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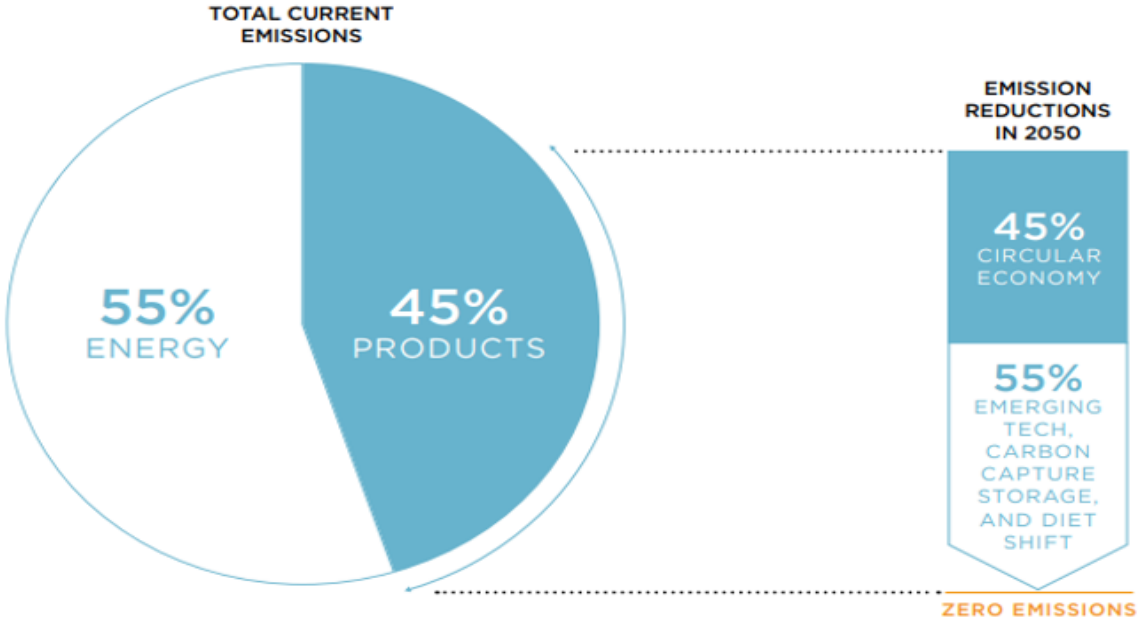
Creating Value from a Circular Economy

Professor Fiona Charnley
Director of the Exeter Centre for the Circular Economy
Director of the UKRI Circular Economy Hub

Setting the Scene

Each year, the UK requires 1.2Bn tonnes of materials to sustain the current economy

- 92M Tons of textile waste produced globally each year, 87% end up in landfill or incineration, <1% are recycled, the average garment is worn 7-10 times
- Global use of construction minerals ~ 55 Gt in 2020
- The Chemical sector is the UK's second highest industrial emitter with 18.4 million tonnes of CO2 emissions
- The extraction of seven major metals (Fe, Al, Cu, Pb, Mn, Ni and Zn) accounts for 15% of the global primary energy demand and 12% of the global GHG emission



Climate change is as much an economic and social crisis as it is an environmental crisis: the costs of climate change to the global economy are projected to amount to **$54 trillion** by the end of the century

Completing the picture: How the circular economy tackles climate change (ellenmacarthurfoundation.org)

The Materials Challenge

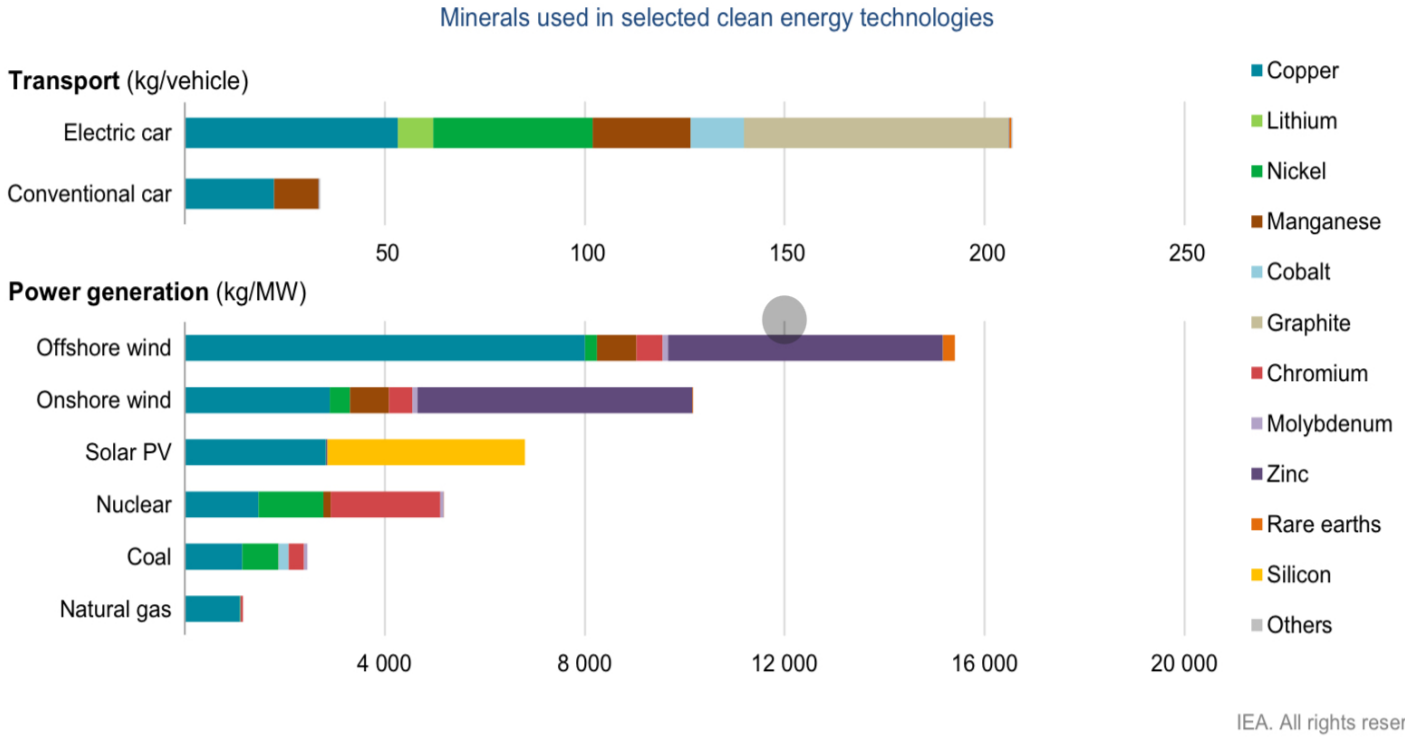
To replace all UK ICE vehicles with electric would require:

- 2x total annual world Co production
- World production of Nd
- 75% of the world's Li production

Only 4 of the 27 raw materials considered critical by the EU in 2017 have an end-of-life recycling input rate (EU EOL-RIR) of 10% or higher

