ROADMAPS AND WHOLE SYSTEM TRANSITIONS

Insights and evidence from the NICER Programme

Carol Pettit[1] and Frances Wall[1] using presentations by Sampriti Mahanty[1], Halid Abu-Bakar[2], Stephen Evans[3], Katherine Adams[4] and Mohamed Osmani[4], Matthew Royle[5], and Russell Hall[6]

CE-HUB
UKRI National Interdisciplinary Circular Economy Research

NICER PROGRAMME

University of Exeter

UK Research and Innovation

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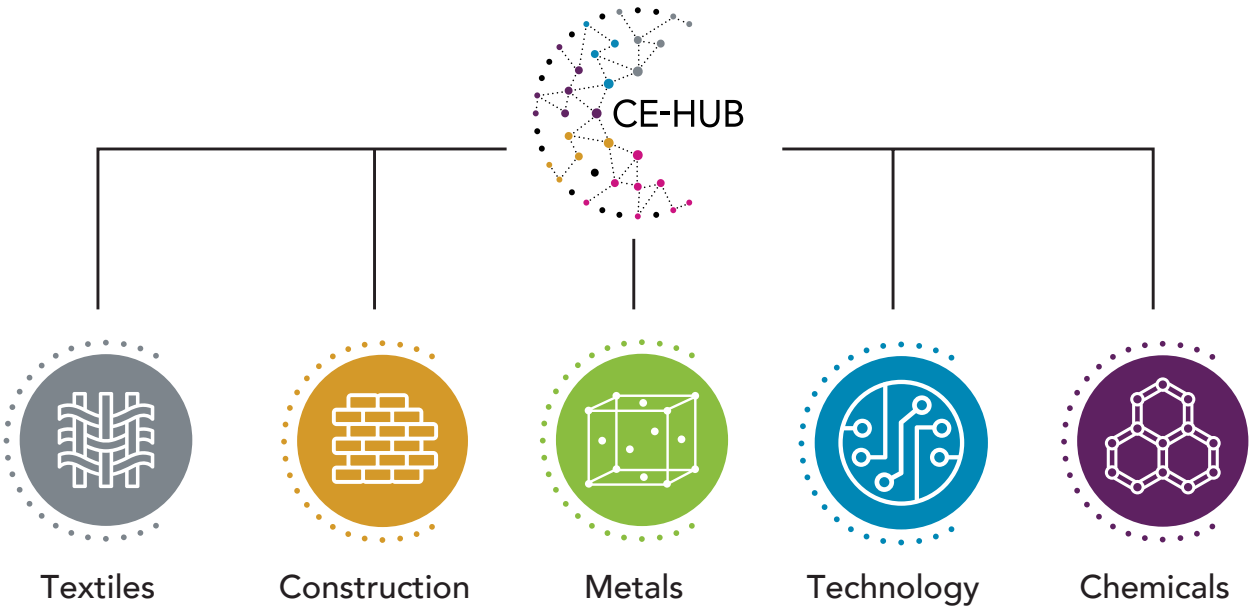
About the National Interdisciplinary Circular Economy Research Programme

The National Interdisciplinary Circular Economy Research (NICER) programme is a £30 million four-year investment from UKRI and the Department for Environment, Food & Rural Affairs (DEFRA) to deliver the research, innovation and evidence base needed to move the UK towards a circular economy. Launched in January 2021 and comprising initially of 34 universities and over 150 industrial partners, NICER is made up of five Circular Economy Research Centres each focused on a specialty material flow, and the coordinating CE-Hub:

- 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 University College London
- The National Interdisciplinary Centre for the Circular Chemical Economy (CircularChem), led by Surrey 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

NICER is the largest and most comprehensive research investment in the UK Circular Economy to date. It has been delivered in partnership with industrial organisations from across sectors and DEFRA to ensure research outcomes contribute to the delivery of industrial implementation and government policy. A core aim of the programme is growing the Circular Economy community through a significant programme of outreach and collaboration.



About the NICER Insight Reports series

The objectives of the NICER programme are to:

1. Accelerate understanding and solutions to enable circularity of specific resource flows,
2. Provide national leadership, coordinate and drive knowledge exchange across the programme as a whole and with policy, consumer, third sector and business stakeholders,
3. Ensure research is embedded with stakeholders by involving businesses, policymakers, consumers and society, the third sector, and other affected groups and communities at every part of the programme.

The transition towards a UK circular economy requires a whole system approach. This means that, in addition to accelerating knowledge at the resource and sector level, there are a number of agnostic system level enablers or drivers that can be applied to accelerate adoption at scale. The purpose of the NICER Insight Report Series is therefore to highlight learning from across the NICER Programme in relation to these system wide enablers.

EXECUTIVE SUMMARY

NICER Insights Activity on Roadmaps and Whole System Transitions

This report presents an overview of the roadmap research activities undertaken and the key insights gained through collaborative discussions held through a series of webinar talks by researchers from each of the five Circular Economy Centres and the CE-Hub of the NICER Programme (Annex 1).

In the first year of the NICER programme, the CE-Hub and each of the Circular Economy (CE) Centres contributed their initial insights towards a 'Ministerial roadmap' document prepared for Defra (Nov 2021) as part of a Vision 2050 exercise. These initial roadmap insights were then revisited at an Impacts and Legacy Workshop held in conjunction with the NICER programme Mid-term Review (Jan 2023). The Insights Activity was an outcome from that mid-term review.

The transition towards a UK circular economy requires a whole system approach. This means that, in addition to accelerating knowledge at the resource and sector level, there are a number of agnostic system level enablers or drivers that can be applied to accelerate adoption at scale. The purpose of the NICER Insight Report Series is therefore to highlight learning from across the NICER Programme in relation to these system wide enablers.

This particular Insights activity on Roadmaps and Whole Systems Transitions was conducted through a series of monthly webinars organised and hosted by Met4Tech (held January to May 2024) where Researchers from the CE-Hub and five Centres presented their approaches to roadmaps and shared the initial findings (Annex 1). The presenters are included as authors to this Insights report prepared by the Met4Tech organisers (Pettit and Wall).

This Insights activity covers key questions such as:

- What is a circular economy roadmap and why is this important;
- Which types of roadmaps are being created and applied in NICER;
- What are the key findings from each Centre; and,
- What are the learning lessons for next time?

The collective insights from this collaborative activity are as follows:

1. Roadmaps are included in most Circular Economy strategies.
2. A roadmap is a strategic tool for describing the shared expectations for the circular economy and includes a practical action plan for the stakeholders (system actors) to achieve the shared vision over a delineated time period.
3. Circular Economy Roadmaps have common key characteristics.
4. Until the NICER programme, there were not many roadmaps on metals, minerals, or chemicals.
5. Roadmapping should start with developing a better understanding of data for stocks and flows of resources (materials) and their products.
6. Collaboration with stakeholders is essential and interdisciplinary studies are useful.
7. Roadmaps suggest actions for the future – but the future is uncertain.
8. Roadmapping needs to include responsible innovation protocols to avoid unintended consequences.
9. Terminology is important; CE terms should be defined to ensure common understanding.
10. Roadmaps will need buy-in from government and other stakeholders to be used and support (funding) to keep up-to-date.

