UNIVERSITY OF CAMBRIDGE
INSTITUTE FOR SUSTAINABILITY LEADERSHIP

# Innovation for Sustainability

## The driving force of circular economy start-ups

清华大学产业发展与环境治理研究中心
Center for Industrial Development and Environmental Governance
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CIDEG

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**Acknowledgements**

The research was partially grant funded by the Tsinghua–Cambridge Joint Research Initiative. The authors would like to sincerely thank Prof. Henning Sirringhaus and Dr Jingcheng Hou at the Strategic Partnerships Office for their support, as well as colleagues from Tsinghua University: Yun Li, Jiakun Zhao, Runbin Wang for their contributions to the research.

Thanks to Eliot Whittington, James Cole and Bianca Drotleff for their comments and suggestions.

Thanks also to Dr Adrian Lucas, Alison French, and Anne Sorkamo for their editorial and design support.




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| | |
|---|---|
| B2B | business to business |
| B2C | business to consumer |
| C2C | consumer to consumer |
| CBM | circular business model |
| CE | circular economy |
| EBITDA | Earnings Before Interest, Tax, Depreciation and Amortisation |
| EC | European Commission |
| MSME | micro, small and medium-size enterprise |
| NGO | non-governmental organisation |
| R&D | research and development |
| ROI | return on investment |
| SME | small and medium-size enterprise |

# Executive summary

**Circular Economy (CE) is often heralded as a panacea with potential to achieve 'green' growth by decoupling economic activity from the consumption of finite resources and negative ecological impacts. It has gained momentum both among policy makers and corporations globally. However, the implementation of CE is still low and no major shift towards it has yet occurred.**

It is widely acknowledged that the transition to a circular economy is challenging due to the complexity of global supply chains[1] and fragmented markets. As a result, many companies are merely focusing on easier or fashionable isolated areas, such as recycling or downcycling. Building the circular economy requires innovative solutions that transform industries through new materials, energy and ingredients alongside new business models, product designs, logistics and recovery solutions. In recent years, there has been a growing momentum of CE entrepreneurial activity with significant investment being made into start-ups with innovative and circular solutions. In addition, small ventures are willing to rapidly adopt the necessary radical shifts in business models, so they are well placed to accelerate the circular economy transition.

Despite the growth in the number of circular start-ups, they have not been studied extensively to date. This exploratory and empirical study aims to better understand the role of entrepreneurship in a circular economy transition through qualitative methods, conducting semi-structured interviews with 60 start-up founders from various sectors. In addition, this research-based publication also aspires to share insights into the key characteristics of innovative circular businesses seeking commercial success and societal changes that would not be possible through classic commercial strategies. Understanding the strategies these entrepreneurs employ can increase the chances that others will succeed and inspire more circular innovation. To achieve this, the study explores the motivations that drive the entrepreneurs to set up businesses, value propositions and business models, as well as challenges they have faced, and how they overcome adversity. The findings have been analysed qualitatively and categorised in four themes: **people**, **context**, **business model**, and **challenges/ barriers**.

We first investigate the **people** element (Chapter 3), focusing on the entrepreneurs behind circular start-ups. Our findings show that they possess strong intrinsic motivations, personal values, and passion for the circular economy. These common threads are powerfully illustrated with excerpts from selected interviews with start-up founders. Coupled with a holistic view of circularity, they can be driving forces behind the transition to a CE.

Next, the **business models** taken by entrepreneurs among the interviewees sample can be mapped onto five categories: platform-based, design-based, waste-based, service-based, and nature-based models,[2] which are further elaborated in Chapter 4. CE start-ups identified the challenges of operating within the current, predominantly linear, manufacturing and supply chain world, requiring novel strategies to create effective collaboration. Our study found three key strategies that these start-ups are using to achieve impact beyond their size:

- Building connectivity and enhancing traceability, enabled by digitalisation,
- Collaborating and sharing in a way that helps grow the market without sacrificing their competitive position,
- Vertical, horizontal and impact expansion.

However, strategies alone cannot guarantee success. Most start-ups shared challenges in growing their business in addition to wanting to trigger change in traditional industries. To increase their chances of success, they need to better understand **the context in which they operate**. Chapter 5 investigates key factors which could influence business success or failure, including:

- CE regulations,
- consumer awareness,
- competing with the conventional linear market,
- investment, and
- forging cross-industry partnership.

Although the notion of circular economy is easy to relate to and understand in theory, complexity reveals itself in practice. Circular start-ups face many **challenges and barriers** (Chapter 6) that are common to any new business. Additionally, they are confronted with challenges that are specific to their circular products and business models in the following areas:

- financial and economic viability,
- unintended consequences and rebound effects,
- organisational aspects,
- engaging with the supply chain, and
- deploying innovative technology.

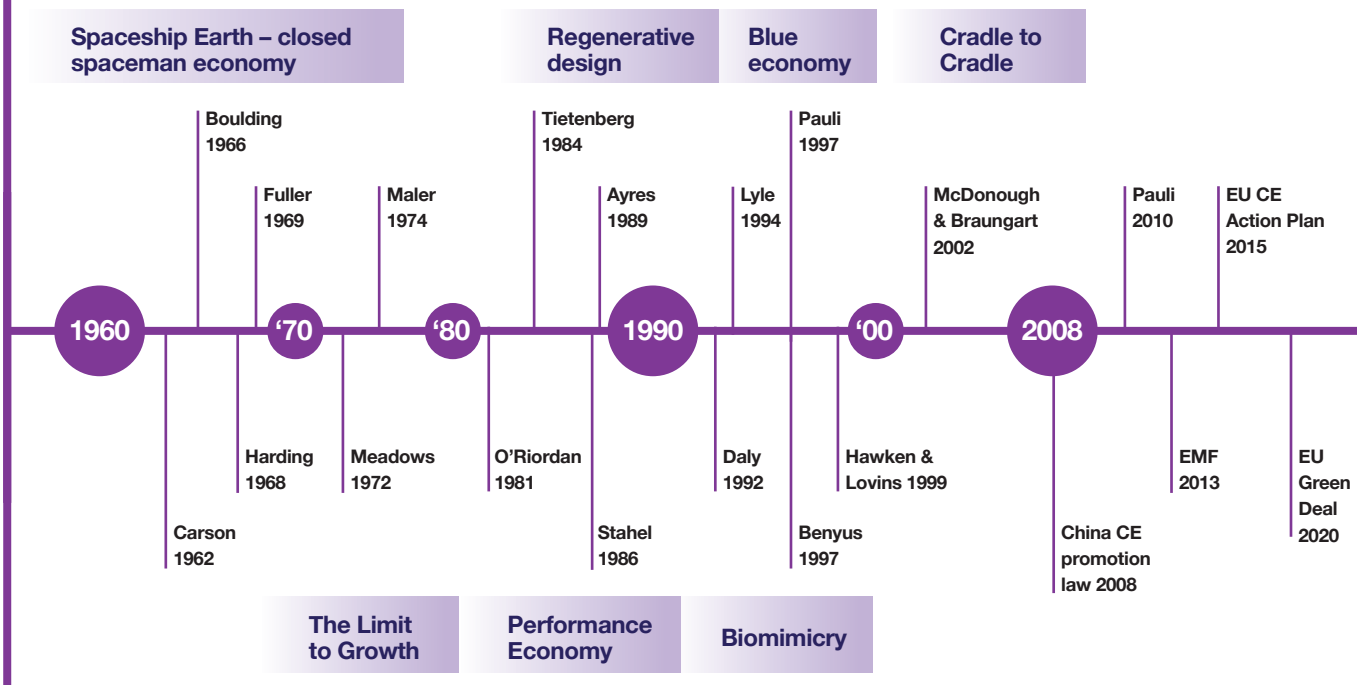
In summary, this publication outlines why entrepreneurs are driving forces in accelerating circular transition and what makes them successful at 'doing good and doing well' in an innovation ecosystem that is conducive for their growth. The study is based on empirical analysis of the four interconnected elements of entrepreneurship, **people, context, business model, and challenges/ barriers**.

# 1 Evolution of circular economy concepts

## The origin of the circular economy

The circular economy (CE) is not a new concept. Over half a century ago, the spaceship earth concept was developed by Kenneth Boulding as a metaphor for our living planet with limited resources.[3] Boulding argued that the earth system is a closed-loop economy, where resources and waste can be the same and materials should be kept in use as long as possible. The notion of the spaceship economy has underpinned prominent later concepts, including performance economy,[4] Cradle to Cradle,[5] planetary boundary[6] and biomimicry,[7] which the CE draws insights from.

