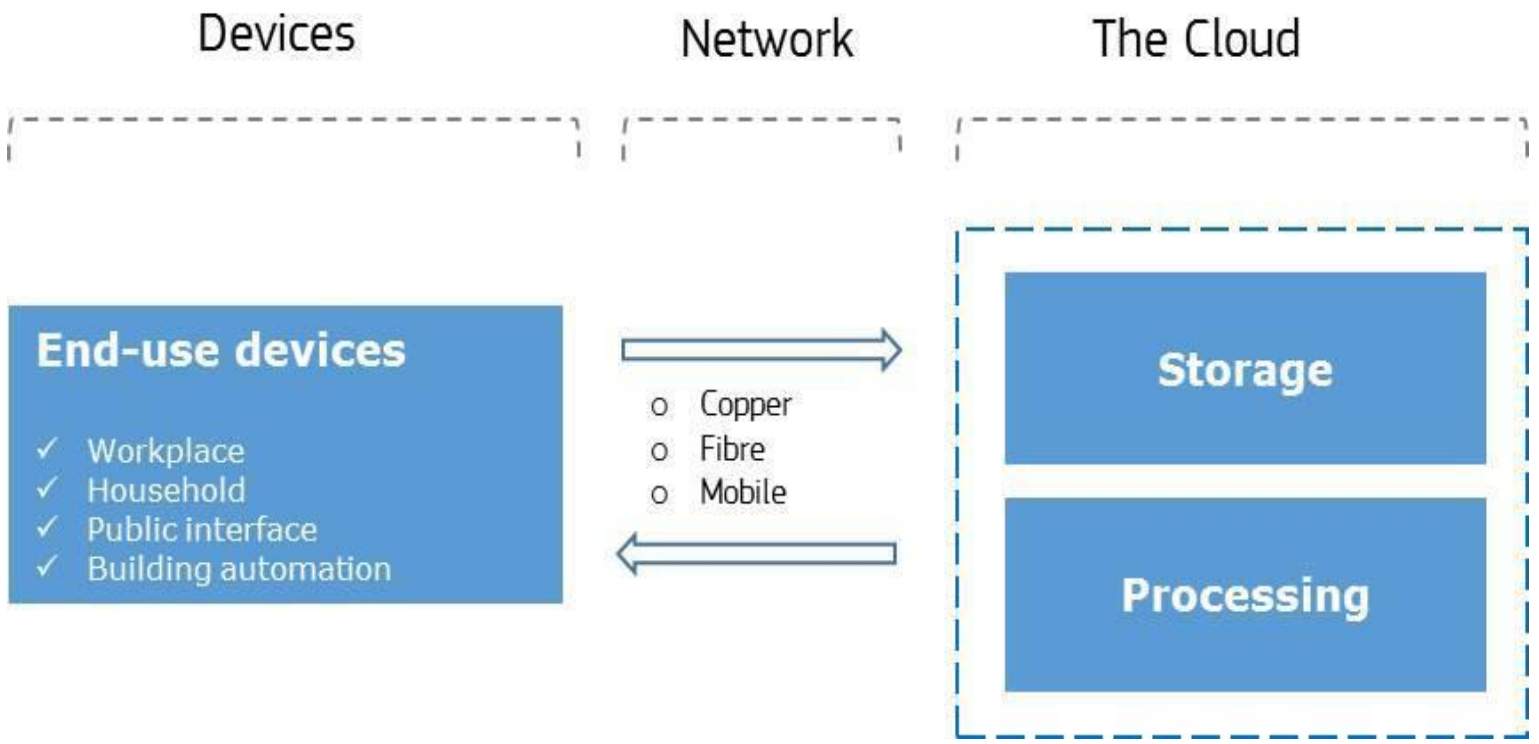
Study Tasks

Task 2 - Definition and categorisation of different sectors/products under 'ICT products' Task 3 - Potential for Energy Savings	*Presented on 23 Nov 2021*
Task 4 - Material Efficiency: Collection of data Task 5 - Analysis of potential for material efficiency Task 6 - Analysis of trade-offs and synergies Task 7 - Analysis of user behaviour implications	*Today's subject*
Task 8 - Grouping of products Task 9 - Analysis of Life cycle costing implications Task 10 - Compilation of possible policy instruments Task 11 - Suitability for different policy instruments Task 12 - Final Policy Recommendations	*Next stakeholder meeting (by the end of 2022)*

Today’s presentation structure (Tasks 4-7)

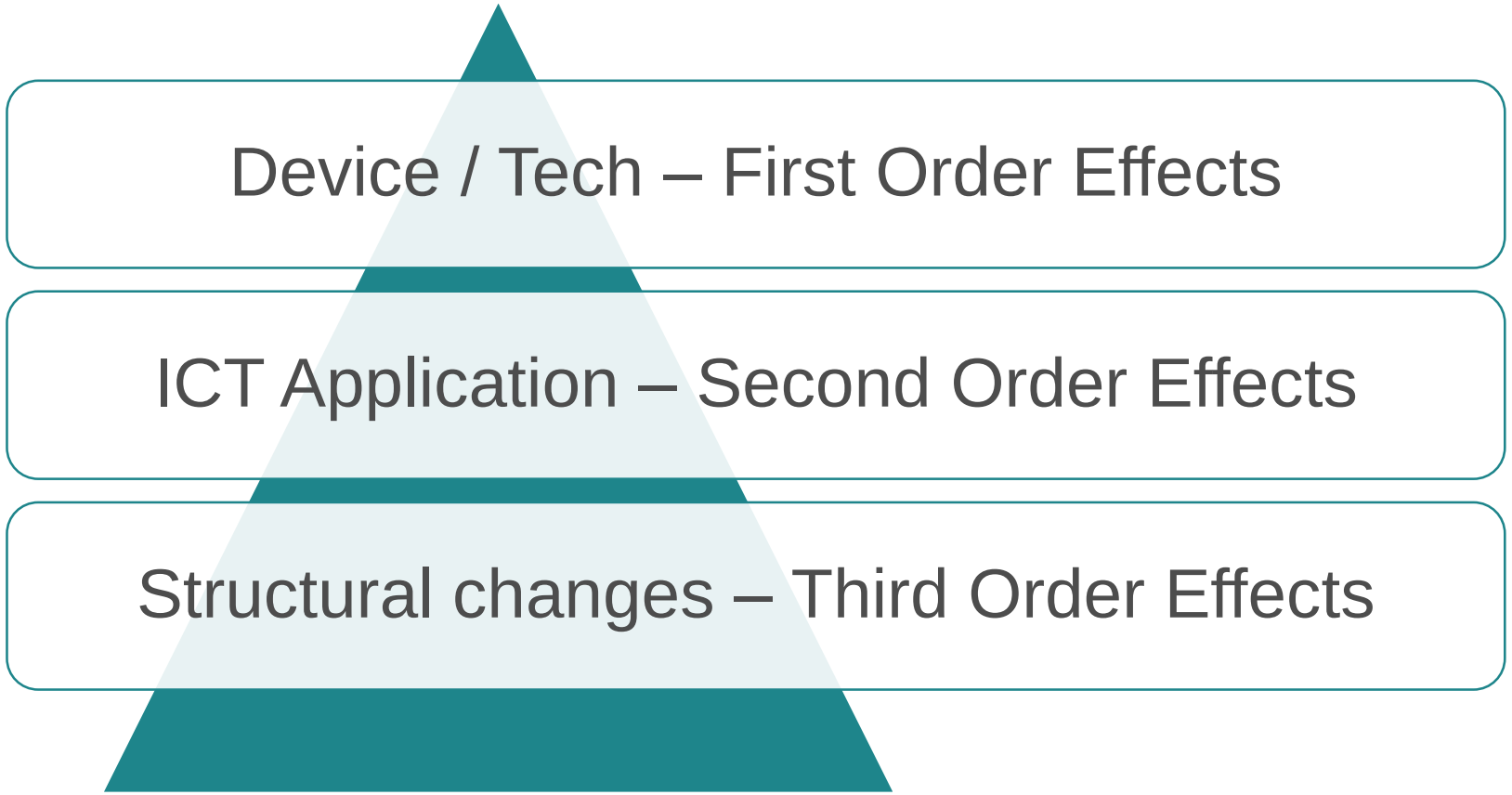
1. Lifecycle Impacts (Task 4)
2. Obsolescence (Task 4)
3. Material efficiency strategies (Task 5-6)
4. User behavior survey (Task 7)

The approach of the study

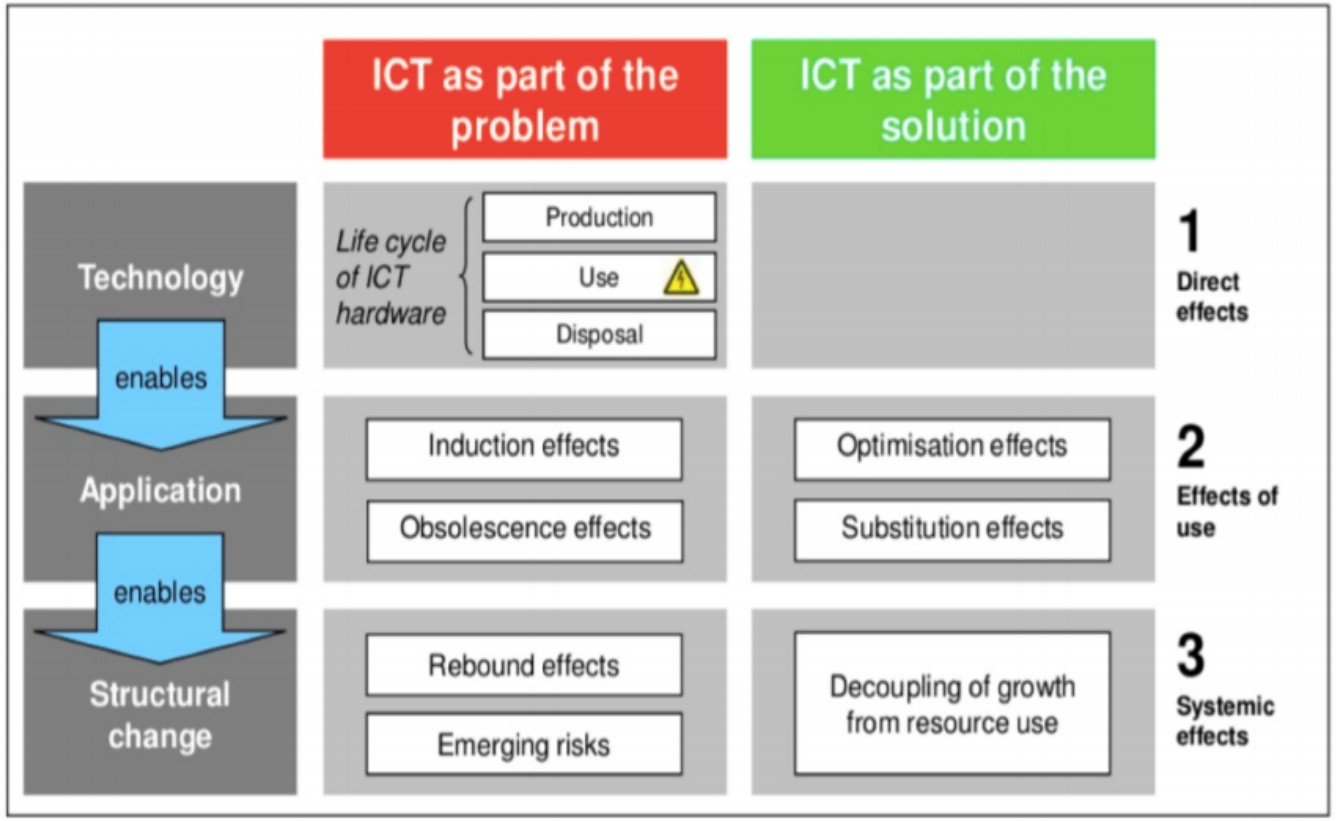


The main characteristic that ICT product groups share is that they (increasingly) allow communication between devices