The insights described here cover ten topics that were discussed in the roadmap talks. Thus, this roadmap insights report summarises and compares the various approaches and collates the learning lessons derived through this collaborative cross-NICER activity.

1. Roadmaps are included in most Circular Economy strategies

Roadmapping is included in most circular economy (CE) strategies. This is no surprise because CE almost always involves a change from the current state of a linear (take, make, use, waste) economy to a more circular system. Even if the challenge of the technological innovations is met, the technologies need to be linked and combined with other agents of change to encourage new business models and different consumer behaviour. Hence the need for integrated consideration of change over time.

The interest in roadmaps as aids to policy and regulation is illustrated by the request from Defra in November 2021, in the first year of the NICER programme for the CE-Hub and each of the CE Centres to contribute their initial insights towards a 'Ministerial roadmap' document (November 2021) as part of a Vision 2050 exercise. These initial roadmap insights were then revisited at an Impacts and Legacy Workshop held in conjunction with the NICER programme Mid-term Review (January 2023). All of the NICER centres have either developed new roadmaps or used existing roadmaps during their research. The approaches taken by each CE Centre are summarised below (Figure 1).

The CE-Hub conducted a comprehensive review of many (1000+) roadmaps and distilled the patterns into a methodological framework and created a Roadmap Dashboard that covers the existing (published) roadmaps for many global jurisdictions and numerous materials. Two of the CE Centres - Met4Tech and Circular Chemicals - have applied similar approaches for the roadmapping process, and each have developed a new CE roadmap that starts with the current state, considers challenges/barriers, and shows an action plan (timeline) to achieve a shared future vision of a more circular economy in the UK. The Circular Metals roadmap provides a strategic plan and modelling scenarios for emissions reduction (i.e. achieving Net Zero) in the UK Steel industry. The TCC have created a stakeholder engagement platform on circularity for the textiles sector and also shared a previous roadmap strategy developed for the chemicals (oil) industry in Singapore. The ICEC-MCM has applied an existing roadmap method (already embedded in UK policy) called the 'Zero Avoidable Waste Route Map' (ZAW) onto their research programme; and their findings will inform the ongoing development/use of the ZAW route map in UK policy and projects. The roadmaps are mostly aimed at a broad audience of policymakers, industry, researchers and citizens (Table 1).

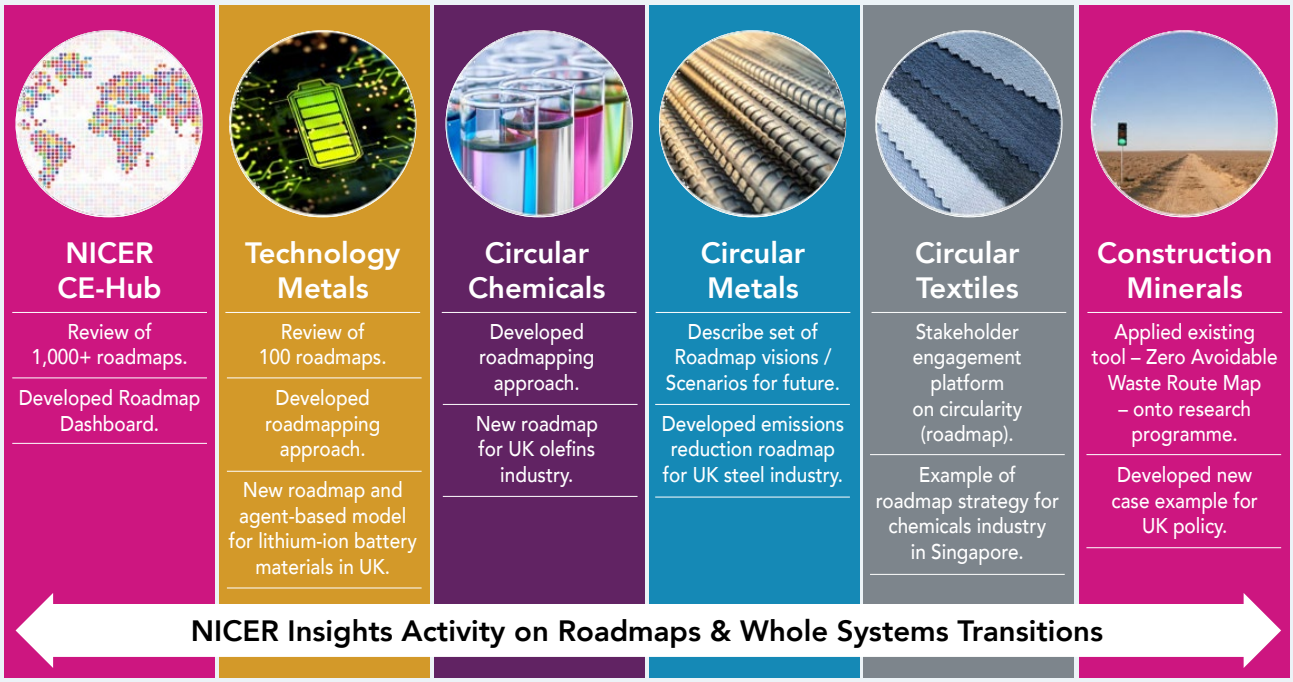
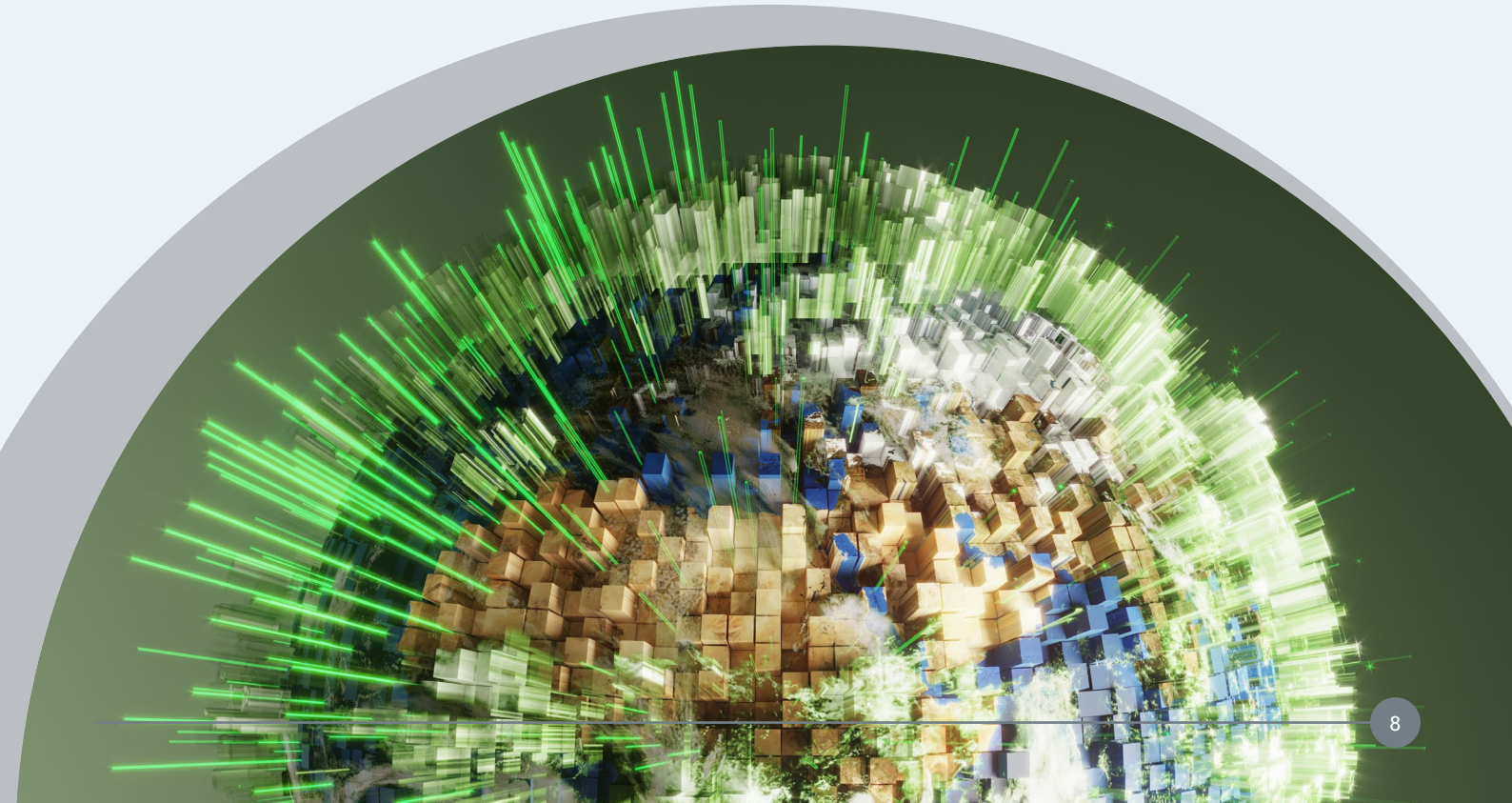


