



Bottom-up case studies of circular economy startups

RETRACE 4th ESR Training School on "Innovative Bottom-up Circular Economy Business Models"

Marvin Henry, December 2020



Contents



Purpose and research design

Typology of circular start-ups (CSUs)



Circular start-ups are key innovators to drive the sustainability transition

- CE has become a **widely discussed topic and key issue in the context of sustainability** for politicians, scholars and industry alike
- Key reason for this is the fact that CE is considered to have **most traction** in comparison to other recent sustainability concepts and is seen as a **solution to address sustainable development**
- The **private sector is highly relevant** in the transition towards CE and faces great opportunities implementing circular business practices such as closed loop systems. However, many companies struggle to establish circular business models (CBMs) and processes – **especially multinationals and incumbents hardly achieve any measurable impact** despite increasing efforts to do so
- **So far, no research has been conducted on circular start-ups** but mostly on approaches to CE by incumbents and multinationals. However, **startups tend to have a higher disruptive ambition** than incumbents and are in a **better position** to drive circularity innovatively due to their structure

Linear



Classical recycling



Circular



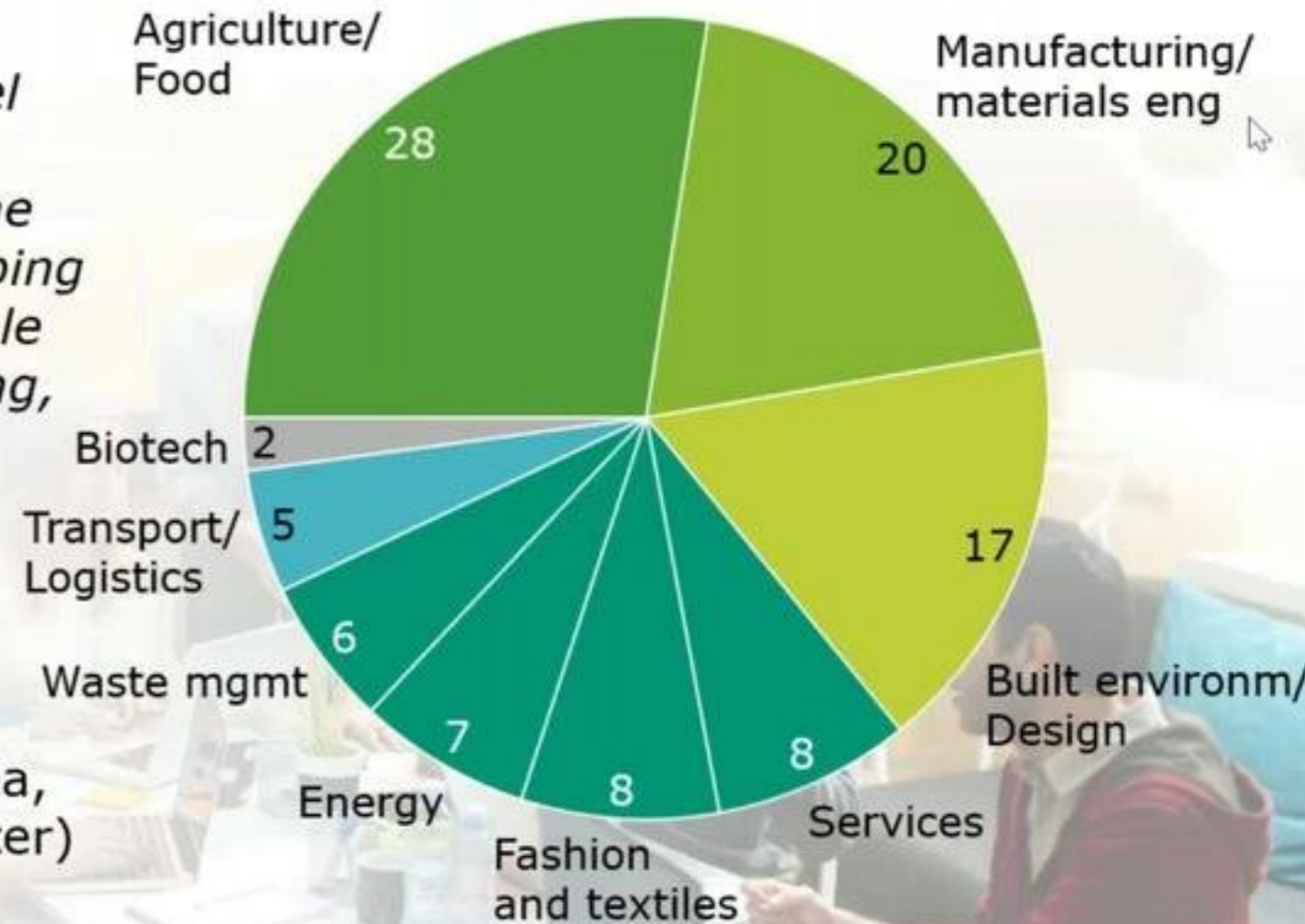


Scope of our work are >130 start-ups with a circular business model

4 criteria for start-ups involved

