

## RESEARCH ARTICLE

# Pursuing sustainability advantage: The dynamic capabilities of born sustainable firms

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## Abstract

‘Born sustainable firms’ (BSFs) – firms founded with an explicit strategic intent to operate in a sustainable manner play an important role in the sustainability transition and represent a significant but underutilized research site. Adopting the dynamic capabilities (DC) perspective, this paper explores BSFs’ pursuit of their environmental and social goals. Having first assessed and confirmed its relevance to the BSF context, a high level framework of DC processes is operationalized. Through a dialogic approach, comparing the literature and empirical material from 12 BSFs from a wide range of sectors and locations, an in-depth picture of 28 processes underlying sensing, seizing and transforming meta-capabilities emerges. All but one of the detailed processes can be linked to prior research and are specific, though not unique, to BSF. Whilst the operationalized framework of DC processes in the BSF context extends prior research, the established notion of competitive advantage – framing organizational goals and impact in terms of financial outcomes and strategic performance relative to rivals – is problematic in this context. We therefore reconceptualize BSF’s organizational goals and impact in terms of ‘sustainability advantage’, that is, maximization of environmental and social performance within the constraint of economic viability. In addition, we identify two key dimensions of advantage: time horizon, which ranges from immediate to longer term impact, and scope, which ranges from organization-centred to system-wide impact. The findings have clear implications not only for sustainable entrepreneurship but also for incumbent firms moving towards genuine sustainability.

## KEYWORDS

entrepreneurship, problematization, SMEs, start-ups, strategic management, sustainable development

## 1 | INTRODUCTION

The sense of urgency to tackle overconsumption, environmental degradation and social inequity has become widespread in recent years. The challenges ahead call for a transition from the usual ‘do-less-harm’ thinking to more proactive ‘do-no-harm’ or, even better, ‘do-

good’ paradigms that restore and enhance the natural environment (Isil & Hernke, 2017; Pagell & Shevchenko, 2014). Whilst many well-established companies are pursuing ambitious programmes to improve collective social and environmental outcomes (Bocken & Geradts, 2020; Figge et al., 2002), they nevertheless prioritize private economic benefits (Busse, 2016). Furthermore, progress is slow

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because of the daunting complexity of change programmes. For example, Unilever, a sustainability champion in the corporate world, had to drastically lower the ambition of its sustainable living plan after the hostile take-over bid from Kraft-Heinz in 2017 and subsequent shareholders' demand to focus on immediate financial benefits (Smit, 2019). New ventures, on the other hand, do not suffer from path dependency and lock-ins (Markard et al., 2012), and their visionary entrepreneurs (Kearins et al., 2010) have greater freedom to pursue their goals.

Drawing an analogy to the notion of 'born global' firms (Mckinsey & Co, 1993), we regard 'born sustainable' firms (BSFs) as those which were established with explicit strategic intent to operate in a sustainable manner from the outset. BSFs seek to contribute directly to regenerating the environment and driving positive societal changes. In other words, BSFs address environmental and social needs before economic gains, seeking to create shared value (Porter & Kramer, 2011). Internalizing the cost of environmental and social harm of economic activities, BSFs promise to be a solution to, rather than a cause of, environmental degradation or social injustice (Cohen & Winn, 2007; York & Venkataraman, 2010). The mutually constitutive nexus between environmental/social value on the one hand and economic value on the other is a relevant area of analysis, and BSFs—in contrast to large corporations—provide a suitable site for its examination (Osorio-Vega, 2019).

In order to thrive in the complex, uncertain and dynamic context of the sustainability transition (Markard et al., 2012), BSFs need to strategically organize their resources (Bocken & Geradts, 2020; Davies & Doherty, 2019). The dynamic capabilities (DC) perspective has been developed to explain firm performance in dynamic environments (Teece et al., 1990) and thus may be helpful in understanding of how BSFs are capable of thriving. DC deployment occurs through the sensing, seizing and transforming meta-capabilities, each with discrete microfoundations — distinct skills, processes, procedures, structures, decision rules and disciplines (Teece, 2007). Microfoundational thinking is increasing significantly in research in the strategy realm (Tarba et al., 2020) and, when applied to DC, often takes shape through a processual focus (e.g., Dixon et al., 2014). The aim of this study is to theorize the strategic development and management of BSFs and inform our understanding of how BSFs can contribute to the sustainability transition. Our first research question is:

RQ1: What are the processes that underpin the dynamic capabilities of 'born sustainable' firms?

The DC framework according to Teece (2007, 2014, 2018) is premised upon two assumptions: it applies to large established firms; desired outcomes are high financial returns and outstanding strategic performance relative to rivals. In line with Teece, most research and theory building on DC has focused on established firms (Zahra et al., 2006). Some studies, however, investigated DC in smaller businesses or new ventures, elaborating key antecedents such as the backing of venture capitalists (Arthurs & Busenitz, 2006), the presence of an international entrepreneurial culture (Buccieri et al., 2021), and attributes of the entrepreneur (Evers, 2011), or elaborating key outcomes such as successful firm formation (Newbert, 2005),

international competitiveness (Evers, 2011), and ethical and competitive performance (Arend, 2013). Studies that elaborate the nature or the process of DC development in smaller businesses or new ventures are scarce, however (Newbert, 2005; Zahra et al., 2006), and even more so when such firms pursue positive environmental and social impacts. The notion that the primary goal of a firm is achieving high levels of profit over the long term does not fit the BSF context. Rather, their driver is more appropriately construed as the pursuit of 'sustainability advantage' — that is, to maximize environmental and social performance within the constraint of economic viability. Our second research question explores this view of BSFs' aims:

RQ2: What are the key dimensions that frame sustainability advantage?

We address these research questions through a dialogic approach, systematically comparing literature from past empirical and conceptual research, and our own empirical material (Alvesson & Kärreman, 2007).

Below, we first summarize key aspects of prior DC research, before grounding the BSF context in the literature. We then set out our research methodology. The 12 BSF cases from a wide range of sectors and locations are described. Based on the literature and our empirical material, the processes underlying DC and the dimensions that frame sustainability advantage are elaborated. We close with discussion and conclusions on the emerging in-depth picture of DCs and the outcomes that allow BSFs to contribute to the sustainability transition.

## 2 | DYNAMIC CAPABILITIES: PERSPECTIVE AND PROCESSES

### 2.1 | The roots of DC

The DC perspective extends the essentially static view of resource-based theory by examining how resources are created and refreshed over time in the face of changing business environments (Helfat & Peteraf, 2003; Teece et al., 1997). Going beyond attending to firms' VRIN (valuable, rare, inimitable and non-substitutable) resources, it addresses "the mechanisms by which firms learn and accumulate new skills and capabilities" (Teece et al., 1990, p. 11). This DC perspective emphasizes that competitive advantage does not emerge solely from the possession of resources, but rather the way these resources are deployed and renewed over time in the face of changes in the external environment (Ambrosini & Bowman, 2009).

Winter (2003) proposes that a firm's basic functional activities that permit its existence, for example, product development, strategic marketing or supply chain management (SCM), can be termed operational capabilities. DCs on the other hand are 'meta-capabilities' that give the organization the capacity to understand environments, recognize the value of resources and respond through appropriate changes to its operational capabilities. In other words, whereas operational capabilities maintain the status quo, DCs allow the firm to alter the way it makes a living (Helfat & Winter, 2011).

Two distinct schools have emerged within DC research, which Arndt and Pierce (2018) have named after their leading authors, Teece and Eisenhardt. Put simply, the ‘Teecian’ perspective (originating in Teece et al., 1997) focuses on meta-capabilities, whereas the ‘Eisenhardtian’ perspective (originating in Eisenhardt & Martin, 2000) relates to ‘best practices’ which yield temporary competitive advantage (Arndt & Pierce, 2018: p. 414), routines which Teece labels ‘ordinary capabilities’ and Zahra et al. (2006) call ‘substantive capabilities’. Some scholars favour “integrating the two contradictory views” (Peteraf et al., 2013). Others are more cautious since the two schools reflect “fundamentally different conceptualization[s] of dynamic capabilities that have been underplayed through linguistic similarities, but [which] become apparent when looking at the underlying understanding of the concept of bounded rationality, search, routines, evolutionary fitness/survival, and resource heterogeneity.” (Arndt & Pierce, 2018: p. 419).

This study follows the Teecian view of DC, which was developed in the context of environments experiencing rapid technological change and holds that DC can be a source of competitive advantage over time (Peteraf et al., 2013: p. 1394). The Teecian view complements the BSF context in several ways. There is a focus on long-run advantage in highly dynamic and uncertain settings. Though not all BSF focus on technological change, all are concerned with complex changes in the sustainability transition. Many are involved in product or process innovations, and their adoption, whilst also operating in sectors in transition. Overall, the Teecian view of DC “emphasize [s] the entrepreneurial capability within a firm of the top management team and others to adapt to and influence these rapidly evolving environments.” (Arndt & Pierce, 2018: p. 415).

## 2.2 | DCs processes and the advantage(s) they yield

Whilst the (Teecian) DC perspective has become a highly influential management theory in the past 15 years (Pisano, 2017), arguably its practical use remains limited due to ill-defined conceptual boundaries and a tendency for researchers to tautologically equate the existence of DC with organizational success and vice versa (Cepeda & Vera, 2007; Schilke, 2014). To overcome these limitations, Teece (2007: p. 1319) argues that a more granular understanding is needed and that it is necessary to identify what he terms the ‘micro-foundations’—‘the underpinning skills, processes, procedures, organizational structures, decision rules and disciplines’. In his seminal article, Teece (2007) elaborates a set of managerial capabilities which, taken together, constitute each of three ‘higher order’ capabilities (Teece, 2018: p. 40): sensing (i.e., processes for spotting and shaping market and technological opportunities); seizing (processes that define the business models/proposition and getting it established) and transforming/reconfiguring (processes of ongoing learning, strategizing, structuring and governing). These three DCs and their subcapabilities— all described in processual terms— constitute our starting point for empirical analysis.

Teece (2007: p. 1320) positions DC as explaining the sources of ‘enterprise-level competitive advantage over time’, aligning with the conventional view of competition focused on the firm and profit. Whilst the notion of advantage is clearly relevant to the goals of BSF, the primacy of *competitive advantage for profit* cannot be assumed. Based on an emerging stream of studies that highlight the embeddedness of firms within society and the natural environment (Borland et al., 2016; Hermelingmeier & von Wirth, 2021; Markman et al., 2016; Montabon et al., 2016; Muñoz & Cohen, 2018), we anticipate BSF will pursue a complex blend of outcomes, based on securing environmental, social and economic gains, for firm level and collective benefit. Therefore, in this study, we adapt Teece’s framework of DC processes and explore what can be termed ‘sustainability advantage’— maximizing environmental and social performance within the constraint of economic viability.

