

ATEA SUSTAINABILITY FOCUS

March 2022

Get more from less

– extending the lifespan of IT products



Get more out of less

Time to focus on lifespan extension



The ASF Advisory Board consists of representatives from leading public and private companies with a background in IT, sustainability or purchasing. Over the last few years, the Board has issued four previous reports: on **Transparency**, **Circular Economy**, **Closing the Loop on Materials** and **Faster, Together!**. The goal is to provide the industry with valuable insights into the expectations of the Nordic market and recommendations on how to address urgent issues.

DIGITALIZATION IS AN essential element of the sustainable transition.

For society to thrive within our planetary boundaries we need to rethink how we live, move and interact. Time and time again have we seen how digitalization will help us along the way, but to fully realize this potential, the wave of digital innovation itself needs to be more sustainable.

Reducing resource consumption is key in mitigating the heavy environmental and social burden from manufacturing of IT products. Simply put:

We need to get more out of less.
This is best done by extending the lifespan of products, the Nordic IT buyers say.

Atea Sustainability Focus (ASF) consolidates the voices of Nordic IT buyers to accelerate the sustainable transformation of the IT industry. In five powerful reports ASF has presented market insights and analyses on how the IT industry meets the expectations on urgent sustainability issues as well as recommendations on how to address them.

The survey that supports this report shows that prolonged lifespan is the most urgent concern among buyers. Buyers realize that this is a systemic challenge that involves the relationships between multiple actors in the value chain, including buyers themselves who in fact have the power to alter the market dynamics through their behaviors.

This year's report highlights how it should make economic sense for all actors involved to work to extend the actual lifespan of IT products, as much of the intrinsic value embedded in IT products is not fully captured today. It also points out actions that can be taken right away.

Previously, the recommendations in the ASF reports have exclusively targeted the industry. This year, the ASF Advisory Board – the group of committed and leading buyers that analyze the ASF dialogue and consolidates the recommendations to the industry – include actions for buyers as well. The message from the Nordic IT buyers is clear:

It's time to radically expand product lifetime. We are ready to do our part. Let's get to work and get more out of less. ■



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Five powerful years for positive change

FIVE YEARS AGO, a group of representatives from Nordic IT-buying organizations gathered in Sweden to word a powerful sustainability message to the global IT industry. This marked the beginning of the Atea Sustainability Focus (ASF) and a new way to speed up the transformation by utilizing our common force to drive positive change.

The epicenter of this common force is ASF. The initiative enables the Nordic IT buyers to communicate their sustainability preferences with a united voice and to provide the industry with valuable intelligence and actionable recommendations. By using dialogue, collaboration, and mutual understanding as tools for transformation, ASF brings the industry closer to its most important stakeholders – the buyers.

In these five years, the power of ASF as a platform for collaboration has only grown stronger.

What mainly started as a megaphone for one-way communication has become a powerful force for change.

As buyers are becoming more active and take on a larger responsibility, we have now reached a point where buyers invite the industry to collaborate. In last year's report *Faster, Together!* the buyers invited the industry to co-create a roadmap for circularity and climate neutrality. With the network *Leadership for Change* the buyers decided to create a market for sustainable IT. The next big step was taken this year when the buyers started to include themselves in the recommendations. That is a great way forward to secure the IT sector's contribution to the Agenda 2030 and the Paris Agreement.

This progress makes me immensely proud. It is great to see that the industry – the Responsible Business Alliance as well as leading brands – see the power of the ASF. It's clear that they value the access to the mature and progressive buyers of the Nordic market that the ASF initiative provides. Valuable steps have been taken regarding reporting and transparency. The RBA has co-founded the Circular Electronics Partnership and there is a continuous dialogue around IT sustainability with the Nordic stakeholders.

However, Nordic IT buyers won't settle with that. To paraphrase the ASF Advisory Board, five years in to this initiative it's time to rock the boat. This year the message is stronger and more concrete than ever: We need to extend the lifetime of IT products.

The results from the more than 600 organizations taking part in the online survey have never been more aligned. The same applies to the members of the ASF Advisory Board. Even though there are several pressing sustainability issues, going forward we need to focus on extending product lifespan.

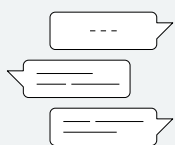
What this report shows above all is the power of a common force. Let's use that power to drive the necessary change for the extended lifetime of IT products. ■



Camilla Cederquist,
Atea Sustainability
Focus project manager

A handwritten signature in black ink, reading 'Camilla Cederquist'.

CAMILLA CEDERQUIST,
Atea Sustainability Focus project manager



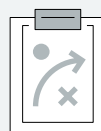
Stakeholder dialogue

Nordic IT buyers identify key sustainability aspects through an online survey and offline dialogues.



Industry analysis

Sustainability experts conduct an industry analysis to identify how the industry performs on the aspects identified by the buyers.



Recommendations

The ASF Advisory Board, comprised of leading IT and sustainability professionals from Nordic companies, municipalities and organizations, formulates concrete recommendations.



Handover to the industry

RBA and its member companies decide on specific activities to implement the recommendations from the ASF Advisory Board.

Nordic organizations drive sustainable transformation of IT



2018: Transparency



2019: Circular Economy

AN IMPORTANT PART of the Atea Sustainability Focus (ASF) is to follow up on how the reports are received and processed by the Responsible Business Alliance (RBA) and its leading members. RBA is a coalition of the largest IT brands and many of their sub-suppliers that collaborate to drive sustainable value for workers, the environment and business throughout the global supply chain. This makes the alliance an obvious and dedicated recipient of the ASF reports. Hence, the follow up includes dialogues with RBA as well as with representatives from leading manufacturers.

This summary is based on discussions with RBA European Director Bart Devos during the annual ASF Advisory Board meeting in November of 2021, as well as on written input.

ASF has published four reports, each putting urgent sustainability issues in focus:

- 2018: Transparency
- 2019: Circular Economy
- 2020: Closing the Loop
- 2021: Faster, together!

The different themes of the ASF reports reflects how RBA has transitioned from having a supply chain focus on sustainability to a more holistic approach where circular economy, climate and buyer engagement are high on the agenda.

Worth mentioning is RBA's first ever presence at COP26 – United Nations Climate Change Conference, and the Nordic Buyers Roundtable in Stockholm. The fact that the Nordics was selected for

the first stakeholder roundtable shows how valuable the input from this region is to the RBA. Important is also The Guide to Responsible Procurement of Goods and Services that help give buyers confidence in the products they procure from RBA members. The engagement in the Circular Electronics Partnership, where the RBA is one of the founding organizations, should also be highlighted.

RBA's decision to publish the membership category for each member, as mentioned in the statement on the next page, is no small change. By taking this step RBA helps buyers make more informed decisions. The membership category communicates to buyers what to expect from the supplier in terms of maturity and implementation of sustainability across the organization and in the supply chain. The fact that the members of the RBA voted in favor of this change also indicates that the industry is increasingly embracing the concept of transparency.

RBA HAS TIME and time again emphasized the importance of the ASF, from calling it a game changer back in 2017 to saying that the inputs and signals from the ASF has had a great influence on the progress of RBA (European Director Bart Devos at the Advisory Board meeting). This confirmation is important. The RBA is one of the most influential actors within IT sustainability, and it is by having an impact on the actions and agenda of the RBA that the ASF can make the most difference.

The ASF Advisory Board is very pleased with the collaboration during these five years and with the achievements so far.

In the 2021 report *Faster, together*, however, the Board expressed a need to speed up change and suggested a more hands-on collaboration through a series of roundtables, with the ambition to develop a joint roadmap for a circular and net-zero IT sector. Two roundtables have been conducted, focusing on identifying obstacles and creating a shared vision. The project continues, involving both the RBA and leading brands.

Statement from the Responsible Business Alliance

The ASF reports provide excellent insights and analysis and serve as important market signals that help inform our work. As the world seeks to deliver a green transition that is equally fair and inclusive, we are proud to convene industry for collaboration on driving sustainable supply chains. Now that we have reached another milestone with the publication of this latest ASF report, it's time to look back at the progress we've witnessed over the past year.

