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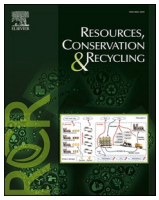

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Laptops at work: The laptop user as a stakeholder in organizational ICT circularity

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ABSTRACT

Laptops in the current economy most often fall short of their potential useful lifetimes, regularly being replaced before their true end-of-life. Increasing laptop lifetimes can play an important role in improving circularity for high-impact ICT equipment. We expand on existing literature about consumer behavior toward laptop lifetimes by examining the role of individuals who use laptops that are instead owned by their company. A total of 20 semi-structured interviews with company-owned laptop users revealed distinct differences in laptop lifetime perspectives when the user is not the owner of the laptop relating to prioritization of performance over circularity, limited feelings of attachment, ownership, and responsibility for company-owned laptops, influences of company culture on circularity, influences of personal habits and perspectives, and limited consideration of circularity without prompts from the employer. Organizations and legislators can use these results to develop tools such as digital product passports that increase organizational circularity for ICT.

1. Introduction

Electrical and electronics equipment (EEE) contributes to quality of life, access to information, social connections, and business efficiency (Beardsley et al., 2010; Schweer and Sahl 2017). However, growth in electronics production and electronic waste (e-waste) generation presents societal challenges to sustainability (Baldé 2024). The European Union's (EU) Circular Economy Action Plan (CEAP) puts special focus on resource use for EEE and information and communications technology (ICT) and their high potential for circular interventions through circular design, more efficient recycling, and increasing lifetimes of existing products.[1]

In comparison to other EEE categories, laptops have especially short lifetimes. For example, the average laptop lifetime is estimated at 4–5 years (Baldé 2020; Bakker et al. 2014; Woidasky and Cetinkaya 2021), while a 7 year lifetime is desirable environmentally (Bakker et al. 2014). Short laptop lifetimes are exacerbated by user behavior (e.g., lack of repair or reuse) (Bakker and Schuit 2017; Woidasky and Cetinkaya 2021). To increase laptops' lifetimes, it is important to understand how perceptions and behaviors of those purchasing, using, and disposing of laptops affect circularity. Current literature has explored how consumers perceive and adopt circularity in their own products and under which conditions they are more likely to adopt these (e.g., Bigliardi et al. 2022; Boyer et al. 2021; Wallner et al. 2022; Wang et al. 2020). However, these circularity perceptions and behaviors are based on their own products and are thus likely to differ for products that are purchased, owned and maintained by the organizations that they work for. The employees' perceptions and behaviors concerning circularity of laptops has thus far remained a gap in the literature. This is noteworthy as the business-to-business market represents a significant base of laptop users with the potential to make big circular impacts.

The studies that did investigate organizations' ICT circularity explored procurement and upper-level decision-making for internal lifecycles of organizational ICT equipment (McMahon et al. 2024; Qazi and Appolloni 2022; Kristensen et al. 2021). However, employees using company-owned laptops, and their perceptions' effect on organizational circular decision-making, are understudied. Our research adds a novel perspective to organizations' ICT circularity by investigating these employees' perceptions and behaviors towards their laptops. These laptop users are differentiated from consumers and upper-level organizational decision-makers by the fact that company-owned laptop users are uniquely not the purchaser, and they are not personally responsible for maintenance, nor financially responsible for replacement. Even though at first it may seem that employees have little influence concerning

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[1] https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

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professional laptop choices, past research on organizations' ICT circularity has proposed that employees may push their own preferences (e.g., brand, model, appearance), even though these would be outside of the necessary specifications for their work, which was recognized as a barrier for organizations' ICT circularity (McMahon et al. 2024). Such cultural norms and behaviors can impede circular initiatives demonstrating that employees are a significant stakeholder to investigate.

We examine professional laptop users' perceptions on circular practices, i.e., repairing malfunctioning laptops, using refurbished laptops, or using laptops for extended times. We contribute to the extant literature by 1) expanding insights on ICT-specific organizational change toward circularity and 2) investigating attitudes and behavior regarding circular solutions of company-owned laptop users. These insights can contribute to the development of digital product passports (DPP) for laptops, an important upcoming tool in EU circularity policies.

The remainder of the paper is organized as follows. First, we present a literature review in which we discuss policies for lowering e-waste related to laptops, the role of employees as a stakeholder in organizational laptop circularity, and the importance of individuals in the circular economy. Second, we present the methodology of the in-depth interviews that were conducted with a total of 20 employees. These interviews were coded, resulting in 26 codes and five themes that are presented and discussed in the next section. The paper ends with a conclusion that highlights the importance of the research, its limitations, and managerial implications.