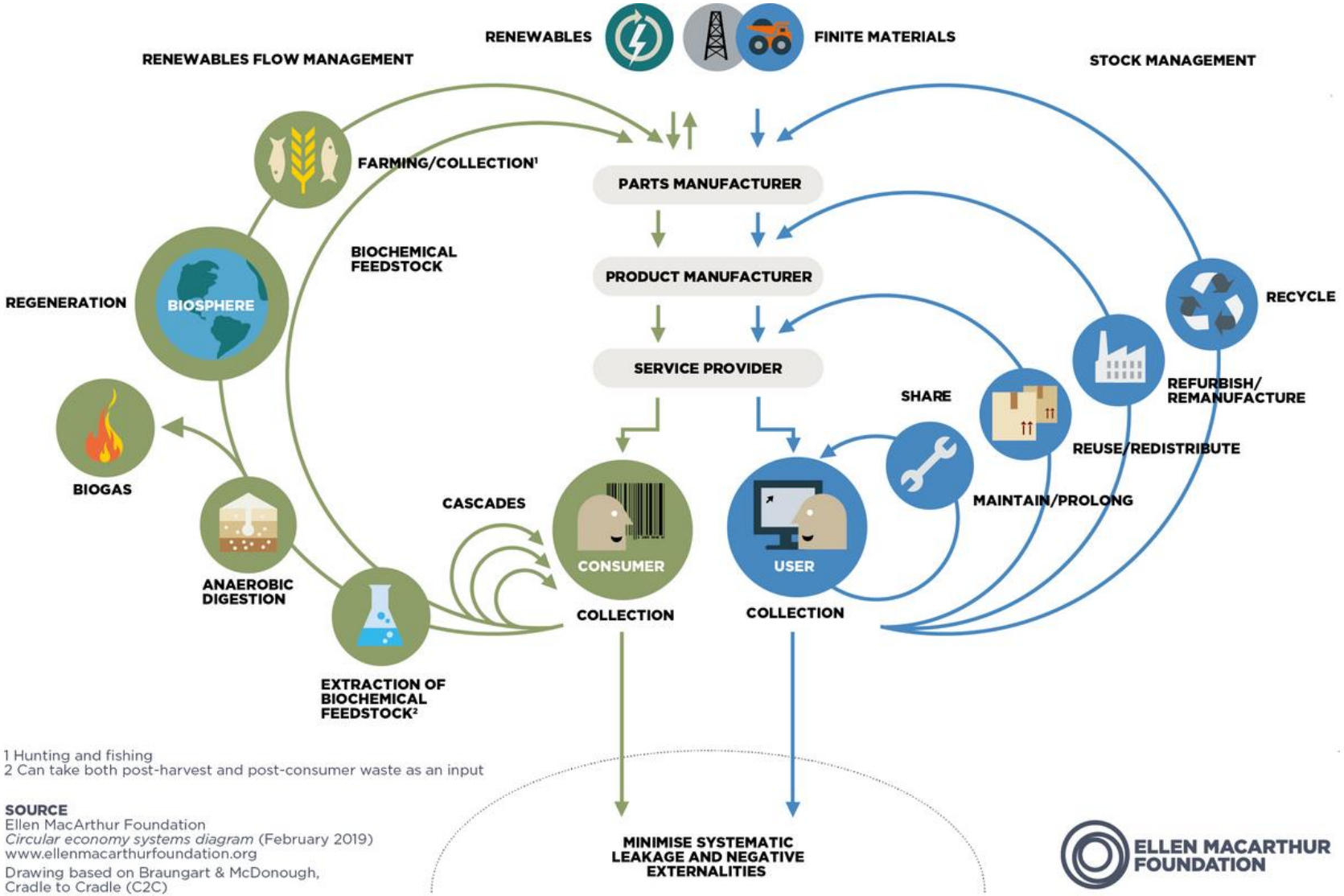
Currently, the UK remains close to 100% import reliance for these metals, most of which arrive already in components or products

The rapid deployment of clean energy technologies as part of energy transitions implies a significant increase in demand for minerals



news: IEA: Critical materials play essential role in clean energy transitions (dieselnet.com)

The Circular Economy Framework

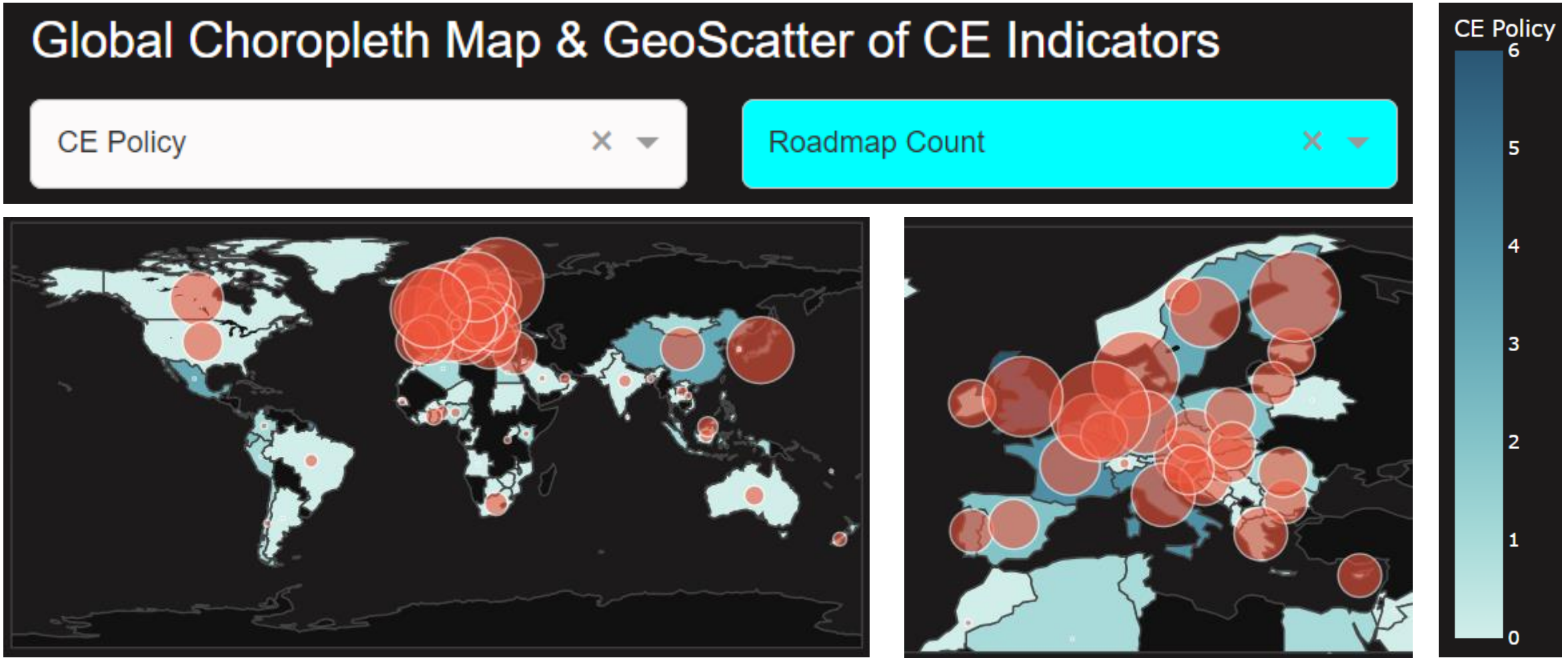


1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

SOURCE
Ellen MacArthur Foundation
Circular economy systems diagram (February 2019)
www.ellenmacarthurfoundation.org
Drawing based on Braungart & McDonough, Cradle to Cradle (C2C)