- Business models based on circularity
 - *"circular operations on the micro-level that aim at fully closing product or material loops and thereby making the 'end-of-life' concept obsolete, or keeping resources in use for as long as possible through reducing, alternatively reusing, recycling or recovering them."*
- Not older than 5 years at date of interview/data gathering
- Independent
- Active in Berlin, Amsterdam/Randstad area, London (12 CSUs from Australia added later)

Sector overview, In %



>30 of the start-ups were interviewed in 1on1 sessions



Included business models range from high-tech B2B to community-based B2C

| |  |  |  |  |  |
|----------------|---|---|---|---|---|
| CSU archetype | Design-based | Waste-based | Platform-based | Service-based | Nature-based |
| Sector | Sustainable construction | Food/beverages | Materials engineering | Renewable energy | Agriculture |
| Business model | Modular, biomimicking insulation material and construction system using bio-based materials (e.g. mycelium) | Collection of surplus food (e.g. from restaurants, supermarkets) and selling via retail locations and online shop | Collaborative platform for open source material recipes for a circular economy | Modular and reusable lithium-battery based on innovative energy storage technology | Localized/modular insect farming using bio-waste Protein production for animal feeding |
| Market | B2B/B2C | B2C | B2C | B2B | B2B/B2C |



Potato starch



Green tea



Kombucha fabric



Agar bioplastic (heated)



Cork / agar - starch



Coffee grounds (used)