2. Literature review

2.1. Policies for lowering e-waste from laptops

To counter negative impacts of e-waste, the EU first introduced the WEEE (waste EEE) Directive (2008/98/EC) governing proper disposal, collection, and treatment of e-waste (Directive 2008/98/EC). However, as recycling has its limitations (Hsu et al. 2019; Baldé et al. 2024), the CEAP now also targets earlier steps, including improving circularity in product design, manufacturing, business model development, and product reuse/repair capabilities.

The Eco-design Directive sets minimum sustainability standards for production of energy-related products, including laptops, to improve energy efficiency, reduce environmental impacts, and incorporate sustainability at all lifecycle stages through product design. The upcoming Eco-design for Sustainable Products Regulation (ESPR)[2] expands the Eco-design Directive (2009/125/EC) to more product categories and includes provisions for durability, repairability, recyclability, and use of recycled content (Directive 2009/125/EC).[3] The ESPR further incorporates the use of DPPs that provide accessible, comprehensive information on products' environmental impacts, material use, repairability, and recyclability. However, for successful implementation of DPPs, we need an understanding of the necessary information that aids in sustainable decision-making (Kurteva et al. 2024; Adisorn et al. 2021). At present, it is ambiguous what kind of information different stakeholders would need from DPPs. Our research contributes to this knowledge gap by providing insights into what information laptop users in an organizational context need to make informed decisions about circularity. These insights can be used to design effective future DPPs.

[2] https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en

[3] https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en

2.2. Employees as a stakeholder in organizational laptop circularity

While environmental impacts of organizations are often examined in relation to the products they produce and place on the market, their internal processes, such as purchasing of (circular) laptops, also have significant impacts (Klein et al. 2020). Organizations' ability to exert control over internal resources and processes (e.g., decision-making for thousands of laptops) makes a particularly interesting case for change toward circularity, as they typically have great control over internal processes (Lozano 2013).

How organizations make internal decisions is often understood in terms of decision-making units (DMUs), the different roles in an organization that participate in making a given decision. DMUs typically consist of initiators, employees/users, influencers, buyers, and gatekeepers (Charnes et al. 1978). An important aspect of decision-making in a DMU is that the buyer role in a business is not the only role influencing the purchasing process and all roles have their specific influence (EJ's marketing book).

The employee/user perspective, however, remains largely unexamined in circular ICT decision-making. Employees (in our case, laptop users) can put pressure on circular initiatives (Jakhar et al. 2019). Upper-level decision-makers in organizations have suggested that employees have, in part, exerted influence on ICT decision-making through device preferences and personal beliefs about their employers' practices (McMahon et al. 2024).

2.3. The importance of individuals in the circular economy

Existing literature on individuals' behavior with ICT devices (i.e., smartphones, laptops, etc.) is largely focused on 'regular' consumers, who pay for and use their own devices. These consumers meet different obstacles for performing circular behaviors, like long-term use of laptops, repair, and purchase/use of refurbished laptops.

First, consumers compare products based on different values (e.g., emotional, functional, etc.) that influence their decision to keep or replace a product (Van den Berge et al. 2021). For instance, for products with frequent technological developments, the desire to use new features or a more powerful processor can override the functional value of already owned products and therefore persuade consumers to replace their product prematurely. Furthermore, convenience of replacement (e.g., next day delivery, relatively low prices) and advertising deals can encourage replacement of well-functioning products (Güsser-Fachbach et al. 2023; Van den Berge et al. 2023). The influence of the 'novelty factor' and convenient/attractive deals are particularly influential in decisions for personal electronics like laptops (Jaeger-Erben et al. 2021).

Second, effective and accessible repair is important for postponing product replacement. However, broken goods are often simply replaced by new products instead of being repaired (Magnier and Mugge 2022) and this unlikelihood to repair products is suggested to be increasing (Sabbaghi et al. 2016). For illustration, only one third of laptops had been repaired in their lifetime (Woidasky and Cetinkaya 2021). Consumer market repair is hindered by lack of consumer knowledge and skills to complete repairs, especially for complex products like laptops, and lack of useful resources to learn (Sabbaghi et al. 2016). Subsequently, the cost of repair is often perceived as high in comparison to new products (Jaeger-Erben et al. 2021; Van den Berge et al. 2023; Tecchio et al. 2019).

Third, refurbishment can provide important benefits to consumers as refurbished products provide a cheaper alternative to new products (Van Weelden et al. 2016; Bigliardi et al. 2022). Despite an interest in refurbished products, consumer acceptance of refurbishment is limited by lack of familiarity and concerns for contamination/hygiene, computational performance, and risk for obsolescence (Van Weelden et al. 2016; Wallner et al. 2022). Reducing signs of previous use and fostering a positive image of refurbished products as environmentally beneficial, low-cost, and high performance through labelling can

increase acceptance of refurbished products (Mugge et al. 2017; Wallner et al. 2024; Boyer et al. 2021).

