

# System Enablers for a Circular Economy



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# Executive Summary

Achieving a circular economy requires a fundamental systems-level change in our economy. All levels of government, industry, and civil society will need to rally behind the common goal to shift from our current extractive and wasteful linear economy towards a regenerative, circular one.



We are at a tipping point. We can keep trying to tweak business-as-usual and make minor improvements to a failing system, or we can make fundamental, systems-level changes and create a resilient, collaborative, and thriving construction sector fit for the future.

Our current linear economy and focus on economic growth are maintaining levels of carbon emissions and resource use that are exceeding our planetary boundaries.<sup>1</sup> So far, our efforts to decouple the economy from these impacts have proven largely unsuccessful, compared to the impact required. A circular economy is an important part of the puzzle to solve the challenges we are facing.<sup>2</sup>

Our current system is contributing to the climate and biodiversity crises.<sup>3</sup> To stand a chance of solving these interlinked crises, we need to move to a new way of thinking, working, and delivery; a circular economy must be part of the equation, to minimise virgin resource use in the built environment and maximise reuse at a higher value.

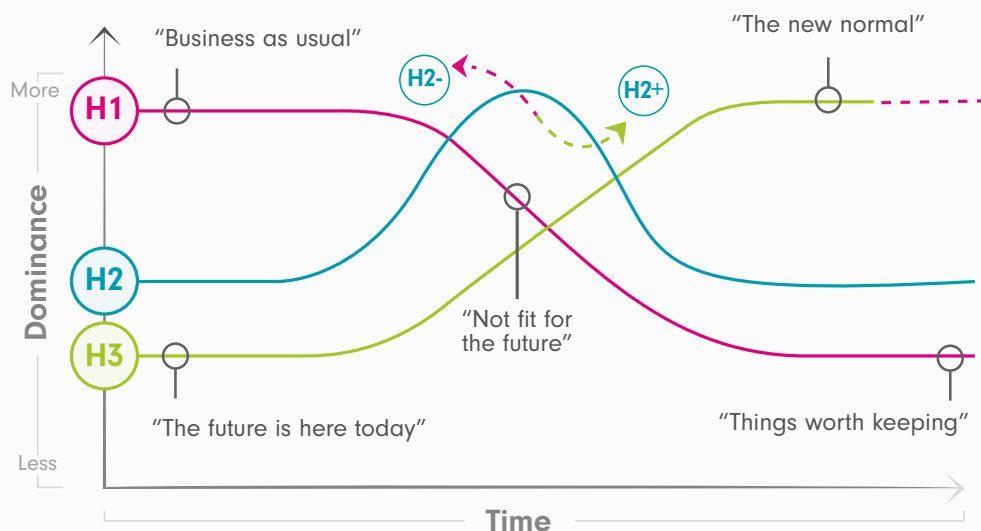
This report uses the Three Horizons framework<sup>4</sup> as a way of mapping how a shift could take place from the established patterns of the first horizon (business-as-usual) to the beginning of new patterns and emerging future in the third horizon. Disruptive innovations and industry actions of the second horizon will be crucial to make the shift from the current system to the emerging future a successful one.



The goal is to shift to an economy wherein the consumption of resources balances with the capacity of the Earth to naturally regenerate those resources. The future of our economy, and especially the built environment, must acknowledge the fact that a model of infinite extraction does not work within the limits of

our finite resources. While the rapid reduction of carbon emissions and resource use must take priority over undirected economic growth, a circular economy might offer an opportunity for growth within our carbon budgets and planetary boundaries.

### The Three Horizons model<sup>5</sup>



### STRATEGIC OBJECTIVES

To achieve this emerging future and vision of a regenerative, circular economy, a set of strategic objectives provides a tangible trajectory in environmental, social and economic terms.

#### > Environmental:

- Planetary boundaries are not exceeded
- The true value of raw non-regenerative materials is reflected in their price (balance tips in favour of secondary materials)
- Zero carbon trajectory

#### > Social:

- Mindset shift in high-income nations – consumption behaviour and high-consumption lifestyles
- Less demand for 'new' things
- Low-resource lifestyles
- Established routes for sharing resources and information
- Fairer distribution of resources we use
- Holistically take on our role as stewards of the built environment

#### > Economic:

- Reliant on regenerative, renewable, and inclusive resource flows
- Urban development supports localised loops (e.g. knowledge, space, and tools needed to maintain, reuse, upcycle and recycle materials locally and regionally)
- Creation of new sustainable market opportunities such as secondary materials market as well as the market for eco-designed products
- Focus on a thriving economy beyond GDP growth











## Industry enablers

To deliver these objectives, eight industry enablers have been identified. These provide ways to drive the shift from business-as-usual toward a mindset of doing more good rather than just doing less bad, considering the full life cycle of buildings and starting to do more to fully reflect the potential triple bottom line (social, environmental, economic) impacts.

Delivering these industry enablers should act as a tipping point in our mostly linear economic system, building a foundation upon which a circular economy across the built environment can become the default way of operating. Targeted and meaningful action by practitioners to demonstrate the art of the possible is vitally important, and this report sets out a multitude of actions that stakeholders can take to make this a reality.

The eight enablers can drive top-down and bottom-up change, support the sector by sharing knowledge and promoting open and honest partnerships and provide the financial, legal, and physical infrastructure required for maximising the (re)use of our valuable resources and materials.

-  Collaboration and early engagement
-  Secondary materials market
-  Circular economy design principles
-  Green contracts and leases
-  Tax and legislation
-  Green finance
-  Metrics, benchmarks, and indicators
-  Education





# Introduction

Whilst it is necessary to transition to a circular economy within the built environment, most of our economy is still deeply rooted in a linear system.

The way we manufacture and procure materials and products contributes to overshooting our planetary boundaries and reliance on the just-in-time availability of products that match a strict set of specifications, perpetuating our make-use-waste economy. Globally connected supply chains and established processes are part of a complex system that has proven to be challenging to adapt. The way things stand, our linear economy is accelerating the interlinked climate and biodiversity crises rather than actively decreasing our emissions and resource use.<sup>6</sup>

As the name implies, a circular economy requires a fundamental systems-level change in

our economy. All levels of government, industry, and civil society will need to rally behind the common goal to shift from our current extractive and wasteful linear economy towards a regenerative, circular one.

This report sets out some paradigm shifts required to transition to a new vision and emerging future scenario. Recognising that this needs to be supported by changing behaviours and innovation within the industry, this report identifies eight central industry enablers that can lead to critical tipping points for the transition ahead, and proposed policy and industry action for these enablers to be implemented.

## Other relevant work by UKGBC

Previous work undertaken by UKGBC and other organisations has demonstrated the need for a shift to a circular built environment. UKGBC's 2019 [Circular Economy Guidance for Construction Clients](#) identified five circular economy design principles which help enable a circular economy. This was followed by the 2020 ['Reuse' and 'Products as a Service' implementation packs](#). In the [Net Zero Whole Life Carbon Roadmap for the Built Environment](#), implementing a circular economy is cited as a necessity to achieve carbon emission reductions in line with national targets and carbon budgets. In August 2022, UKGBC published a report on the [Insights on How Circular Economy Principles can Impact Carbon and Value](#) which provided evidence to support the use of implementing circular design principles to achieve carbon reductions and generate value.

## Report purpose and target audience

This project identifies both systemic barriers and enablers to shift the built environment from a linear to a circular system. This piece of work will be relevant for a wide range of stakeholders in the built environment including national and local authorities, clients and developers, asset owners, designers, product manufacturers, builders, insurers/underwriters, demolition contractors, and recyclers.

## Project methodology

To deliver this project a Task Group was formed of 17 individuals who represent the construction industry and wider supply chain including engineers, product manufacturers, and materials suppliers. Desktop research and a series of workshops were undertaken with the Task Group to collate and discuss information, as well as individual interviews and topic-specific meetings




to discuss content in greater detail.

The workshops identified the barriers to achieving a circular economy and explored enablers to overcome them. These enablers have been consolidated into their present form through an iterative process and review. Furthermore, the Task Group investigated and collected key stakeholder actions necessary to deliver these enablers and help transition the built environment industry to a more circular one.

The Task Group's research included a literature review to ensure industry alignment and relevance of the findings in this report. The Task Group and several external supporters and reviewers have also reviewed and provided feedback on this report during its creation, with further details in the Acknowledgements section.

## Report structure

After the introduction, this report is structured into three main sections:

-  **A systems change:** this section introduces the Three Horizons Model for systems change that this report is based on.
-  **The economic shift:** this section explores a vision for a circular economy, an emerging future and goal, accompanied by a set of strategic objectives to work towards.
-  **Industry enablers:** this section outlines eight industry enablers that support the economic shift and help achieve the strategic objectives from the previous section. Associated policy and industry actions are recommended to support these enablers.



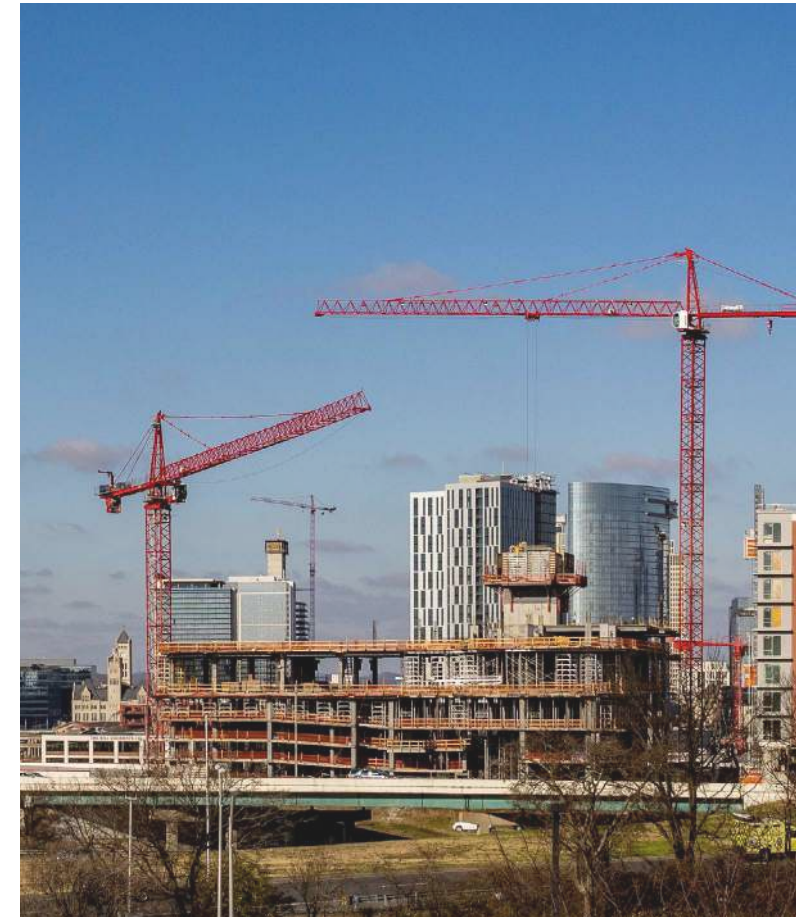
# A systems change: from linear to circular

How can we transform the current system to make circular value creation second nature, easy to do, financially rewarding, and embedded so that future innovations don't revert to old systems?

A system is a set of things, interconnected in a self-governing network of relationships that produce their own patterns of behaviour.<sup>7</sup> This behaviour cannot be determined by looking at the parts that make up the system alone, and their outcomes are often surprising or unintended. Systems can create conditions that lead to their own failure. Parts of the way our economy operates can be seen as an example. The linear economy is under multiple threats it has itself created. Built on the idea of infinite supply of resources, their fading availability, as well as impacts from climate change and biodiversity loss, put not only the economic system but our society as a whole under threat.

Because of the complex nature of systems, changing the way they operate is a challenging task. Differing time horizons make coordination challenging, existing infrastructure supports the current way things are done, and inconsistent visions for the changes ahead can make the direction of travel unclear. Many might not recognise that the current system is not fit for purpose and requires change.

To facilitate navigating this complexity, this report uses the Three Horizons Model for systems change. Looking along the short, medium, and long-term timelines, this model helps us work out how to prioritise our actions now and in the future.