Coffee / agar - alginate



Calcium carbonate



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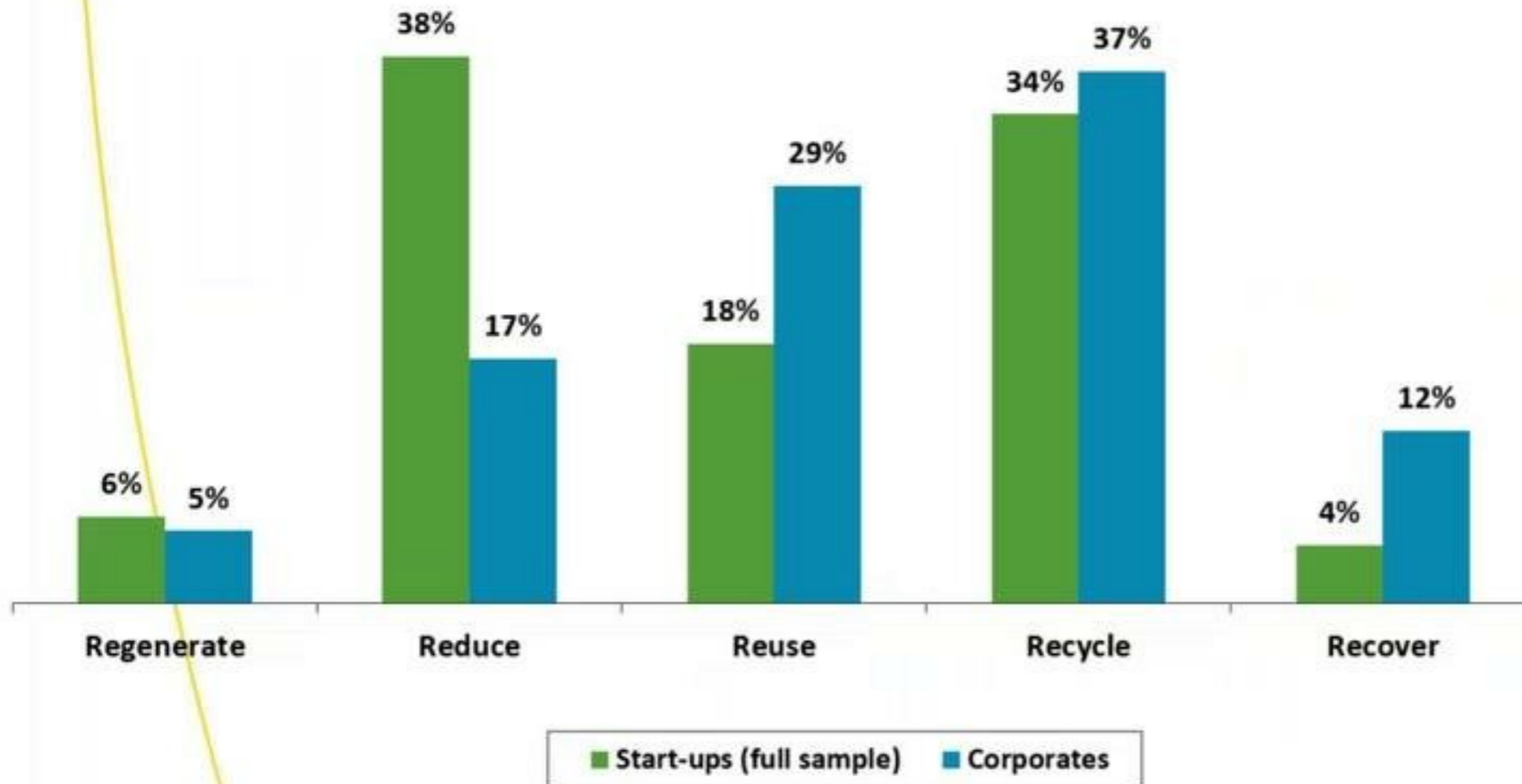
Based on our findings we extended the 4R-framework with 'Regenerate'

| Circularity Strategy | Definition |
|----------------------|---|
| Regenerate | Maintain and increase the delivery of biological ecosystem services (i.e. the benefits provided) to society, for instance through urban agriculture, green roofs or aquaponics |
| Reduce | Increase efficiency of product design or manufacturing by preventing or minimizing the use of specific hazardous materials or any virgin materials, or allowing for more intensive product use |
| Reuse | Bring products or materials back into the economy after initial use or extend the productive lifespan of products and their parts (through repair, maintenance, second-hand markets, etc.) |
| Recycle | Process materials through e.g. shredding or melting to obtain the same (upcycling) or lower (downcycling) quality |
| Recover | Treatment of residual flows with recovery of embodied energy (e.g. incineration) |



CSUs pursue higher ranked circular business model strategies than corporates

Circularity strategies: CSUs vs corporates
% of all R-strategies pursued



Key insights

- **44% CSUs vs 23% corporates** are active in the high-ranked strategies 'Regenerate' and 'Reduce'
- Incumbents higher represented in 'Reuse' due to **high costs and complexity** of reverse logistics, and dominance of business models in the **technical cycle**

Evaluation based on analysis of multiple R-strategies pursued per organisation (corporates: 2.6; start-ups: 1.5). The data for corporate circularity strategies was proportionally scaled from the base of all organisations analysed to the base of all strategies identified due to different sample size and organisation sizes within the samples; only concretely mentioned circular activities were counted; no general statements were made in corporate reports. The original coding in the reference study did not include 'Regenerate'; to adjust for this and following the abovementioned logic, R-related activities in company reports studied that relate to 'Design for Regenerative Systems' are included in the graph as the 'Regenerate' strategy by corporates (5.3%; deducted from 'Reduce' strategy since this is the only strategy whose coding keywords contained the term "design" in the original study's 4R mapping).



