STRATEGY PAPER FOR CIRCULAR ECONOMY: MOBILE DEVICES

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ABSTRACT

Sustainability challenges can only be addressed at a systemic level, and this is why the GSMA is proud to play a role in helping the mobile industry become more sustainable. In 2016, the mobile industry was the first industry to commit fully to the 17 United Nations Sustainable Development Goals and, in 2019, the GSMA Board set a climate ambition on behalf of the industry to reach net zero carbon emissions by 2050 at the latest. Earlier this year, the GSMA published its first Strategy Paper on the Circular Economy, which focussed on how network equipment can evolve towards more circular business models. Continuing the exploration of circularity, this paper looks at the largest environmental impact of the mobile industry – mobile devices. The report has been developed with Ethos, a Swedish management consultan-cy specialising in sustainability, in collaboration with Tele2, as the Project Group lead, and Project Group members from the GSMA.

KEYWORDS: *GSMA, Tele2, mobile devices, circular economy.*

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Introduction

Consumption of natural resources is already at an unsustainable rate and is increasing. Scientific evidence indicates this will lead to a collapse in the natural systems upon which humans depend. However, existential challenges such as climate change, waste, pollution, resource scarcity and biodiversity loss can be solved by moving to a more circular economy, and this idea is gaining recognition globally.

For the telecommunications industry, one of its biggest environmental impacts is from customers accessing connectivity through connected devices. This strategy paper therefore focusses on the opportunities to transition both mobile devices and customer premises equipment such as routers to more circular business models. In developing a circular approach for the industry, the research has referenced widely agreed principles of a circular economy as well as existing frameworks and metrics that are already being used, both within the industry and in other sectors. There has been consideration of current and proposed circular economy policies that governments around the world are implementing.

The circular model includes a vision for 2050 to help drive the industry towards a sustainable future. This is defined as a future where devices have as long a lifetime as possible, where they are made with 100% recyclable and recycled content using 100% renewable energy and where no device ends up as waste. The strategy paper explores how telecommunication operators can understand their current position within the circular economy, how they can accelerate the circular transition by engaging with key stakeholders in the value chain and how to measure progress by using circular metrics and actions covering both 'entry-level' participation and 'leadership-level'.

The benefits of this approach are broad, being environmental, social and economic:

• Extending the lifetime of all smartphones in the world by just one year has the potential to save up to 21.4 million tonnes of CO2 emissions annually by 2030, equal to taking more than 4.7 million cars off the road.

• A reduction in the 30m adults and children currently experiencing adverse health impacts from informal e-waste recycling.

• A refurbished mobile device market predicted to be worth more than $140bn by 2030, compared to $50bn in 2020.

This strategy paper further explores the barriers to achieving a circular economy for devices, along with circular incentives and existing examples of best practice. The paper outlines four immediate opportunities to improve circularity:

1. Understand product flows, increase the number of devices collected from consumers and create a foundation to measure reclaimed devices and treatment method by share of recycled, repaired, reused and reclaimed devices.

2. Increase consumer awareness, based on understanding consumption habits in terms of end-oflife treatment and incentives to increase longevity of devices.

3. Engage with suppliers to improve eco-design and sustainable production leading to greater repairability and durability of devices, which will increase their lifespan.

4. Engage with repairers and recyclers to increase the number of devices that are reclaimed, repaired and recycled to maximise value retention within the economy.

Positioned between consumers, device suppliers and repairers/recyclers, telecommunication operators have a fantastic opportunity to contribute to a circular transition for devices, both from a direct control perspective as well as through influence and partnerships.

By moving to a circular business model for the industry, negative environmental and social impacts will be reduced. This means the industry can meet its demand for materials without depleting the global supply of finite resources. It will also create new market and employment opportunities and will support a just transition given supportive government policies and incentives.

Two product groups are included in the scope of this strategy paper: mobile devices and customer premises equipment. The term 'devices' will be used hereafter to describe both product groups.

Mobile devices

The product category 'mobile devices' includes smartphones, tablets and feature phones, which may be similar in material content but can vary in size.

Customer premises equipment

The customer premises equipment (CPE) product category includes in-home devices such as set-top boxes, internet routers, Wi-Fi hubs and access points.