## 3 | THE CONTEXT: ‘BORN SUSTAINABLE’ FIRMS

The sustainability transition demands that firms genuinely pursue sustainability. The paradigm of industrial ecology highlights in that regard *responsibility*, assigning a moral dimension to economics and deepening the role of the actor to being much more than resource maximizer (Ehrenfeld, 2000; Muñoz & Cohen, 2018). Industrial ecology contests the underlying idea of development shaped by neoclassic economic arguments and claims more specifically that human welfare does not equal economic output; the assumption of continuous growth is not realistic; the physical and material reality of natural resources determines their availability on the longer run; and technological innovations will not provide all the necessary solutions to the problems (Ehrenfeld, 2000). Industrial ecology gained recognition among management scholars when the limitations of ‘triple bottom line’ thinking, that supposedly gives equal weight to economic, social and environmental outcomes (Elkington, 1998), became clear. The economic dimension denotes a firm’s self-interest, whilst the social and green dimensions reflect interests of third parties, typically considered as externalities in decision making models. Moreover, the economic dimension often refers to short-term pressures, whilst the social and green dimension has a longer term scope. Consequently, when faced with a trade-off, the firm is most likely to prioritize the economic dimension (Busse, 2016). In other words, the supposed balanced approach— for instance, the aim to achieve double digit growth and controlled raw material consumption— is difficult, if not impossible, to realize, as recently recognized by Elkington (2018) himself.

In contrast, an ecologically dominant logic suggests that, if the aim is to balance resource production and consumption over time and to assure intergenerational equity, we have to prioritize the environment first, society second and economics third (Markman et al., 2016; Montabon et al., 2016). It acknowledges the problem of non-substitutability of economic, natural and social capital, non-linearity of capital depletion, and irreversibility of capital deterioration (Dyllick &

Hockerts, 2002). In short, it refers to a triple embedded view as opposed to the triple bottom line view (Muñoz & Cohen, 2018).

Entrepreneurship research demonstrates firms can contribute to the sustainability transition (Cohen & Winn, 2007; Genus, 2020; Muñoz & Cohen, 2018; Parrish, 2010; Shepherd & Patzelt, 2011). Bocken et al. (2014) identified a range of archetypes of novel, sustainability-centred business models with various combinations of eight objectives: maximize material and energy efficiency; create value from 'waste'; substitute with renewables and natural processes; deliver functionality rather than ownership; adopt a stewardship role; encourage sufficiency; re-purpose the business for society/environment; and develop scale-up solutions.

New ventures have been called the emerging 'Davids' aiming to slay the greening 'Goliaths' (Hockerts & Würstenhagen, 2010). Visionary entrepreneurs (Kearins et al., 2010) have greater freedom to pursue genuine sustainability through dynamic and recursive activities that generate and refine potential opportunities (Shepherd, 2015). As such, entrepreneurs do not necessarily exploit some pre-identified opportunity, but the opportunity is rather an emergent result of entrepreneurial actions and environmental contingencies (Akemu et al., 2016). In the latter case, entrepreneurs "take a set of means as given and focus on selecting between possible effects that can be created with that set of means" (Sarasvathy, 2001: p. 245). Through entrepreneurial action focused on innovation and resource allocation, a future is shaped, not merely anticipated. This is evidenced by the influx of venture capital funding to green tech start-ups (The Economist, 2020; York & Venkataraman, 2010).

New ventures are not merely a scaled-down version of large firms (Arend & Wisner, 2005) but rather differ from large firms in three key ways. First, 'resource poverty' is both a condition and differentiator (Welsh & White, 1981). Second, new ventures are structurally simple with little functional focus or specialization in roles, where owner-founders have a pivotal role as they typically perform the role of relationship and network manager (Ellegaard, 2006). Third, new ventures are often not accountable to external shareholders, in which case financial reporting loses urgency and measures of success should be aligned with founders-managers' motivations (Herron & Sapienza, 1992). With this introduction of the theoretical (DC) and empirical (BSF) contexts in mind, we now turn to our empirical approach.

## 4 | STUDY METHODOLOGY

### 4.1 | Research perspective

Though this study does address a gap in prior research, our perspective and research strategy align with problematization (Alvesson & Sandberg, 2011). We identified that investigating BSFs would require an approach which is contextualized, processual and generative, and which is sector agnostic. Teece's (2007, 2014, 2018) DC perspective supports such analysis. However, this has several underpinning assumptions which do not fit the BSF context,

notably an orientation to established, highly competitive firms seeking profit maximization in the long term. Thus, we question an 'in-house assumption' (Alvesson & Sandberg, 2011) of the DC perspective: whereas advocates of DC assume that long-run financial and strategic performance relative to rivals are the ultimate desired outcome of firms (Schilke, 2014), BSFs view financial performance as a necessary condition but rather pursue positive environmental and social impacts.

Our cross-case analysis involved a dialogic process between the literature and this study's empirical material, with theories regarded as "instruments that provide illumination, insight and understanding" rather than "the underlying engines of generalized empirical patterns" (Alvesson & Kärreman, 2007: p. 1267). The literature has been reviewed in several iterations, before, during and after empirical data collection and analysis, and following both more exploratory approaches (general literature on DC, sustainability, entrepreneurship and SCM) and highly structured searches on Web of Science (mapping DC studies which intersect with at least two of the three fields of sustainability, entrepreneurship and SCM). Including SCM allowed us to provide a context rich analysis of the cases, recognizing BSF are embedded in complex networks of suppliers, customers and other stakeholders. We rigorously compared and contrasted insights from the literature and those from empirical material, leading to the insights described in detail below.

### 4.2 | Sample

The unit of analysis is the BSF. Case selection criteria were as follows: (a) Founders had an explicit and central goal to be a sustainable business (with at least an environmental dimension to align with the triple embedded view, and possibly an additional social dimension); (b) the company was commercially viable, and environmental/social impact was served through the same activities as economic value creation (as opposed to dependence upon philanthropy or grants); (c) the firm was established at least 5 years before the moment of the interview (as an indicator of economic viability and to provide a longitudinal perspective of goals, capabilities and outcomes). We used purposive sampling with snowballing technique to approach companies for participation. Interviewees signed a consent form that included permission to record the interview.

Theoretical saturation (Yin, 2003) was reached with 12 cases. Table 1 shows that the 12 BSFs operate across a variety of sectors, in five countries across three continents.

The cases can be inductively classified into three types according to their customer offering (see first column of Table 1):

- 'Greened product': five firms (DeviceCo, CompostCo, HousingCo, LightCo and BeanCo) offer a more sustainable product to directly substitute an established one (a 'fair' electronic consumer device, biodegradable disposable food containers and utensils, eco-housing, energy efficient lighting, fuel logs and biochemicals produced with waste coffee grounds, respectively).

TABLE 1 Case study company profiles

		Realizing sustainability through/with			
Company	Actors →	Upstream	Internal operation	Downstream	Wider network
<ol style="list-style-type: none"> <li>Country of origin (year of foundation)</li> <li>Number of FTE</li> <li>Customer offering</li> <li>Business model</li> </ol>	<p>Sust. Advantage + viability ↓</p>				
<p><b>DeviceCo</b></p> <ol style="list-style-type: none"> <li>xx (20xx)</li> <li>50 FTE (in 2017)</li> <li>Greened product</li> <li>Adopt a stewardship role: To design and sell a fairer consumer electronic device and lead reform in the electronics sector.</li> </ol>	<p>Ecological</p>	<p>Tier 2 suppliers: Improve mining practices.</p>	<p>Design team: Foster modular thinking.</p>	<p>Customers: Repair themselves. NGO: Organize return logistics at end of life.</p>	<p>NGO: Put the issue on the agenda. Certification bodies: Certify green practices. Legislators: Prohibit damaging practices.</p>
	<p>Social</p>	<p>Tier 1 suppliers: Improve labour conditions. Tier 2 suppliers: Improve labour conditions.</p>	<p>Employees: Demonstrate cultural and social sensitivity.</p>	<p>Customers: Prioritize suppliers' employee wellbeing over own desires.</p>	<p>NGO: Put the issue on the agenda. Certification bodies: Certify social practices. Legislators: Prohibit unfair working conditions. Competitors/complementors: Set up fair trade supply chain.</p>
	<p>Economic viability</p>	<p>Tier 1 supplier: accept production in small batches at 'low enough' cost.</p>	<p>Employees: Receive fair wages. Employees: Participate in grassroots marketing (shift own lifestyle).</p>	<p>Distributors: Promote the device. Consumers pay price premium to compensate for lower frequency of buying.</p>	<p>Influential campaigners: Create buzz</p>
<p><b>CompostCo</b></p> <ol style="list-style-type: none"> <li>USA (2009)</li> <li>37 (in 2017)</li> <li>Greened product</li> <li>Create value from waste: To design and sell compostable disposable foodservice products based on agricultural residuals and low energy-intensive production processes, and to help customers closing the loop.</li> </ol>	<p>Ecological</p>	<p>Tier 1 suppliers: Adapt equipment, introduce innovations in processes and materials Tier 2 suppliers: provide residuals for Tier 1 raw materials.</p>	<p>R&amp;D: Create internal capabilities to develop product range</p>	<p>Customers: Facilitate waste management. Consumers: Use the right bin. 3PL: Manage separate waste streams. Industrial composter: Compete for feedstock.</p>	<p>Legislators: Create laws on single-use packages; create space for new waste stream. Incumbent waste haulers: Accept new players/streams. Research institutions: Speed up R&amp;D on materials. Certification bodies: Certify green practices.</p>
	<p>Social</p>	<p>Tier 1 suppliers: Improve labour conditions</p>	<p>Employees: Participate in voluntary work next to job.</p>	<p>Certain customers (e.g., schools): Receive discounts.</p>	<p>Social enterprises: Receive high share of profit. Certification bodies: Certify social practices.</p>
	<p>Economic viability</p>	<p>Tier 1 suppliers: May become competitors when the market continues to increase.</p>	<p>Employees: Provide superior performance despite the absence of productivity performance bonuses.</p>		<p>Composters: Present in close by locations.</p>
<p><b>HousingCo</b></p> <ol style="list-style-type: none"> <li>Spain (2014)</li> <li>&lt;10 (2017)</li> <li>Greened product</li> </ol>	<p>Ecological</p>	<p>Builders: Shift to modular structures, without concrete and JIT delivery of materials.</p>	<p>Design team: Foster modular thinking and use of recycled and recyclable materials.</p>	<p>Higher income individual customers: Appreciate eco-housing.</p>	<p>Legislators: Provide subsidies for energy efficient housing. Government bodies: Foster social housing.</p>
	<p>Social</p>				

(Continues)



TABLE 1 (Continued)