ICT Impacts on Sustainability



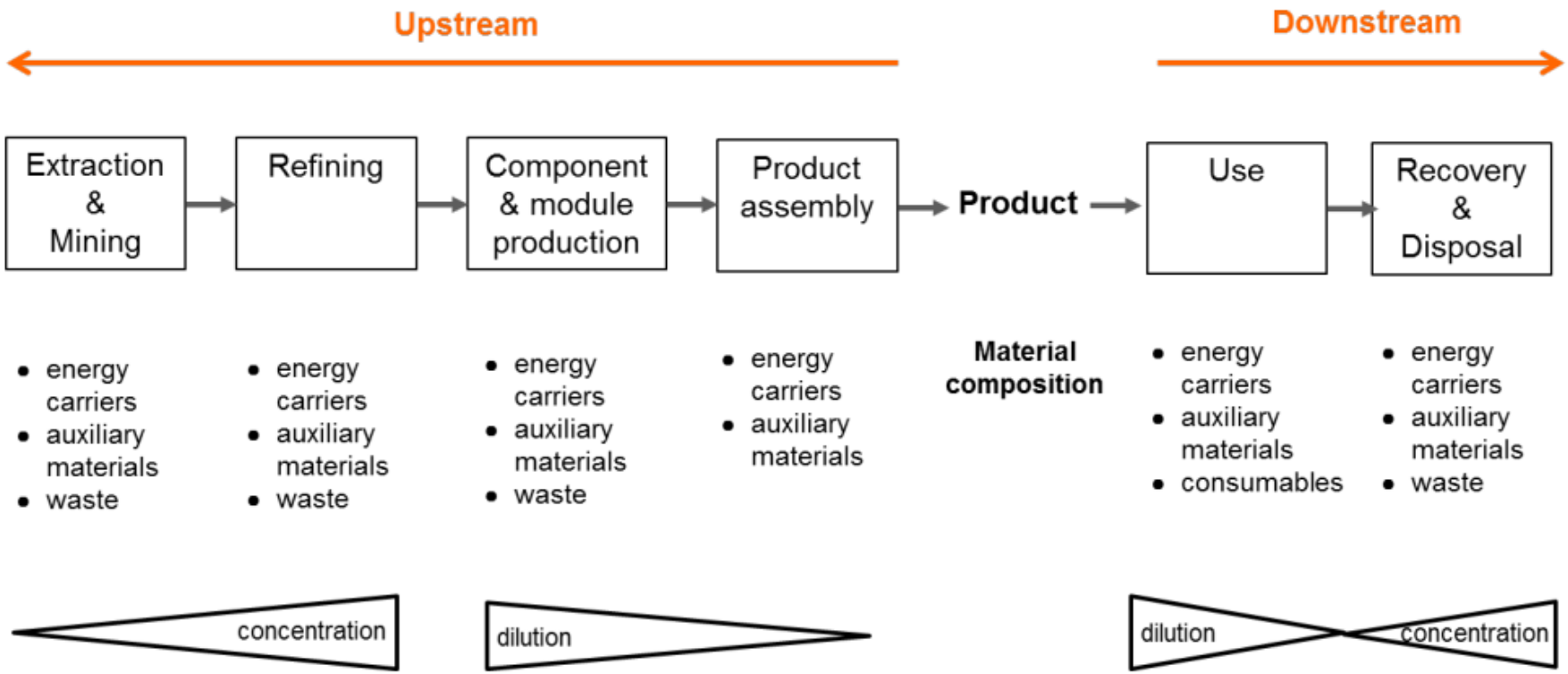
The approach of the analysis



Source: Hilty et al., 2015

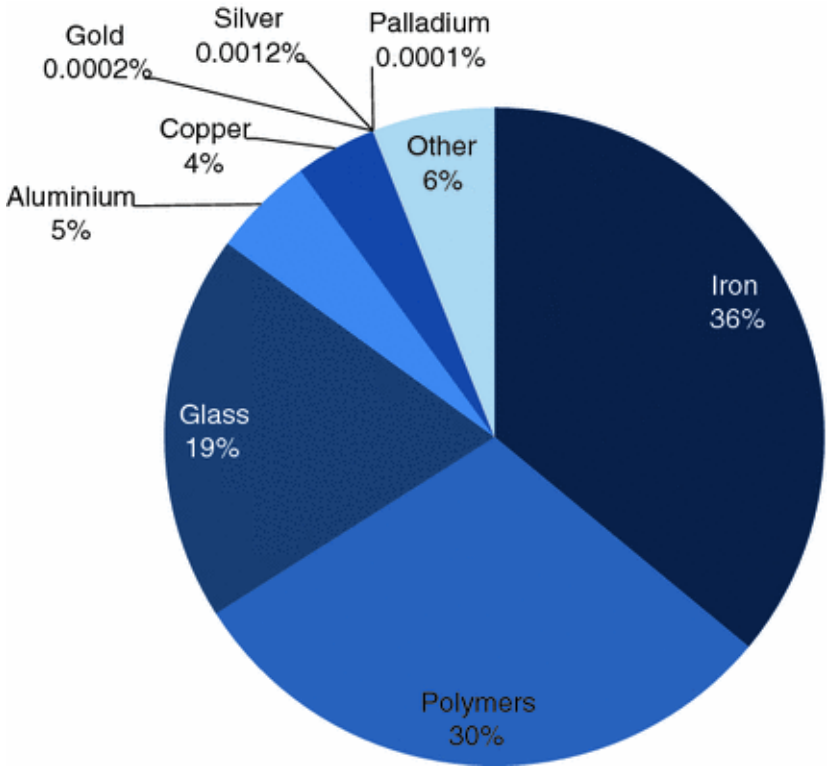
1. Lifecycle Impacts

Processes and material flows contributing to the material basis of ICT



Source: Wagner et al. (2014). The material basis of ICT

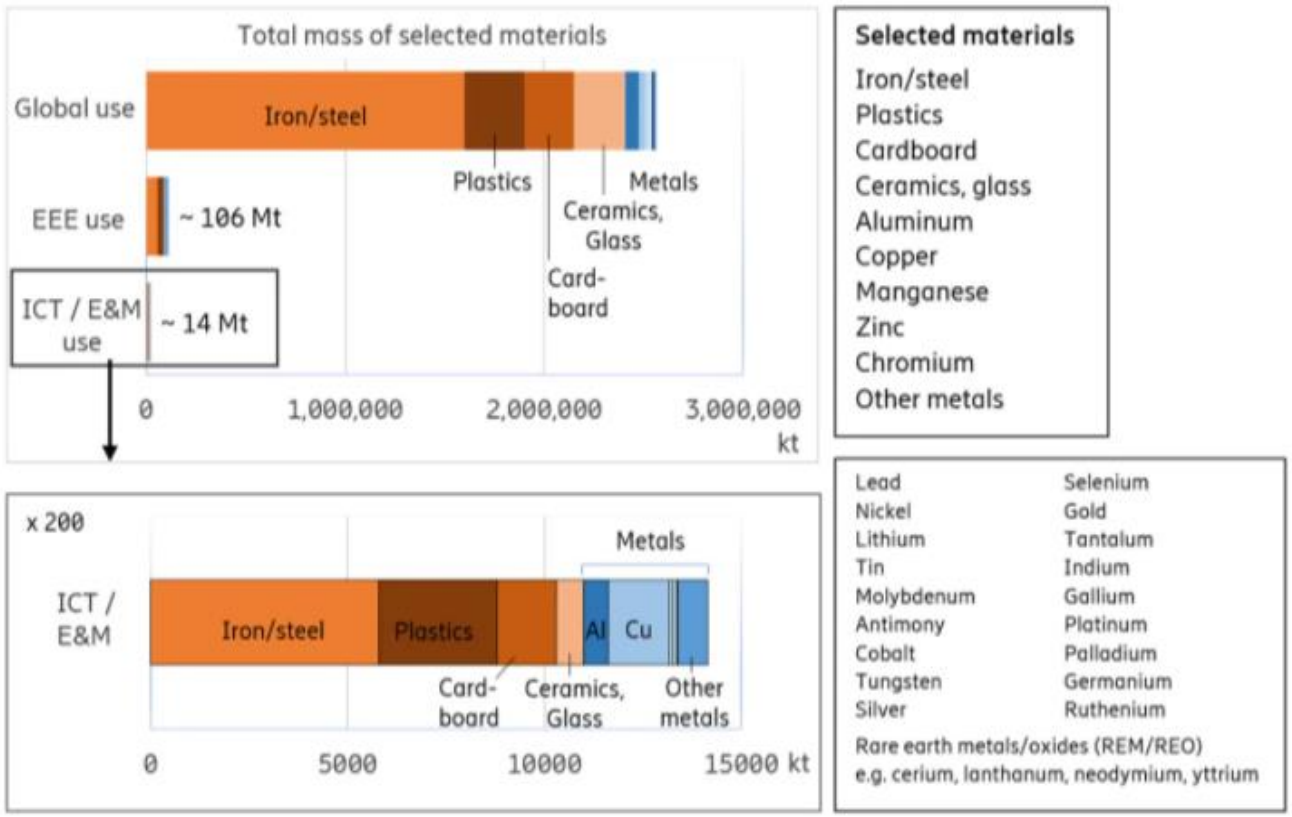
ICT products: characterization in terms of materials



Relative mass distribution of the materials contained in EoL consumer ICT devices in Switzerland (reference year 2010)

Source: Wagner et al. (2014). The material basis of ICT

ICT products: material use and impacts



ICT= 0,5% of Material Use

0.6%-1.3% material Carbon Footprint

24%-48% ADP abiotic depletion

Relative mass distribution of the materials contained in EEE (above) and ICT / E&M devices. Source: Ericsson (2018)

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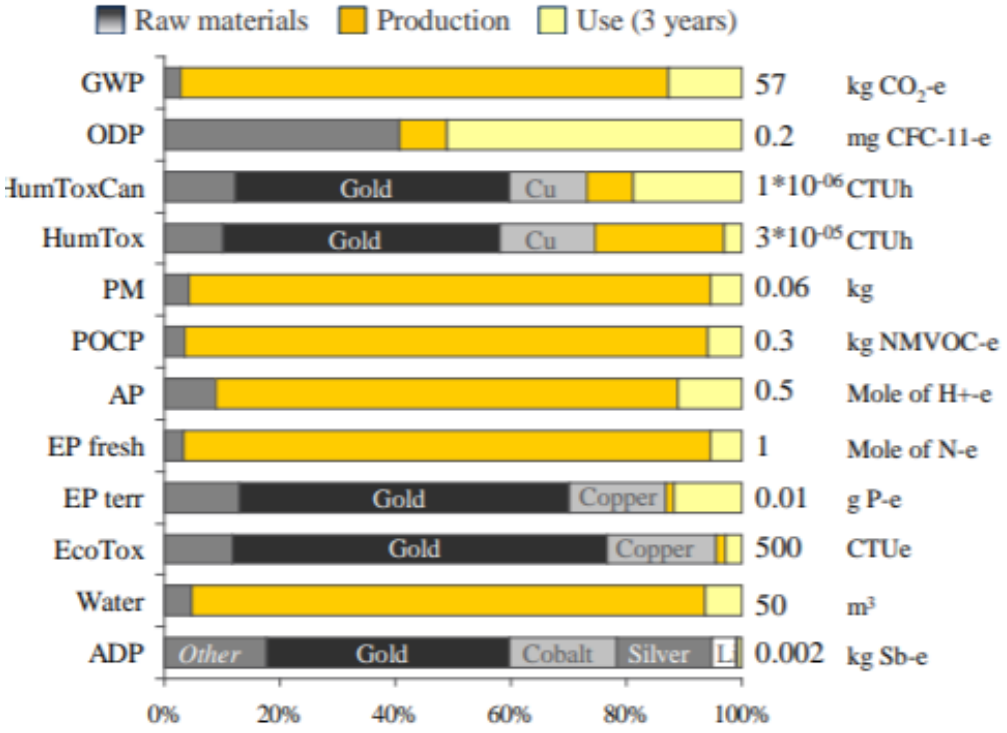
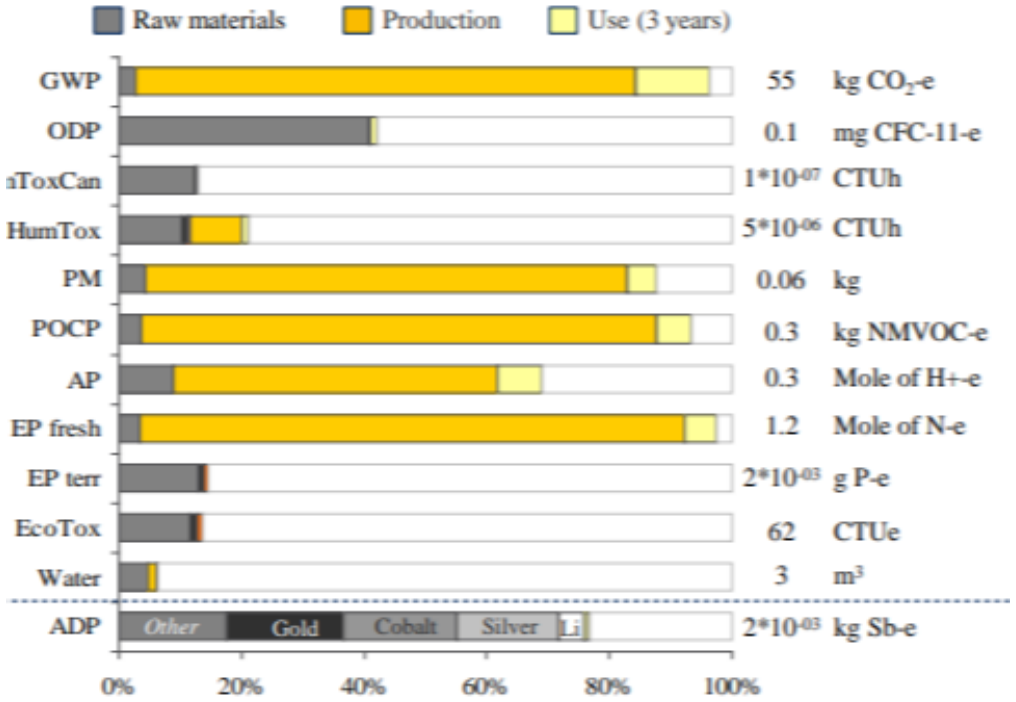
Materials and life cycle impacts



Total life cycle result for all impact categories for smartphone Z5 with accessories using Ecoinvent database and adopting a 50/50 recycling approach with 19% recycling of gold assumed.



Total life cycle result for all impact categories for smartphone Z5 with accessories using GaBi database for gold and energy production and a 50/50 recycling approach with 83% recycling of gold assumed.

Source: Ercan et. al., (2016)

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Different perspectives: supply risk, environmental relevance and social aspects

Material	Raw Materials of High Supply Risk / Relevance (EU List of Critical Raw Materials)	Raw Materials of High Environmental Relevance*	Social Impacts and Conflict Minerals Regulation (EU) 2017/821
Antimony (Sb)		X	
Borates (B)	X		
Cobalt (Co)	X	X	X**
Copper (Cu)		X	
Chromium (Cr)		X	
Hafnium (Hf)	X		
Gallium (Ga)	X		
Germanium (Ge)	X	X	
Gold (Au)		X	X
Graphite (C)	X		
Indium (in)	X	X	
Lithium (Li)	X		
Magnesium (Mg)	X		
Manganese (Mn)		X	
Nichel (Ni)		X	
Niobium (Nb)	X		
Rare Earth Elements (REE)	X		
Palladium and other Platinum Group Metals (PGM)	X	X	
Silicon metal (Si)	X		
Silver (Ag)		X	
Tantalum (Ta)	X		X
Tin (Sn)			X
Tungsten (W)	X		X

*The Environmental relevance is based on the "OekoRess II" assessment (Dehoust et al., 2020) and includes the materials classified as high he aggregated environmental hazard potential (EHP).

** Conflict Minerals Regulation (EU) 2017/821 does not include cobalt in the EU list of conflict minerals.

Manufacturing of ICT

GLOBAL LEVEL IMPACTS

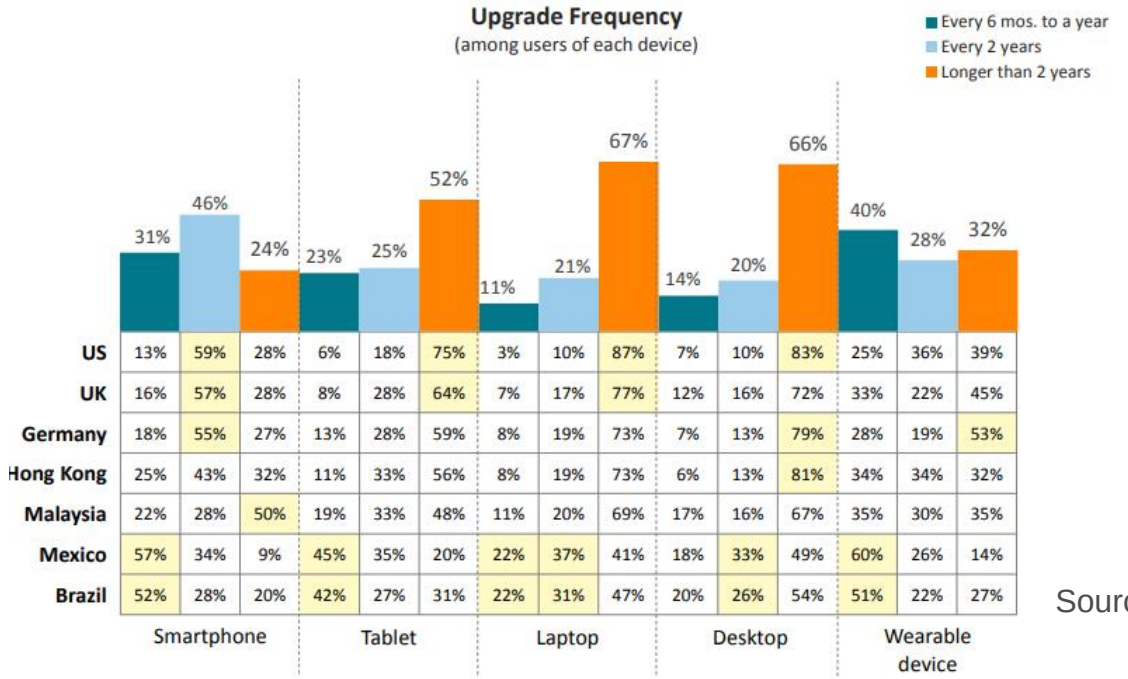
- **Global Warming:** huge amount of electricity consumed during the energy intensive production processes of semiconductor components. Moreover, a considerable quantity of PFCs is consumed during manufacturing process

Manufacturing of ICT

LOCAL LEVEL IMPACTS

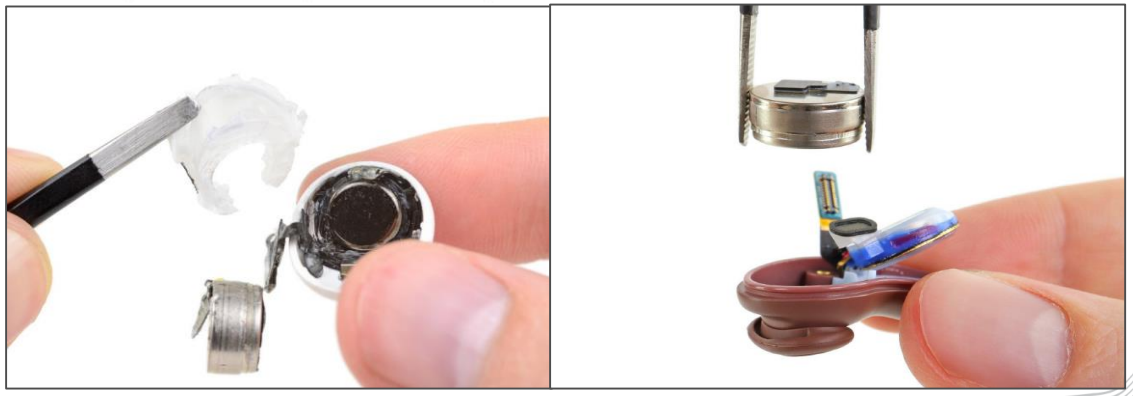
- **Water eutrophication:** the quality of water surrounding microelectronic plants is largely damaged by intensive usage of nitrogen and phosphorous acids, especially in wet cleaning processes.
- **Imported volume of raw water:** stress on water is mainly due to ultrapure water used for production and general plant functioning. Manufacturers are more and more challenged on water control issues.
- **Human eco-toxicity**: manufacturing, especially for the semiconductor package, rejects a large range of metals, in different physical forms (particulate and solid). The release of metals in water induces potential effects on toxicity. Other specific liquids (resins, solvents, silicon products, bases and acids) must be controlled regarding potential toxic effects during manufacturing and use in plants.
- **Photochemical oxidation:** several steps of wafer and package processing consume solvents producing VOCs and plant facilities damage the quality of air (boilers, air refrigerators). Photochemical oxidation (also called summer smog) accounts for these pollutions.