The strategy paper was developed through:

• Desktop analysis of new and existing research on the circular model and the circular economy within the telecommunications industry.

• Interviews with industry experts and circular economy practitioners and dialogues with project members.

Currently, the global population is using natural resources corresponding to 1.75 Earths. This means that the global economy uses resources at a rate faster than nature can regenerate, causing resource depletion. The consumption of resources is also accelerating – by 2060, global GDP is projected to triple in size and the world's resource consumption is estimated to double.

If these trends continue, the environmental and socio-economic consequences will be severe. The effects of resource depletion will be seen not only through a reduced ability to mitigate and adapt to climate change, but also through its impact on biodiversity and ecosystems. Disruption of planetary systems is already seen through global warming and more extreme weather such as heatwaves, storms and flooding.

The environmental impact of the telecommunications sector is derived from activities throughout the value chain, from raw material extraction and processing, production and assembly of electronic devices to packaging and

transportation, as well as by the energy consumed through use of devices and in waste management.

The use of connected devices is expected to grow, and this digitalisation can enable the future low carbon economy and a more resilient society. Mobile technology is already harnessing the Internet of Things (IoT) and artificial intelligence (AI) to create solutions that allow societies not only to mitigate emissions, but also to adapt and become more resilient to the impacts of climate change.

At the same time, demand for these solutions will further accelerate the consumption of raw materials6 required to manufacture devices such as mobile phones and routers. Currently, around two billion phones are sold annually and more than 90% of the global population owns a mobile phone. In 2021, there were an estimated 7.78 billion active smartphones and feature phones around the globe. [1-3]

This number is projected to increase; by 2030, the total number of smartphones and feature phones is predicted to reach nine billion. A similar trend is seen in the global router market, which is predicted to almost double from 2020 to 2030.

The value chain of devices

The value chain of devices is long and complex, with hundreds of businesses involved.

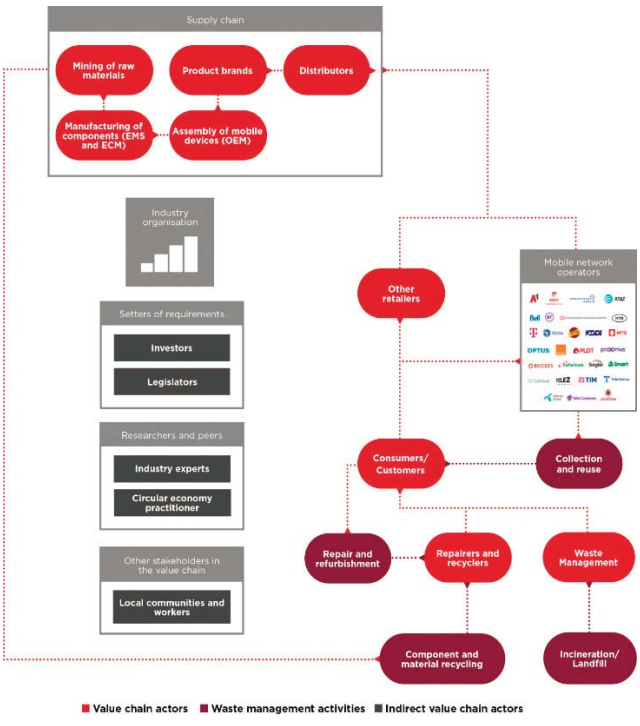

Fig. 1. A simplified version of the value chain of devices. Depending on countries and business model, the value chain can vary to some extent

As an example, an iPhone contains components from more than 200 suppliers. Each step of the value chain entails circular economy-related challenges and opportunities. Simplified, the manufacturing of devices consists of three main areas: raw material extraction, component manufacturing and assembly.

More than 50 different materials could be found in an average smartphone, such as: 29% plastic, 16% ceramics, 15% copper and compounds, 10% silicon plastics, 10% other metals, 9% epoxy, 8% other plastics and 3% iron13. The material in all 7.78 billion smartphones and feature phones around the globe could contain an estimated 124,000 tonnes of copper, 2,721 tonnes of silver, 264 tonnes of gold and 117 tonnes of palladium.