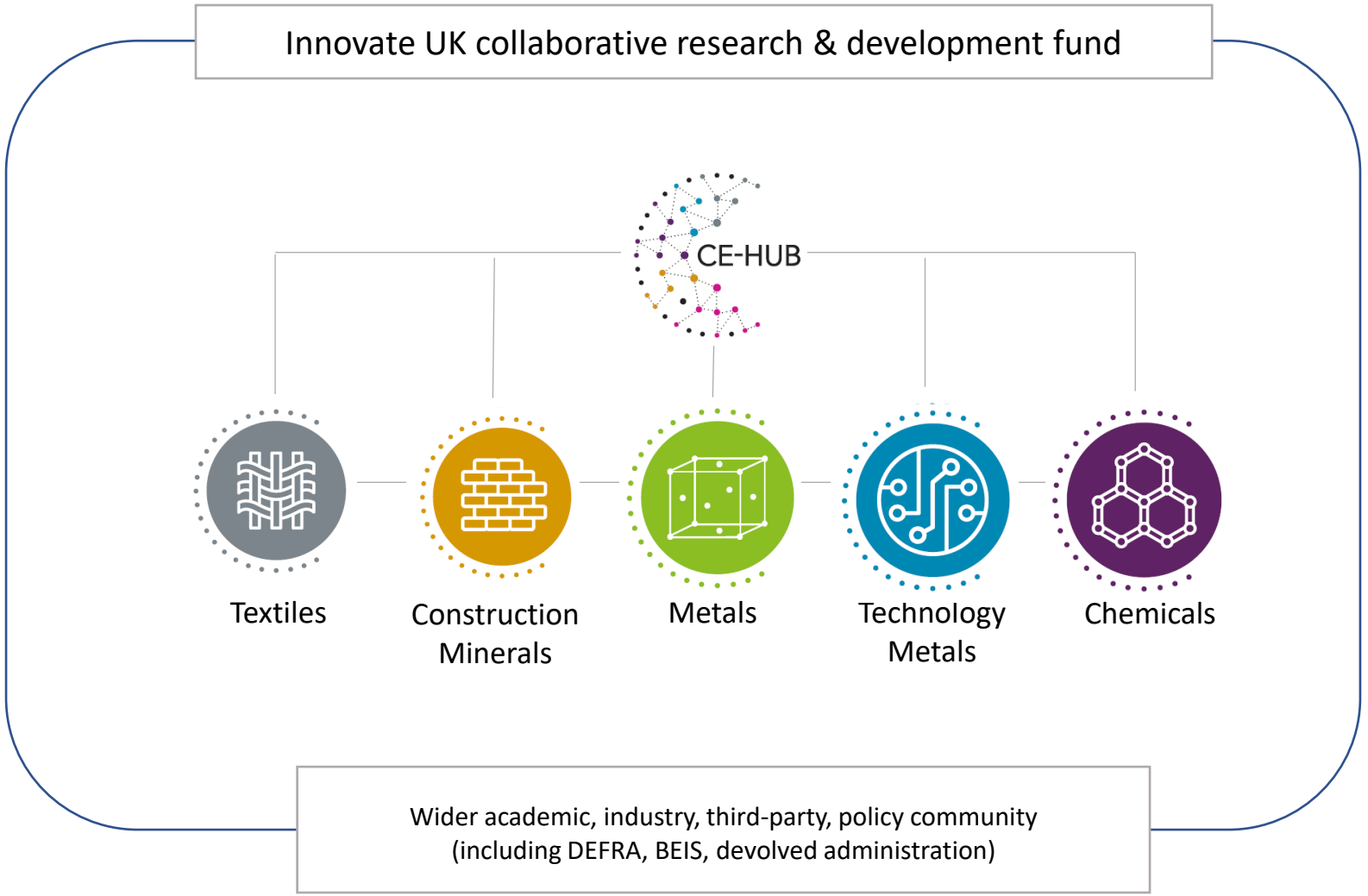
ELLEN MACARTHUR FOUNDATION

Circular Economy: Global Activity



117 / 60% of countries have a Circular Economy Road Map and / or refer to it within their national strategy and policies

National Interdisciplinary Circular Economy Research Programme



Circular Economy Centres

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The Textiles Circularity Centre will turn bio waste (post-consumer textiles, crop residues and household waste) into renewable materials to create a UK circular textiles economy

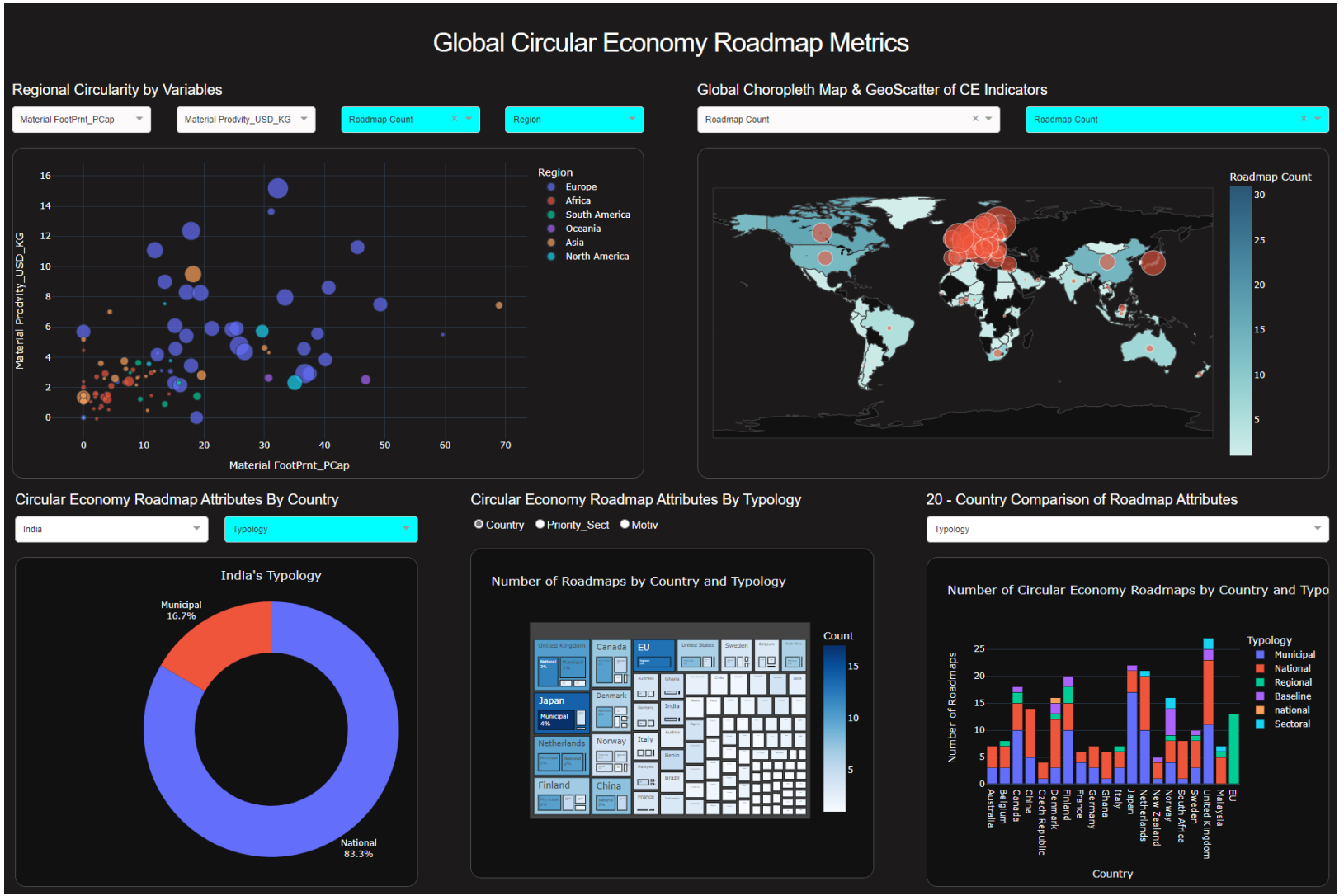
The Interdisciplinary Circular Economy Centre for Mineral-based Construction Materials focuses on improving the way we use materials such as aggregate, cement and glass, in infrastructure

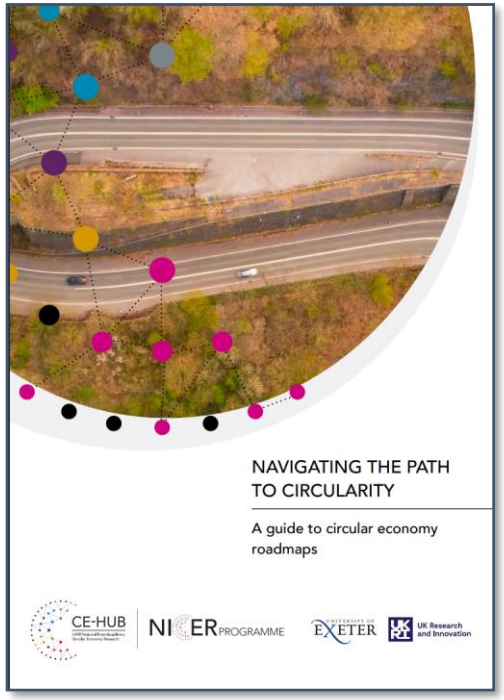
CircularMetal aims to transform the metals industry and make the UK the first country in the world to have fully circular metals system

Met4Tech aims to identify system-level interventions to enable circularity in the production, use and reuse of technology metals

CircularChem aims to transform the UK chemical industry into a more resource-efficient, productive and higher value system

Global Activity: CE Roadmap Dashboard





[Circular Economy Roadmap Dashboard - CE Hub (ce-hub.org)]