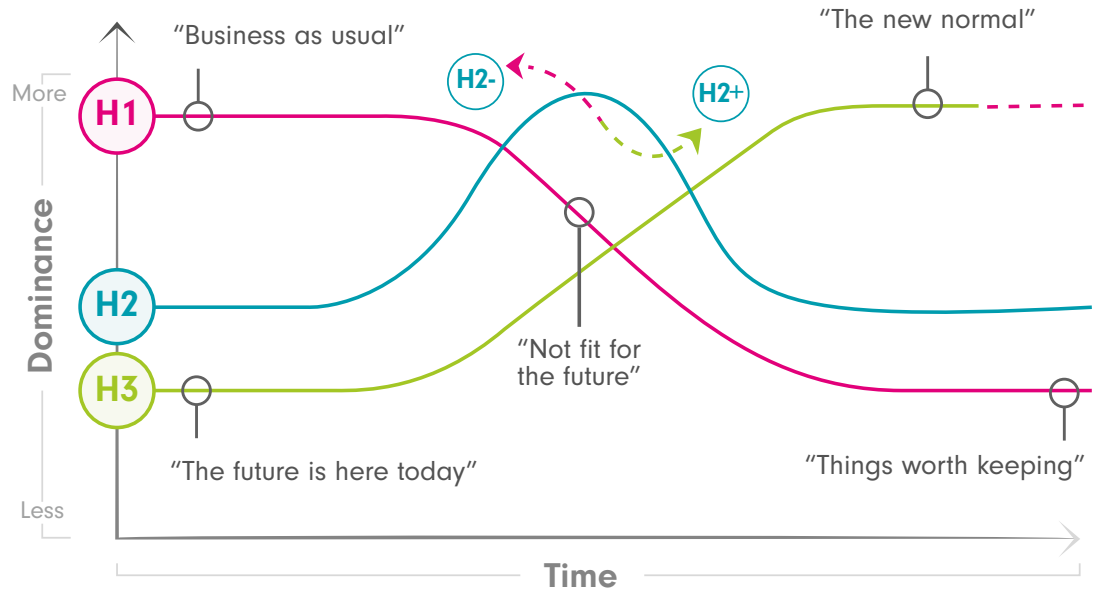
# The Three Horizons Model

The Three Horizons Model is a way of structuring our thinking about the transition towards an emerging future, giving us a simple tool to handle the complexity of multiple facets of change happening at the same time, and over time. It acts as a roadmap to resolve tensions between incremental change and radical transformation.

In a complex world, each of these horizons is needed to create meaningful change by bringing these different perspectives together in a constructive way to face the challenges ahead.

The built environment industry's current business-as-usual approach is an extractive, 'use and dispose', linear economy (Horizon 1). This report will look at some important changes required for a regenerative, circular built environment (Horizon 3 – chapter ii). In addition, it will outline practical industry enablers that can be harnessed to deliver this (Horizon 2 – chapter iii).

FIGURE 1: THE THREE HORIZONS MODEL



H1

### Horizon 1:

The current dominant system, or business-as-usual. Thinking within this horizon means managing existing realities for the system to remain successful. The Three Horizons Model assumes that this system is no longer fit for purpose under emerging conditions and will need to adapt and/or decline.

H2

### Horizon 2:

The innovations that help us transition from our current system (Horizon 1) towards the emerging future (Horizon 3), by showing us that a new system is possible. Note that these innovations might not always be supporting the emerging future (H2+) but can manifest the current system in new ways (H2-). Careful evaluation of which Horizon they support is paramount.

CHAPTER iii

H3

### Horizon 3:

The emerging future of a radically different world and vision to aspire to that should become the new business-as-usual over time.

CHAPTER ii

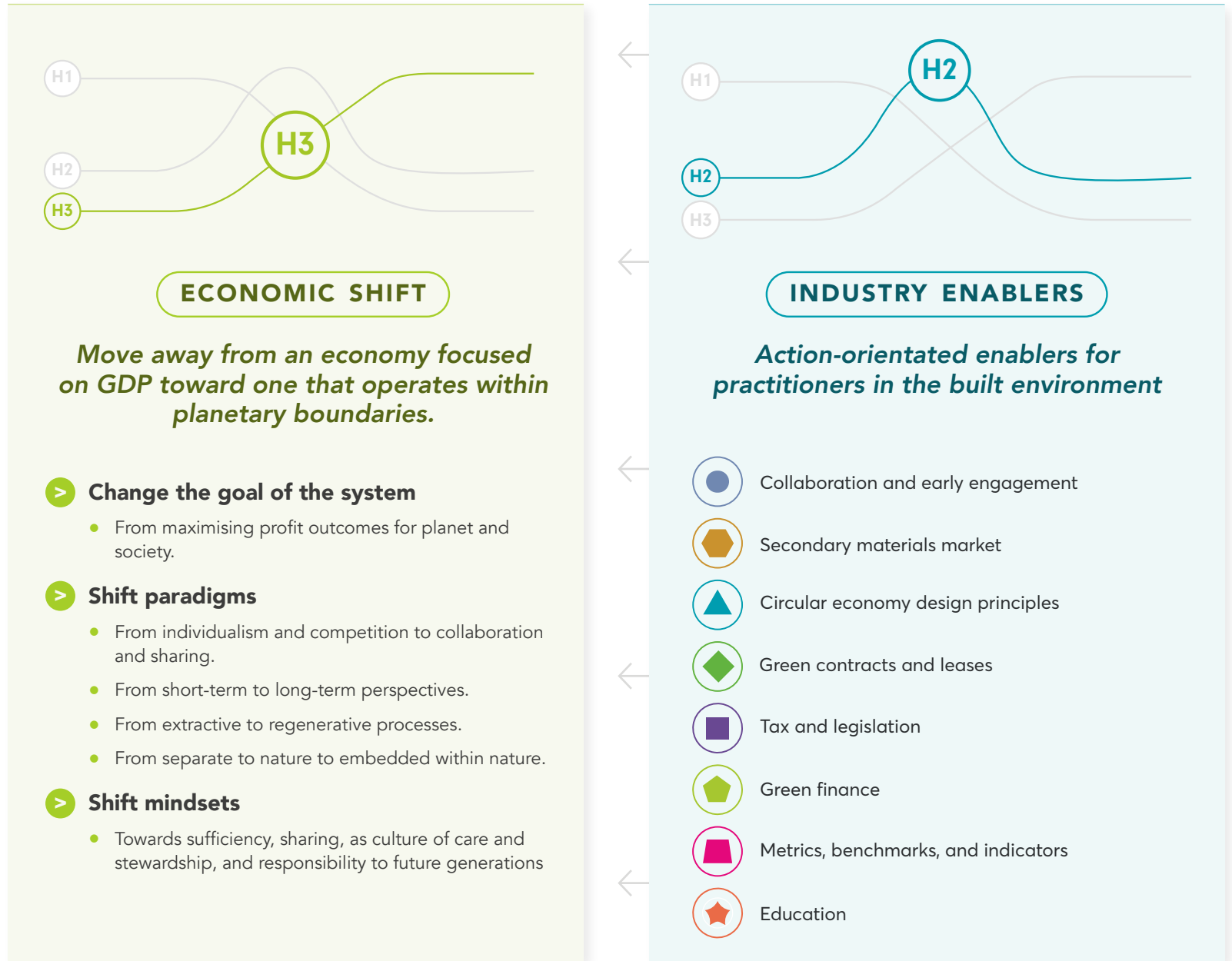




## In the next chapter

The next chapter looks at H3 and the emerging future we are trying to create. Chapter iii then proposes industry enablers that will support the shift from our current system towards the vision of H3

FIGURE 2: H3 AND H2 IN THE CONTEXT OF THIS REPORT





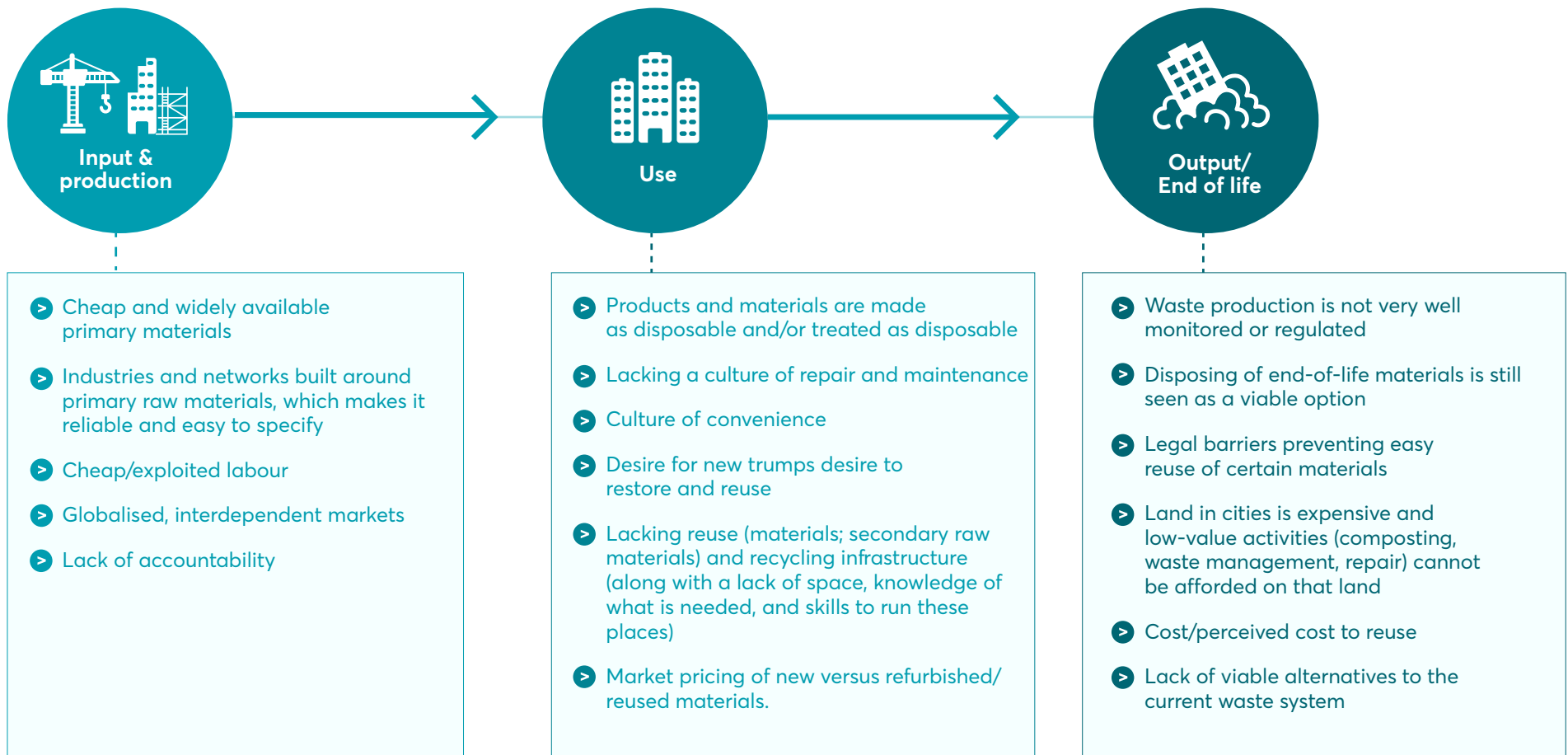
# Economic shift

Complex systems can't be understood by simply looking at their constituent parts in isolation. For this reason, this chapter looks at inherent flaws of the current system, exposing why changing its goal is necessary to drive change, informing and enacting the shift from the current linear to a circular built environment.



# What drives our linear economy?

Our current economic model is based on the business-as-usual assumption of the infinite availability of resources and labour that support a linear economy. The table below summarises some of the main drivers behind this.



## Issues with Linear Economy

There are several issues with our current linear economy. Empirical research shows that our current efforts to decouple our economy from unsustainable resource use have been insufficient, and the gross domestic product (GDP) remains tightly linked to our consumption of natural resources.<sup>8</sup> The same is true regarding carbon emissions; current efforts to decouple GDP from carbon emissions have been limited, and evidence suggests that the required reductions in carbon emissions and resource use cannot be achieved through current decoupling rates.<sup>9</sup>

Similarly, UKGBC's [Whole Life Carbon Roadmap](#) and its underlying models state that we will not be able to stay within our carbon budgets without adopting a circular economy. The shift from linear to circular is therefore a fundamental necessity in our response to the climate emergency.

Assessing our economy only via its GDP is not an indicator of good long-term outcomes for a low-carbon economy. While economic stability is essential, we need to incorporate other elements into our assessment of what a good economy looks like.

**The goal:** To create an economy whereby the consumption of resources balances with the capacity of the Earth to naturally regenerate those resources. The future of our economy must acknowledge the fact that a model of infinite extraction does not work within the limits of our finite resources. Rather than assessing the health of our economy against growth in GDP, we must move towards an economy that operates within planetary boundaries, shifting from maximising profit and growth at all costs to positive outcomes for the planet and society. While the rapid reduction of carbon emissions and resource use must take priority over undirected economic growth, a circular economy might offer an opportunity for growth within our carbon budgets and planetary boundaries.



### STRATEGIC OBJECTIVES

To accelerate the shift from a linear to a circular economy, some strategic objectives have been identified. These objectives provide long-term pathways to cluster and direct various efforts made in the short and medium-term.

