Circular IT Management in Practice

Impacts and Insights

Make the sustainable choice easy with TCO Certified

Global sustainability certification for IT products

TCO Certified is the leading sustainability certification for IT products, driving social and environmental sustainability throughout the IT product life cycle.

Comprehensive, up to date criteria

A new generation of TCO Certified is launched every three years, to meet the most pressing sustainability challenges and drive faster change.

Independent verification of compliance

Compliance is independently verified, both pre and post certification. TCO Certified also includes a system for dealing with identified instances of non-compliance.

A circular approach to IT products

In this year's edition of Impacts and Insights, we're deep-diving into circularity. In a circular economy, resources are handled responsibly. The goal is to extend product lifetime and recirculate all materials without producing any waste. What does this actually mean for IT products — and how can the circular economy be implemented on the ground, when you procure and use IT products? What stands in the way for circularity and how can these obstacles be removed?

To answer these questions, we've spoken to experts in the field (including our own), interviewed people on the frontline of circular procurement, and checked in with some IT brands to get a snapshot of how the transition is going.

This is the result. A report explaining how the linear production and consumption of IT products contribute to the climate crisis, the unsustainable depletion of natural resources and enormous amounts of toxic e-waste, but also how a circular approach can contribute to solving these sustainability issues. Our ambition is to go further than listing theories and provide concrete help for those of you who want to take the next step in managing IT products in a circular way. This is why we have asked everyone we've interviewed for practical tips. At the end of the report, all 33 hands-on tips are collected, to help you move forward.

One thing we've learned during our work with this report is that the most important thing is to actually get started. The transition to the circular economy is essential, and we all need to play an active part in making the switch. It doesn't matter so much what the first step is as long as you take it.

Key findings

1. Using your IT-products longer (and reselling them once you're done using them) is the single most important thing you can do to save natural resources and cut greenhouse gas emissions.

2. Implementing circularity helps maximize the value of your IT investment, when products are kept longer and sold for re-use.

3. Market demand is key to accelerating the pace of change. Think circular when you're purchasing IT products and include criteria with a circular approach in your procurement contracts.

4. Circularity includes IT management throughout the life cycle. You need to implement circular practices in your own organization. This will impact employees, so you need to have them onboard.

5. Improved supply chain responsibility can accelerate our transition to a circular economy.

6. We all need to acknowledge that circularity is a team effort and no one can do it alone. Both internal and external cooperation is key!

7. Many circular solutions are already in place — we now have to use them. It doesn't matter so much what the first step is as long as you take it.

Contents

Patience is my best friend — and worst enemy

Over the years, I've become more patient. Before, I used to think "how difficult can it be?", but now I have much greater understanding for the challenges and scale of change.

More boring? Possibly.

But I've realized that there's value in slow and steady; and I'd rather build something with stable foundations than a house of cards.

Since TCO Development's vision is that all IT products should have a sustainable life cycle, I can benefit from having a little patience. Changing the direction of a global industry with thousands of different actors takes time. I wish it was different, but this isn't something that's going to happen in a matter of months or even years. It requires painstaking work, step by step, over many years.

Which makes it all the more gratifying to see the successes we've had with TCO Certified, generation 8 since its launch in December 2018. It was a bold initiative, and we didn't know how it would play out. Never before in TCO Development's nearly 30-year history had we taken such a major sustainability step and challenged the IT industry so much. We established an entirely new set of criteria focusing on circularity and tightened already tough social and environmental requirements. I'll admit that I wondered whether we had gone too far, setting standards that too few products and their manufacturing facilities could meet.

Uncertainty changed to relief when applications began to flood in. The IT industry has stepped up to the plate, and for the first time, I'm seeing them bring sustainability into the core of their operations. Meanwhile, hundreds of purchasing organizations have taken responsibility to buy more sustainable IT products with the help of TCO Certified, which creates collective pressure to drive the industry forward.

Progress is needed. The sustainability challenges facing humanity are hard to grasp and I believe that many of us are struggling to find solutions to them. In these circumstances, I see this as a strength. If we're to succeed in addressing the broad range of challenges we face, from the climate crisis to the reduction of biodiversity and the growing problems associated with chemicals and e-waste, we need the solutions we are already familiar with as well as solutions we haven't even imagined yet. What this change means in practice, in five or ten years, is of course unclear. I'm preparing myself to be unprepared.

After all, so much has happened in the past year. Large parts of the population are beginning to see sustainability as something that affects us all. Attitudes towards buying second hand are changing and we're increasingly seeing value in IT products after their first users are done with them. I'm seeing companies that work with reuse growing and new ones emerging. The linear business model is beginning to be challenged.

Sören Enholm, CEO, TCO Development.

The move toward a circular economy is an entirely necessary paradigm shift – one that will be painful. Structures that have existed for many years will be torn down. But the circular economy also creates new opportunities, and scope for innovations. Achieving this fully will, as I have outlined, require patience. But taking the first step on this journey doesn't require any patience whatsoever. On the contrary, a little impatience is probably good to make things happen. Practical solutions are already in place and many people have already started this journey - we just need to follow in their footsteps.

This report is full of tips and practical examples of how to achieve circular management of IT products. Read and be inspired. Share your experiences with others. It is by standing together and helping one another to move forward that we will succeed — equipped with a good mix of patience and impatience.■

Circular impacts

Linearity
undermines ecosystems and the economy

In today's society, the linear economy is the norm.

But when you think about it, this economic system makes no sense. It means that we take virgin natural resources and make products from them which we then discard once we're done using them — often after a relatively short time. The products are then replaced by others, made in exactly the same way.

The linear economy is based on the assumption that the planet's resources are infinite — that we have an endless supply of oil, water and rare earth metals that we can use freely. We also assume that we and the earth are equipped to deal with large amounts of waste, which is the result of linear thinking. Why do we continue to make things to be thrown away and use materials that last forever in single use products?
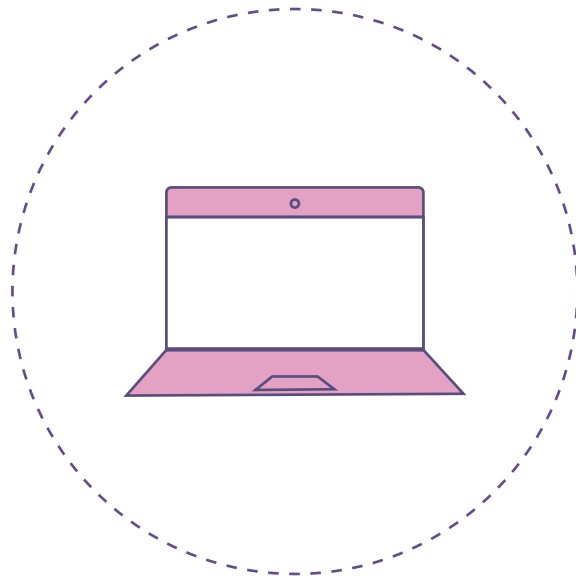
What circularity means for IT products

By turning natural capital into energy and products, our current, linear way of producing and consuming products has created unprecedented economic growth that has raised millions of people out of poverty. However, it also requires extensive and intense use of natural resources and that is really starting to catch up with us.

We have caused the climate crisis by generating dangerously high levels of greenhouse gas emissions. Fragile ecosystems have been ruined, leading to the loss of biodiversity, soil degradation, polluted oceans and a lack of fresh water. Valuable natural resources are running low. Ultimately, the damage we do to our planet will undermine its ability to provide us with natural capital, and affect our health and well-being as well as our future economic prospects.

Resources are re-used in the circular economy
The circular economy is a way of making ends meet. The logic is simple — it means that we use natural resources responsibly so that we don't risk exhausting them, reduce greenhouse gas emissions to manageable levels, and protect land and water for the benefit of all in the long term.

IT products are made to have a longer life
When the circular economy is introduced, the linear take, make, use, dispose model, where natural resources are turned into waste, is replaced with a model where products, components and materials are looped back into the system to be used again and again. To enable extended product lifespans and product reuse, IT products are durable and can be upgraded and repaired. Vital components that easily break or lose capacity can be replaced. Products are of high quality and are possible to take apart to allow for refurbishing and remanufacturing solutions. When a product has reached the end of its usable life, materials are seen as valuable resources that are recycled to replace virgin materials in the manufacture of new products. The ultimate aim is to eliminate waste altogether. ∎

Is circularity the same as recycling?
Recycling is an important part of the circular economy — once a product can no longer be used, it is necessary to take care of and repurpose the materials it contains. However, circularity includes so much more — from business models to consumer behaviors and material flows. Most materials decrease in value every time they are recycled, which makes recycling a less favorable solution than repairing and upgrading products. Read more about the effects of product life extension and recycling on page 17.

