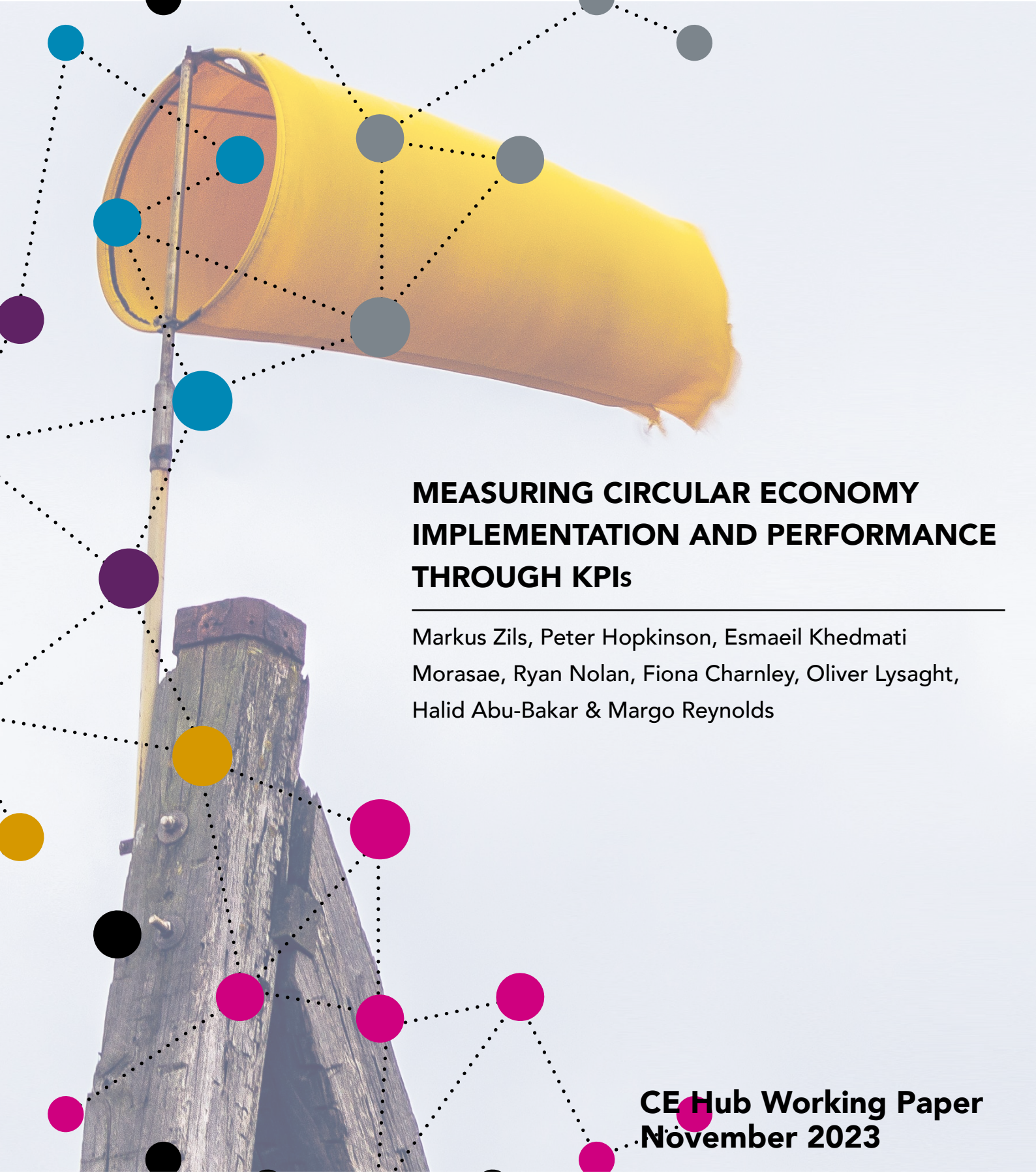

MEASURING CIRCULAR ECONOMY IMPLEMENTATION AND PERFORMANCE THROUGH KPIs

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CE-HUB
UKRI National Interdisciplinary Circular Economy Research

NICER PROGRAMME

University of Exeter

UK Research and Innovation

About the National Interdisciplinary Circular Economy Research Programme

The National Interdisciplinary Circular Economy Research (NICER) Programme is a four-year £30 million investment from UKRI to move the UK towards a circular economy.

The Programme is made up of five Circular Economy Research Centres, each focused on a speciality material flow, and the co-ordinating CE-Hub (detailed below). The Programme aims to deliver research, innovation, and the evidence base to move the UK towards a resilient UK circular economy. The NICER programme is the largest and most comprehensive investment in the UK Circular Economy to date and is delivered in partnership with industrial organisations from across sectors and the Department for Environment, Food and Rural Affairs (DEFRA), to ensure research outcomes contribute to the delivery of industrial implementation and government policy.