Figure 1

Table 1. NICER programme roadmapping activities.

NICER Centre	Type of Roadmap	Stakeholder engagement	Results – Outputs	Users of the Roadmap
CE-Hub	Detailed review of over 1000 types of roadmaps.	Many webinars have been held on the roadmap review findings.	**Roadmap dashboard** (interactive platform), presenting examples from numerous global jurisdictions and a wide range of materials. Several **publications**.	Researchers. Policymakers. Industry companies. Citizens.
Met4Tech Technology metals (critical minerals)	Review of 100's of roadmaps, and creation of a roadmapping approach that is specific for technology metals. Process involves steps for: current state, future vision, challenges (trade-offs, barriers, etc.), and an action plan to achieve the future vision. Set of Roadmap Highlights - Narratives to describe future scenarios.	Roadmapping activity through collaborative workshops with project partners and external stakeholders. Roadmap development involved deep dives, design sprints, constructor workshops, user interviews, and writing sprints. The roadmap draws on the new data and research outputs from the main themes of the project.	**New Tech metals CE roadmap for lithium-ion battery materials** used in EVs and renewable energy storage; and an **Agent-based model** of the UK battery system. *Battery roadmap will be an **online (interactive) report** and a set of **publications**.* **CE roadmap for rare earth elements used in magnets** for motors, wind power, and electronics. *Magnet roadmap will be a summary report **(infographic)** and a journal series of **publications**.*	Policymakers. Industry companies. Researchers. Citizens.
Circular Chemicals **Olefins (e.g. ethylene)**	Application of a roadmapping approach to examine new and renewable feedstocks and flows of olefins, and potential new routes for ethylene production, involving a vision exercise, consideration of gaps and trade-offs, the policy timeline, and an action plan.	Roadmapping activity involved many (50) interviews. Collaborative workshop held with project partners and wider stakeholders. The roadmap draws on the new data and research outputs from the main themes of the project.	**Briefing papers** on the roadmap workshop and data gaps. **Workshop report.** **Rich picture** – artist interpretation of the roadmap. ***Publications***.	Industry companies. Researchers. Policymakers.
Circular Metals **Steel**	Roadmap is a strategic plan that defines a goal against a timeline. Roadmap began with a vision exercise, and also involved modelling of steel production and emissions.	Vision report was developed through stakeholder consultations and reviewed/agreed at a workshop. Describe a series of future visions / scenarios for metals.	**Vision report (2022)** **Scenario-based CE roadmap for steel** (for Defra)**.** **UK Steel industry – emission reduction roadmap** *(report)***.**	Steel Industry companies. Policymakers. Researchers.

NICER Centre	Type of Roadmap	Stakeholder engagement	Results – Outputs	Users of the Roadmap
Textiles Circularity Centre (TCC)	Future vision[1] – analysis of scenarios for reducing the environmental impacts of the UK clothing economy (providing 6 routes through a roadmap towards a 50% reduction in impact). Scenario assessment[2] – value flow analysis of apparel-textiles. Time horizon[3] – investigated a future pathway where distributed place-based CE supply chains for apparel-textiles are adopted in the UK.	These roadmaps were informed by insights from studies held in the TCC's stakeholder-engagement platform – **The Regenerative Fashion Hub**. These studies involved multiple stakeholders including apparel businesses, materials start-ups, designers, charities, local government and citizens.	***Publications.*** [1]Millward-Hopkins, *et al.* (2023). Scenarios for reducing the environmental impacts of the UK clothing economy. [1]Muranko *et al.* (2025). Social production networks: exploring principles of place-based circular supply chains for clothing. [2]Iacovidou *et al.* (2025). Value flow in the clothing industry: a transitional study. [3]Tassell El Baz *et al.* (2025). Barriers and drivers to a Social Production Network future for the UK.	Apparel-textiles industry e.g. UKFT Local government e.g. ReLondon, National government e.g. Defra NGOs e.g. WRAP.
ICEC-MCM **Construction Minerals** **Waste materials**	Applying a previous roadmap - Zero Avoidable waste Route Map to construction minerals. ZAW Route Map was prepared in a previous project funded by BEIS, and is supported by Defra.	ICEC-MCM have mapped (aligned) their Centres research activities against the ZAW route map. Project partners include those who developed the ZAW route map (Defra, EA, several construction associations, etc.).	**Zero Avoidable Waste Route** map is an online interactive pdf document. *ICEC-MCM will do a **series of policy briefs**.* ***Additional briefs** to capture other ZAW route map recommendations.*	Policymakers. Industry companies. Researchers. Citizens.



2. A roadmap is a strategic tool for describing the shared expectations for the circular economy and includes a practical action plan for the stakeholders (system actors) to achieve the shared vision over a delineated time period.