Transparency remains a top-level priority, for the Responsible Business Alliance (RBA), its members and stakeholders. That is why the RBA decided to publicly disclose RBA Full and Regular membership levels, starting in early 2022. We are also committed to continuing our dialogue with public buyers, through regular discussions and issue-driven conversations. Nordic buyers play a crucial role in encouraging companies to advance their sustainability journeys. We are proud to have started more formal engagement with Nordic buyers through a dedicated RBA Nordic Buyers Roundtable in Stockholm, and we are committed to

build on this in the near future. The ASF report will continue to be important input to the agenda setting for those dialogues.

The RBA understands the vital importance of environmental issues such as climate change. The RBA stood side by side with the UK government at COP26 to drive the push for the tech sector's commitment for climate action. Our Code of Conduct, supported by resources like the GHG Management Guide, helps ensure that every tier of the supply chain is able to accurately measure, report, and decrease their carbon emissions. Additionally, the RBA has developed a roadmap toward assuring that recycled materials and components are produced in accordance with our high labor, safety, and environmental standards, providing more opportunities for the industry to build truly circular supply chains that benefit users, workers and the planet.

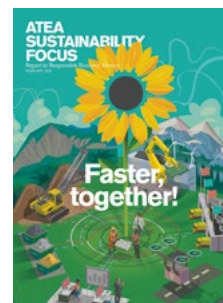
For the year to come, we hope to achieve even more progress in these important areas, while we also focus on preparing for the implementation of mandatory due diligence legislation. To that end, we stand ready to help buyers navigate the impacts of mandatory due diligence on their organizations.

As embodied by the ASF, collaboration is the prerequisite to impactful solutions for the pressing challenges of protecting the environment and human rights globally. The RBA is committed to enabling that and looks forward to continuing this journey with the ASF community. ■

ROB LEDERER,
CEO, The Responsible Business Alliance



2020: Closing the Loop



2021: Faster, together!

It's time to radically extend product lifetime

Digitalization is an essential element of the sustainable transition, and it will drive the volumes of products and solutions for IT. There is therefore no option but to make digitalization itself sustainable, and the way to do it is by maximizing value while minimizing the use of resources. For this reason, we suggest radically extending the lifespan of IT products.

BUSINESS AS USUAL is no longer an option. The pandemic has proven the vulnerability of the current linear model, as the entire just-in-time, complex system wobbled under lockdowns and chain effects. This linear model is not only vulnerable, but also economically flawed. We have a system that depends on an increasing flow of finite resources, processed in fragmented and highly specialized supply chains that does not create incentives for reducing waste, and where transactional consumption models lead to an unnecessary destruction of economic value.

For these reasons, Nordic buyers identify radically extending the lifespan of IT products as the most urgent issue for the whole industry to address. Society and business must be able to thrive within the planetary boundaries. It is time for a fundamental change – and together we can make it happen.

Transition in progress

In 2019, we, the members of the ASF Advisory Board, expressed the need for the IT industry to transition to climate neutrality and circularity by developing a 2050 industry-wide roadmap. In 2020, we focused on closing the loop on materials, as this was something that could be immediately addressed.

We recognize that the industry has made some progress, both as a collective and as individual companies. The Responsible Business Alliance's (RBA) work within the circular materials taskforce and the Circular Electronics Partnership, along with different brands' ambitious goals for targeting resource consumption and carbon emissions are just a few examples. This work should continue.

Extended total lifespan necessary

However, as the vulnerabilities of the current system become more and more visible and urgent, we find that it is absolutely necessary to address the issue of lifespan of IT products.

From a climate and environmental perspective, radically extending the lifespan of products and components is the one action that most likely will lead to the biggest reductions of emissions and resource consumption, including minerals and metals, water and energy.

Supply-chain impact and circular design

In coming to this conclusion, we considered the opportunities for the industry to

address this issue, both at the collective and individual level. At the collective level, we see opportunities for the industry to examine the impact on the supply chain in transitioning to a circular economy as well as developing guidelines around circular design and common reporting standards.

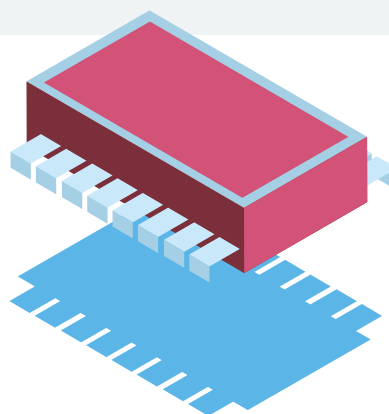
A need for new business models

We recognize that there needs to be a business case for change and that this puts a big responsibility on us as buyers. We are determined to be the change we want to see, and we are prepared to do what it takes to create the right incentives for the industry to accelerate its work on this topic.

Best practice in circular procurement

Through Leadership for Change, we have an opportunity to drive best practices in circular procurement. We can, by weighing circularity into our tenders, provide incentives for extending the total lifespan, as well as creating demand and understanding for solutions that radically extend the lifespan of IT products. As buyers we are willing to collaborate with the industry to explore new and more sustainable ways of consuming IT.

ASF Advisory Board sees that the following is required by the industry as well as the buyers to support the transition to an economic system built on maximizing value with a minimum of resources.



Recommendations for the Responsible Business Alliance

- Assess, develop and recommend standards on lifespans: What is out there, what can be used by the industry, what aspects are critical for prolonged lifespan and to minimize the use of resources?
- Develop practical guides and tools such as a maturity model for brands and suppliers on the different aspects of the circular economy.
- Develop guidelines for how buyers can set effective procurement requirements on this.
- Assess and inform on what impact the shift to circularity will have on livelihoods and skills, and the respective roles of both governments and industry in reskilling workers.
- Influence granular reporting standards that are more representative of the IT industry (PCF, EU PEF, ITU).
- Support more specifically the sustainability journey of less mature producers of peripherals and accessories within the RBA's scope.
- Engage in the removal of external barriers for this transition, by for example influencing international and government policy to facilitate export of used IT equipment and recycling of rare materials.

Recommendations for the brands

- Counteract software-induced hardware obsolescence by collaborating across functions and organizations to enable more software-enabled functionality, possibilities to upgrade and extended support.
- Collaborate with buyers to develop consumption models that create more value from each manufactured resource, focusing on functionality and allowing for reuse, refurbish, service and upgrade.
- Take an active part in reframing the narrative on products and technology, where focus is on maintaining and upgrading functionalities rather than transferring functionalities to new products.

Recommendations for the buyers

- Establish policies on sustainable IT that promote radically extended product lifetime and reduce the use of resources.
- Involve the organization's IT department in procurement processes early on to remove negative perceptions and practical obstacles with a prolonged lifespan.
- Communicate within the organization the environmental benefits of an extended lifespan.
- Request refurbished products and products with a high degree of recycled components in the supply chains.
- Push for longer product-life expectancy, including increased focus on functionality and corresponding service agreements.
- Include take-back clauses in agreements and make sure products are recovered after use.
- Secure a match between product specification and employee needs, to avoid over-consumption of resources.

ASF Advisory Board

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About the dialogue

THE FINDINGS IN this report are based on a stakeholder dialogue with IT-buying organizations in the Nordics. The dialogue consists of an open online survey during the field period of May to September 2021. The results of the survey have been supplemented by five in-depth interviews with respondents working with sustainability, IT or procurement in the public as well as private sector. In addition, insights from meetings held with the members of the ASF buyers' network, Leadership for Change, have been weighed into the analysis.