The 4 year programme launched in January 2021, initially comprising of 34 universities and over 150 industrial partners, with a key aim of growing the Circular Economy community through a significant programme of outreach and collaboration.

- The National Interdisciplinary Circular Economy Research Hub (CE-Hub), led by the University of Exeter
- The Textiles Circularity Centre (TCC), led by the Royal College of Art
- The Interdisciplinary Circular Economy Centre for Mineral-based Construction Materials (ICEC-MCM), led by UCL
- The National Interdisciplinary Centre for the Circular Chemical Economy (CircularChem), led by Loughborough University
- The Interdisciplinary Circular Economy Centre for Technology Metals (Met4Tech), led by the University of Exeter
- The Interdisciplinary Centre for Circular Metals (CircularMetal), led by Brunel University London.

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Introduction

As interest in Circular Economy (CE) has grown, the number of questions about its potential costs, benefits and real-world impacts has also risen. This has led to a proliferation of research papers analysing a vast number of motivations, definitions, classifications and visual representations of CE.

The scope and scale of CE implementation can be categorised at different levels of aggregation, such as material, product, firm, value chain, sector, national and international. This involves accounting for varied economic, social and environmental costs, benefits and impacts. As a result, many different key performance indicators (KPIs) and metrics have been proposed to support different activities including 1) measurement, monitoring and evaluation of the current linear 'take-make-waste' economy, 2) defining and measuring more circular target states and 3) specifying the actionable steps various actors could take to reach those targets.

The role and importance of KPIs and measurement is relevant to internal and external stakeholders to provide accountability for CE claims, build a robust scientific evidence base and avoid cherry picking isolated aspects of a product or organisational behaviour and claiming positive 'circularity'. Adopting new forms of circular-related KPIs promotes the interactions and negotiations of various organisational actors (Bridwell-Mitchell, 2016), thus coupling society-centric concerns with internal, or business-centric, practices (Wickert, 2021; Gond et al., 2017).

Typical enquiries and questions about the definition, selection and application of KPIs for CE include:

- Agreement/recommendation on the best KPIs to measure progress towards circularity and the required interventions
- Which KPIs and processes are found to be effective in driving internal change and action?
- Examples of CE monitoring and evaluation frameworks to connect activities and interventions at different scales/transferable across entire value chain
- How to ensure KPIs remain aligned with the guiding principles of CE
- What financial metrics are used to demonstrate the business case for CE?
- How to account for non-financial direct and indirect environmental and social impacts?
- What relevant data is accessible, reliable and dynamic (can be managed in real-time) enough to underpin KPIs?
- Scope of accountability of chosen measures of success

In this short CE-Hub working paper, we describe some recent developments and provide illustrative examples of approaches to CE KPIs. Our intention is to signpost and inform discussions among policy, industry and academic researchers interested in CE KPIs and their practical application. From this we conclude the need for a more systematic taxonomic approach to CE KPI development, aligned to the guiding principles of CE at multiple measurement points, at different scales, and across whole-system endeavours. This framework will be set out in a forthcoming accompanying paper.

International

Internationally, several key organisations have provided a variety of indicators or are in the process of developing their own KPIs, including:

OECD: The OECD report 2021 collected an inventory of 474 indicators and draws from Chapter 5 of the OECD 2020 report: The Circular Economy in Cities

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and Regions. The inventory gathers input, process and output indicators employed by governments, primarily European, at different levels, classified into 5 categories Environment (39%): emissions, output material process and production and consumption. Governance (34%): education, capacity building and regulation, Economic and business (14%): expressed in monetary units like value-added, public investment in circular economy projects, and activities performed by and within companies. Infrastructure and technology (8%): indicators to measure the existence of tools, technologies and spaces that boost the circular economy. Jobs (5%): Gathers indicators associated with employment and human resources.

EU: The EU monitoring framework for circular economy presents country and aggregate statistics for a range of CE relevant KPIs across 5 themes – production and consumption, waste management, secondary raw material, competitiveness and innovation, global sustainability and resilience – in the form of a dashboard. Definitions for each indicator, their associated data sources, metadata and trends, provide fast and easy visualisation with additional links to further resources publication and data information.

United Nations: The United Nations is developing a CE KPI framework and in parallel actively supports dialogue and initiatives to align CE with their Sustainable Development Goals (SDGs) and Resource management framework. The 17 SDGs and associated 169 targets are being increasingly adopted by both public and private sector actors across the globe. The most recent SDG progress report (2023), however, states the promises enshrined in the SDGs are in peril and many goals will be missed without acceleration. The United Nations Economic Commission for Europe (UNECE) and OECD are consulting on joint guidelines on measuring circular economy, comprising core and complementary indicators, with a view to implementation guidelines to be developed in 2024.