While these consumer-focused studies have provided important insights on how individuals make decisions about laptop circularity, employees are likely to view company-owned laptops differently from their personal laptops. For example, users of company-owned laptops do not need skills to conduct repairs on complex products, are not responsible financially for replacement or repair, and conduct different activities than in personal use. This study contributes by investigating the role of employees as users of company-owned laptops in circular decision-making.

3. Methods

We explored employees' perceptions and behaviors of circularity decisions for company-owned laptops using semi-structured interviews (see Appendix A for the interview scheme). Semi-structured interviews offer versatility and flexibility relating interviewees' real-world experiences to our study (Galletta 2013). Interviews were conducted with employees of large organizations across various job types; all interviewees used company-owned laptops for their work. The developed interview guide explored criteria with which employees choose work laptops, factors that influence their acceptance of more circular laptop practices (e.g., repair, refurbishment, long-term use, etc.), and their perceptions on circular decision-making in their organizations.

3.1. Participant selection

Purposive sampling identified organizational employees who use company-owned laptops. Recruitment of initial participants was conducted from partnering organizations in the Circular Resource Planning for IT (RePlanIT) project. Further participants were selected through a university consumer panel, recruiting participants who used a company-owned laptop for their everyday work activities. RePlanIT is a Dutch national project supporting organizational ICT decision-makers to improve their organization's circularity. The project involves private and public organizations of varying size.

3.2. Interviews

Twenty semi-structured interviews were conducted across eight large ($\geq$500 employees[4]) Dutch organizations with employees using company-owned laptops. We aimed to achieve variety in participants in terms of gender, age and the amount of years at the current company (13 male, 7 female; 3 years or less at current company: 5 respondents; 4–10 years: 6 respondents, $>$ 10 years: 7 respondents; 2 respondents did not provide this information; age was not recorded but varied from $\pm$30–60 years). Table 1 details interviewed participants.

The average interviews duration was 45 mins. Performance specification needs varied based on job role and could impact perceptions on laptop decision-making. Therefore, participants were asked to specify the computational performance needs required for their daily work:

Low computing needs: nearly exclusive use of low-performance programs (e.g., email, video conferencing, word processing, etc.)

Medium computing needs: some use of moderate-performance programs (e.g., photo editing, software testing, etc.)

High computing needs: frequent use of high-performance programs (e.g., mapping software, software development, heavy graphic design, etc.)

The interview guide led discussion of important attributes of their work, what factors interviewees consider when choosing a company-owned work laptop, what, if any, circularity factors influence their decisions, and their experience with and/or acceptance of refurbishment or repair of company-owned laptops. Interviewees were provided with standardized informed consent documents prior to participation. Transcripts were anonymized and not shared in unanalyzed form.

3.3. Analysis

Interviews were conducted in-person, recorded for transcription purposes, and subsequently coded using the software program Atlas.ti. Due to its flexibility and suitability to inductively code qualitative research, we conducted a thematic analysis (Braun and Clarke 2006). In such an inductive approach, the themes identified emerge from the data and the process of coding occurs without trying to fit the data into a pre-existing theory or framework. This enabled us to have an open perspective regarding the data, which was deemed critical for studying the novel topic of circularity for work laptops. Employees' behaviours and perceptions towards work laptops were expected to differ from traditional consumer-laptop interactions, and therefore, existing theories may only provide an incomplete overview of the relevant factors.

We further followed recommended practices for reporting the novelty and contributions of qualitative data analyses by Pratt (2009) by relating our themes to existing theories in the literature in Appendix B. We determined that saturation was reached with these 20 interviews as the final five interviews resulted in $<$4 % of new subcodes and no new codes.

Following Braun and Clarke's (2006) steps for thematic analysis, an initial 64 subcodes were determined and subsequently reviewed for accuracy and to merge duplicate and/or similar codes. The resulting 26 codes were reviewed and adjusted among the three authors to improve reliability in analysis and were then grouped by commonality into preliminary themes. Through discussion within the research team, categories were further consolidated into five themes. Additional information on codes and their relation to themes can be found in Appendix C.

4. Results and discussion

Our results first discuss how interviewees using company-owned laptops understand laptop lifetimes. Subsequent subsections lay out in five themes how company-owned laptop users consider decisions about the lifetime of their laptop and what influences acceptance of circular laptop practices.

4.1. Employees' perceptions on laptop lifetimes

We found that understanding of company-owned laptops' lifetimes varied widely. When asked how long their laptop should last, interviewees gave estimates between three and ten years, although they were not always certain, responding with statements like "I don't know." (P5; P6) and "as much as it can/as long as I am using it." (P2; P11; P14).