Raw material extraction, primarily mining practices, has negative environmental and social impacts due to contamination of air, soil and water by chemicals, heavy metals or acidic minerals when these are emitted or mixed with wastewater. Mining activities can cause soil erosion and loss of biodiversity as the practices include modification or destruction of habitats.

Production and assembly of components is not only material-intensive, but is also energy-intensive. It often uses fossil fuel energy sources, which is why approximately 80% of the climate impact from a smartphone comes from the production stage of the device and its components. According to the United Nations Environmental Programme (UNEP), resource extraction and processing of fossil fuels, metals and minerals make up 36% of global greenhouse gas emissions and 7% of global biodiversity loss.

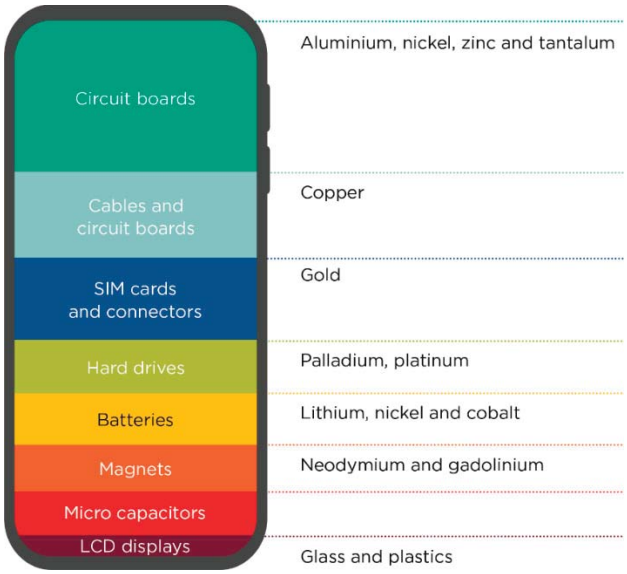

Fig. 2. An example of materials in a mobile phone

The average use time of a phone is around three years. However, the technical lifespan is between four and seven years and the optimal lifetime for a mobile phone in terms of minimising its climate impact could be at least 25 years. However, extending the lifetime of all smartphones in the world by one year has the potential to save up to 21.4 million tonnes of CO2 emissions annually by 2030, equal to taking more than 4.7 million cars off the road [4-7].

The current rate of consumption of devices contributes to the growing generation of e-waste (electronic waste such as discarded electrical or electronic devices), with a considerable amount of it being outside of formal waste management. It is estimated that as much as 86% of global e-waste is estimated to be treated outside of formal waste management, with small IT and electronics such as devices constituting around 9% of the total e-waste generated.

The final destination of many of these e-waste streams is unknown, but can end up in regular waste collection, dumped in landfills or burned in both formal and unregulated settings. There are data and knowledge gaps across all electronic waste streams, including devices such as routers and mobile phones.

As an example, where specific regional data is available, official take-back rates of mobile phones rarely exceed 15%, meaning that 85% of mobile phones are not formally recycled. However, this data does not include mobile phones stored in people's homes or those which are either passed on or sold to other consumers.

As significant amounts of e-waste are handled outside formal systems, fully functional devices could be discarded or recycled instead of collected and reused or repaired, losing the full potential of their useful lifecycles as well as the embedded value in components, materials and energy.

Social impacts

Apart from environmental impacts, the life cycle of devices is also associated with social issues that impact individuals and communities. Evidence has been uncovered of extraction of much-needed minerals present in mobile devices being associated with human rights risks. For example, in raw material mining of conflict minerals and cobalt, there are recorded instances of child labour, such as in mining of gold in Ghana and mining of cobalt in the Democratic Republic of the Congo.

Poor labour conditions including the lack of safety equipment or deficient security practices have also been documented in several countries such as Bolivia and Bulgaria, where materials such as tin, silver and copper are sourced for devices. Mining of raw materials may also lead to the release of toxic metals and contamination of soil or freshwater, not only affecting workers' health, but also local communities in proximity to mining areas or dumpsites. Moreover, communities that can be affected by proposed mining activities or which are in proximity to planned projects within the value chain are at risk of being neglected from the planning process. In Armenia, the planning of a gold mine failed to include local residents in the Environmental Impact Assessment, resulting in a number of protests.