**Figure 1. Historical evolution of the circular economy concept**




Adapted from Tuladhar (2022) p89

## Circular economy 1.0: the 'R' framework

The traditional view of the CE assumes that resources are finite and that, by improving the efficiency of resource use and reducing resource waste, social and economic value can be created with fewer resources, environmental pollution can be reduced and resource consumption decreased, achieving sustainable development.

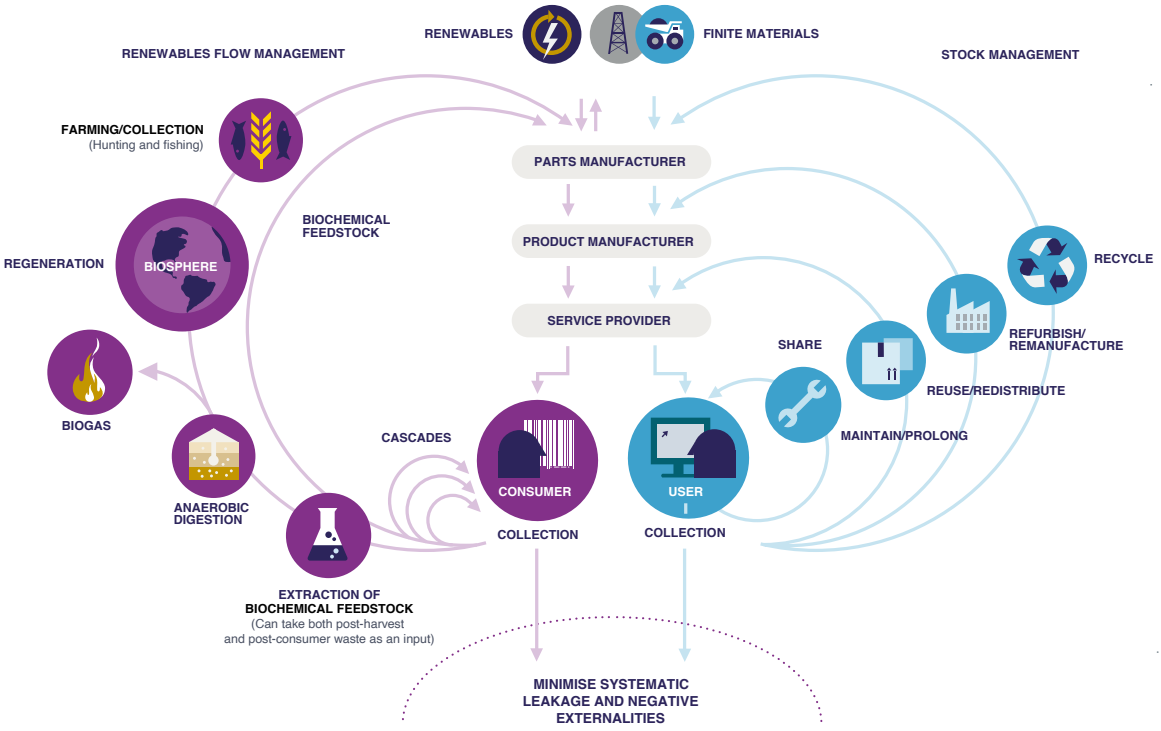
The circular enterprise applies this concept of the CE to the whole process of production and management, following the principle of **3R** – **reduce, reuse** and **resource** (the R *framework*) – or even more recent 10R (refuse, reduce, resell/reuse, repair, refurbish, remanufacture, re-purpose, recycle, recover energy, re-mine).[8] It strives to maximise resource use and minimise waste in all aspects of production, recycling and general use with the CE development model: *resource – product – waste – recycled resource*. The object of the CE is not just about waste management but also the whole process of material production and consumption.

## Circular economy 2.0: a new economic paradigm

The R framework has been useful in making the linear economy more efficient and less wasteful. However, attainment of a true CE requires a system-level shift away from the business-as-usual linear economy. Beyond the traditional R framework, a CE attempts to integrate economic activity and environmental wellbeing in a sustainable way. It is described as an alternative to the traditional economic model as it acknowledges the fundamental role of the environment, its functions and, most importantly, the interplay between the environmental and the economic systems.

This crucial shift has been promoted and championed by several non-governmental organisations (NGOs) and think tanks. A popular definition of CE is given by the Ellen MacArthur Foundation (EMF): "restorative and regenerative by design, underpinned by a transition to renewable energy and materials" in order to decouple economic activity from the consumption of finite resources.[9] This definition considers the flow of finite resources as being divided into two types – the *biological cycle* and the *technical cycle* (see Figure 2). In the technical cycle, products are kept in economic circulation through reuse, repair, remanufacture and recycling. In the biological cycle, nutrients from biodegradable materials are returned to the earth through processes such as composting or anaerobic digestion.

**Figure 2. Circular economy system diagram, also known as the butterfly diagram**




Source: Ellen MacArthur Foundation, 2015

This CE 2.0 sets itself apart from the traditional R framework in two ways. Firstly, it emphasises restoration and regeneration, rather than prevention and reduction.[10] Secondly, it is led by a system redesign, where *waste is designed out* rather than merely reused and recycled (design from waste). In other words, a CE is aimed at optimising the system as a whole rather than its components. Value is created from redesign and radical solutions, rather than by simply improving resource efficiency.

# 2 The case for circular start-ups

## The growing momentum of circular innovation

The CE is often heralded as a panacea to achieve green growth. It has gained momentum both among policymakers and corporations, with the European Commission (EC) being at the forefront of establishing regulations and implementing CE policies. In 2015, the EC adopted the first CE Action Plan, which was put into action between 2015 and 2019.[11] In the European Union's Green Deal, CE is seen as a growth strategy, decoupling economic growth from the ecological impacts associated with economic activities.[12]

Leading consultancy firms, NGOs and think tanks believe the CE presents a trillion-dollar opportunity[13] as it gives business a competitive advantage. A number of multinational firms have voiced their intentions to 'close the loop' by implementing eco-design, reverse logistics and/or creating more circular production systems. For instance, Unilever adopted the Waste-free World circular strategy[14] and Intesa Sanpaolo Bank created a €6 billion CE fund[15] to support innovation.

Since the beginning of 2022, circular start-ups, for the first time, have made global headlines raising significant funding. For example, Twig, a UK fintech start-up with a circular business model, has raised $35 million in series A funding.[16] On the investment side, private equity fund Circularity Capital has recently announced a €215 million Circularity European Growth Fund, making it the largest specialist CE private equity fund globally.[17] In the UK, London has earned itself the reputation as a hotspot for circular start-ups, mostly thanks to the city's commitments.[18] ReLondon (formerly the London Waste and Recycling Board) launched the Circular London and Advance London initiatives in 2018,[19] aiming to strengthen collaborations and engagement around the CE and enable small and medium-size enterprises (SMEs) and start-ups to leverage the benefits of the CE. These movements indicate that a fundamental, structural transition to the CE may be under way.

## However, circular implementation is slow

While the transition to a CE model is exciting, actual implementation is still very limited. With analyses indicating that less than 10 per cent of the global economy is circular (and declining),[20] there is insufficient evidence to conclude that large-scale momentum of CE is growing. Why?

For large companies, CE activity is more likely to be at the margins due to the lack of mandates, costs, logistical hurdles and inertia.[21] This leads to a stronger focus on end-of-life management and materials sourcing rather than transforming core business models.[22] It is widely acknowledged that the transition to a CE is challenging due to the complexity of the global supply chain[23] and fragmented markets – therefore, many companies are merely focusing on easier or fashionable isolated areas, such as recycling or downcycling. As a result, no major shift towards a CE has yet occurred.

Transitioning to and scaling up a circular model requires continuous strategy iteration and looking beyond traditional supply chains. This is a view supported by scholars who stress that, in a CE, "value is no longer created by firms acting autonomously, but by firms acting together with parties external to the firm".[24] In other words, a systematic approach is required.

## Why start-ups? Green Goliaths vs. Emerging Davids

A series of studies have revealed that big corporations tend to invest a substantial amount of money in new products and technologies, then commercialise them through *established* business models, but often have little interest in, and/or huge inertia against, *innovating* business models. Most CE activities initiated by big corporations were oriented towards the main product and packaging, focusing on end-of-life management and sourcing rather than circular product design and the business model.