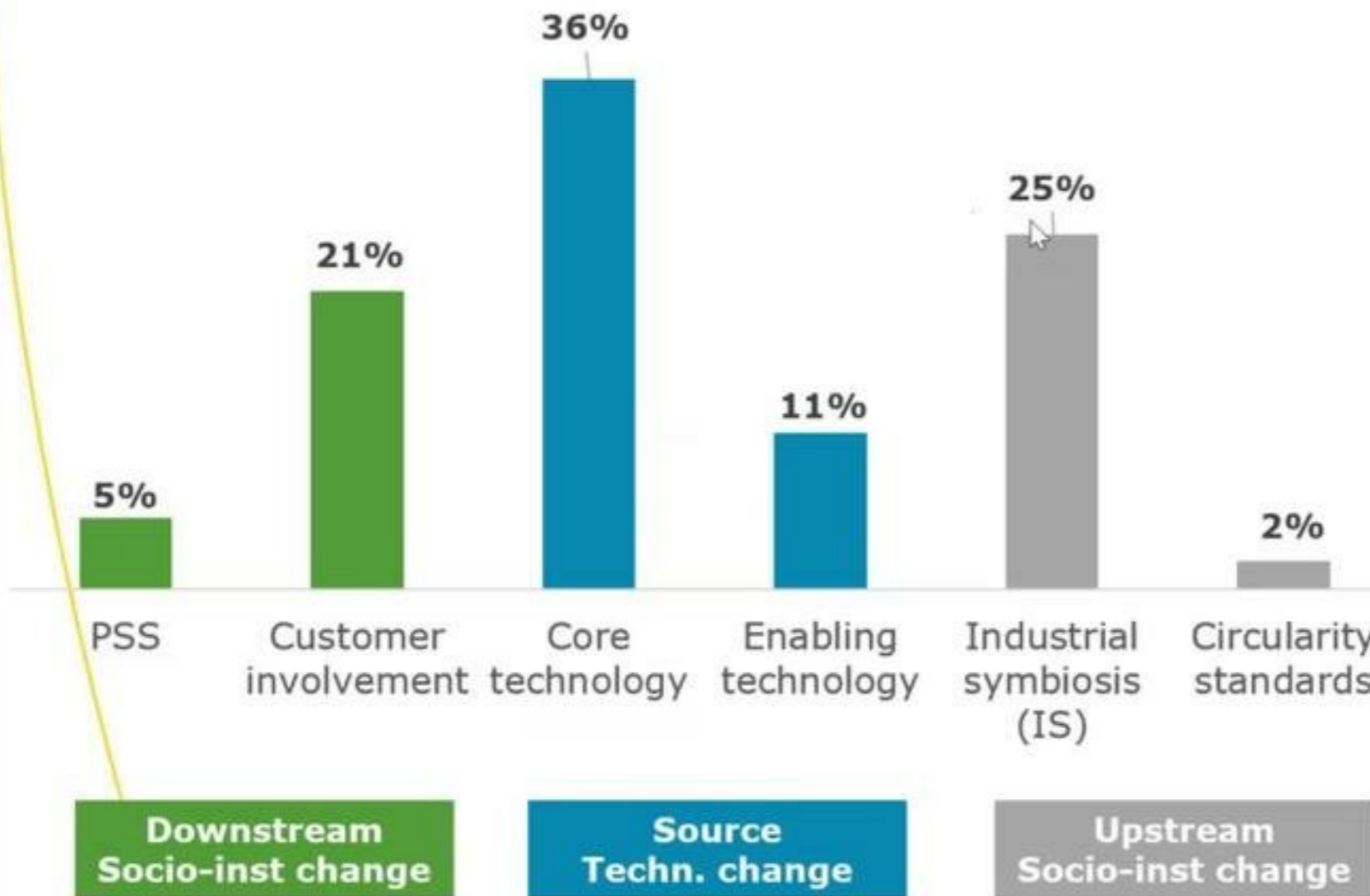
Circular business model innovation types can be allocated based on value chain focus