Interviewees' perceptions of what affects laptop lifetimes aligned with previous findings that laptops often reach end-of-life (EoL) for reasons other than whether they still function (e.g., economic considerations, etc.) (Bakker and Schuit 2017; Woidasky and Cetinkaya 2021). Interviewees experienced that many decisions made about laptop lifecycles are not in their control and/or not their responsibility. For instance, they acknowledged that lifecycle management (LCM), a tool used by the organization's decision-makers to assign laptops' economic lifetimes, will in many cases determine EoL at the decision of the organization and its service contracts. Interviewees suggested that technological advancement and decreasing quality of performance over time affected lifetimes of laptops negatively. The presence of these perceptions can make an employee less likely to accept a refurbished laptop.

Employees perceived certain qualities of laptops to influence their lifetime positively, including high-quality materials/ brands, durability,

[4] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Enterprise_size

Table 1
Basic profile of interviewed participants. Interviewees were asked to participate from their perspective as a laptop user.

Parti-cipant	Gender	Interviewee Job Description	Type of Organization	Years at organization	Specification Needs
1	M	Infrastructure management	Local Government	44 years	High
2	M	Quality management	Local Government	23 years	Low
3	M	Development permitting	National Government	4 years	Low
4	M	Project leadership	National Government	Not shared	Low
5	F	Application management	National Government	5–6 years	Low
6	F	Financial analysis	National Government	8 years	Low
7	M	Not shared	National Government	Not shared	Low
8	M	Not shared	National Government	6 years	Low
9	M	ICT service management	National Government	27 years	Low
10	F	Not shared	National Government	22 years	Low
11	M	Head of ICT department	National Government	20 years	Low
12	M	Server service management	National Government	20 years	Low
13	F	PhD candidate	University		
	5 years	Medium			
14	M	ICT service management	University	17 years	Low
15	F	Location management	University	3 years	Low
16	F	Product testing	Consumer Organization	3 years	Medium
17	M	Technical consulting	IT Service Company	1 year	Low
18	F	Marketing	Energy Equipment Producer	2 years	Low
19	M	Digital services advising	Local Government	5 years	Low
20		Design management	Energy Sector	<1 year	Low

continuous compatibility, upgradability, and repairability. Assurance that laptops have these qualities can make employees more likely to accept refurbished or longer lasting laptops.

(P14): " [I] think it would be nice if you had some kind of certificate that would say this laptop can still be used for the coming three years or four years… Some kind of certainty that if you accept a refurbished laptop, you don't have to replace it in one or two years again."

Employees suggested that poor treatment of laptops would be a common reason for premature EoL. This perception leads to lifetime-affecting behavior that is within the control of the employee.

(P9): "When you use it like it is your own machine and [are careful with it]… there is no problem. You don't throw it [around], for example. You put it on your desk and you work on it and that's it."

Theme 1: Laptop functionality (physical features and computational performance) is considered before circularity

Employees first considered how they use their laptop to appropriately choose physical features that suit their needs. These included weight and durability for transportation needs, screen size for comfortable viewing, and, less commonly, the presence of accessory components (e.g., keyboards, ports, biometrics, etc.) to meet needs/desires.

For previously used laptops, visual condition was an important factor, along with hygiene and presentability in professional meetings.

(P10): "If it looks really sticky… or there are damages on it, then I think I'd say no… It has to look nice for work… If you are in an external meeting, you cannot have people say, 'Oh look at that. It's damaged. It's rubbish.'"

Secondly, laptops' computational performance and reliability was a main priority. Interviewees searched for assurance that the laptop, regardless of its circularity status, features, or novelty, would "do the job" consistently. While physical and performance needs vary across job roles, the ability to perform their work with a laptop that "does the job" comfortably and efficiently was considered paramount. Employees would often prioritize their specific physical and performance needs/desires over common features in design-for-circularity (i.e., repairability, upgradability, CO2 in production, recyclability & recycled content.

(P4): "No [I wouldn't consider recyclability], it's nice, but… I'm ashamed… I only want to know that it works, otherwise it doesn't matter."

Interviewees were more likely to accept a refurbished, long-lasting or repaired laptop if they were assured that it would be compatible with their work programs and maintain necessary performance requirements (i.e., speed and battery life). Additionally, employees argued that this decision depended on the convenience of being able to continue working, such as how much time the repair process required. Although they were unlikely to choose a refurbished laptop without prompting, interviewees were near unanimous in that they would accept a refurbished laptop given these assurances. DPPs could thus assist organizations by providing the necessary information, which organizations can tailor to the needs of their employee base. For instance, by using full information for upper-level decision-making and narrowing useful information for dissemination at the everyday company-owned laptop user level.