Realizing sustainability through/with	
<p>4. Maximize material and energy efficiency: To design and sell modular energy efficient houses with sustainable materials, affordable to lower income groups.</p>	<p>Lower income individual customers: Can afford to rent decent quality housing.</p> <p>Housing cooperatives: Switch to ecological ('deep green') housing.</p> <p>Bankers: Fund novel ownership structures and novel building methods.</p>
<p>LightCo</p> <ol style="list-style-type: none"> <li>xx (20xx)</li> <li>54 (2017)</li> <li>Greened product</li> <li>Encourage sufficiency and deliver functionality rather than ownership: To design, install and maintain customized efficient lighting solutions that minimize ceiling heat.</li> </ol>	<p>Managers: Make a difference at the end of career, and leverage experience and contacts for low wage.</p> <p>Entrepreneur: Green impact is inherent to technological development (LED). R&amp;D: Pursue innovation and patents.</p> <p>Industrial customers and governments: Switch away from traditional high-energy lighting.</p> <p>Industrial customers and governments: Buy directly from LightCo versus from traditional distributors' channel.</p>
<p>BeanCo</p> <ol style="list-style-type: none"> <li>UK (2013)</li> <li>35 (in 2018)</li> <li>Greened product</li> <li>Substitute with renewables: Develop, produce and sell biofuels and biochemicals recovered from coffee grounds.</li> </ol>	<p>R&amp;D: Pursue innovation and patents. Production: Locate facilities close by feedstock.</p> <p>Industrial customers: Switch away from petroleum based chemicals to biochemical Consumers: Shift away from fossil fuels to biofuels.</p> <p>Incinerators or industrial composters: Compete for feedstock. Legislators: Coordinate the competition for feedstock.</p>
<p>3DPrintCo</p> <ol style="list-style-type: none"> <li>USA (2012 – bankrupt in 2019)</li> <li>24 (in 2017)</li> <li>Process equipment</li> <li>Maximize material and energy efficiency: Design, produce and sell 3D printing hardware, software and services.</li> </ol>	<p>Coffee houses: Segregate coffee grounds (avoiding landfill taxes).</p> <p>Waste haulers: Incorporate stream in existing business. New coffee houses: Sign up for the service.</p> <p>Filament suppliers: Collaborate to create green materials that suit the machine.</p> <p>Entrepreneurs: Green impact is inherent to technological development (3DP). Management: Has to demonstrate the added value of their 3DP (modular, range of materials, use in manufacturing)</p> <p>Customers: Switch away from traditional production methods to improve footprint. Industrial and prosumer customers: Buy less frequently, given modular design and reparability, and pay price premium.</p> <p>Makers base (community of practice): Develop novel approaches to existing and new problems. Competitors: Fast growing in an extremely dynamic market</p>
<p>WaterCo</p> <ol style="list-style-type: none"> <li>Spain (2014)</li> <li>&lt;10 (in 2017)</li> <li>Process equipment</li> <li>Substitute with renewables and natural processes: Design, assembly and maintenance of desalination plants with inverse osmosis.</li> </ol>	<p>R&amp;D: Develop solar energy powered facility.</p> <p>Customers (hotels): Promote the greener solution. Customers (factories): Need clean water in remote areas with unreliable water supply.</p> <p>Legislators: Allow this kind of installation, next to big suppliers of clean water, with related pipelines and distributed brine return.</p>

TABLE 1 (Continued)

Realizing sustainability through/with	
Economic viability	<p>Research institutes: Collaborate in developing the solution.</p> <p>Entrepreneur: Connects multiple players and provides service contracts.</p> <p>International sales agents: Help to sell the product internationally to overcome the small customer base.</p> <p>Legislators: Provide subsidies for the underlying R&amp;D</p>
Ecological	<p>Component suppliers: Collaborate in continuous system improvement.</p> <p>Customers: Switch away from traditional energy sources to renewable ones</p> <p>Legislators: Incentivize the shift to renewable energy.</p>
Social	<p>Founder: Influences legislators and sector associations, being active in public and sector-related events.</p> <p>Management: Active in local community building.</p> <p>Legislators: Affect demand when introducing regulatory changes</p>
Economic viability	<p>Founder: Runs a highly diversified organization.</p> <p>Employees: Accept lower wages.</p> <p>Academic community: Provide evidence on benefits of renewable energy.</p>
Ecological	<p>Millers: Consume less energy for milling; obtain higher yield; avoid transport of residuals.</p> <p>Farmers: Can mill rice themselves (versus through a big central mill) and thus receive bigger share of the margin.</p> <p>Banks: Have to facilitate the acquisitions of mills by smaller farmers</p>
Social	<p>Management: Cross-subsidies: Consultancy pays for mill development.</p> <p>Incumbents: Have to allow new entrants.</p>
Economic viability	<p>Management: Cross-subsidies: Consultancy pays for mill development.</p> <p>Legislators: Must adapt the current significant, varied and complex constraints to facilitate distributed waste-to-energy processing.</p>
Ecological	<p>R&amp;D: Pursue innovation and patents on wind turbines and AD.</p> <p>Customers: Can locally process waste and generate green energy.</p> <p>International sales agents: Sell the product internationally and manage regulatory barriers.</p>
Economic viability	<p>Customers (foodbanks): Have the capacity to receive and store the food</p>
Ecological	<p>Food owners: Take the decision to donate and avoid the food waste to go to landfill.</p> <p>Regional legislators: Rise landfill taxes.</p>
Social	<p>Food owners: Take the decision to donate and combat hunger.</p> <p>Founders: Rooted in local communities</p> <p>NGO: Put the issue on the agenda.</p> <p>Legislators: Create laws that allow human consumption of certain food waste and create incentives to foster donation.</p>
Ecological	<p>Food owners: Take the decision to donate and avoid the food waste to go to landfill.</p> <p>USA (2012)</p> <p>&lt;10 (in 2017)</p> <p>Waste sector</p> <p>Develop scale up solution: Technology (app) for the matching of supply and demand of food waste, to combat hunger.</p>
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(Continues)

TABLE 1 (Continued)

Realizing sustainability through/with	
Economic viability	<p>Food owners: Connect to the app or delegate this to shipper.</p> <p>Shippers: Coordinate with food owners on the issue and change delivery behaviour in case of rejected food.</p> <p>Management: Create sufficient number and value of transactions (revenue is from taking a slice of tax rebate).</p> <p>Owner: Is flexible to do personal brokering and campaigning.</p> <p>Customers: Have to connect to the app</p> <p>Community: Create buzz on the service</p> <p>Academic community: Create sense of urgency by providing evidence on nutritional value and potential health risks of cascaded use of food waste.</p>
Ecological	<p>Retailers: Provide space to locate the clean points.</p> <p>Consumers: Deliver domestic waste in clean points.</p> <p>R&amp;D: Develop processes to prepare different waste streams for recycling.</p> <p>Consumer packaged goods companies: Buy consultancy on packaging re-design.</p> <p>Recyclers: Buy feedstock.</p> <p>Legislators: Create laws to end single-use packages and incentives for companies to invest in novel processes.</p>
Social	<p>Consumers: Are educated in the clean points.</p> <p>Management: Provides fair work to former street waste pickers.</p> <p>Certification bodies: Certify social practices.</p>
Economic viability	<p>Management: Cross-subsidises: e.g. difficult plastics with income from easier plastics; waste collection point costs with consultancy income.</p> <p>World Economic Forum: Assigns prize.</p>

- ‘Process equipment’: five firms (3DPrintCo, WaterCo, HeatCo, MillCo and ContainerCo) sell equipment which can be used by customers in an ecologically or socially advantageous way (3D printing hardware, small-scale desalination plant, renewable energy production, waste-reducing rice milling equipment, modularized anaerobic digestion plant, respectively).
- ‘Waste management’: two companies (FoodCo and CycleCo) focus on waste management services (an app-based food waste brokerage; waste management facilities and consultancy, respectively).

### 4.3 | Data

Case data stem from secondary sources (e.g., company websites including blogs; interviews with founders posted on Youtube; popular press releases) and a semi-structured interview with the founder/chief executive of the BSF or their nominee. Single-respondent research designs are well accepted when the unit of analysis is a small or medium enterprise (Kull et al., 2018). Interviews lasted 1–2 h and were recorded for subsequent transcription and analysis.

Appendix A shows the interview schedule that included four main themes: (1) the firm; (2) the network of customers, suppliers and other partners; (3) the link between activities and outcomes; (4) supply management. In asking early on in the discussion how the firm was doing compared to initial expectations and asking *why* and *how* follow-up questions throughout the interview, we gained insights into firm's development over time. We did not pose direct questions about DC but listened for, and then questioned to expand upon, relevant comments made by interviewees. We focused the final part of the interview on upstream issues, to ensure we had a supply-side understanding of the firm to complement the customer-side insights which would emerge more naturally in response to the earlier questions.

### 4.4 | Analytical procedures

To ensure the overall ‘trustworthiness’ of our research (Shah & Corley, 2006), evaluated against criteria of confirmability, credibility, transferability and reliability (Welch & Piekkari, 2017), the processes followed across the different stages of research (Kaufmann & Denk, 2011) align with standards for the quality of conclusions in qualitative research in Miles et al.'s seminal ‘methods source-book’ (2014: pp. 310–314).

Both co-authors have been closely involved in the different analytical steps and iterations. We co-wrote the longitudinal case narratives, following a template with sections on: timeline and milestones; goals; market and technological opportunities; items that cut across DC; sensing; seizing; transforming/reconfiguring; outcomes; and operational capabilities. The narratives help in connecting goals with progress and setbacks, and in providing a longitudinal and processual view of the case.



During the analysis stage, we learnt that one firm went out of business (3DPrintCo) and that another only survived through cross-subsidies (MillCo). Both firms thus did not meet the condition of economic viability at a certain stage and could not attain sustainability advantage. Consequently, the evidence from both cases was used in a careful and limited way. For RQ1, analysis is centred on the 10 remaining cases, though where the two cases align with other findings and the examples are rich illustrations of the DC process, we have used selected quotes in the findings presented below. In analysing advantage, the two cases are analytically useful as outliers (Miles et al., 2014: pp. 301–302).

We co-created the codebook in NVIVO 12, coding interview transcripts and case narratives. Whilst coding, we were informed by the literature but allowed new codes to emerge. The codebook of microfoundations matured through multiple iterations, through constant comparison across the literature and the empirical material (Eisenhardt, 1989). After the initial coding per case, both authors engaged in a further, more inductive, phase undertaking systematic pairwise comparison of the 10 economically viable cases till we reached theoretical saturation, having completed 32 of the 45 possible pairs (see example in Appendix B). This approach was important for eliciting detailed insights on the similarities and differences between the cases independent of their sectoral contexts and business models.