The roadmapping process was developed by Motorola in the 1970s and involved creating a structured visual representation of the strategy to achieve a desired future state. Roadmapping is beneficial for communicating visions, bringing together resources from multiple stakeholders, stimulating research, and tracking progress [CE-Hub 2023].

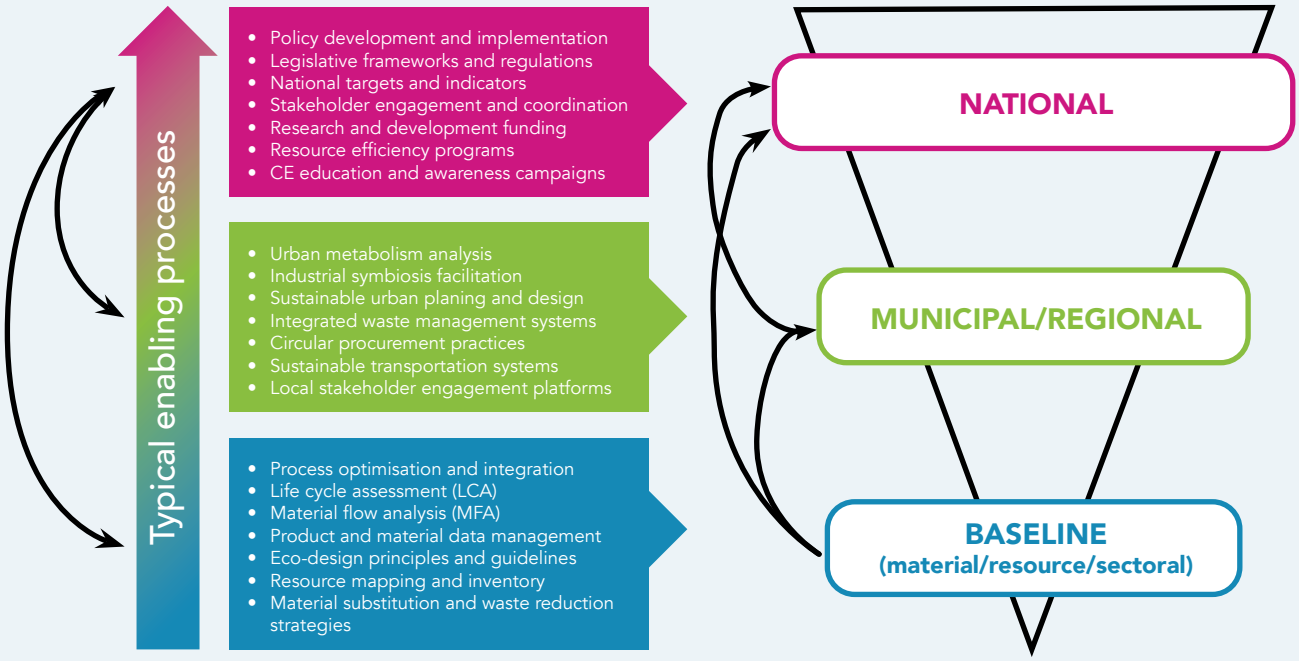
'The process of roadmapping involving different system actors is considered to be equally important as the final roadmap itself.' (Mahanty, 2024)

Abu-Bakar *et al.* (2024) conducted a comprehensive review of many (1000+) roadmaps, distilled the patterns into a methodological framework and created a **Roadmap Dashboard** (CE-Hub 2023b) that covers the existing (published) roadmaps for many global jurisdictions and numerous materials. They included all circular adoption strategies sharing key characteristics as Circular Economy Roadmaps (CERMs) as outlined in **'A guide to circular economy roadmaps'** (CE-Hub 2023a).

"Circular Economy Roadmapping is a strategic planning process that helps organisations to identify and prioritise and action that can facilitate a transition towards a circular economic model. A roadmap outlines the steps needed to achieve the circular economy goals, including timelines, resources needed, and key stakeholders." (Abu-Bakar *et al.*, 2024)

The typological framework developed, and examples of different roadmaps at each level, are shown below.

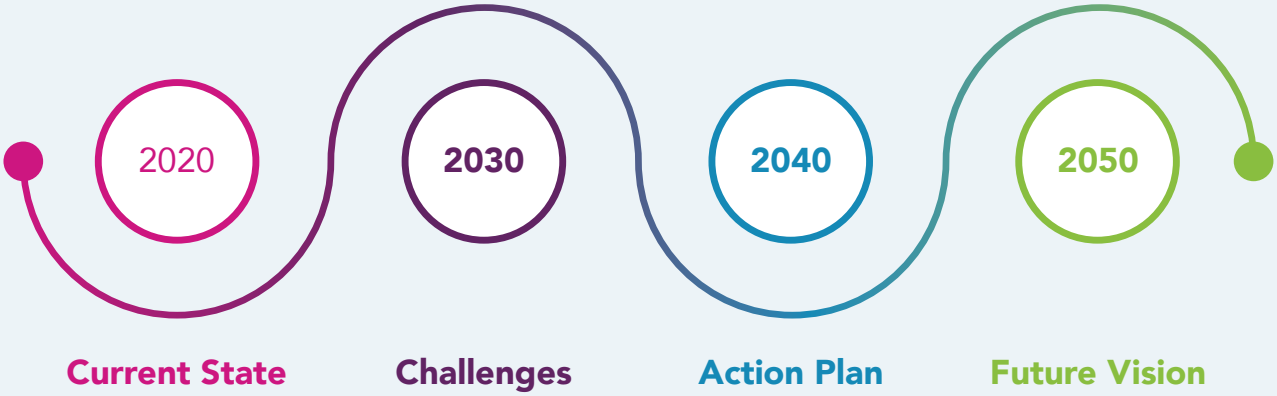
CERM Typological Framework



3. Circular Economy Roadmaps have common key characteristics

The main elements in a roadmap are: (1) **future vision** or target state; (2) **current state** or situational picture; (3) **action plan** or strategy to get from the current state to the target state; and (4) **time horizon**, including dissemination of the roadmap. It is important to outline measurable targets in a roadmap through indicators or measures of success for milestones and the target or vision (Mahanty *et al.* 2024).