| Value chain focus | CBM Innovation Category | CBM Innovation Type | Description |
|--------------------------------|---|--|---|
| Downstream (consumers) | PSS (servitisation/ no customer ownership) | Use phase-oriented | Improved usage efficiency through renting, leasing, sharing, extended after-sales services |
| | | Result/ performance-oriented | Improved usage efficiency through subscription-based business models or pay-per-use, i.e. focusing on the functionality |
| | Active consumer involvement | Return, repair, reuse | Inclusion of consumers in after-use product/resource lifecycle; enabled by value recovery and take-back processes at the source |
| | | Collaborative consumption | (Cultivation and) Usage of shared assets within communities, potentially including shared ownership |
| | | (Educational) Consumer engagement | (Open-source) Knowledge sharing to change customer preferences and/or diffuse distinct CE practices, materials or processes |
| Source (focal organisation) | Core technology | Source material | Substitution of source materials with less resource-intensive, novel alternatives (bio-based, more durable, biodegradable, recyclable) |
| | | Product design | Increase interchangeability, upgradability, modularity, energy-efficiency or maintainability of products and product components |
| | | Key process | Novel production method or innovation of sub-processes enabling circularity |
| | Enabling technology | Sharing platform | Enables increased product utilisation rate and reduced material throughput through shared use/access/ownership |
| | | Trading platform | (Web) Platform to facilitate the exchange and resale of products and materials |
| | | Asset tracking | Tracking of products/components to enable adequate end-of-life treatment or create transparency on resource availability and origin |
| Upstream (suppliers, partners) | Industrial symbiosis (IS) | Input-oriented | Structured <i>inter-organisational</i> collaboration to create value from residual resource streams of external organisations or usage of shared assets |
| | | Output-oriented | Structured <i>inter-organisational</i> collaboration to create value from residual resource streams of focal organisation or usage of shared assets |
| | Circularity standards/ accreditation | Sourcing, manufacturing, transport/packaging | Establishing of process/material standards with suppliers through knowledge sharing and backward integration of activities along the supply chain |



CSUs influence systems through customer involvement and industrial symbiosis

Circular business model innovation categories
% of all innov. types



Key insights

- 2/3 of start-ups innovating in **core technology** combine this with **socio-institutional innovation**
- This CSUs confirm the theoretical view that **new technology must build up the required socio-institutional embedding** to be successful
- **Core-technology** is the **most represented** innovation category. It includes business models around nickel-iron batteries or bio-based construction materials



63% of circular start-ups pursue design- and waste-based business models

Dominant criterion for CSU archetype

% of data sample (n=128)