A model for circularity

In a circular economy, the aim is to keep products and materials in use as long as possible. Products are designed for a long life and are durable, repairable and upgradeable. When products no longer can be used, materials are seen as resources that are reused in new products. The more a product can keep its original shape, the more it will retain its value, which is illustrated by the circles in the diagram below. Circles closer to the user are more resource efficient than circles that are further out.
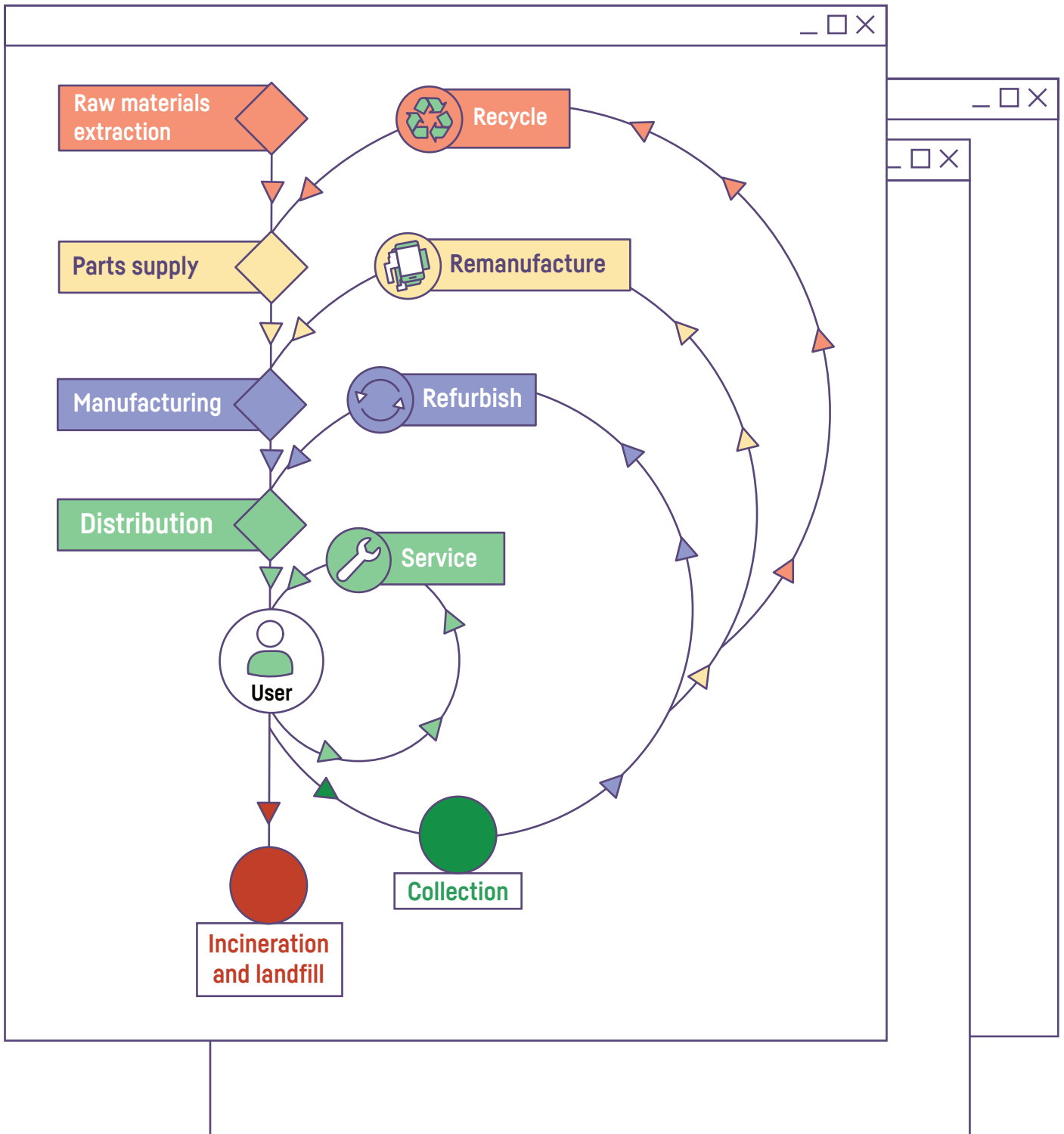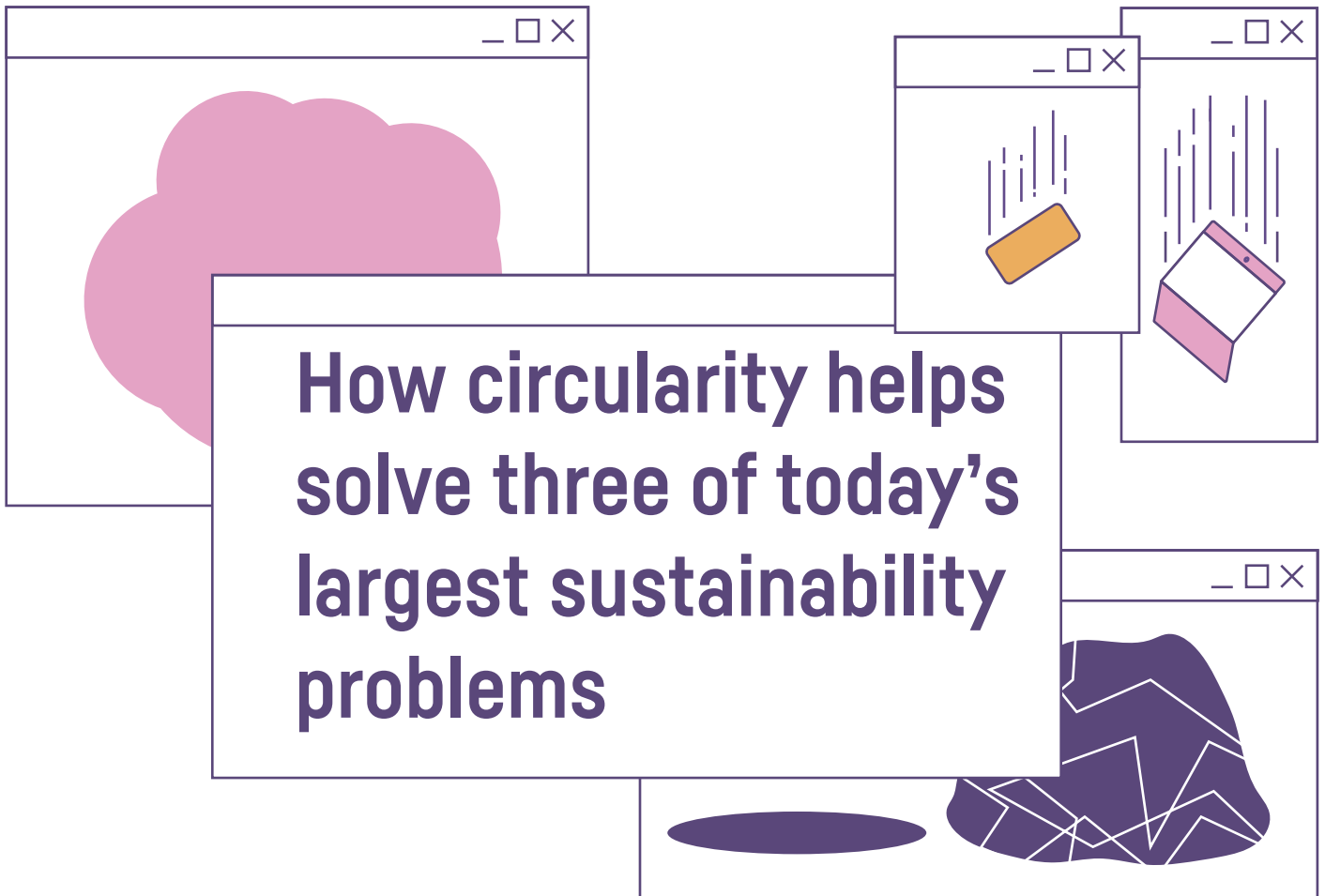
How circularity helps solve three of today's largest sustainability problems

OUR CLIMATE
Reducing greenhouse gases

Challenge: IT products are a source of greenhouse gases throughout their life cycle, from manufacturing through to distribution, use and disposal. A lot of effort goes into the use phase and making products more energy efficient, but for many IT products, the majority of the greenhouse gas emissions are actually created in the manufacturing phase.

How circularity helps: By extending the life of IT products, fewer brand new products are needed and greenhouse gas emissions from manufacturing can be reduced. Reusing components and materials to manufacture new products are other ways of reducing climate impact — less energy is needed and the use of fossil fuels such as coal, oil and natural gas is reduced. Using recycled plastics instead of virgin plastics can also reduce energy use in manufacturing. ▶

NATURAL RESOURCES
Ensuring enough supply for tomorrow

Challenge: Electronic products contain a number of scarce, valuable resources. Our rapid consumption of IT products with little or no recovery of components and materials at end of life lead to resources being consumed at an alarming rate. Reserves of some natural resources are already running low.

How circularity helps: By recovering resources from products that are no longer in use, the need for virgin raw materials can be reduced or even eliminated. This also gives economic benefits — in 2016, it was estimated that electronic waste contained gold, silver, copper, platinum, palladium and other recoverable materials worth around 55 billion euros — and these numbers grow year by year.[2]

E-WASTE
Using valuable resources and preventing pollution

Challenge: With more than 50 million metric tonnes generated annually, e-waste is the world's fastest growing waste stream. Only 20 percent is safely recycled.[1] Unsafe handling leads to hazardous substances leaching into soil, water and air, harming both human health and the environment.

How circularity helps: The goal of circularity is to prevent e-waste. The best way of doing this is by extending product life and reusing products and components. For existing e-waste, material recovery is important. Collecting and safely recycling e-waste is a way of taking care of valuable materials whilst protecting human health and the environment from toxic substances. It also makes sense also from an economic perspective — one metric ton of e-waste contains 100 times more gold than one ton of gold ore.[2] ■

Overcoming the obstacles

The transition to the circular economy is a paradigm shift that will require fundamental changes to how we approach materials, design, and use of products, as well as how business models are shaped to generate revenue. Today, a number of obstacles stand in the way of the circular economy. Overcoming them will require a dedicated, all-in effort that begins now. ▶

RECYCLE

REMANUFACTURE

REFURBISH

SERVICE

WOW

NEW

OMG

Used products perceived as inferior

Product performance needs vs perception

Poor battery lifetime

Lack of communication

Unsustainable, linear business models persist

Barriers to repair or upgrade

Lack of supporting legislation and incentives

Inadequate or lack of warranties

Concerns about data protection

Products are too fragile

Products are not designed for recycling

Materials contain hazardous substances

Not enough economic incentive for safe recycling

Products don't reach recycling facilities

Lack of a circular mindset

Unsustainable, linear business models persist
Linear business models where the purpose is to sell as many products as possible, are highly profitable in purely financial terms, but fail to account for the true costs of pollution and waste creation. These models must be replaced by circular models, for example where products are offered as a service.

Lack of supporting legislation and incentives
In most countries, legislation that regulates how e-waste should be handled is lacking or very weak. This needs to change. Other ways of speeding up the transition to the circular economy include financial incentives that encourage the reuse of products, and that makes it economically advantageous to use recycled materials instead of virgin resources.

Used products perceived as inferior
IT brands work hard to attract us to the most recent product models. Today, part of the positive user experience is owning something new, while reused IT products are often perceived as less attractive. Could users focus on functionality instead of looks, and could a second-hand or remanufactured product be perceived as a modern, conscious choice?

Product performance needs vs perception
Until recently, computer software has continually required more hardware performance which has made IT devices obsolete after only two to three years. This is no longer true, and our mindsets need to change. By purchasing a high-performance product, you can keep it longer, or sell it to a second-hand owner.

Lack of communication
While waste from one industry can be valuable for another, large amounts of resources are lost because of a lack of understanding and communication between different industries. A fully circular value chain requires collaboration between industries throughout the product lifecycle.

Technical obstacles

Concerns about data protection
Fear of confidential data leakage results in many IT products being stored in drawers and basements instead of being made available for reuse. If manufacturers provide users with secure data sanitization software, this can be avoided. Many professional refurbishment companies also offer safe data removal.

Poor battery lifetime
Portable IT products are often discarded because the battery has lost its ability to hold a charge, even though the product is otherwise fully functioning.

Batteries should therefore be of good quality and be replaceable.

Barriers to repair or upgrade
Too many IT products are discarded because of single components that stop functioning or that become outdated. We need to promote a repair culture, where products can be disassembled, repaired and upgraded with commonly available tools. Replacement parts and service manuals should be freely available.

Inadequate or lack of warranties
A product warranty provides the brand owner with an economic incentive to design a high quality product. Once the warranty expires, the cost for repairing IT products is difficult for the purchasing organization to estimate, which may lead to those products being replaced. Extensive warranties encourage both durable product design and longer usage time.

Products are too fragile
Mobile products are carried around in pockets and backpacks, which causes a lot of wear and tear. To enable a longer life, IT products must be durable and endure high and low temperatures.

Not enough material reuse

Materials contain hazardous substances
Materials containing hazardous substances are unsuitable for recycling or use in new products. By replacing hazardous substances with safer alternatives, materials can be safely recycled and maintain compliance with increasingly stricter legislation.

## Products don't reach recycling facilities
Only around 20 percent[3] of discarded IT-products reach a safe recycling facility. The rest may end up in landfill, is incinerated, or illegally exported to regions where e-waste legislation is weak or non-existent.

Products and materials are not made for recycling
Materials often lose in value in the recycling process. Materials that are present in very small amounts are difficult and costly to extract. Batteries can become a fire hazard in the recycling process if they can't be removed and end up in the shredder.