Accessories, chargers & consumables



Source: LexisNexis, 2016

Source: Fraunhofer IZM et al



Source: iFixit

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End of life

- In 2019, the formal documented collection and recycling of WEEE worldwide was 17.4% of e-waste generated.
- 82.6% (44.3 Mt) of e-waste generated in 2019 globally is not handled by formal channels
- 8% of the e-waste is discarded in waste bins and subsequently landfilled or incinerated. This is mostly comprised of small equipment and small IT

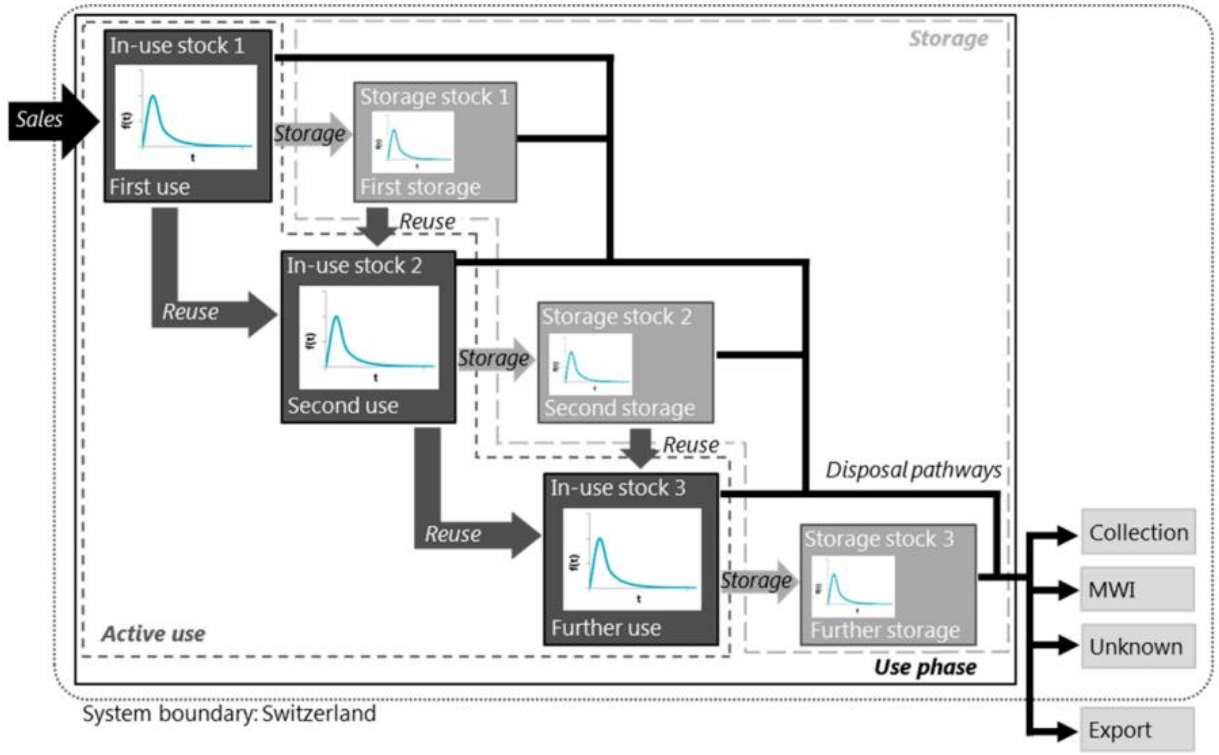
Health effects on workers, children with exposure to informal e-waste management

- *Injuries*
- *Adverse birth outcomes.*
- *Increased or decreased growth.*
- *Altered neurodevelopment, adverse learning, behavioural outcomes*
- *Effects on the immune system.*
- *Effects on lung and liver function.*
- *DNA damage*

Source: Global E-waste Monitor, 2020

2. Obsolescence

Lifetime of ICT devices on the market

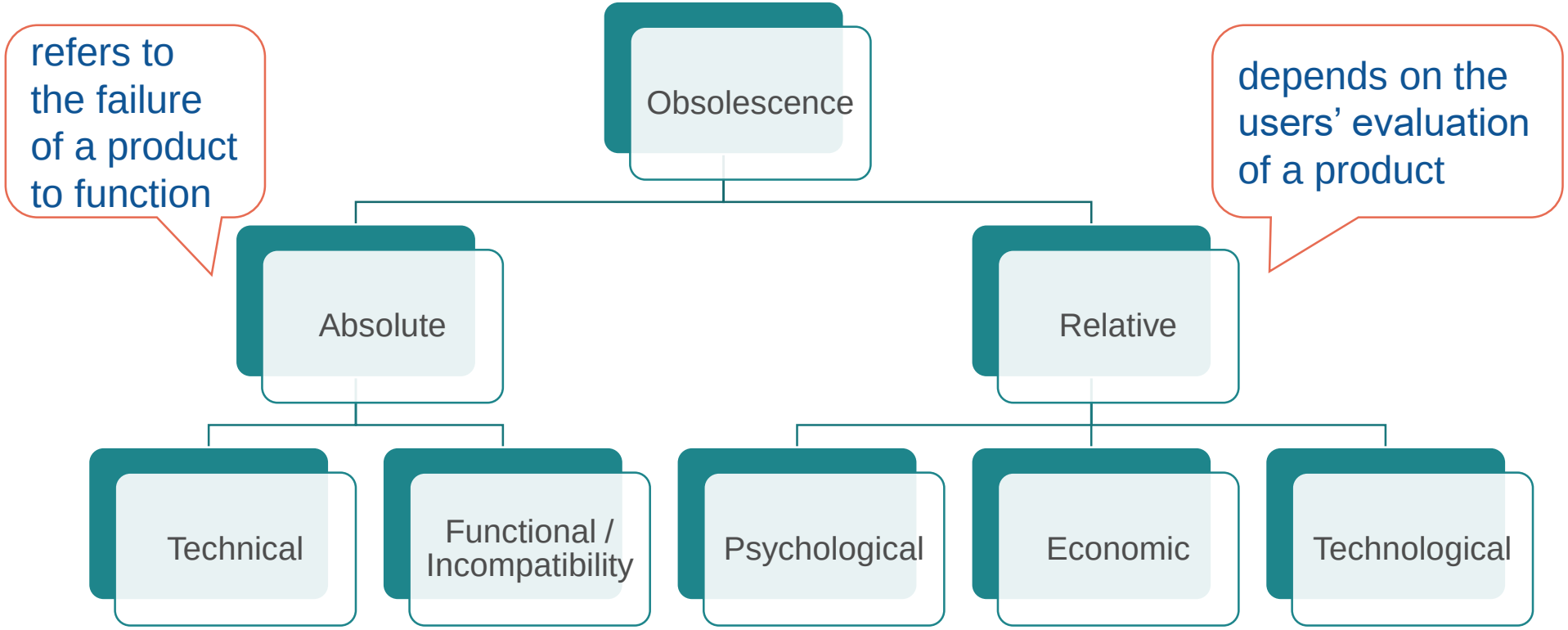


Source: Thiébaud et al. (2017b)

A **useful** or **actual lifetime** refers to the time from the moment a product is sold to when it is discarded or replaced (EEA, 2020).

Service lifetime refers to the time from acquisition to exit from active use (Zhilyaev, 2021).

Taxonomy of obsolescence



This classification is based on the scientific literature (EEA; Cooper, Prakash …)

Absolute and relative aspects do not work "in silos". These aspects can interact and contribute to the end of life of an ICT product.

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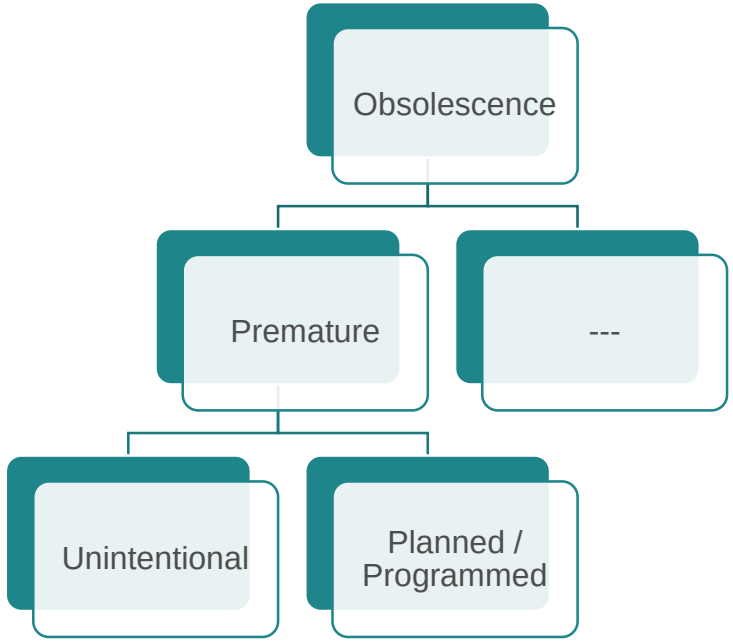
Taxonomy of obsolescence



Premature obsolescence *describes the phenomenon of 'the disposal of a product at a point in its 'life' that arrives too soon'. (Prompt Project, 2020)*

Premature obsolescence implies a comparison between the actual and designed lifetimes (EEA, 2020). It can occur when a product's useful lifetime does not live up to:

i) what is possible – the designed lifetime; or

ii) What is desirable – the product lifetime as reasonably expected by consumers, or the optimal lifetime from a sustainability perspective, taking state-of-the-art technology into account.

If the premature obsolescence is intentional, it is referred to as planned or programmed obsolescence.

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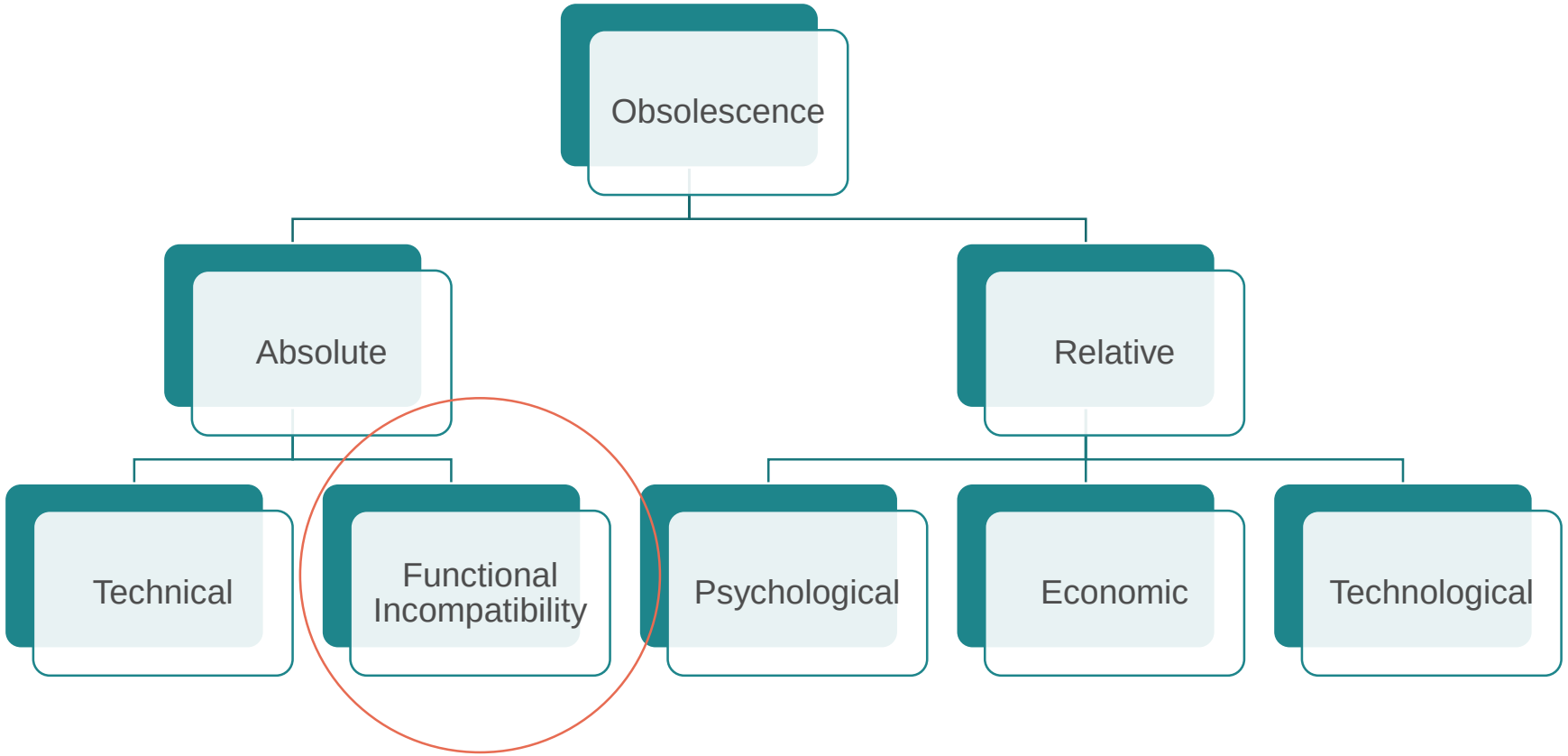
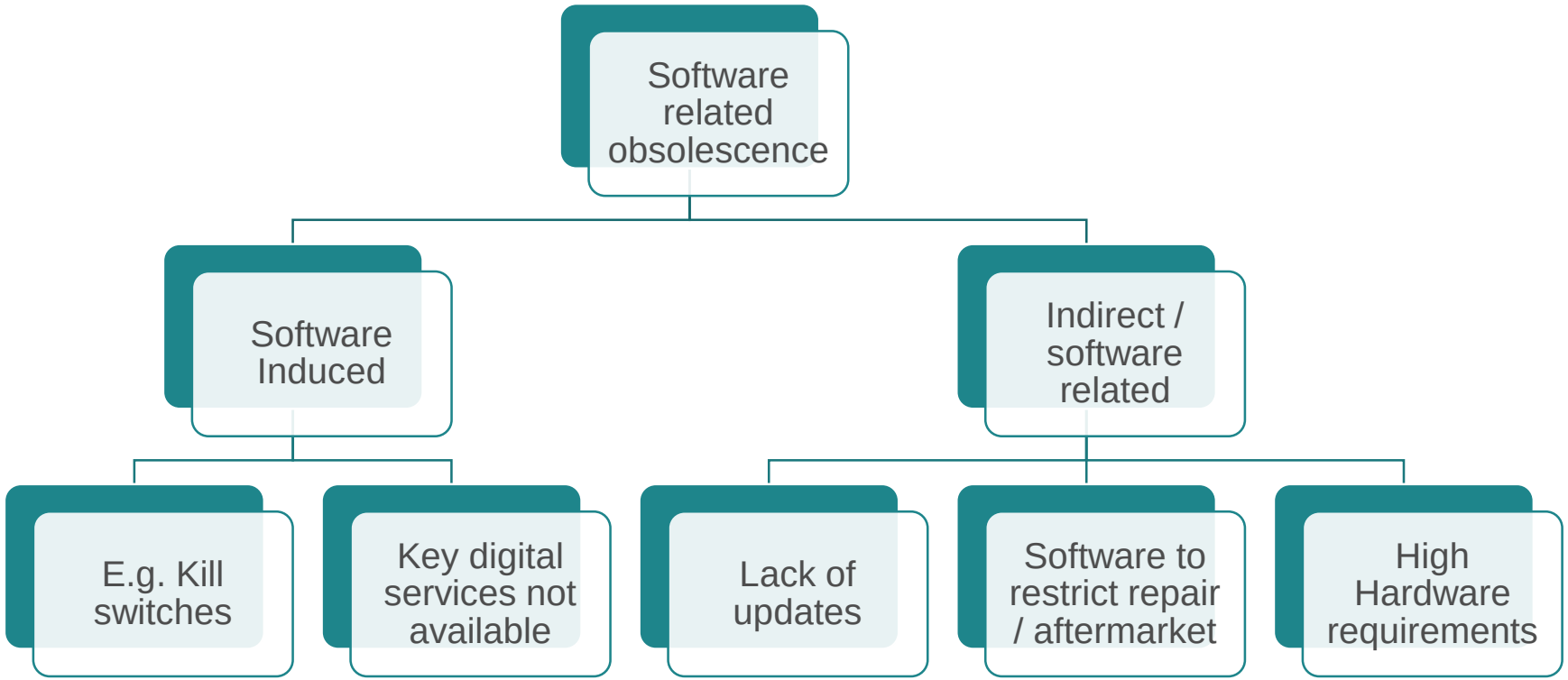
Functional / Incompatibility obsolescence: software