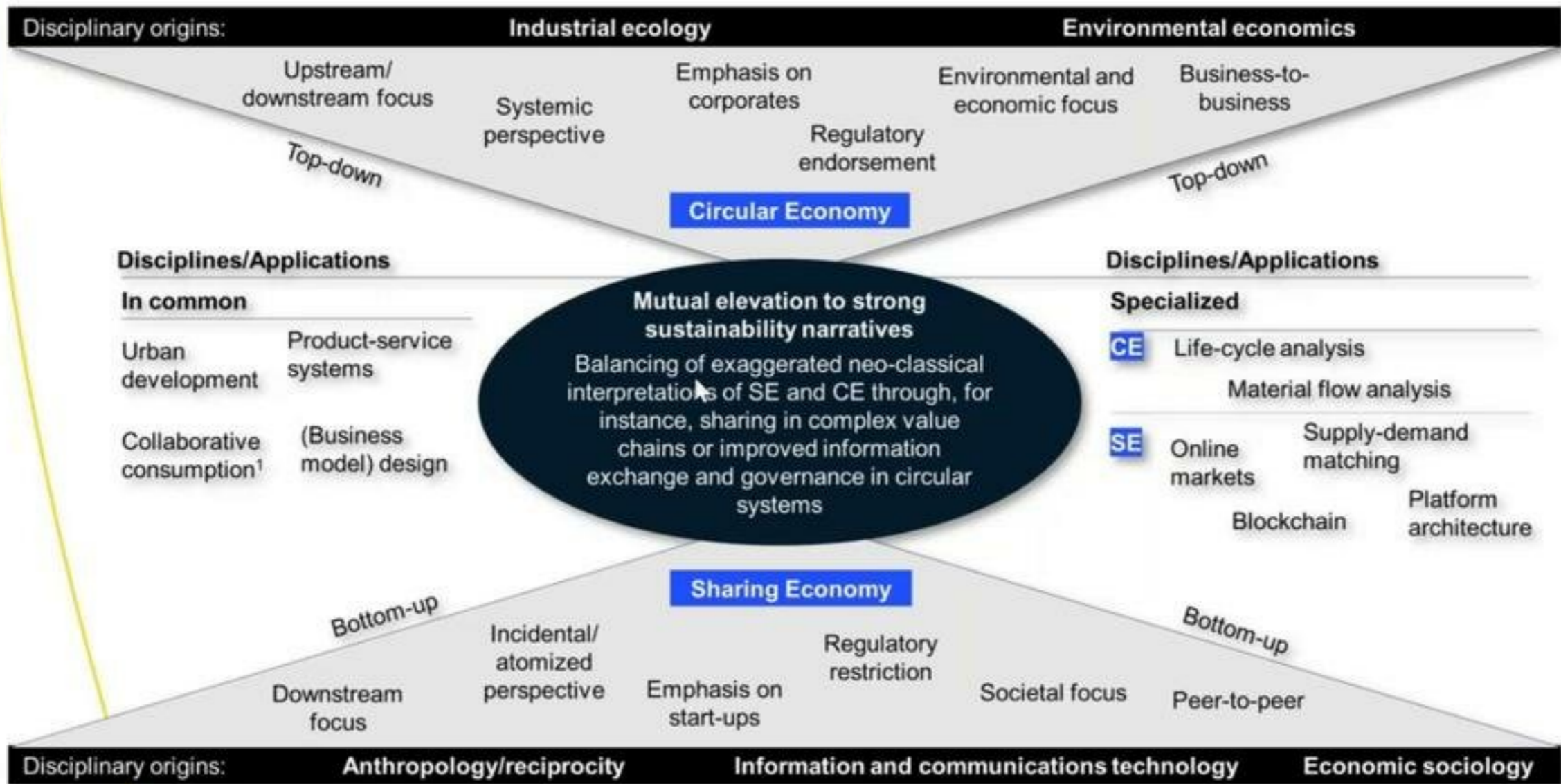
| | <i>R-strategy</i> | <i>Innovation category</i> | <i>Description</i> | |
|-----------------------|-------------------|----------------------------|--|------------|
| Design-based | Reduce | Core technology | Adopting circular innovations mostly in the pre-market phase through source material minimization, product design or production process efficiency | 36% |
| Waste-based | Recycle/Recover | Industrial symbiosis | Seeking to extract value from unexploited external waste streams (e.g. recycled plastic, CO2, surplus food) | 27% |
| Platform-based | Various | Enabling technology | Pursuing sharing/trading business models built around B2B, B2C or C2C marketplaces for (idle) resources | 19% |
| Service-based | Various | PSS | Embedding products in service-systems aiming for higher and better controllable usage efficiency. | 9% |
| Nature-based | Regenerate | Various | Increasing the delivery of (products and) services based on nature-based systemic solutions | 6% |

There is a marginal number of seven cases of CSUs that would fit to more than one cluster. For these, the authors applied a qualitative assessment based on the concrete type of innovation pursued and the key elements of the business model.



So far, CE is mostly approached top-down – the sharing economy can help to balance this

The battle of the buzzwords: A comparative review of the circular economy and the sharing economy concepts



1. According to Belk (2014) and Botsman (2013), including industrial symbiosis



Please do not hesitate to get in contact 😊

Follow-up questions and comments are welcome!

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