Not enough economic incentive for safe recycling
In many countries, it's cheaper to export e-waste than to handle it domestically in accordance with stricter safety regulations. Virgin raw materials are often also cheaper than recycled materials since they don't bear the full cost connected to the sustainability impacts in mining and refining. To make more high-quality recycled materials available on the market, environmental legislation must be stricter, and be enforced. ∎
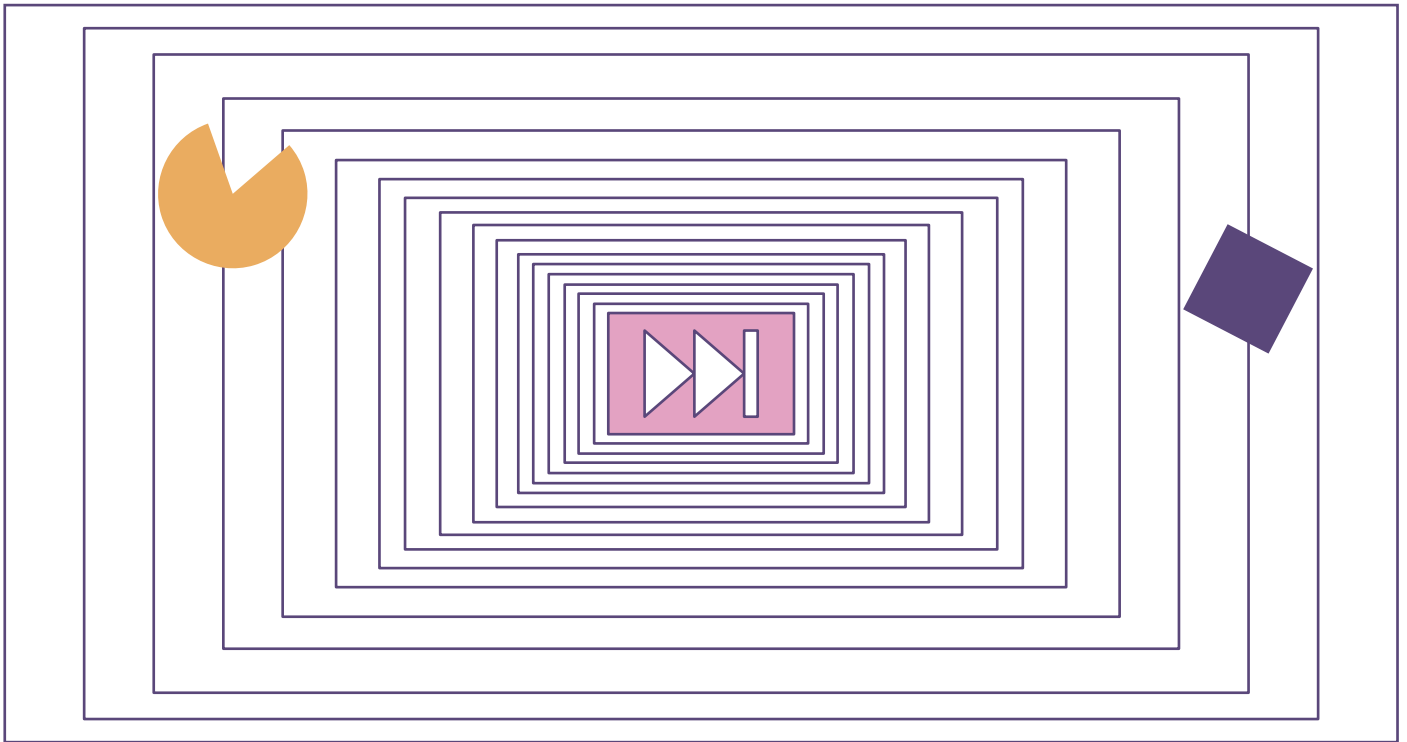
How human and worker rights can accelerate the circular transition

Today's circularity agenda includes environmental sustainability factors such as climate and resource consumption. Stephen Fuller, expert in supply chain management at TCO Development, argues that social issues must also be included — and that human and worker rights can actually be used as levers to accelerate our transition to a circular economy.

❝ The electronic devices we purchase are the result of a manufacturing process through a complex supply chain. From the miners that dig up the minerals used in electronic components all the way to the final assembled product, there are thousands of workers involved in a device's production. Compared to other product supply chains such as textiles, the multi-tiered supply chain of the IT industry dwarfs all others and should realistically make these products very expensive and valuable to us. A major reason why their price and value remains low is that these complex supply chains make it difficult to manage human rights risks and they contain a high concentration of cheap labor. So it is perhaps unsurprising that the majority of the world's IT production takes place in the developing world. There, local governments are known to ignore human rights and established labor laws to stimulate business investment. The electronic devices we buy remain cheap as long as we accept that the abuses of human rights, working conditions, labor rights and social benefits the workers endure to make them can continue.

❝ If we are prepared to pay the true environmental and social costs of our IT use, the circular transition can be made in a way that benefits everyone.

If we want a circular economy, we must consider social responsibility. In fact, treating workers in the IT industry fairly can help speed up the transition to the circular economy. In meetings with IT product manufacturers, I've often heard that investing in social improvements to meet the criteria in TCO Certified results in an increase in production costs and a reduction in revenue. It's not surprising — giving workers a reasonable salary and social benefits will of course increase the cost of manufacturing. However, it is the ▶

only reasonable way to go, and apart from the fact that respecting workers' rights promotes a healthier working environment, it will also make the circular take-make-use-reuse economy all the more possible.

Why? Because higher production costs will mean higher purchasing prices, and that is the single most effective way of driving the development of longer lasting products that users want to keep, service, and

Stephen Fuller, Senior Criteria Manager, supply chain and chemical management, TCO Development.

repair rather than dispose of and replace.
More expensive IT devices will also be an incentive for IT brands to give more room to circular business models, for instance product-as-a-service solutions where the IT brand retains ownership of the product and the user pays for the function and value it can offer during a set time period. Suddenly, revenue generation is not exclusively linked to selling as many products as possible. Instead, it makes business sense to manufacture durable IT devices that are designed for a long life, and that can be repaired and upgraded so that each product can be leased for as long as technically possible. This is of course a dream scenario for anyone who wants to realize the circular economy.

So, if social responsibility in the IT product supply chain can lead to worker well-being, environmental stability, and create new job opportunities connected to circularity, why has so little progress been made?

In many countries where IT products are manufactured, local governments do not enforce human rights and labor laws, which means that responsibility falls to manufacturers and brand owners to make sure workers in their supply chain are treated fairly. Two problematic issues are excessive working hours and living wages. These issues are interconnected, since as long as minimum wage levels do not provide workers with enough income to cover their living costs, they are more likely to agree to or request to do excessive

overtime. Excessive overtime leaves a worker with little to no time over for rest, recreation, family or further education. Requiring IT manufacturers to take responsibility for these issues when local governments are not doing so is challenging. Allowing workers reduced working hours and a higher salary are improvements that lead to an increased price of the delivered product. By implementing such improvements, the manufacturer risks losing a client's business to other less scrupulous competitors to maximize profits and keep retail prices competitive.

TCO Certified has included criteria on socially responsible manufacturing since 2009 with many successes. One of the main drivers for brand owners and manufacturers to implement more sustainable practices has been financial incentive, where TCO Certified is used as a tool for winning public and private procurement contracts. We listened to manufacturers telling us about the risk of losing contracts and financial support if they invested in social improvements. To combat these negative outcomes, we started categorizing factories based on risk in TCO Certified generation 8, allowing brand owners to choose factories that work proactively with social issues. This way, more ambitious factories get more business, which is an incentive for factory management to prioritize their work with sustainability, invest in improvements and implement labor laws. Factories that don't fulfil requirements are removed from our accepted factory list and are no longer permitted to manufacture certified products. This is a huge shift. For the first time, we turn what used to be a business disadvantage — providing better working conditions for employees — to a business advantage, and by doing that, the pace of implementing social and environmental responsibility in the supply chain of IT products can quicken.

It's widely accepted that the short life we currently give IT products leads to a number of sustainability issues that need to be addressed very urgently. Manufacturing a sustainable product is not just about which product uses the most recycled content or is the easiest to recycle. It is the whole life cycle of the product that tells us if it is truly sustainable. How it is made, used, and treated at the end of its usable life. By allowing social considerations within this chain to drive circular development, we can create sustainable solutions that benefit both people and the environment in the long term. If we are prepared to pay the true environmental and social costs of our IT use, the circular transition can be made in a way that benefits everyone. ∎

Study: circular management of notebooks
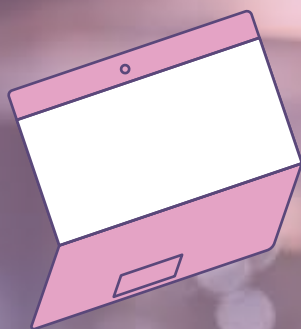
Circularity in practice: How to manage notebook computers responsibly

How can principles of circularity be implemented into the procurement and use of notebook computers? How can you cut greenhouse gas emissions and save money at the same time? We've listened to experts in the field and analyzed the data. Here you'll find practical, science-based advice on key considerations such as extending product life, energy efficiency, and why you should think twice before recycling.

Around 170 million notebook computers are produced and sold globally every year. Even though their manufacture requires a large amount of energy as well as a number of finite natural resources, their service life is often short. The typical IT contract is based on a three to four year use cycle. After that, many organizations face difficulties disposing of products, with many of them ending up as e-waste even though they are fully functioning. This way of handling IT products goes against the principles of the circular economy, where products should be kept in use for as long as possible, to save resources and retain value. The good news is the urge to implement more sustainable practices is growing. However, there are many choices to make during a notebook's life cycle and it's not always easy to know what's best. We've looked into this issue to clarify what the most responsible way to manage notebook computers is. How can organizations reduce environmental impact and help promote a more circular life cycle?

Recycling — a less favorable solution in a circular economy
In theory, recycling may seem like a viable way to harvest precious metals and other materials from a notebook. But in reality, a very small amount of the assets included in our IT products are currently recovered in the recycling process. First of all, only around 20 percent of global e-waste actually reaches controlled recycling facilities. The rest may end up in landfill, is incinerated, or illegally exported to regions where e-waste legislation is weak or non-existent.

Even in those cases when a product reaches a controlled recycling facility, materials tend to lose value, or are lost altogether. There are several reasons for this. Notebooks contain a large number of materials and typically, recycling facilities cannot recover them all. Materials that are present in very small amounts are difficult and costly to extract. Rare earth metals and conflict minerals, such as tantalum, are often used in small quantities and are in many cases not recovered at all. Metals, such as gold, cobalt and palladium are only partially recovered during recycling and need to

## Many IT products end up as e-waste even though they are fully functioning.

be extracted from the mines continuously to meet the demand. A material that often loses its value during the recycling process is plastic. The output is a downcycled, lower quality product. Plastics in notebooks may also contain harmful flame retardants and plasticizers that cause harmful health effects during recycling processes and make the materials unsuitable to use in new products.

Recycling methods are continually evolving, and in some leading-edge facilities, recycled materials are of higher quality, in some cases even similar to virgin materials. These higher end materials can be reused in the same type of product as they once came from, which meets one key aspect of realizing the circular economy. However, there are very few of these facilities, and bringing these solutions to scale will take time. For now, the focus must be on avoiding e-waste as much as possible. ▶

Conclusion 1

Extending product life cuts greenhouse gas emissions
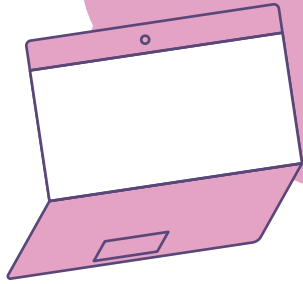
29 percent reduction when notebooks are used for six years instead of four.