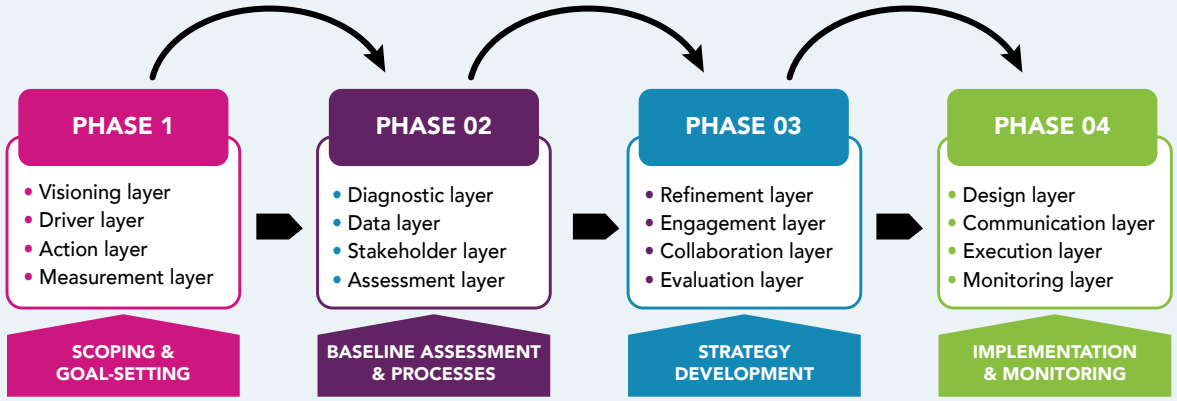
Circular Economy Roadmap



The CE-Hub researchers (Abu-Baker *et al.*, 2024) identified four strategic phases for Circular Economy Roadmaps (CERMs), as follows:

- **Phase 1** – Scoping and Goal Setting: Establishing Direction and Clear Objectives.
  This phase involves defining the purpose and scope of the roadmap, setting specific, measurable goals, and prioritising strategic imperatives.
- **Phase 2** – Baseline Assessment and Processes: Comprehensive Analysis of Current State.
  Involves a detailed analysis of the current state, such as stakeholder mapping, and assessing the alignment of current models with CE principles.
- **Phase 3** – Strategy Development: Formulating Targeted Strategies for CE Implementation.
  Focuses on developing strategies based on previous assessments, engaging stakeholders, and testing feasibility through pilots and case studies.
- **Phase 4** – Implementation and Monitoring: Executing and Evaluating the Effectiveness of Strategies.
  This final phase includes the execution of strategies, monitoring their effectiveness, and adapting based on feedback and continuous improvement.

Strategic Phases of CERM



4. Until the NICER programme, there were not many roadmaps on metals, minerals, or chemicals

Most CE roadmaps have been created for regional or national circular economy involving multiple materials. Some roadmaps have been designed to be material agnostic – and can be applied to different industries and different industry sectors. There are far fewer roadmaps for the complete systems of metals, minerals or chemicals but these allow more co-creation with stakeholders, the incorporation of research results and more specific proposals for actions. Although there are generic elements to a roadmap, and some generic challenges from moving from a linear to a circular economy, each individual material has its own challenges and potential solutions. CE tends to involve local actions, especially when considering end of life options and most roadmaps concentrate on regional cluster or national level actions. However, most materials supply chains, and especially metals (including critical minerals) are international. This needs to be recognised in the national roadmaps, and more thought might be given to international symbiotic collaboration on CE actions.

As yet, there is no international roadmap for critical minerals, for example, even though many of these materials are very specialist and likely to be routed through just a small number of suppliers, remanufacturers and recyclers, rather than local or even national industrial ecosystems. International dimensions to roadmaps are also important to consider the whole value chain, considering that most original raw materials in the UK come from overseas.

5. Roadmapping should start with developing a better understanding of data for stocks and flows of resources (materials) and their products

Data are essential to the understanding of the potential to improve CE practices. Collecting these data is challenging, as national statistics and trade code data may not be appropriate or transparent for the materials being mapped. The CE-hub provided a comprehensive review of UK public data assets for circular economy modelling, using a value chain taxonomy as the guiding structure for policy scenario exploration. Economic and social dynamics can then be added using a variety of techniques including soft systems methodology.

"Soft system-based approaches use multiple sources of data to fill gaps and accommodate the complexity of the problem being addressed" (Mahanty, 2024).

The Met4Tech Centre has created a 'National Virtual Observatory' at the British Geological Survey (BGS) for primary and secondary technology metals, with information on key products, metals and flows. The Met4Tech NVO has close association to the Critical Minerals Intelligence Centre at the BGS.

UK Technology Metals Observatory

The CE-Hub has created a CE- systems observatory and working in collaboration with the Office for National Statistics and Defra to utilise public and industry data assets across the value chain to firstly produce a materials flow, overlain with economic activities and actors, analysis across a range of materials. From this barriers and challenges to circularity are mapped in order to explore model scenarios, demonstrate the business case for change and build the roadmaps.

Knowledge Hub Archive

6. Collaboration with stakeholders is essential and interdisciplinary studies are useful

All of the new CE roadmap(s) have been developed through collaborative activities involving stakeholder interviews/workshops and by integrating the new data and research outputs obtained from the main themes of the research projects. A wide range of participatory techniques are available to be employed including: rich pictures, interviews, focus groups, surveys, mind mapping, deep dives, design sprints, workshops, iterative feedback, and participant observation (Mahanty, 2024). It is good to have representatives participate from each step in the value chain, including different groups of stakeholders (i.e. industry, policy, NGO, etc.). It may be difficult to reach specific actors (e.g. large OEMs) to attend workshops, but these companies generally have an industry association or sector contacts who will take part on their behalf.

The TCC's approach to developing roadmaps involved revealing authentic insights from stakeholders to envision a transformation pathway to a future vision of the UK where there is an increased reuse of apparel-textiles (Milward-Hopkins *et al.*, 2023). This approach describes a distributed place-based circular economy system – called the Social Production Network (Muranko *et al.*, 2025).

Policy actors, who are likely to be stakeholders and users of the roadmaps, will have different vision aims. For example: Defra looks at zero waste, while DESNZ looks at resource efficiency (net zero), and DBT considers CE and criticality. Therefore, a roadmap may need to relate to several policy targets in addition to move to a more circular economy. In order to accommodate different users, the vision exercise might be approached from several different directions, for example: sustainable feedstocks, reducing waste and pollution, renewable energy, technology change, substitution, and circularity principles (reuse, repair, etc.).

From the academic point of view, a roadmap may be a technical output but multidisciplinary teams can consider policy, regulatory and social sciences aspects which are important in implementing solutions. There may be some conflict between the complex systems that reflect the full technical details of a CE system, and the simplification required to produce clear policy guidelines (Met4Tech experience).

The actions in a roadmap may be carried out by a variety of stakeholders and are not necessarily all recommendations for government policy. Industry actors can often move faster than policy makers to make 'quick wins', which are good to include in a roadmap from either government or industry.

7. Roadmaps suggest actions for the future – but the future is uncertain

All roadmaps contain an element of time and look to the future to attain the target vision. However, in most cases the future is rather hard to predict and so it is a challenge to have a single robust roadmap. A solution to this is to have a set of options that allows people to investigate future possibilities. Roadmaps can allow the user an element of exploration or alternatively provide a set of different scenarios for the future.

For example, the TCC used its stakeholder-engagement platform protocol, and the stakeholder insights to undertake future scenario assessment using a value flow analysis (Complex Value Optimisation for Resource Recovery). This research investigated a pathway to the future scenario where the Social Production Network is a norm in the UK, through identifying and understanding the barriers and drivers to implementing localised supply chain configurations (Tassell El Baz *et al.*, 2025).