In contrast to established incumbents, start-ups have been considered more likely to adopt radical and transformational business models from the beginning[25] owing to their higher acceptance of risk and their flexibility to emerging opportunities.[26] Start-ups can therefore play the pivotal role in stimulating a circular transformation.[27] However, they are generally less capable of addressing a broad range of sustainability issues due to their limited resources, smaller influence and relatively narrow business focus. This sometimes leads to creating a niche, exclusive market for themselves.[28]

There has been much debate about whether larger or smaller firms are more open to, and capable of, pursuing sustainable entrepreneurship. 'Green Goliaths' (market incumbents) and 'Emerging Davids' (small firms) play different roles at different stages of industry evolution.[29] Sustainable transformation of industries is therefore brought about by the interaction of both large and small players.

## Circular entrepreneurship in system-level transformation

System-level change is key to the circular transition; sometimes referred to as 'circular disruption'[30] – a more radical, system-wide transformation that may fundamentally upend the existing socio-technical system.[31] To achieve that, entrepreneurship has been recognised as a major conduit for sustainable products and processes. New ventures are often presented as an answer to many social and environmental concerns. The CE has already stimulated innovation and a wealth of entrepreneurial opportunities in some locations, such as Amsterdam, Berlin and London.[32] Being new market entrants with circular as a core business strategy, start-ups tend to take a more holistic and radical approach than conventional incumbents. In this report, entrepreneurs involved with such circular-focused businesses and start-ups are referred to as 'circular entrepreneurs.'

## Aims and objectives of this study

Despite the upsurge in circular start-ups, the study of circular entrepreneurship is still a novel concept in scientific literature[33] and only a relatively small number of empirical scholarly studies have been carried out on circular ventures to date.[34] Furthermore, previous literature has lacked examination of the motivations of circular entrepreneurs themselves or the specific challenges and barriers they experience in building their ventures.

This project contributed to the research in this area and explored the overarching question: **How can circular entrepreneurs move the economy towards a more circular one?** The study's objectives were to build an understanding of the role that entrepreneurs play in the transition to the CE by:

- assessing the understanding of the CE among entrepreneurs
- analysing their motivations for setting up circular ventures
- exploring the context in which they operate
- examining the circular business models adopted and identifying the challenges and barriers encountered.

To achieve this, structured interviews were undertaken with entrepreneurs from around 60 start-ups based in the UK and China. The findings have been rigorously analysed, organised and distilled into this study, providing a valuable contribution to the contemporary landscape of entrepreneurship in sustainable business and the CE.

# Research framework

This study uses an entrepreneurship framework based on that presented in 1996 by Sahlman,[35] adapted to incorporate and/or emphasise factors found in contemporary circular start-ups:

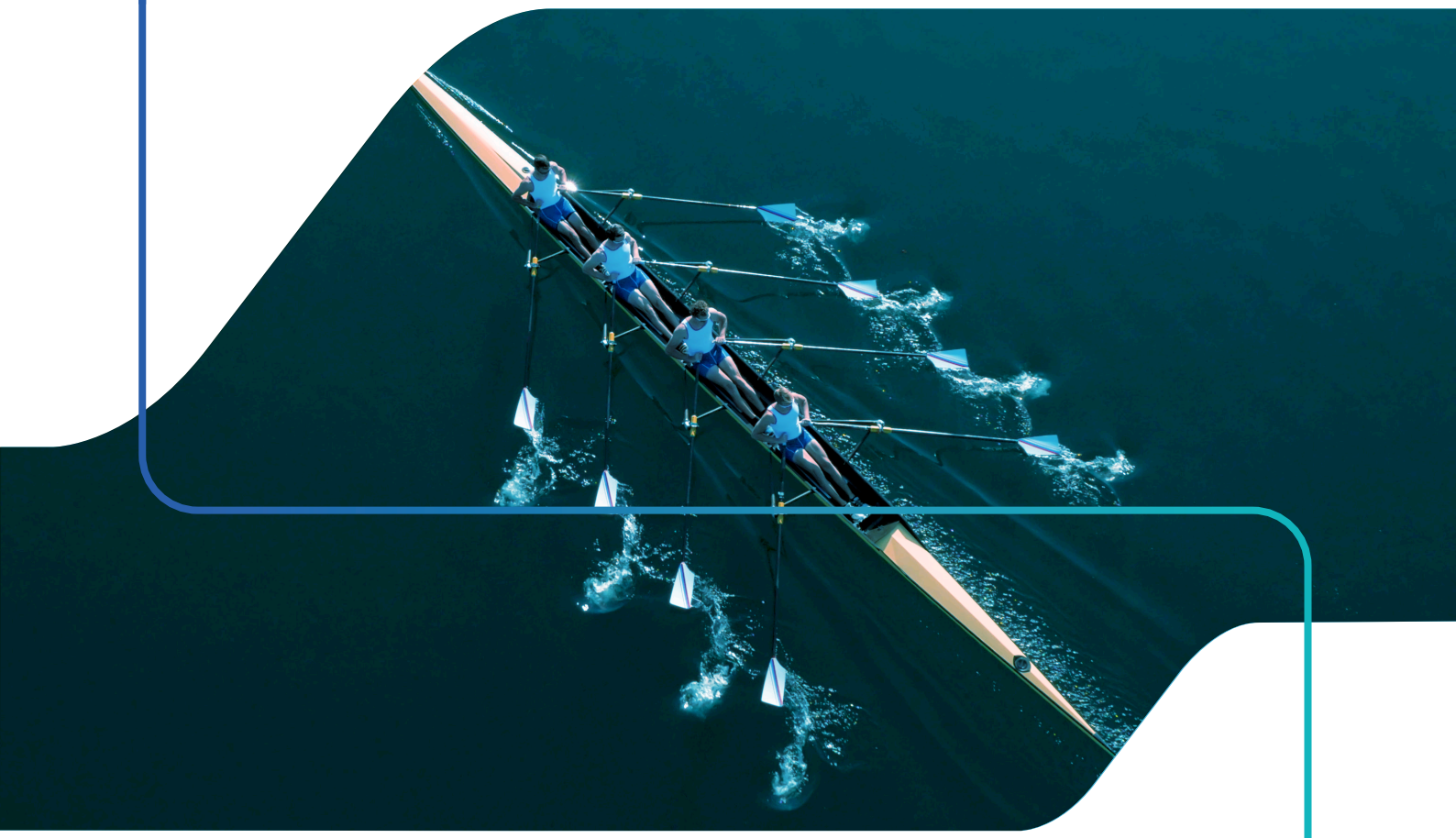
**People**
the entrepreneurs themselves and those who bring resources into the venture.

**Context (external)**
the environment in which the business operates and is embedded.

**Circular business models**
the venture's circular business model, strategies, services and products.

**Challenges and barriers** for circular start-ups.

These four components are interdependent and dynamic – entrepreneurs need to function with, and consistently respond to, both internal and external changes and consider all four perspectives simultaneously.



# 3 People: entrepreneurs' motivations, goals and mindsets

**The motivations, goals and mindsets for entrepreneurs to start circular ventures are presented in Figure 3.**

**Figure 3. Motivations, goals and mindsets expressed by circular start-up interviewees**

| Intrinsic and personal values | Goals and mindsets |
|---|---|
| • Personal passion<br>• Entrepreneurship as a force for change<br>• Challenging convention<br>• Doing good and doing well<br>• Solving problems<br>• Duty and responsibility<br>• Celebrating cultural heritage | • Achieving zero waste/waste mindset shift<br>• Holistic and systemic shift mindsets<br>• Social benefits<br>• Tackling climate change<br>• Collaboration and connectivity<br>• CE not the goal itself |

According to our findings, circular business founders consider entrepreneurship as an opportunity to operate their businesses according to their **personal values and passion**. In turn, this rewards them with self-realisation and autonomy over their career choices. Before starting their own ventures, many of the founders we interviewed worked in established companies and witnessed environmental pollution and damage from traditional industry. Frustration at the slow change of big companies led them to change their career to better align with their personal values. As some of them stated:

> *"[I] was absolutely shocked at the lack of sustainability responsibility within those businesses… there's a real opportunity here on both the commercial side [and] the sustainability side."*

> *"I'm very passionate about the planet and people. I started the brand because I used to work in the fashion industry and I saw the direct impact it had on workers and people."*