National Circular Economy Hub

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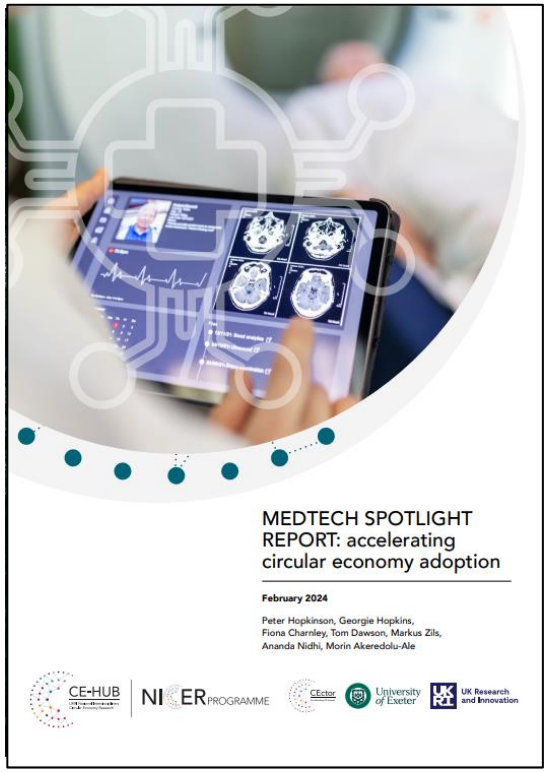
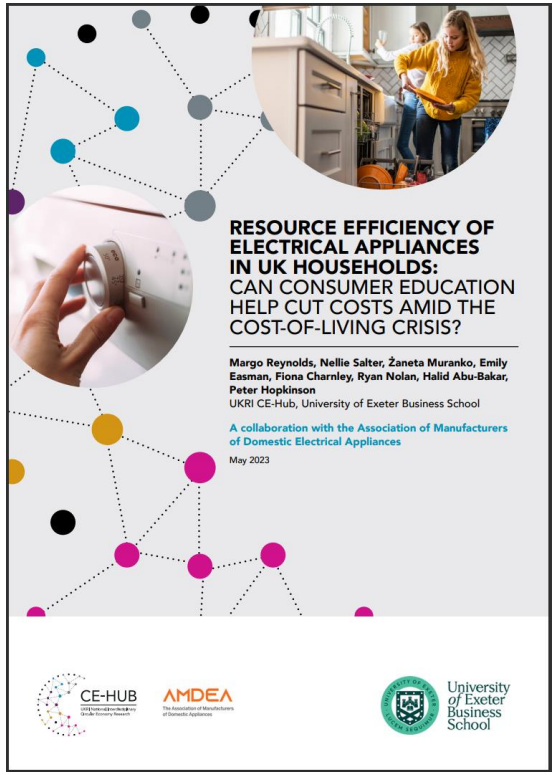




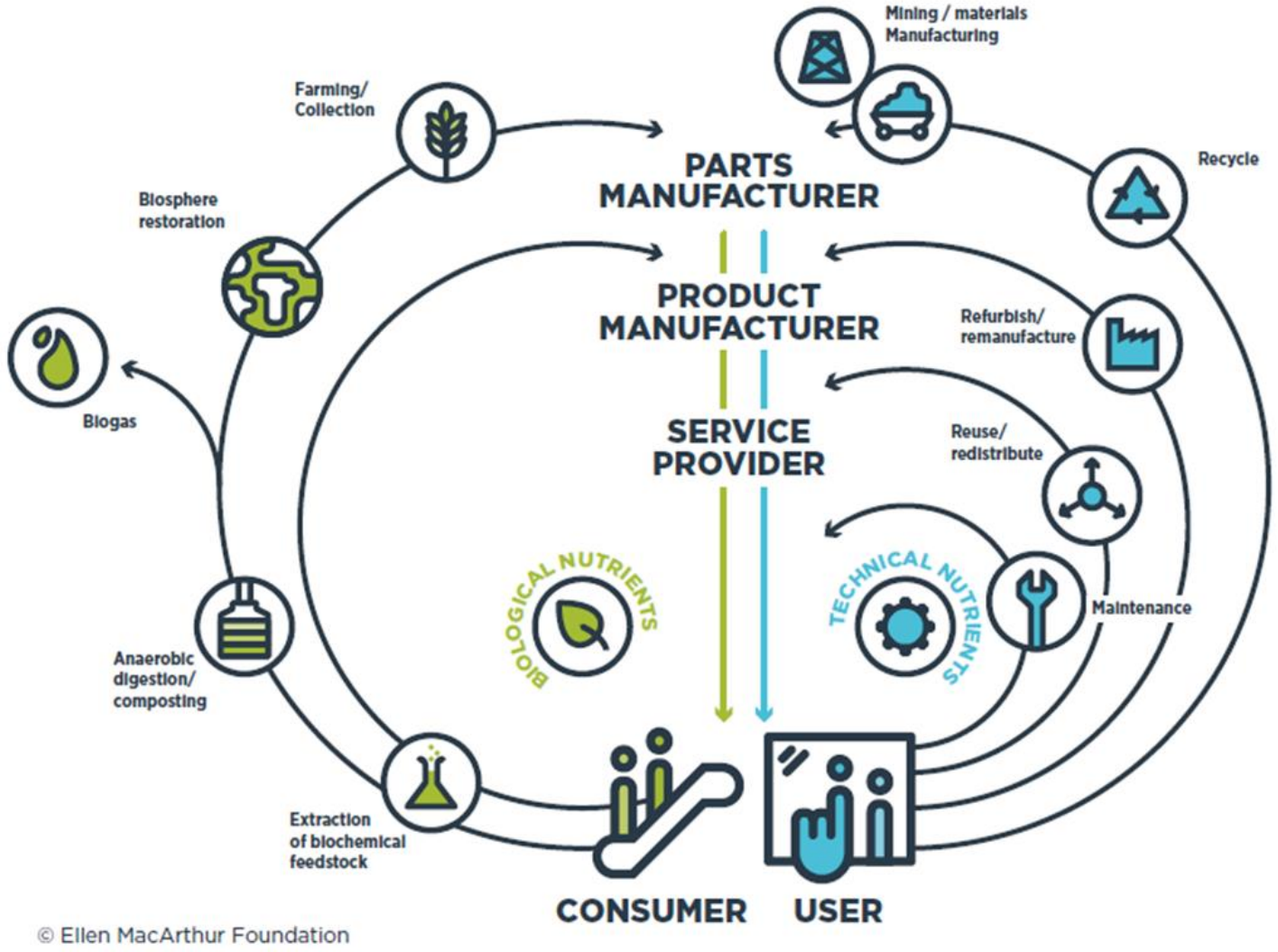
[Accelerating the Transition towards a Net Zero NHS]

[amdea-consumer-behaviour.pdf]

[Connected Everything 2050 Report FINAL (1).pdf]

Reynolds, M., Salter, N., Muranko, Z., Nolan, R., Charnley, F. (2024) Product life extension behaviours for electrical appliances in UK households: Can consumer education help extend product life amid the cost-of-living crisis? *Resources, Conservation and Recycling*, 205,107527, https://doi.org/10.1016/j.resconrec.2024.107527

A Value Led Approach to Design



Taxonomy of Value

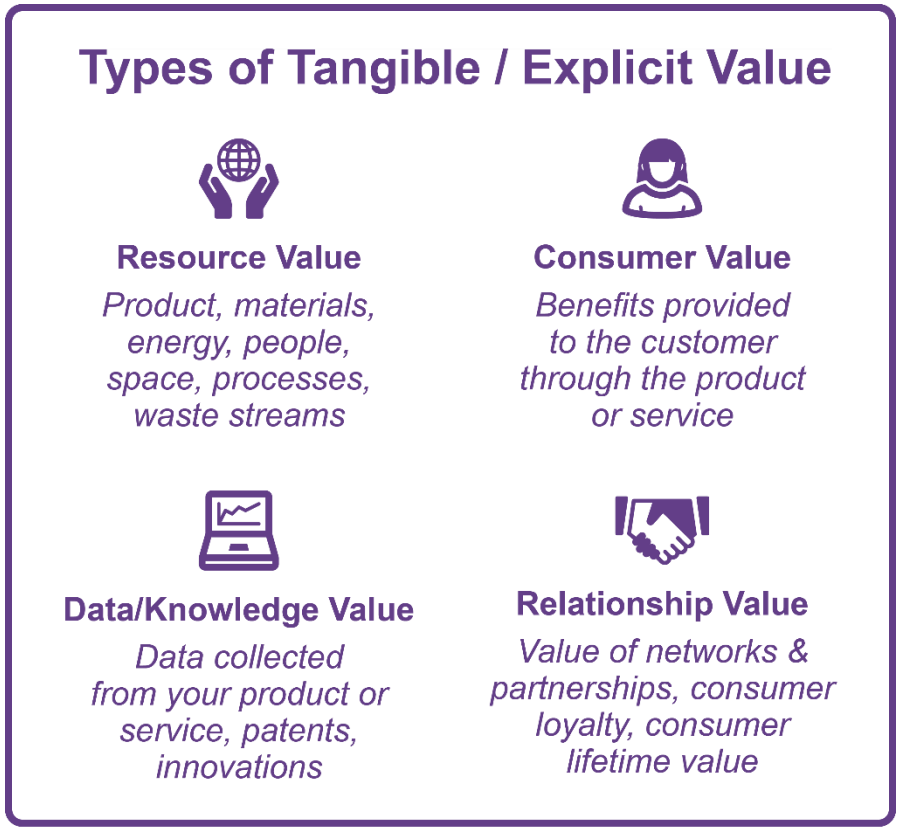
The Taxonomy of Value framework, developed by Haines-Gadd and Charnley (2019), helps to identify and understand the different types of value available within the circular economy system. Through literature review and case study analysis they propose there is **Tangible/Explicit** and **Intangible/implicit** value within the Circular Economy.