Freedom of speech can be negatively impacted in the value chain of devices. In gold and copper mining in Bulgaria, cases of intimidation and silencing workers from speaking up regarding poor working conditions have been reported. Similar issues are also visible in manufacturing, for example in China and Vietnam, where workers can be exposed to poor working conditions related to (for example) long working hours and excessive overtime, lack of worker representation and trade union rights as well as insecure contracts.

The increasing generation of e-waste, with significant amounts processed in the informal sector, also pose a risk to people's health and safety. For example, as many as 18 million children and adolescents and 12.9 million women could be at risk from adverse health outcomes associated to e-waste recycling. Poor e-waste management may also lead to contamination of nearby areas. Much of the informally treated e-waste is estimated to be illegally traded or dumped, predominantly in Ghana and Nigeria.

The way forward

With these negative environmental and social impacts in mind, there is an urgent need to accelerate the circular transition of the economy to be able to meet the demand for materials without depleting the global supply of finite resources. This would also reduce both the environmental and social impact of devices. The devices in scope should be used for longer and resource efficiency, reuse, repair and recycling rates should increase.

While demand for new devices remains high, there is already evidence of a budding circular economy – 11% of smartphones sold worldwide today are refurbished and the market is increasing. Consumers are also becoming more interested in second-hand products as well as sustainability at large.

Devices are being used for longer. In the past seven years, the mobile phone replacement cycle has increased by 10 months, from 24 months in 2014 to 34 months in 2021 worldwide. This trend is expected to continue, with the refurbished mobile device market predicted to be worth more than $140bn by 2030 compared to $49.9bn in 2020. To put this into context, the global telecommunications market was valued at $1,708bn in 2021.

The environmental, social and economic benefits of moving towards a more circular economy for devices are clear. The purpose of this strategy paper is therefore to explain how the industry stakeholders can take leadership in working towards a sustainable telecommunications industry in general, and to improve the circularity and long-term sustainability of telecommunication devices in particular.

A circular economy

A circular economy is defined as an economy that retains the value of materials and products for as long as possible, moving from a linear economy (take-make-dispose) to a system where resources are used more efficiently and waste is reduced.

Moving from a linear to a circular economy requires transformation to a system that uses less material, extends the longevity of products, increases product use and recirculates products, components and resources back into the material flows of the economy.

In 2020, the global economy was estimated to be 8.6% circular, meaning that more than 90% of the world is still stuck in a linear economy where material and products do not get recycled or reused, but end up being wasted.

The circular economy is beginning to be embedded in policy across several continents:

• The EU's Green Deal51 and the Circular Economy Action Plan

• The US's National Recycling Strategy

• hina's Development Plan for the Circular Economy

• Africa's African Circular Economy Alliance

• Latin America's Circular Economy Coalition Latin America and the Caribbean.

However, the focus on how to deal with circular devices varies, from increasing recycling rates to prolonging the lifetime of devices or empowering consumers with the right to repair. There is a need to have an agreed approach for the circular economy of devices to achieve a system shift in the global economy. By exploring best practice across these regions, along with what individual businesses are doing, this strategy paper proposes a globally relevant approach. In response to national strategies and action plans, as well as to boost circular economy overall, numerous organisations and companies have published frameworks on the topic [8-10].

Circularity frameworks and metrics

Circular economy frameworks and indicators are widely discussed topics by internationally acknowledged organisations, such as the 'Circular Transition Indicators' by the World Business Council for Sustainable Development (WBCSD), 'Circulytics' by the Ellen MacArthur Foundation, 'CIRCelligence' by Boston Consulting Group and 'the Circular Gap Metric' by Circle Economy. The GSMA also recently published the ESG Metrics for Mobile, including metrics connected to waste, repair, reuse and recycling.

In addition to metrics developed by industry initiatives, emerging regulation and internationally developed standards are also incorporating the circular economy – for example, European regulations such as the Corporate Sustainability Reporting Directive (CSRD), the Sustainable Finance Disclosure Regulation (SFDR) and the EU Taxonomy.