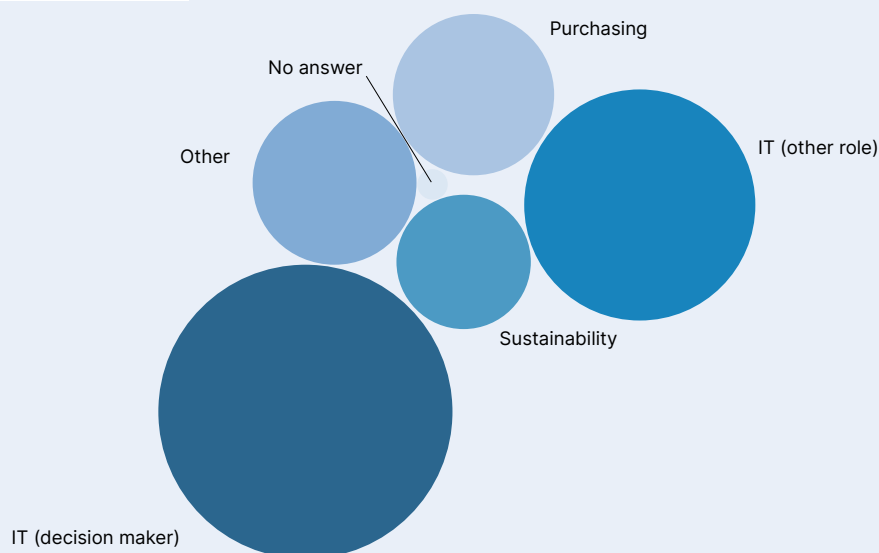
Like last year, a major part of the respondents are IT decision makers in large organizations. Most of them report that sustainability is a priority when procuring IT. This indicates that the majority of the respondents are engaged in sustainability issues and frontrunners – both as organizations and as individuals within their organizations.

More about the results can be found on page 13. ■

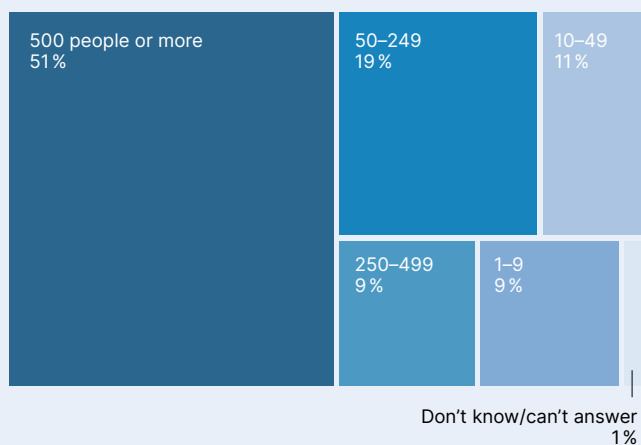
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respondents of which a major part are IT decision makers in large organizations.

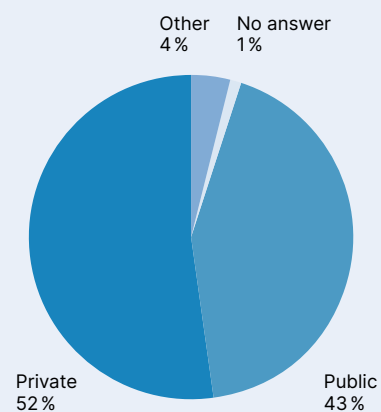
Role of respondents



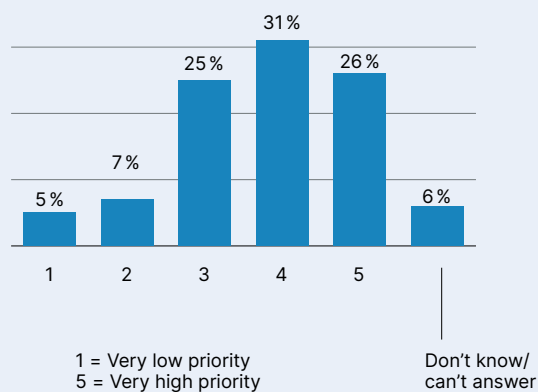
Company size



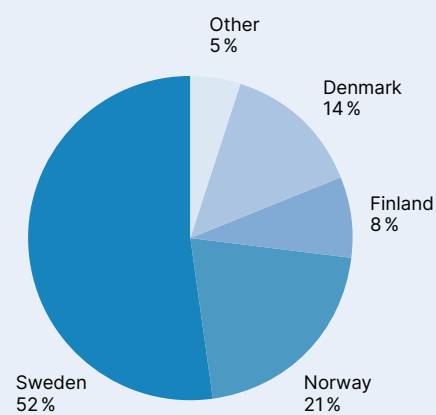
Sector



Priority of sustainability in connection to IT



Country



What the buyers say

The Nordic IT buyers are known to be among the most advanced when it comes to adopting new technology as well as in their approach to sustainability. This makes them highly relevant and important as stakeholders for the IT industry in its effort to support sustainable digitalization.

The Nordic IT buyers that participate in the Atea Sustainability Focus are the most engaged and mature, which make them an inspiration to IT buying organizations around the globe. Here is what they have to say.

There is room for advanced sustainability requirements

While a major part of the respondents (57%) claims to prioritize sustainability in procurement of IT, only 38 percent say they specify a range of criteria including qualification requirements, award criteria and contract terms (Figure 1). Of these only a third use award criteria with price reductions, which indicates that there is room for further advancement in this area. This is confirmed by the answers to what the respondents believe is the most important thing they can do to contribute to more sustainable IT: create and reinforce a process, and internal collaboration around how you specify, verify and monitor sustainability requirements.

Lack of time and evaluation major obstacles

When asked about the biggest challenges to their own opportunities to work with IT sustainability, the top three

Figure 1. Which of the alternatives below best describes how you specify sustainability requirements in the procurement of IT?

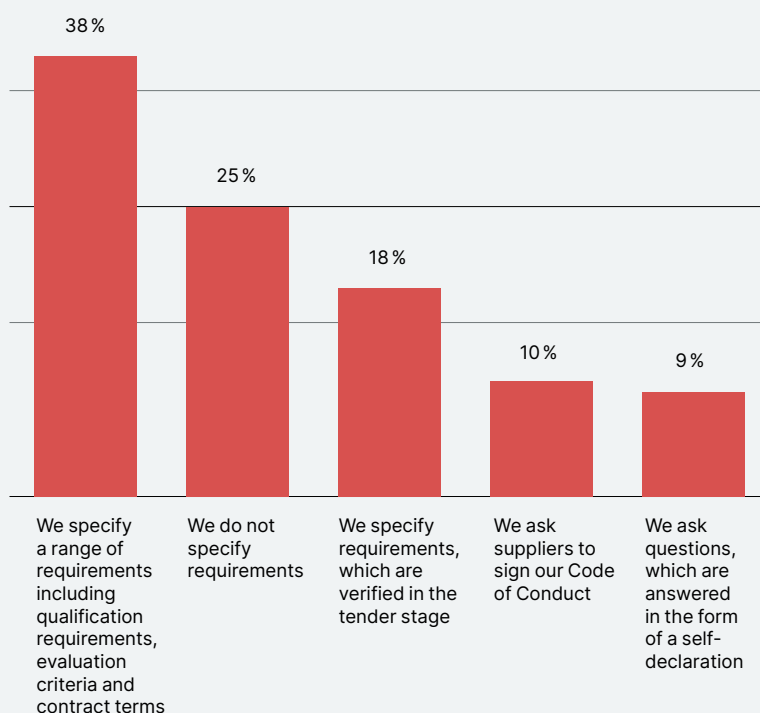
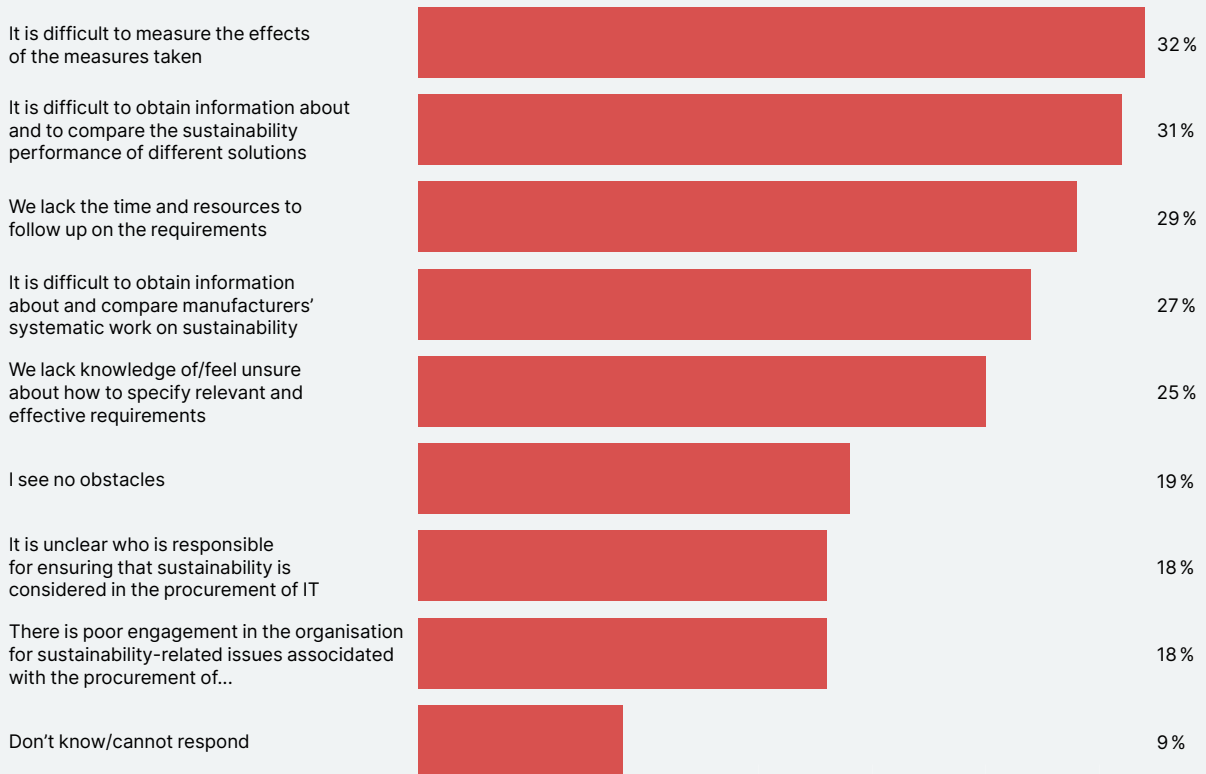