We referred repeatedly to the detailed descriptions of the microfoundations of DC described by Teece (2007), initially to test whether his framework of DC processes was in fact relevant and meaningful in the BSF context, and subsequently to tease out the detail of the processes within the specific BSF context. We held multiple discussions to compare and contrast emerging findings and prepared the data summaries. The draft findings on DC processes and advantage were considered against the results of further literature review. With this dialogic approach, we sought to ensure recent research was taken into account and critically evaluate the internal and external consistency of prior research on related topics but in other contexts than BSF. This leads to robust findings which are specific, though not necessarily exclusive, to the BSF context. Together, these multiple, iterative analytic steps enabled 'zooming in and out' (Nicolini, 2009) and a contextualized, structural and processual perspective of the strategic development of the case companies.

## 5 | FINDINGS

The findings are presented in three sections: a descriptive account of the cases explains their goals and strategic development; the DC constituent processes; and dimensions of sustainability advantage. Reflecting our dialogic research approach, the findings below refer to empirical material and supporting references from extant literature.

### 5.1 | The goals and strategic development of the case study companies

Bocken et al.'s (2014) archetypes proved useful in describing in generalized terms the goals and business rationales of the 12 case BSFs. As shown in Table 1 Column 1 (and indicated in the case descriptions below with underlining), our sample represents all business model archetypes (Bocken et al., 2014), demonstrating the high variety of context in our BSF sample. Further, BSFs rely on multiple stakeholders to achieve their goals, though the degree of interdependence varies. The last four columns of Table 1 show this variety, summarizing how upstream and downstream actors, as well as internal stakeholders, regulators, NGO, certification bodies, banks and others, impact the achievement of environmental and social goals whilst sustaining economy viability.

DeviceCo developed operational capabilities around (grass roots) marketing, SCM and design, which allowed it to adopt a stewardship role, promoting a fairer electronic consumer device and leading reform in the electronics sector towards a more responsible use of materials and improved working conditions across the supply chain. Key events in the evolution of the company that helped assure sustainability advantage were the following: the launch of a modular, easy to repair and durable device with a licenced design; the establishment of collaborative agreements with NGOs, to improve social conditions in Tier 2 suppliers and to organize return logistics at end of life; and the launch of newer models of their device that facilitated further control of the supply chain through insourcing design activities and rights.

CompostCo developed operational capabilities around design, marketing and sales that allowed it to create value from waste, promoting compostable disposable foodservice products based on agricultural residuals and energy-efficient production processes. Key events in the evolution of the company were the following: the achievement of multiple certifications on organization and products; the internalization of R&D processes; and the establishment of a service helping customers to close the material loop.

HousingCo developed operational capabilities related to design and SCM to maximize material and energy efficiency, promoting modular, energy efficient houses with sustainable materials, affordable to lower income groups. Key events in the evolution of the company were the approval of several large scale social housing projects and acceptance of an important equity share of a hotel chain, which guaranteed economic viability.

LightCo developed operational capabilities related to design and project management to encourage sufficiency and functionality rather than ownership, promoting customized energy efficient lighting solutions (LEDs). Key events in the evolution of the company were the following: launches of increasingly superior lighting solutions; the assurance of supply capacity from a premium quality electronics factory; and the launch of an online B2B channel for direct sales of their lighting services to end customers.

BeanCo developed operational capabilities related to R&D to 'substitute with renewables and natural processes', developing, producing and selling biofuels and biochemicals recovered from coffee grounds. Key events in the evolution of the company that helped assure sustainability advantage were the following: developing a viable biofuel product; the assurance of the contract with a major supplier of coffee grounds; the acquisition of a large scale biomass drier; and achieving a reliable income stream from the biofuel to fund ongoing R&D on higher value biochemicals.

3DPrintCo developed design capabilities to 'maximize material and energy efficiency', designing, producing and selling 3D printing hardware, software and services. Key events in the evolution of the firm were the following: the establishment of a maker's platform; the outsourcing of production activities; the establishment of alliances with filament suppliers; and finally bankruptcy.

WaterCo developed operational capabilities related to systems integration, sales and maintenance to 'substitute with renewables and natural processes', that is, the design, assembly and maintenance of desalination plants with inverse osmosis. Key events in the evolution of the company were the following: the multiple grants received to operate as a pilot site within research networks; the re-design of the system to be based on solar power; and internationalization with help of agents.

HeatCo developed operational capabilities related to project management and communication to 'substitute with renewables and natural processes', that is, the installation and maintenance of solar panels and heat pumps, with a strong energy transition and community focus. Key events in the evolution of the company were the following: the founder's trip to Africa where his determination to do something to combat global warming was born; multiple interaction moments with legislators to advocate for green energy solutions more advantageous for consumers; and the diversification from solar into thermal and heat solutions.

MillCo developed operational capabilities related to machine design to 'maximize material and energy efficiency', that is, to design and implement simpler but 'state of the art' low-power rice-processing machinery that facilitates distributed milling and allows redistribution of wealth. Key events in the evolution of the company were the development and testing of increasingly efficient and easy to manage mills. Sectoral dynamics, highly determined by two major incumbents, made it difficult to build the business, which continues thanks to ongoing subsidy.

ContainerCo developed operational capabilities related to R&D, sales and project management to 'create value from waste', that is, to develop and install turnkey anaerobic digestion systems in shipping containers. Key events in the evolution of the company were the following: winning business development grants; the untangling of the idiosyncratic legislative landscape of each single new project where different parties compete for feedstock; and the establishment of research alliances on waste management.

FoodCo developed operational capabilities related to logistics and food system design to 'create value from waste' and 'develop a scale up solution', developing and implementing technology (an app) for the

matching of supply with demand of food which would otherwise be wasted, to combat hunger. Key events that allowed the organization to move towards sustainability advantage were the following: the shift in focus from national to regional markets; adding novel services such as administrative handling of tax-exemption forms for donors; and the creation of structures for learning among multiple involved players.

Finally, CycleCo developed operational capabilities related to design and engineering for a circular economy to 'create value from waste' through the creation of local recycling (clean) points, and consultancy on packaging and waste management. In addition, CycleCo aimed to 'repurpose for society' through the provision of fair work to former street waste pickers. Key events in the evolution of the company were the following: recognition as a B-corp company; international expansion; and diversification into consulting with major consumer packaged goods brands on re-engineering of packaging.

## 5.2 | The constituent processes of DCs

### 5.2.1 | Sensing

Sensing and shaping of new opportunities is a scanning, creation, learning and interpretive activity formed by processes that 'direct internal R&D and select new technologies', 'tap supplier and complementor innovation', 'identify target market segments, changing customer needs and customer innovation' and 'tap developments in exogenous science and technology' (Teece, 2007). Figure 1 shows the expression of those processes within the specific BSF context with relevant supporting references from the literature. Appendix C (1.1–1.4) provides a comprehensive overview of representative empirical data. For example, the *selection of new technologies* is driven by uncertainty, as expressed in the BeanCo interview:

We call it the shifting sands of [BeanCo]! We're getting into a steady state now, but it's been a bit of a rollercoaster due to the fact that, because no one's ever done this before with coffee, the challenges we've had along the way have dictated where we go. But we are an agile company. And we are not scared to change track.

### 5.2.2 | Seizing

The sensed new technological or market opportunities have to be seized through new products, processes and services, shaped by processes of 'delineating the customer solution and the business model', 'selecting decision-making protocols', 'selecting enterprise boundaries to manage complements and control platforms', and 'building loyalty and commitment' (Teece, 2007). Figure 2 shows the expression of those processes within the specific BSF context with relevant supporting references from the literature. Appendix C (2.1–2.4) provides a comprehensive overview of

<b>Sensing</b> Teece (2007) micro-foundation	
<b>Sensing processes operationalized in the BSF context</b> Description and relevant literature	
1.1 Direct internal R&D and select new technologies	<b>1.1.a Choosing direction triggered by uncertainty</b> The direction of R&D and selection of new technologies is triggered - rather than stymied - by uncertainty. • Relevant literature: Hmieleski and Baron, 2008; Kirchoff et al., 2016; York and Venkataraman, 2010.
	<b>1.1.b Selecting through trial and error</b> Experimentation with different technologies/solutions precedes the selection of a technology. • Relevant literature: Hockerts and Würstenhagen, 2010; Knoppen et al., 2011.
	<b>1.1.c Compensating limited internal resources</b> Internal R&D processes are limited due to scarce internal resources, increasing the importance of 1.2 and 1.3. • Relevant literature: Beske et al., 2014; Reynolds, 2011; Welsh and White, 1981.
1.2 Tap supplier and complementor innovation	<b>1.2.a Exploratory learning within an eco-system</b> The locus of exploratory learning is the eco-system rather than the focal firm. • Relevant literature: Ehrenfeld, 2000; Ghisetti et al., 2015; Muñoz and Cohen, 2018.
1.3 Tap developments in exogenous science and technology	<b>1.3.a Building learning alliances</b> Alliances with public and private research institutes grant access to developments in exogenous science and technologies. • Relevant literature: Arend and Wisner, 2005; Davies, 2009; Kasouf and Celuch, 1997.
1.4 To identify target market segments, changing consumer needs and customer innovation	<b>1.4.a Identifying opportunities based on sustainability</b> Business opportunities relate to green or social issues, while profit follows. • Relevant literature: Cohen and Winn, 2007; Shepherd and Patzelt, 2011; Stephan et al., 2016.
	<b>1.4.b Identifying opportunities based on capabilities</b> Opportunities are crafted through recursive activities; i.e., a focus on means rather than outcomes. • Relevant literature: Akemu et al., 2016; Sarasvathy, 2001; Shepherd, 2015.
	<b>1.4.c Identifying opportunities based on cognition/morality/emotions</b> Cognition, morality and emotions of the founder(s) are intimately tied when tapping ideas. • Relevant literature: Kaesehage et al., 2019; Paulraj et al., 2017; Shepherd, 2015.

**FIGURE 1** Sensing processes of dynamic capabilities within born sustainable firms

representative empirical data. For example, *enacting legislation* is key to delineate the customer solution, as expressed by the founder of ContainerCo:

There is an inherent block in the market for new technology, because you can't introduce a solution when regulations don't yet allow it. So we tried for a long time to negotiate with the hazardous waste people, so that we could take 1000 tons of waste, which is currently classified as hazardous, and which costs an airport or an airline an enormous amount of money to deal with given that it has to be dealt with in a hazardous waste facility. The carbon footprint is huge as there aren't very many of those and it's traveling long distances in the vehicle.

### 5.2.3 | Transforming

Success in the previous two stages leads to augmentation of enterprise resources and the need to continuously manage threat and reconfigure those resources. This is shaped by the processes 'decentralization and near decomposability', 'governance', 'cospecialization' and 'knowledge management' (Teece, 2007). Figure 3 shows the expression of those processes within the specific

BSF context with relevant supporting references from the literature. Appendix C (3.1–3.4) provides a comprehensive overview of representative empirical data. For example, aligning incentives of external stakeholders is key for governance, as expressed by a key manager at DeviceCo:

One of the learnings we took away is that we can have high ambitions, but in order to achieve them we need to have a common ground and aligned views on how to get there together with our supplier.