Tangible/explicit value is value that can be capitalized upon:

- *Resource value, Customer Value, Relationship Value, Data/knowledge Value*

Intangible/implicit value is value that is generated as a result of circular systems:

- *Stability and control, Symbiosis, Positive Social Impact, Altruism, Behaviour Change*



Haines-Gadd, M., Charnley, F. (2019). Creating a Taxonomy of Value for a Circular Economy

Circular Business Models

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Circular Supplies

Optimising the design of materials or products using of renewable energy, bio-based or fully recyclable input material to replace single-lifecycle inputs

Resource recovery

Recover useful resources and energy out of disposed products or by-products

Product Life Extension

Extend working lifecycle of products and components by repairing, upgrading and reselling

Product as a service

Offer product access and retain ownership to internalise benefits of circular resource productivity.

Enabling Solutions

Enabling resource productivity, including extending asset life, enhancing multiple use cycles and reducing waste.

Notpla / Biohm

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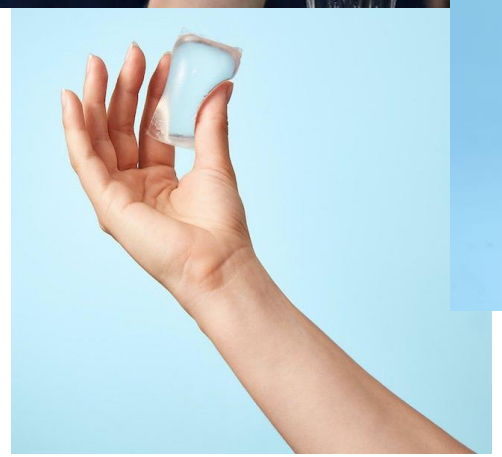
[Ehab Sayed, Biohm: Inspired by Nature - CE Hub (ce-hub.org)]

Circular Supplies

Optimising the design of materials or products using of renewable energy, bio-based or fully recyclable input material to replace single-lifecycle inputs



materiom

Growing the regerative materials economy through materials science, open data and AI

Elvis & Kresse

Resource recovery

Recover useful resources and energy out of disposed products or by-products

RESCUE

TRANSFORM

DONATE

[Elvis & Kresse, Kresse Wesling: Fashion and Textiles - CE Hub (ce-hub.org)]

Solar PV

£3.5Bn turnover & 11,500 jobs in 2022 in the UK
CAGR approx. 30% between 2011-2021 in the UK & worldwide
UK govt. has strong ambitions to grow solar capacity 5 times by 2035, equal to 70GW

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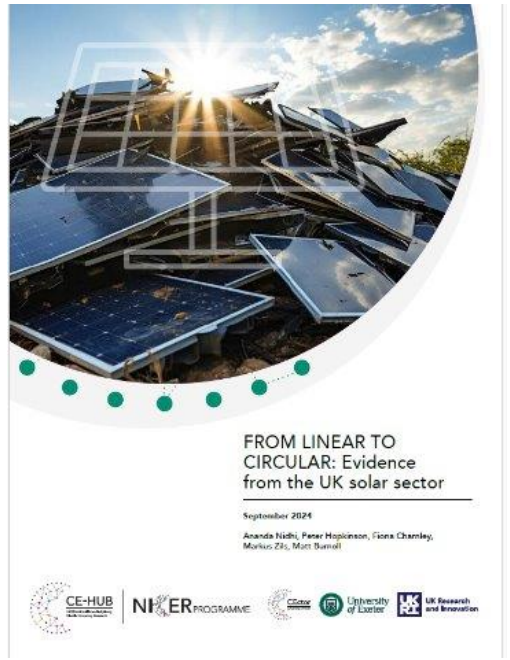
Extended lifespan and high value recycling of solar panels

UK currently has 830KT of combined Al, Cu, Ag & glass embedded in solar PV – projected to grow to 6.6mnT by 2050.

Current: Panels retired at less than 15years with low recycling rates/ recovery of metals
Opportunity: Increase recovery rate of metals and feed back into domestic supply chain through high value recycling
Reduced import needs for solar panels



High Value Manufacturing

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Product Life Extension

Extend working lifecycle of products and components by repairing, upgrading and reselling

Revolution Zero

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Product Life Extension

Extend working lifecycle of products and components by repairing, upgrading and reselling

30 years of healthcare waste

34,000 tonnes surgical textiles/year in UK

Expensive and vulnerable supply

Net Zero challenges

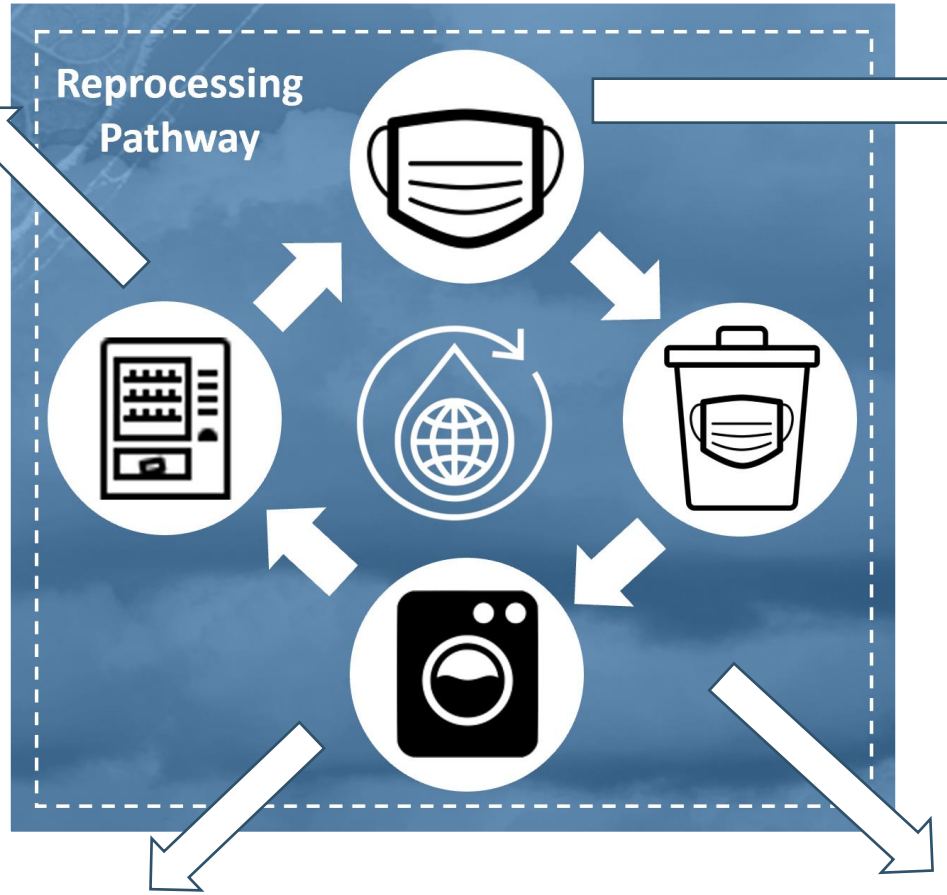
Behaviours and practices where linearity has become normalised

Re-use is unhygienic or unsafe

It's more expensive, impractical, inconvenient

Circular Journey of Re-useable PPE

PPE processed, packed, ready for use



PPE in use

Sterilised and decontaminated on site

Used masks and textile recaptured

Does Circularity Deliver?