To identify the best way of lowering greenhouse gas emissions, it's important to know how and when these emissions are produced. We looked at 15 carbon footprint reports[345] for 14 inch business grade notebook computers from Dell, Lenovo and HP, commonly in commercial use worldwide, and interviewed Siddharth Prakash[6], senior researcher at the Oeko-Institut in Germany, specializing in policies and instruments for sustainable consumption and production. We investi-

gated the greenhouse gas output from manufacturing, distribution, use and disposal, and how purchasing new, more energy efficient notebooks impacts greenhouse gas emissions, compared with extending the life of an existing device. Combining all these sources of information, our analysis concludes that a vast majority of the greenhouse gases are emitted in the manufacturing phase. Looking at a scenario where a notebook is used for four years, the total carbon footprint is 299 kg during its life cycle. Of this, 79.8 percent of the greenhouse gases are emitted in the manufacturing phase, 6.8 percent during transportation, 13.2 percent in the use phase, and 0.2 percent at end of life.
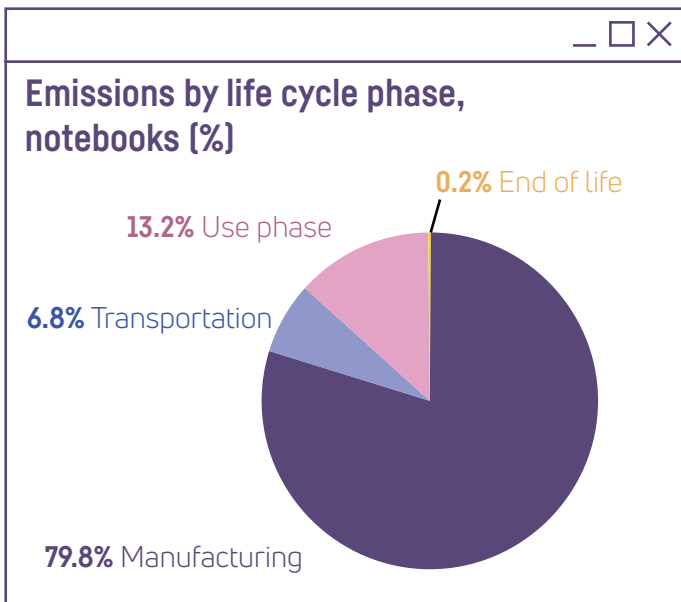
Adding two years to product life reduces emissions by 30 percent

As almost 80 percent of emissions occur in the manufacturing phase, extending product life will clearly lead to lower average annual emissions. Let's compare two possible use scenarios, where notebooks are used for either four or six years. How much does adding another two years of use time impact greenhouse gas emissions? When a notebook is replaced every six years instead of every four, you end up with a total of 53.1 kg of carbon dioxide equivalents per year, instead of 74.7 kg. This is a reduction of around 21.6 kg per year, or 28.9 percent. ▶

Emissions by life cycle phase, notebooks (%)

0.2% End of life
13.2% Use phase
6.8% Transportation
79.8% Manufacturing

RECOMMENDATION Due to the large proportion of greenhouse gas emissions in the manufacturing phase, it's important that notebook computers are given a long life. Choose to buy a durable product that is possible to repair and upgrade and use it for as long as possible. Choose one with enough performance to cover your needs for a long time. High-performance products are also more attractive on the second-hand market.
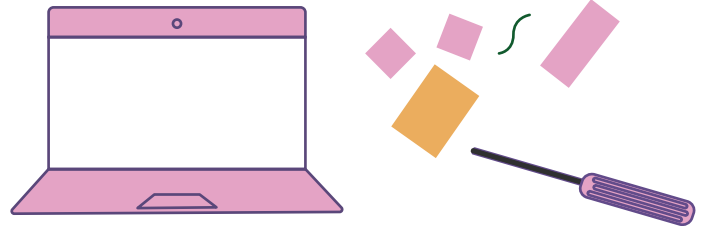
Emissions lower when notebooks are upgraded instead of replaced

390 kg

Upgrading notebooks and using them for two more years leads to a **28 percent cut in greenhouse gas emissions.**

For most users who work with standard software programs, notebook computers may function well for at least six years without upgrades to hardware such as hard drives, memory or battery. Sometimes though, and especially for users who work with more performance-demanding software, upgrades to hardware are needed in order to extend the notebook's life. How will this affect greenhouse gas emissions?

A 2016 study from the German Öko-Institut looked at the effects of extending the life of notebook computers from three to six years. Fifty percent of the products were upgraded with a new battery, a new internal memory, (from four to eight gigabytes), and had the original hard disk drive replaced with a faster SSD. The study showed that even though these upgrades were made, the extended life resulted in a reduction of related greenhouse gas emissions by approximately 390 kg CO_2 (28 percent) per computer workplace, (including the notebook computer, docking station, external display, keyboard and mouse), over a period of 10 years.[7] ▶

These parts were replaced

Battery
New battery

Memory
From four to eight gigabytes

SSD

Hard disk
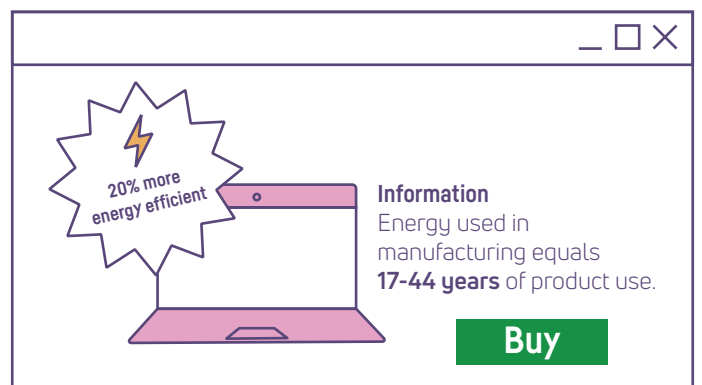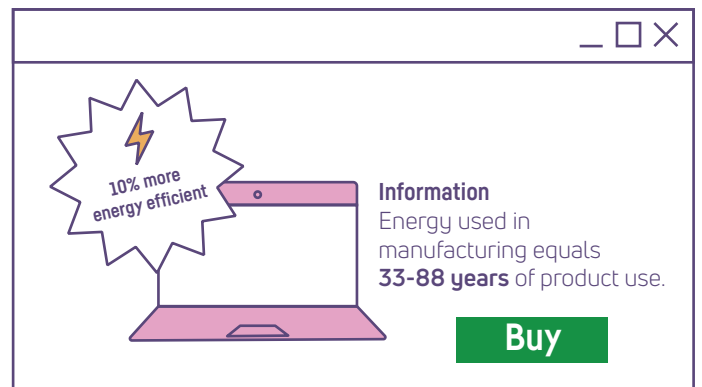Original part replaced with SSD

RECOMMENDATION If the capacity of your notebook computer no longer meets your needs, or if any part of it is broken, make sure to upgrade or repair it. It could then serve you, or another user, for another few years. Extending the lifespan of notebooks is a choice that can cut greenhouse gas emissions also in those cases where hardware upgrades are necessary.

Conclusion 3

Buying new doesn't compensate for emissions from manufacturing

Many electronic products have become increasingly energy efficient, and in some cases, purchasing new equipment has actually been a way of lowering the environmental impact of the product during its life cycle. Is this also the case for notebook computers today?

Because the production phase of a notebook computer represents a majority of the total greenhouse gas emissions during its life cycle, the answer is no. Purchasing a new and more energy efficient product will not cut total greenhouse gas emissions, even if the new product is used for a very long time. If energy efficiency improves by 10 percent between two generations, the new notebook must be used between 33 and 88 years before the reduction in energy consumption in the use phase has made up for the greenhouse gas emissions while producing the product. If energy efficiency improves by 20 percent, that period falls to between 17 and 44 years. The large time span is due to the fact that data varies between calculation models. Irrespective of which end of the scale you look at, no notebook is used for that long.[8] ▶

10% more energy efficient

Information
Energy used in manufacturing equals **33-88 years** of product use.

Buy

20% more energy efficient

Information
Energy used in manufacturing equals **17-44 years** of product use.

Buy

RECOMMENDATION Maintain and keep your current device longer. Considering the full life cycle, prematurely replacing an old notebook computer with a new and more energy efficient device will lead to more greenhouse gas emissions, not less. The positive effect of saving energy in the use phase is overshadowed by the enormous energy consumption in manufacturing, from raw materials extraction through to assembly.

Conclusion 4

Extending the life of a computer workstation from three to six years saves **28 percent of the cost, or 527 euro.**

Save 527 euro
Discount 28%

Keep

# Circular solutions are better also from a financial perspective

Purchasing new IT equipment in short contract cycles is expensive. It is often more costly than it needs to be, especially in the era of "best overall value" procurement, where factors like sustainability and life cycle cost are taken into account in procurement, alongside product price. Also, treating used IT products as waste instead of extending their life or even reselling them is a missed opportunity for cost savings and income. By extending lifetime from three to six years, the cost of purchasing and using a complete computer workstation can actually be reduced by 28 percent, or 527 euro (570 US dollars), over a period of 10 years, even when the cost for upgrading 50 percent of the notebooks with new RAM, SSD and battery is factored in. Savings also include a reduced cost for purchasing the products, and for administering the procurement process when notebooks are purchased in longer intervals.[7]

Some may think that purchasing new, more energy efficient notebooks will lead to significantly reduced energy costs but the effects are very marginal. The savings from buying new laptops every three years instead of every six years only results in a reduced electricity cost of two euro (2.16 US dollars) per notebook computer, which translates into six kilograms CO2 per device.[7] This is negligible in comparison to the increased cost of acquisition, as shown above, and the increase of greenhouse gas emissions that stem from manufacturing these new notebook computers.

Notebook computers that no longer meet the requirements of your organization, or for other reasons are replaced with newer devices, may be of great interest to other organizations or private individuals. According to IT refurbishing firm Inrego, a three-year-old notebook computer can be sold to a professional refurbisher for around 100 euro (108 US dollars).[9] Purchasing used equipment can also save a substantial amount of money and significantly lower the total cost of ownership of the notebook. Stephen Haskew from the UK based remanufacturing firm Circular Computing explains that a new-looking, upgraded notebook computer in general costs 40 percent less than a comparable, brand new product.[10] So extending product life, whether it is by purchasing products second hand or reselling your used equipment, may be wise also from a financial perspective. ▶

RECOMMENDATION Allow IT products to live longer. Apart from reducing environmental impact, keeping devices for a longer time, buying used products whenever possible and giving them a second life is in most cases also better from a financial perspective, even when service and upgrading costs are included. To get closer to the actual cost of managing notebook computers with a certain lifespan, make sure to include the administrative cost of IT purchasing, installation, and the cost or income from disposal of notebooks in your total cost of ownership model.
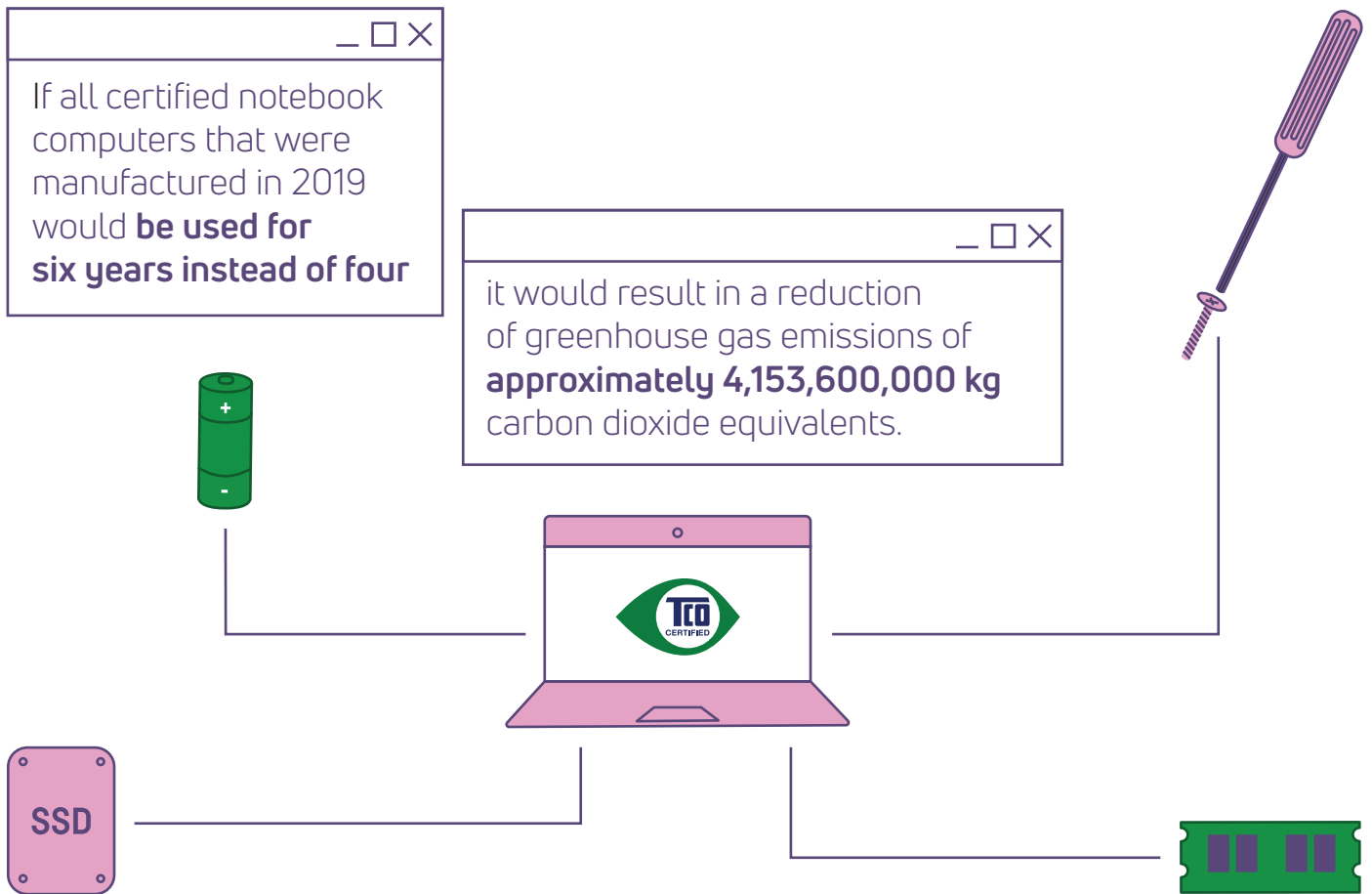
Notebook design for a longer life