The belief that **entrepreneurship can be a 'driving force' for change** is one of the most dominant themes among the start-ups interviewed, followed by a strong will to **challenge conventional industries**. In contrast to other types of entrepreneurs, some circular business founders do not primarily seek unmet consumer demands—they create new consumer demand for circular products/services over linear ones. As one shared during the interview:

> *"I witnessed first-hand the reason why fashion needs to change: it's become a race to the bottom on cost—and that means a lot of corner-cutting … So, I want to use my experience to bring [about] positive change."*

They possess a well-balanced value of wanting to both **'do good and do well'** – their circular business can 'do good' for society and simultaneously 'do well' as a business. None of the interviewees were driven by purely economic success or profit maximisation. The **social benefits** of CE were mentioned by a few participants, such as increasing local employment and building communities. A few community-led social enterprises in this study have demonstrated that bottom-up activities (eg peer-to-peer sharing and swopping workshops), built on community participation, can empower the wider community. These grassroots initiatives foster a community spirit and transform sustainable lifestyles and livelihoods for increased wellbeing.[36]

Besides intrinsic values, circular entrepreneurs in our sample are also driven by a desire to contribute to the economic and environmental challenges that are shaped by the broader context, which is in line with the scholarly view of a CE requiring a systemic shift.[37] Entrepreneurship provides an opportunity to apply their **holistic** idea of circularity into business. Some interviewees argue the **CE itself is not the end goal**; it is a means to achieve the end goals of: zero waste ("sending as little waste to landfill as possible"), tackling climate change ("trying to become net zero") and creating a more equal society ("bringing back employment in my local area").

Respondents self-identified as '**problem-solvers**' and see it as their 'duty and responsibility' to do so: "Entrepreneurs are problem-solvers. They are the hustlers who dedicate a lot of energy and build a team to validate just one value proposition."

In addition, they are willing to challenge the **traditional mindset of waste** having no value and to form a new circular way of thinking. As two fashion clothing start-ups elaborated "we really like the idea of seeing the beauty in something that you would traditionally see as waste. So, it's very much about altering the way that we see things. What we're really trying to do is to elevate these [fashion] designers to be seen as artists."

Some entrepreneurs are driven by a passion to **celebrate their cultural heritage**, setting up their own business aligned with this personal value: "I'm originally from Central Asia. I learned from my grandmother how to crochet, how to sew, how to knit." Similarly: "Made in England used to have a certain cachet, or a certain kind of prestige around it, where the quality involved, the machinery involved, [was] understood and appreciated. But, strangely, I don't think in England we see it that way. So, the emphasis of my brand is on Made in England."

# 4 Circular business models (CBMs)

**Interviewees' approaches to transitioning from a linear to a circular economy can be mapped onto the five circular start-up business model archetypes defined by Henry et al. (2020):[38] *platform-based*, *design-based*, *waste-based*, *service-based* and *nature-based*.**

## Platform-based

At their core, platform-based business models are built around marketplaces for exchanging excess or surplus materials or products. An increasing number of peer-to-peer sharing platforms are appearing in fashion, retail, logistics and for creating industry symbiosis – the main functions being sharing information and trading underused materials or products. In this circular business model, digital technology is a prominent theme, with interviewees stating that it enables, supports and accelerates their businesses.

Connectivity, collaboration and mindset shift were mentioned as key factors of a CE by several interviewees. The entrepreneurs asserted that "data is going to be absolutely key to [the] CE". They noted that many businesses "approach CE in a siloed way, building their own reverse logistics and infrastructure". Or, as one participant articulated: the "connectivity layer is missing." Observing the current disconnection as a business opportunity, several start-ups have created digital marketplaces to match excess materials and products with buyers.

Digitalisation has often been the spark for creating a circular solution in the first place, providing an open opportunity for a company to rethink its future, strategy, value chain, value creation, operations, pricing model, sales channels and customer engagement.

In some cases, digitalisation is used to connect data, partners, devices and customers in individual/isolated parts of the value chain. This enables efficient use of data for designing and implementing circular strategy – for example, transitioning from selling products to selling services. "Digital technologies enable us to understand what is not durable in these garments; [for example] whether it's [the] zip that always [breaks] or the seam that is always the first thing to break."

Beyond simply sharing information and connecting users, some start-ups focus on creating the digital twin (or digital passport) of products. This rapidly enables trusted, quality information to be passed on and accessed with changes of ownership, and also generates information and collects data about products. Businesses are inspired by "what Distributed Ledger Technology should and could be doing, but not in the way that it has been architected".

Similarly, "blockchain-enabled solutions can store and share data in a secure and efficient way and they should be adopted on a large scale". The data is then accessible to all parties in the chain and has other co-benefits. With "technology such as blockchain, you can guarantee the provenance of the circular economy – an example would be reusable PPE [personal protective equipment]." Another stated: "We call [our platform] an identity centric platform for building trust. So we designed something that was based on the principles of distribution of control and ownership."

These technologies could enhance information flows across value chains and improve monitoring and verification processes. Additionally, specific algorithms could be used to verify data travelling with the product and ensure that the necessary information is included.

Despite the advantage of these technologies, one interviewee stressed that it can be a double-edged sword: "we are also really aware that technology is not a silver bullet. I think what we do is maybe 10% of helping organisations, the rest is really mindset, attitude and skill building for people."

## Design-based

Design-based circular start-ups have innovation in their core strategy, from alternative materials (eg plant-based materials to replace plastics) and process efficiency (eg 3D printing) to product design (eg modular consumer goods). Most of this group focuses on 'upstream' innovation. An increasing number of businesses focus on redesign – 'building circularity into the design phase' – shifting from designing *from* the waste to designing *out* the waste. Founders in this CBM group were driven by the higher value arising from it. One manufacturer stated the importance of aiming to "re-design the whole product so that it can feed into the [CE] loop and make the whole operation easier." In other words, aiming for products that are 'made to be remade.'

Compared to a platform-based business, this type has a higher barrier to entry. It can require years of R&D before the technology is ready for the mass market. Some start-ups invented ground-breaking technology that might radically alter the way things are traditionally made. That can help to attract attention from incumbents that have the potential to scale up the innovation. As one interviewee stated, "the value added is tremendous – larger than what [our corporate partners] are currently doing and that's the reason why they have a strong incentive to work with us".

Strong and competitive technology is key for companies like these – and it often requires breaking through a bottleneck in the industry to create a competitive product. This not only helps the company succeed in the market, but also makes it more likely to obtain financing. However, the upfront investment in technology development often leads to higher product prices.

## Waste-based

Waste-based start-ups use recycled materials mostly obtained from post-consumer products or post-producer waste streams. These are secondary materials, since they often lose their sustainability to their original use and can be re-applied anywhere. While value is destroyed or lost in a linear economy, CE is essentially aiming to 'find value in the waste' and recognising that 'there is a strong business case in doing so'. Several start-ups have built their businesses on this model through repurposing, reusing, recycling and upcycling wasted or unwanted materials.

The circularity thinking also spurs opportunities for **cross-pollination** in different sectors. For example, one start-up not only recycles agricultural waste, but also invented new technology to turn it into biodegradable paper. Another interviewee saw their business in terms of an *open-loop* CE model, rather than a *closed-loop* one. "Our process [is] more like an open-loop system. We've some material that was sourced from the biomass [and we] used it to produce our bio-based leather, which is biodegradable at the end of life. We source it from nature and incorporate [our product] into the nature system."

Recycling and remanufacturing applications in the study were wide-ranging. Examples include: recycling solid waste resources, such as waste plastics, into environmentally friendly products; recycling large plastic pellets for composting or reuse; cleaning and recycling plastic bottles, to give them a better chance of being remade into new bottles; using technological innovation to achieve resourceful use of livestock manure and high-value use of biogas; and dismantling and reusing unusable furniture for secondary sale.

They often proposed their own solutions, sometimes requiring technological development to help achieve recycling and reuse and, therefore, may face various technical bottlenecks. These companies are faced with the problem of attracting consumers and, when the products are successfully remanufactured, the need to be re-sold. They carefully analyse their potential customer base and add value to their products according to their customer's preferences.

## Service-based

A service-based business model is one in which a company primarily provides customers with access to services or products, with ownership of the goods remaining in the hands of the company. The primary business strategies within this model are sharing, leasing and product-as-a-service. Service-based models bring businesses and customers closer together and revenue is generated through a long period of service – and so, customer loyalty is key to success. Start-ups adopting this model are therefore incentivised to design and sell durable products, and a key objective here is to prolong the lifespan of products or maximise their efficiency.