#### > Environmental:

- Planetary boundaries are not exceeded
- The true value of raw non-regenerative materials is reflected in their price (balance tips in favour of secondary materials)
- Zero carbon trajectory

#### > Social:

- Mindset shift in high-income nations – consumption behaviour and high-consumption lifestyles
- Less demand for 'new' things
- Low-resource lifestyles
- Established routes for sharing resources and information
- Fairer distribution of resources we use
- Holistically take on our role as stewards of the built environment

#### > Economic:

- Reliant on regenerative, renewable, and inclusive resource flows
- Urban development supports localised loops (e.g. knowledge, space, and tools needed to maintain, reuse, upcycle and recycle materials locally and regionally)
- Creation of new sustainable market opportunities such as secondary materials market as well as the market for eco-designed products
- Focus on a thriving economy beyond GDP growth

# The planetary boundaries

Nine planetary boundaries have been identified by Rockstrom et al (2009) to show when we surpass 'safe' levels of impact of nitrogen, phosphorous, carbon, and water cycles, climate, stratospheric and ocean circulation systems, aerosol loading, and chemical pollution levels.<sup>10</sup> Passing these boundaries destabilises the Earth's natural systems and can lead to the climate

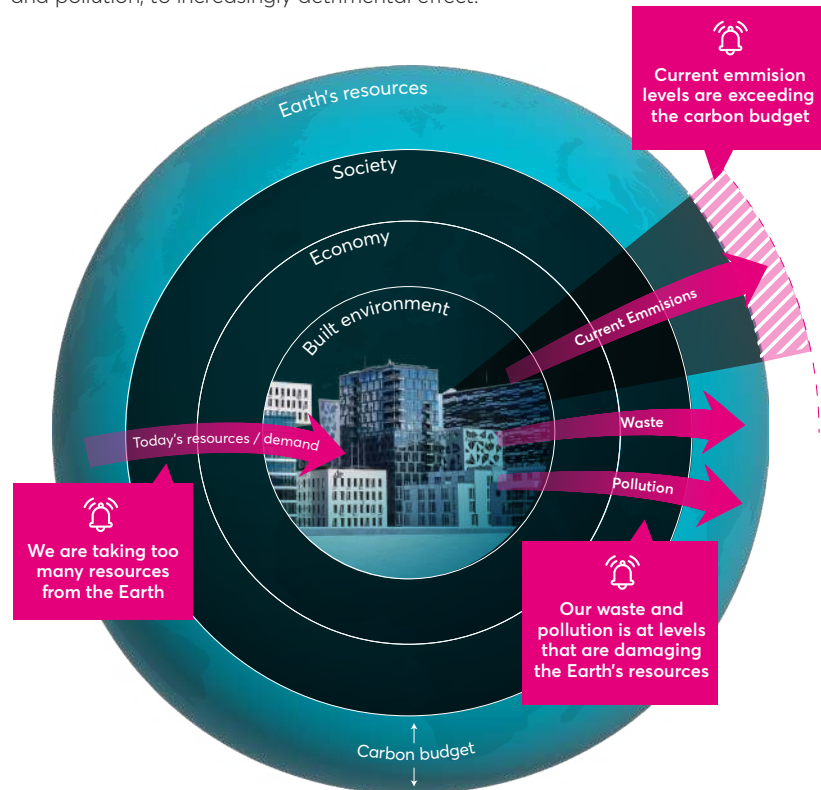
change impacts we see today. Reducing our impact on these systems and cycles to below the boundary will help support a safe earth system for human habitation.

The Planetary Boundaries find application within the Doughnut Economics model. This uses the planetary boundaries as an outer limit with complimentary social boundaries as an inner foundation, creating a safe and just space for humanity within the 'doughnut'.

FIGURE 3: THE BUILT ENVIRONMENT AND ITS USE OF RESOURCES

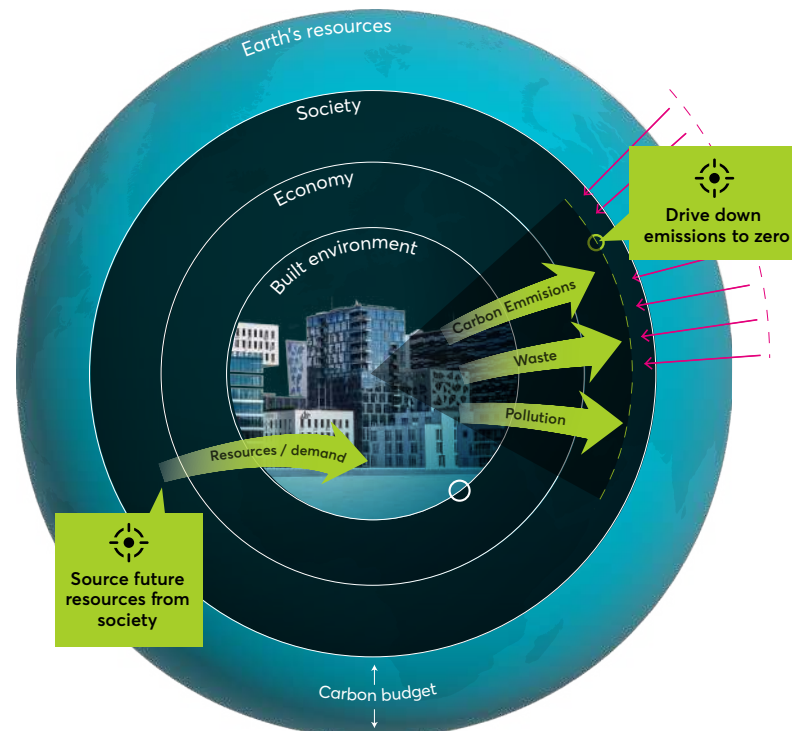
## TODAY

We are currently overshooting several planetary boundaries such as carbon and have also pushed beyond what our ecosystems can cope with on waste and pollution, to increasingly detrimental effect.



## FUTURE

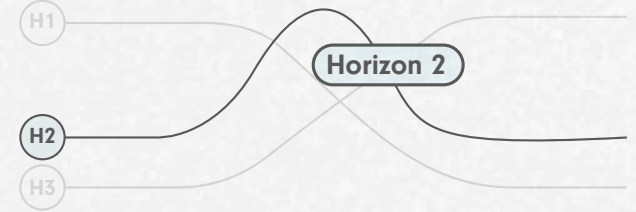
Our economy and the built environment are embedded in society and the environment, operating in balance with the Earth's resources.





# Industry enablers

This chapter outlines some more practical, action-orientated enablers that help deliver the strategic objectives.



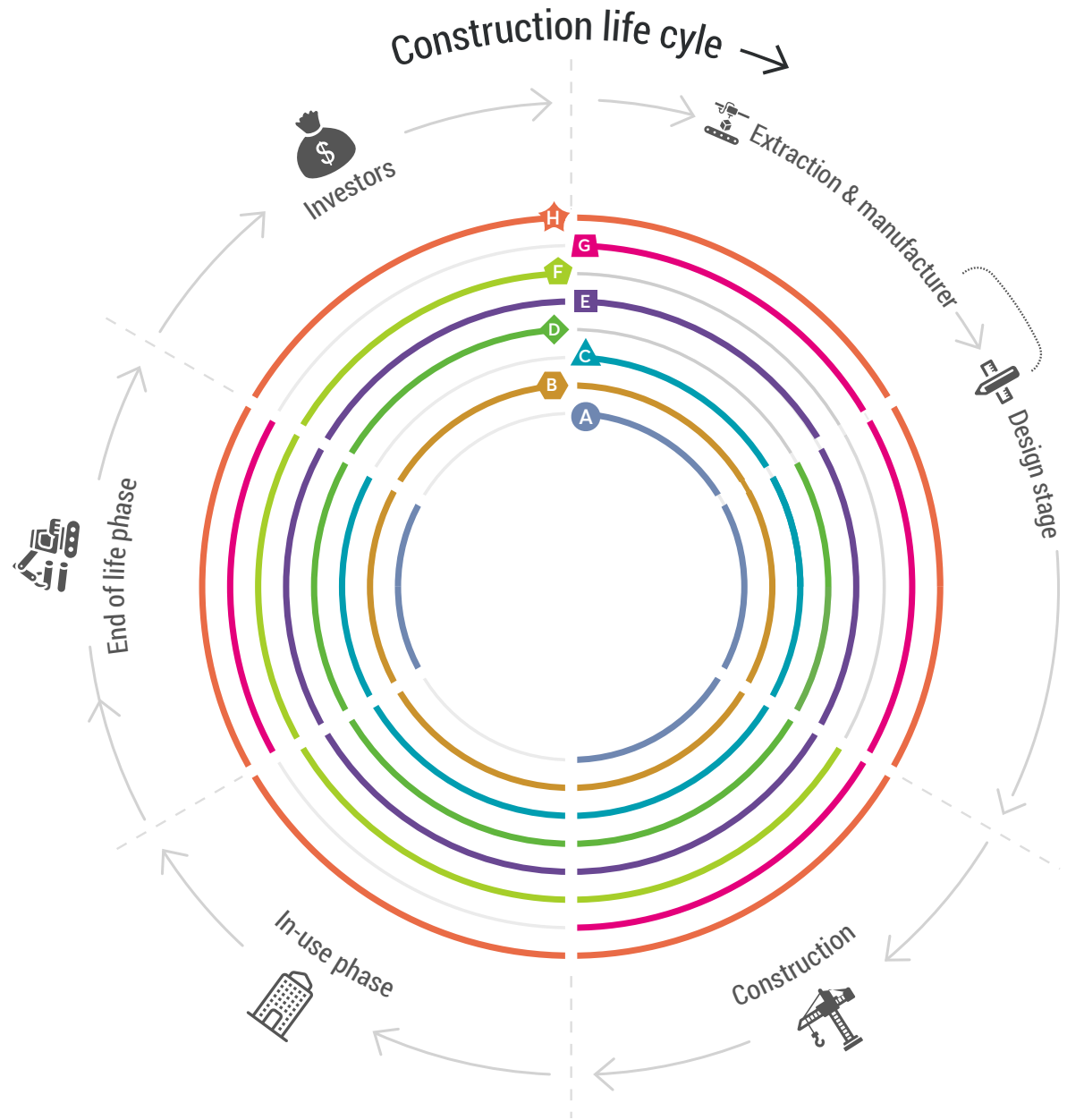
The industry enablers presented in this report are based on the sphere of influence of practitioners in the built environment. They constitute focus areas to work towards with the potential to act as critical enablers for the shift from a linear to a circular built environment.



**FIGURE 4: INDUSTRY ENABLERS AND THE CONSTRUCTION LIFE CYCLE**

This diagram shows where the individual enablers apply in the construction process

- A** Collaboration and early engagement
- B** Secondary materials market
- C** Circular economy design principles
- D** Green contracts and leases
- E** Tax and legislation
- F** Green financing
- G** Metrics, Benchmarks, and indicators
- H** Education







A

# Collaboration and early engagement

Turning the highly linear and fragmented construction process into a more collaborative approach, enabling circularity.



#### Related enablers:

-  Secondary materials market
-  Education

#### Barriers it addresses:

##### **Knowledge gap between stakeholders.**

Designers and engineers sometimes lack the practical expertise of contractors, demolition contractors, and deconstruction engineers, and vice versa. This leads to inefficiencies between the design and delivery teams, as well as incompatibilities between design and build that only arise in later stages of the project which can often only be overcome at a high cost, if at all.

##### **Established and mature processes in place.**

The construction industry follows an established, formalised process that is based on linear thinking. The process is often dictated by programme and just-in-time need for materials.

##### **Lowest-cost tendering is the norm.**

Contracts are commonly awarded at the lowest cost in a highly competitive tendering process. Therefore, contractors are incentivised to optimise finances over quality, discouraging exploration of circular economy principles if they don't come at a clear cost saving. The emphasis on low cost can also lead to the dismissal of innovation.

**Fragmentation of the industry.** The established, business-as-usual construction process is characterised by individual, disconnected work packages in the design and build approach, pushing risk down the supply chain. The complexity of the construction industry will only increase in the transition to circularity before it settles into the next business-as-usual, making siloed processes highly inadequate in the transition and in fact not conducive to the collaborative approach required to be competitive in future scenarios.

#### How it helps overcome them:

Early engagement when considering circular economy is likely to achieve the biggest impact. A more collaborative approach enables knowledge from various project stages to be shared and considered where it previously has been absent. To overcome current barriers, there needs to be a common vision/shared goal, and a connection between early project stages with later ones. For example, by involving demolition contractors in the design process, challenges to deconstruction can be addressed early on, leading to a *design for disassembly* as a precondition for the successful implementation of a circular economy in the construction industry. If the option to retain a building is properly considered before the team assumes demolition, chances are higher that a retrofit approach is taken.