While extending the lifespan of notebook computers is necessary for reducing the climate impact of the IT sector, not all of them are designed for a long life. Circularity and product life considerations must be made up front — at the design and manufacturing stages. Today, too many products are disposed of because they break easily and are difficult to repair or upgrade.

The notebook computer is a mobile product, and it needs to be durable, withstand wear and tear as well as high and low temperatures. Vital components must be replaceable, so products should be possible to disassemble and spare parts need to be available. Battery quality is important too — products are often replaced because of poor battery performance.

Criteria in TCO Certified enable circular solutions
In 2019, around 32 million notebooks certified according to TCO Certified, generation 8 were manufactured. These products are verified to meet a comprehensive set of sustainability criteria that are designed to promote a circular approach to the way IT products are manufactured and used. To enable a long lifespan, certified products must be durable and upgradeable as well as possible to repair and recycle. The notebook computers that meet the strict requirements of TCO Certified, generation 8 are well positioned for a long service life.

If all certified notebook computers that were manufactured in 2019 would be used for six years instead of four, it would result in a reduction of greenhouse gas emissions of approximately 4,153,600,000 kg carbon dioxide equivalents[11]. This equates to the annual average carbon footprint of 833,888 people.[12]

One more year!
If extending the notebook purchasing cycle by two years seems like a big step to take, know that even one year product life extension has a substantial impact. Keeping notebook computers for five years instead of four reduces greenhouse gas emissions by 64.9 kg carbon dioxide equivalents per notebook, or 17.4 percent. For an organization with 1,000 employees, this means a cut of 129,800 kg over a 10 year period.∎

Practical solutions

Notebooks should have a first life of at least six years

Siddharth Prakash is a senior researcher at the Oeko-Institut in Germany, specializing in policies and instruments for sustainable consumption and production. He has published several reports on IT and sustainable consumption, and has provided his expertise in the development of criteria for many Type-1 ecolabels worldwide, such as the German Blue Angel, the EU Ecolabel, and Thailand's Green Label. He also works in green public procurement policy and implementation, especially in Southeast Asia.

Viktor Wennström is currently busy developing criteria for the next generation of TCO Certified that will be launched in 2021. He is also responsible for the quality assurance of the certification's verification systems, and makes sure that test methods and assessments are accurate and comparable. Here he talks with Siddharth Prakash about the future of sustainable IT products.

Siddharth Prakash, Oeko-Institut. Credit: Private.

Viktor: Siddharth, you've been involved in sustainability and IT for more than 20 years. How come you made this the focus of your career?

Siddharth: I think the Earth Summit in Rio 1992 was a turning point for me. I was 14 years old at the time and was taken aback by the magnitude of environmental damage taking place. A few years later, I made a decision to study environmental protection at university. Since then, I've worked for 12 years at the Oeko-Institut, giving advice to political decision-makers, companies and consumer and environmental organizations worldwide. It was during my work within the framework of the EU ecodesign directive that I gained deep insights into the environmental impacts of IT products.

Viktor: What would you say are the most pressing sustainability issues when it comes to IT products right now?

Siddharth: It's the extremely short usage time of our IT products. The majority of the environmental impacts of IT products, including greenhouse gas emissions, are emitted in the production phase. When you analyze the life cycle of an IT product, you can see that a majority of the greenhouse gas emissions are so called 'scope 3 emissions' which means that they are emitted in the supply chain. As IT products become more energy efficient, also due to the regulatory framework of the EU ecodesign directive, manufacturing has a much higher impact than the use phase.

Other aspects are resource consumption, hazardous materials and e-waste. These are major problems. I've ▶

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worked a lot with the informal sector in Africa and Asia related to e-waste issues, and I've seen what kind of problems they face in terms of recycling and disposal of IT equipment. For example, when cables containing brominated flame retardants are burned to retrieve copper, extremely harmful dioxins and furans are emitted.

Viktor: What needs to happen for the IT industry to become more circular and sustainable?

Siddharth: We need to focus more on the design and production phase. In a circular economy, you want durable products that can be repaired and reused as much as possible. You need high quality components and a modular design where the battery and other parts can be taken out without destroying the product. You also need to be conscious about material choices. For instance, by limiting the diversity of plastic types in a product, avoiding certain coatings on plastics and avoid including toxic substances in materials, recycling rates can improve.

Viktor: What strikes me is that the knowledge is there, and in many cases also the methods for making improvements. How can we accelerate change?

Siddharth: I think one important key is market demand. With the size of their investment volumes, the purchasing power of public procurers is considerable. I think that the leverage they have lies in asking manufacturers and service providers to offer products that are repairable, reusable and with a minimum quality, and a minimum service life.

Viktor: What is your view on ecolabels and sustainability certifications and what role they can play in the development of sustainability?

Siddharth: If you combine ecolabels with public procurement, you can really push the industry in the right direction. EU procurement directives (2004/18/EC and Directive 2004/17/EC) allow using ecolabels as a source of environmental criteria for specifications, as a form of verification, and in the award phase. So, in technical specifications, you can, for instance, ask that all notebooks meet the sustainability criteria in TCO Certified for notebooks, or specify that products carrying TCO Certified for notebooks will be deemed to comply with the requirements. Of course, any other appropriate and reliable means of proof will also have to be accepted.

Ecolabels have a key role to play by showing that it is possible to achieve certain standards and provide indicators to policymakers on how to target those values over a longer period of time, for example, the develop-

ment of mandatory minimum standards. Ecolabel criteria are not developed out of the blue — they are based on the life cycle approach and analysis of technology and the market. This means that they show the potential of the best available technologies in the market. The market share these products have might not be very high, but still, ecolabels have this approach to push the market towards more ambitious targets.

Again though, ecolabels would not be able to achieve substantial transformation as standalone instruments, but when they are used by public procurers, they can have a significant impact.

Viktor Wennström, TCO Development.

Viktor: Finally, in a circular world, how long do you think it's reasonable that a notebook lasts?

Siddharth: A minimum first use of six years is absolutely possible from the perspective of the current state of technology. After that, they should be professionally refurbished and channeled for second-hand use. When purchasing new equipment, you should always estimate whether the equipment will still meet your performance requirements in the coming years. Otherwise, you will end up replacing the product before it reaches its technical life-span. To ensure a longer use, you can also demand a minimum guarantee time from your provider, for instance of three years. The warranty should cover repairs and replacement, but also on-site reconditioning within one to two working days, and batteries. If you also include strict requirements on the quality and durability of mobile devices, including batteries, this helps ensure that purchased products are of high quality. ∎

Refurbishing and remanufacturing
– two ways of extending the life of an IT product

It is increasingly clear that if you want to protect the environment – and your own budget – extending the service life of your IT products is key. But how do you do this in practice? We spoke to two companies that specialize in the refurbishment and remanufacture of IT products. In this article, we identify the differences and similarities between the two, and the benefits of buying and using refurbished and remanufactured products.

Whats the difference?
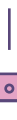
Refurbishing
To maintain quality, products are tested for functionality and defects. Worn components are replaced. Data stored on the product is deleted. The look of the products sold by a refurbisher vary, depending on how they have been handled by the previous owner.
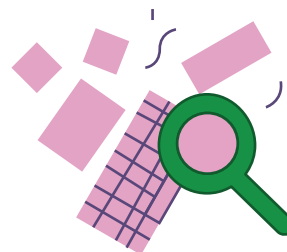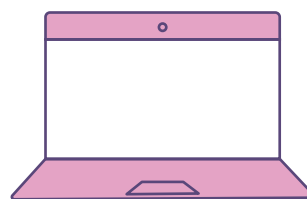
Remanufacturing
Products are cleaned from data, and deconstructed. Each component is checked individually. The product is then reconstructed using a combination of reused, repaired and new parts. All products are identical and new-looking when they leave the factory.

"Huge numbers of fully functional computers and smartphones are discarded every year"

Refurbishing company Inrego buys used IT products and upgrades and repairs them to give them a new lease of life for new users.

Refurbished IT products from Inrego's plant in Sweden are sold in more than 87 countries. We spoke to Erik Pettersson, Circular Innovation and Environmental Manager, and Katarina Magnusson, Key Account Manager at Inrego.

Erik feels that organizations and private individuals are very much more positive towards buying and selling second-hand now than they were 10 years ago. In recent years, Inrego's turnover has seen annual growth of 20 percent. But so much more could be done. Erik and Katarina are in constant contact with companies that are about to dispose of fully functional IT equipment, despite the fact that these resources could generate income.

" Does a newer version of a computer make you better at your job?

"Unfortunately, large amounts of perfectly functional IT products are disposed of, or stored until they've lost their value. In the past year, we've bought more than 180,000 IT products from companies and consumers and we could buy more. The demand for reconditioned IT products is definitely there," says Erik.

How do you renovate the products that you buy?
"There's a big difference between used IT products and the refurbished products we sell because we replace worn components, erase hard disks, and test equipment to maintain quality," says Katarina.

"We delete all data stored on products securely, and sellers receive certificates confirming this. We then test the product and carry out upgrades and replace parts if necessary," she adds.

Why should an organization buy refurbished IT products?
"I feel that many organizations haven't thought about what they actually need in terms of performance. They buy the latest versions of devices but when I ask them

exactly what it is they need to do their work, we can agree that buying reconditioned computers with equally good performance at lower prices is a perfectly acceptable alternative," says Katarina.
She continues:
"When someone says that they only buy new, I get really interested. I ask them: 'do you need new computers? And is it that the housing of the computer that

Erik Pettersson and Katarina Magnusson, Inrego.

you want to be new, or the software inside? Does a newer version of a computer make you better at your job? Or can you take the difference buying a used device would give you and invest it in something that actually develops you and your business? And you can protect the environment at the same time.'"