Understand the baseline → Identify value leakage → Quantify business case → Outline scaling options

Illustrative use case: Harmonic ultrasonic shear
NHS England est. **£125m procurement spend to 2030**

Application: Est. 70% of devices eligible for remanufacture
Current: Just **1.7% of total number procured** are remanufactured
Opportunity: Cost saving approx. 50% from OEM original
CO2e emissions reduction reported 46% from OEM original

Use: Laparoscopy and other surgery
Specifics: Two OEM Class IIb SUDs (HARH23 & HARH36)
Data sources: NHS Sustainable procurement data, drawing from NHS Supply Chain central & devolved NHS Trusts, remanufacturing data & product specific LCA reports

Accelerating the Transition towards a Net Zero NHS

Riversimple

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Product as a service

Offer product access and retain ownership to internalise benefits of circular resource productivity.

Okorie O, Charnley F, Russell J, Tiwari A, Moreno M. Circular business models in high value manufacturing: Five industry cases to bridge theory and practice. Bus Strat Env. 2021;1–23. https://doi.org/10.1002/bse.2715

Circular Value Network

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Mining company

€ per month per g

MEA supplier

€ per month

€ per month per hour run time

€ bonus for efficiency

Fuel cell manufacturer

€ per month

€ per month per hour run time

€ bonus for efficiency

riversimple

€ per month

c per km

Digital Technology: Rolls Royce

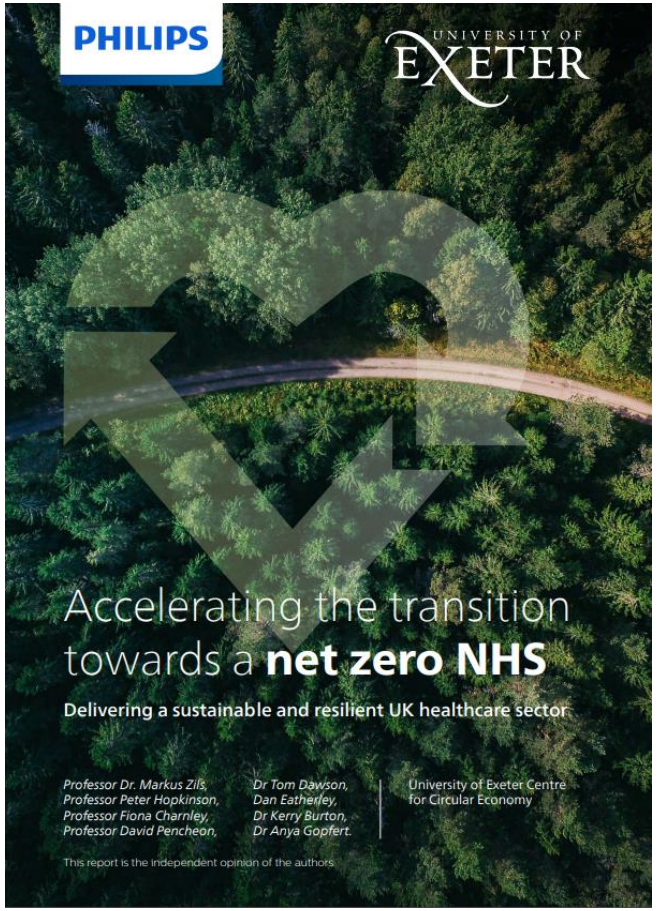
Enabling Solutions

Enabling resource productivity, including extending asset life, enhancing multiple use cycles and reducing waste.

Charnley, F.; Tiwari, D.; Hutabarat, W.; Moreno, M.; Okorie, O.; Tiwari, A. Simulation to Enable a Data-Driven Circular Economy. Sustainability 2019, 11(12), 3379; https://doi.org/10.3390/su11123379

Adoption and Implementation:
Having a good idea is only the start!

- Acceleration and scale up of CE solutions
- Integration of multiple business models – one size does not fit all
- Metrics and KPIs
- Road maps, pilots and experimentation
- Buy-in and education – across all functions
- Technology enabled
- Policy & Legislation
- User Behaviour



Accelerating the Transition Towards a Net Zero NHS

Circular Economy in Business: What have we learned?

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WANTS

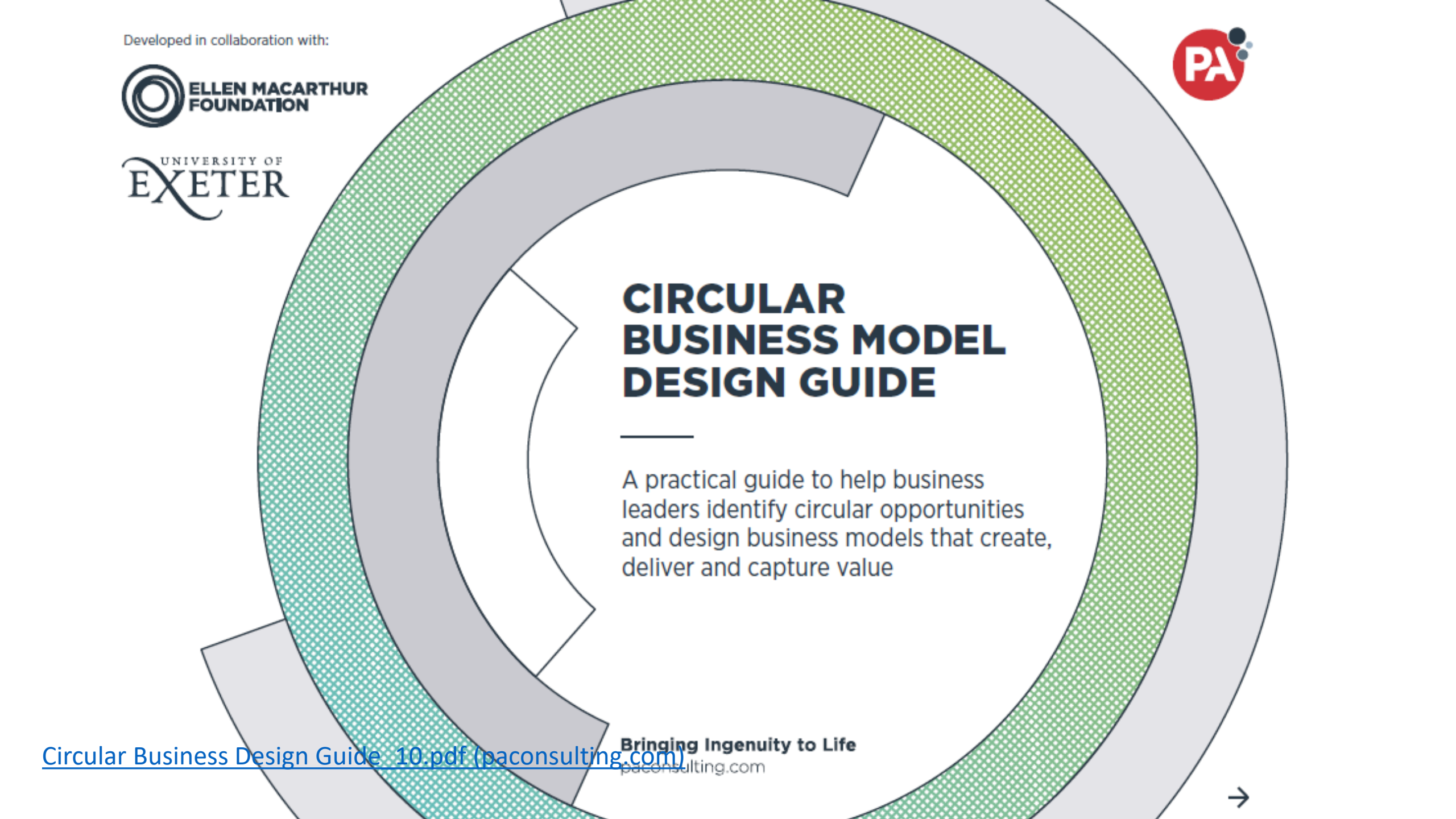
- Detailed case studies and examples of adoption (inc. failure)
- Tools and methods to support collaboration (int. functions and ext. S'holders e.g. suppliers)
- Blueprints, toolkits, guides to support adoption
- Shared learning between functions and sectors