Theme 2: Employees feel less attachment, ownership, and responsibility for company-owned laptops

Although promoting the emotional value of products through attachment can play a positive role in extending lifetimes (Van den Berge et al. 2021), the majority of interviewees felt little to no attachment to the physical laptop itself. They did, however, feel attachment to the data contained by the laptop and the ability to do their work that the laptop allows. This ability could however be accomplished by any appropriate laptop. Employees attributed their lack of attachment to not being the owner of the laptop, the easy replacement through the organization, and to laptops being perceived as merely a tool to complete tasks. Employees felt that they would feel more attached to the laptop if they used it for personal activities or if they had put time into personalization (e.g., settings, decoration, etc.).

Some interviewees felt that lack of attachment may decrease caretaking behaviors and desire to keep the laptop longer, especially because replacement is guaranteed and is an easy process which they are not financially responsible for.

(P4) "It's not mine. If I get another one, it works as well as this one. The software on this would be the same as the other one, so I am not attached to it."

Upper-level ICT decision-makers suggested that strong attachment to an individual laptop or very specific features can hinder their ability to make wide-scale circularity improvements (McMahon et al. 2024). While the amount of employees using company-owned laptop who have strong opinions about the computer they use for work will vary across companies, we found that most employees preferred to defer decision-making about company-owned laptops like money spending and saving, repair, replacement, and laptop circularity to the equipment owner (i.e., the organization).

(P1) "I can't decide about this. This is not my decision. It's a decision of [the organization]. And I hope they make decisions on the same terms that I do. Even better."

This responsibility and ownership shift highlights an important

distinction between 'regular' consumers and employees using company-owned laptops: consideration of repair cost. High perceived cost is a major contributor to consumers rejecting repair, as it is coming out of their own pockets (Jaeger-Erben et al. 2021; Van den Berge et al. 2023). However, users of company-owned laptops are not responsible for repair cost and thus this barrier is less relevant to company-owned laptop users.

While employees did not feel like these decisions were their responsibility, they did state a sense of responsibility to care for company-owned laptops and to make wise financial decisions.

(p. 8) "We are a government; we have to make sure that we spend our money right."

Theme 3: Circular transition through company culture

The majority of employees did not feel that they were encouraged by their organization to make decisions that extend the lifetime or circularity of their laptops. However, perceptions of what effective encouragement should look like were mixed.

Interviewees felt that when improving sustainability and circularity in all decision-making processes was emphasized as part of the company's culture or policy, laptop user decision-making would more likely be made with sustainability and circularity in mind.

Initiating company culture and policy shifts toward more sustainable and circular ICT practices is likely to be facilitated by the feeling of trust interviewees have in their ICT department and organization. All interviewees expressed trust that their employer will provide a laptop suitable for their work, conduct competent repairs, and make wise decisions about refurbishment and replacement. They suggested this trust could be further facilitated by assurances, tests, and guarantees of functionality (or replacement of nonfunctional laptops). These measures also encouraged employees to accept a refurbished laptop.

(P10)" If I have a computer from the boss, I expect it works. If it doesn't work, I have to bring it to the desk and I get a placement or a payment. It's inevitable. It's always there… I don't have to question that"

Theme 4: Company-owned laptop users bring personal influences, experience, and knowledge to decision-making at work

Personal influences, such as ICT knowledge or interest, previous experience with devices, repairs, and refurbishment, and personal interest in sustainability and circularity were stated to influence the decisions employees make about their company-owned laptops. The majority of interviewees felt they lacked the knowledge to make effective decisions about circularity in their laptop's lifecycle (e.g., functionality and compatibility predictions, resources used in production, repairability, service history, environmental and social impact of production/waste treatment, etc.). Often, comparisons with other products they were more knowledgeable about (e.g., cars, washing machines, coffee makers, furniture, etc.) were used to shape decisions made about their company-owned laptops. Previous positive experiences with repaired or refurbished devices, at work or at home, made employees more likely to feel confident accepting a repaired or refurbished device.

Additionally, their personal habits and values toward sustainability and circularity, as well as those of family, friends, and coworkers, and the cultural norms of their community, also had an effect on the decisions employees make.

(P15) "I should treat [it like] at home… I repair the clothes, [my spouse] repairs the machines, and we take care of our bikes and our cars… I think that would be normal."

Employees who were more concerned about sustainability and circularity at home were more likely to choose sustainable and circular options for their company-owned laptops as well.

On the other hand, employees using company-owned laptops had similar hesitations for refurbished equipment at work as they do for their personal computers at home, and their personal concerns and experiences can affect their acceptance of a refurbished laptop at work. Like for 'regular' consumers, concerns for hygiene, longevity, and continued compatibility created hesitation among participants when considering refurbished company-owned laptops (Van Weelden et al. 2016; Wallner et al. 2022).

However, these concerns are more easily alleviated in the workplace, where interviewees stressed their trust that the employer would provide them with a suitable laptop, and will replace it as needed. Considering this, most interviewees would accept a refurbished laptop at work without issue, but were unlikely to choose one without prompt. Use of a DPP could increase confidence in refurbished laptops by sharing functionality information along with environmental benefits.