Why do you think that so many organizations buy new instead?
"I think that many organizations buy new because they lack knowledge and experience in this area. I'm seeing growing numbers of people using refurbished IT products having bought a computer or phone for example," says Katarina. ∎

About Inrego: Inrego buys, refurbishes and sells used IT equipment. The company was established in 1995, is headquartered in Sweden and has 170 employees.

"We need to change people's attitudes to IT products that aren't brand new"

Organizations often choose to purchase new IT products because they can afford to do so. They haven't established: What is the true cost of my purchasing?

The words of Stephen Haskew, Strategic Sustainability Executive at Circular Computing, a company that specializes in remanufacturing notebook computers. The company uses other people's waste as raw materials, and their factory, located in Dubai, has the capacity to produce 500,000 new-looking, upgraded notebook computers per year.

Stephen, can you explain what remanufacturing is?
"We collect laptops from all over the world. In our factory, we clean the products of data and deconstruct them down to component level. The performance of every piece is checked individually — the battery, LCD, keyboard and the motherboard for example.

> ❝ That IT products are unusable after their first life. It's not true — but you need to look after your equipment.

"Components that are beyond economic repair, or low performing, are replaced or upgraded. All machines come out of production with an SSD and at least 8GB RAM as standard. The chassis is then repainted and the keyboard is reprinted to the localized language. The screen is replaced or repaired as required.

"Every machine that comes in has had a different life to the next one. So we had to develop a process that makes every single machine identical when they leave the factory. This requires a technical expertise that is unique.

What's the advantage for the purchasing organization?
"Customers often think of circularity as 'recycling 2.0' and responsible disposal, which is very important, of course. What we need is that large organizations get involved in reuse, and of course as well, they have a responsibility to the e-waste they generate. Buying remanufactured IT products is a way of marrying your sustainability agenda with your purchasing agenda — why remake what is already made, as long as the user, and organization are not asked to compromise. A reuse model also significantly lowers your total cost of ownership."

Can all IT products be remanufactured?
"No. Some products are not made to have a second life — they are not durable enough and with a performance and integrity that is too low from the start. The products we work with are enterprise grade which means that they are durable, sold in large volumes and accepted by the business world. Our current range is from 2015 to 2017 but we're still selling some machines from 2013."

Stephen Haskew, Circular Computing. Credit: Private.

"We've chosen to work with seven models and carry 10,000-20,000 in stock which means that clients can have the same model delivered in large quantities, quickly."

What's the most common misconception when it comes to IT products and circularity?
"That IT products are unusable after their first life. It's not true — but you need to look after your equipment. Why do we think we can use something for another three or four years without servicing it? The relationship most people have with technology is unique to this industry and needs to mature. Remanufacture provides this service, and lengthens the life of the product without risk to the buyer, which is good for the environment and great for the budget." ∎

About Circular Computing: Circular Computing is a UK-based company that has remanufactured notebook computers for five years and refurbished IT products for 25 years.

How we manage the transition to circularity – three IT brands explain

A lot needs to be done to ensure IT products have a sustainable and circular life cycle. We have spoken to the three largest notebook computer brands to get a snapshot of how the transition is going.

Responses from Dell have been provided by Tom Moriarty, who is responsible for energy efficiency and eco-design regulations and standards in Europe, the Middle East and Africa.

HP is represented by Madeleine Bergrahm, Nordic sustainability manager, who also works on issues related to public procurement in the EU.

From Lenovo, we spoke to Thomas Hedin who is responsible for environmental and sustainability issues in the Nordics and Benelux.

To what extent is your organization stuck in the linear economy?

Dell: Dell was started with an efficient supply chain model and a commitment to designing products with the whole lifecycle in mind. Increasingly, that has meant embracing a circular approach and the idea of systems thinking. We began using recycled-content plastics in some desktop products in 2007 and have increased the scope and volume of our efforts since, creating a closed-loop process in 2014 that recycles plastics reclaimed through our takeback programs back into new components for new computers. Still, the transition is ongoing and much more needs to be done. We have set a goal to take back one "like" product for every product we deliver to customers but have a long way to go. We also aspire to increase recycled and renewable content in our products to more than 50 percent and in our packaging to a full 100 percent — all by 2030. These are lofty goals, and we must dig deep into our portfolio to identify the scalable opportunities.

HP: If you look at what we sell, we're clearly hardware-heavy at the moment, but our strategy includes the goal of moving towards providing more services. That's where we want to go. In print, we've sold printing services instead of selling printers as pieces of hardware for a long time. We've had a "closed loop" for the recycling of toner cartridges for 27 years, and in the past 12 months have added hardware such as PCs and printers to the list of products from which we reuse materials in a similar way. This is a circular service, it's just that nobody has described it as such.

Lenovo: Our business is based on developing and selling products, which is linear. But we have also worked with Asset Recovery for many years, which is a service where we buy back products from customers, revamp them and resell them, so they get a new lease of life. We know that our products have a high second-hand value and can have a considerably longer life than our customers typically keep them. For example, as an add-on service, we can offer up to five years' warranty on our business products. We have also worked with ▶

products as services for a number of years, a type of lease or "Device as a Service". This does not yet represent a major share of sales, but we are ready for it to grow.

What is circularity for you?

Dell: It is related to the inputs and materials used as well as how those are recovered, but it also extends to the way value is delivered or created. By looking at the whole system, we can use resources more efficiently and for longer periods of time. Our circular economy programs are built on a foundation of actively applying sustainability thinking to the lifecycle of our products and services. Our product engineers understand that you must design with the end in mind – how can we ensure the materials in our technology can be kept in the economy when a customer is done with the product. We design to make sure things are modular and easy to repair, so that end doesn't happen before it should.

HP: It's partly about things like reducing use of non-renewable raw materials by using a greater proportion of recycled materials. But this is just the tip of the iceberg. It's really the business model we need to look at. How do we change as an organization internally? It's also about cooperation with users and others. It doesn't matter if a product contains 50 percent recycled material if it isn't used long enough, and isn't recycled, or is recycled in the wrong way. This is super-interesting and we need to work together with users. It's all about teamwork.

Lenovo: It's partly the business side of things as I just described. And it's partly about how products are manufactured - that we take in more recycled material, plastics and metals. We've worked on this for many years. Some of our products contain 85 percent recycled plastic and are certified according to TCO Certified Edge[13]. We also work with collecting used products, both in Europe, where there are regulations concerning this, and in other regions where such systems are not in place. We have tough requirements in terms of how materials are managed to ensure they are recycled correctly.

What are the challenges going forward?

Dell: ICT is a rapidly evolving technology and placing restrictions on innovation and design techniques can lead to unintended consequences resulting in the exclusion of new technologies in future designs. The broad range of agendas of different stakeholders engaged in developing circular economy regulatory policies can create challenges in developing cost-effective solutions. Case in point are initiatives around reparability. Solutions need to consider the quality of the repair and the liability for the repair when legislation is being enacted.

HP: One challenge is that we manufacture such a large number of products so it is difficult to manage small flows of recycled materials. We need suppliers that can provide large flows of consistent quality. The transition to circularity is also an internal process — how do we change so that our sales people and not only our service sales people know how to sell a service? How do we generate revenue for that, how does payroll look? Similarly with our retailers; in our relationships do we need to rethink so that they are paid to sell a service rather than a product. We're only at the start of that process. But above all, we need to get users and customers to see the value of buying a service instead of a hardware product.

Lenovo: In terms of sales of refurbished products, we don't actually see any challenges. It's a service to be able to offer this to our customers who want to see a return on their old products. In terms of recycled materials, it's a challenge that there isn't enough recycled plastic of sufficiently good quality. Notebooks need to be thin and lightweight, so it's harder to use simpler types of recycled plastic. It's easier with displays, as weight isn't such a factor. We also have a number of products with which we use aluminium and other lighter metals instead of plastic.

What are the most effective ways of accelerating the development of circularity in your organization?

Dell: Collaboration is a key factor in the success of circular economy programs. Internally, commitment is necessary from all levels of the organization, working from both the bottom up and from the top down. In Dell we are fortunate that Michael Dell embraces the circular economy and there is executive support for environmental initiatives that advance the circular economy programs.

HP: Demand from buyers. We can develop the hardware ourselves. But a circular product is a collaboration with the user. Currently, only a small number of buyers are interested. If the interest was there, we could develop these services more.

Lenovo: An important parameter is to ensure that recycling of, for example, plastics is improved. Projects are underway in Sweden and in many other countries to improve recycling of plastics from electronics and IT products, which we see as a positive trend. Demand from our customers for refurbished products is also key of course. As things look today, on the Nordic market, the majority of refurbished products are sold to to other countries in Europe. ■

Purchasers on the frontline
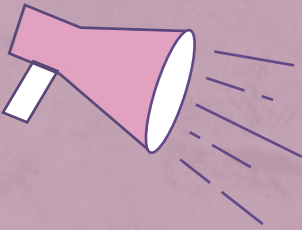
Effective cooperation is key to successful circular IT procurement

Circularity is an enjoyable and exciting field because it demands a strong focus on our own consumption behaviors. So says Ulrika Svallingson, sustainability coordinator at Malmö City Council in southern Sweden. The city is aiming to be climate neutral by 2030 and has already worked with circular management of IT products for 10 years.

Ulrika started working at Malmö City Council's procurement unit just over two years ago. She was appointed to the newly-created position of sustainability coordinator for social responsibility, which was introduced because the municipality wanted to get a comprehensive grasp of the social aspects of procurement and purchasing.

Malmö City Council has ambitious sustainability goals. Two years ago, the council decided that the UN's Sustainable Development Goals should be reflected in local targets and form an integral part of local budget processes. The municipality works with Fairtrade City and participates in several local, national, and international networks related to sustainable development and the environment, including the EU's Circular Public Procurement initiative that has participants from Sweden, Finland, Poland, Russia, Latvia, Denmark and the Netherlands.

Ulrika believes that circular issues are closely linked to both social and environmental sustainability, and that the municipality has considerable potential to make a real difference with its purchasing. The council works closely with its supplier, Atea, which provides sustainability expertise and solutions for the reuse of products. However, it is not enough to influence suppliers — to achieve circular management of purchased products, the municipality needs to focus on its own behaviors.

"Of course we can make our own demands and influence suppliers and other stakeholders, but in terms of circular economy issues, these put demands on us as an organization. It's also about thinking intelligently about how we use the products we buy," says Ulrika.

To promote circularity, the council purchases products with longer service lives and ensures that warranty periods are as long as possible. In the absence of warranties, nobody will repair products when necessary. The city council seeks to ensure that product use is optimized; for example, those working for the municipality for a limited period are given older computers than people who are expected to work for a longer period. Smartphones are provided with covers so

Ulrika Svallingson, Malmö City Council. Credit: Lisa Ernberg.

they last longer. As much as possible, IT products are reused internally when they are insufficient for certain users but perhaps work perfectly well for someone else.

The municipality also works with collecting old IT equipment. If a device is still useable, all data on it is deleted so it can be resold to new users outside the council. Products that have reached the end of their service life are recycled. The aim is to collect all IT products used by the municipality. In 2019, a major initiative was organized for council employees. Searches of offices and storage areas revealed some 7,500 computers, smartphones and other IT products that could be collected and reused or recycled. Employees were also invited to seminars on the importance of reuse and how sustainability requirements can be included in procurements.

"This energized employees across the city and we received extremely positive feedback. It became really concrete when you saw the amounts of electronic waste that were collected outside city hall," Ulrika says.

What is the key to achieving circular management of IT products?
"We're a large organization with highly differentiated ▶

requirements and contexts. You need to know what your organization needs to be able to see what can be done better. This is why it's incredibly important that functions and areas of expertise cooperate. At an early stage, we coordinate with our specialist sales people who know the market and know the technical limitations we work with. We also work closely with our IT coordinators throughout the city. They have extensive knowledge about our operational requirements, what we need and when we need it."