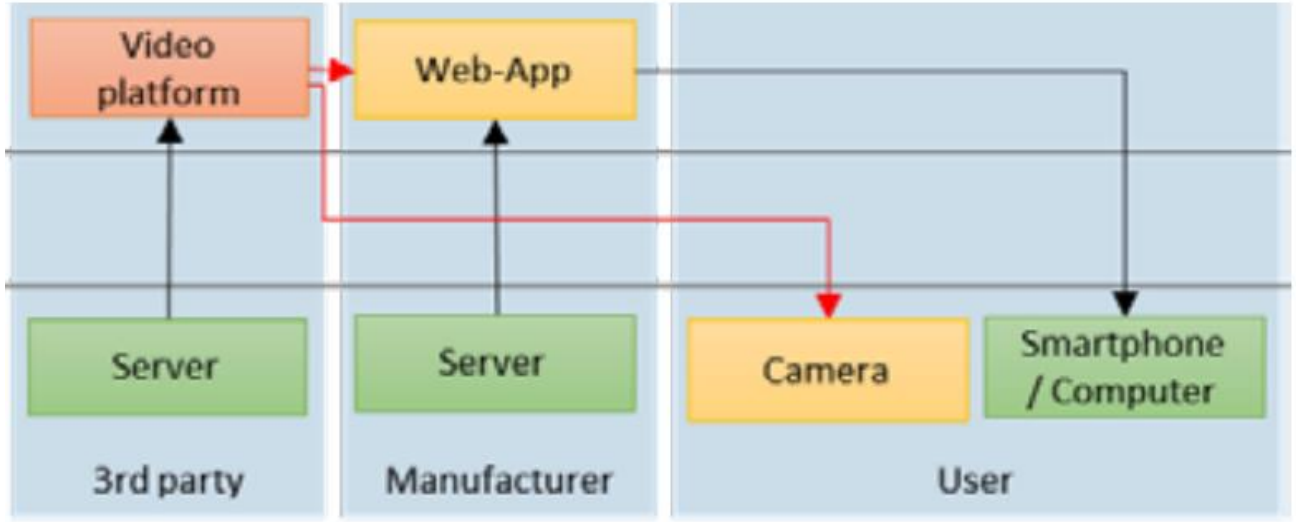


Incompatibility obsolescence (also called functional obsolescence): when the product no longer works properly (loss of functionalities / degradation of performance) due to lack of interoperability of software and/or hardware.

Software related obsolescence



“Belkin - Wemo NetCam” case study



The use of the camera is bounded to the use of a specific video-streaming platform to remotely monitor live video from security cameras.

The shutdown of the third party security video service platform (iSecurity cloud) caused the obsolescence of the entire product system

Source: Wagner et al. 2020

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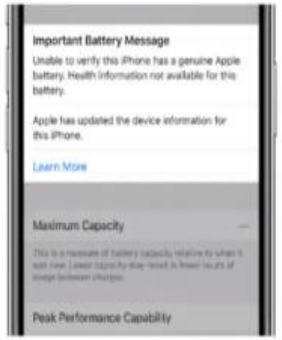
Parts pairing

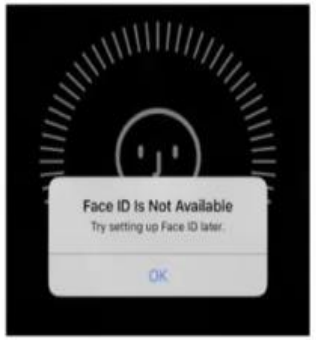
It is made possible by serialisation of some spare parts, which is paired by manufacturers to an individual unit of a device using software.

Allows manufacturers of smartphones and other electronic products to control who can perform certain types of repairs (in particular replacement of hardware components).

Screen



Battery



Face ID

Touch ID

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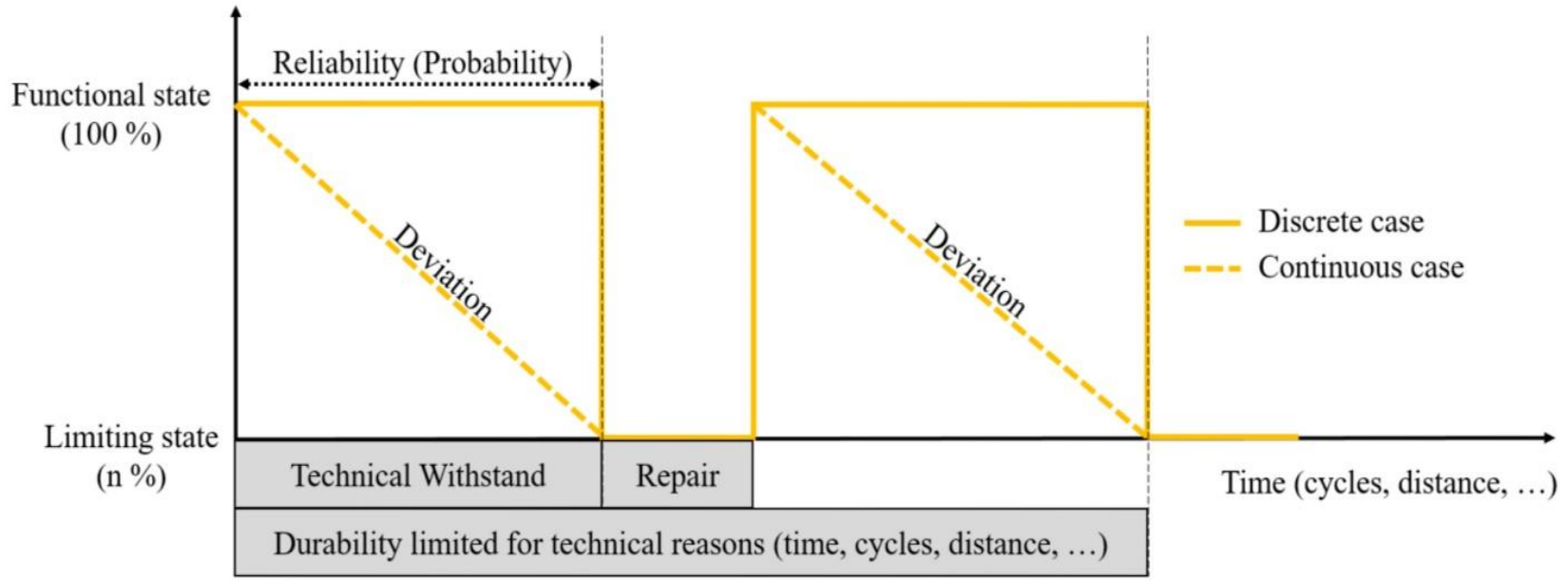
3. Material efficiency strategies

Strategies for lifetime extension



Relationship between reliability, repair and durability (adapted from EN 45552:2020).

Reliability requirements in product policy

Product group	Reliability aspect
Smartphones and tablets (proposals for reliability requirements).	Scratch Resistance
	Resistance to accidental drops
	Ingress Protection
	Battery endurance in cycles
	Instruction for battery maintenance
EU green public procurement criteria for computers, monitors, tablets and smartphones SWD(2021) 57 final	Information on battery state of health
	Battery Protection Software
	Intelligent Charging
Servers and data storage products Commission Regulation (EU) 2019/424	Information on Operating Condition Classes (temperature and humidity)

Firmware / Software updates

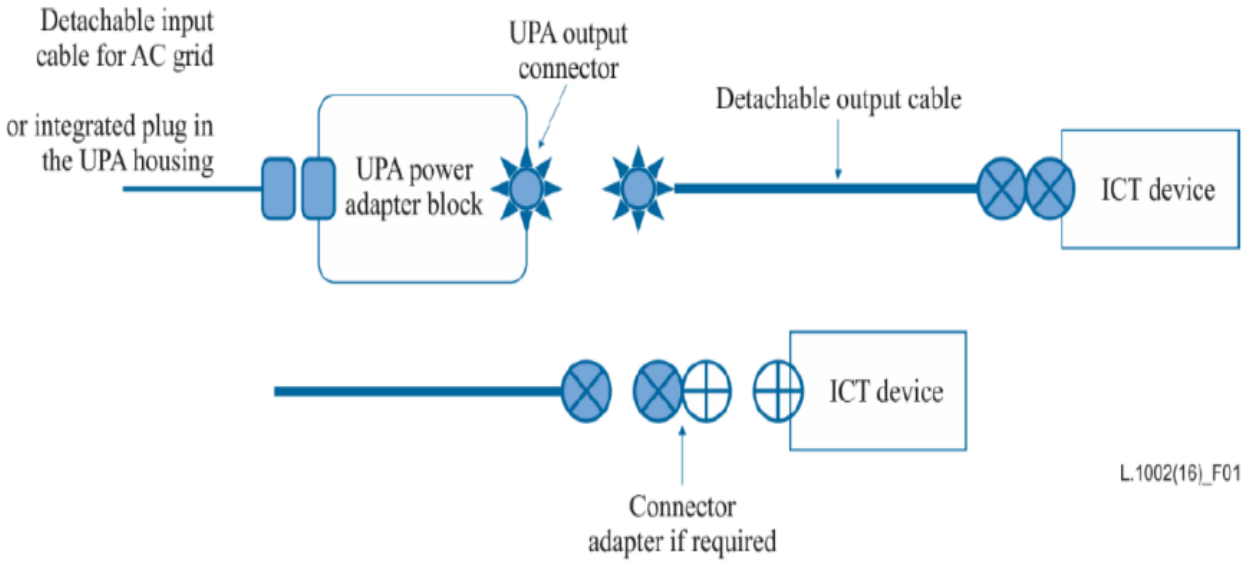
Product group	Software Aspect
Electronic Displays (Commission Regulation (EU) 2019/2021) **Servers and data storage products (EU) 2019/424**	Firmware and safety updates shall be made available for a X years after the placing on the market of the last unit of a certain product model
Electronic Displays (Commission Regulation (EU) 2019/2013	Info. on minimum guaranteed availability of software and firmware updates, and of product support more generally
Smartphones and tablets (proposals for reliability requirements)	Minimum requirements for the availability of software functionality / security updates Software updates to be available after maximum X months from the release of an update of the underlying operating system.

Reparability / Upgradability

Product group	Reparability / upgradability aspects
Servers and data storage products **Commission Regulation (EU) 2019/424**	Easy of disassembly of key components:
Electronic displays **Commission Regulation (EU) 2019/2021**	Availability of spare parts; Access to repair and maintenance information; maximum delivery time of spare parts
Smartphone and Slate Tablets (proposals)	Availability of spare parts Access to repair and maintenance information Maximum delivery time of spare parts information on maximum expected price of spare parts disassembly requirements including types of tools, fasteners, working environment and skill level Combination of the previous factors + additional factors in a overall score to score the reparability

Modularity and Interoperability

Product group	Interoperability aspect
Proposal for Common Chargers for mobile phones, tablets, digital cameras, headphones or headsets, handheld videogame consoles, portable speakers, *e-readers, keyboards, mice, portable navigation systems, earbuds and laptops*.	Common charger: harmonised charging port; harmonised fast charging technology; unbundling the sale of the charger from the sale of the electronic device; improved information for consumers.



DC Cable is the weakest element of the system

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Reusability

Product group	Reusability aspect
Servers and data storage products **Commission Regulation (EU) 2019/424**	Functionality for secure data deletion shall be made available for the deletion of data contained in all data storage devices of the product.
Smartphone and slate tablets (proposal)	The devices include a software function, that resets the device to its factory settings and erases securely by default address book, text messages and call history; Information that data encryption is enabled by default shall be displayed in the course of configuring a new device, including an explanation that this eases data erasure through factory reset;

Design for remanufacturing

Design strategies
Improve the ability to be identified of products/parts
Ability to locate access points and fasteners
Accessibility of parts
Ability to be disassembled/assembled
Wear and damage resistance during the remanufacturing process steps

Design strategies relevant for remanufacturing according to the EN45553:2020

Recyclability

Guideline and design strategies
Use common plastics in the product such as ABS, PP, PA, PC, PC/ABS, HIPS, PE (polyethylene), where possible.
Avoid polymer blends.
Avoid glass fibre-filled plastics.
Minimise the use of thermoplastic elastomers
Avoid the use of thermoset rubbers
Minimise additives in plastic materials.
Avoid thermosets and composites.
Do not use plating, galvanizing, and vacuum-metallization as a coating on plastics.
Avoid the use of coatings on plastics.
Minimise the use of thermoplastic elastomers.
Avoid the use of foam.
Minimise the use of magnets.