Figure 2. What obstacles do you see for your organisation's opportunity to prioritise sustainability in the procurement of IT?



answers have remained the same since Nordic IT buyers started to communicate their sustainability preferences to the industry through the ASF platform in 2017. The main obstacles still are:

- Lack of time and resources to follow up on requirements
- It is hard to measure the effects of actions taken
- It is difficult to get information about, and to compare, the sustainability performance of manufacturers and products. (Figure 2)

This does not necessarily mean that nothing has happened over the years. Increased maturity can also lead to expanded demands around sustainability information and desired effects. However, IT buyers need more support and feedback from the industry in terms of comparability and effects, and procurement and follow-up processes need to become more efficient.

Strategy for sustainable IT a priority

There may be a trend towards a more holistic view of IT sustainability. Setting a strategy for sustainable IT tops the list of

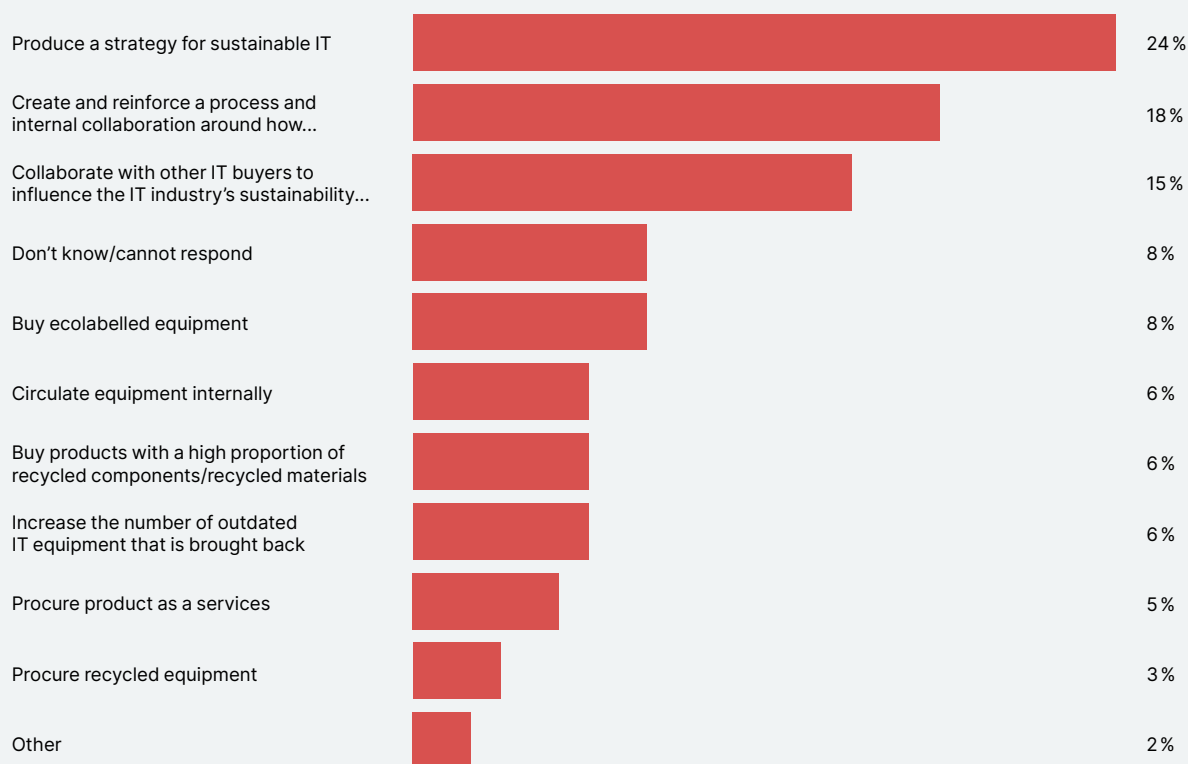
actions that the respondents think will have the most impact on their part (figure 3).

New ways to extend lifespan necessary

The respondents were also asked to describe what the industry should prioritize to:

1. Contribute to a more circular manufacturing and handling of IT
2. Reduce its climate impact
3. Guarantee good working conditions and respect for human rights in the supply chain

Figure 3. In your view, what is the most important thing your organization can do to contribute to more sustainable IT?



Respondents could choose only one alternative for each question.

Increasingly, IT buyers want to find ways to prolong the lifespan of their IT assets. The topic was a priority in 2020 and remains so in 2021. All top alternatives for the question about circular manufacturing and handling of IT can be tied to this issue (figure 4): increasing product lifespan (26 %), circular design (23 %) and circular business models (18 %).

Low interest for reused products

It is a bit surprising, though, that

the respondents seem unaware of what actions on their part that has the most impact on product lifespan. Actions like increase asset recovery, buy reused and circulate IT equipment internally all ranked low in the list of what respondents say is the most important thing they can do to contribute to more sustainable IT.

The survey shows that few are buying reused equipment (8 %). In interviews respondents say they want the industry to offer reused equipment, indicating that it is a matter of supply rather than attitudes. Today, procuring reused

equipment requires buyers to go outside of their traditional supply chains.

Like last year, interview participants express that they would like the industry to clearly communicate the expected lifespan of products.

Need to reduce use of virgin material

According to 33 percent of the respondents the industry should focus on reducing the use of virgin and/or fossil materials to minimize its climate impact (figure 5). This signals an awareness of

Figure 4. What do you feel the IT industry should be focusing on primarily in the next few years in order to contribute to a more circular manufacturing and handling of IT?