Internationally adopted standards like Global Reporting Standards (GRI) and Sustainability Accounting Standards Board (SASB) also have metrics regarding circular economy.

Circularity model for devices

To materialise the potential of circular devices, the GSMA has defined a shared industry vision to 2050. All actors in the telecommunication ecosystem will need to work together to achieve this vision:

"Devices with as long a lifetime as possible, made with 100% recyclable and recycled content, 100% renewable energy and where no device ends up as waste"

To achieve the vision, a circularity model has been developed. The model includes two overarching concepts of 'maximised longevity' and 'zero waste', which permeate the four solutions to commonly observed barriers related to a circular economy for telecommunication operators. As circularity is not achieved in isolation, the solutions entail collaboration with stakeholders across the value chain.

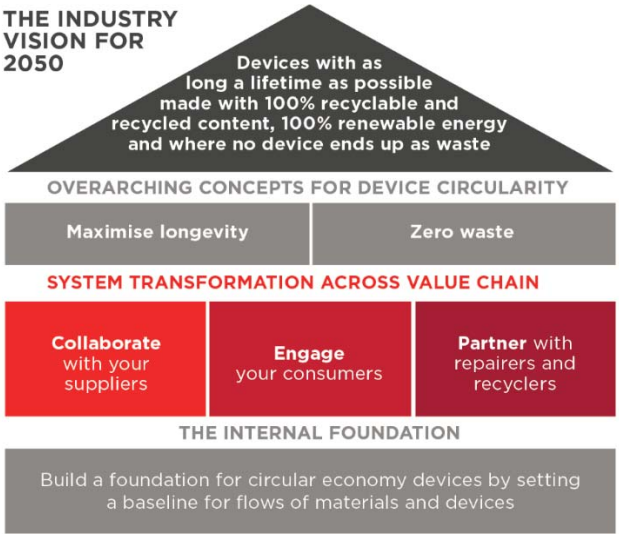

Fig. 5. The circular model displaying the circular transition for devices.

Source: GSMA

Boosting circularity: barriers and opportunities

The roadmap to a circular economy for devices introduces four steps to incentivise the transition towards maximized longevity and zero waste. Actions are both directly for telecommunication operators as well as in cooperation with others. Given that every telecommunication operator is embarking on the circular economy journey from a different starting place, each step of the roadmap consists of both 'entry-level' and more advanced 'leadership-level' actions.

Lack of data on end-of-life of devices

The data of global take-back rates of devices varies in availability and, where data is available, the take-back rates rarely exceed 15%. Available data only concerns devices that have been handed into a formal recycling facility and do not consider the secondary market that exists among customers. There is an evident data gap on what happens to the device when the first consumer no longer needs the device but does not return it to a telecommunication operator.

In many parts of the world, data is lacking and this could have several explanations. For example, there are limited organised or formal systems for the take-back of e-waste and devices in many countries in Africa. However, the data are estimates and, as an example, MobileMuster – accredited under the Australian Government's Recycling and Waste Reduction Act 2020 – reported a 98% recycling rate of the collected mobile phones.

Choosing suitable metrics to measure device flows

By gathering data on the flow of devices, a foundation for circular economy for devices can be built and actions can be targeted to improve circularity. There are two sets of actions and metrics recommended: 'entry-level' and 'leadership'. Measuring device flows will help operators understand their current circular status for devices, and also improve the understanding across the industry.

Tele2 'Mapping of material flows'

As a result of Tele2's ambitious efforts to reduce emissions by 90% in their own operations in two years, the majority of Tele2's emissions lie within its value chain today. Transitioning to a more circular economy has the potential to decrease the environmental impact of Tele2's value chain and is one of four key focus areas of Tele2's sustainability strategy.

In the autumn of 2021, Tele2 mapped out the most important material flows of its operations and identified key questions for moving forward in the circular transition. The material flow analysis included both network infrastructure, offices and stores as well as customer products in B2B and B2C offers. Material inputs of around 3,000 tonnes were identified. Excluding the network equipment, the largest material flows in terms of weight concerned plastics and different metals such as aluminium and coppe.

The analysis showed that around 8-15% of all procured mobile devices are either reused or recycled. To close the loop for mobile devices, the number of reclaimed devices must increase. The insights from the material mapping will be used to further develop Tele2's understanding and im-plementation of circular economy for devices.