### 5.3 | Unpacking sustainability advantage

Whilst the relationship between DCs and performance can be seen as mediated by the (resulting) quality of operational capabilities (Zahra et al., 2006: p. 943), according to Teece (2007), DCs are the sources of competitive advantage over time. Those following the Teece view of DC (e.g., Schilke, 2014) have promoted financial performance and strategic performance relative to rivals as measures of this competitive advantage. We questioned this notion of the advantage that BSFs seek through their strategic choices and activities, from the outset of our study. The exploratory and cross-sectoral design of this study means it is not possible to draw conclusions about the configuration of DCs and BSF's performance over

<i>Seizing</i> Teece (2007) micro-foundation	<b>Seizing processes operationalized in the BSF context</b> Description and relevant literature
2.1 Delineating the customer solution and the business model: selecting technology and product architecture; designing revenue architectures; selecting target customers; designing mechanisms to capture value	<p><b>2.1.a Engaging a broad range of stakeholders</b> Relative importance of customers and shareholders decreases in favor of other stakeholders, such as workers, communities, citizens, and the planet. • Relevant literature: Busse, 2016; Davies and Doherty, 2019; Markman et al., 2016; Montabon et al., 2016.</p> <p><b>2.1.b Enacting legislation</b> To adapt to but also challenge and influence existing rules, public policy, norms and legislation (i.e., institutional dynamics) in order to capture value. • Relevant literature: Hmieleski and Baron, 2008; Hoogendoorn et al., 2019.</p>
2.2 Selecting decision-making protocols: recognizing inflection points and complementarities; avoiding decision errors and anticannibalization proclivities	<p><b>2.2.a Moral filtering</b> Moral judgements of entrepreneurs operate as a filtering device and steer decision making. • Relevant literature: Osorio-Vega, 2019.</p> <p><b>2.2.b Balancing long term vision and short term realities</b> Short-term decisions may be in conflict with the vision of the firm but guarantee its economic survival and meeting the vision at the longer term. • Emergent from data.</p> <p><b>2.2.c Leveraging ambiguity</b> Ambiguity creates space to accommodate the different actions and motivations of stakeholders involved. • Relevant literature: Van Burg et al., 2013</p>
2.3 Selecting enterprise boundaries to manage complements and control platforms: calibrating asset specificity; controlling bottleneck assets; assessing appropriability; recognizing, managing, and capturing cospecialization economies	<p><b>2.3.a Building collaborations</b> Collaborative approaches are predominant over transactional approaches • Relevant literature: Miemczyk et al., 2016; Shepherd and Patzelt, 2011.</p> <p><b>2.3.b Networking and bridging to connect nodes in a network</b> Beyond the more prevalent dyadic action in supply chains, simultaneous action with suppliers and customers, or with NGO and suppliers, accelerates the adoption of new practices and solutions. • Relevant literature: Stekelorum et al., 2020.</p> <p><b>2.3.c Navigating new supply markets</b> BSFs shape and adapt to new supply markets – that emerge in an increasingly circular economy - and existing markets with fundamental shifts in behavior and practices. • Relevant literature: Knight et al., 2015.</p>
2.4 Building loyalty and commitment: demonstrating leadership; effectively communicating; recognizing non-economic factors, values and culture	<p><b>2.4.a Inducing shifts in customer behavior</b> Rather than following customer behavior, BSFs use communication and subtle activation of self-accountability of consumers to shift their behavior. • Relevant literature: Pelozo et al., 2013.</p> <p><b>2.4.b Managing attractivity to build suppliers' commitment</b> Suppliers that are dis-incentivized by the small volumes of the new venture have to be convinced by other customer characteristics such as contribution to sustainability or shared market information. • Relevant literature: Vanpoucke et al., 2014</p>

**FIGURE 2** Seizing processes of dynamic capabilities within born sustainable firms

time. The data do however provide insights into how BSFs' aims can be framed in terms of advantage, in a form which we term 'sustainability advantage', to highlight the anticipated positive environmental and social impact and to distinguish it clearly from conventional 'competitive advantage'.<sup>1</sup>

As anticipated, and integral to our initial conception of BSF, for BSF founders, financial viability is a necessary condition, and financial performance is not maximized at the cost of environmental/social performance. In other words, financial performance is a necessary but not sufficient condition for achieving sustainability advantage. For example, CompostCo donates every year approximately 20% of profits to selected social enterprises, DeviceCo assures better wages across the supply chain reducing its gross profits, and CycleCo subsidizes recycling of difficult materials (e.g., polypropylene) with income from recycling easier materials.

Comparative analysis of the firms' goals, achievements and setbacks highlighted two critical dimensions of the sustainability advantage they pursued: time horizon and scope. Several BSFs had experienced difficult periods in terms of cash flow that forced them to take decisions that prioritized financial outcomes at certain times,

whilst postponing the intended environmental and social impact. For example, HousingCo had to pitch for development projects that were 'light green' rather than 'deep green', in order to survive and be able to sell the 'deep green' solution in the future. 3DPrintCo was selling equipment to customers who used filaments based on non-renewable materials for as long as it took to convince them of the benefits of filaments made out of renewables. WaterCo installed plants powered by fossil fuels as long as clients were unwilling or unable to fund solutions powered by solar energy. CompostCo started to sell their compostable products even though customers were not (yet) channelling their waste to industrial composters. CycleCo facilitated the recycling of household waste whilst observing that packaging design did not yet optimize recycling efficiency. Whilst their overall direction and aspirations for impact over the long-term were stable, their expectations about the timescales in which these would be achieved had to be adjusted.

The second dimension of the sustainability advantage that emerged throughout our analyses refers to scope of impact. The number of stakeholders involved to pursue the environmental and social goals varied considerably across the cases (see Table 1): a greater

<i>Transforming</i> Teece (2007) micro-foundation	<b>Transforming processes operationalized in the BSF context</b> Description and relevant literature
<b>3.1 Decentralization and near decomposability:</b> adopting loosely coupled structures; embracing open innovation; developing integration and coordination skills	<b>3.1.a Managing tensions between stakeholders for joint action</b> Manage tensions between objectives of diverse stakeholder groups that need integrated decision making. Such tensions often stem from different scopes of system and time. <ul style="list-style-type: none"> <li>Relevant literature: Busse, 2016; Davies and Doherty, 2019.</li> </ul> <b>3.1.b Selecting and retaining talent</b> Selection and retention of talent increases the possibility to deal with cognitive tensions and as such the development of integration and coordination skills. <ul style="list-style-type: none"> <li>Relevant literature: Wu and Pagell, 2011.</li> </ul>
<b>3.2 Governance:</b> achieving incentive alignment; minimizing agency issues; checking strategic malfeasance; blocking rent dissipation	<b>3.2.a Aligning internal incentives</b> Commitment and more precisely affective commitment of the workforce is vital minimize agency issues, especially if initial wages are low. <ul style="list-style-type: none"> <li>Relevant literature: Wu and Pagell, 2011; Wichmann et al., 2016.</li> </ul> <b>3.2.b Aligning external incentives</b> Supply Chain practices focus on developing suppliers, aligning agendas and assuring compliance across the chain. <ul style="list-style-type: none"> <li>Relevant literature: Chowdhury et al., 2019; Vanpoucke et al., 2014; Villena and Goia, 2018; Vurro et al., 2009.</li> </ul> <b>3.2.c Communicating transparently to multiple stakeholders</b> Open communication and transparency are key, as the founders and firm's agenda and actions will be likely be scrutinized by communities and markets. <ul style="list-style-type: none"> <li>Relevant literature: Osorio-Vega, 2019.</li> </ul>
<b>3.3 Cospecialization:</b> managing strategic fit so that asset combinations are value enhancing	<b>3.3.a Combining assets along the chain</b> Asset combinations with third parties through collaborative arrangements in order to jointly exploit the stipulated tasks and explore improvements <ul style="list-style-type: none"> <li>Relevant literature: Arend and Wisner, 2005; Davies, 2009; Kasouf and Celuch, 1997.</li> </ul> <b>3.3.b Advocating change</b> Strategic fit of the firm hinges upon the broader eco-system in which it operates, and therefore considerable effort goes into transforming the system. <ul style="list-style-type: none"> <li>Beske et al., 2014; Carbone et al., 2019</li> </ul>
<b>3.4 Knowledge management:</b> learning; knowledge transfer; know-how integration; achieving know-how and intellectual property protection	<b>3.4.a Measuring impact</b> Measures of success go beyond economic measures to focus on impact on environment; social and economic inclusion; health and well-being; and, civic engagement. <ul style="list-style-type: none"> <li>Relevant literature: Herron and Sapienza, 1992; Parrish, 2010; Stephan et al., 2016.</li> </ul> <b>3.4.b Combining multiple roles</b> Employees play multiple roles with different associated knowledge and function as such as knowledge brokers. <ul style="list-style-type: none"> <li>Relevant literature: Ellegaard, 2006.</li> </ul> <b>3.4.c Data-driven learning on the eco-system</b> Companies capture data on the broader system in order to continuously innovate. <ul style="list-style-type: none"> <li>Relevant literature: Sarkis et al., 2011; Villena and Goia, 2018.</li> </ul>

**FIGURE 3** Transforming processes of dynamic capabilities within born sustainable firms

number of stakeholders points to a more ambitious view of desired impact with a shift from an organization-centred to a system-wide scope. Whilst ContainerCo, LightCo, BeanCo, WaterCo and 3DPrintCo had a more organization-centred perspective towards delivering value in green and social terms, the other cases demonstrated a more systemic perspective. For example, DeviceCo was established with the ambition to change the consumer electronic industry 'from the inside' and therefore developed an explicit strategy for sharing its learning across the industry.

Growth of the firm is required to generate revenue to fund further initiatives, and to be a more attractive customer to its key suppliers and therefore more influential in change within the supply chain. Growth is necessary to better deliver the wider goal to transform the sector, rather than to achieve a leading position among its sector rivals or greater profitability. Foodco's ambition to combat hunger by 'food rescue', and cascaded use of healthy food that rejected by retailers, is caught up in a complex web of food and tax regulations and multiple roles and responsibilities along the food supply chain.

The CEO of HeatCo wanted to 'do something' for climate change without – initially – a fixed view of how this would be done. Gradually, the business focused on installation of several renewable energy solutions. Whilst it is prospering, growth for higher profit does not feature in the founder's discourse. The company's success is however important in providing the context from which the founder can advocate for renewable energy at a national level, and in terms of developing a team of committed experts and bringing new jobs to a rural community.