NEEDS

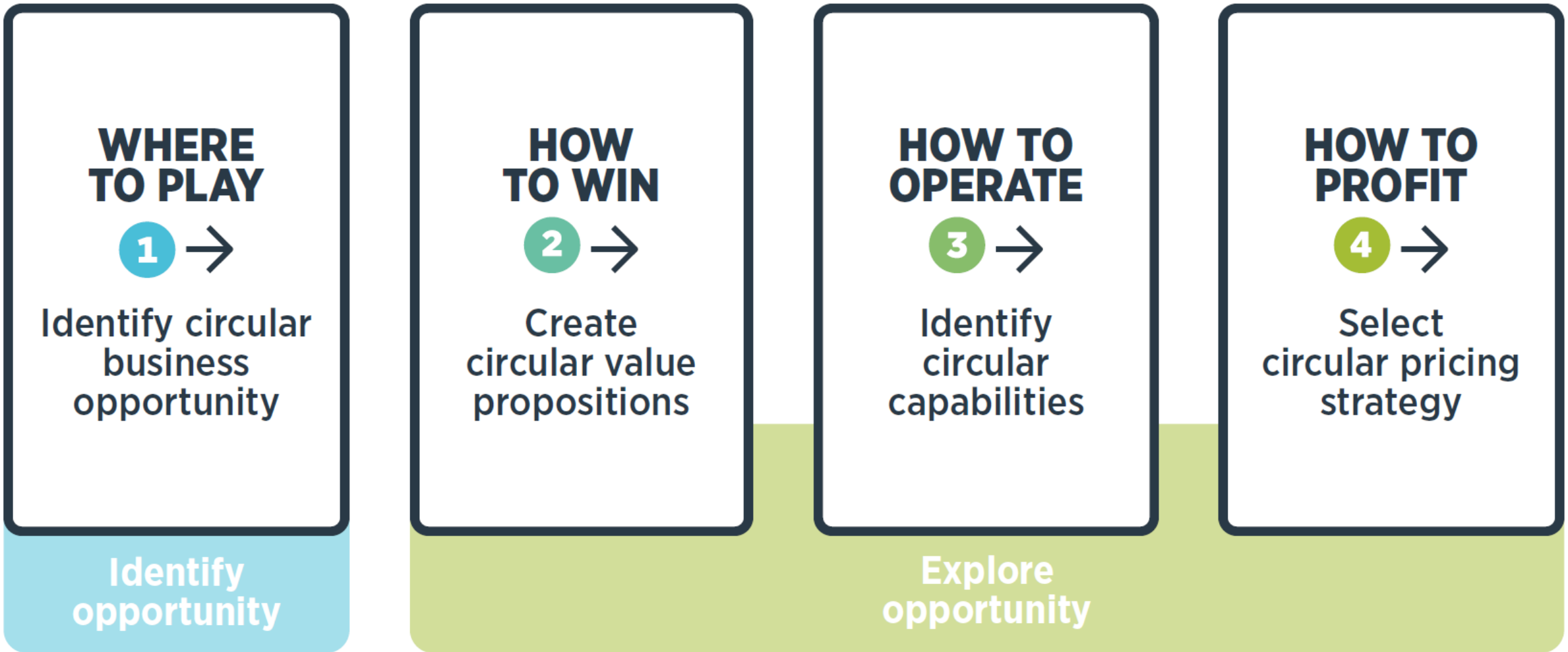
- Evidence to make the business case (int. & ext)
- Specific KPIs to set targets and measure progress
- A common language
- Use of digital tools to accelerate adoption
- Regulatory frameworks & policy
- Persuasion & articulation

CHALLENGES

- Organisational culture, skills, capabilities, mindset & governance
- Behaviour change, influencing consumer participation in CE models
- Whole system approach inc. trade-offs
- Data, analytics, measurement
- Enabling a 'Just Transition'
- Translation of academic theory to practice



[Circular Business Design Guide_10.pdf (paconsulting.com)]


WHERE TO PLAY
1
Identify circular business opportunity
HOW TO WIN
2
Create circular value propositions
HOW TO OPERATE
3
Identify circular capabilities
HOW TO PROFIT
4
Select circular pricing strategy
Identify opportunity
Explore opportunity

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Thank you!

Email: f.charnley@exeter.ac.uk

Circular Economy Knowledge Hub: www.ce-hub.org/knowledge-hub

Circular Economy Masterclass: http://business-school.Exeter.ac.uk/circulareconomy/masterclass.Pdf

Metrics and KPIs!

Why measure?

- Combatting greenwashing
- In response to external pressures
- To gain further buy-in / make the business case
- To comply with legislation
- To empower others – integrated KPOs throughout the organisation

What to measure?

- Percentage (by mass) of physical products designed to be circular
- Employment: jobs generated
- Education: percentage of employees completing CE training

Circular Economy in Healthcare

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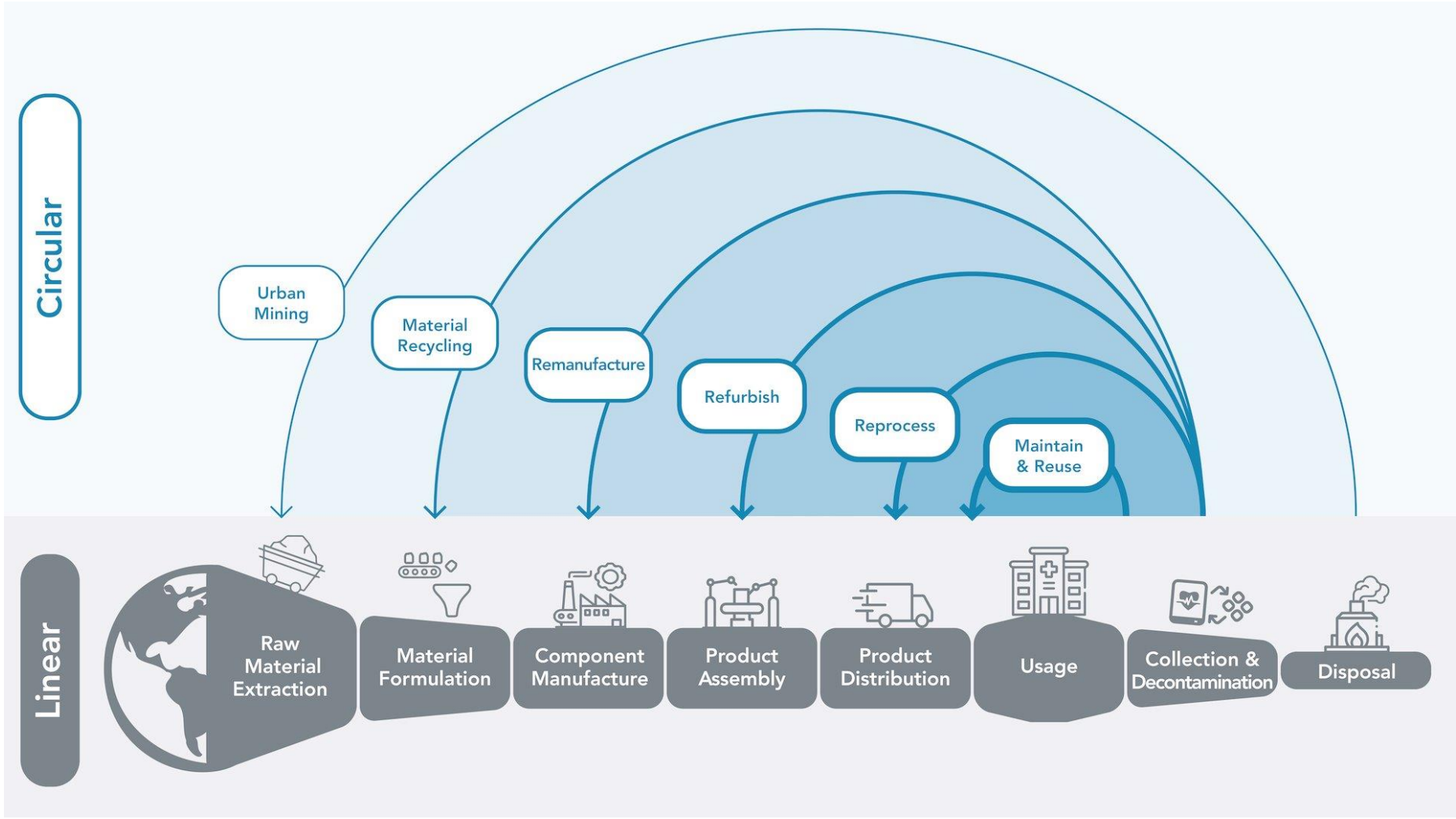