The biggest challenge to this business model is setting up reverse logistics,[39] which has a high capital investment and a long payback period. This typically asset-heavy business model is often more problematic for start-ups than it would be for large corporations[40] owing to smaller financial resources and lack of formalised planning.[41] Some companies offer services to take customers' unused goods and reuse or resell them; competitiveness here lies in having a variety of channels for consumers to dispose of the goods.

Some participants were sceptical about this model as, in their view, it does not stem the current overproduction and overconsumption economic model. However, advocates note that the model addresses a challenge to circularity that, "at the end of the day, we won't be able to recycle or upcycle everything".

## Nature-based

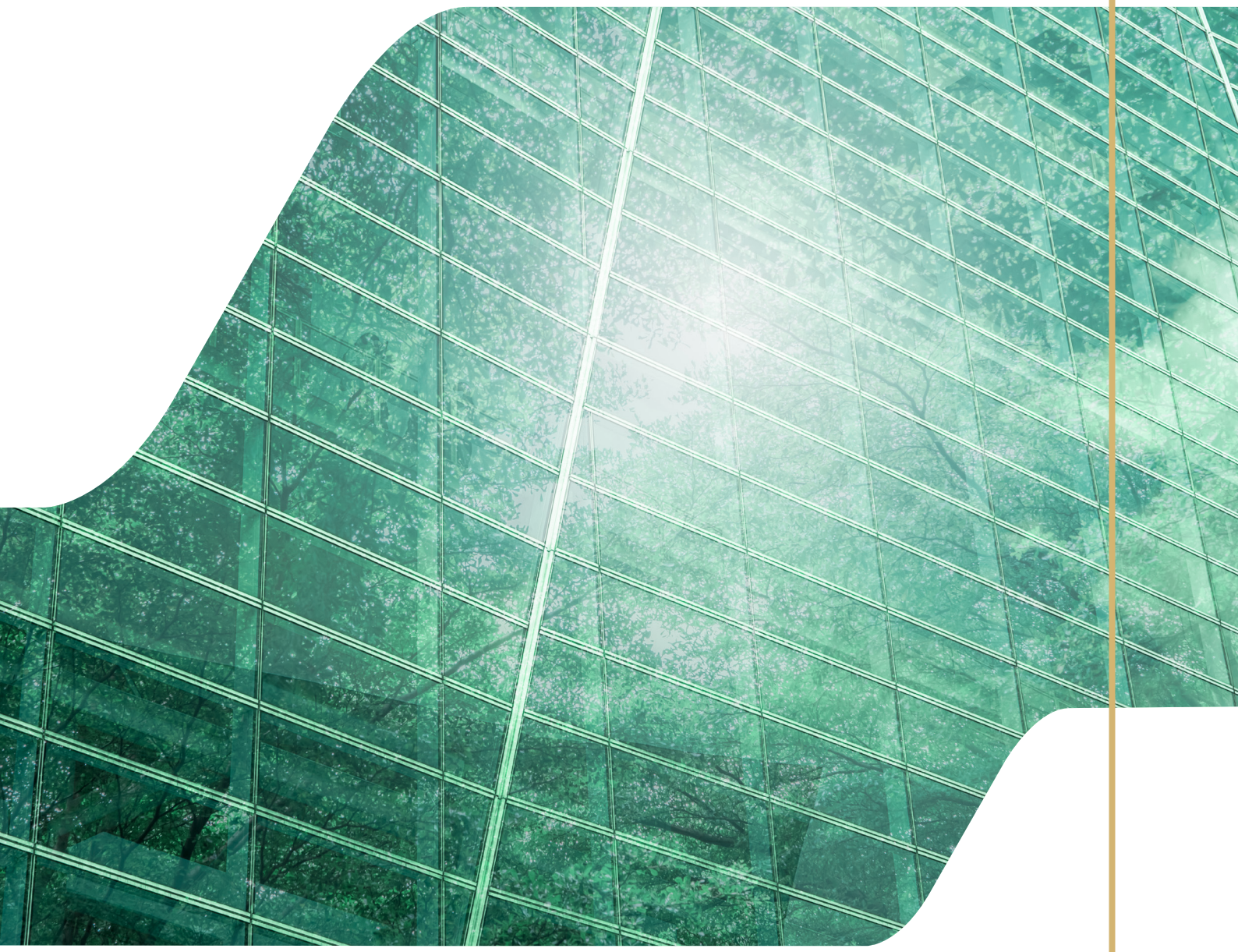
The distinctive features of nature-based companies are that they not only try to avoid any environmental harm, but also seek to maintain and increase the delivery of products and services to regenerate the nature system. Companies operating a nature-based business model generally recycle at the biological level in Figure 2.

Some companies focus on recycling slaughter by-products that, currently, cannot be used as animal feed. They use enzyme technology to transform them into a protein material that animals can then digest and absorb efficiently. In the agricultural sector, some participant companies use microbial technology to rehabilitate soil and establish a CE agro-industrial park based on the approach of 'farming – resource – backfill' to produce high-quality agricultural products in a circular way. Another example of the diverse range of ideas in the nature-based model is a business that cultivates and grows energy plants on a large scale and turns them into aviation paraffin.

Strong and competitive technology is key for companies like these – and it often requires breaking through a bottleneck in the industry to create a competitive product. This not only helps the company succeed in the market, but it is also more likely to obtain financing. However, the upfront investment in technology development often leads to higher product prices.

## Vertical, horizontal and impact expansion strategies

Among the interviewees, circular start-ups pursue a diverse range of strategies to maximise their contribution to the CE transition. In the interview sample, some are choosing a *vertical* strategy; for instance by developing their own electric-powered logistics system. Others focus *horizontally* along the value chain, seeking to encourage and influence their business partners to embrace more circular practices. A further sample favours *impact expansion* through open-source sharing and dissemination of best practices; for example, running workshops and podcasts, not only to raise public awareness, but also to create extra streams of income. Through these business model innovations and experiments, start-ups are developing and testing circular approaches in a real-life context.[42]



# 5 Context: external conditions

**Context is the environment where a business operates, with opportunities and risks that could influence business success or failure. Several contextual themes emerged in this study:**

- **regulation and the role of government**
- **consumer awareness of the circular economy**
- **competition with the conventional market**
- **support from incubators, accelerators and knowledge centres (eg universities)**
- **partnership and collaboration**
- **industry associations.**

## Regulation and the role of government

Only two of the UK participants in this study mentioned tightened government regulation and legislation as a motivation to launch their start-ups. “The government sets out new regulations on green labelling, which require businesses to be more transparent and truthful in what they claim.” “Better regulation and oversight is really important.” One start-up identified the business opportunity in implementing these policies: “We’ve built a design prototype for the European Union – they’re particularly interested in [understanding] how they can build the infrastructure to support digital product passports.”

In these cases, government rules were essential in setting up participants’ ventures, and stricter policies were welcomed to open new business markets and incentivise innovation. Some in the fashion sector also stated that this gives them a competitive advantage when compared with high street brands. Governments may also mandate the development of whole industries or markets, as in the case of degradable plastics to replace single-use plastics.

In addition to setting policies, governments may influence other contextual factors. For example, they may become clients through public procurement, bring awareness to significant new requirements or facilitate co-operation and connection with partners. Interviewees believed that governments are more receptive to a new circular initiative if the staff involved possess a strong understanding of CE, a positive attitude to learning and an ability to apply or transform a start-up’s expertise.

However, not all start-ups held positive views. Tightened regulations – for instance, the enforcement of the EC’s Green Deal – were not seen, in general, as an incentive. The majority of the study sample thought a lack of regulation was a problem. Some were also sceptical about the impact of circular policy in their sector: “policy does not feature in my world at the moment as a co-founder of a high-growth start-up.” CE incentives are also open to a risk of abuse. It was mentioned that some CE industrial parks have even been set up primarily to obtain CE subsidies rather than to actually advance the CE.

Some participants suggested there is a paradox in the existing incentive policies; a contradiction between innovation and regulation. Business should constantly innovate, yet innovation entails risk, which governments and regulators often want to reduce – thereby affecting established companies’ desire to innovate. In addition, fiscal incentives or subsidies targeted at large enterprises may be less effective because those businesses are often the most reluctant to accept a new technology, which is key in circular activities today.

Several interviewees in China noted that existing European CE policies often possess specific quantitative targets and roadmaps, which they thought could be helpful to clarify direction in future domestic policies.