Choosing suitable metrics to measure device flows

Entry-level actions and metrics will help to understand what proportion of devices are wasted, recycled and refurbished. Leadershiplevel actions and metrics go a step further and measure overall device reclamation rates, and what devices are composed of.

Entry-level action:

• Set up a structure (e.g. system tool or Excel) to collect data regarding devices.

• Quantify number of collected devices and number of devices being incinerated or landfilled, recycled, repaired and reused.

Entry-level metrics:

• Mobile device and CPE waste generated in tonnes per fiscal year.

• % of mobile devices and CPEs recycled by unit sold per fiscal year.

• % of mobile devices and CPEs recycled by purchase price per fiscal year.

• % mobile devices and CPEs repaired and reused by unit sold per fiscal year.

• % mobile devices and CPEs repaired and reused by purchase price per fiscal year.

Leadership-level action:

• Based on the entry-level data, conduct an assessment on data gaps, how to improve data quality and leverage points.

• Estimate material content (plastic, metals, critical minerals, etc.) of procured and reclaimed products to understand the material value of input and output flows.

Leadership-level metrics:

• Percentage of mobile devices and CPE collected from consumers of total units sold in fiscal year.

• Weight and share of renewable, reused and recycled material in procured devices and CPEs.

Consumers want to do more, but need information

Consumers are critical to achieving a circular transition for the devices because, once the devices are sold, the consumer is in control of the device. Understanding consumer behaviour is a difficult and complicated task, and aspects such as affordability, information availability, social norms and preferences can all affect the final behaviour of the consumer [11-12].

However, consumer awareness of sustainability and circularity is on the rise. For example, 51% of consumers globally think that the consumer electronics sector is not doing enough to reduce, reuse and recycle waste.

In addition, 72% of consumers would like to buy products that are more durable and 47% want to buy second-hand instead of brand-new items. Also, 53% of consumers are comfortable with using second-hand phones. When it comes to purchasing a device, consumers feel less engaged and aware. A majority (80%) of EU citizens think it is hard to find information on durability and repairability, and 64% think that it is hard to tell how long a device will last65.

India	74%	UK	44%
China	62%	US	44%
Spain	52%	Sweden	37%
Italy	50%	Germany	43%
France	47%	Netherlands	37%
Australia	47%	Norway	29%
		Japan	24%
OVERALL	45%		

Fig. 8. Consumer interest in buying exclusively from brands that practice circularity. Percentage of respondents who say they are interested in buying exclusively from brands that concentrate on circular and sustainable practices

Source: Capgemini Research Institute, ciruclar economy surbey, August-September 2021, N=7,819 consumers

Moreover, consumers are concerned with how data security and integrity are ensured when a device is collected, creating a barrier to returning the device68. Around the world, consumers are still holding on to old devices; an estimated 700 million second-hand mobile phones are left unused in the EU alone when they could be recycled, refurbished or even reused by someone else69. A majority save the devices as a spare but, for others, either concerned regarding data security or not knowing where to hand in old devices, they just end up in peoples' drawers.

Consumers must have the knowledge and opportunity to care for devices while in use to maximise longevity and also return devices they no longer need so the device can be reused or recycled.

Telecommunications operators can provide consumers with the information needed to promote them into a change of behaviour. To measure consumer engagement, telecommunication operators can use not only descriptive and qualitative metrics, but also estimations of the destination of the fate of devices based on findings from consumer surveys.

Once the company has gathered information on consumer habits and mapped the potential destination, the next step involves communicating with the consumer to potentially affect their behaviour – for example, through communication campaigns to raise awareness on how to turn in devices, caring for devices or promoting the use of ecolabels.

The supply chain for devices is complex

To achieve a circular economy for devices, there is a need for collaboration and communication within the value chain. A recent study shows that 49% of telecommunication operators see the complexity of supply chains as a barrier for circular economy. At the same time, 84% believe that a circular economy can help solve challenges within the supply chain.