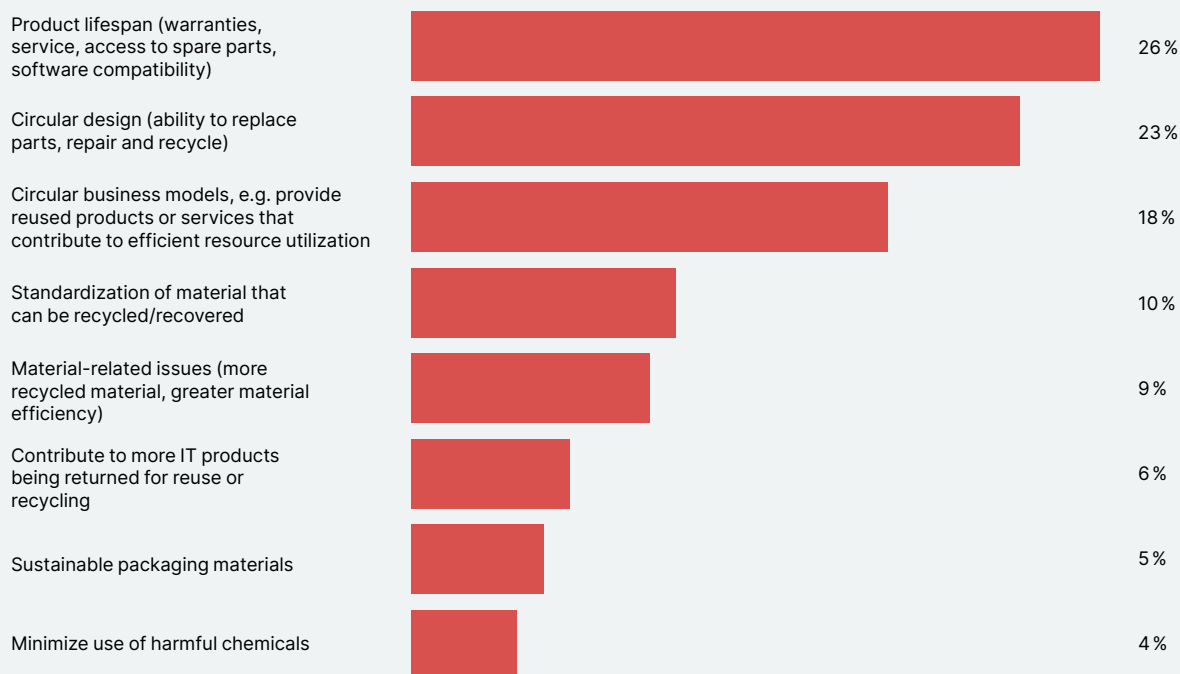
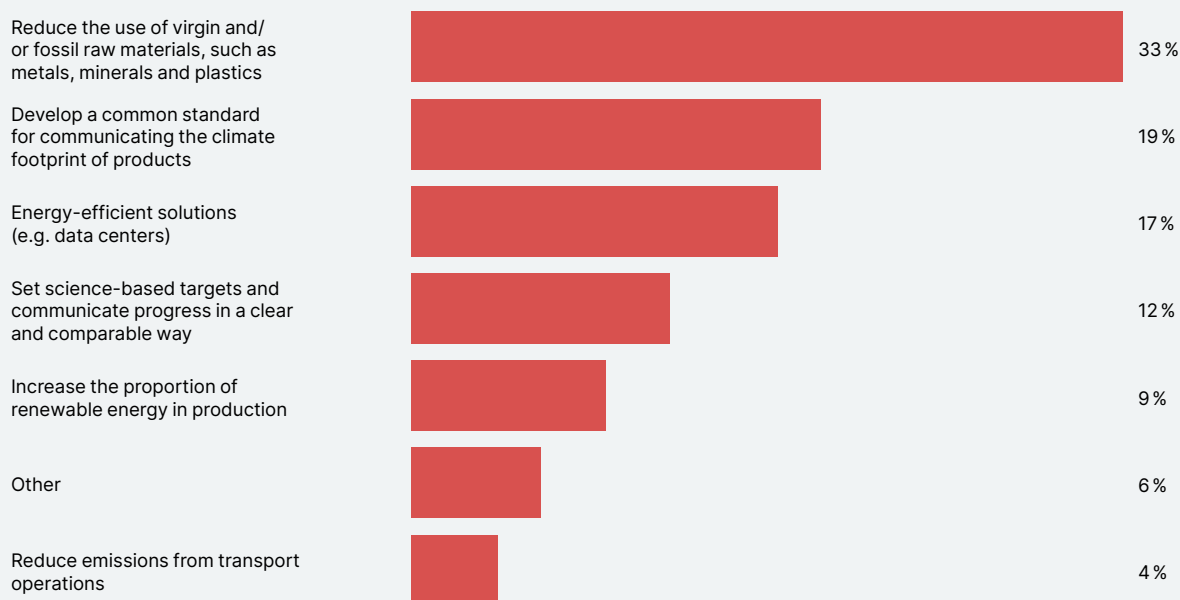


Figure 5. What do you think the IT industry should focus on over the next few years in order to reduce its climate impact?



the connection between reduced resource consumption and the climate.

According to Nordic IT buyers, standardization is key to address this issue, both standardizing for how the climate footprint is communicated and standardization of components and accessories.

In the survey, those that prioritize IT sustainability put a slightly higher emphasis on the need for the industry to develop a standard for communicating climate

footprint. Twelve percent of survey respondents say they include the impact of IT procurement in their sustainability reporting.

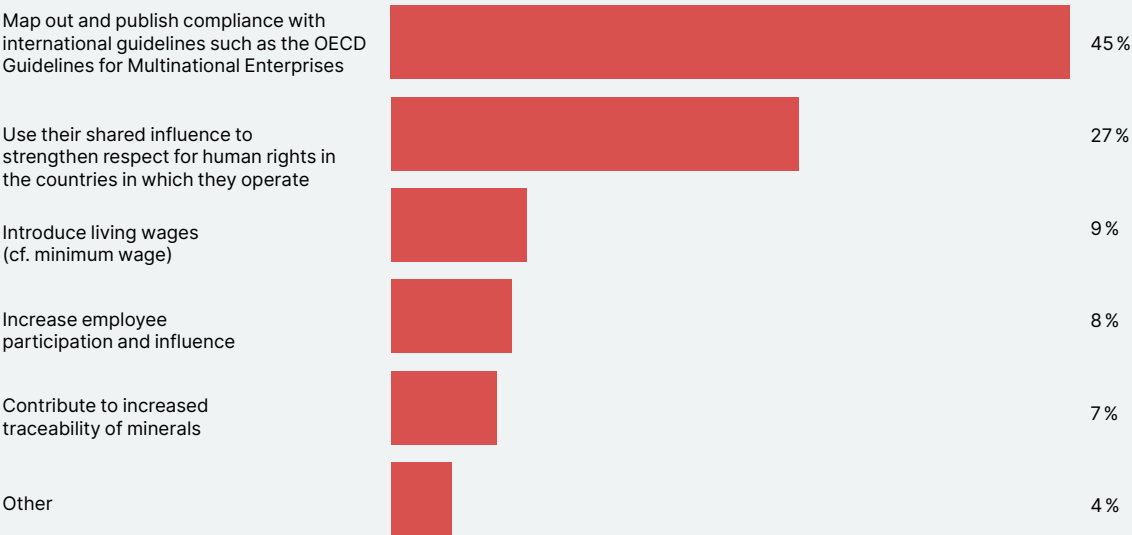
Request for increased transparency

Like in the previous ASF reports, respondents believe that the social issues will gain more traction within their own organizations.

What is evident this year is that transparency is back on the table. The recent attention around forced labor in China and the

different European legislative proposals on due diligence might have had an impact. When asked what the industry should focus on to guarantee good working conditions and respect for human rights, the top answer was to map out and publish compliance with international guidelines (figure 6). This issue was also brought up in interviews and during the roundtable with Nordic organizations organized by the Responsible Business Alliance in Stockholm, Sweden in October 2021.

Figure 6. What do you think the IT industry should be focusing on primarily in the next few years in order to guarantee good working conditions and respect for human rights in the supply chain?