Guidelines and design strategies for the use of recyclable materials that will be recycled by WEEE recyclers (H2020 project PolyCE)

4. User behaviour survey

Demographics

- 7 EU Countries (Germany, France, Hungary, Italy, Poland, Spain and Sweden); 1000 per country
- Age: consumers aged 18-34, 35-49 or 50+
- Different level of digital competence
- Different profile of use (streaming)

Product group scope

- Laptops
- Smartphones
- Tablets
- Smart TVs
- Gaming consoles

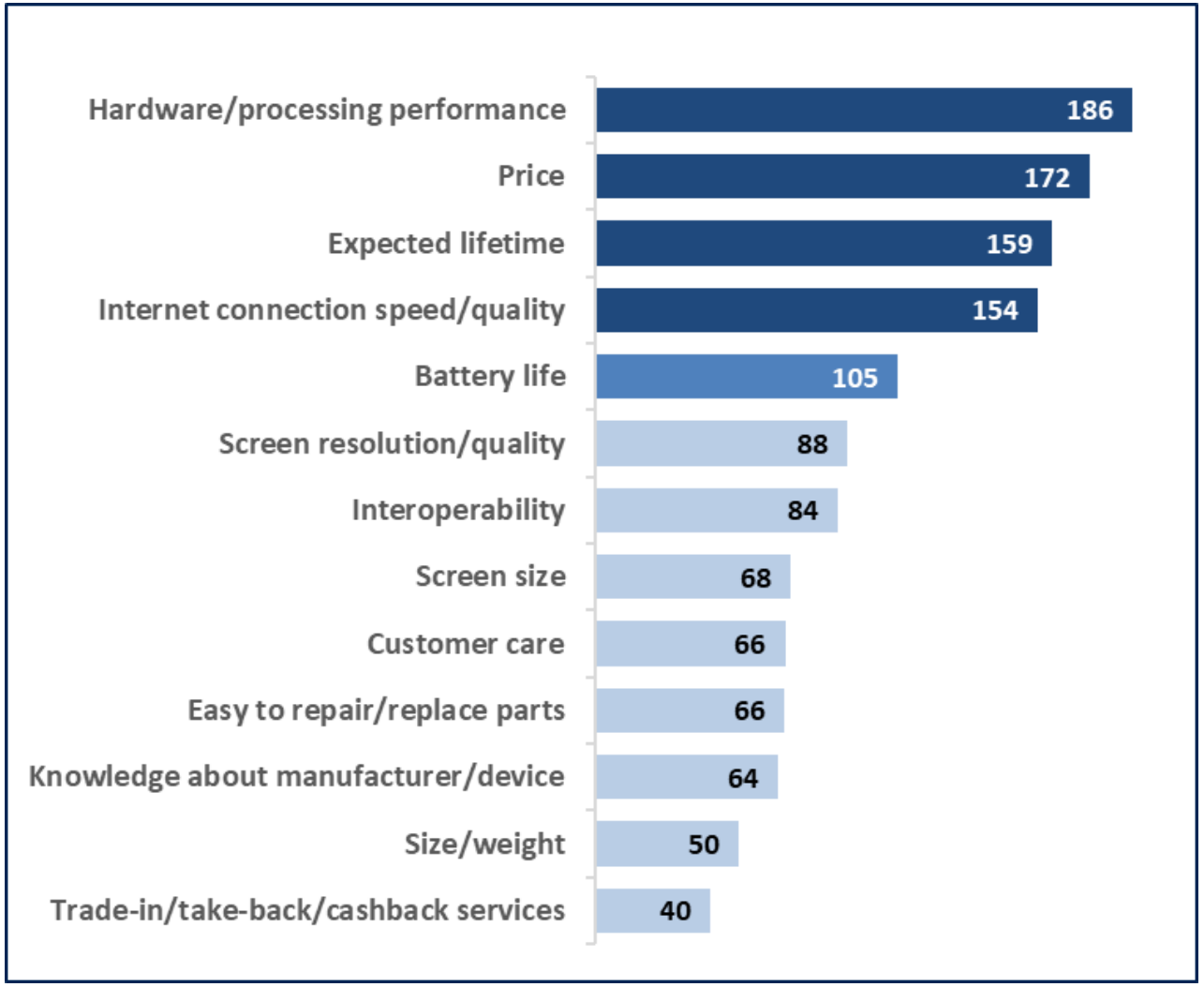
Subject scope

1) **Factors that affect purchasing decisions**

2) **Use behaviour of consumers, particularly on streaming**

3) **Motivation to replace their device**

Factors when buying a laptop



MaxDiff (Maximum Difference Scaling) approach –

Factors affecting purchasing decisions

Performance characteristics

factor	Laptop	Smartphone	Tablet	Smart TV	Gaming console
Hardware performance/processing speed	1	6	2		2
Battery life	5	2	5		
Storage space		4			
Internet connection quality/speed	4	5	3	6	4
Media platform/apps availability					5
Screen resolution	6	8	6	2	
Screen size	8	9	7	4	
Camera		7			
interoperability	7	11		7	
Total number of factors measured	13	15	12	11	9

Environmental characteristics

expected lifetime	3	3	4	3	3
Energy label class				5	
easy to repair / replace parts	10	12	9	10	7
customer care	9	14	10	8	8
Trade-in/take-back/cashback	13	15	12	11	9
Total number of factors measured	13	15	12	11	9

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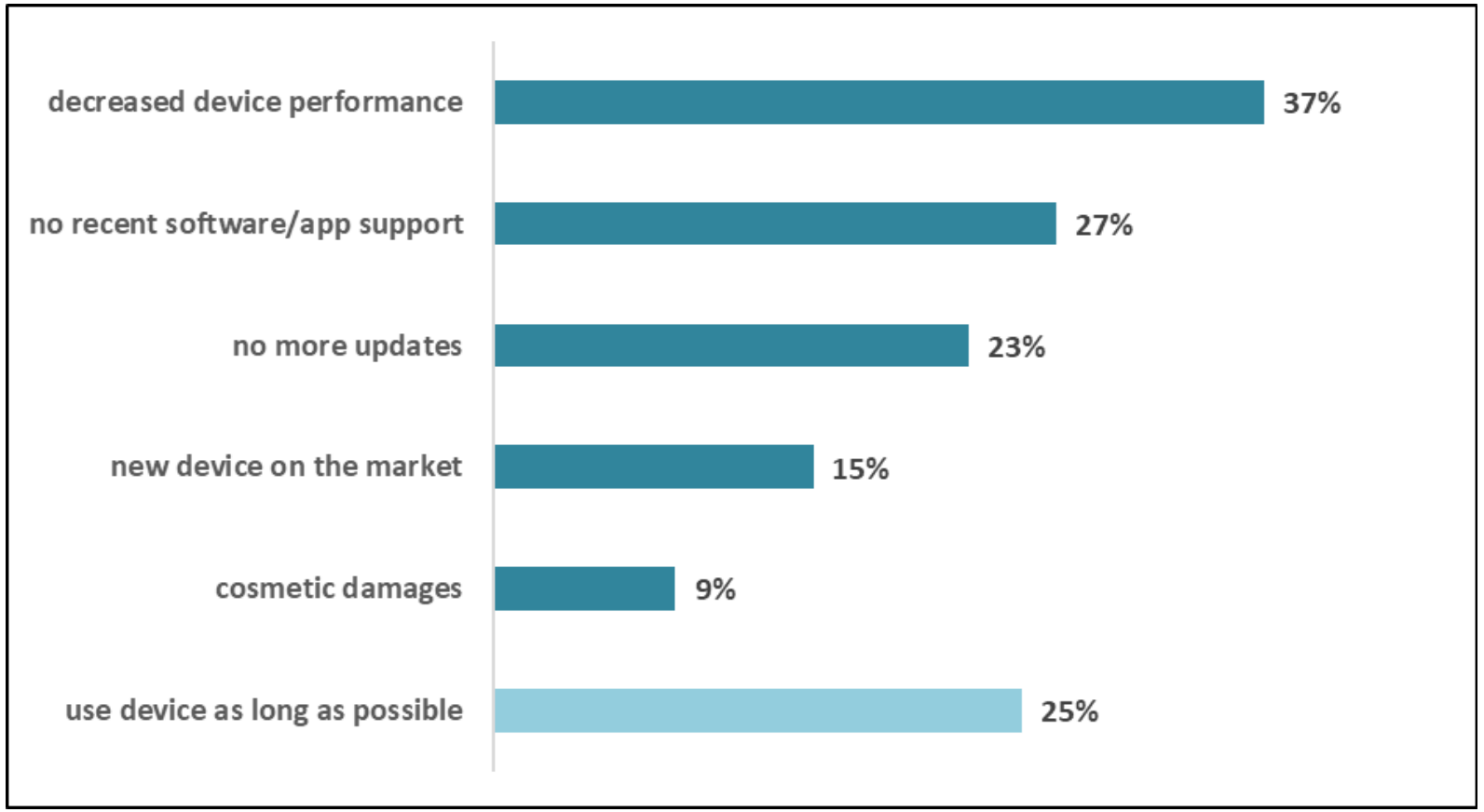
Reasons for replacement

Why and when consumers would envisage to replace their device (and whether different attitudes towards device replacement result in different expected use lengths)

Laptops



Very similar results for *Smartphones* and *Tablets*

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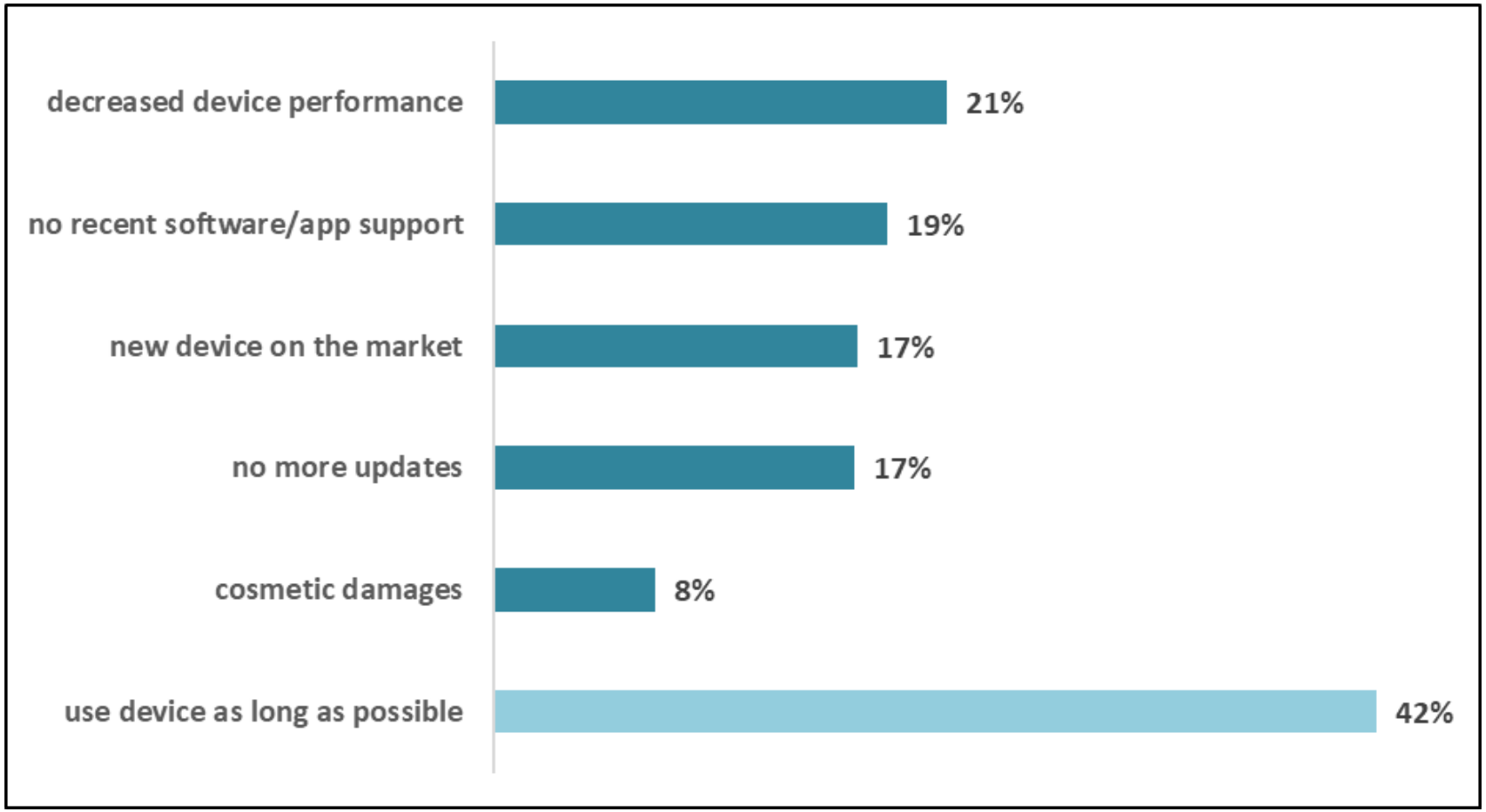
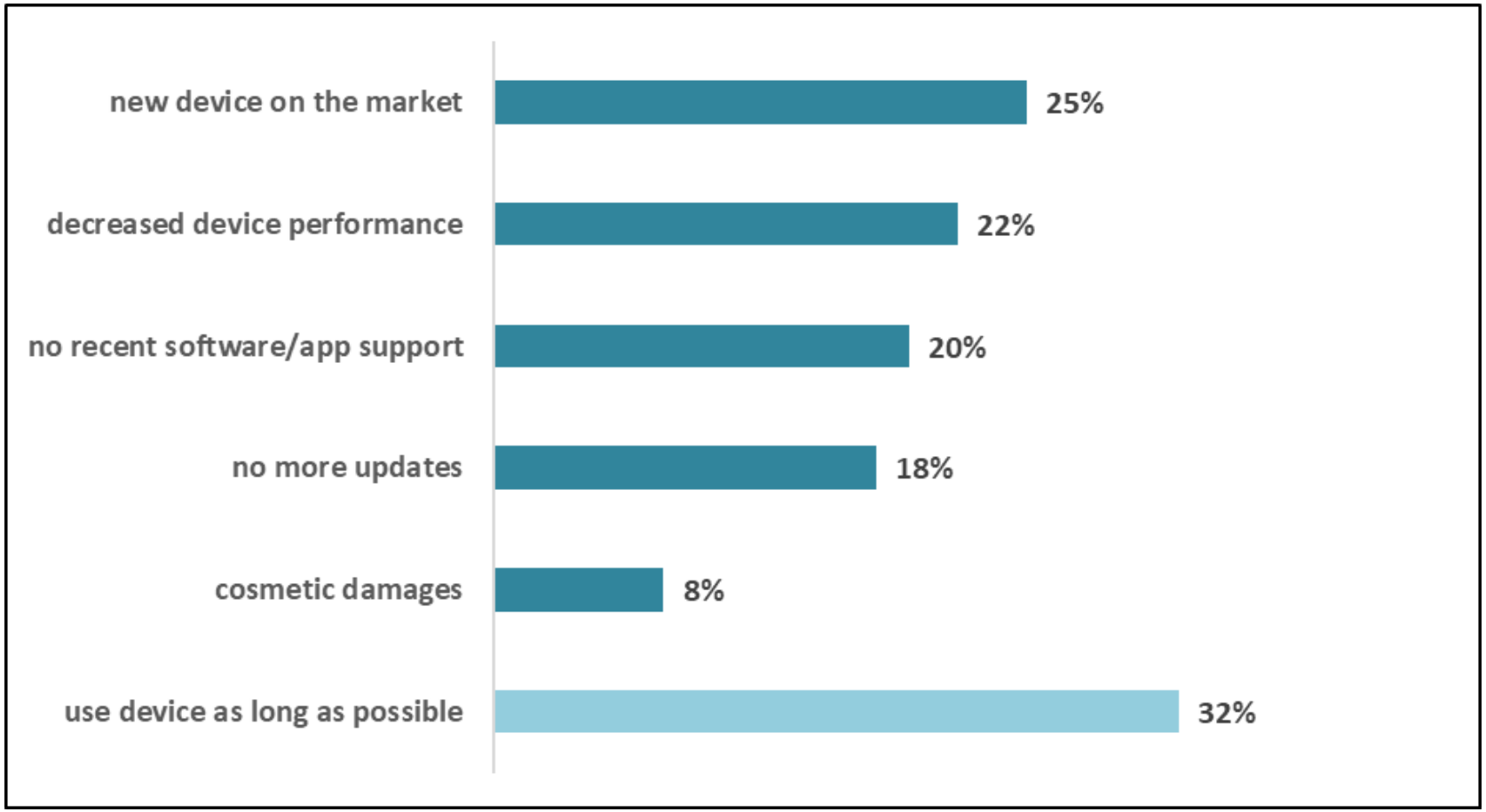
Smart TVs