The TCC's future scenario assessment involved a value flow analysis of apparel-textiles using the Complex Value Optimisation for Resource Recovery (CVORR) process (Iacovidou *et al.*, 2025). The analysis assumed a system that is "transitional" i.e. between that which currently exists and the TCC future vision. The Time horizon investigated a future pathway where distributed place-based CE supply chains for apparel-textiles are adopted in the UK.

New technologies give the additional challenge of creating roadmaps for flows that do not yet exist. This is the case for lots of important flows though, for example, the battery materials studied by the Met4Tech Centre. The Met4Tech researchers have combined the new roadmapping methodology for technology metals with an agent-based model of the UK battery system for simulation of several battery highlights scenarios looking towards 2050, and testing potential interventions (e.g. design, technology, policy, business models, etc.) for the lithium-ion battery materials system in the UK.

Another way to tackle this problem is to form the action plan in the roadmap element around short-term (2030), medium (2040), and long-term (2050) goals and actions, which have progressively greater uncertainty. For example, as shown in the UKRI Circular Chemicals Centre Roadmap (Royle, 2024), the UK Steel Emissions Roadmap (Hall, 2024), and the Zero Avoidable Waste route map (ZAW 2022).

8. Roadmapping needs to include responsible innovation protocols to avoid unintended consequences

Responsible research and innovation is important to avoid unintended consequences of research and likewise, it is important to consider whether there might be unintended consequences of CE roadmaps too. This aspect might be more explicitly included in future roadmaps.

An example of a possible future unintended consequence might come from the minimum levels of recycled materials in lithium-ion batteries stipulated in the European Critical Raw Materials Act. This could encourage more recycling of lithium-ion batteries before they reach the end of their useful life, or even before they have been used for any time at all, in order for manufacturers to meet the targets for recycled material.

Other examples include the point that using more materials, which is counter-intuitive to CE thinking and might be ruled out, might pay off if it gives a building, for example, a longer life. Likewise, it may not always be less energy intensive to recycle than to process primary raw materials.

Here are several of the 'lessons learned' from the development and application of the Zero Avoidable Waste route map (Adams and Osmani, 2024):

- *"There could be material that is used inefficiently but produces no or little waste."*
- *"Recycled content or recycling may be more energy intensive option with greater environmental impact. Downcycling of materials may be a better option if it is replacing the use of primary resources."*
- *"There may be more end-of-life issues for offsite systems, as they may have more complex materials/ products combined that are harder to separate."*

9. Terminology is important; CE terms should be defined to ensure common understanding

The UK needs better names (new definitions) for wastes and scrap materials. The Met4Tech Centre has prepared a paper with agreed definitions for the technology metals CE. There is new guidance on CE frameworks, terms, etc. available from **ISO/TC 323 on Circular Economy**.

10. Roadmaps will need buy-in from government and other stakeholders to be used and support (funding) to keep up-to-date

In order for the roadmapping research in NICER to have maximum impact, work will need to continue after the NICER programme to champion and update the roadmaps produced. Materials roadmaps are likely to date very quickly owing to technology changes. However, following the end of the NICER programme there will be no funding for maintenance and updates and there is a risk that, depending on the serendipity of future funding awards to the teams involved, without further support, the ongoing usefulness of this research will not be maintained.

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TCC – Muranko *et al.* (2025). Żaneta Muranko, Eevee Zayas-Garin, Gareth Loudon, Sharon Baurley (2025). Social production networks: exploring principles of place-based circular supply chains for clothing.

TCC – Iacovidou *et al.* (2025). Eleni Iacovidou, Phil Purnell, Sharon Baurley (2025). Value flow in the clothing industry: a transitional study.

TCC – Tassell El Baz *et al.* (2025). Catriona Tassell El Baz, Żaneta Muranko, Gareth Loudon, Sharon Baurley (2025). Barriers and drivers to a Social Production Network future for the UK.

TCC – Millward-Hopkins *et al.* (2023). Joel Millward-Hopkins, Phil Purnell, Sharon Baurley (2023). Scenarios for reducing the environmental impacts of the UK clothing economy. Journal of Cleaner Production

TCC stakeholder-engagement platform – **The Regenerative Fashion Hub**.

Textiles UK– **https://wrap.org.uk/resources/guide/textiles-2030-roadmap**

Textiles Global – **https://www.unep.org/resources/publication/sustainability-and-circularity-textile-value-chain-global-roadmap**

Construction Minerals – Overview of construction sector CE roadmaps (by Halid Abu-Baker) **https://www.youtube.com/watch?v=w0KIk5UUJFY**

Construction Minerals UK – A short guide to the Construction Resources and Waste Roadmap (BRE, Defra, etc.). **https://files.bregroup.com/bre-co-uk-file-library-copy/filelibrary/pdf/rpts/waste/Roadmap_8-page_low-res-1.pdf**

Construction Minerals UK – Adams and Osmani (2024) – Katherine Adams (Reusefully Ltd.) and Mohamed Osmani (Loughborough University), 2024. Presentation on: 'Zero avoidable waste in construction route map'.

The Zero Avoidable Waste Routemap in Construction, 2022 **https://www.constructionleadershipcouncil.co.uk/workstream/green-construction-board/**

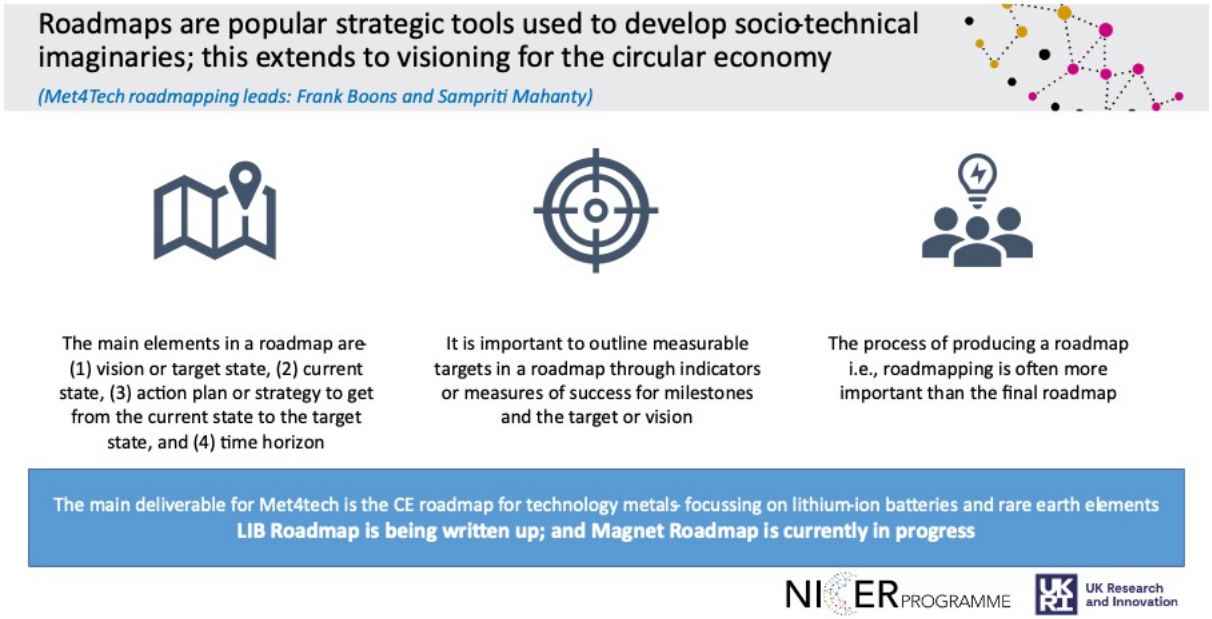
Annexes

Annex 1

List of online insights talks given to the NICER programme in the course of preparation of this insights report and screen shots of key learning lessons from these talks.