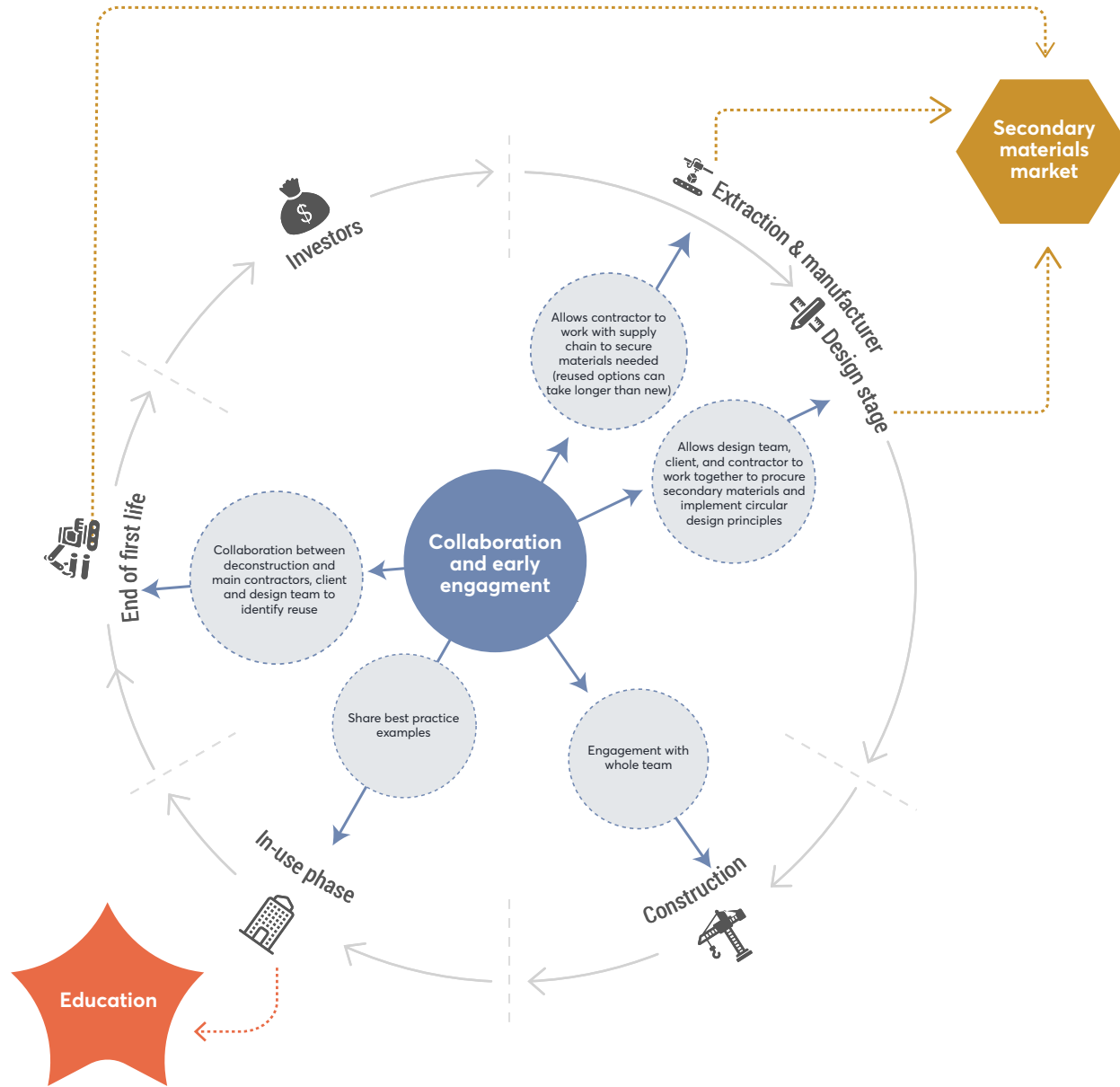
#### Detailed enabler

##### **Integrated Project Insurance (IPI)**

Also known as insurance-backed alliancing contracts, IPI is a model for procurement in the construction industry. To overcome fragmentation, all involved parties sign up to a single multiparty contract with shared responsibility, encouraging collaborative working.<sup>11</sup> This ensures a more integrated design, especially between the design and delivery teams. With deconstruction engineers involved from the very start, this can facilitate a better uptake of circular economy principles and lead to delivering higher quality.



FIGURE 5: COLLABORATION



## Stakeholder actions

### INDUSTRY ACTIONS:

- **Clients** should appoint demolition contractors or deconstruction engineers as part of the design team, or early enough so pre-refurbishment or pre-demolition audits can be considered by design teams.
- **Architects, engineers, developers, and owners** explore the use of models for collaboration and construction procurement such as [IP insurance](#) or the [Two Stage Open Book](#) model.
- **Architects and engineers** should involve the expertise of **contractors** and **demolition contractors** early on (Stage 1/ Stage 2) to inform the design based on salvaged materials by sharing pre-refurbishment or pre-demolition audit. The **contractor** can help to de-risk low-carbon designs, ensure buildability and optimise procurement.<sup>12</sup> Early structural reviews help assess the quality of existing materials for reuse.
- **Architects** engage early with **contractors** and **manufacturers** to explore secondary or regenerative materials and products and incorporate performance-based procurement.
- **Contractors, cost consultants, QS, and project managers** express interest in trialling new forms of contracts such as IPI or the Two Stage Open Book model. Look for partners who are also expressing an interest.
- **All stakeholders** should share best practice examples and challenges so the industry can learn how different processes (e.g. procurement of reused materials) can happen.





# B

## Secondary materials market

A marketplace for materials and construction products that had a previous life. Easy to procure from.



### Related enablers:

-  Collaboration and early engagement
-  Circular economy design principles

### Barriers it addresses:

#### Limited availability of secondary materials.

Since reused materials only become available when a building reaches its end of life and is carefully deconstructed, timelines of material demand and availability often don't align. Tight programmes on most construction projects make it difficult to procure secondary materials, which means most projects default back to traditional procurement routes using new products and virgin materials.

#### Limitations on storage of secondary materials.

Because of the tight timelines in the construction industry, storage of secondary materials is often necessary until their destination and onward use are confirmed. A lack of widespread storage options, and often high costs associated with it, make it difficult to store materials, rendering potential reuse more unlikely.

#### Difficulties in the procurement of secondary materials.

Secondary or reused materials compete with a global market of new materials that offer a reliable and quick route of procurement in a tried and tested process at fixed prices. Reused materials, in comparison, lack this ease of procurement and currently require some investigation into their availability, quality, associated warranties, and cost.

**Risk is pushed onto contractors.** When second-hand materials are specified without availability and access to these products, the risk for procuring disproportionately sits with contractors as they might not be able to procure the specified materials at the required time.

### How it helps overcome them:

A functioning secondary materials market is essential for mainstreaming the procurement of reused building materials by making this process easy and accessible, and therefore a true alternative to the current procurement of new products. The wide availability of these secondary materials will help distribute risk fairly and give confidence to markets and

procurers. There are currently two main approaches – reuse hubs and manufacturers offering refurbished products. Both hold value, depending on the type of product. Simpler building materials such as bricks, steel, and insulation are suited to reuse hubs, while more technical products are better suited for manufacturer schemes – for example, refurbished lighting, raised access floors, and glass partitions.

### Example application

#### Material passports

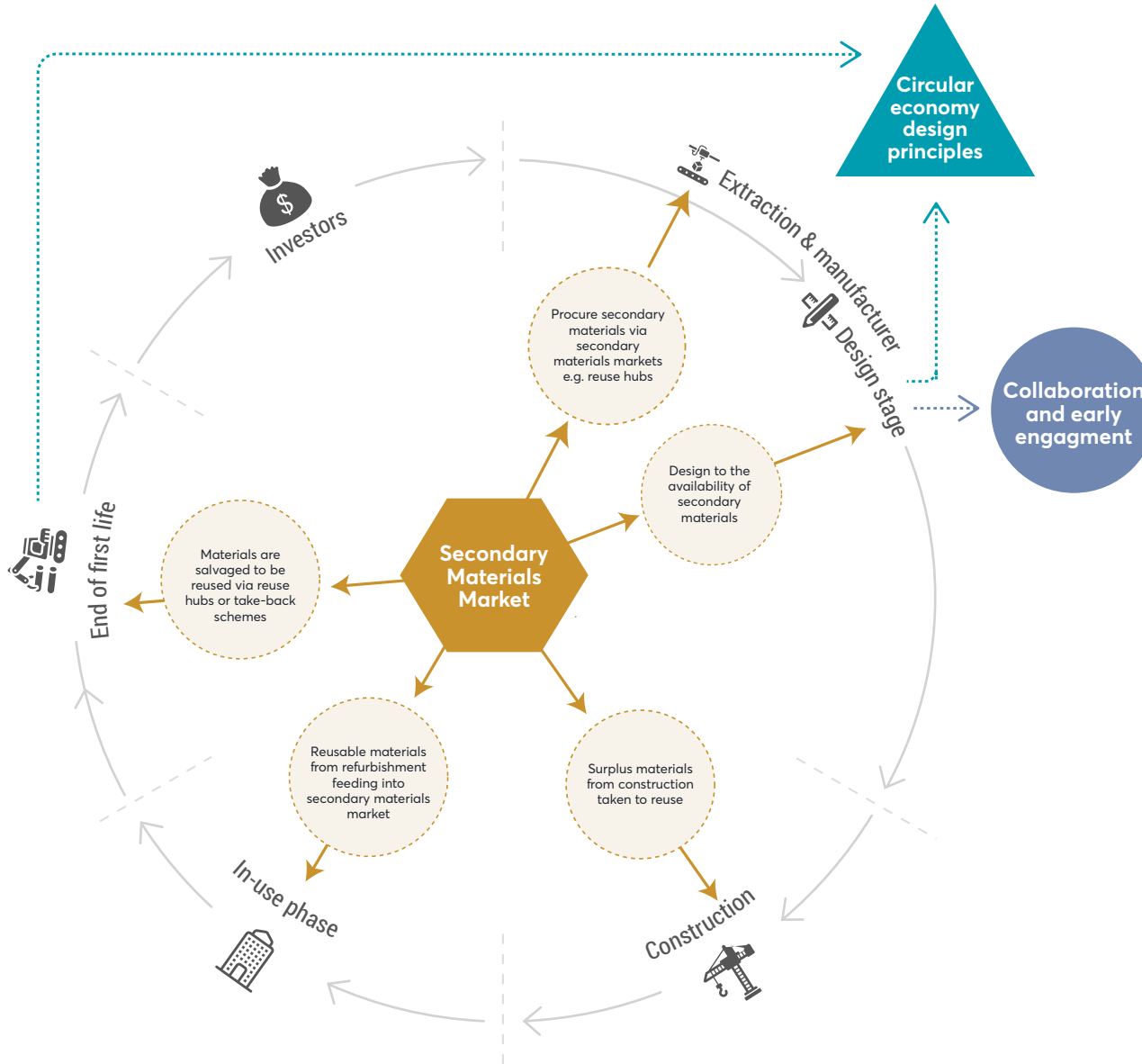
Material passports offer a tool to gather data on construction products and materials, linked to an accessible database. This provides proof of provenance, as well as clarity on existing materials and refurbishment cycles, critical information to obtain the confidence of buyers in a secondary materials market.

By providing detailed information on the composition of a building prior to its deconstruction, a material passport can act as an enabler for potential reuse as it provides insights to designers on the future availability of materials. This 'track and trace' element is vital for the Horizon 3 vision of buildings being designed according to the availability of secondary materials.

#### Reuse hubs

To overcome the shortage of storage for secondary materials, local reuse hubs can offer an affordable solution. This way, materials that free up from deconstruction can be stored, remanufactured, and restored, building a basis for a second-hand materials market for construction procurement. This will also increase quality control and support the development of higher-value secondary markets.

FIGURE 6: SECONDARY MATERIALS MARKET



## Stakeholder actions

### POLICY ACTIONS:

- **National government** to establish a nationwide second-hand materials database, building on city-level networks.<sup>13</sup>
- **National government** needs to incentivise secondary materials markets to be established and create conditions for investment.
- **National government** update waste planning policy to require space provision is made in local plans and provide funding for this.
- **National government** to introduce pre-demolition and pre-redevelopment surveys nationally to identify items for reuse and recycling, with **local authorities** providing channels to where they can be applied and stored.
- **Local authorities** should collate information on secondary material availability and storage centrally as part of a public database illustrating supply potential.
- **Local authorities** to explore local sites for the possibility of providing storage space as part of a reuse hub as well as digital options and supporting businesses which already offer these services.<sup>14</sup>
- **Local authorities** to support the growth of regional specialist circular products and services relating to the construction industry. Work with and mobilise supply chains.<sup>15</sup>

### INDUSTRY ACTIONS:

- **Investors** explore, with legal teams, contract arrangements to address risk i.e. warranty and liability for reuse products and materials. A suggested approach is that the responsibility of the product should sit with the client and the responsibility of installation should sit with the contractor even where products are taken off-site. This will be a commercial negotiation between the client and the contractor.<sup>16</sup>