HousingCo aspires to change the housing sector by introducing ecological and social housing but to do so relies on changing attitudes among local authorities, builders, housing associations and finance institutions. CompostCo aspires to mitigate all problems associated with single-use plastics, but its customers rely on access to composting facilities which varies greatly between regions, being dependent on local legislation, municipal facilities and existing waste service companies. They provide support to customers to navigate these complexities. By contrast, tightening waste regulations combined with

growing community activism are driving rising demand for CycleCo's services that is considered a leader influencing the sustainability transition in Latin America because of their active work with producers, retailers, waste haulers and consumers.

In summary, we find, first, that BSF seek sufficient, not superior, financial performance, thus uncoupling the notion of advantage from profit. Second, BSF seek to excel in their environmental and social impact, and it is this impact that is central to the notion of sustainability advantage. Third, the time horizon and scope dimensions of sustainability advantage proved to be important to understand the impact ambitions of the BSFs.

## 6 | DISCUSSION, CONTRIBUTIONS AND FURTHER RESEARCH

### 6.1 | Discussion: DC processes

The BSF cases provide evidence on all 12 microfoundations (four for each meta-capability) provided by Teece (2007), thus confirming their relevance in the BSF context. Through further, iterative analysis, with constant comparison of empirical cases and between data and the literature, the Teece (2007) framework of DC processes is operationalized in 28 more specific processes. Literature and our empirical sources converged for 27 of the 28 constituent processes of BSF DCs. "Balancing long term vision and short term realities" (2.2b under *seizing*) was an important process in our empirical evidence, though not one we found in the literature reviewed.

All 28 constituent processes are potentially relevant to each BSF, but (i) they are not equally important to each BSF and (ii) whilst the processes are specific to BSFs, they are not unique to BSFs. With increasing BSF maturity and the consequent creation of a knowledge base and organizational memory, learning processes will develop and may converge with those of established firms (Zahra et al., 2006). In other words, some proposed processes may decrease in importance over time – for example, selecting new technologies/solutions through trial and error (*sensing*) – whereas other processes may increase in importance over time – for example, experimentation facilitated by data-driven learning on the eco-system (*transforming*) (Zahra et al., 2006). In addition, though we acknowledge that the operationalization of DC is different in ethical driven organizations versus competitive organizations (Arend, 2013), we do not presume that all microfoundations are different across the two types of organizations. Overall, our proposed framework of 28 processes underpinning *sensing*, *seizing* and *transforming*, as summarized in Figures 1–3, lends itself to supporting actionable managerial decision making and further empirical research in the field of DC.

### 6.2 | Discussion: Sustainability advantage

None of the firms were operating in established ways in established sectors. Their success cannot meaningfully be measured by comparing

them with rivals or according to their profitability. Whilst BSF remain rare and innovative, their performance needs to be considered primarily in terms of their founding vision and goals, rather than some external benchmark, in line with Klapper et al. (2021). Superior performance is not a function of profit or performance relative to competitors in their markets, but a function of delivering the green/social impact central to their purpose.

The evidence from the 12 cases highlights two key dimensions – time horizon and scope – that contribute to the understanding and evaluation of the pursued advantage. The time horizon dimension points to delaying the intended green/social impact, when financial viability requires prioritizing cash flows. The absence of financial slack hinders the proactive quest for positive environmental/social impact<sup>2</sup> (Nwoba et al., 2021). In addition, depending on the patience of possible external investors, the BSF will have to deliver a certain speed of financial returns on investment (Doherty et al., 2014). How financial viability evolves over time thus dictates the relative weights of green/social impact versus profit. As such, BSFs illustrate the flaw of the win-win assumption – i.e., that companies can genuinely balance environmental, social and financial goals – behind triple bottom line thinking (Isil & Hernke, 2017). Such balancing acts between environmental/social goals and short-term financial realities may result in tensions for BSF managers (Carollo & Guerci, 2018) and impact the perceived integrity of leadership by employees (Wei et al., 2019).

Postponing the desired green/social impact does not however take away the BSF status from the firm, since their initial intentions have not changed. Rather, the time dimension of sustainability advantage highlights how advantage is pursued over time, through balancing of relative weights of green/social and profit impacts. In general, 'balancing long term vision and short term realities' (2.2b under *seizing*) and 'communicating transparently to multiple stakeholders' (3.2.c under *transforming*) were important to explain this possible 'juggling' of impact pursued over time.

Firms experience varying degrees of flexibility on their journey towards delivering their vision. Some BSF had an 'all or nothing' proposition: without the environmental/social value, there is no business. In other words, the time horizon of pursued advantage cannot be broadened. For example, ContainerCo sells a single system that allows decentralized waste-to-energy processing; all of FoodCo's actions reduce hunger and avoid food waste; and LightCo always focuses on the latest generation of efficient lighting solutions. This group of firms does not have a mixed portfolio of incremental and radical innovations (Kennedy et al., 2017) that would allow switching to the less desirable, but possibly easier to sell and more profitable, incremental innovations when the cash position so demands. The case MillCo was extreme in its 'all or nothing' proposition which, combined with considerable market entry barriers, could not achieve financial viability without relying on cross-subsidy and several government innovation grants.<sup>3</sup>

The scope dimension refers to the target of the intended environmental and social impact; that is, the system level at which benefits will be experienced. In line with the ecological perspective that highlights the responsibilities of economic actors, firms have a 'boundary-less responsibility' for the actions of their whole supply chain

(Amaeshi et al., 2008) and the impact on the human and biophysical worlds in their eco-system (Borland et al., 2016). Change advocacy then needs to take place on a broader level (Beske et al., 2014; Villena & Gioia, 2018) and outcomes of firm activities have to be portrayed with a societal and planetary scope (Hermelingmeier & von Wirth, 2021). Such expanded scope is in contrast to the organization-centric conception of sustainability present in studies involving self-referential discussions on how sustainability can aid a particular organization (Isil & Hernke, 2017).

The scope dimension is closely related to the need to reflect on the meaning of *sustainability* advantage, in line with Milne and Gray's (2013: p. 18) critique: "One is drawn to enquire how such a bewildering situation arose: how can something so self-evidently not connected with sustainability [read: all industrial processes that involve the consumption and manipulation of energy and materials, leading to the production of products, services and wastes] be so widely understood as (corporate) sustainability?". Reflecting upon our cases, Milne and Gray might ask: Do we really need more drinking water in remote areas, typically to meet demand from tourism? Or should the focus rather be on limiting tourism to remote areas? In a similar vein, do we need compostable disposable products for the food industry? Or should the focus be rather on shifting consumption patterns? That however is not straightforward. 3DPrintCo and DeviceCo illustrate the challenges and risks for companies which, in line with circular economy principles, aim to reduce demand for their product through, for example, modular design and increased durability (Prieto-Sandoval et al., 2018), thus potentially reducing future income streams. In general, despite being founded with strong pro-environment and pro-social values, the extent to which the BSFs investigated in this study successfully address Milne and Gray's criticism varies widely.

### 6.3 | Contributions

Society needs businesses that drive up, rather than undermine, ecological and social standards (Dyllick & Hockerts, 2002; Isil & Hernke, 2017). BSFs — firms established with an explicit strategic intent to operate in a sustainable manner from the outset, and seeking to contribute to regenerating the environment and driving positive societal change — are therefore key to sound economic development. Our focus on BSFs, rather than the mainstream focus on well-established firms doing less harm, allows us to explore how firms pursue sustainability advantage and contribute to the sustainability transition (Osorio-Vega, 2019). BSFs demonstrate the feasibility of radical change (Stephan et al., 2016) shifting market equilibria within a sector (Cohen & Winn, 2007). As such, we respond to the call to provide examples of real progress, rather than adhering to 'mythical indices' to capture sustainability (Aragón-Correa & Rubio-Lopez, 2007: p. 378), and our study's first contribution lies in delineating the notion of BSFs.

Deploying the DC perspective in the strategic management of BSF helps to step back from sector, customer or product specific issues, and to understand better what connects the strategic

development of BSFs as an important group of firms for accelerating the sustainability transition. Our second contribution lies in operationalizing the microfoundations of DC in the entrepreneurial and sustainability-oriented context of BSFs, providing a level of granularity and context specificity that supports actionable managerial decision making (Pavlou & El Sawy, 2011). Through several iterations between the literature and empirical material on 12 cases, we have developed Teece's (2007) 12 microfoundations into 28 constituent processes. All processes but one can be linked to prior research, and they are specific, though not unique, to BSF. As such, the study confirms the relevance of Teece's (2007) DC process framework for the specific BSF context. The holistic nature of our framework contrasts with current piecemeal approaches towards understanding the pursuit of sustainability opportunities (Muñoz & Cohen, 2018).

By contrast, the conventional notion of (competitive) advantage—the gain from effective performance through DC—is problematic and has to be reconceptualized. We challenged the assumption regarding financial performance and strategic performance relative to rivals as ultimate desired outcome variables. We show that DC is also needed when the firm's ultimate aims refer to regenerating the natural environment (Aragón-Correa & Rubio-Lopez, 2007) and that superior performance is more appropriately judged in terms of achievements against the anticipated green/social impact. Thus, our third contribution lies in elaborating 'sustainability advantage' and its two dimensions. The time dimension acknowledges that business leaders' relative emphasis on economic versus green/social goals may shift over time. It acknowledges the practical complexities of building a BSF and allows for making more humble claims regarding the actual impact achieved. The scope dimension acknowledges that business leaders have different degrees of ambition for environmental and social change, ranging from organization centred to system wide. A systemic scope implies evaluation of success including performance/well-being of the eco-system in which the BSF is embedded.

Our claims are based on a methodology that has given voice to practitioners, which has been absent for too long in the debate on entrepreneurship and entrepreneurial outcomes along all three dimensions of sustainability (Klapper, 2021). In addition, the rich analysis of the outcomes pursued by the BSF cases helps overcome the overly simplified dichotomization between conventional and sustainable entrepreneurship and their respective outcomes (Dyllick & Hockerts, 2002; Klapper et al., 2021).

### 6.4 | Limitations and further research

Whilst the number and variety of cases is a strength of this study, the longitudinal case narratives were developed with retrospective data and relied on a single interview (usually with the founder) to complement documentary data. Reflecting upon our research process, we noticed that founders are often skilful story tellers and that this places particular demands on the skills of the interviewer. It also highlights the need for secondary data to enable triangulation of the case evidence, but especially to assess the extent to which sustainability

aspirations have been met over time. Real-time, longitudinal studies are needed to provide further insight in the practice of DC (Easterby-Smith et al., 2009) and their influence over time on performance and how they are mediated by operational capabilities (Zahra et al., 2006). More in-depth case studies would also be an opportunity to gather data from BSFs' key partners, providing a stronger stakeholder network perspective.