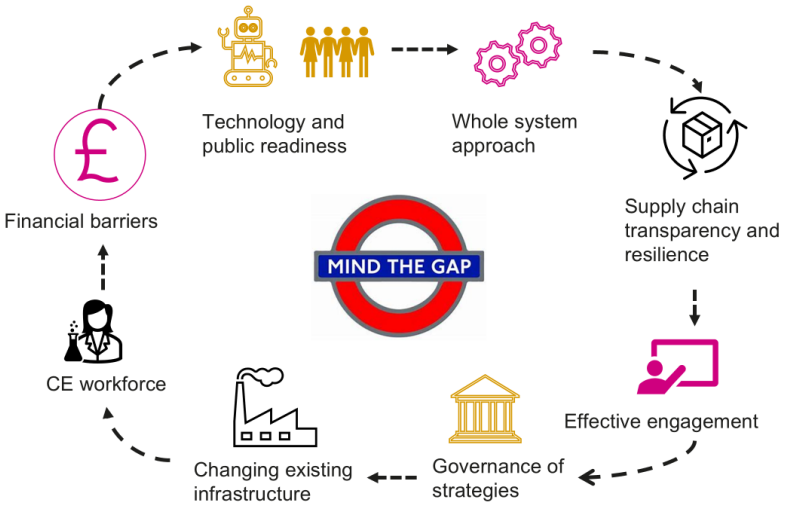
- Sampriti Mahanty (UCL), Met4Tech: 'A soft systems approach to circular economy roadmaps'
- Halid Abu-Bakar (University of Exeter), CE-Hub: 'Circular Economy Roadmapping - Strategy & Structure'
- Matthew Royle (Newcastle University), Circular Economy of Chemicals Centre: 'Roadmap for a circular economy of chemicals: progress so far'
- Frances Wall (University of Exeter), Met4Tech: 'Circular Economy Roadmap for Tech metals in the UK'
- Stephen Evans (University of Cambridge), Textiles Circularity Centre: 'De-carbonisation scenarios for the Singapore Chemical Sector'
- Russell Hall (University of Warwick), Circular Metals: 'A scenario-based roadmap for the UK Steel industry'
- Katherine Adams (Reusefully Ltd.) and Mohamed Osmani (Loughborough University), ICEC-MCM: 'Zero avoidable waste in construction route map'

Sampriti Mahanty (UCL), Met4Tech: 'A soft systems approach to circular economy roadmaps'



Matthew Royle (Newcastle University), Circular Economy of Chemicals Centre: 'Roadmap for a circular economy of chemicals: progress so far'

Gaps emerging



Action plan

Short term (2024-2030)	Medium term (2030-2040)	Long term (2040-2050)
UK chemicals/material strategy	Plastic packaging designed for a circular economy	Zero virgin fossil carbon in chemicals
Unified clear voice from senior representative group – strong chemistry council	Phase out incineration of waste	50% renewable carbon content required for products
Clear terminology for a circular economy	Reliable supply of renewable electricity (24/7 supply)	New energy efficient technologies for CO_2 utilisation at TRL 8-9
Shared platform for product carbon footprint and LCA data with standardised approach	Elimination of scope 1 and 2 emissions	Renewable feedstocks at 50% by 2050
Scaled CCS and CCU facilities	Safe and sustainable by design principles implemented and regulated	Direct air capture economically viable
Affordable renewable hydrogen on stream	Hydrogen economy deployed	Electrified steam cracker furnaces in the production of olefins
Harmonised waste collection with infrastructure for biodegradable products	25% renewable carbon content required for products	Zero avoidable waste by 2050

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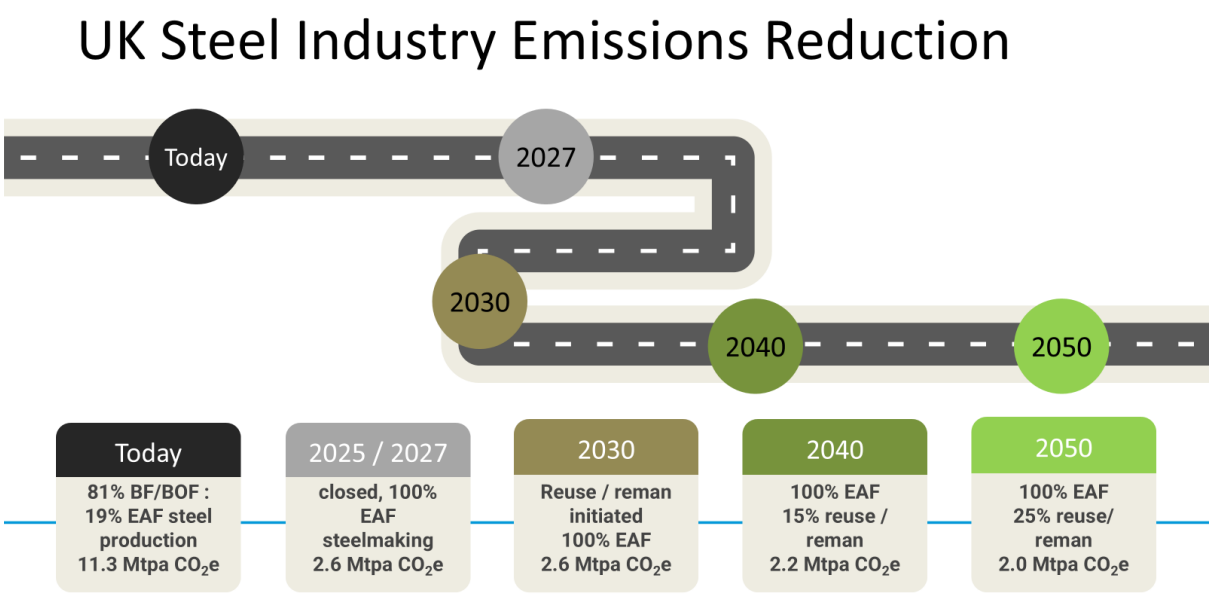
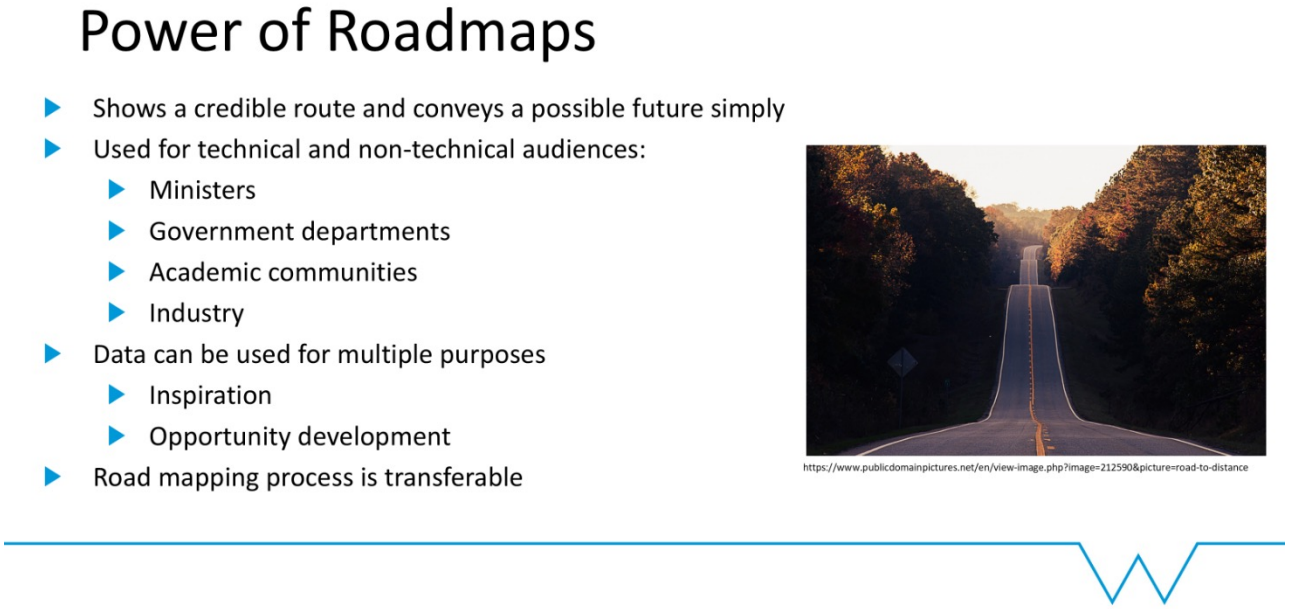
Russell Hall (University of Warwick), Circular Metals: 'A scenario-based roadmap for the UK Steel industry'