## Consumer awareness of the circular economy

Respondents generally felt there is a strong focus on CE at national level and in some industries, whereas public awareness is limited – with a greater awareness of concepts such as carbon reduction and sustainability than of CE. This view agrees with a previous study.[43] Even venture capitalists were reported as not understanding CE.

Of the UK study participants, the strongest external motivation expressed is the general industry trend moving towards circular, creating new market opportunities and demand in rental, resell and aftercare of products – "there's a sense that the fashion brands are pushing towards the circular business model, looking at the end of life of the product, trying to incorporate different materials, trying to phase out plastic…efforts that the industry as a whole is making".

While recycling is the most popular trend in CE development in some territories, participants believe this should not be the sole focus. They felt there should be more effort made to guide public participation and to educate in order to form a better environment for circular and sustainable development in society.

## Competition with the conventional market

CE start-ups are competing both with other CE businesses and those in the conventional market. Important competitive factors include: products, technology, efficiency, scale, experience, team, logistics, price/value and the length of the product/service chain.

Competitive pricing with the conventional market can be challenging for CE businesses. They often have high research and development costs and have not yet achieved the cost reductions associated with traditional mass production. To address the pricing challenge, CE companies promote value over price in an attempt to minimise comparisons with conventional market products. Other pricing techniques include offering different product/service grades and prices depending on customer requirements.

Some participants felt that it can be challenging for CE companies to generate profit from a single industry segment or project without supporting regulations, policies or incentives. However, competitive advantage may be gained by virtue of extending the length of the product/service chain to form a larger closed loop.

## Support from incubators, accelerators and knowledge centres (eg universities)

Some start-ups in this study rely on the support of business incubators, such as Tsinghua University Science Park and TusStar in China. Support from formal institutions such as these usually entails protection and nurturing, and can help start-ups survive their early stages.[44] Universities also provide support through research and development, and play a key role in developing CE-focused incubators and accelerator programmes, many of which are not-for-profit and funded by the public sector.[45] One important function of these incubators is to foster an ecosystem (government, private sectors, corporations, etc.), helping to match appropriate resources for developing circular ventures. Additionally, accelerators and incubators can provide early-stage ventures with access to funding and relevant knowledge transfer to support business development.

## Partnership and collaboration

Collaborations and partnerships are central in facilitating a CE, including B2B and B2C relationships. All participants indicated that collaboration is essential because "no individual company would be able to produce entirely circular products themselves." Participants in the study tended to use the language of collaboration and partnership, rather than competition. They perceive themselves as part of the solution, enabling others, raising awareness and empowering consumers to make better choices. Partnerships help start-ups to close the loop, complementing each other's strengths to achieve a truly circular economy.

Many interviewees mentioned how partners help and influence their entrepreneurial activities, including: technology, channels, products, projects and markets. For example, one study participant co-operated with courier companies over a number of years to develop a reverse logistics model of direct collection and delivery, achieving high efficiency and cost savings. Another sells predominantly through third-party channels, achieving rapid scaling through agents and tapping into large, established domestic and international channels. As mentioned with platform-based businesses, online platforms have been set up by participants to enable buyers, sellers and even consumers to connect and exchange information, good practices and resources. Interviewees noted that advice and help provided by professional third parties can make a system more secure and reliable. In some cases, partners simultaneously provide projects, technology and funding.

These findings echo previous studies asserting that established businesses (whether previously in transition towards CE or not) and circular start-ups are becoming more intertwined and are beginning to create synergies for CE diffusion at scale.[46] Circular start-ups can make a critical contribution to supporting the transition to a CE by helping large companies engage in circular activities, often overlooked by the latter, and leading the way to the next level of circularity.

## Industry associations

Interviewees expressed differing views on whether industry associations have a positive impact for start-ups. Most thought associations acted as a hub for elements such as: policy interpretation, standards setting, government communication, business communication, third-party certification, study visits, front-end promotion and resource links. SMEs and MSMEs (micro, small and medium-size enterprises) often struggle to make an impact and/or have a limited voice within the market. They are more likely to be heard when they join an industry association and use it effectively to carry out activities or voice their demands. However, some interviewees suggested that trade associations predominantly help companies to communicate a message or assist with promotion and do not substantially help with the development of the industry as a whole. Trade associations also generally require companies to pay a fee and SMEs/MSMEs often have difficulty funding this.

# 5 Challenges and barriers

**Circular start-ups face many challenges that are common to any, such as financing and competition with large established businesses. In addition, they are confronted with challenges that are specific to their circular products and business models. Most of the interviewees acknowledge that the CE is easy to relate to and understand in theory, but that complexity reveals itself in practice. "CE is common sense", commented one interviewee, yet participants did not believe that a single *truly* circular business actually existed. The challenges and barriers that arose from the interviews are presented in Figure 4 and explored below.**

**Figure 4. Challenges and barriers identified by circular start-ups**

| Financial and economic viability | Unintended consequences | Supply chain, market and global | Organisational |
|---|---|---|---|
| • Fundraising<br>• Growth and scaling paradoxes<br>• Up-front costs and tax issues<br>• Reverse logistics costs<br>• Pricing<br>• Income diversification | • Overproduction and overconsumption<br>• Consequential carbon emissions<br>• Secondary environmental harm | • Engaging suppliers/ manufacturers<br>• Partnership with other brands<br>• Customer demand and behaviour<br>• Pandemic | • Growth and scaling up<br>• Limited human resource |

## Financial and economic viability challenges and barriers

### Private equity and loans

Despite the creation of many new CE-focused investment funds, research shows only around 2.5 per cent of global venture capital investment (of $171 billion, in 2017) was made in circular start-ups.[47] This was illustrated by one of the study participants: "I went around venture capital people and said 'sustainable fashion is going to be really big.' I had an idea around resale and they all laughed at me." Interviewees across the board felt that the current private capital market, in general, lacks a sufficiently deep understanding of CE.

While CE financing is growing, available investment in start-ups is still insufficient in most sectors,[48] in contrast to that available to established companies looking to finance changes to existing practices and supply chains. As one interviewee noted: "There isn't support for smaller fashion brands. Within the sustainable space, [funding] tends to go to bigger players, or the supply chain, rather than people on the ground making the change."

Furthermore, funding is not equally distributed among sectors, being skewed towards technology start-ups where larger returns are expected.[49] Interviewee experiences bear this out: "[Investors] are looking [more] into the tech space, where [they] invest a bit of money, you go public and then: boom." Similarly: "I did approach a few angel investors and the feedback was 'the ROI [return on investment] isn't that appealing.'"

In China, shareholders are mostly funding businesses themselves, which limits investment and growth. Most of the Chinese start-ups in the sample requiring finance have used bank loans predominantly, taking the form of credit loans or mortgages on entrepreneurs' properties. These financial and economic challenges for CE start-ups are common and have been highlighted in previous academic studies.[50]

Some entrepreneurs have followed other equity finance routes. For example, start-ups may receive funding through joint-venture strategic partnerships with large enterprises. Alternatively, corporate executives may personally invest in a venture, receiving an equity stake, and jointly running the business with the founder(s). Access to venture capital in China from famous institutions, such as Qiming Venture Partners and CSC Financial, can also be obtained by listing on the National Equities Exchange and Quotations (NEEQ) financial market.

**Grants and public funding**

Some early-stage start-ups turn towards government CE grants for funding. However, interviewees mentioned that the application process is difficult and time consuming. Therefore, some hired a professional grant writer; others avoided government grants altogether, because of the difficulties – "it really affects the traction of the business, because I'm pulled away to do that." Furthermore, interviewees felt it is not always clear when and where to apply for grants: "I know [the government has] this funding, but I don't know what's happening and how to access that and set up the project." In China, it was felt that it is difficult for start-ups to get off the ground. To obtain financial support, companies need to provide a range of filing and assessment documents and meet certain requirements, which are very difficult for a start-up to fulfil.

Of the participants in this study, only one was optimistic about circular investment: "When we pivoted into building a circular economy model, we very quickly got investment. So, I do believe in the investment side; there is a strong appetite for the circular economy, especially in the UK."

Several participants in China considered the state to have provided considerable subsidies for SMEs, together with policies such as interest rate reduction and entrepreneurship support for rural revitalisation, which have helped start-up financing. Chinese businesses thought it was sometimes easier to raise private finance if they received local government backing for their local enterprises. As high logistics costs affect efficient distribution of products, it was felt that subsidies in that area can be of particular assistance.