Summary and take-aways

- Respondents claim to prioritize sustainability, but few set advanced sustainability criteria.
- Setting a strategy for sustainable IT is the most important action according to the Nordic IT buyers.
- Product longevity still is the number one issue, however respondents don't seem to value their own contribution, such as asset recovery and buying reused.
- Standardization – of both information and components/accessories – is a hot topic.
- Transparency has resurfaced as a prioritized topic both regarding social issues and in the sense that buyers want transparency around climate footprint.
- Transports and packaging rank low in the survey, which suggests buyers want the industry to focus on the bigger issues.
- For reducing climate impact, respondents want the industry to act rather than to set up goals e.g., by reducing the use of virgin and/or fossil materials.

Creating change

The ASF survey states that collaboration with other buyers is one of the most important actions for more sustainable IT (figure 3). Leadership for Change is a new and unique initiative, under the Atea Sustainability Focus' umbrella. Determined to be the change they want to see, Nordic IT-buying organizations founded the network Leadership for Change to create a market for more sustainable IT solutions. The network rests on two pillars. The first pillar is a manifesto that states that members shall weigh sustainability into their IT procurement decisions and favor suppliers that are in line with the 1.5-degree climate target. The suppliers should also be resource efficient and respect human rights. The second pillar is knowledge sharing and capacity building. As a result of this, the Leadership for Change is in the process of producing its first best practices around circular IT and creating an IT sustainability strategy. ■

Why don't IT products live longer?

Summary

IN A CIRCULAR ECONOMY it is essential to keep products intact for as long as possible. Although IT devices are complex products filled with numerous metals and minerals, their actual lifespan is short. By increasing product longevity several of the most pressing sustainability challenges within the IT industry can be mitigated. That includes the CO2 footprint of production, consumption of natural resources and the generation of e-waste. However, whereas the environmental gains of increased product lifespan are evident, many of the economic benefits have yet to be realized.

"[...] extension of the service life of ICT products has been identified as the main strategy for minimising the total environmental impact of ICT products."

Prakash et al., 2016

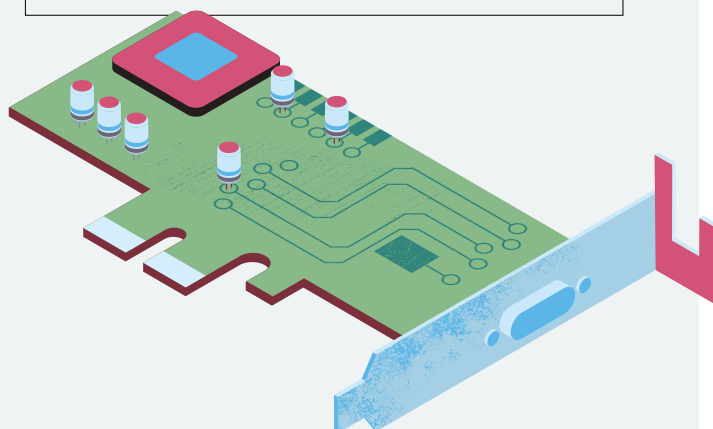
Laptops can have a technical lifespan for about ten years, but this is rarely the case. Increased repairability is often highlighted as the solution, but if products already are designed to live longer than they actually do, poor repairability is not the main obstacle. This means there are other solutions to focus on.

This analysis shows that the challenge is a lack of a repair culture, mainly due to high costs and habitual contract periods, rather than lack of repairability. It highlights that it is presumptions and convenience that hinder the procurement of reused equipment rather than insufficient quality. The solutions can be

found in circular business models that incentivize the producers to design for durability. The business models should include efficient asset recovery to make sure products and components quickly get back into the loop, and where repair and remanufacturing are natural parts of the ecosystem in which all actors strive to maintain the value of the devices. These business models can be implemented today.

However, regardless of business models, the actual product lifespan will not increase unless the issue of software/hardware compatibility is resolved as this heavily influences the potential lifespan of hardware.

The scope of this analysis is small IT products, primarily laptops, for B2B use.





Product lifespan

About 80 percent of the carbon footprint is already embedded in a laptop at the point of sale. Increasing product lifespan is therefore essential in order to reduce the environmental burden the product carries from the start.

Product lifespan can be divided into three categories (European Environment Agency, 2020):

1. Actual lifetime
The interval from when a product is sold to when it is discarded or replaced.
2. Designed lifetime
The time period that the manufacturer intends its product to remain functional, which is shaped through design and after-sales services.
3. Desired lifetime
The average time that consumers want the product to last.

Case studies confirm a 2.3 years shorter average lifetime of electronic devices than what they are designed or desired for (European Environment Agency, 2020), meaning IT devices are discarded while they are still functional (thrown

away, stored or recovered). For the first use cycle, literature suggests a lifespan of three to five years and for the second use around two to three years (Prakash et al., 2016, Thiébaud et al., 2017). For laptops specifically, research suggests a first life of at least six years in the scope of technical opportunity (TCO Certified, 2020), however, this is rarely observed in reality.

The environmental footprint of a laptop is to a great extent determined by a few components such as the motherboard, SSD and display. It can therefore be said that a product's lifetime is dependent on the quality of these components, since replacing them comes with a high environmental cost.

The role of design

Design is the key to reduce the environmental and climate footprint of IT products. Many of the decisions made in the design phase affect the product's lifespan and its ability to be repaired and recycled. Powered by the so called "right to repair" movement and legislative measures like the French reparability index, much of the discussion around life extension has focused on reparability and modularity. However, while design-related reparability can be improved in many ways, a standard laptop can still be repaired today.

Elementary to circular design is the inertia principle coined by Walter Stahel, which is a design hierarchy where the most preferred option is to keep the product intact and at its highest value.

"Do not repair what is not broken, do not remanufacture something that can be repaired, do not recycle a product that can be remanufactured. Replace or treat only the smallest possible part in order to maintain the existing economic value."

Walter Stahel

Following this school of thought, more attention should be put on other types of circular design tools such as design for durability, design for standardization and design for upgradeability and adaptability. Design for durability can be especially important for small IT products as it reduces the need for replacing carbon-intensive components. Design for standardization increases the possibility to reuse these components.

Dell Technologies believes that sustainability needs to be considered on a component level. According to Karthik Suryanarayan, Director of Sustainability Strategy, a risk with modular concepts where customers are responsible for switching high-footprint components like semiconductors and motherboards, is that they might go to waste instead of being reused. In that case the only thing extended is the life of the shell.

The potential for a long product lifespan is to a large extent determined at the design stage, where preventing the products from breaking down in the first place perhaps is most important.

The role of software

The actual lifespan of hardware is heavily dependent on the compatibility of software. This is commonly referred to as software obsolescence, which can be divided into two categories:

1. Technical obsolescence where sales and support for the software terminate. As an example, end of support for Windows 7 in early 2020 contributed to an increase of PC sales by 2.3 percent after a long time of decline (Gartner, 2020).
2. Functional obsolescence where changes in hardware requirements to support the software makes the hardware obsolete.

The issue is increasingly recognized by the regulators. For example, the upcoming EU eco-design directive will stipulate availability of security updates for at least five years and functional updates for at least three years.

The industry is responding, especially the smartphone industry where for example Samsung recently announced that it will support selected Galaxy devices for three generations of major Android OS updates, and Apple's latest iOS 14 extends support back to iPhone 6s (2015). While it is apparent that more needs to be done, software-driven hardware obsolescence is not brought up by large industry initiatives such as the roadmap developed by the Circular Electronics Partnership. As hardware and software in most cases are supplied by different parties, resolving this issue will require more dialogue and collaboration.

"Computer hardware can last for 10–12 years – or as long as the software and chip manufacturers deem fit."

Steve Haskew, Head of Sustainability at Circular Computing

Economic considerations

There are inherent economic benefits to be retained through circular strategies (TCO Certified, 2020). Since the market favors the linear approach of 'take, make, waste', these are not being fully realized. Environmental and social impacts are not internalized, and since the production often takes place in low-wage countries, while refurbishing more often is located in high-wage countries, linear solutions have a competitive advantage.

In theory, margins on a reused product could be very high since no production costs occur. Customers recovering used assets will benefit from the residual value, and customers buying reused equipment will benefit from the lower price. Since

most laptops have a longer designed than actual lifetime, it is evident that the full product value is not being realized, which the fact that the e-waste generated annually is conservatively valued to 57 billion USD also indicates (Forti V. et al, 2020).