- **Developers** should prioritise the reuse and retention of existing building structures within urban development sites wherever possible. They can also engage with **local authorities** and supply chains to support and drive city-level second-hand material markets to accelerate circularity and material reuse.<sup>17</sup>
- **Developers** start the process of commissioning a pre-refurbishment/pre-demolition audit if a product and material inventory has not been prepared for the building.<sup>18</sup> Pre-demolition surveys are key to identifying reuse and retention opportunities.
- **Developers** ensure the programme planning allows for materials to be removed, stored, and retrieved for reuse. Timing will be dictated by the recommendations from the audit report that is commissioned and should be reviewed again at the concept stage.<sup>19</sup> Work with the **contractor** and **project manager** if reusing on the same site.
- **Developers** establish a pre-design tender service agreement with the design team to get their input in setting the brief for reuse. This would engage discipline experts from the design team to define targets for the reuse of the existing asset based on the scheme. The service could include a site visit and sharing of the inventory data where the audit data is not available yet.<sup>20</sup>
- **Developers** and **architects** explore the use of material passports on projects. This will help make materials easily identifiable when disassembling buildings/fit-outs in the future and provide traceability. This way, a material inventory can be built to inform design teams of future material availability. This principle can also be applied to refurbishment projects, storing data so that deconstructed elements can be used in the near future.
- **Architects** and **engineers** specify the use of secondary materials where possible or specify based on performance rather than a specific product. **Developers** should encourage the reuse of materials in the project brief and agreements at each stage. Include aspirations to maximise reuse including KPIs as per recommendations from the design team, and details of reclaimed products and materials to be used within the contract and demolition/refurbishment contractor tender documentation.<sup>21</sup>
- The output from the **design team** should include targets for reuse, as well as a comparison between reusing the entire asset versus using just parts or materials.<sup>22</sup>
- **Architects, structural engineers, and contractors** all have roles throughout the stages of increasing project detail (initial high-level site appraisals through to detailed demolition planning). A requirement should be made for the demolition/refurbishment contractor to review the audit and inventory data and provide comments. The products and materials identified for reuse within the development should be specified to be carefully disassembled and stored.<sup>23</sup>
- **Architects** and **engineers** review material inventory data (or audit data) and project brief with reuse targets to identify potential options for reuse within the new scheme and see where further investigation or information is required. Incorporate reclaimed items within design whilst also factoring in opportunities for ensuring that the reuse of products and materials allows for further disassembly in the future. This should also feature in the performance specifications or structural engineer's scope.<sup>24</sup>
- **Occupiers** can add to the tenancy agreement whereby the tenant must notify the Facilities Estate Manager of any changes that will be made to the building during the lease. This process enables any unwanted materials to be sent for onward reuse and new materials to be added to the inventory.<sup>25</sup>
- **Occupiers** should regularly maintain the inventory and update the data management tool (spreadsheet, online library, BIM, material passports). This should be updated with reuse from maintenance and the space plan such as furniture.<sup>26</sup>
- **Demolition contractors** should recover products and materials for reuse as identified in the contract documents. Ensure all elements are intact, not damaged, and stored in a secure place.<sup>27</sup>
- **Contractors** carry out detailed pre-refurbishment and pre-demolition audits, to ensure that existing materials can be kept at their highest value.<sup>28</sup> The proposed deconstruction methodology should be included in the Operation & Maintenance manual along with final construction information indicating all elements in the new asset. This will provide the basis for the material and product inventory. If BIM were used, the model should be included in the handover.<sup>29</sup>
- **Contractors** work with the supply chain to identify opportunities and relationships for procuring reused materials. Ensure products are installed to enable future reuse.
- **Manufacturers** and **contractors** work to create takeback schemes for refurbishment, resale, and recycling of their products or work with third parties to provide these services.<sup>30</sup>
- **All stakeholders** share the reuse information with the quantity surveyor (QS) and identify cost-saving opportunities for the project i.e. cost benefit of material reuse. This should be factored into the overall cost analysis by the **quantity surveyor**. The information should also demonstrate energy and carbon savings.
- **Manufacturers** should provide material passports for products/assemblies/fabricated elements which align with [BAMB best practice guidelines](#).





# Circular economy design principles

An architecture characterised by reversible connections, allowing buildings and components to be taken apart in a way that allows for future reuse or lengthens the building's life by being flexible and adaptable.

This should be considered within the wider context of circular economy design principles, as outlined in UKGBC's [Circular Economy Guidance for Construction Clients](#) and [Insights on how Circular Design Principles Can Impact Carbon and Value](#).



### Related enablers:

-  Secondary materials market
-  Education

### Barriers it addresses:

#### Limited availability of secondary materials.

Current buildings are not designed to be deconstructed, so construction materials are damaged during deconstruction or just demolished, rendering potential onward reuse difficult.

#### Design as barrier to future refurbishment.

Flexible and adaptable approaches to refurbishment, redevelopment, and repair are partly prohibited by a construction design that does not focus on the ability to be adapted, or partially or fully disassembled, making demolition or partial demolition more likely.

**Tight construction programmes.** Clients have strict programmes and cost drivers, conflicting with deconstruction which takes more time and is often, initially, more expensive. The whole picture is not addressed if the value of salvaged materials from deconstruction is neglected.

### How it helps overcome them:

A deconstructable architecture that uses reversible connections over compound materials creates the basic conditions to enable the onward reuse of materials by making it easier to salvage materials without damage. This makes building design in response to secondary material availability more likely. By designing in layers according to their lifespan, the full potential of circular design principles can be harnessed. While structural elements are likely to last for decades and beyond, short-life layers such as building services and fit-out need to be circulated more often. Design for flexibility and adaptation ensures a building remains fit-for-purpose and premature demolition can be avoided.

### Stakeholder actions:

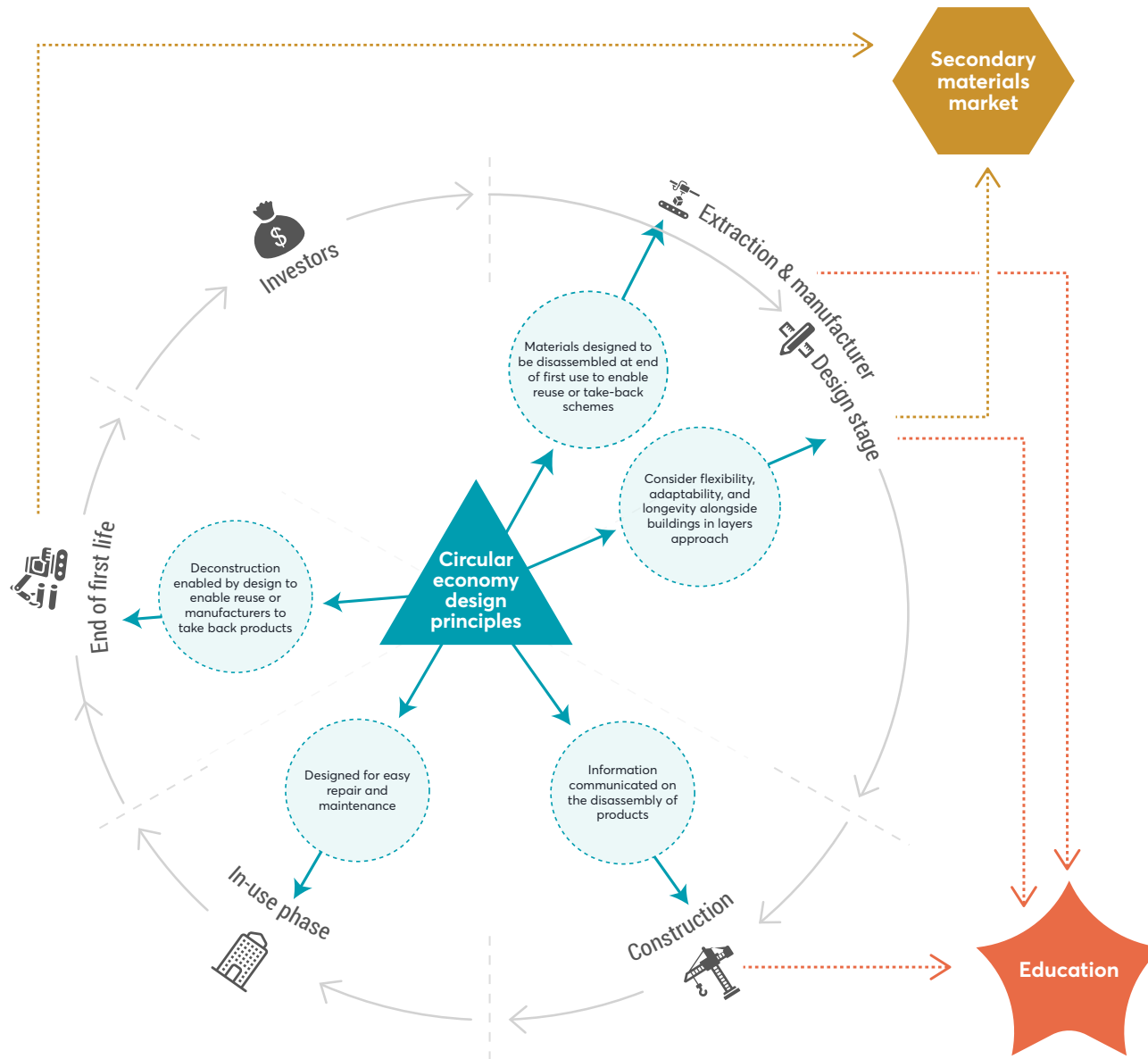
#### POLICY ACTIONS:

- **National government** to develop an extended producer responsibility policy (as per EEEE or End of Life Vehicle Directive) ensuring take-back schemes or mass balance recycling initiatives are in place.
- **National government** should incentivise the use of circular design principles and work with **local authorities** to have policies supporting this. A national circular economy planning framework policy should be developed.
- **Local authorities** should require all developments to demonstrate design stage actions taken to reduce embodied carbon throughout the life cycle of the building and maximise opportunities for reuse through the provision of a Circular Economy Statement.<sup>31</sup>
- **Local authorities** should support the growth of regional specialist circular products and services relating to the construction industry, working and mobilising supply chains.<sup>32</sup>

#### INDUSTRY ACTIONS:

- **Investors and agents** should understand and communicate the benefits of design for disassembly to the asset owners.
- **Developers** should adopt circular economy design principles and construction processes for residential, commercial, and major infrastructure projects.<sup>33</sup>
- **Clients** should evaluate circular economy design principles and set out clear objectives in contracts and track performance (Refer to UKGBC publications [Circular Economy Guidance for Construction Clients](#), [Implementation guides](#), [Insights on how circular economy principles can impact carbon and value](#)).

FIGURE 7: CIRCULAR ECONOMY DESIGN PRINCIPLES



- **Design team, contractors, and clients** should develop technical guidance for deconstruction and reuse and ensure necessary information/documentation (and BIM if available) is handed over to facility management, owners, and occupiers.
- **Design teams** need to use circular economy design principles to avoid composite materials and chemical fixings, opting for reversible, mechanical connections wherever possible and design in layers (see UKGBC’s publications on [Circular Economy](#) for more information, [Circular Economy Guidance for Construction Clients](#)).
- **Architects and engineers** should prioritise reuse, demonstrating to clients how the existing structure or sub-structure can be retained whilst still achieving site development potential. **Structural engineers** should proactively identify opportunities to utilise reused structural elements and design for disassembly, and advocate for maximum re-use of existing building structure/substructure (and if structures must be demolished, advocate for controlled deconstruction over demolition to maximise reuse potential of structural components).<sup>34</sup>
- **Occupiers** need to adopt circular economy design principles (e.g. as part of fit-out) and ensure materials are reused where possible. Engage in the reuse market.
- **Manufacturers** should design products in a way that disassembly and take-back are possible in the future with reuse or components split for recycling at end of use.<sup>35</sup> Manufacturers should provide information to design teams and contractors on end-of-life options for their products. All **material manufacturers** should develop embodied carbon reduction plans for their products and operations, focusing on reducing materials, energy usage, manufacturing waste, packaging, and transport needs.<sup>36</sup>




# D Green contracts and leases

Expand traditional contracts and leases with legally binding clauses that set requirements on circularity, carbon, and wider sustainability.



#### Related enablers:

-  Collaboration and early engagement
-  Secondary materials market
-  Circular economy design principles

#### Barriers it addresses:

**Circular economy actions outside of the stakeholder's scope.** Due to the fragmentation of processes and responsibilities in the built environment, the ambition of one stakeholder might not necessarily impact the actions of another. For example, a building can be designed according to circular economy principles, but the fit-out falls into the occupier's responsibility and might favour non-circular options.

**Short-term nature of ownership and occupancy.** Owners and occupiers don't have a vested interest in the end-of-life of buildings and fit-outs if it falls outside of their responsibility, leading to best practice approaches of a circular economy not being implemented.






#### How it helps overcome them:

Green contracts and leases ensure that the client's aspirations are extended to the leaseholder. They place an obligation on the landlord and tenant to cooperate on environmental and sustainability issues in order to promote and improve the Environmental Performance of the building. Green contracts hold parties accountable to a set of agreed clauses, in this case on sustainability and circularity. Mainstreaming these kinds of contracts and leases will also support the development of a culture of saying no to engaging with unsustainable practices, raising the bar for the industry as a whole.