To facilitate cooperation, the city council has launched a sustainability forum for IT products. This brings together employees and managers focusing on a variety of issues such as technology, communication, the environment, social issues and procurement, as well as municipality supplier, Atea. The group discusses sustainable IT use from a broad-based perspective — from specific needs in procurement processes, to how they could create behavioral changes that support circularity.

"The sustainability forum is extremely beneficial to our work. All these skill sets are needed to drive the IT issue forward because it is so multi-faceted. There is broad agreement in the group about the importance of sustainability," explains Ulrika.

What has been most challenging?
"It's been challenging to introduce new routines and processes because there are considerable conflicts of interest in IT, both internally and in the segment as a whole. We want products to last longer, but that may undermine profitability in the segment or be at odds with what's most convenient for the organization. Sometimes, it's easier and even cheaper to replace IT products frequently than it is to service and repair them.

"It's sometimes also about how budgets are structured, that IT products have tended to be written off after a certain number of years and that warranties are only valid for fixed periods."

Ulrika explains that it has been tough to grasp how the municipality's behavior can promote circularity. Because individual buyers and employees have to change how they do things and re-evaluate their purchasing, Malmö City Council has had to work hard on its own structures and encourage everyone to pull together — to accept used products and to return products in a condition that makes it possible to use them in other contexts. It has been demanding, but has also worked to significantly create awareness around sustainable consumption and the sustainable use of resources. "Social and environmental aspects often go hand-in-hand and the circular mindset completes the picture.

By working internally with these issues, we hope to create awareness that behind every product there's a person and an environment to consider."

When Malmö City Council started work on sustainable and circular procurement back in 2010, it included IT products as a prioritized category," Ulrika says, because "they have an immense impact on the environment and social sustainability". The council uses the TCO Certified sustainability certification for the procurement of displays, notebook computers and all-in-one PCs.

❝ Social and environmental aspects often go hand-in-hand and the circular mindset completes the picture.

Why did you choose to use TCO Certified?
"TCO Certified includes criteria that match our own. When we buy a product that's certified, we know that these criteria have been met and that we don't need to allocate resources into following up on these requirements. That's invaluable to us," Ulrika explains.

"On top of making it considerably easier for us to both make requirements and conduct follow-up, the certification helps us to accelerate the rate at which we move the market towards increased sustainability because we use the same requirements as other buyers. TCO Certified also contributes to greater transparency between buyers and suppliers. Another extremely important factor is that TCO Certified includes so many different sustainability aspects: circularity, chemicals, social issues, conflict minerals as well as ergonomics.

The council is currently drawing up clear guidelines for sustainable management of IT products within the municipality and promoting examples of best practice that are shared with IT coordinators and decision makers. The next step is to support the development of more sustainable smartphones. Progress in this area lags behind other IT products such as computers and displays, but by developing collaboration with suppliers and other stakeholders, Malmö City Council is taking an active role in taking this issue forward.

"It's so exciting! We believe that there are many different approaches to achieve this, which might include our own purchasing patterns and attitudes, as well as options on upgrades, extended warranties and sustainability certifications," Ulrika says.∎

"Extending product life cuts CO2 emissions and we get money back for our used equipment"

The City of Aalborg pioneered circular procurement in Denmark with a project involving school furniture in 2016. It was the first fully circular tender in the country and attracted a great deal of attention. Two years ago, the municipality expanded their circularity focus to also include IT products.

"When we first started speaking to the IT departments, they said their only objective was to get IT equipment for employees so that they could do their jobs. They use 2.5 percent of the total procurement budget and they had not included sustainability in their demands," says Birgitte Krebs Schleemann, project manager for

Birgitte Krebs Schleemann, City of Aalborg. Credit: Private.

sustainability procurement at the City of Aalborg. She is working to implement circular procurement practices at the municipality and has cooperated with IT staff and management to incorporate circular and sustainable elements into processes and daily habits. The City of Aalborg has seven different political departments — all with their own IT departments. This made the change process more extensive and complex. The first step Birgitte took was to interview all the municipality's IT teams to understand their daily business and priorities.

"I visited the seven departments, asking a series of questions. How do they buy equipment? How often are laptops replaced? Do they repair products and how do they dispose of products that no one is using anymore?"

"They had never talked about this before. It was a whole new world for them. Initially, I thought that the seven departments were very different but then I realized that they all needed the same thing. It's been a long process though, because each department wanted to do this in their own way."

> **" Once they realized that they could get some money back for our used equipment, this argument was gone.**

Birgitte learned that notebook computers were often thrown out after only three to four years. IT departments saw no value in discarded IT products, they just wanted help to get rid of them. Only three of the seven departments had agreements with anyone that would take care of used equipment — and they got very little money in return.

Poorly formulated agreements also prevented circularity. According to an agreement with a supplier, the City of Aalborg received a discount on new purchases if the old equipment was destroyed. On top of this, she discovered that one of the biggest obstacles to re-selling IT products was an old policy stating that the city logo must be engraved on all notebook computers. This was a political decision from a time when computers were extremely expensive and the discussion of sustainability and circularity was non-existent. These factors made reuse and resale almost impossible. Instead, the vast majority of fully functioning computers and phones were turned into e-waste.

Once these discoveries were made, Birgitte started to identify ways to implement more sustainable practices, not least when it came to product lifetime and end-of-life handling. She calculated that simply by keeping ▶

notebook computers six years instead of three, the city could cut CO2 emissions equivalent to heating and powering all municipality buildings in the city for a whole year. It would also reduce waste equivalent to that produced annually by 3,000 households.

Did anyone object to these changes?
"The IT departments were positive — what they were afraid of was partly to change their habits, but mainly, the potential cost. They thought that sustainability would be expensive and that nobody would be interested in buying our old equipment, even though it was only three years old. They had also made calculations showing that it would be too expensive to keep a laptop more than three to four years, due to staff hours needed for upgrades and servicing once the warranty had expired."

"Once they realized that they could get some money back for our used equipment, this argument was gone."

Birgitte explains that the financial benefits will be even greater going forward because the municipality's former policy of engraving its logo on all notebook computers has recently been reversed. The marking will be replaced with removable stickers and DNA labelling. This decision will save money — because engraving is expensive — and generate more income since the value of used computers on the second-hand market will increase. And of course, more computers will now be given a second life.

Today, all seven IT departments have an agreement with a repair and re-sale company that takes care of their used IT products. The next step will be optimizing the agreement to include even better solutions for sustainability and circularity, such as specifications of how many laptops and mobile phones will be reused, repaired, used as spare parts or for material recycling. They would also like to include requirements for transportation and packing to minimize the use of virgin raw materials and CO2 emissions.

How would you describe this development?
"A lot has definitely happened. Getting people onboard has been the first step and an interesting journey. Engagement among IT staff and management is really great now, and I can see that there's a lot of low hanging fruit ready to be picked. We just have to get going."∎

"Without circular procurement, your sustainability work will be seen as just window dressing"

The Netherlands aims to develop a circular economy by 2050. It's a small country, heavily dependent on imports, and to meet this ambition it needs to cooperate with others. Joan Prummel from the Dutch Rijkswaterstaat meets with organizations from around the world to help them implement circular procurement practices.

Why does the government of the Netherlands have a strong focus on circularity?
"Circular economy is not a goal in itself but a means to an end. Circular economy in our view is a systemic approach to deliver on and contribute to several issues. Think not only of resources but also carbon emissions, job creation, pollution, land and water use, and social circumstances. Circular economy as a system will contribute to many of the UN Sustainable Development Goals (SDGs) we all agreed on. It is not 'the solution' but we see it as the best way forward towards a sustainable, social, healthy, and prosperous society.

"We are a very small country, dependent on imports and exports, so if we want to implement a circular economy, we need the countries around us to be circular as well. We need to import circular products and export circular products to circular markets. About ten years ago, we made the connection between circularity and procurement. The 'production' of a government is mainly legislation and subsidies and policies, but our own behavior is very much linked to the products we buy. To impact resource efficiency and resource management, we need to interfere with the market, using procurement as a lever."

What's the most important key to succeeding with circular procurement?
"I would say collaboration. If the main aim is to establish a circular economy, there is no way to close loops on your own. You need to partner with stakeholders throughout the life cycle to get things done. There is no point in, for instance, pushing your recycling industry to get a lot of materials out of products if nobody is using these materials in new products. And there is no point in having a proper circular design of products if no one is buying them and using them.

"Internal collaboration is also vital. You need commitment for design, for recycling and certainly also for procurement. Procurement is, in itself, a facilitating process, instigated by clients in an organization. These are the people who are in a position to push sustainability and circularity, and give room for procurement as a process, to engage with markets and get to the best solutions. Contract management is also vital. A large proportion of circular practices actually occur after a product is purchased. Will it be repaired, and recycled at end of life?

66 You need to partner with stakeholders throughout the life cycle to get things done.

"Join networks and learn from other countries. That's basically our approach, why we are where we are at the moment. From the outset, we engaged others and encouraged others to start experimenting. In 2013, we set up the Green Deal for Circular Procurement, a learning network with 50 participants committing to just two things: the first was to experiment with circular procurement; and the second, share whatever you learn. Together we create a lot of new insights and knowledge."

Are IT products included in your work with circularity?
"Computers, displays and phones are a huge part of what we use in our daily work so they were included from the start. In this sector, a lot of critical materials are used so whatever you can achieve would have extra benefits because it would not only look after closed loops of products and materials but also closed loops of critical materials.

"However, this global market is quite difficult to influence. We started by looking at the back-end of our use. When we buy computers for instance, we tend to use them for three to five years before we replace them. The old ones are still good enough for some ▶

purposes, for instance, schools or sports clubs. So we started looking at how to change our own processes to make that happen, with focus on lifetime extension and second use."

Joan Prummel, International Advisor, Circular Economy at Rijkswaterstaat. Credit: Private.

What would be your advice to an organization wanting to get started with circular procurement of IT products?

"In general, I would say get as much information as possible that is already available online. Start where you see your first easy-to-accomplish benefits. Even if the benefit is not that big, what you learn is important. So, just start somewhere and try to improve from there. Use your common sense, there are a lot of steps you can take quite easily. For instance, why would you automatically need new equipment? You can ask for products that include more reused components. You can require your products to be disassembled and handed in to safe recycling, It's not that difficult to start making a difference.

"If you have an ambition of circularity, you should go to the supply chain, explain what your ambitions are and check what they are able to do. It's very easy to over-demand but if your suppliers are not ready for that, nothing will happen. And if your ambitions are too low, then you're not challenging them to innovate. So you need to know where they are."

From a circularity perspective, is leasing IT products better than buying?

"Leasing in itself has nothing to do with circularity — it's just a financial construction. It can, however, enable suppliers to come up with circularity tools since they retain ownership of the product. If you include end-of-life handling in your contract, leasing is promising because in a leasing contract your products will always go back to the supplier. If you don't add any requirements about what happens end of life, leasing is as good or bad as any other contract."

What benefits would you say circularity gives the purchasing organization?

"The circular economy as a system delivers on a number of the 17 SDGs. It's not only about responsible production and consumption, but also about carbon emissions, pollution, land and water use, smart cities, innovation, and jobs and education.

"It will most often lead to financial benefits as well. The simple idea of having residual value of products at the end of your use means that you get a bit of money back, but also that you're creating jobs. And you can influence where new jobs are created. That's certainly a great direct benefit for the public sector — fewer people claiming unemployment benefit reduces public expenditure.

"Many organizations have policies in place to reduce their carbon footprint. Budget and effort spent on circular economy will lead to carbon benefits as well. This means you'll achieve better results on your carbon emission targets with the same investment, (or you can spend less to achieve your goals. My personal view would be you'll have more money to spend on improvements or in other areas. So there's a lot of direct and indirect benefits of the circular economy.