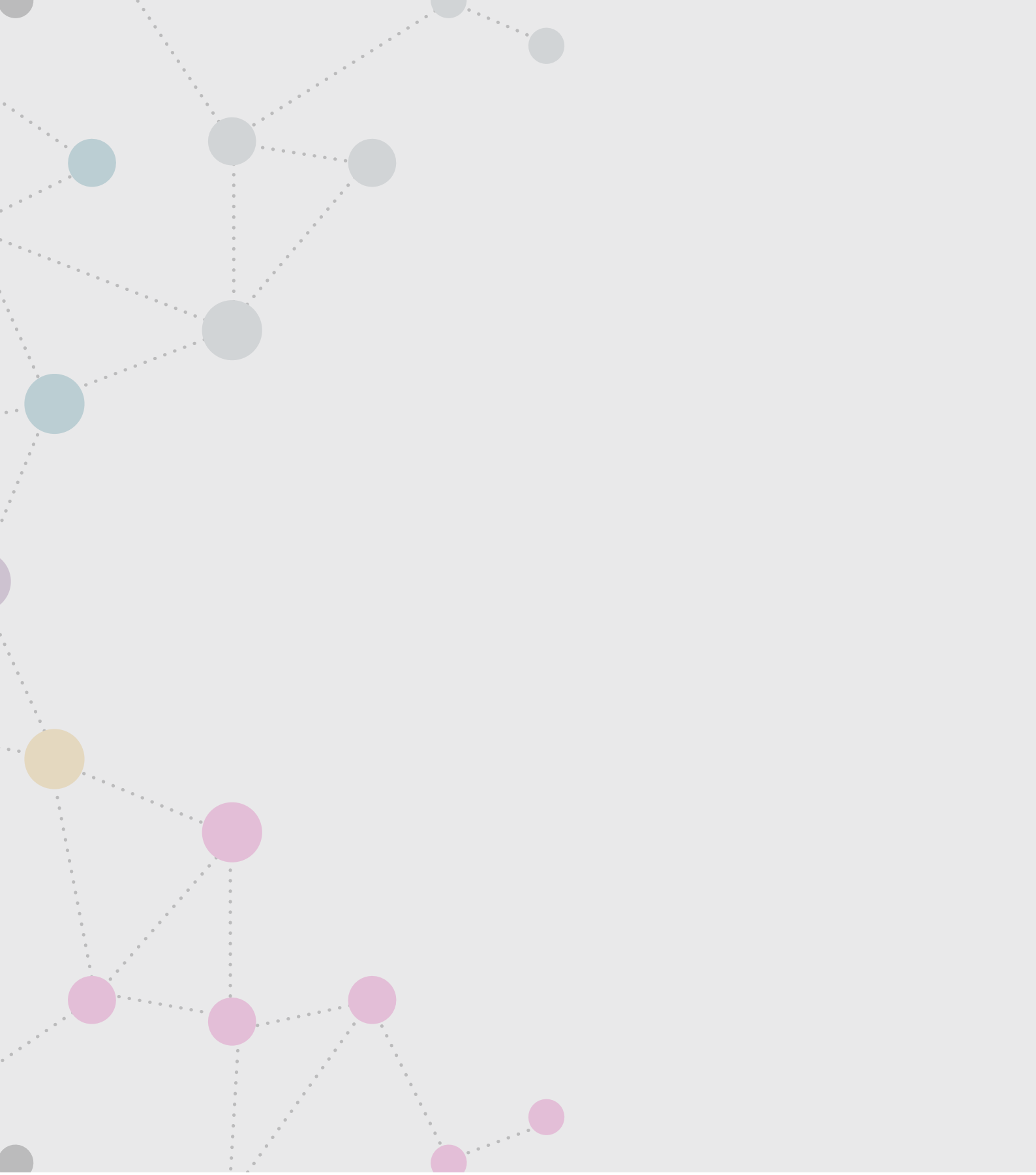


Katherine Adams (Reusefully Ltd.) and Mohamed Osmani (Loughborough University), ICEC-MCM: 'Zero avoidable waste in construction route map'

The routemap

Lessons learnt

- Keep it simple
- Be clear in its scope
- Important to have buy in from both Government and Industry
- Need to relate to key policy/target
- Use experts to develop
- Doesn't have to be an expensive exercise
- Can also be a key document for understanding– what has happened and why and what needs to happen and why
- Have actions that are doable now
- Be mindful of the language used i.e. waste v circular economy
- Needs support/funding to keep it present/updated
- Lack of data, so difficult to have quantified targets/outcomes



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