Stakeholders in the supply chain, such as manufacturers and product brands, play a key role in terms of the circular performance of the devices, with the possibility to design devices to prolong their life, increase recyclability and keep them free from hazardous materials. It is also important to consider possible vulnerable stakeholders within the supply chain, such as workers and local communities.

In order to ensure a fair transition of the industry towards a circular economy, manufacturers can play a key role to ensure that violations against human and labour rights are avoided within their supply chains.

Telefónica: Accelerating Circular Economy through innovating supply chain processes. Regarding CPE, Telefónica has developed and deployed VICKY in Brazil, an initiative that has been recognised for its innovation by the industry (i.e: Gartner, Forbes).

This platform, based on Blockchain, is now tracing millions of CPE yearly, from components manufacturing to distribution, installation and reverse logistics across the E2E value chain. Telefónica uses this initiative to lead the transition to circular economy, while creating business value through a more efficient, faster, simpler and sustainable supply chain. With more than 100 different companies involved in the process, placing more than 15 million pieces of equipment on the market each year, it has drastically improved product recovery rates (up to +25p.p.), refurbishment processes, product lifespan, product design and recycling and scrapping rates, intending to collect 100% of the uninstalled or inactive equipment, both in customer premises and in collecting points.

In addition, for mobile devices, Telefonica uses MARA, a fully omnichannel process that allows consumers to automatically assess their devices and access the Telefónica trade-in programmes anywhere, providing instant and real value added to customers without risks (0% discrepancies rate) and, at the same time, defining the best device destination (reuse, resell, repair or recycle) before collecting them.

Targeted and specific supplier engagement is needed

Preconditions to prolong product lifecycles such as repairability and durability lie outside telecommunication operators' direct control as such factors are defined in the design phase of a product. Nevertheless, operators jointly hold significant purchasing power as retailers of devices around the world.

There are also technical limitations on the longevity of devices (for example, software upgrades, lifetime of components such as the battery or the availability of replaceable components). The technically useful lifetime is limited because these obstacles prevent use of the device after a certain number of years. These limitations should be considered when telecommunications operators have ownership over the design process, such as white-labelled CPE.

All forms of industry initiatives and partnerships are key to creating a systemic change towards a circular economy for devices. Telecommunications operators may engage with suppliers and product brands to target the barriers created by complex supply chains. By requesting brands to design and produce devices with longer lifespans, higher repairability and more recycled components and materials, the telecommunications operators have the potential to positively influence the market.

Three metrics are suggested in the engagement with suppliers. The first and second relate to criteria set towards suppliers to increase circularity of devices. The second metric enables the organisation to further comprehend the circularity of their flow of devices in terms of aspects that could result in a longer lifetime for devices. The third metric concerns procedures for following up suppliers.

Untapped potential in secondary markets

Although the market demand for second-hand and refurbished devices is starting to increase, only 11% of smartphones sold worldwide are refurbished. A global circular transition will move employment from primary

production, such as resource extraction, to secondary and tertiary production, such as the recycling and refurbish sectors. Estimations predict a loss of eight million jobs globally within industries such as mining and manufacturing, but these can be relocated within new growing sustainable businesses, if given the right incentives.

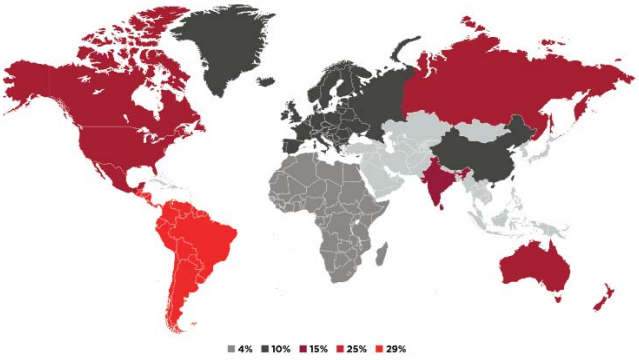

Fig. 10. The map displays the market growth rate of refurbished smartphones in 2020-202176. The market growth rate for refurbished smartphones rose by 15% in 2021 from 2020, with Latin America and India as frontiers

**Figures for Oceania and Russia are based on the global average as data is unavailable. Source: GSMA*

Forecasts show that the world market for second-hand smartphones has the potential to grow by 11% each year from 2019 to 202477. However, economic feasibility and cross-border legislative challenges hinder the secondary markets to tap into more of the value from circular devices. Currently, the economic feasibility of repairing a broken smartphone ends before the device reaches three years of use.