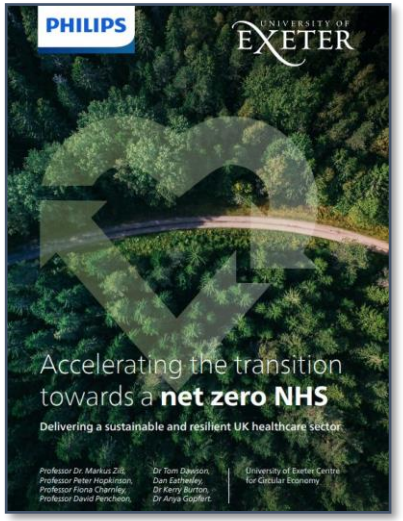

Can Digital Technologies Increase Consumer Acceptance of Circular Business Models? The Case of Second Hand Fashion

A review of companies use of digital technologies, the six phases of a customer journey associated with use of a second hand fashion platform from pre to post purchase and the associated barriers and where they occur

sustainability MDPI

Article

Can Digital Technologies Increase Consumer Acceptance of Circular Business Models? The Case of Second Hand Fashion

Fiona Charnley [1,*], Fabienne Knecht [2], Helge Muenkel [3], Diana Pletosu [4], Victoria Rickard [5], Chiara Sambonet [6], Martina Schneider [7] and Chunli Zhang [8]

[1] Exeter Centre for the Circular Economy, University of Exeter, Rennes Drive, Exeter EX4 4PU, UK
[2] Clariant International Ltd., Hardstrasse 61, 4133 Pratteln, Switzerland; fabiennesophie.knecht@clariant.com
[3] Sustainable Finance, DBS Bank, 12 Marina Boulevard, Singapore 018982, Singapore; helgemuenkel@dbs.com
[4] Sustainable Finance, Crédit Mutuel Arkea, Descartes Street, 29860 Le Relecq-Kerhuon, France; pletosu.diana@gmail.com
[5] Victoria Rickard Consultancy, 116, Priory Road, London N8 7HP, UK; rickardconsultancy@gmail.com
[6] Tommy, Jordan House, 47 Brunswick Place, London N1 6EB, UK; chiarasambonet@gmail.com
[7] RSchneider Wegam Schaechle 5, 78144 Schramberg, Germany; martina@schneider.de
[8] WuKett Ltd., 66a Cumberland Street, Edinburgh EH3 6RE, UK; info@wuckett.com
* Correspondence: f.charnley@exeter.ac.uk

Abstract: Experimentation with, and the implementation of, circular business models (CBMs) has gained rapid traction within the textiles and fashion industry over the last five years. Substitution of virgin materials with bioderived alternatives, extending the lifecycle of garments through resale, and rental services and the recycling or upcycling of garments are some of the strategies being used to reduce the 1.2 billion tonnes of greenhouse gas emissions and 92 million tonnes of waste associated with the sector in 2017. However, whilst CBMs demonstrate environmental and economic benefits, low consumer acceptance is considered by business professionals and policymakers to be one of the main barriers to the transition towards a circular economy. Digitisation is widely acknowledged as a catalyst for innovation in many sectors and digital technologies are driving new ways to exchange and share goods and services, enabling companies to match the supply and demand for, otherwise underused assets and products. Online platforms, in particular, have played a crucial role in driving the growth of used goods and resale in other consumer goods markets, such as consumer technology. A mixed methods approach, including a review of 40 organisations operating second hand fashion models, a consumer survey of over 1200 respondents and in-depth interviews with 10 organisations operating second hand fashion models, is adopted to reveal (a) the barriers to consumer acceptance of reuse models in the fashion industry, and (b) how digital technologies can overcome these barriers. Findings highlight the significant progress that organisations have made in using digitalisation, including data analytics, algorithms, digital platforms, advanced product imagery and data informed customer communications, to address barriers associated with convenience, hygiene, trust and security. Furthermore, the study identifies opportunities for the development of more sophisticated digital technologies to support increased transparency and address concerns associated with the quality, authenticity and sourcing of materials. Positioned at the interface of digitisation and consumer acceptance of circular business models, this study makes an important contribution to understanding consumer barriers and how to address them and concludes with a set of recommendations for practitioners.

Keywords: sustainability; fashion; circular economy; consumers; digitisation; technology; second hand; resale; reuse; engagement

1. Introduction

Clothes are a fundamental part of human daily life. Population growth and lifestyle changes have resulted in a very significant growth of the global apparel market, which

[Sustainability | Free Full-Text | Can Digital Technologies Increase Consumer Acceptance of Circular Business Models? The Case of Second Hand Fashion (mdpi.com)]

Can Digital Technologies Increase Consumer Acceptance of Circular Business Models? The Case of Second Hand Fashion

Findings are derived from a review of 40 organisations operating second hand fashion models, a consumer survey of over 1200 respondents and in-depth interviews with 10 organisations operating in second hand fashion models

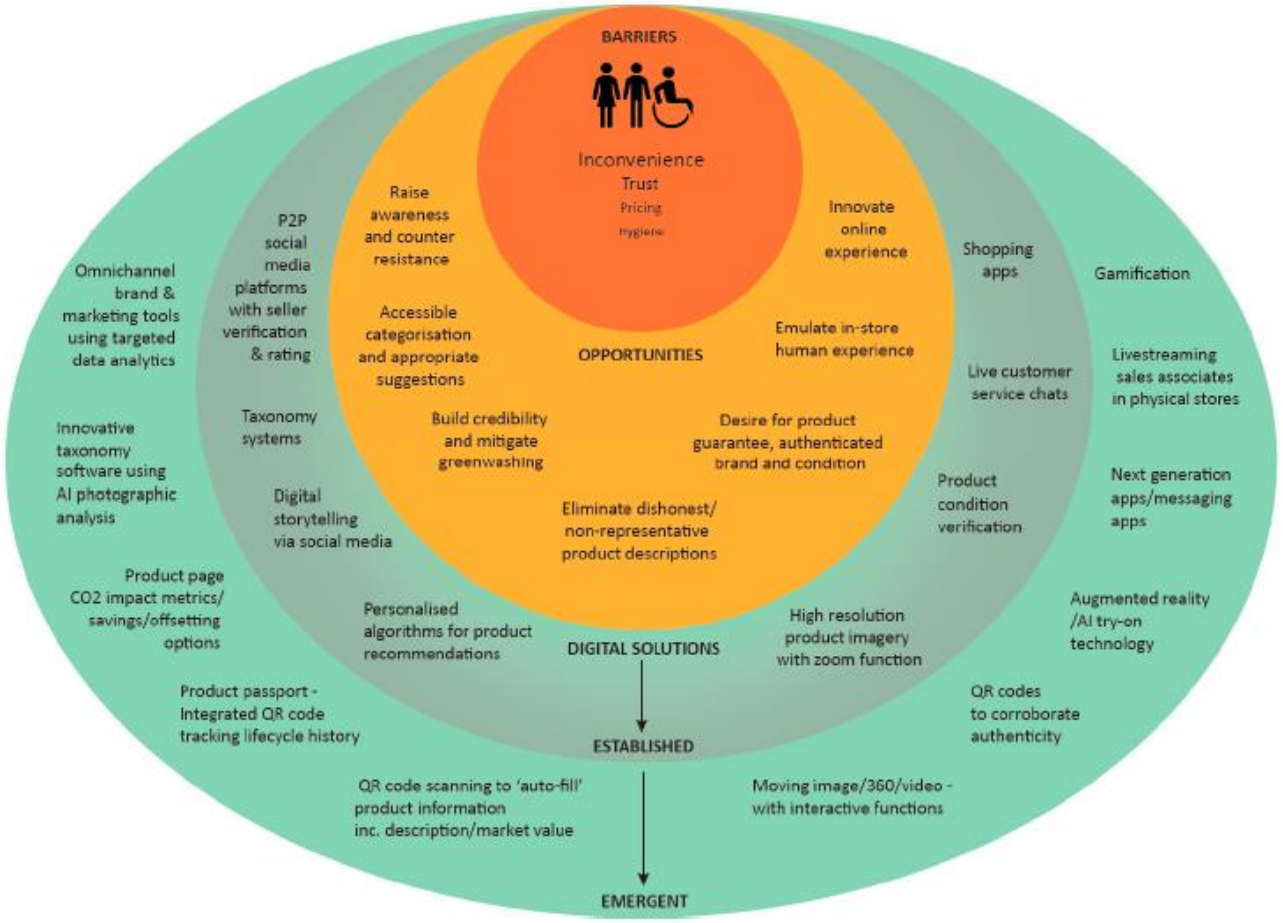

Figure 9. Recommended digital solutions to overcome certain consumer barriers and drive SHF opportunities.

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