Therefore, extending the lifetime of a laptop through reuse (possibly including reselling and refurbishment) helps save natural resources and reduce greenhouse gas emissions as well as obtain the inherent economic value. The prolonged lifetime also delays the need for recycling components and maximizes the value of the initial investment. This is important also because today's recycling processes are unable to recover all of the valuable metals and minerals from e-waste. Ultimately, products and components are reused, avoiding the manufacturing of new ones (TCO Certified, 2020).

Summary of economic and environmental aspects of prolonged lifespan

- The actual lifespan of laptops is shorter than the designed lifetime, indicating that many products are discarded prematurely
- If you were to follow the inertia principle of circular design, design for durability should trump design for repairability
- Addressing the role of software in making hardware obsolete is key to extending lifespan
- There are potential economic benefits in increased product lifespan as it maximises the initial IT investment

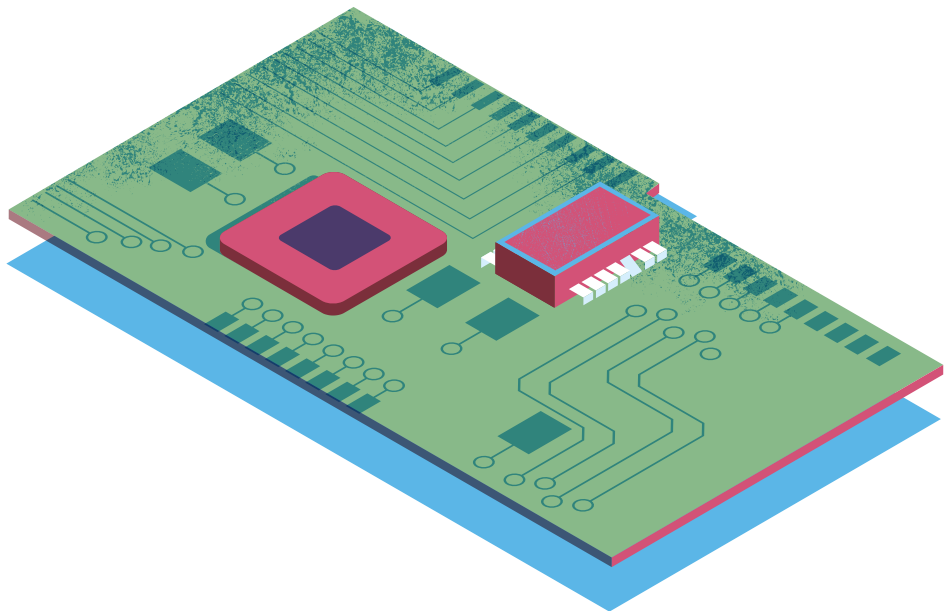
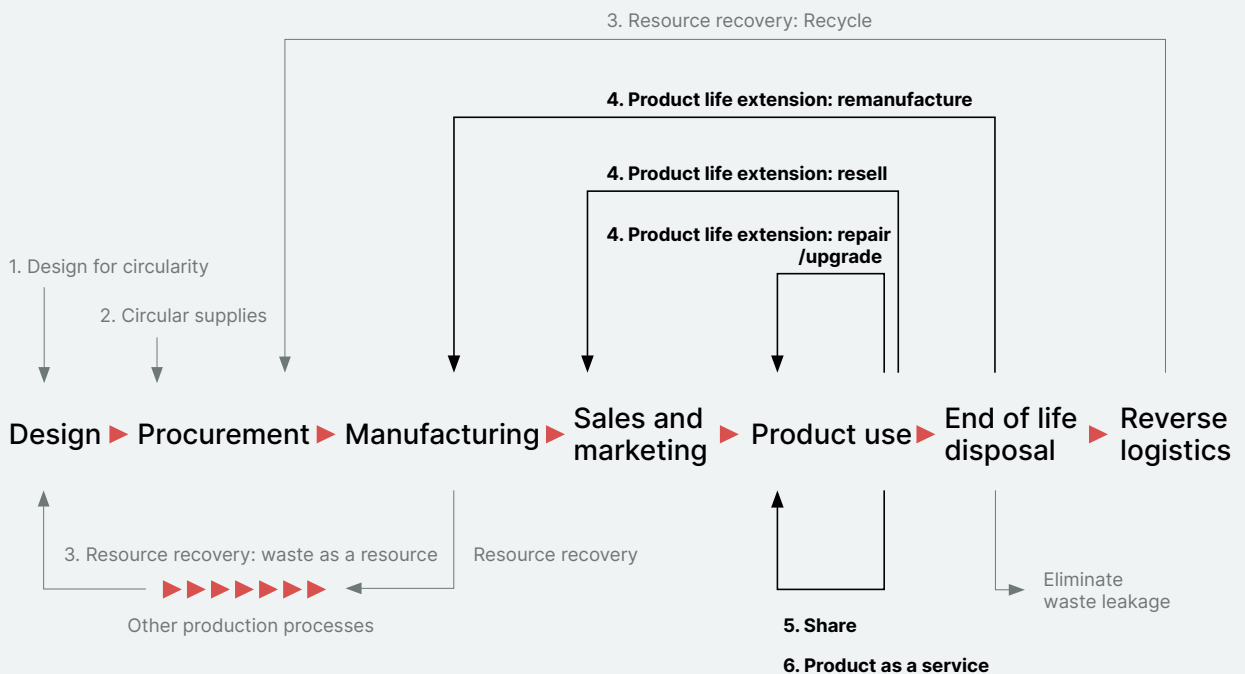


Figure 7 depicts the possible transformation paths from a linear to a circular value chain through adding different circular strategies, focusing on those that extends the use life of a product (in no order of priority):



4

Within several value chain steps product life extension strategies are possible to avoid devices reaching their end of life. Examples are upgrading, reselling, repairing and remanufacturing. These circular strategies are important tools to retain the underlying value.

5

A further simple circular strategy that can be applied during the product use is sharing. The underlying rationale is the avoidance of manufacturing another product since one device could possibly satisfy the need of several persons. For example, if employees switch between home office and office work, added screens can be shared amongst those in the office space, saving both resources and money.

6

Product-as-a service is an emerging strategy amongst IT suppliers, where the function rather than the physical product is supplied. Thereby, the supplier retains the ownership of the device, with the incentive to apply product life extension measures when necessary.

Barriers to lifetime extension

A variety of economic, technical, organizational and societal factors hinder the extension of the lifetime of IT devices.

Desires, norms and perceptions

The perceived lower quality of second-hand products and the cost incentive of new products, coupled with consumer preferences for the latest device model hampers the spread of lifetime expansion services (European Environment Agency, 2020).

“It’s more cool to buy almost new devices than to keep the device you have. It’s mostly social psychology.”

Although complex, IT products are viewed as consumption goods to a larger extent than for example cars and washing machines. Desire to keep up with (perceived) technological advancements that are often emphasized in the introduction of new models (or is it rather fear of missing out?), is another factor affecting the product use time. As one of the IT buyers in ASF Leadership for Change said: “It’s more cool to buy almost new devices than to keep the device you have. It’s mostly social psychology.”

There is also the concept of second hand IT products being viewed as inferior. “Second hand is second best” as Steve Haskew of Circular Computing puts it. Steve even means that perception is the biggest barrier to extending product lifespan. “When the warranty ends, the product is expected to break down.”

Lack of repair culture

In the current contractual landscape, the regular warranty and service agreements comprise around three years (Dodd et al., 2016). Outside of the warranty period, repair of damaged products is in most cases cost intensive, especially when targeting expensive internal components such as the motherboard (ibid.). The lack of economic incentives for both the industry

and the customer has created a replace rather than a repair culture. Upgrading of used products is done by specialized actors such as the Nordic company Inrego and British Circular Computing. Within this sphere, the requirement of time-intensive manual labour leads to cost-ineffective refurbishment services falling behind the automation within the production of devices (Atasu et al., 2021).