Interviewees thought that prominent government policies around the CE and carbon neutrality goals have made investors start to pay attention to this field and become more keen to see 'green genes' in start-ups. In China, recycling businesses are the most favoured by investors.

Rather than relying entirely on state policy subsidies, some interviewees felt they should adopt a combination of subsidised, policy-directed business models with a market-oriented approach to commercialisation and profitability. For example, wind power and photoelectricity have global market potential, going beyond state policy and subsidies.

**Growth and scaling paradoxes**

Scholars have raised the question of whether a CE is compatible with the current growth-based economic model. They argue there is no empirical evidence that absolute decoupling from resource use can be achieved on a global scale against a background of continued economic growth.[51] Similarly, they hold the view that most circular business strategies cost money and therefore negatively impact profit margins.[52] In their view, this is a problem because a CE will not be achieved as long as the growth imperative drives the economy.[53]

The growth trajectories of circular/green economy start-ups were considered more likely to be linear than exponential; highly dependent on capital investment and often delivering long returns on that investment. Realistically, therefore, practitioners, investors and supply chain partners need to exercise more patience and stamina.

However, in this research, a few founders expressed little ambition to achieve growth or seek profit as a stand-alone purpose of building the ventures – a view which contradicts some previous research in the field.[54] Some start-ups are undergoing an intentional degrowth stage. "I think it's paradoxical to produce more to reduce", which led some to intentionally reduce production: "[we] offer a capsule wardrobe of five to eight drops per year of a new [clothing] product". Regarding traditional equity fundraising for growth, one company in the study decided to avoid equity investment: "I do not want to take any investors on board. I'm not trying to sell or outgrow my business. I want to keep it at the size it is, with a smarter division between a physical product and service offering."

**Up-front costs and tax accounting implications**

Businesses with a product-as-a-service model are challenging to implement since it has cost and cash flow structures that are very different from those in the conventional pay-for-ownership model. For example, two study participant ventures retain ownership of their products and, until the asset base is large enough to circulate products that are fully paid-off, each new customer necessitates investment in a new product. This upfront investment entails a longer payback period than selling the products, putting pressure on cash flow.

In addition, the different asset ownership and financing structures affect taxation, making rental product models less attractive than their linear counterparts. As one participant described, "under a conventional business model, an acquired product may be presented as an asset on the balance sheet, providing collateral for lenders. However, under a circular business model, the buyer may not own the product in the conventional sense, resulting in less collateral for the lenders and, thus, higher interest costs."

A reduced asset base also reduces tax-deductible depreciation. Depreciation on the products owned by the service provider is included in the service payments, reducing the EBITDA (Earnings Before Interest, Tax, Depreciation and Amortisation) of the buyer. The higher interest costs and reduced EBITDA have a combined negative impact on tax-deductible amounts under EBITDA interest deduction accounting rules. This means buyers are less drawn to the rental model of big machinery, despite the benefits.[55]

Recycling start-ups also highlighted up-front funding costs as challenges. In their case, these are associated with the development of new technologies and equipment or in the building of sales channels.

**Reverse logistics costs**

Reverse logistics is the process of retrieving redundant parts and materials in order to reintroduce them into the production process, with the aim of 'closing the loop' or slowing down virgin resource usage. Many start-ups are trying to set up take-back and buy-back schemes or reverse logistics. Most of the recycling companies in the study reduce costs by using direct collection and delivery reverse logistics or by combining online and offline deployment models. The key benefits of reverse logistics are: cost reduction, waste avoidance and customer retention.

However, this process can be costly, with a high capital investment and a long payback period. As one participant stated, "I think the biggest barrier to a successful circular economy is the prohibitively large pricing [component] associated with reverse logistics. How do we get things to and from people at scale?" One start-up from the study is seeking to reduce the upfront investment by involving consumers in reverse supply chain activities: "anybody can post their garments to us…one benefit [to us] is a modest revenue stream".

**Accessibility vs. premium pricing**

Should circular start-ups set an accessible price for products/services to encourage a customer behaviour shift or charge a premium to reflect the true cost of production? Participants' views on this question were divided.

In the fashion sector, for example, locally manufactured and durably designed cloth costs more. This pushes up product prices and inevitably restricts the finished products to customers with the economic means to afford relatively expensive and high-quality products, which limits the growth potential to niche markets and reduces accessibility.[56] Some entrepreneurs accept this and see it as positive: "In the fashion industry, it's a race to the bottom", resulting in "[customers] losing the connection to the product".

However, convincing potential users about the superiority of circular options and creating a demand for them can be challenging. Faced with consumers' resistance to circular innovations, and/or a reluctance to pay a higher price for circular products or services, some businesses are engaging with customers and being more open about the real cost. One interviewee stressed that "making it accessible doesn't have to mean making it cheap" and started a campaign for price transparency. Another explained, "we have a strong educational approach as I realised customers are not ready. So, we need to take them on board…take them by their hands and bring transparency, showing where we produce things, how much we pay to suppliers and [the] cost to make them."

For some participants, however, accessibility is the key to scaling up the CE; otherwise, it will become exclusive to those who can afford it: "Obviously, a lot of [customers] can't just go and buy very high-end sustainable designers' clothes." Similarly: "I disagree [that] consumers have to pay more for sustainable products. I want to create a brand able to compete with global brands [on] price."

**Income diversification**

One challenge of degrowth is financial stability. Therefore, some start-ups are creating multiple income streams through "a smarter division between a physical product and a service". For example, podcasts, workshops and event organisation have been tried by interviewees in order to increase income diversification.

## Unintended consequences and rebound effects

There are unintended consequences of CE strategies, practices and business models – often referred to as *rebound effects* when the eco-efficiency of a productive system is offset by an increase in production or consumption.

**Overproduction and overconsumption**

Interviewees noted that the booming sustainable and ethical fashion sector might lead to overproduction and overconsumption – as one stated: "Isn't it paradoxical that we produce more to reduce waste?"

**Consequential carbon emissions**

Reverse logistics (eg for rental and sharing CE business models) may – despite increasing material efficiency – actually increase carbon emissions, associated with increased mobility, especially at a large scale. Some participants were concerned about this and were therefore sceptical about the trade-off between material efficiency and carbon reduction: "How are we going to justify to ourselves [and] to consumers, in the name of circular economy, [if] we end up producing more carbon emissions?" One interviewee also raised the concern that most SMEs are not measuring the carbon emissions associated with the return of products, so the extent of these trade-offs were not clear – "is rental really better than the linear model? Should we try to invest into selling to one person [with the intention that] they keep it and repair it?

Or should we try and include as many people as possible owning the same item, because [in that scenario] we don't know the carbon footprint?"

In order to address this issue, be transparent with customers and permit increasing scrutiny, companies have responded in various ways. With products manufactured in developing countries before shipping to the UK, one start-up conducted a life-cycle assessment of the carbon emissions and proved that their products have 28 per cent less $CO_2$. Another chose to offset its carbon emissions by planting trees through a third party, and another built its own local logistics system using electric cargo bikes to transport products.

**Secondary environmental harm**

Some interviewees expressed concern about secondary environmental harm from waste recycling. For example, the current process of waste collection, transportation, transfer and centralisation can take up to a week, and sometimes longer, which can lead to decomposition emissions. New technologies may help to reduce these timescales.

## Supply chain and market challenges and barriers

Many participants indicated that they are constrained by what the market demands – and without market demand, there is little chance of being circular and economically viable. Challenges come from both engaging suppliers/manufacturers as well as from the linear mentality of consumers.

**Engaging suppliers and manufacturers**

Circular start-ups, as of today, are still operating within a dominant linear supply chain, characterised by a 'sell more, sell faster and sell cheaper' ethic. Moving to a CE model therefore involves effective co-operation and engagement with suppliers and manufacturers. Some participants reported this as a significant challenge, echoing previous research.[57] Aptly put, one interviewee stated that "all the manufacturing, and a lot of the design expertise, are within the factory, so it's difficult to implement any new circular design initiative without their support". Another expressed a similar view: "One main challenge has definitely been manufacturing...finding somewhere in the UK that can manufacture [at a scale] between an individual seamstress and a huge facility." Very often, producers lack the technology needed to redesign, remanufacture and reuse a previously used product effectively.[58]

**Partnerships and collaboration challenges**

Collaborations are essential to scale up novel and powerful CE propositions – combining the innovation, agility and transformative capability of start-ups with the resources, capital and scaling strengths of larger corporations. However, these collaborations require careful and intelligent governance and support based on shared guiding principles and mechanisms.[59]

Sometimes, larger businesses were reported to be unwilling to collaborate with start-ups until scalability had been proven; a catch-22: "These large brands were only willing to talk to us if we [already] had scaled ourselves. [We were asked:] could we provide this service nationally, if not internationally?"