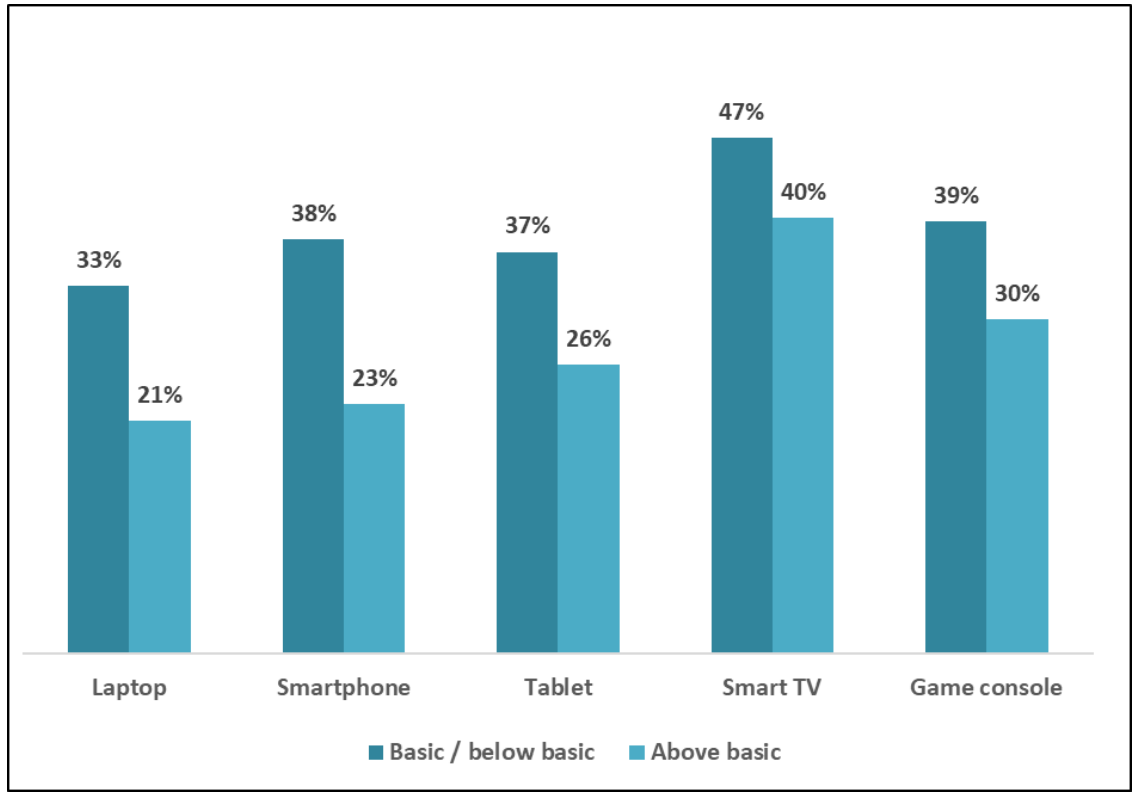

decreased device performance
21%
no recent software/app support
19%
new device on the market
17%
no more updates
17%
cosmetic damages
8%
use device as long as possible
42%

Game consoles

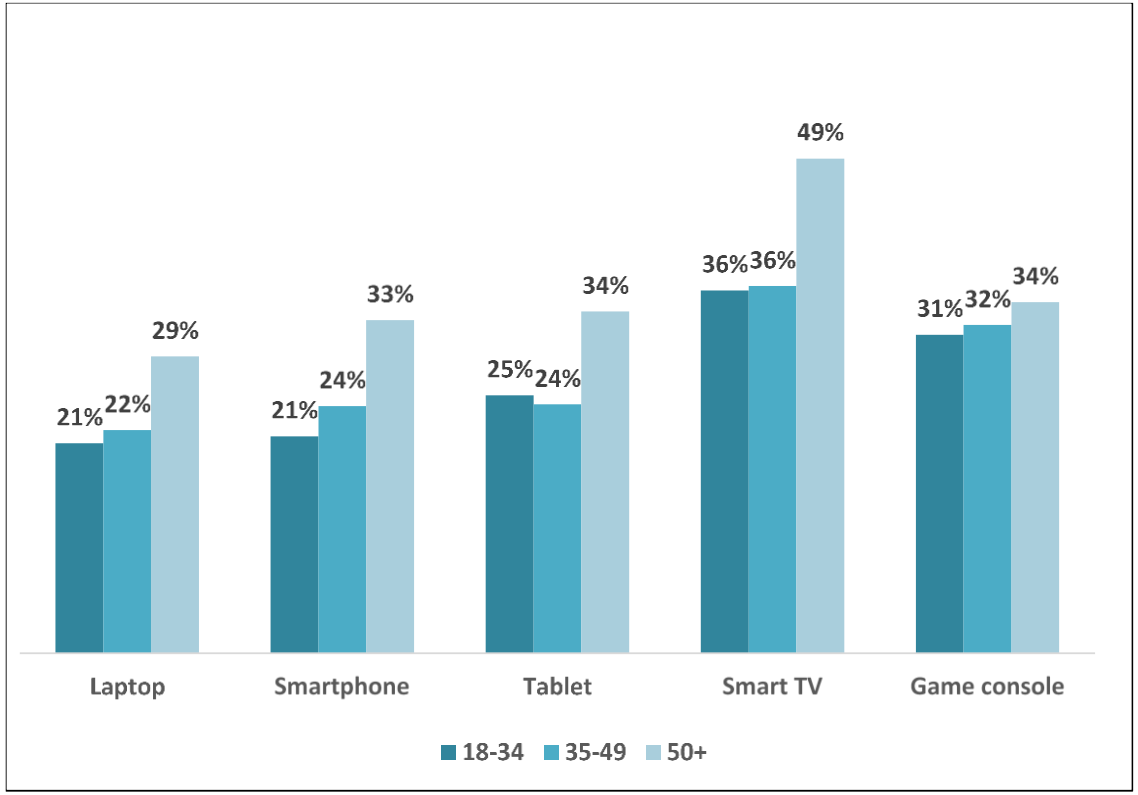


Using device as long as possible

(per digital competence level)



(per age group)



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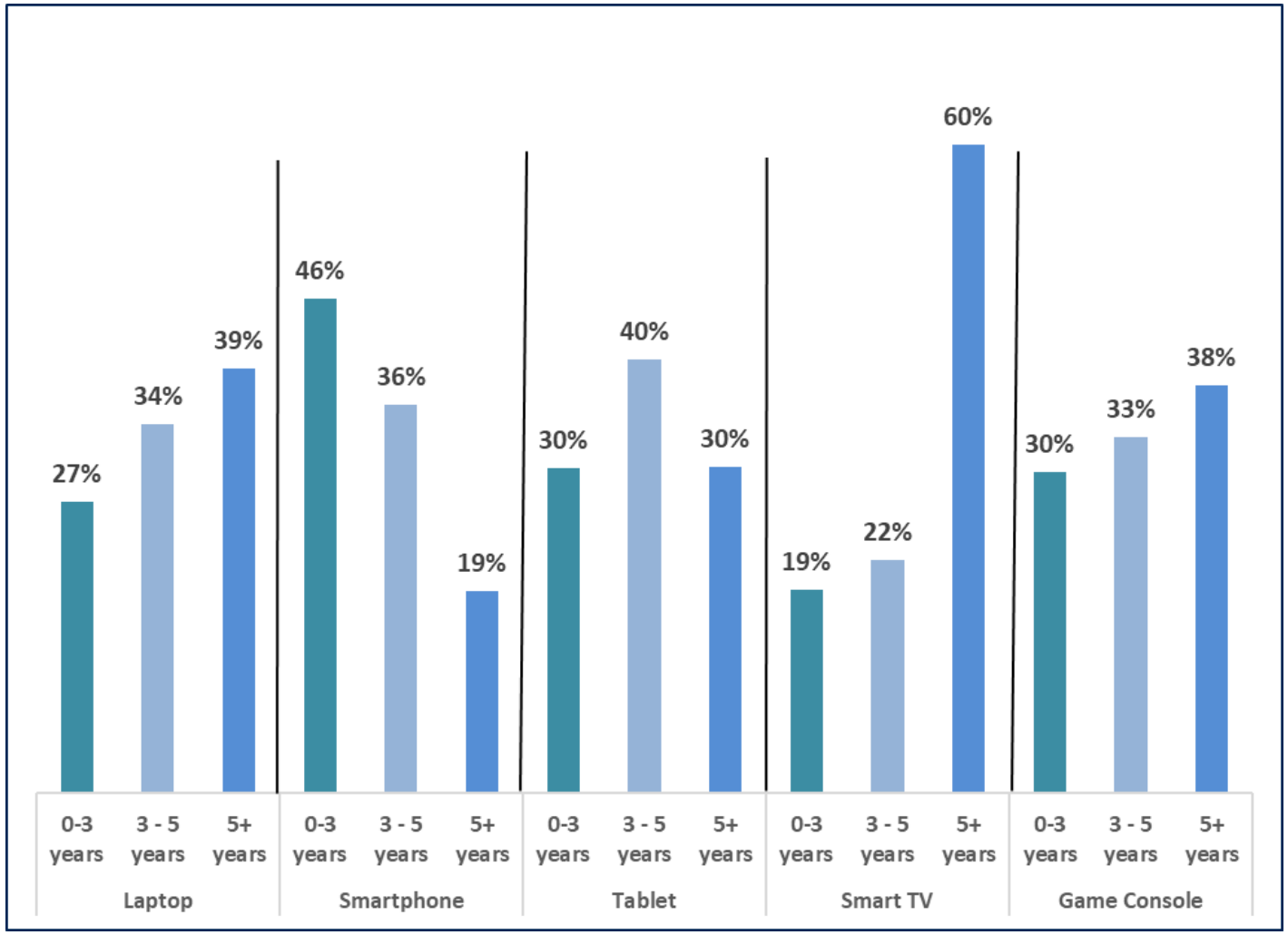
Expected use length



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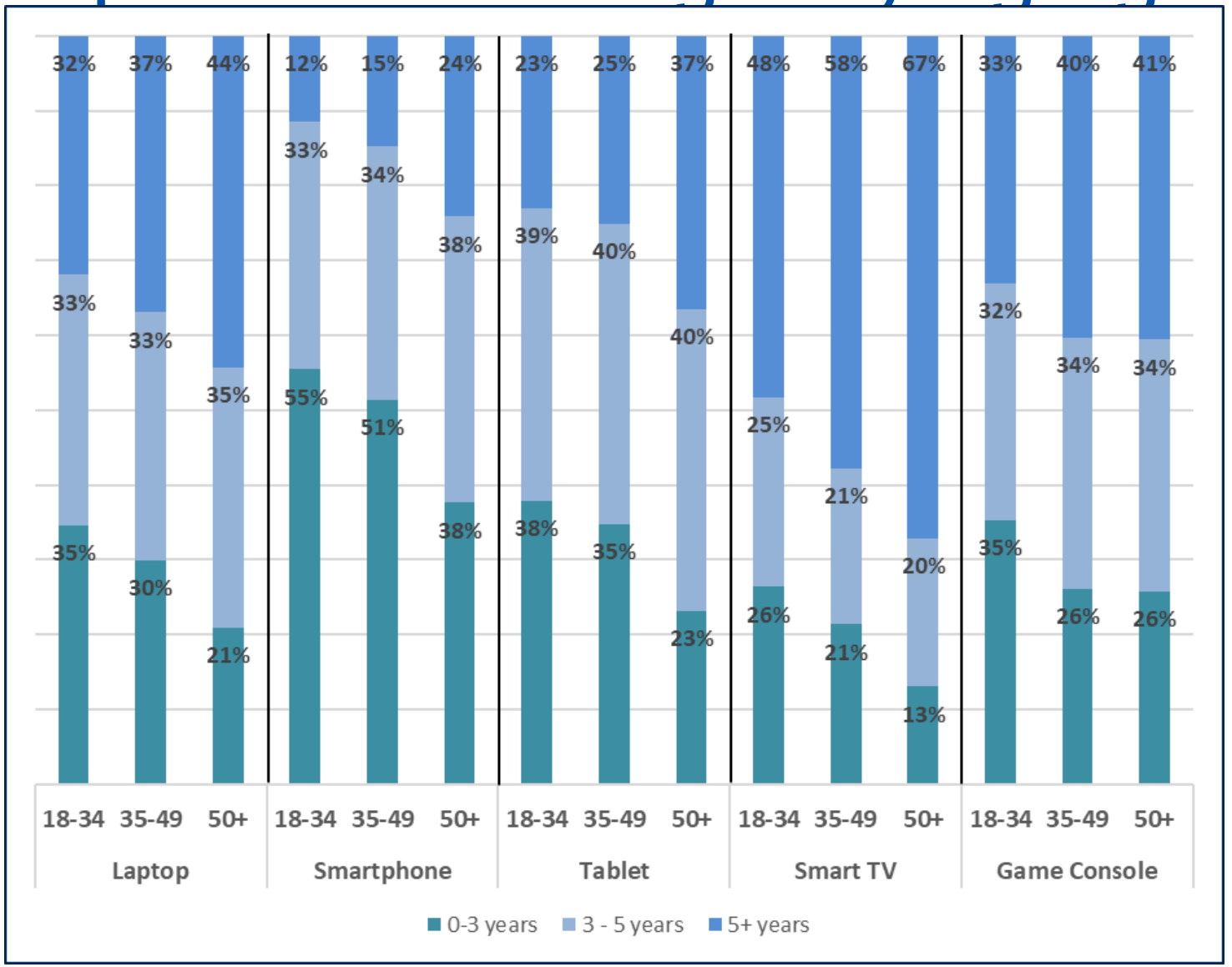
Expected use length by age group



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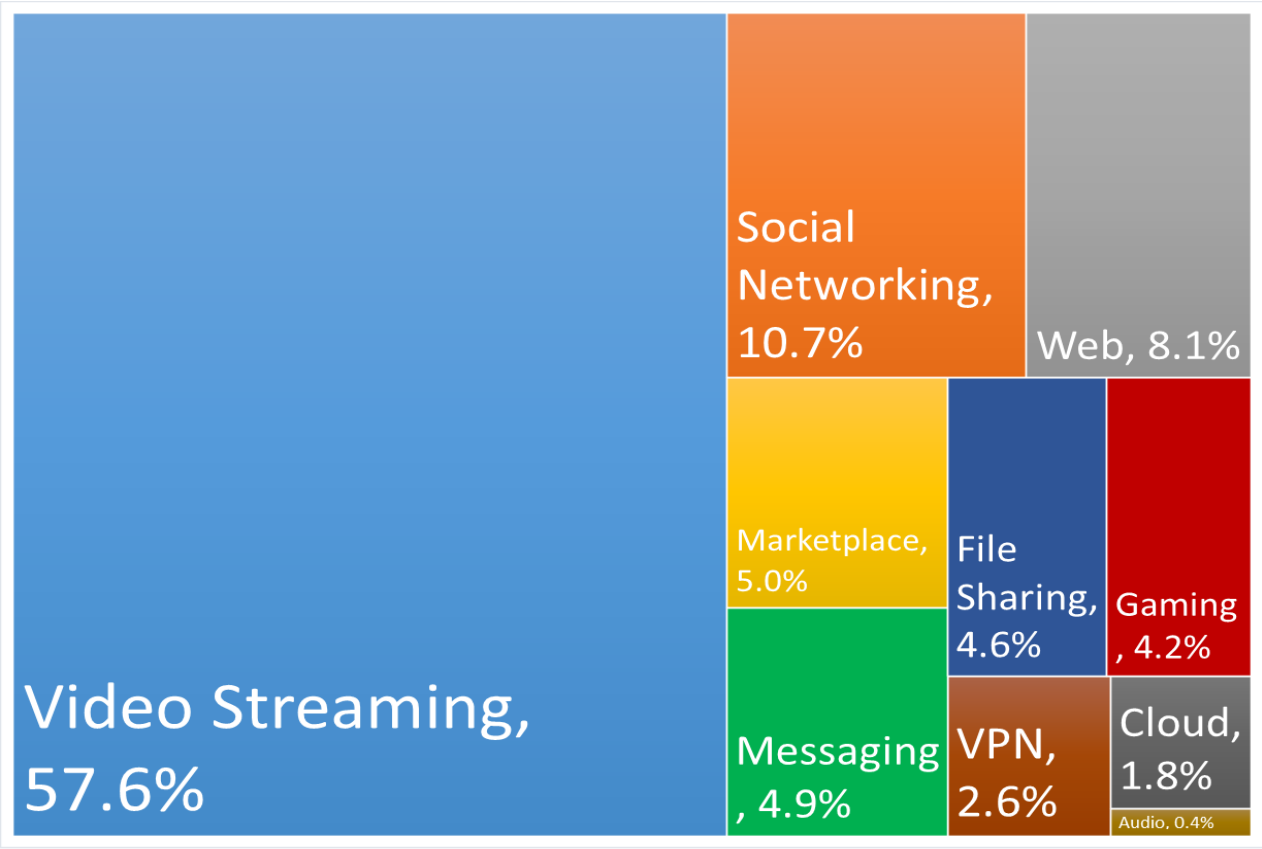
Streaming behaviour

- **How often** consumers engage in **various streaming activities** and **how much time** they spend on these activities.