#### Example application

### The Chancery Lane Project

The Chancery Lane project is an international initiative collaborating to develop contracts that are integrated with sustainability objectives. They create publicly available, legally sound contract clauses that anchor sustainability considerations via legally binding contracts. Find below some examples of clauses related to circularity:

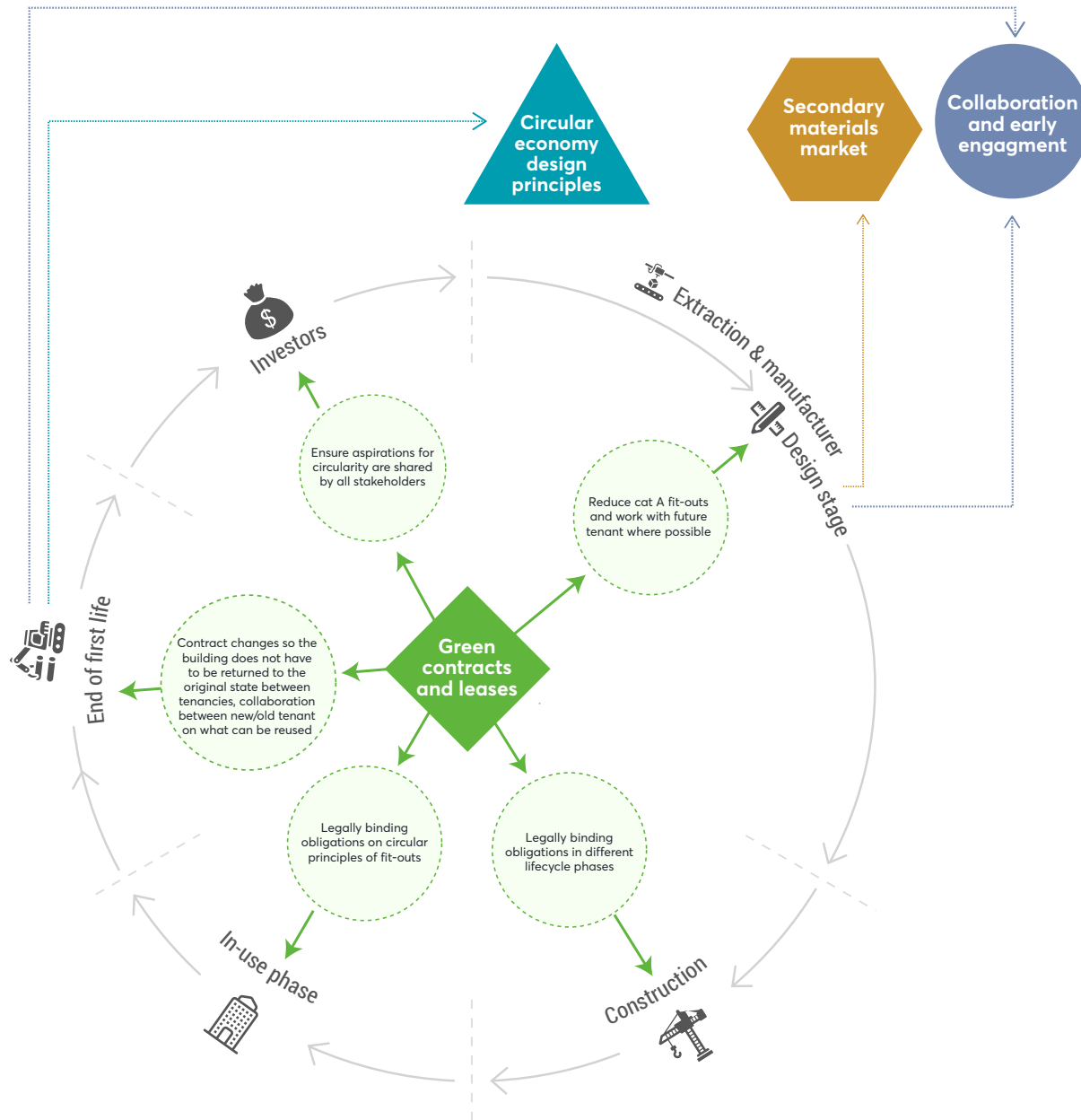
-  [CE principles in leasing arrangements for repairs and alterations](#)
-  [Measuring carbon budget in procurement of construction projects](#)
-  [Climate aligned construction waste management](#)
-  [Resilient landscape design](#)
-  [Water audits in supply chain](#)

#### Guidance:

### Better Buildings Partnership Green Lease Toolkit

This toolkit aims to guide owners and occupiers to come to suitable agreements for their circumstances, based on best practice recommendations. It offers pre-established green lease clauses that can be included in new leases. In addition to owners and occupiers, letting agents, lawyers, and managing agents will find useful information in [this toolkit](#).

FIGURE 8: GREEN CONTRACTS AND LEASES



**Stakeholder actions:**

**POLICY ACTIONS:**

- **National government** to review Landlord & Tenant Act 1954 to require by law that all new business leases include green lease clauses, the standards of which should be developed with industry.<sup>37</sup>

**INDUSTRY ACTIONS:**

- **Owners and developers** to develop alternatives to Cat A fit-out wherever possible.
- **Owners** should embrace green contracts and leases for their assets. These might include clauses on fit-out, waste avoidance, restrictions on material selection, or responsibilities for deconstruction at the end of the lease.
- **Owners and occupiers** should add a clause to the tenancy agreement whereby the tenant must notify the Facilities Estate Manager of any changes that will be made to the building during the lease. This process enables any unwanted materials to be sent for onward reuse and new materials to be added to the inventory.<sup>38</sup> This could also be achieved by requiring material passports to be used.
- **Industry** to develop green clauses to be inserted into standard leases with **landlords** and **tenants** working cooperatively to share data and improve data collection.
- **Occupiers** need to move away from the expectation of full autonomy on fit-outs and embrace green leases and contracts.






# E

## Tax and legislation

Tax, legislation, and policy that direct industry and markets towards circularity by addressing the true cost and value of materials and helping circular approaches and businesses to grow.



### Related enablers:

-  Secondary materials market
-  Circular economy design principles
-  Green finance

### Barriers it addresses:

**Low taxes on resources favour a linear economy.** Resources are cheap and do not reflect the real cost of using them, as externalities such as environmental damage, carbon emissions, and scarcity are not sufficiently factored in.

**VAT currently incentivises new buildings over retrofit.** At present, the standard rate of 20 percent is charged for most repair and maintenance work, while demolition and new buildings come with a zero percent rate.

### How it helps overcome them:

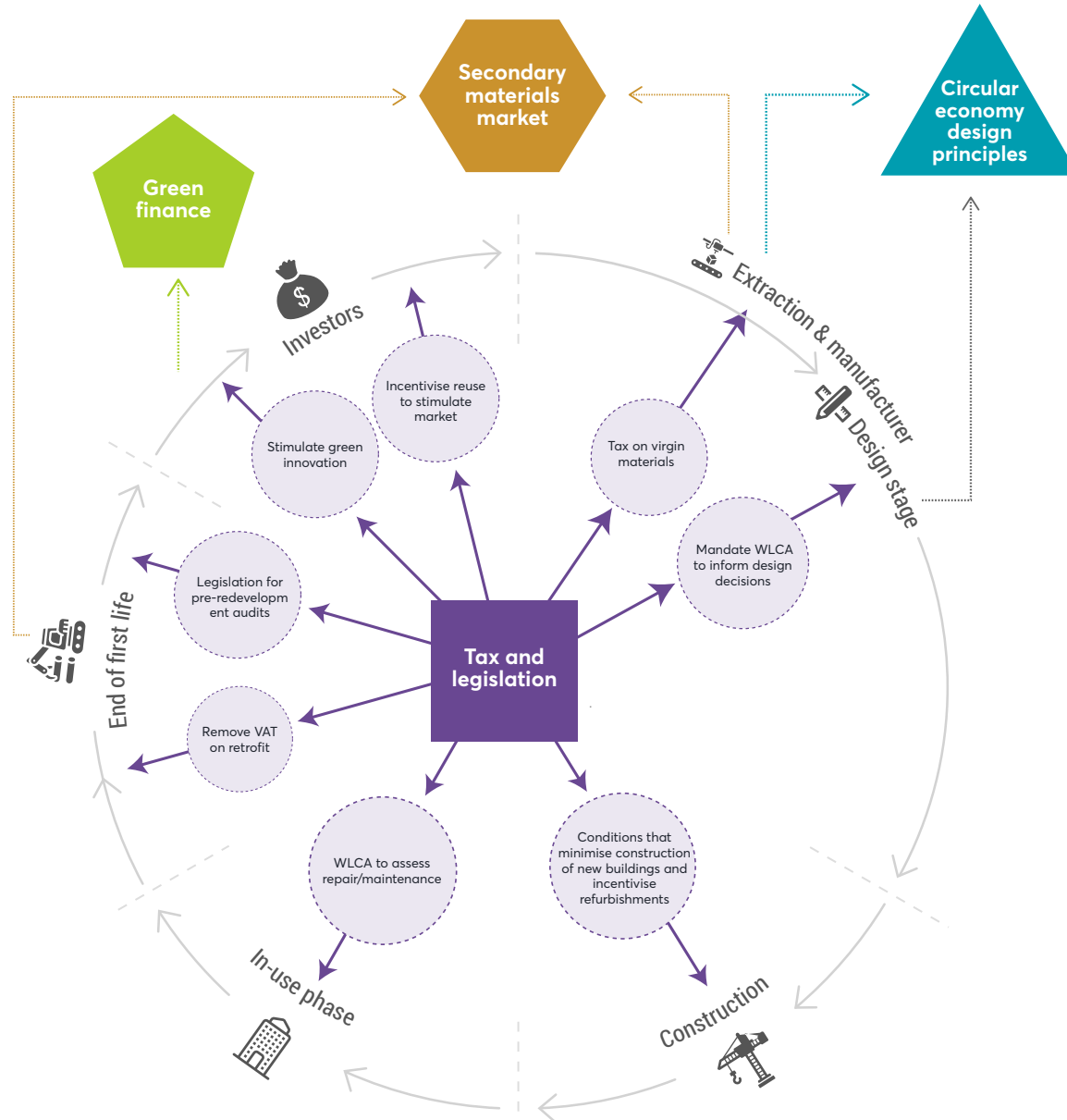
A tax system that encourages resource-efficient decisions rather than penalising them will provide the right conditions to transition investment from new developments towards more retrofit. Taxing virgin materials higher than secondary ones can be a powerful financial lever to promote a shift from a linear built environment to a circular one.

### Stakeholder actions:

#### POLICY ACTIONS:

- **National government** should lower VAT on retrofits to 0% which retain the building's structural frame and achieve energy performance targets (to incentivise reuse over demolition) - while proportionally increasing the VAT on new builds to make this change fiscally neutral.<sup>39</sup>
- **National government** should consider a virgin materials tax (on certain materials) to push for reused and regenerative materials.
- **National government** should set minimum standards (limits) for Upfront Embodied Carbon by 2025 for large buildings (>1,000m<sup>2</sup>) in more mature sectors (i.e. those with sufficient asset level benchmark data) with associated fiscal incentives and penalties.<sup>40</sup> The [UKGBC Whole Life Carbon Roadmap](#) outlines further building types and targets.
- **National government** to develop an extended producer responsibility policy (as per IEEE or End of Life Vehicle Directive) ensuring take-back schemes or mass balance recycling initiatives are in place.
- **Local authorities** should require Circular Economy Statements (see London's CE Statement policy).
- **Local authorities** should have a minimum percentage of secondary materials as a planning requirement to give certainty to the market for secondary materials and drive investment in materials passports and reuse hubs.
- **Local authorities** can help to implement the embodied carbon restrictions with Whole Life Carbon Assessment (WLCA) reporting.

FIGURE 9: TAX AND LEGISLATION



**INDUSTRY ACTIONS:**

- **Developers** should include targets for embodied carbon and material reuse alongside operational energy intensity targets in project briefs. Whole Life Carbon should be established as a first-order consideration within initial site development appraisals. This will usually result in the prioritisation of refurbishment and/or extension, as opposed to demolition and new build.<sup>41</sup>
- **Contractors** will need to work with their supply chains and **material manufacturers** to set carbon intensity reduction targets, require mandatory disclosure of supply chain data, and track and reduce construction site emissions. Carbon should be evaluated alongside cost in all value engineering exercises.<sup>42</sup>
- **All product manufacturers** should develop embodied carbon reduction plans for their products and operations, focusing on reducing materials, energy usage, manufacturing waste, packaging, and transport needs.<sup>43</sup>



# F

## Green financing

Using the scale, reach and expertise of private sector investors, banks, and the financial services sector to stimulate and support businesses to make the shift from a linear to a circular economy.



### Related enablers:

-  Collaboration and early engagement
-  Secondary materials market
-  Circular economy design principles
-  Tax and legislation

### Barriers it addresses:

**Business-as-usual is cheap.** In many cases, tapping into the existing linear system is the quicker and cheaper option compared to more innovative pathways.

**Insurance currently favours the linear economy.** Finance is an essential enabler for the transition to a circular economy but investment in circular activities remains far below the necessary levels. Regulations, markets, investment tools, and practices, including financial risk assessment, are adjusted to linear models, and risks linked to linear business models are largely not taken into account. The circular economy is still an immature market and risks are perceived as high. Many circular economy models are difficult to evaluate from a risk perspective and many circular solutions require collaboration across value chains.

**Linear financial models.** Traditional financial assessment methods and current financial systems tend to favour conventional linear business models and are not aligned with the purpose of retaining the value of materials by reusing them. Ideally, banks should adopt a holistic approach and finance the value chain. However, banks typically finance single entities, risks and profits are unevenly divided within the value chain and, therefore, this holistic approach is hard to accomplish.

**Unpriced externalities.** Since negative environmental impacts are often not factored in, the true cost remains hidden, making harmful materials and practices appear cheaper than they should be compared to if costs had been assessed holistically.