It may be hard for a start-up lacking capital, access to distribution channels and economies of scale to enter a market that is already occupied by large players. One participant illustrated, "it's a chicken and egg question. Brands won't commit to you unless you show the scalability. But you need to fund in order to build up your factory and we need to iterate a product before we scale it up."

Another issue raised by interviewees is where the inertia of the larger business partners slows the implementation of innovation: "Big brands are slow in terms of onboarding innovation. What we see with the established players in the alternative leather industry is that it might take [maybe] five to seven years to even announce something."

**Customer demand, awareness, attitudes and behaviour**

Despite an increasing interest in sustainability and CE concepts, participants mentioned that most consumers do not act upon these interests, leading to a lack of market demand to incentivise circular start-ups. As one interviewee illustrated, "[our offering] was falling on deaf ears and a lot of the time it's [down to] the consumer to change their habits – but there wasn't enough [interest]".

In China, CE is still a relatively new concept, compared to regions such as Europe and the US. Consequently, interviewees there noted a more limited market and customer demand for circular products. They felt low brand awareness of start-ups constrained growth and that the Chinese market prefers larger companies.

In Chinese society, second-hand products are not perceived with a good image and their acceptance is geographically dispersed. Companies adopting this model need to both precisely target existing receptive customers and increase acceptance of the concept through publicity. The second-hand sector needs further education and promotion to embrace this CE approach.

One participant company, whose main output is highly 'green' agricultural products, is facing problems with a low level of client trust in their product, confirming the need for an evolution in customer attitudes.

**Global events**

As with the majority of businesses, CE start-ups are impacted by global or regional events, such as the COVID-19 pandemic, which both positively and negatively affects the study participant companies. The most significant effect has been in the supply chain, especially for those who rely on the international supply chain. Investors have also been more selective. In some sectors (eg retail), the pandemic changed consumer behaviour regarding what to buy, how to buy and where to buy. In response, some start-ups have adapted their business from physical to e-commerce and virtual engagement with customers, which has been positive in some cases.

## Organisational challenges and barriers

Most of the start-ups in the study have fewer than 50 people, and this limited organisational capacity commonly inhibits their growth speed. "We're only a small team of three people at the moment, so it's very difficult for us, even if we [are] given the opportunity to do a pop-up."

Participants also noted the cost and time challenges involved in building up the diverse, yet specialised, organisational talent and resources in CE ventures, including: equipment, internet technologies, hardware, software, raw materials, operations, public welfare and so on.

# 7 Conclusions

**The key conclusions of this study are presented below together with important aspects considered worthy of future exploration.**

**Circular entrepreneurs can be the driving force behind the circular transition for the following reasons:**

- **Intrinsic motivation, personal values, passion for CE, a strong determination to be a force for change and to 'do good and do well'.** These qualities drive circular entrepreneurs to set up their own business, which gives them the autonomy and the speed of change that large incumbents lack.
- **Possession of a holistic view of the circular economy and awareness of ultimate goals behind the CE.**
- **The business models and strategies of circular start-ups are higher in circularity.**[60] Large companies are, in general, adopting CE activity at the margins, such as with end-of-life management, materials sourcing, recycling, etc. They have inertia and little interest in radically innovating their business models. In contrast, circular start-ups embrace strategies that are higher in circularity. They turn new technology, networks and markets into concrete actions to generate, and take advantage of, new business opportunities.[61]
- **The creation of new markets of novel circular products/services**, rather than primarily seeking unmet consumer demands. **A collaborative mindset** is key to advancing a circular economy, yet current collaborative challenges need better understanding and solutions. There is consensus that a collaborative mindset is essential to advancing a CE; no single business can tackle the wasteful linear economy alone. This concurs with studies which argue that a network approach of circular businesses is needed to prevent countless individual systems implementing CE principles in a siloed way.[62] Each type and size of business has a different role in the transition to CE; sustainable transformation of industries is brought about by the interaction of both large and small players. Collaboration takes a number of forms, including: partnerships with industry incumbents, aiming to diffuse their innovation at a larger scale; supply chain and manufacturing partners; financial players; government institutions; NGOs; knowledge centres, incubators, accelerators and consumers.

There is a lack of research regarding the concept of entrepreneurial ecosystems applied to the CE.[63] To date, most research has focused on an individual circular business model or product/service. Further research is required to better understand how circular start-ups build their business ecosystems and develop collaborations.

**CE awareness, demand, attitudes and behaviour require much improvement at the consumer level.**

While CE awareness and attitudes are relatively well developed at government level and in some industries, such as fashion, consumer awareness is still considered severely lacking and problematic in most sectors. Concepts such as sustainability and carbon reduction have much greater awareness. Additional effort is required to increase consumer awareness of CE – evolving consumer mindsets and driving demand for circular products and services over linear ones, accelerating the transition to CE practices on a larger scale.

**Private investment in CE is low, investor understanding of CE requires improvement, and government grant application processes may benefit from clarification and simplification.**

While CE financing is growing, and the market has strong potential, available investment from the private sector is still insufficient and skewed towards technology ventures.[64] Investor understanding of CE was reported as relatively poor with expectations and mindsets still predominantly linear, eg: pursuing exponential rather than more linear growth trajectories, seeking unrealistically short ROI timescales and harbouring profitability concerns – findings that are consistent with research studies.[65] Government grants and subsidies are available, but the application processes were reported as challenging or confusing.

## 7. Conclusions

**Pricing CE offerings is challenging and presents a dilemma between accessibility and niches.**

The pricing of CE products and services presents a significant challenge for a number of small CE businesses. Firstly, with current higher costs and lower volumes, it is difficult for circular offerings to compete on price with traditional linear economy alternatives. Secondly, entrepreneurs disagree on whether pricing should be set for accessibility, despite higher costs today, or be transparent, accepting that current customers will be concentrated in a high-end niche. A few approaches to this issue were presented, but pricing is a challenge which warrants significant further exploration, being key to both CE business economic viability and the growth of CE beyond niches.

**Manufacturing and supply chains are still largely linear, which is challenging for CE businesses.**

Linear economy culture dominates the supply chain. Moving to a CE model therefore involves effective co-operation and engagement with suppliers and manufacturers – but participants in the study stated this is a significant challenge. To implement a CE in the supply chain, novel strategies, technologies, practices, frameworks, vision, mission, unique thinking and training are needed.[66]

**Unintended consequences are a challenge and require better identification and quantification.**

Unintended consequences and rebound effects arise from CE practices, including: overproduction and overconsumption (eg from growth and scaling demands), consequential carbon emissions (eg from reverse logistics) and secondary environmental harm (eg from waste recycling). Participants in this study recognised these important challenges and noted the difficulties in identification and measurement. Therefore, further studies should perform life-cycle assessments to better identify and analyse rebound effects.[67] If/when the economy moves further towards circularity, the need to mitigate these effects will become increasingly important.

**Government regulation – mixed views expressed.**

Unexpectedly, only a few start-ups in the study considered tightened government regulation as a motivator to launch their ventures, although some noted it as a competitive advantage over linear economy businesses. However, regulations were not seen as an incentive in general – and some interviewees were sceptical of their impact and the effects of the opposing forces of regulation and innovation. These views somewhat contradict the importance placed by scholars on the development of policy and regulation to promote CE in a cohesive way.[68] The findings suggest a need for further study to ensure legislation and incentives have the desired effects.

**Social benefits of CE are important and often overlooked.**

The social benefits of CE were mentioned by participants, including increasing local employment and community building. Currently, most CE literature comprises a narrow coverage of social benefit in job creation. There seems to be no clear understanding of the extent to which the CE could contribute to subjective well-being,[69] and our empirical study provokes further research on how the CE can help to benefit society and become more equitable and inclusive.

In conclusion, the transition to a circular economy requires a holistic approach that transforms industries through new materials, energy, and business models. The study shows that entrepreneurs are playing a crucial role in accelerating this transition, but more needs to be done to support their growth and success. By understanding the strategies and challenges of circular start-ups, we can inspire more circular innovation and pave the way towards a sustainable future.

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