Affordability is another aspect that needs to be included to incentivise purchases of second-hand or circular devices. Currently, the cost of a second-hand phone is, on average, about half the cost of a new one, but the cost depreciation varies depending on model and where in the world the phone is given a new life. It is important to ensure that second-hand or circular devices are not too expensive because the most common barrier to owning a mobile phone, according to people in both low- and middle-income markets, is the cost.

The global average cost of a smartphone is around 26% of an average monthly income. However, there are large differences and the cost can be more than double in some regions. In addition, the industry must also understand and overcome logistical and legislative challenges related to exporting functional second-hand devices to enable cross-border export – for example, within the EU, where the WEEE regulation prevents e-waste from being transported across EU countries.

This also concerns second-hand devices when it comes to shipping refurbished products from one country to another. All actors that either recycle, refurbish, repair or enable the reuse of devices are retaining resources and value in the industry.

Many opportunities to enable the cascading use of devices lie in the secondary market. With a variety of offers, devices can be used several times with new consumers, ideally within the same country, but also in others. Repairers, recyclers, and other waste management operators are vital partners in the transition towards a circular economy because they enable the transitions of the material flows from being linear to become circular. Waste management operators are also important to be able to safely discard hazard-ous waste that needs to be disposed of. telecommunication operators can develop partnerships with repairers to overcome and capitalise on barriers to secondhand markets and to ensure the quality of refurbished and repaired devices – for example, by incorporating quality warranties of refurbished devices [13].

Conclusions and Recommendations

This strategy paper outlines a model telecommunications operators can use to increase circularity for devices and contribute to the vision for 2050. The model includes actions and metrics both for ‘entry’ and ‘leadership’ levels, as well as how to engage with key stakeholders in the value chain.

To implement the actions presented in this strategy paper, both company-wide and industry-wide collaboration is vital. Implementation will be strengthened and accelerated by support from senior management within and between companies. As telecommunications operators learn more about the circular economy for devices, implementation of actions must be continuously evaluated and adjusted.

This includes consideration of operators’ unique business models and markets. To contribute to the industry reaching the common vision by 2050 and to go further in the circular transition for devices, telecommunications operators will need to develop more interventions than those presented in this strategy paper. In addition, a circular transition requires a unified industry with consistent methodologies and communication [14, 15].

Even though individual companies incorporate the circular economy and work towards more circular devices, all actors within the industry and the value chain are needed to create a circular economy for devices. Aspects include, for example but not exclusively:

• B operators:

– Develop common regional take-back schemes within the industry with a focus on transparency.

– Evaluate circular services and refurb/recycling methods.

– Lead by example – apply circularity principles for own-branded CPE.

• International collaboration with actors upstream in the value chain

– For example, by deciding on a harmonised method and criteria to classify circular products both to use for eco-labelling as well as procurement criteria.

• ngaging with downstream actors such as consumers and waste operators:

– Further understand consumer incentives at national levels by conducting cross-operator consumer surveys about successful consumer incentives.

– Promote the development of industry accreditation standards for recycling stakeholders to ensure the maximum economic and sustainable benefits are consistently derived from devices.

• Within the GSMA community:

– Promote the findings of this strategy paper by launching training to put the entry and leadership actions into practice.

– Promote and facilitate a global approach to collaboration between the telecommunications industry and other actors within the industry – for example, to initiate research projects.

Acknowledgments

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[6] www.apple.com/supplier-responsibility/pdf/Apple-Supplier-List.pdf

[7] World Economic Forum, 2019 - A New Circular Vision for Electronics, Time for a Global Reboot.

[8] The estimate has been made based on the US Environmental Protection Agency that estimates that for every million cell phones that are recycled, around 15.9 tonnes of

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[13] The calculations have been made using the estimation from the European Environmental Bureau, 2019.

[14] Assuming a typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year (EPA, 2022www.responsiblemineralsinitiative.org/about/faq/general-questions/what-are-conflict-minerals/

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