The mentioned barriers point towards the not yet achieved transition to circular designed devices embedded in circular business models and the reconfiguration of the value chain, organisations and the industry (Buith & Ewalts, n.d.). On the contrary, current business models and production systems rely on the number of sales as the criterion for success (Chatterji, 2021). Consequently, a lack of infrastructure, specifically facilities to recondition devices at a large scale and the unavailability of spare parts are prevalent (ibid.).

Low recovery rates hamper reuse

Too much IT is being stored or is unaccounted for at end of life. According to Mobile Phone E-waste Index, there are approximately 771 million unused mobile phones in the 27 European countries covered by the index (Rebuy 2020). This means there is a great resource stock of reusable IT that is not being exploited. It also means a great value loss, as the opportunity to reuse and recycle these devices decrease over time.

Improved recovery will increase the supply of reused equipment, which in turn could lead to buying reused becoming more mainstream. Today, organizations must go outside of their normal procurement routines and specifically ask for reused in their request for tenders. One example of how this might be changing

is the recently announced pilot project where HP Inc partners with Dutch Flex IT to offer reused equipment on a global scale.

Also, increased recovery rates will ensure that valuable and carbon-intensive components can be reused, which could support the development of a repair culture.

Linear and organizational lock-ins

The prevailing economic model doesn't favor long product use, and changing status quo is always challenging. These challenges can be found both on the industry and buyer side.

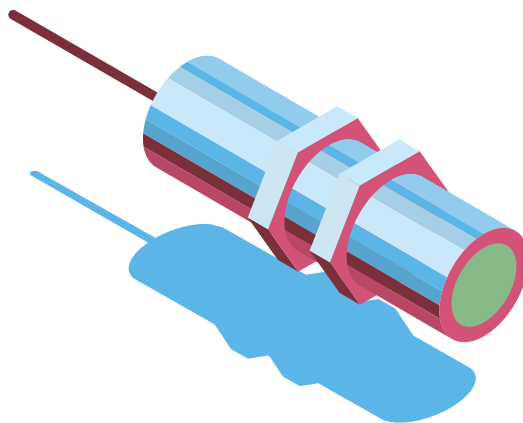
Industry aspects

Current business models are built around fast, transactional sales. Other models, such as those focusing on reuse, can be perceived as a threat to the sales of new products; however, a study on eight global organizations showed that offering remanufactured/refurbished products may lead to new sales and new business opportunities (Ellen MacArthur Foundation 2018).

According to Steve Haskew at Circular Computing, the big manufacturers shouldn't see circularity as a threat. "It's a combined and collaborative strategy. You need a balance between linearity and circularity – at this time circularity relies on core, and core comes from the production of new products."

Organizational aspects

The linear business model has created a replacement culture where products are routinely replaced after about three years. IT departments are organized around this behavior. Keeping products longer will require more service and mean a higher failure rate, which may threaten



productivity and expand the burden on the IT department. Increasing the share of reused products requires flexibility around supply and ability to manage a more differentiated hardware stock.

(The above-mentioned barriers were identified during interviews with respondents in the ASF dialogue and members of ASF Leadership for Change.)

Design

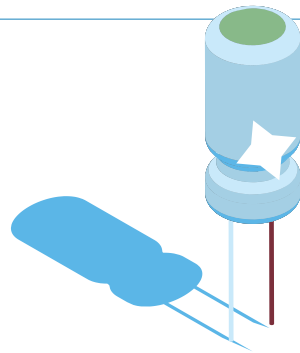
Even though laptops and other IT devices already have a longer designed than actual lifetime, a lot more can be done on the design level to extend lifespan. Some design-related barriers identified by the Circular Electronics Partnership (and also highlighted by the Advisory Board in the 2019 ASF report) are:

- a lack of industry-wide standards and definitions for circular electronics products and services
- a lack of collaboration between stakeholders engaged in product development and life-cycle partners
- insufficient actionable training for designers and engineers

As an example, designers may be faced with having to do trade-offs between durability and repairability. By overcoming the barriers above, more guidance on how to handle these conflicts can be provided.

Summary of factors preventing laptop lifetime extension

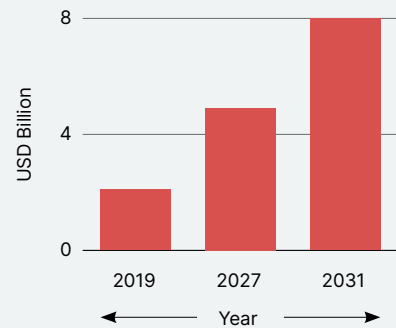
- Perceptions and norms regarding reused
- Pre-determined warranty periods and contract lengths
- Linear lock-ins hampering growth of circular business models
- IT departments organized around continuous replacements
- Different parts of circular design may require trade-offs



Market developments

The global laptop market is expected to reach around 109 billion USD in 2025, translating into a 0.4 percent Compound Annual Growth Rate, CAGR (Grand View Research, 2018). The size of the refurbished computer and laptop market accumulates to less than five percent the size of the global laptop market in around the same time period but constitutes a much higher CAGR (11 percent). (Figure 8)

Figure 8. Depiction of refurbished computer and laptop market development 2019–2031



Device-as-a-service (DaaS) is also growing. In 2015, no major PC manufacturers offered a DaaS option, but by 2019 this number had grown to 65 percent (Accenture, 2020). According to UnivDatos Market Insights, the DaaS market is expected to exceed USD 300 billion by 2027, with a CAGR of 25 percent. At the moment, the most common device to lease is by far printers.

Through multiple policy approaches within the Circular Economy Action Plan, the EU directly targets the value loss of electronics and ICT products (EC, 2021). Examples are the Eco-design Directive, right to repair and an envisioned EU-wide take back scheme for mobile phones, tablets and chargers (ibid.). In 2021, France introduced a self-declared repairability index to increase transparency for consumers (ibid). The index informs about the level of easiness to repair an electronic device (ibid). Hence, regulators are ramping up efforts to increase product lifespan.

Summary of market developments

- The market for refurbished computers and laptops and Device-as-a-Service options grows more rapidly the overall PC market.
- Regulatory efforts around product longevity of IT products are increasing.

Future outlook

The market demand is seen as key to accelerate the pace of transformation (TCO Certified, 2020). Extending product lifespan must be a joint operation overcoming barriers and providing benefits on both an industry and IT-buying company level. The path forward lies in the way we consume IT products, rather than in the products themselves, which is best realized by identifying and scaling circular business models, since these can be attractive to both industry and buyers. This is also something that can be done today.

Keeping products longer

Organizations can hang on to their equipment longer. According to members of ASF Leadership for Change, it is possible to move from three to four years without experiencing any negative impacts. Adding more years would require the equipment to be regularly serviced in order to maintain value and functionality. The viability of such a model would increase if equipment of high quality was sourced from the beginning, something that could also incentivize the industry to develop attractive service offerings around long-lasting products.

Device-as-a-Service

As shown in the previous section, Device-as-a-Service (DaaS), is growing rapidly. DaaS has the potential to provide substantial environmental benefits. According to a study commissioned by HP Inc, DaaS

solutions for commercial PCs have lower environmental impacts than retail for all life-cycle assessment categories. Impact reductions range between 25–30 percent compared to the linear model (HP, 2020). Optimal supply (no overprovisioning) and 100 percent recovery can provide both economic and environmental benefits for all actors; however, the DaaS model is not sustainable per se. Short and rigid lease periods, insufficient asset recovery and supply of exclusively new equipment are factors that can affect product lifespan negatively. DaaS models incorporating used equipment would further incentivize the industry to extend lifespan of products as more value can be retained from each product.

Increasing share of reused equipment

IT-buying organizations can increase the demand for reused equipment as well as contribute to market supply by increasing asset recovery. The industry can make reused products a mainstream offering to “regular” business users and increase collaboration with refurbishing and remanufacturing specialists. ■

Summary of future outlook

- The most efficient way to increase product lifespan today is through business models that push for more sustainable consumption
- Benefits for both industry and IT-buying organizations are key
- DaaS has proven to have substantial environmental benefits if done correctly
- Industry and buyers can collaborate around making reused equipment more mainstream

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