In early readings of the data, one's attention is drawn to the interviewee's (often passionate) expression of personal values and ethical concerns. This values perspective is not central to our analysis. Following Teece (2007), the emphasis was on a processual perspective and an organization-centred analysis of DC. Values could be featured, however, in future research uncovering the interaction between individual – moral, emotional and cognitive – characteristics (Kaesehage et al., 2019; Shepherd, 2015), interpersonal interactions (Salvato & Vassolo, 2018) and organizational structures and processes (Paulraj et al., 2017). Individuals, social processes and structures are embedded in a nested and temporal hierarchy and their interaction thus contributes to DC development (Felin et al., 2012).

More closely related to the present study, we foresee three lines of inquiry, as highlighted in Figure 4.

First, further investigation of DC in BSFs is needed, evaluating and developing the framework of 28 DC processes (Figures 1–3) or focusing on particular sets of processes and assessing its value in various BSF contexts – for example, in different sectors or in different business models. Such research should also focus on the link between DC processes and sustainability advantage. Our study has provided the necessary nuance of the processes and outcome variables, but the methodology does not allow us to draw conclusions on the connections between capabilities and outcomes. Configurational analysis of case studies would be helpful here (Doty & Glick, 1993), for example, to classify firms in terms of degree of flexibility to postpone environmental/social goals as and when required due to economic viability pressures.

Well-established firms on the other hand may continually review their philosophical position and transition from anthropocentrism to ecocentrism (Borland et al., 2016). This transition is important, given their established markets and potential widespread impact

(Hockerts & Würstenhagen, 2010). A second line of inquiry then resides in assessing the relevance of the DC process framework and the notion of sustainability advantage to well-established firms which aim to become more sustainable (Aragón-Correa & Rubio-Lopez, 2007; Bocken & Geradts, 2020).

Third, when well-established firms enter the arena of companies pursuing sustainability advantage, BSF will have to become even better in their pursuit of environmental and social goals. Future research may focus on sectors where well-established firms are making genuine efforts and considerable progress, possibly challenging the economic viability of BSF. BSF may then begin to function as more conventional firms or be the drivers of new heights of sustainability advantage highlighting the philosophical contrast between those who believe that sustainability challenges can be overcome within the current socio-economic systems and those who believe that a radical paradigm shift is needed (Isil & Hernke, 2017). Overall, BSFs are an important part of the sustainability transition, potentially a source of inspiration and learning for other firms, and worthy of further research and policy support to enhance their DCs and positive environmental and social impact.

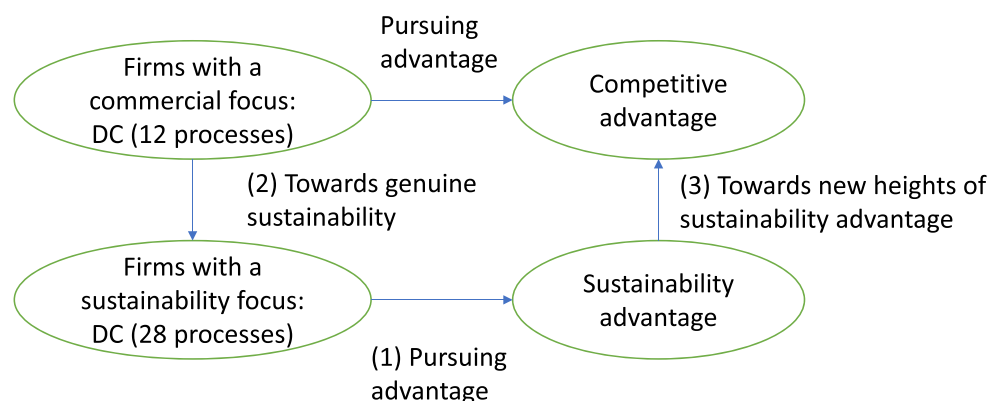
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#### ENDNOTE

- <sup>1</sup> The term 'competitive advantage' is often preceded by 'sustainable' (e.g., Vanpoucke et al., 2014) to emphasize that advantage needs to endure over time, rather than referring to environmental or social outcomes. It follows that it could be said that BSF pursue 'sustainable sustainability advantage'. Rather, we would use 'enduring sustainability advantage'.
- <sup>2</sup> As noted by the interviewee from 3DPrintCo (personal correspondence, 2022), even when a BSF is closed down, learning is not lost. Entrepreneurs apply insights to future enterprises and yield environmental/social value there.
- <sup>3</sup> MillCo's vision and very long-term approach is now coming to fruition. The company is well on track with its five year business plan (to 2025)



**FIGURE 4** Future research [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]



for major, international growth underpinned by a 'machinery as a service' business model." (MillCo CEO, personal correspondence, 2022)

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## APPENDIX A: INTERVIEW: GUIDE

TABLE A1. Question schedule for semi-structured interviews

Main theme	Questions
Your firm	
Strategic objectives and business model	<ul style="list-style-type: none"> <li>• What is your business about? What opportunities are you exploiting? What are your goals?</li> <li>• How do you compete? Who are your main competitors? What are the main risks/uncertainties you face?</li> </ul>
Performance expectations vs. outcomes	<ul style="list-style-type: none"> <li>• How is the firm doing compared to initial expectations?</li> <li>• How do you judge whether you are succeeding?</li> </ul>
Your network	
Key customers and how they are served	<ul style="list-style-type: none"> <li>• Who are your main customers?</li> <li>• How do their requirements vary?</li> </ul>
Key suppliers and how they deliver	<ul style="list-style-type: none"> <li>• Who are your main suppliers? What key products and services do you buy?</li> <li>• How do you organize your contracts and relationships with suppliers?</li> <li>• Are they sources of new insights related to your sustainability goals? How?</li> </ul>
Other partners	<ul style="list-style-type: none"> <li>• Are there any other key organizations with which you work?</li> <li>• Are they sources of new insights related to your sustainability goals? How?</li> </ul>

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Main theme	Questions
Linking activities to outcomes	
Tracing environmental objectives	<ul style="list-style-type: none"> <li>• What are the main ways you organize your business to achieve your environmental objectives?</li> </ul>
Tracing social objectives	<ul style="list-style-type: none"> <li>• What are the main ways you organize your business to achieve your social objectives?</li> </ul>
Tracing economic objectives	<ul style="list-style-type: none"> <li>• What are the main ways you organize your business to achieve your objectives for growth? For profitability?</li> </ul>
Supply management	
Weaknesses and threats	<ul style="list-style-type: none"> <li>• What difficulties do you face with regard to               <ol style="list-style-type: none"> <li>i) specific suppliers?</li> <li>ii) your supply base in general?</li> <li>iii) how you do supply management?</li> </ol> </li> </ul>
Strengths and opportunities	<ul style="list-style-type: none"> <li>• What strengths and opportunities do you see in your suppliers, supply base and your ability to manage supply issues?</li> </ul>
Alignment	<ul style="list-style-type: none"> <li>• What are critical issues from the standpoint of your key suppliers? What do your key suppliers need from you in order to fulfil your expectations?</li> </ul>

## APPENDIX B: EXAMPLE OF PAIRWISE CASE COMPARISON

TABLE B1. Extract of data summary from inductive, pairwise analysis of cases

BSF-X (X) and BSF-Y (Y)	Key similarities	Key differences
Priorities and impact	Both prioritize environmental/social over profit, and both have a vision of wider impact.	X wants to make a difference wrt climate change. Y wants to transform a business sector (something about the scope and specificity of the goal).
Metrics/values stated	Both focus on well-articulated standards/ goals and measure performance.	Different ways of doing this, given X family business versus very public profile of Y.
Values	Very strongly value driven	
Supply chain		X creates supply chains de novo; Y has to change practices within supply chains (persuade partners to change) and develop new elements in the chain (e.g., logistics for returns, distributing spare parts and advice on use).
Performance evaluation	Both check on how they are doing on green and social goals and values.	For Y, it is a large scale, rigorous process. Low key for X
Scale/nature of business		Y is a very small player in a sector of multinationals. X is a family business in a sector with many small businesses and few very large ones.
Influence over sector, leadership	Both are influential.	Y is very upfront, with evangelizing/ educational/campaigning/piloting/showcasing type role; X more low key but influential at national policy level and spends a lot of time on it.
Visibility		Success depends on how Y works being visible to all; for X, success lies in renewables displacing non-renewable energy sources.

(Continued)

BSF-X (X) and BSF-Y (Y)	Key similarities	Key differences
Green logic	Both are about producing a green version of a product.	F produces the good through subcontractor; X produces and installs the kit for others to produce the good.
Innovation		Y has to innovate radically on many fronts; X much more incremental/low key.
Customers	Both require end customer demand change.	
Resilience	Both emphasize having to organize their business to cope with uncertainty.	

Note. Key similarities and differences were identified inductively (centre and right hand column) and subsequently labelled (see left hand column). The themes in the left-hand column were determined from the data, and the resulting tables reviewed to identify common themes across pairs. These themes were then fed back into the iterative, comparative analysis of the cases and informed the further review of literature.

## APPENDIX C: MICROFOUNDATIONS OF DC IN THE BSF CONTEXT: REPRESENTATIVE DATA FROM EMPIRICAL MATERIAL

Microfoundations	Representative data
1.1 Direct internal R&D and select new technologies	
1.1.a Choosing direction triggered by uncertainty	<ul style="list-style-type: none"> <li>• Uncertainty is a thread throughout the cases and its sources are diverse: Technological changes, customer demand and timing, supplier's capabilities legislative landscape, and competitors' actions.</li> <li>• However, founders highlight their ability to be triggered by uncertainty: "We call it the shifting sands of [BeanCo]! We're getting into a steady state now, but it's been a bit of a rollercoaster due to the fact that because no one's ever done this before with coffee, the challenges we have had along the way have dictated where we go. But we are an agile company. And we are not scared to change track." (BeanCo)</li> </ul>
1.1.b Selecting through trial and error	<ul style="list-style-type: none"> <li>• BeanCo tried the biodiesel option but abandoned because it was not commercially viable.</li> <li>• Pilot testing with customers (BeanCo, ContainerCo, WaterCo)</li> <li>• Experimenting with different technologies (LightCo) and processes (DeviceCo)</li> </ul>
1.1.c Compensating limited internal resources	<ul style="list-style-type: none"> <li>• BSFs overcome the lack of internal sources by building upon external contacts such as mentors (HeatCo, LightCo, DeviceCo), friends or industry contacts (BeanCo, CycleCo, FoodCo, 3DPrintCo, HousingCo) and relatives (ContainerCo, HeatCo).</li> <li>• Consequently, the boundaries between internal and external sources are rather fluid and the selection of new technology may be driven by non-company resources: "[name of one of the founders of 3DPrintCo] has built a 3D printer. We were hanging out at the maker's base in San Francisco and the Vice President of [another company name] came in and saw the machine. This is late 2011, 2012. He then asked what would it cost to make 10,000 units of this one machine. We were seeing dollar signs at this point and answered, "Okay, we'll get back to you on Monday." Went away over the weekend, sat down, did all the calculations, 10,000 units. That's a lot of units, how would we make these. Made a big plan. Came back on Monday, presented everything to him. He leaned back and said, "Oh, that's great. Thank you very much for providing me the data. I was just curious." (3DPrintCo)</li> </ul>
1.2 Tap supplier and complementor innovation	
1.2.a Exploratory learning within an eco-system	<ul style="list-style-type: none"> <li>• Tapping external knowledge occurs to a great extent within relationships with suppliers (CompostCo, LightCo, DeviceCo, WaterCo) or within broader eco-systems, where the focus extends beyond the single dyad. Examples of such eco-systems are the maker community (3DP), a local food recovery network (FoodCo), the engineering society (HousingCo), the solar trade association (HeatCo), regional waste haulers (BeanCo), and broad collaboration structures including government agencies, NGO, industry and non-profit organizations (CycleCo, DeviceCo).</li> <li>• DeviceCo comments: "You do not base your decision only on what this company tells you, but also on what the industry knows about this company. The industry involves all the people that</li> </ul>