(P2) "If you can [ensure] it works now and foresee that it will work for another two years, that should be maybe part of the… information."

Theme 5: Sustainability and circularity are desired but not prioritized

Employees did not initially list design for circularity features, such as repairability, recycled content, recyclability, reduced CO_2 in production, and upgradeability when asked for the most important features of their work laptops. Due to the prioritizing of physical and performance features and the lack of feelings of ownership and responsibility, sustainability and circularity are often not considered in work laptop decision-making.

(P13): "[Circularity] would only affect my decision if… I'm sure that it's similar performance. And then sustainability of the material would come later in the work laptop decision."

However, when prompted about these features, the importance of design for sustainability, repair, refurbishment, and long-term use was acknowledged, and often personally valued, by those interviewed. Resource efficiency, energy efficiency, waste reduction, and preventing environmental degradation were the most common reasons that sustainability and circularity were considered important. Additionally, addressing social issues, such as unfair and unsafe labor practices, were also considered to be an important impact of improving sustainability and circularity.

(P2) "If there is absolute assurance that there will be no child in [poor working conditions] and there is a stamp on it that's by… an organization you can trust. I think maybe that will appeal to a feeling of doing something good."

The acknowledged importance of sustainability and circularity presents an opportunity for employers and ICT departments. In line with the opinions of interviewees, employees can be prompted to make decisions that benefit sustainability and circularity when they are provided information at the decision-making point.

(P2) "if you let me think about those other possibilities, I think I will follow a bit more my heart and will count the effects on the environment… I think it's my second thought."

Information can include, for instance, noting which initial laptop choice has a better circularity score. Employees suggested, however, that their employers should avoid large amounts of detailed information that may lead to confusion. The development of DPPs can centralize this information, from which organizations can tailor circularity information to their employees' needs.

Managerial implications and the case for digital product passports

Research has investigated the limitations and barriers to circularity across various stakeholders influencing the lifetime of laptops, from governments and compliance agencies (McMahon et al. 2019; Grafström et al. 2021), downstream supply chain partners (Govindan and Hasanagic 2018), organizations (McMahon et al. 2024; Kristensen et al. 2021), and private consumers (Jaeger-Erben et al. 2021; Magnier and Mugge 2022; Van den Berge 2023).

At each level of laptop user, there is a perception that the decisions of other stakeholders are out of their control, in particular for everyday users of company-owned laptops, who are not responsible for laptop purchase, maintenance, or repair. Thus, communication and collaboration across stakeholders to align goals is essential to the success of a circular economy for laptops and similar products. Furthermore, our results suggest that even though employees do not prioritize circularity, they are open to circular laptops as long as they have assurance that the laptop's functional performance is satisfactory. For managers, this implies that they can introduce circular offerings for work laptops as long

as they openly communicate about the objectives and the functional guarantees that would be in place for employees. This would also trigger a culture change in the organization. We conclude that DPPs can play a crucial role in facilitating stakeholder cooperation by opening communication along the value chain. At present, the lack of such communication is a significant barrier to obtaining information that enables effective circular decision-making (McMahon et al. 2024; Kurteva et al. 2024). We subsequently propose that the information supplied in a DPP could be used in the development of organizational ICT platforms that show the circular benefits and/or consequences of each decision in the lifetime of a laptop. For company-owned laptops, such a platform could encourage employees to choose a refurbished laptop or a model that is not overpowered for their professional needs, or to accept repair or longer term use of a laptop rather than replacement.

4.2. Limitations and future work

Qualitative interviews, especially on such a current issue as circularity, may be prone to social desirability bias, where interviewees feel pressure to give a socially acceptable response. We mitigated this by assuring anonymity of the responses and through careful question framing of neutral questions repeated in different ways. Another limitation of qualitative research is that it provides a comprehensive overview of the different factors that influence employees' relationship and behavior towards their company laptop but does not provide insights in the relative importance of different factors. Future quantitative research is needed to statistically testing these effects.

This research focuses on large Dutch public and private businesses with designated ICT departments, through which laptops are assigned and distributed to users. Designated ICT departments and their model for company ownership of laptops (in which employees have only limited control) is common in large organizations, and therefore enables us to provide relevant insights for large-scale implementation of circularity-improving measures across such organizations. However, small and medium enterprises also represent an important base of business purchasers for laptops. Consideration of the relationship between laptop and user in small and medium organizations, and how differences in decision-making control affect their behavior, is an interesting point for further study.

An assumption underlying our research is that at present, work laptops are replaced prematurely and a longer lifetime could have been achieved. As many organizations make use of standardized service contracts that provide support for a laptop lifetime of four years, it is likely that longer lifetimes are feasible if proper support (e.g., repair services) is provided. It would be interesting for future research to explore the lifetimes of different laptops (privately owned vs. professionally owned) and analyse the current service contracts to provide quantitative support for this assumption.