- Consumer preferences when it comes to the **connection type** to use when streaming (ethernet/WIF vs. a mobile connection)

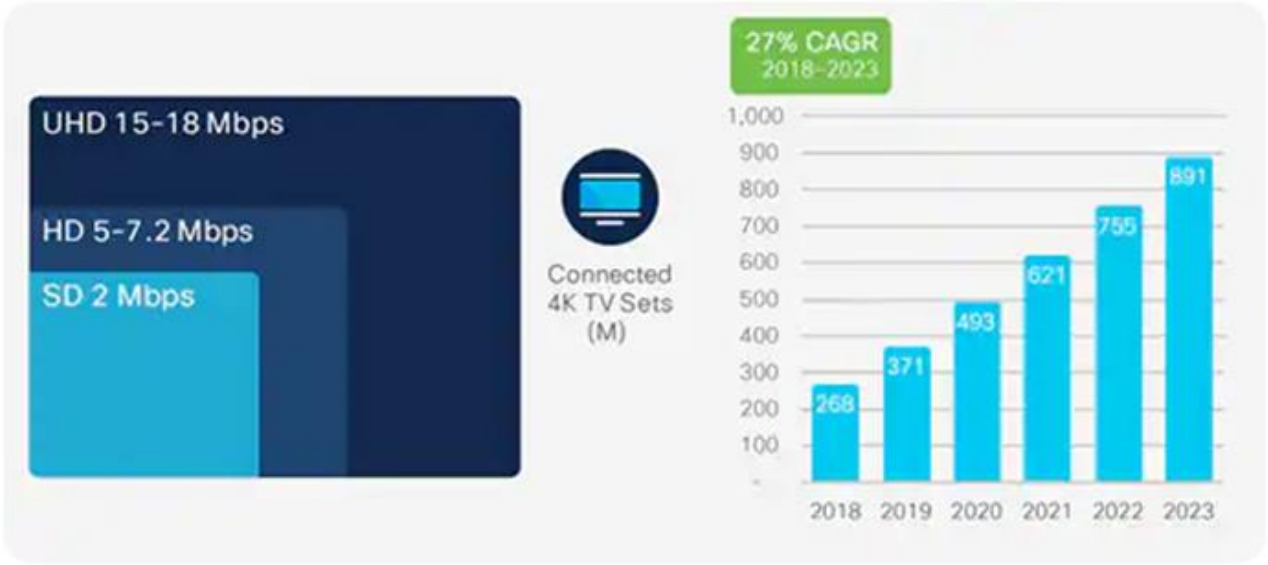
- The **video quality** of the content they stream

Video streaming and total internet traffic share



Global Application Category Total Traffic Share [data from Sandvine 2020] (Task 3 Report)

Video streaming and trends



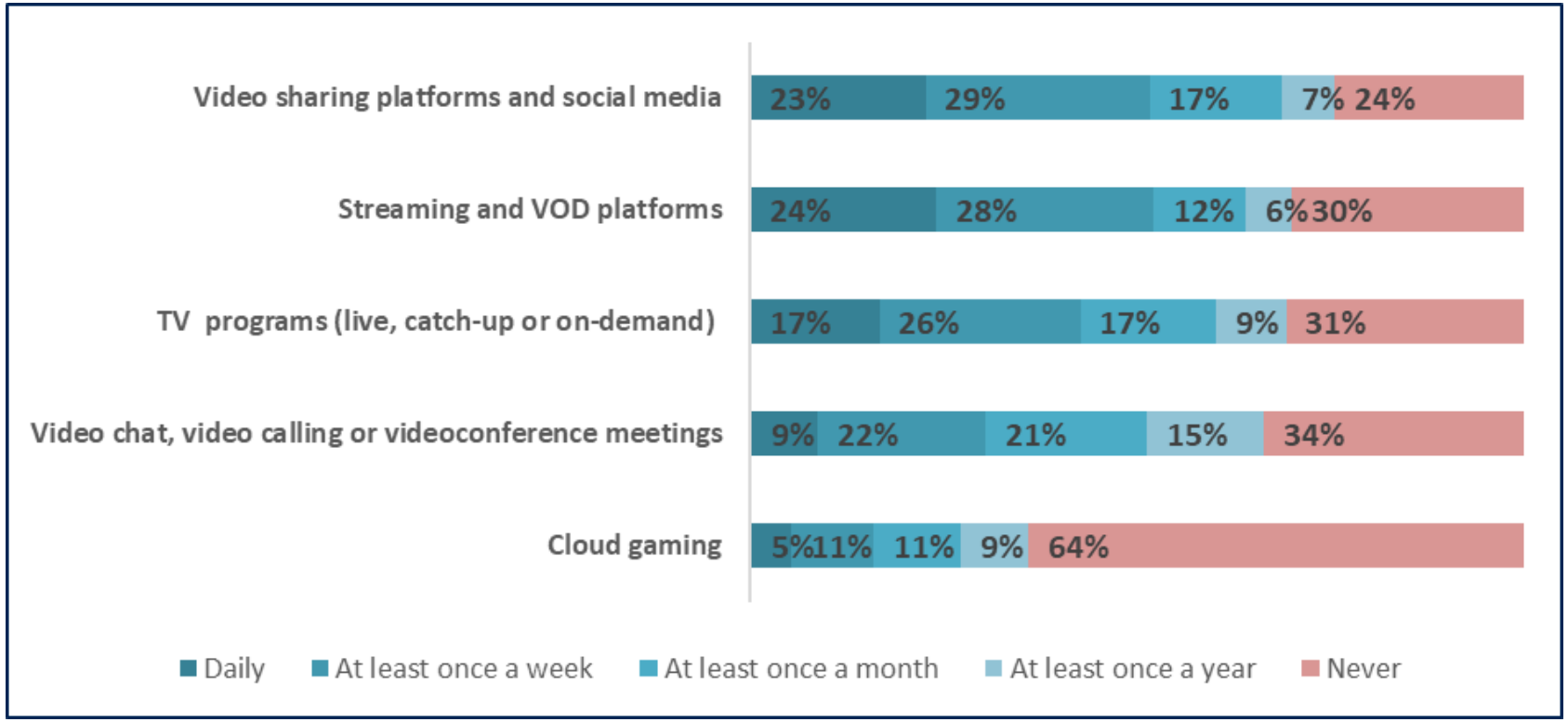
Increasing video definition. By 2023, 66% of connected flat panel TV sets will be 4K. Source: Cisco 2020 (Task 3 Report)

Streaming Behaviour

Five distinct types of streaming activities:

- **Video sharing platforms** (e.g. YouTube) **and social media** (e.g Facebook, Instagram, TikTok)
- Commercial **SVOD/TVOD platforms** e.g. Netflix, Google Play, Amazon Prime, etc.
- **TV programs** streaming from a website or dedicated app (live, catch-up or on demand)
- **Video calls/chats or videoconference meetings**, including online learning activities
- **Cloud gaming** (i.e., playing games via streaming without (fully) downloading them, e.g. via platforms such as PS Now, Xbox Gamepass, Steam Remote Play, etc.)

Frequency of streaming activities by type



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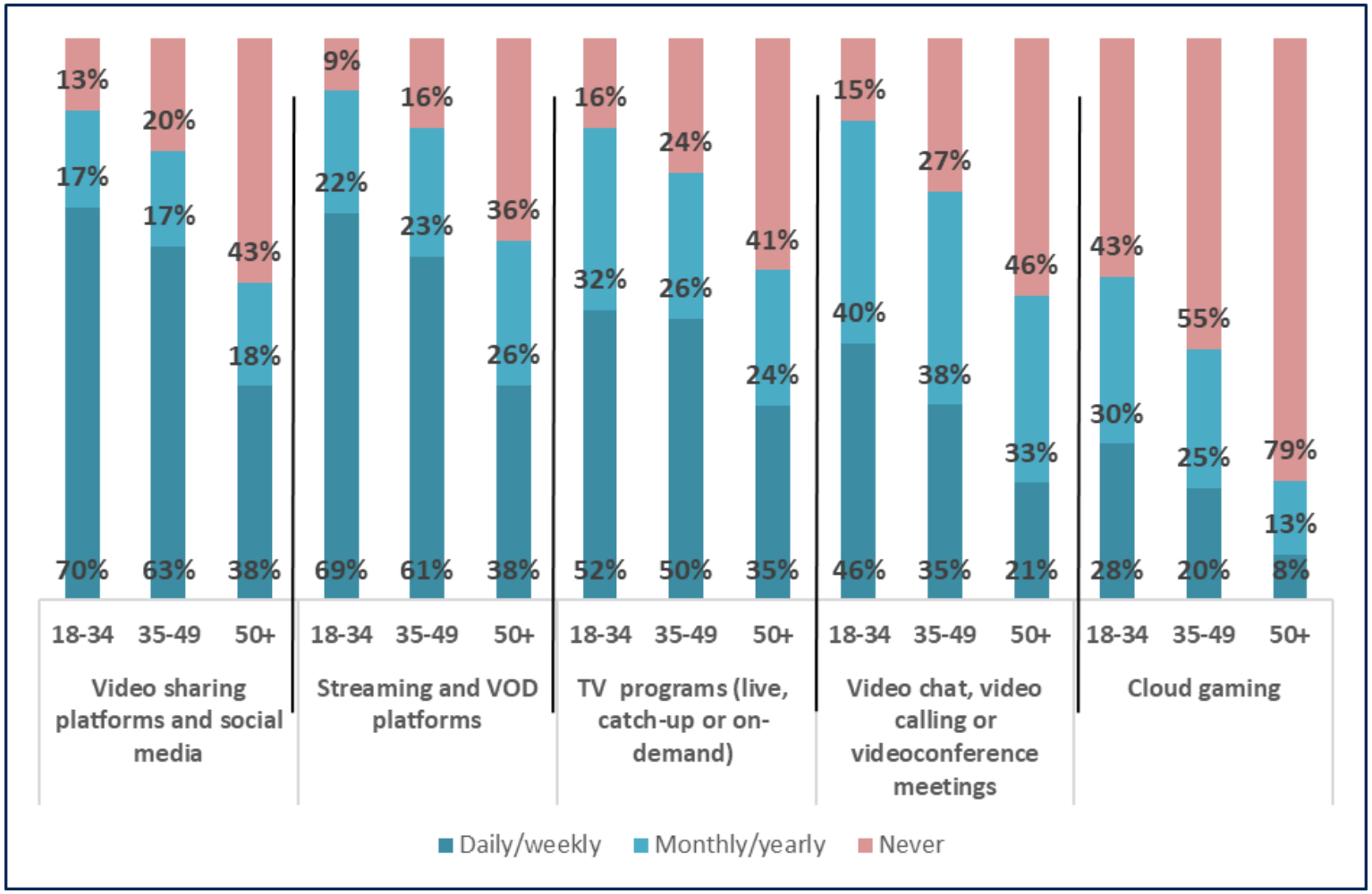
Streaming by age group



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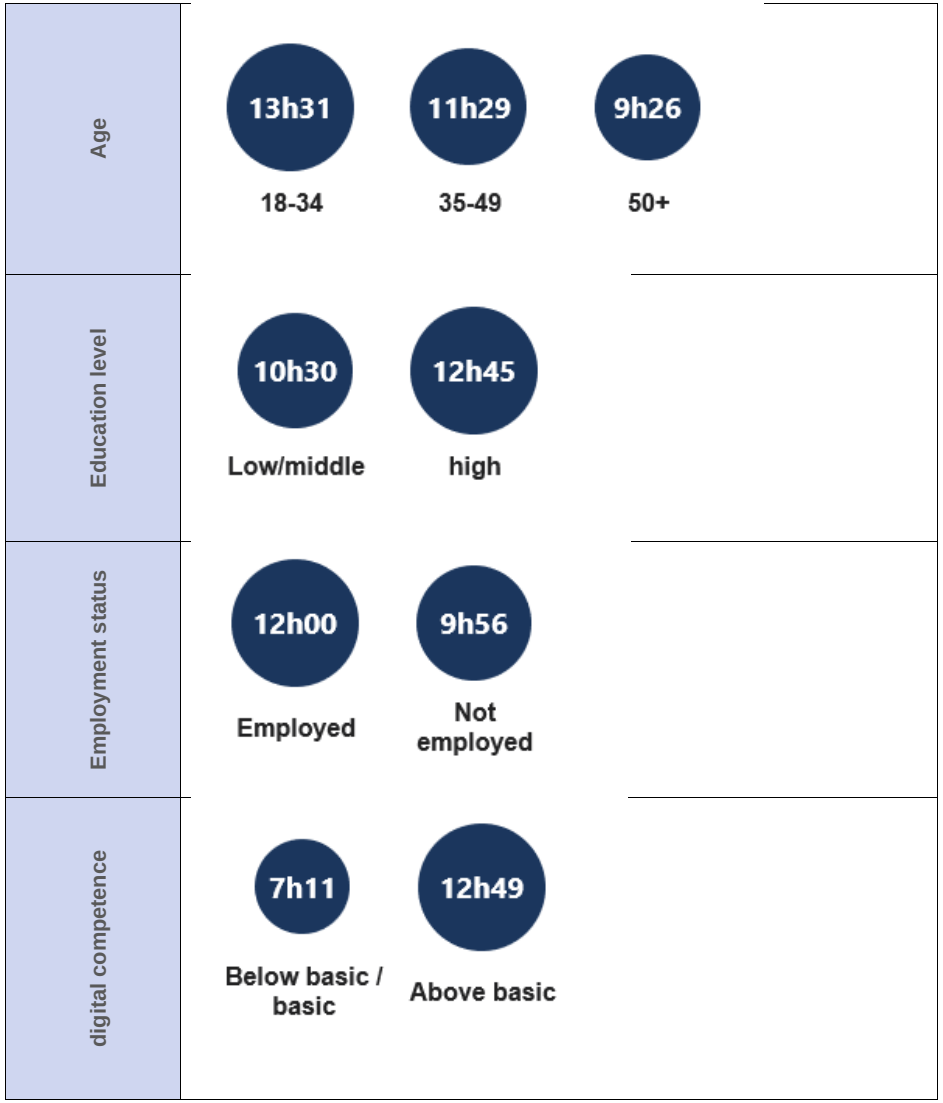
Streaming demographics



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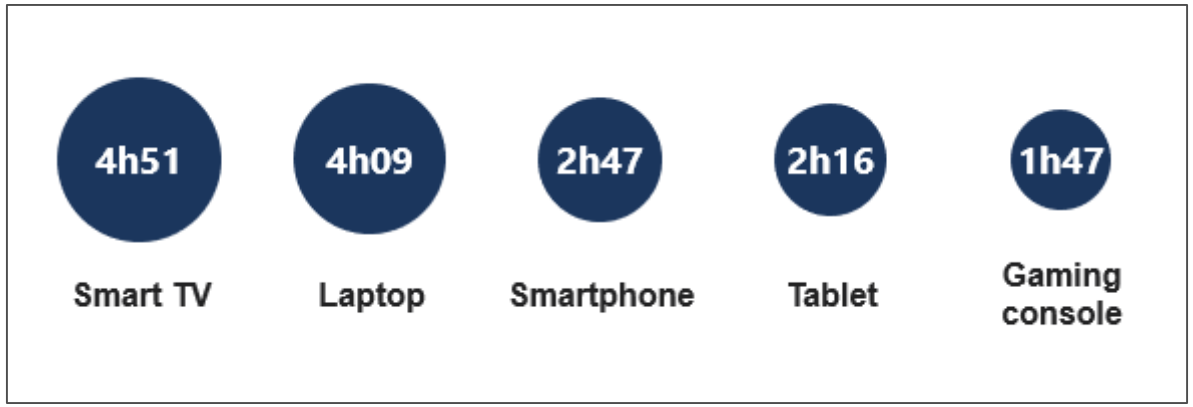
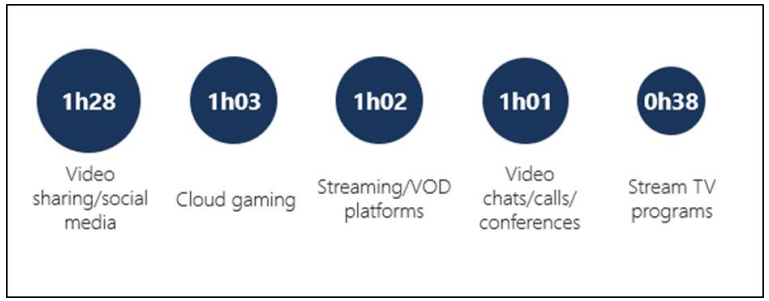
Streaming time per device