### How it helps overcome them:

The shift to a circular economy requires long-term investment and sustained financing. The finance industry can, for example, provide resources for circular investments, offer insurance products suitable for circular

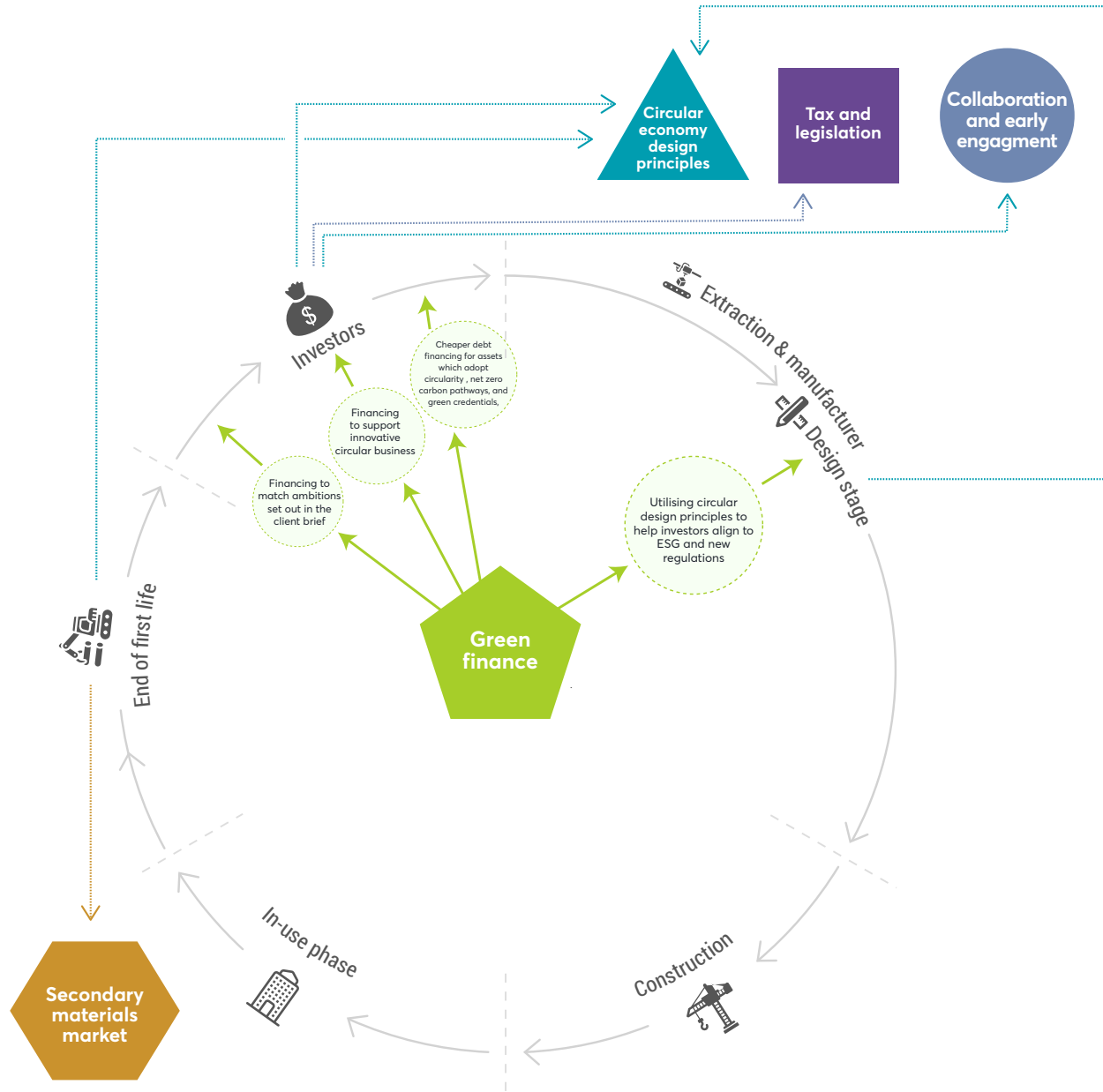
practices, such as leasing and sharing, and develop rating systems and information disclosure requirements that can help improve transparency around sustainability-related business risks. There has already been a steep increase in the creation of debt and equity instruments related to the circular economy, however, far more capital and activity will be needed to scale the circular economy and fully seize the opportunity it presents across the built environment. The role of finance in accelerating the circular economy transition is expected to continue to strengthen, as lenders and investors seek to capitalise on new value opportunities across their value chains as well as mitigate and reduce costs from regulatory risks.

### Stakeholder actions:

#### POLICY ACTIONS:

- **National government** has a key role to play in strengthening domestic policy frameworks to catalyse and mobilise private finance and investment in support of circularity.
- **National government** should invest in circular economy activities and innovation, enhance transparency by mandating disclosure and standardising definitions and metrics for circular activities and provide an enabling environment that can attract both domestic and international investment.
- **National government** should develop reporting standards for the linear risks of investments and incorporate them into standard accounting practices.
- **National government** should develop a definition of circular economy finance, setting criteria and benchmarks for the environmental performance of circular economic activities, labelling financial instruments fit for financing circular economy projects, and increasing awareness and knowledge of the circular economy across the financial sector.

FIGURE 10: GREEN FINANCE



**INDUSTRY ACTIONS:**

- **Banks and financial regulators** should integrate circular principles into risk assessments and modelling, and could explore integrating them in less conventional methods such as green quantitative easing. Blended finance solutions, combining public, private, and philanthropic capital, and adopting more favourable financing terms, can fund harder-to-finance circular economy infrastructure and long-term innovation. Banks and other lenders can also raise awareness through dialogue with clients.
- **Investors** will need to champion their key role in financing the transition to a circular economy, offering the potential for competitive returns while reducing waste, preserving natural resources, and addressing climate change.
- **Owners** should consider circular economy design principles across the life cycle of ownership and as part of due diligence and asset management can help support ESG objectives, deliver value and mitigate against physical, transition, and systemic climate risks.
- **All industry stakeholders** should integrate circular economy design principles, which can help investors align with new sustainable finance regulations (TCFD, SFDR) and deliver on regulators' and stakeholders' expectations.






# Metrics, benchmarks and indicators

Enabling the industry to measure progress by having a consistent set of metrics in place, with benchmarks and targets to drive an uptake in circular economy principles.



### Related enablers:

-  Secondary materials market
-  Circular economy design principles
-  Education

### Barriers it addresses:

**Lack of common goal.** There is currently no industry consensus on how to measure circularity consistently, resulting in the lack of a shared industry goal to work towards on circularity. Circular economy approaches are currently disjointed and incomparable.

**Lack of ability to audit.** Claims around circularity are currently not being assessed independently, leading to varying and unverifiable claims around the circularity of buildings. More companies are embracing circular economy reporting tools and standards, such as GRIs updated 306: Waste standard, WBCSD's Circular Transition Indicators, and the Ellen MacArthur Foundation's Circulytics. However, there remains a significant capacity gap among businesses to meaningfully monitor and report on circularity.

### How it helps overcome them:

A commonly shared set of metrics and indicators, supported by achievable yet ambitious targets will help drive industry action, similar to the carbon targets that emerged in recent years. While metrics alone will not be able to deliver systems change, they provide comparable insights on the status quo of circularity in the built environment, and allow us to measure progress against a baseline, towards an ambitious aspiration.

### Stakeholder actions:

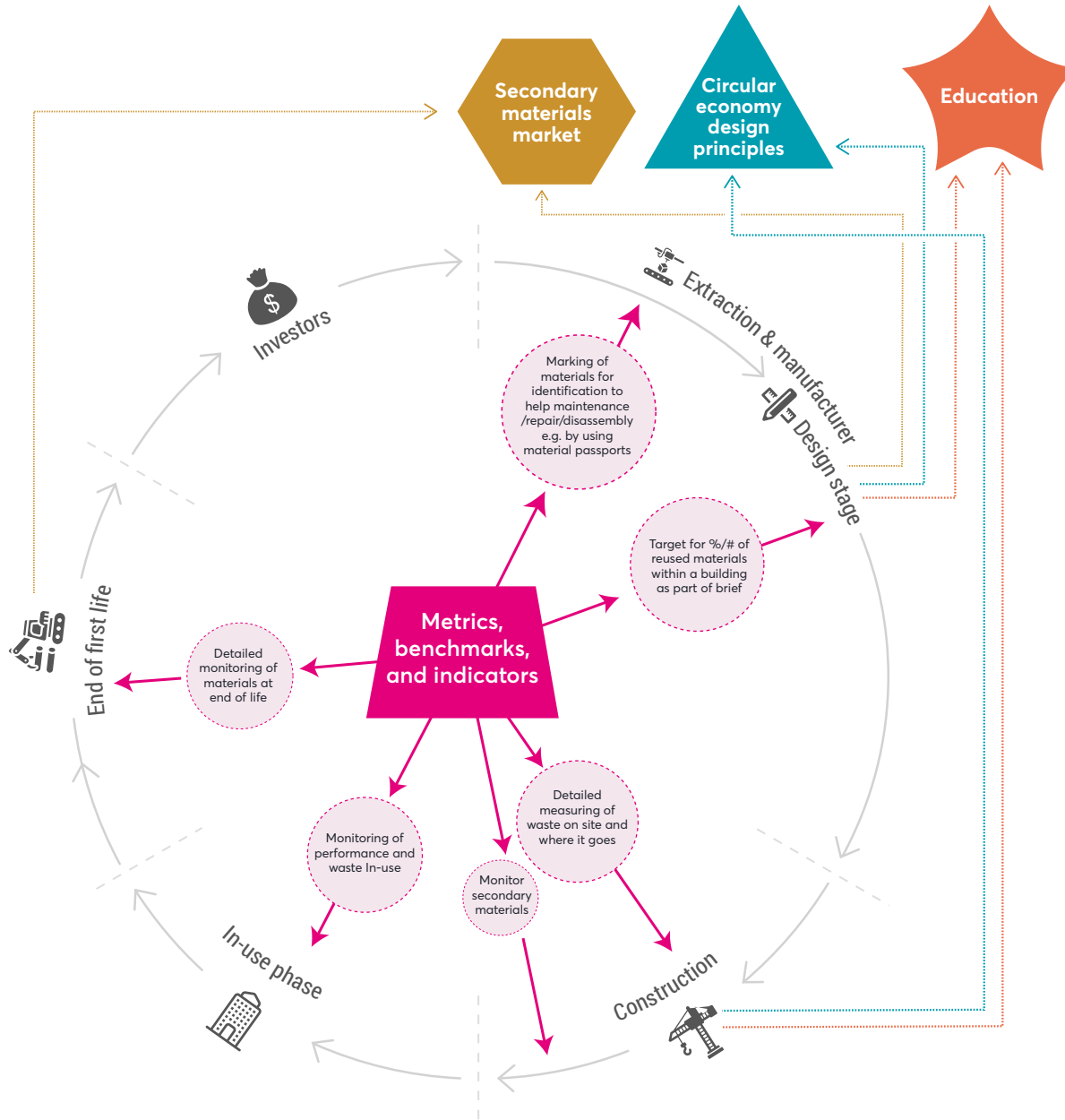
#### POLICY ACTIONS:

➤ **National government and local authorities** should support requirements for WLC data to be collected (see [Part Z](#)). Support the industry in measuring and reporting to help build a database. Set whole life carbon targets with policies that incentivise reuse and regenerative materials.

#### INDUSTRY ACTIONS:

- **All stakeholders** will need to work towards a consistent reporting format and data to allow consistent and comparable data and reporting.
- **Clients, architects, and engineers** should collect and report circularity-related metrics on your projects. **Manufacturers** should do the same for their products.
- **Developers, architects, engineers, contractors, and product manufacturers** all need to increase data transparency via central databases. Data ownership will vary across each stakeholder, requiring a comprehensive effort across the value chain.<sup>44</sup> Quantify the benefits of implementing circular economy approaches on the project.
- **Occupiers and facility managers** need to generate and improve datasets relating to embodied carbon from the use stages of buildings. While a significant share of embodied carbon occurs during refurbishment, repair, and maintenance, the data for this is less prevalent. As with domestic retrofit, non-domestic refurbishment approaches to improving energy performance should be assessed through a whole life carbon lens.<sup>45</sup>
- **Contractors and demolition contractors** should track and report waste data with more granularity.

FIGURE 11: METRICS, BENCHMARKS, AND INDICATORS












# H

## Education

Empowering practitioners and decision-makers with the necessary knowledge to be able to implement circular economy more widely within their work and raising awareness more widely on what is achievable.



### Related enablers:

-  Collaboration and early engagement
-  Secondary materials market
-  Circular economy design principles
-  Green contracts and leases
-  Tax and legislation
-  Green finance
-  Metrics, benchmarks and indicators

### Barriers it addresses:

**The educational skills gap** between reusing, upcycling, and downcycling and the different impacts this can have along with the ability to implement solutions.

**Lack of knowledge of circular design principles.** It is not widely taught or understood how looking at different circular economy design principles can benefit the project depending on its use and make it easier to adapt and deconstruct buildings which can enable further uses of the building and the materials.

**Lack of knowledge on how a circular economy can be beneficial financially.** Seeing buildings as material banks and urban mining can be beneficial to asset owners as they can mean the materials have more value at end of use as they can be sold to be used in future projects.

**Lack of knowledge on carbon and resource intensity of the linear economy.** Awareness of the importance of a circular economy to remain within planetary boundaries is not widely shared among professionals.