Our findings suggest that DPPs should serve as a tool for increasing the ability of each stakeholder to make informed decisions for the steps they each control in a company-owned laptop's lifecycle. Further research on how to access, record, and/or disseminate crucial information about laptops across all relevant stakeholders is necessary for the development of such DPPs.

5. Conclusions

This study expands the understanding of circular laptop decision-making by exploring how employees make decisions for the company-owned laptops they use professionally, as opposed to those they purchase and use as 'regular' consumers in their personal lives. First and foremost, while employees may express a desire for or against circular behaviors, users of company-owned laptops rely heavily on the advice and instruction of the laptop's owner (i.e., their employer), even when it differs from what they may have decided for their own personal laptop. The trust and expectations company-owned laptop users have for their employers to supply them with a reliable laptop provides an opportunity for employers to shape internal organizational circularity through a prioritization of circularity.

While individuals may consider circularity in personal purchases, our interviewees were unlikely to prioritize circularity for company-owned laptops, where they hope their employers provide sound choices. Organizations can increase circular consideration and steer company-owned laptop users into accepting or choosing refurbished products, repair, or long-term use by establishing circularity as a company-wide priority. Company-owned laptop users are likely to respond to prompts and information provided about environmental benefits or consequences of decisions. This information should be provided in an easily digestible, accessible way that does not take time away from the employees' work. For example, internal systems could show comparative circularity scores and environmental impacts at key decision-making points. Support in development of DPPs will greatly facilitate organizations' ability to shape circular decision-making throughout its internal processes, from upper-level decision-makers to the daily users of company-owned devices.

CRediT authorship contribution statement

Kathleen McMahon: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Erik Jan Hultink:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Ruth Mugge:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.resconrec.2025.108186.

Data availability

The data that has been used is confidential.

References

Adisorn, T., Tholen, L., Götz, T., 2021. Towards a digital product passport fit for contributing to a circular economy. Energies 14 (8), 2289.
Bakker, C., Wang, F, Huisman, J., Den Hollander, M., 2014. Products that go round: exploring product life extension through design. J. Clean. Prod. 69, 10–16.
Bakker, C., Schuit, C., 2017. The Long view: exploring product lifetime extension. United Nations Environ. Progr.
Baldé, C.P., Kuehr, R., Yamamoto, T., McDonald, R, D'Angelo, E., Althaf, S., Bel, G., Deubzer, O., Fernandez-Cubillo, E., Forti, V, Gray, V., Herat, S., Honda, S., Iattoni, G., Khetriwal, D.S., di Cortemiglia, V.L., Lobuntsova, Y., Nnorom, I., Pralat, N., Wagner, M., 2024. Global E-waste monitor 2024. International Telecommunication Union (ITU) and United Nations Institute for Training and Research (UNITAR).
Baldé, C.P., van den Brink, S., Forti, V., van der Schalk, A., Hopstaken, F., 2020. The Dutch WEEE Flows 2020, What happened Between 2010 and 2018, 2020? United Nations University (UNU) /United Nations Institute For Training and Research (UNITAR) - co-Hosted By the SCYCLE Programme.