UK National

Historically UK government approaches to resources and waste have been environmentally led, dominated by statutory and reporting requirements framed by the waste framework and the waste hierarchy and targets such as household recycling. Despite these efforts, various reports have shown, the level of productive material circulation through the UK economy (much of it low value recycling) is around 8%, emphasising the need to both reduce resource demand via greater resource productivity and recirculation. In recognition of this, the four separate UK administrations (England, Scotland, Wales and NI) have begun to develop CE policies and strategies, which introduce a wider range of KPIs to address circular economy.

England: The Defra 2018 Resources and Waste strategy was deliberately titled 'Our Waste, Our Resources: A Strategy for England' to emphasise the value which could be derived through the development of a more circular and resource efficient economy. This included through reduced virgin material use and associated environmental impacts, carbon emissions reductions, and benefits to the economy. In 2022, DEFRA published its monitoring framework, a dashboard of indicators including overall resource productivity and material footprint and sectoral waste recycling and recovery, much of it aligned to the EU Eurostat dashboard. Policy update 'Maximising Resources, Minimising Waste' (Defra, 2023), sets out the future actions government will take to maximise resources and minimise waste across key resource intensive sectors such as construction, textiles, food and drink, packaging and electricals.

Scotland: Scotland's first CE strategy, Making Things Last, was published in 2016. Subsequent reports have attempted to define and refine CE KPIs (Taylor and Miller, 2021; Zero Waste Scotland, 2020), aligning broadly to the EU CE monitoring dashboard. In May 2022 the Scottish Government published their consultation for a Route Map to deliver Scotland's 'circular economy', with a string emphasis on recycling and cutting waste. Findings from this consultation have helped form proposals for a Scottish Circular Economy Bill, published in June 2023, with proposals for statutory targets and indicators to measure progress towards reducing waste and the national carbon footprint.

Wales: The Welsh Government published its Beyond Recycling indicators in June 2021, to track progress of their circular economy strategy. In addition to the familiar indicators for recycling and waste management, Beyond Recycling included indicators to scale up prevention and re-use. Further, it placed circular economy beyond a purely material focus by linking to the national indicators under the *Well-being of Future Generations (Wales) Act 2015*.

Northern Ireland: The Northern Ireland Department for the Economy is currently consulting on a circular economy strategy for NI, with a focus on innovation, sustainable production and consumption. The report cites the recent circularity gap report and sets a target

material footprint of 8 tonnes per capita by 2025. The report recognises that measuring CE is complex and is consulting on a wide range of possible indicators, framed around system collaboration, design out waste and managing resources to retain value.

Business Metrics

Business, practitioner organisations and individual firms have developed indicators and reporting to support CE monitoring and intervention/outcome evaluation at a variety of scales. The following examples illustrate the diversity of guidance, approaches and practices.

WBCSD: The WBCSD Circular Transition Indicators (CTI) method, created with member companies, is a quantitative framework that can be applied to businesses of all industries, sizes, value chain positions and geographies. CTI is based on material flows through the company at the inflow and outflow stages and comprises 12 KPIs to diagnose closing loops, optimising loops, valuing loops and understanding the impact of loops (and leakages).

ISO: The International Standards Secretariat ISO/TC 323 is currently preparing a series of new standards (590 series) to harmonise guidance on measuring and assessing circularity (59020), terminology, principles and guidance for implementation (59004), product circularity sheet (59040) and business model implementation (59032). BS8001 Framework for implementing the principles of the circular economy, published in May 2017, predates the ISO series with a general guidance on measurement principles.

Corporate Sustainability Reporting Directive (EU) 2022/2464 (2022) (CSDR): Although not specifically framed as CE, the EU has recently published the new CSDR, which updates the Non-Financial Reporting Directive 2014/95/EU (2014) (NFRD) for reporting environmental information and opens the door for greater visibility of company level CE activity, progress and KPI metrics. A core aim of the CSDR is to increase disclosure on environmental and climate risks and opportunities and provide investors with greater detail about the sustainability of their investments.

Ricoh: Ricoh has operated a CE business model through their Comet cycle since 1994 and runs a global product-service remanufacturing business (Hopkinson et al. 2018). They track and trace every product and consumable leased through their distribution network and assess CE value opportunity through an asset recovery and retention value cascade driven by financial metrics.
Philips: Philips has comprehensive and systematic design and business methodology to drive circularity at product-service scale and has set a clear organisational financial KPIs based on CE sales revenue to scale up their CE transformation.

DS Smith: In 2021, DS Smith introduced their pioneering product-level Circular Design Metrics for packaging, in alignment with their Circular Design Principles developed in collaboration with the Ellen MacArthur Foundation. The tool identifies 8 KPIs, including supply chain optimisation and material utilisation, that clearly indicate a design's sustainability and drives the design process. Over 700 designers have been trained on the tool as of October 2023.