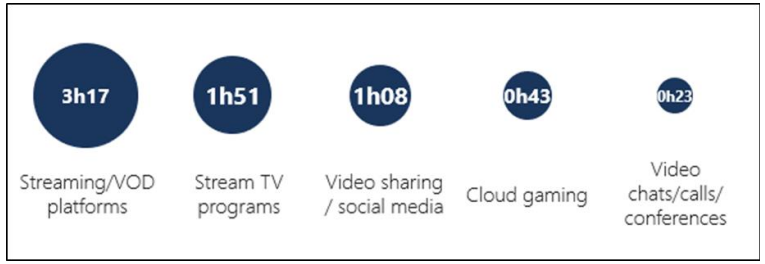
Laptops

Smartphones

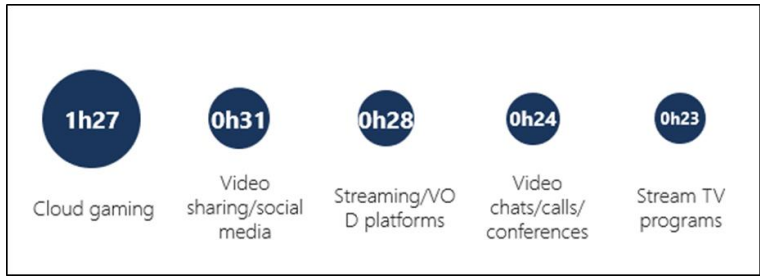


Tablets

Smart TV



Game Consoles



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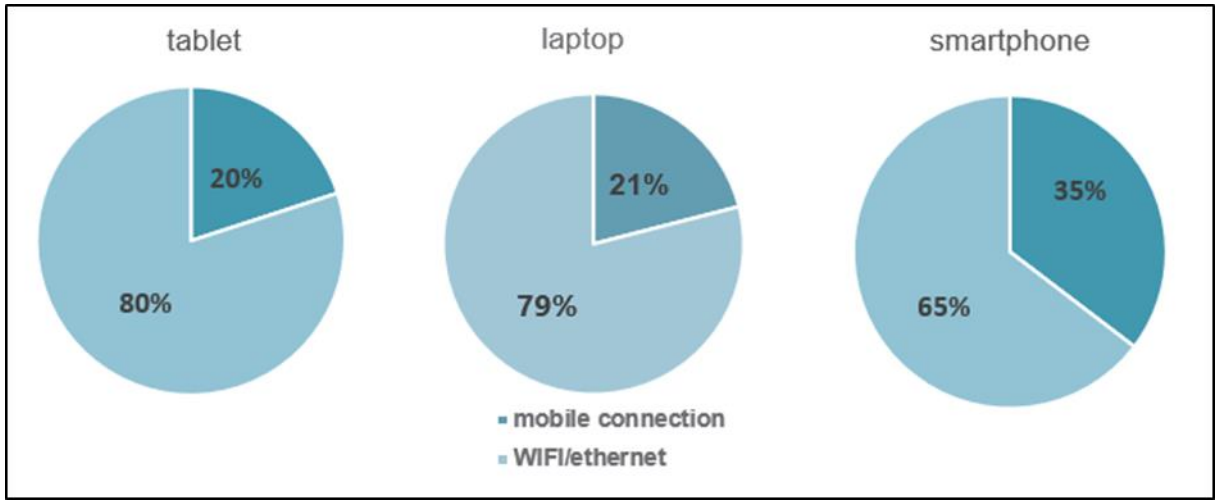
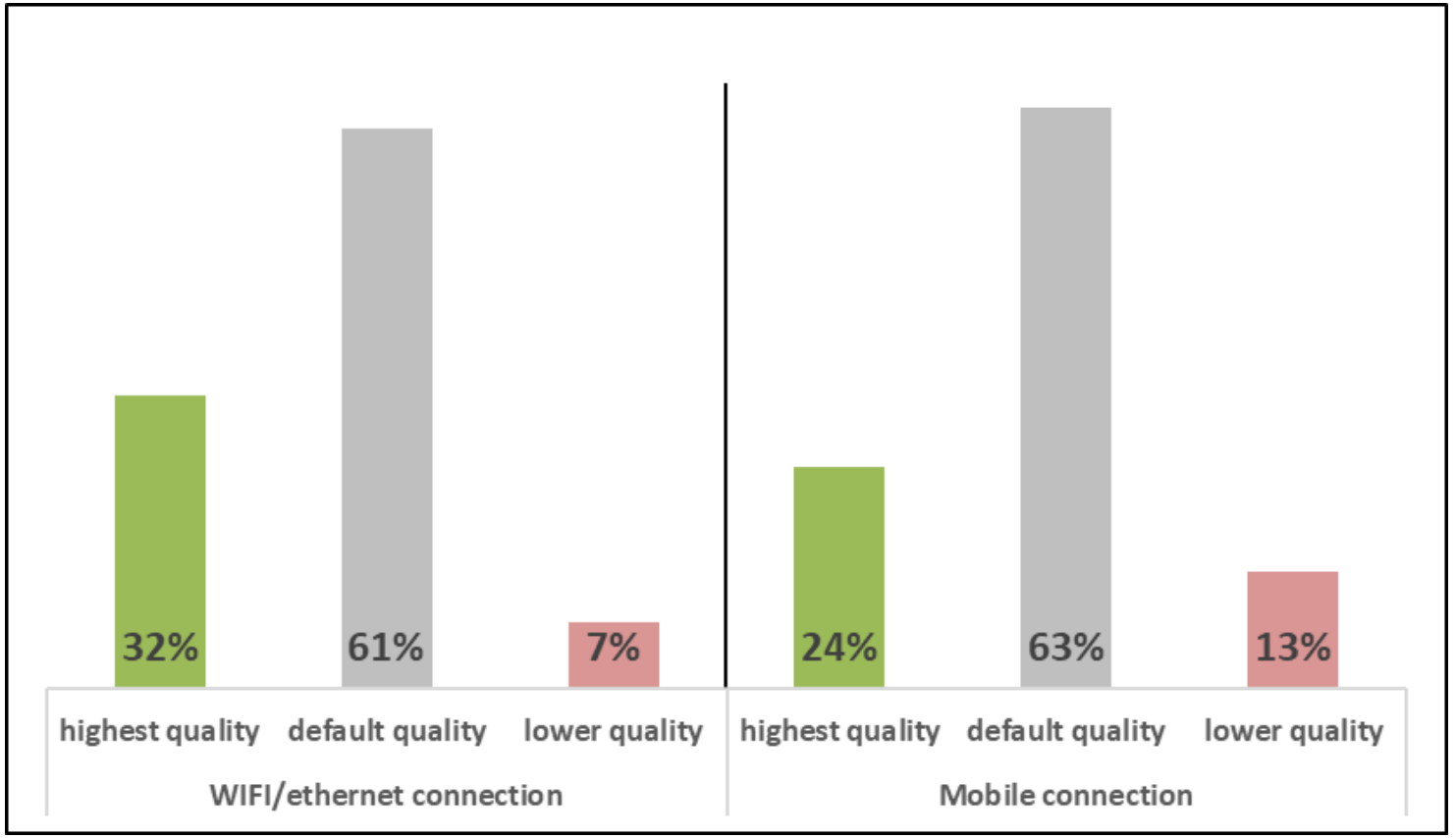
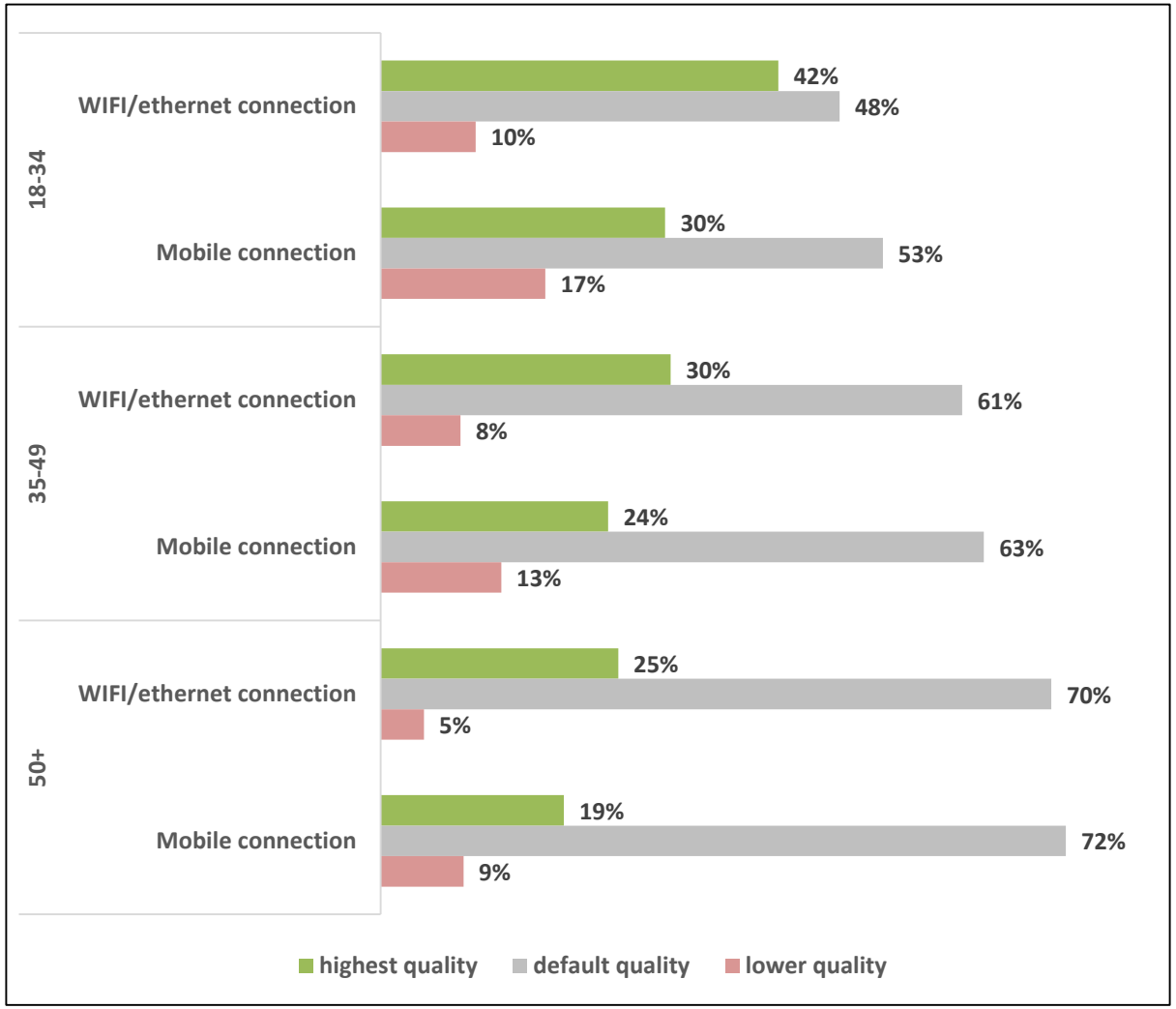
Connection types used for streaming



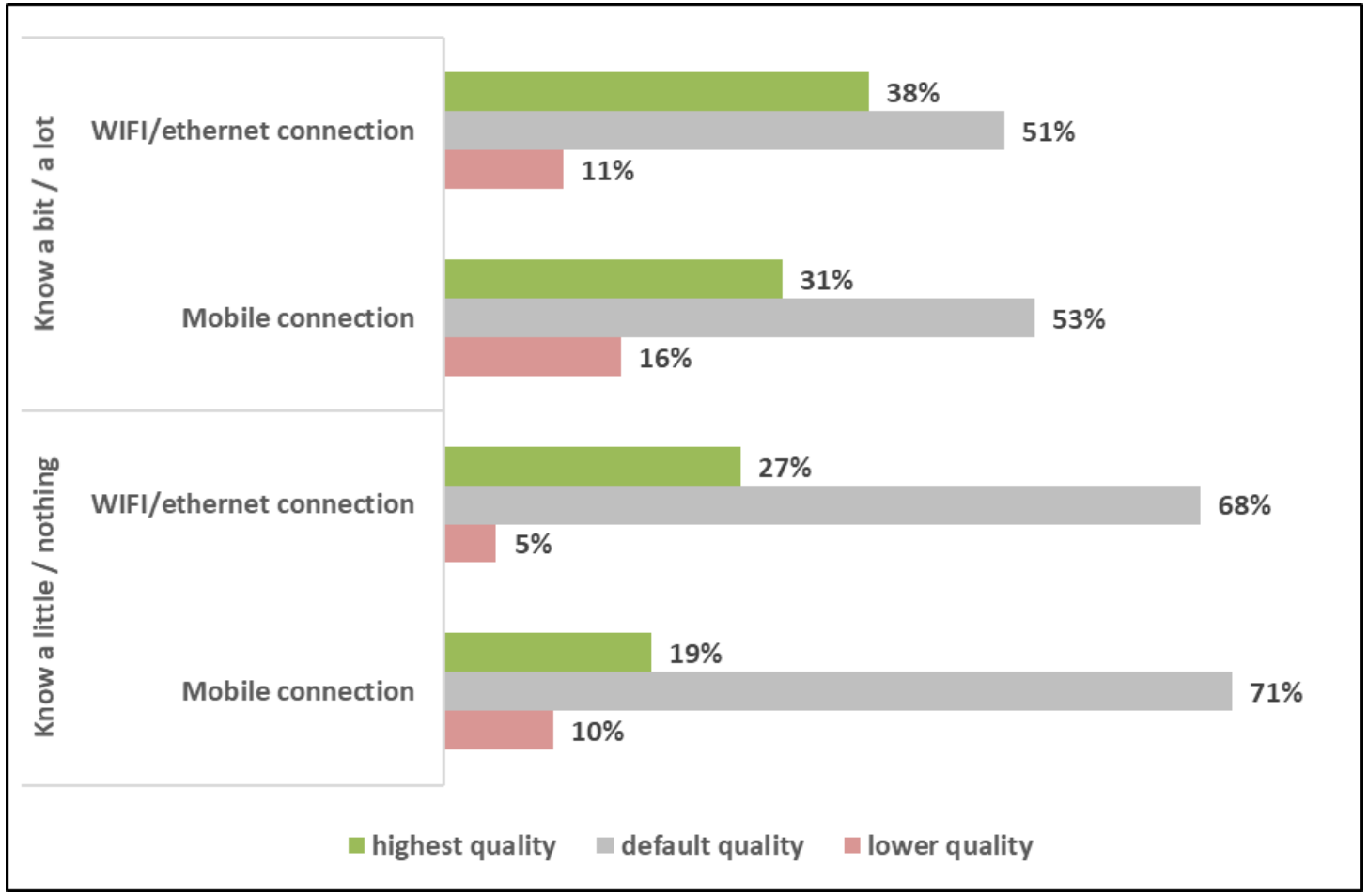
Quality preferences



Quality preferences and age groups



Preferred video quality settings and streaming impact knowledge



Thank you

Project Website:
https://susproc.jrc.ec.europa.eu/product-bureau//product-groups/522/documents

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Thank you

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