Beardsley, S.C., Enriquez, L., Bonini, S., Sandoval, S., Brun, N.O.Ë.M.I.E., 2010. Fostering the Eco Nomic and Social Benefits of ICT. Dutta and Mia (2010). The Global Information Technology Report2009, 2010, pp. 61–70.
Bigliardi, B., Filippelli, S., Quinto, I., 2022. Environmentally-conscious behaviours in the circular economy. An analysis of consumers' green purchase intentions for refurbished smartphones. J. Clean. Prod. 378, 134379.
Boyer, R.H., Hunka, A.D., Whalen, K.A., 2021. Consumer demand for circular products: identifying customer segments in the circular economy. Sustainability. 13 (22), 12348.
Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3 (2), 77–101.
Charnes, A., Cooper, W.W., Rhodes, E., 1978. Measuring the efficiency of decision making units. Eur. J. Oper. Res 2 (6), 429–444.
Directive 2008/98/EC of the European Parliament and the Council of 19 November 2008 on Waste and Repealing Certain Directives. Offic. J. Eur. Union, 22/11/2008.
Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast). Offic. J. Eur. Union, 21/10/2009.
Galletta, A., 2013. Mastering the semi-structured interview and beyond. In: From Research Design to Analysis and Publication, Vol. 18. NYU press.
Govindan, K., Hasanagic, M., 2018. A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. Int. J. Prod. Res. 56 (1–2), 278–311.
Grafström, J., Aasma, S., 2021. Breaking circular economy barriers. J. Clean. Prod. 292, 126002.
Güsser-Fachbach, I., Lechner, G., Reimann, M., 2023. The impact of convenience attributes on the willingness-to-pay for repair services. In: Res, Conserv. Recycl, 198, 107163.
Hsu, E., Barmak, K., West, A.C., Park, A.H.A., 2019. Advancements in the treatment and processing of electronic waste with sustainability: a review of metal extraction and recovery technologies. Green Chem 21 (5), 919–936.
Jakhar, S.K., Mangla, S.K., Luthra, S., Kusi-Sarpong, S., 2019. When stakeholder pressure drives the circular economy: measuring the mediating role of innovation capabilities. Manage. Decis 57 (4), 904–920.
Jaeger-Erben, M., Frick, V., Hipp, T., 2021. Why do users (not) repair their devices? A study of the predictors of repair practices. J. Clean. Prod. 286, 125382.
Klein, N., Ramos, T.B., Deutz, P., 2020. Circular economy practices and strategies in public sector organizations: an integrative review. Sustainability. 12 (10), 4181.
Kristensen, H.S., Mosgaard, M.A., Remmen, A., 2021. Circular public procurement practices in Danish municipalities. J. Clean. Prod. 281, 124962.
Kurteva, A., van der Valk, C., McMahon, K., Bozzon, A., Balkenende, R., 2024. RePlanIT ontology for FAIR digital product passports of ICT: laptops and data servers. Seman. Web. J.
Lozano, R., 2013. Are companies planning their organisational changes for corporate sustainability? An analysis of three case studies on resistance to change and their strategies to overcome it. Corp. Soc. Responsib. Environ. Manage 20 (5), 275–295.
Magnier, L., Mugge, R., 2022. Replaced too soon? An exploration of Western European consumers' replacement of electronic products. In: Res, Conserv. Recycl, 185, 106448.
McMahon, K., Johnson, M., Fitzpatrick, C., 2019. Enabling preparation for re-use of waste electrical and electronic equipment in Ireland: lessons from other EU member states. J. Clean. Prod. 232, 1005–1017.
McMahon, K., Mugge, R., Hultink, E.J., 2024. Overcoming Barriers to Circularity For Internal ICT Management in organizations: A change Management approach., 205. Resources, Conservation and Recycling, 107568.
Mugge, R., Jockin, B., Bocken, N., 2017. How to sell refurbished smartphones? An investigation of different customer groups and appropriate incentives. J. Clean. Prod. 147, 284–296.
Pratt, M.G., 2009. From the editors: for the lack of a boilerplate: tips on writing up (and reviewing) qualitative research. Acad. Manage. J 52 (5), 856–862.
Qazi, A.A., Appolloni, A., 2022. A systematic review on barriers and enablers toward circular procurement management. Sustain. Prod. Consum. 33, 343–359.
Sabbaghi, M., Esmaeilian, B., Cade, W., Wiens, K., Behdad, S., 2016. Business outcomes of product repairability: a survey-based study of consumer repair experiences. Res, Conserv. Recycl 109, 114–122.
Schweer, D., Sahl, J.C., 2017. The digital transformation of industry–the benefit for Germany. Driv. Digit. Transform, pp. 23–31.
Tecchio, P., Ardente, F., Mathieux, F., 2019. Understanding lifetimes and failure modes of defective washing machines and dishwashers. J. Clean. Prod. 215, 1112–1122.
Van den Berge, R., Magnier, L., Mugge, R., 2021. Too good to go? Consumers' replacement behaviour and potential strategies for stimulating product retention. Curr. Opin. Psychol. 39, 66–71.
Van den Berge, R., Magnier, L., Mugge, R., 2023. Until death do us part? In-depth insights into Dutch consumers' considerations about product lifetimes and lifetime extension. J. Ind. Ecol. 27 (3), 908–922.
Van Weelden, E., Mugge, R., Bakker, C., 2016. Paving the way towards circular consumption: exploring consumer acceptance of refurbished mobile phones in the Dutch market. J. Clean. Prod. 113, 743–754.
Wallner, T.S., Magnier, L., Mugge, R., 2022. Do consumers mind contamination by previous users? A choice-based conjoint analysis to explore strategies that improve consumers' choice for refurbished products. In: Res, Conserv. Recyc, 177, 105998.
Wallner, T.S., Haslbeck, J.M., Magnier, L., Mugge, R., 2024. A network analysis of factors influencing the purchase intentions for refurbished electronics. Sustain. Prod. Consum. 46, 617–628.
Woidasky, J., Cetinkaya, E., 2021. Use pattern relevance for laptop repair and product lifetime. J. Clean. Prod. 288, 125425.
Wang, Y., Zhu, Q., Krikke, H., Hazen, B., 2020. How product and process knowledge enable consumer switching to remanufactured laptop computers in circular economy. Technol. Forecast. Soc. Change 161, 120275.