Academic

A scoping review of the academic literature carried out by CE Hub researchers found 45 peer-reviewed papers dedicated to the topic of CE KPIs. A topic-based network analysis found 11 distinct clusters of approaches, or 'mind-sets', pertaining to CE.

Among these mind-sets, the review highlights the dominance of recycling, waste management, and biophysical material flows of CE at the product level. Each mind-set has its own unique focus and associated KPIs. As examples, the 'Recycling' mind-set primarily views CE as a recycling-oriented system and favours KPIs such as recycling rate/index and recyclability benefit rate. Meanwhile, 'Product/Material Longevity' concentrates on the durability of materials and products, offering longevity indicators and combination matrices.

Other mindsets encompass a wide range of themes, including resource efficiency, circularity of products, composite KPIs, sectoral considerations, energy orientation, biological cycles, value-chain perspective, sustainability dimensions, and scale of operations. A full paper on the 11 mindsets is currently under academic review and will be discussed further in part 2 of this working paper.

Next Steps

Our work on KPIs for the circular economy over the past 5 years has shown that the landscape can change quickly and lacks consistency. Businesses, policymakers

and other actors who want to implement CE strategies therefore find it difficult to understand which KPIs can best inform their progress or regulatory disclosure requirements, how they relate to specific interventions or CE principles, and where to look for examples of best practice.

The examples and frameworks provided here offer a short guide on the diversity of approaches. This is an ever-evolving topic that requires connected thinking and practice that spans business, policy and research to enact whole systems change efficiently and comprehensively. This approach aligns with CE Hub and NICER Programme work on KPIs, which will be outlined in our next paper on a practical value chain methodology and taxonomy for CE KPIs based on the guiding principles of CE, driving key interventions and maintaining focus on the overall system goals of the transition from a linear to a more circular economy.

References

Bridwell-Mitchell, E. N. (2016). Collaborative Institutional Agency: How Peer Learning in Communities of Practice Enables and Inhibits Micro-Institutional Change. *Organization Studies*, 37(2), 161-192.

Council Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups Text with EEA relevance. *Official Journal of the European Union*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095 (Accessed 1 November 2023).

Council Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting (Text with EEA relevance). *Official Journal of the European Union*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464 (Accessed 1 November 2023).

Defra. (2018). Our Waste, Our Resources: A Strategy for England. [online] *GOV.UK*. Available at: https://t.ly/Deyjm (Accessed: 31 October 2023).

Defra. (2023). Maximising Resources, Maximising Waste: Policy summary table. [online] *GOV.UK*. Available at: https://t.ly/M1hY8 (Accessed 1 November 2023).

Gond, J.-P., El Akremi, A., Swaen, V. and Babu, N. (2017). The Psychological Micro foundations of Corporate Social Responsibility: A Person-Centric Systematic Review. *Journal of Organizational Behavior*, 38(2), 225–246.

Hopkinson, P., Zils, M., Hawkins, P., and Roper, S. (2018). Managing a Complex Global Circular Economy Business Model: Opportunities and Challenges. *California Management Review*, 60(3), 71–94.

OECD. (2020), *The Circular Economy in Cities and Regions: Synthesis Report*, OECD Urban Studies, Paris: OECD Publishing. https://doi.org/10.1787/10ac6ae4-en.

Scottish Government. (2016). Making Things Last: A circular economy strategy for Scotland. [online] *GOV.SCOT*. Available at: https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/ (Accessed 1 November 2023).

Taylor, E., Millar, F. (2021). Zero Waste Scotland Thoughts on Indicators. (unpublished)

United Nations. (2023). *The Sustainable Development Goals Report: Special Edition*. Available at: https://unstats.un.org/sdgs/report/2023/ (Accessed 7 November 2023).

Well-being of Future Generations (Wales) Act 2015. Available at: https://www.futuregenerations.wales/wp-content/uploads/2017/01/WFGAct-English.pdf (Accessed 1 November 2023).

Welsh Government. (2021). Beyond Recycling: A strategy to make the circular economy in Wales a reality. [online] *GOV.WALES*. Available at: https://www.gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf (Accessed 1 November 2023).

Wickert, C. (2021). Corporate Social Responsibility Research in the Journal of Management Studies: A Shift from a Business-Centric to a Society-Centric Focus. *Journal of Management Studies*, 58(8), 1-17.

Zero Waste Scotland. (2020). Measuring Scotland's progress towards a circular economy to help combat the climate emergency: Results from a preliminary scoping study reviewing key indicators. [online] *Zero Waste Scotland*. Available at: https://cdn.zerowastescotland.org.uk/managed-downloads/mf-bonnmo6p-1684158913d (Accessed 1 November 2023).