**Siloed knowledge.** Expert knowledge is not commonly shared widely between actors across the supply chain. Furthermore, there is insufficient collaboration and exchange between circularity and carbon reductions, as well as the relationship between a circular economy and building for climate resilience and adaptation.

**Perceived cost and risk** rather than real costs and risks often prevent circular principles from being implemented.

### How it helps overcome them:

Sharing best practice and educating every part of the supply chain, industry, and government with the necessary knowledge to transition toward a circular economy. This includes creating a common vision with buy-in from all stakeholders to work towards the emerging future of Horizon 3. Organisations should invest in training for their employees as well as allowing for learning through experience and experimentation to put ideas into practice while upskilling the industry at the same time. Strong collaboration across the industry will be required.

### Stakeholder actions:

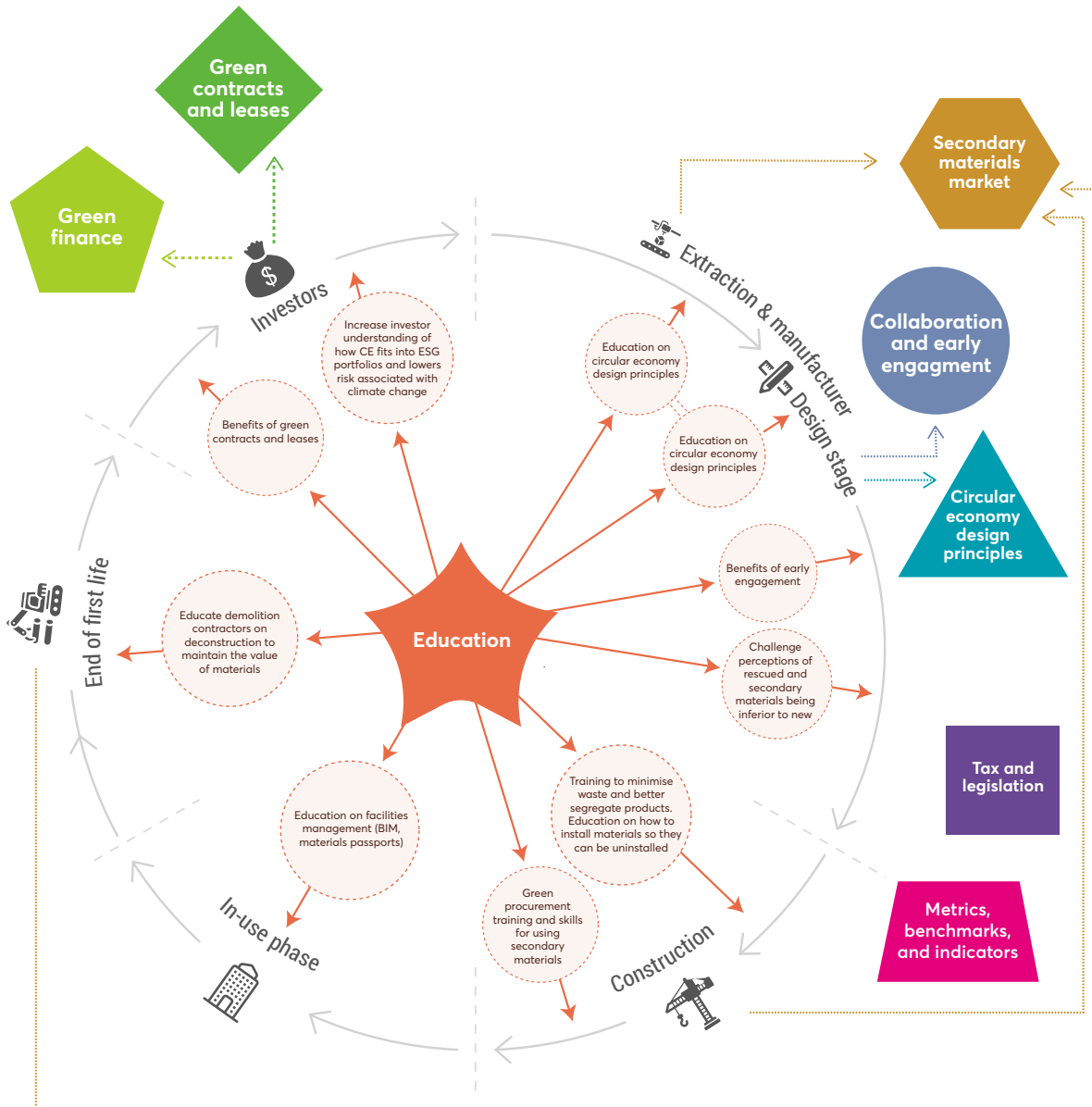
#### POLICY ACTIONS:

- **National government** should send a clear message to the industry on the direction of travel to provide the conditions for increased education and investment in a circular economy.
- **Local authorities** should upskill on expertise and the importance of circularity and whole life carbon in planning applications and the benefits these bring, environmentally, socially, and economically.
- **Local authorities** should perform a skills mapping to identify skills necessary to support the transition to a circular economy and have a policy to support filling the gap.<sup>46</sup>

#### INDUSTRY ACTIONS:

- **All stakeholders** should implement net zero carbon skills and training plans supported by **professional institutions**, to establish carbon literacy among all students and staff.<sup>47</sup> This should also include circular economy design principles and retrofit competency requirements. This applies to **all built environment stakeholders**, not just sustainability professionals.

FIGURE 12: EDUCATION



- **Professional institutions** can help with skills mapping and provide training on key topics as standard to bring up the level of the industry.
- **Business associations** and **NGOs** should work with businesses on sustainability to help with sharing and dissemination of practical learning and best practice.
- **Developers, investors, and agents** need to understand the value of materials through buildings as materials banks - materials as assets.
- **Architects and engineers** need to consider the use of different design principles in the brief dependent on the expected use and lifespan of the building and educate clients on circular economy design principles and how they may benefit the longevity of the building and create value.
- **Architects** should help make reused materials mainstream by educating clients and developers on misconceptions about the aesthetics of reused materials.
- **Architects and engineers** need to work with **contractors** to understand how the design choices and specifications will impact the disassembly of buildings and fit-outs and work with each other to educate the team on how materials should be salvaged to maintain their condition.
- **Demolition contractors** need to become deconstruction contractors who are skilled in deconstructing the whole range of products, each element will need specialist knowledge. Receive training from **contractors** and **manufacturers** on how materials should be installed and uninstalled so that they can be reused, including training on how to repair and increase the lifespan of products.
- **Contractors** and **demolition contractors** should seek further education to understand the value of materials and implications on their reuse vs recycling.
- **Cost consultants, quantity surveyors, and project managers** will need to ensure that circularity as well as carbon is evaluated alongside cost in all value engineering and optioneering exercises.<sup>48</sup>
- **Engineers and manufacturers** should work with **insurers**, so they are aware of how the disassembly and re-testing/warranty occurs. Carrying out due diligence and sharing information with the insurers may help to de-risk reused items, and overcome barriers that are rooted in perception only.
- **Educational institutions** explore circular economy design principles within university-level design courses including design for disassembly and how this can enable reuse and save resources.
- **All stakeholders** lobby and educate government policymakers on long-term thinking.





# Conclusion

The resources of our planet are finite, yet our economy is based on a linear model – a system that is bound to fail. Shifting from a linear to a circular economy is a fundamental necessity in our response to the climate and ecological emergency.

The built environment is a complex system made up of globally connected supply chains and established processes. The complexity of this system makes it challenging to adapt to meet the needs to fix our current crises. Moreover, existing infrastructure supports the current way things are done while differing and diverging visions for the future can make the direction of travel unclear.

Therefore, the transition to a circular economy cannot be achieved with some simple alterations to the status quo but will require a fundamental systems-level change in our economy and cross-industry collaboration. The Three Horizons framework is a model of systems change along short, medium and long-term timelines, which help us to work out how to prioritise our actions now and in the future.

This report has examined the current state of the industry from a systems perspective (H1), identifying some practical industry enablers that are currently emerging (H2) and must be implemented to set us on the necessary path to achieve a regenerative circular economy (H3).

The eight industry enablers identified in this report can support this much-needed shift, acting as tipping points toward a circular future by overcoming key barriers and unlocking circular opportunities. Supported by stakeholder actions, they propose achievable solutions,

bringing us closer to an emerging new way of doing business in the built environment.

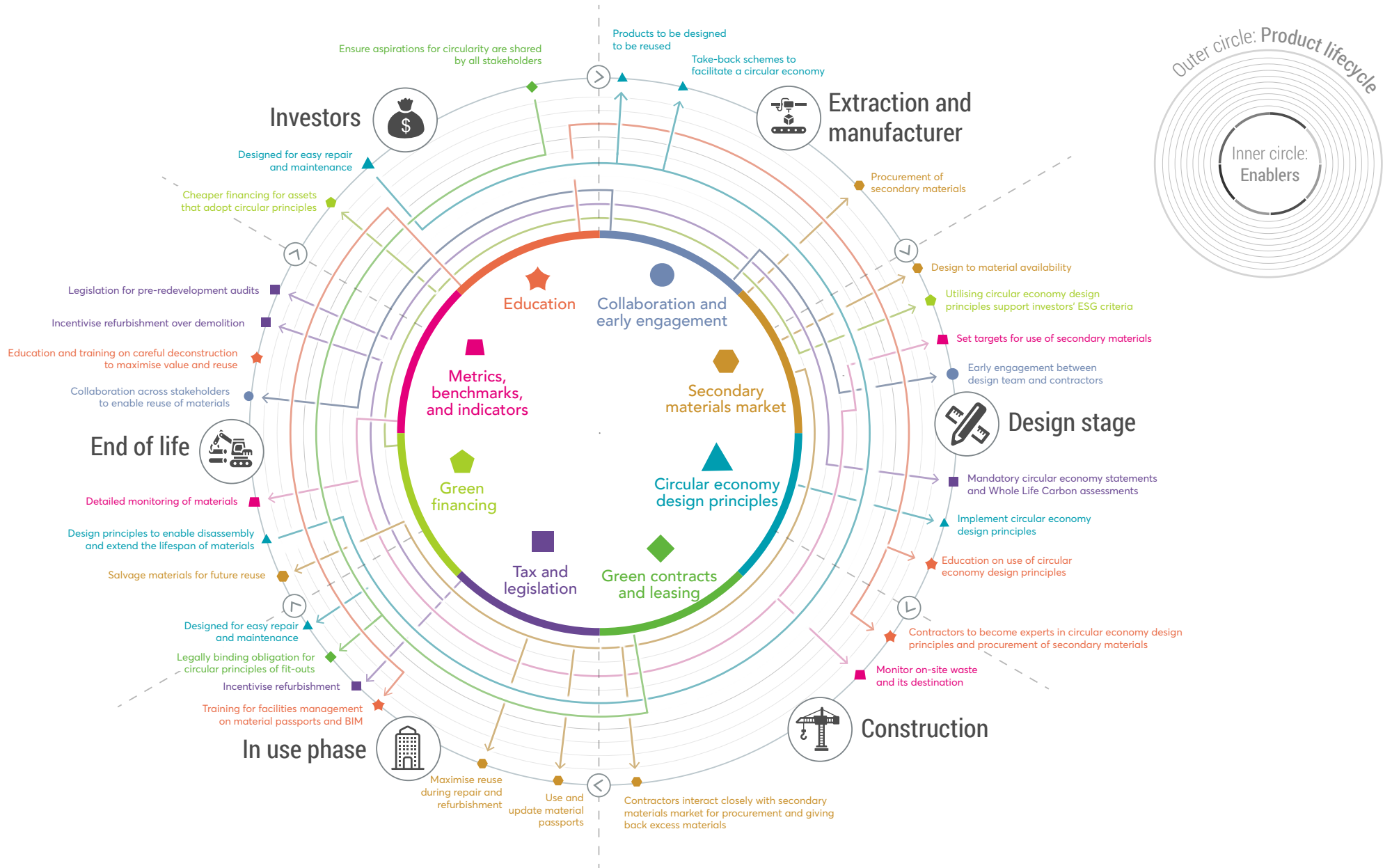
Many of the solutions are already out there. Green contracts and leases are available to be implemented, take-back schemes of construction products are being offered, and circular economy design principles are more regularly being implemented in recent architectural designs. Many are already pioneering a more collaborative approach with contractors being increasingly consulted at the early stages of the design.

Other solutions, such as reuse hubs and material passports are in their infancy and will require concerted industry efforts to develop and become mainstream. As a call to action, this report outlines a set of policy and industry actions for all levels of the value chain to rally behind these enablers and deliver the necessary pieces of the puzzle so they can become the new business-as-usual in a circular built environment.

Transitioning to a circular economy will be a crucial element in tackling the ecological and climate crises. The built environment must drastically reduce its resource use in a short period of time; embracing complexity, novel approaches and business models will be required across all stakeholders of the built environment to deliver this.



FIGURE 13: INDUSTRY ENABLERS SUMMARY



# Acknowledgments

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**ROCKWOOL** – Kathryn James

**Tata Steel** – Matthew Teague

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## Programme Partners



## Project Partner



## Supported by



# Endnotes

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