"And last but not least, for both public and private organizations, circular procurement adds value to your reputation and credibility. If you want to position yourself as a sustainable organization, you need to be able to answer the question 'what are you doing yourself?'. The answer lies within procurement. Even if you have a decent circular product to sell, it's not enough. Not using the principles of circular economy in your organization will be a tremendous barrier to claiming a sustainable position. It will be seen as just window dressing." ∎
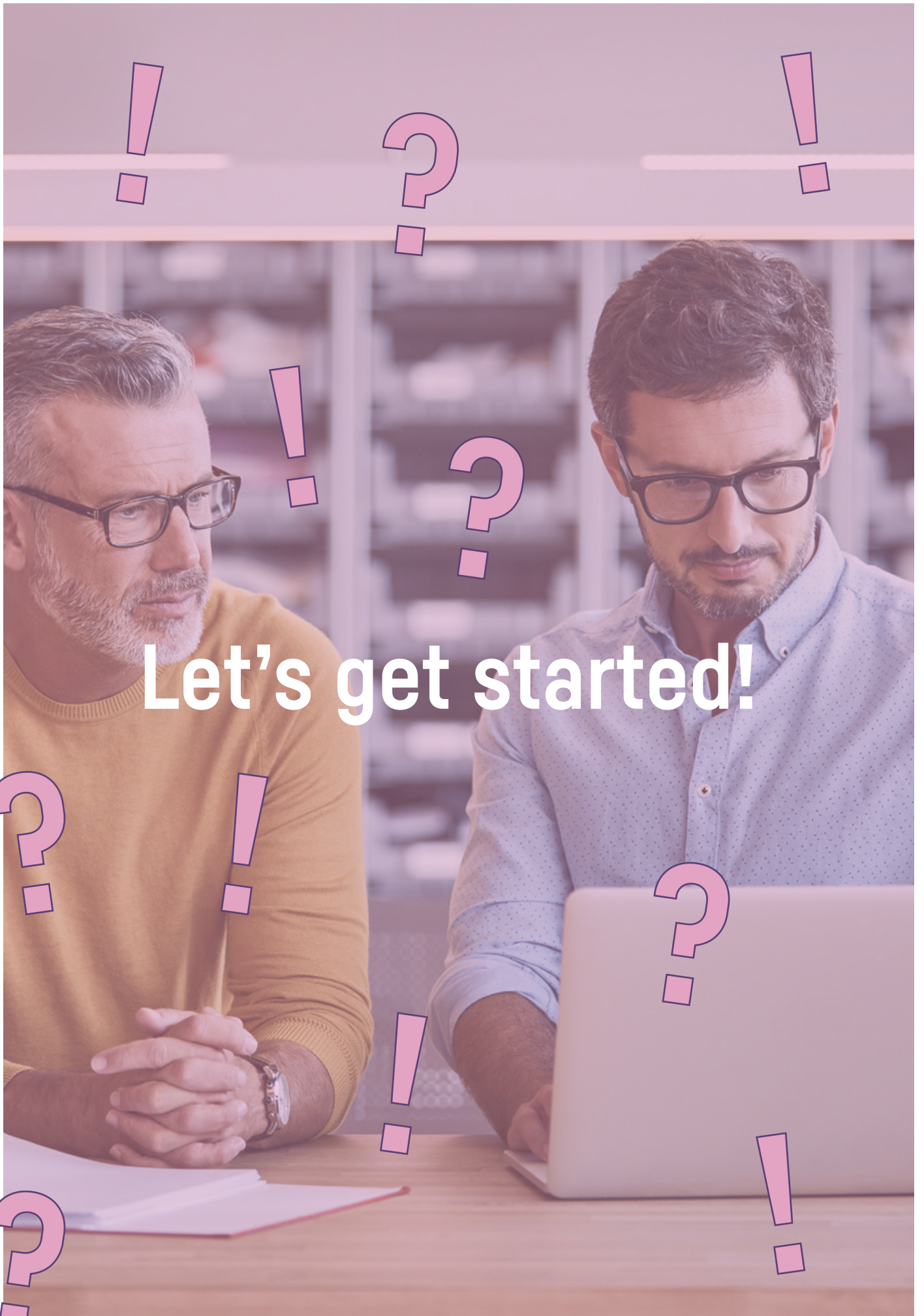
Let's get started!

33 hands-on tips for circular management of IT products

So now we've heard from some inspiring experts on the frontline of circularity and IT. What do they recommend? Here is a collection of their tips (and some of our own). It might seem like a lot — but keep in mind that sustainability takes time, and the main thing is to get started.

Leverage your purchasing power

1. Make your circularity intentions clear for your suppliers. IT brands know that the circular paradigm shift is coming and a push from clients will help them take the big steps needed.

2. Select a supplier with sustainability ambitions. Common priorities can help support your circular and sustainable IT management goals. Make use of pre-competitive dialogs and RFIs to gather information from suppliers.

3. Include circularity criteria in your procurement policies and specifications. Examples could include durability and repairability criteria that will allow you to keep products longer, and criteria for reduction or elimination of hazardous substances that make materials more recyclable.

4. Purchase products that have already been used. Focus on functionality and make use of the possibilities offered by professional refurbishing and remanufacturing businesses.

5. Don't overestimate the environmental and financial effects of changing to a more energy efficient device. In most cases, the potential savings are heavily overshadowed by negative impacts in the manufacturing phase.

6. Ask your supplier for an extensive warranty that covers service, repairs and battery replacements during your estimated use time.

Use your IT products longer

7. Use your IT-products longer — it's the single most important thing you can do to save natural resources and cut greenhouse gas emissions.

8. Think long-term when you purchase an IT product — buy a high-performance product that has enough capacity to meet your needs for several years.

9. Make sure that the products you buy are designed for a long life. They must be durable, upgradeable, and easy to repair.

10. Pay attention to battery life. Mobile IT products are often replaced because the battery has lost its capacity to hold a charge. To extend product life, make sure the battery is of high quality and can be replaced.

11. Extend battery life by keeping the product 20-80 percent charged as often as possible and avoid leaving it in hot spaces.

12. Remember to use the products in a circular manner — repair and upgrade your IT products when needed instead of disposing of them.

Involve the rest of your organization

13. Work to gradually implement circular practices, such as take-back programs, in your own organization. Investigate the current situation thoroughly to identify how and where circular practices can be introduced.

14. A good start can be to interview people involved in IT purchasing and management.

15. Keep an eye out for old habits and policies that stand in the way for circular practices.

16. Be aware of the effects on employees. Engage them and make sure you have a mandate to change their routines.

17. Identify clear incentives — what are the benefits of going circular? It could be cuts in CO_2 emissions, better operative results or lower costs for IT management. ▶

18. Cooperation between functions is vital and will help you make faster progress. Invite decision makers and specialists from at least IT, procurement, sustainability, finance, facilities and communication for regular meetings to discuss circularity.

19. Build your arguments by reading up on the sustainability impacts of IT products throughout the supply chain, including climate, extensive use of scarce, natural resources, e-waste, hazardous substances, and social impacts.

20. Make sure that your hazardous e-waste doesn't end up being illegally exported. Cooperate with a professional waste management firm that handles your end of life products in a safe manner.

21. Categorize people in your organization depending on their IT needs. This will help you optimize the use of devices and find opportunities for product reuse.

22. Accept that change is a process. You need to have a long-term perspective and allow time and space for behavioural changes.

Give your IT products a second life

23. Don't miss out on the opportunity of additional income — resell IT products once you're finished using them.

24. Remember that your IT products may have value even if they no longer meet the needs of your organization. Discuss resale options with a reputable refurbishment or remanufacturing firm. Consider also charitable donations or surplus resale to employees.

25. Develop internal policies and routines for the collection of used IT products. For example, avoid distributing new products to users before the old device is handed in.

26. If you want to resell your products, do it as soon as you've stopped using them. They lose value each month they are kept in storage.

27. Include chargers and cables when you sell the products — otherwise new chargers need to be manufactured and it reduces the environmental benefits and your income.

28. Protect your data — use software for safe data removal, or ensure that the company that you sell products to will manage this securely.

29. Make sure you deactivate digital systems for data security. Failing to do so makes devices useless on the second-hand market.

Join forces with others

30. Team up with other buyers to increase your purchasing power and influence.

31. If you want to implement circular procurement practices, communicate your goals and tactics with internal and external stakeholders throughout the IT product life cycle.

32. Don't be afraid to reach out for help. Join networks, learn from others, and share what you know.

33. Keep in mind that even the smallest contributions are valuable. It doesn't matter so much what the first step is as long as you take it.∎

TCO Certified – a tool for enabling circular solutions

With TCO Certified, it's easier to take the next step in sustainable and circular IT procurement. By including the certification in your product specifications, you get access to products that are durable, repairable, upgradeable and recyclable.
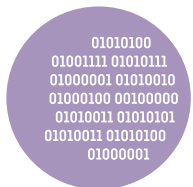
Criteria in TCO Certified have a circular approach

Criteria cover all phases of the product life cycle: material sourcing and manufacturing; use and re-use; recovery and recycling.
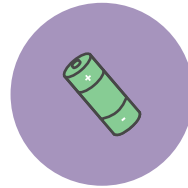
TCO Certified includes criteria for battery life and replaceability. IT products are often replaced because the battery has lost its ability to hold a charge.

The brand owner must provide software which deletes data from computers securely and free of charge, so that the product can be recirculated without risk of data leakage.

Certified products must have at least one year's warranty and spare parts must be available for at least three years after the product model is no longer manufactured.

To promote the circular economy, products must be repairable and upgradeable so that they remain functional for a long time.

By reducing the number of hazardous substances, materials can be safely recycled and reused for a long time to come, and maintain compliance with increasingly stricter legislation.
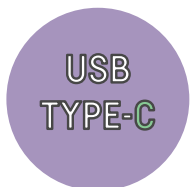
Computers must include an USB Type-C port. By using a standardized connector, fewer cables need to be manufactured and re-use of cables can increase.

Mobile products must be durable and endure high and low temperatures.

The brand owner is responsible for offering take-back options at end of life.

2019 in figures

- More than **100 million certified IT products** were manufactured.
- More than **20,000 hours were spent** on independent verification of compliance.
- Around **3,500 certified product models** were listed in Product Finder.

Ready to get started?

Do you have questions about what's included in TCO Certified and how to use it in contract language? Perhaps you want to know how to ask your vendors to supply certified products, or how to measure the sustainability impact of the IT products you purchase and use? Our dedicated purchaser support team is here to help. Let's talk – our support is free of charge and focused on helping you make more sustainable choices easier.

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9. Interview with Erik Pettersson and Katarina Magnusson, Inrego, 2020-02-17.

10. E-mail interview with Stephen Haskew, 2020-05-11.

11. Based on the example in Conclusion 1, where the carbon footprint from a business grade 14 inch notebook is analyzed.

12. Global personal carbon footprint estimated at 4981 kg co2e emission per person (source: World Bank)https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

13. TCO Certified Edge is a supplemental certification to TCO Certified, intended for best in class products meeting leading edge sustainability criteria.

Thanks to the private and public sector organizations using TCO Certified in their IT specifications, millions of IT users around the world are supporting the shift toward a more circular IT product ecosystem.

Find out more on tcocertified.com.

Toward sustainable IT products

TCO Certified is the world-leading sustainability certification for IT products. Our comprehensive criteria are designed to drive social and environmental responsibility throughout the product life cycle. Covering 11 product categories including computers, mobile devices, display products and data center products, compliance is independently verified, both pre and post certification.

Join us in driving progress toward sustainable IT products.