(Continues)

Microfoundations	Representative data
	work in other electronic consumer companies but also NGO's for example; they are very helpful in an informal way." (PhoneCo)
1.3 Tap developments in exogenous science and technology	
1.3.a Building learning alliances	<ul style="list-style-type: none"> <li>• BSFs build heavily upon alliances to tap developments in exogenous science and technology, for example with public or private research institutes (CompostCo, LightCo, WaterCo).</li> </ul>
1.4 To identify target market segments, changing consumer needs and customer innovation	
1.4.a Identifying opportunities based on sustainability	<ul style="list-style-type: none"> <li>• Inherent to the definition of BSFs and related sampling criteria, all firms have built a business model departing from a desired impact on the green and social environment.</li> <li>• "You have to see us as an awareness campaign that has decided to become a company because it can have a wider impact being a company and being embedding in the supply chain." (PhoneCo)</li> </ul>
1.4.b Identifying opportunities based on capabilities	<ul style="list-style-type: none"> <li>• "I got more into [BeanCo] because my last 10 years has been in renewable energy. So I know all about biomass. When I joined, we were not quite sure which product would fit where." (BeanCo).</li> <li>• "We want to change the world, based on our competencies." (CycleCo).</li> <li>• The founders of ContainerCo and HousingCo propose novel solutions in a certain sector (waste-to-energy and housing respectively), based on extensive industry experience in another sector (oil&amp;gas and SCM consultancy).</li> <li>• In the case of FoodCo, the three founders combine capabilities in the areas of legislation, logistics and food to create a novel solution.</li> </ul>
1.4.c Identifying opportunities based on cognition/morality/emotions	<ul style="list-style-type: none"> <li>• "When I would sit on the deathbed, I could say to my kids, I did something to try and help with climate change. So I was very agnostic about what we did. We could've ended up doing anything as long as it directly helped climate change." (HeatCo)</li> <li>• "We want to change how the industry works in four areas: origin of materials, design of devices, reuse and recycling and working conditions in the chain. What we do is that we use our own operations to get to trigger projects.... We are not there just to create the feel-good products, it's the other way around. We use our products to change stuff. We use the fact that we have a product, that we have a business relationship that we can build upon to start our projects." (PhoneCo)</li> </ul>
2.1 Delineating the customer solution and the business model: Selecting technology and product architecture; designing revenue architectures; selecting target customers; designing mechanisms to capture value	
2.1.a Engaging a broad range of stakeholders	<ul style="list-style-type: none"> <li>• Stakeholders beyond customers and shareholders are as follows: workers along the supply chain including mines, (assembly) factories and collection points for reverse logistics (CompostCo, CycleCo, PhoneCo); communities (CycleCo, FoodCo, HousingCo, MillCo, WaterCo); government (CycleCo, FoodCo, HeatCo, HousingCo)</li> <li>• The relative importance of customers depends on necessities of other stakeholders. PhoneCo decided to delay the delivery of their smartphones to multiple waiting customers, in order to not stress the supply chain and worsen working conditions in the assembly factory in China.</li> </ul>
2.1.b Enacting legislation	<ul style="list-style-type: none"> <li>• In Chile, CPG producers are obliged to demonstrate that they finance the recycling of a certain share of their sales volume and CycleCo does this job for them. Moreover, CycleCo provides consultancy to companies on how to prepare themselves to comply with the new law on packaging.</li> <li>• In the US, food producers may receive tax benefits when they donate food, and FoodCo helps with the administrative process to actually receive such benefits.</li> <li>• In the circular economy, regulations do not keep up with technological developments and BSF have to find ways to work around potential obstacles:</li> <li>• "The regulatory stuff is a pain, especially with the biochems. If those biochems are then going back into the food industry, which were once classed as waste, now we definitely have to prove that it goes through the end of waste and becomes a product again. We're having to do this for the first time, you know, it's never been done before." (BeanCo)</li> <li>• "Whether it's in the financial community, or whether it's in the waste community or the tech community or the health community, right, the regulations are not keeping up with new technology that becomes available. So, there is an inherent block in the market for new tech, because you cannot introduce a solution when regulations do not yet allow it. So we tried for a long time to negotiate with the hazardous waste people, so that we could take 1,000 tons of waste, which is currently classified as hazardous, and which costs an airport or an airline an enormous amount of money to deal with given that it has to be dealt with in a hazardous waste facility. The carbon footprint is huge as there aren't very many of those and it's traveling long distances in the vehicle." (ContainerCo)</li> </ul>
2.2 Selecting decision-making protocols: Recognizing inflection points and complementarities; avoiding decision errors and anticannibalization proclivities	

Microfoundations	Representative data
2.2.a Moral filtering	<ul style="list-style-type: none"> <li>• “President Obama has this thing where he says being on the right side of history. And I think that’s true for technology as well. If you pick the technologies that ultimately are sustainable and are efficient, which is a big part of sustainability. If you are spilling toxic chemicals into a river, that means that you are effectively wasting your resource at the end of the day. And I think that perspective lends itself very, very well when you are building a start-up. Because it just becomes part of the dialog. Okay, are we wasting anything here? Are we picking the right materials in terms of future conditions, not just present conditions?” (3DPrintCo)</li> <li>• “I have always said, the way that I would like to run the company is that we do not set any targets about how much we are going to grow, but we try to do our best in what we do. Meaning that on a day-to-day level, we are doing our best. We are putting our best foot forward, and then let us just forget about how much the company grows.” (CompostCo)</li> </ul>
2.2.b Balancing long-term vision and short term realities	<ul style="list-style-type: none"> <li>• HousingCo had to sell a non-sustainable housing project, in order to get cash for future sales efforts of their sustainable products: “It’s way more easy to sell the traditional product and earn money, than to sell the sustainable one and not lose money. At this stage, the aim is not to earn but to not lose. One important lesson is that we have to give up on issues. Those that are purist, have to have Bill Gates behind them who says here you have 10 mio, and dont worry, you do not need to deviate from the track you set out. On the other hand, if you want to pursue this as an entrepreneur, you cant be superloyal to your misión. If you can achieve 20%, congratulations, after that you can grow towards 30%, etc. ... we abandoned four projects, equivalent to some 2000 homes, because it would not be with the sustainable system. Today we think, we should have accepted the projects, as we would at least have had more cash.” (HousingCo)</li> <li>• In order to attract customers, CompostCo’s assortment includes cutlery based on PLA, and tissues based on paper, whereas fibre-based products are more in line with the mission.</li> <li>• PhoneCo prioritizes distribution through resellers over direct-to-consumers to improve cash flow, even though communication with consumers is vital for achieving their mission.</li> <li>• ContainerCo had to limit its offering in order to obtain financing (either wind or waste).</li> <li>• BSFs employ cross-funding to subsidize less profitable products with the more profitable ones, and as such facilitate working in line with their long term mission. For example. CycleCo subsidizes recycling of difficult materials (e.g., polypropylene) by the recycling of the easier carton or PET. HeatCo were among the first to jump in the photovoltaic business in 2008 and thanks to that could develop other business such as heat pumps. BeanCo B sells coffee logs and thanks to that steady but low margin income stream, can keep their lab work going for higher value product development. ContainerCo on the other hand regret that they lost the opportunity of solar energy: “And we decided we were too late on the solar, which actually is probably the biggest mistake we made in this business, because that would have funded our waste business. So, we could have just been a solar distributor or installer. And that would have funded the rest of the technology development.” (ContainerCo)</li> </ul>
2.2.c Leveraging ambiguity	<ul style="list-style-type: none"> <li>• “We’ve got quite a strong in house legal team. Just because our COO is regulations aware. We have to deal with people like [governmental organization] where it’s much easier not to give an answer, just come back to the question further down the line.” (BeanCo)</li> </ul>
2.3 Selecting enterprise boundaries to manage complements and control platforms: Calibrating asset specificity; controlling bottleneck assets; assessing appropriability; recognizing, managing, and capturing cospecialization economies	
2.3.a Building collaborations to connect demand and supply	<ul style="list-style-type: none"> <li>• The route to market is often defined together with third parties: Together with housing cooperatives (HousingCo), through support of a local network (e.g., B-corp, CycleCO), or partnering up with the utility companies because they try to help direct your customers how to save energy (LightCo).</li> <li>• In case of international sales, BSFs partner up with local complementary organizations that already have a local reputation (WaterCo) or a local network in place (LightCo)</li> </ul>
2.3.b Networking and bridging to connect nodes in a network	<ul style="list-style-type: none"> <li>• 3DP and filament suppliers jointly convince customers of the combined solution.</li> <li>• HeatCo and a battery specialist visit jointly a customer to explain the solution.</li> <li>• HousingCo goes together with the municipality to the bank, so the municipality can be the guarantee for the bank to provide a loan for social housing projects.</li> <li>• “A lot of times, we will be brought in by someone. So right now, we are doing a joint venture type of channel approach with a couple of other companies that are in the waste sector or in the power sector if you want to call it, so there’s a nice synergy between another tech and ourselves.” (ContainerCo)</li> <li>• BeanCo leveraged the power of their customer – That supplied the coffee grounds - to convince the logistics service provider to also haul the coffee grounds, next to the already existing waste streams: “Basically, the sustainability manager of [customer] who we are very close with will say [to the logistics service provider], if you want to do this contract next year, you need to be doing coffee.” (BeanCo)</li> </ul>

(Continues)

Microfoundations	Representative data
2.3.c Navigating new supply markets	<ul style="list-style-type: none"> <li>• BeanCo and CompostCo compete for feedstock with anaerobic digestion and composting facilities.</li> <li>• BeanCo and CompostCo find it difficult to find service providers for the logistics of new waste streams. Such streams are more “dirty” and relatively small compared to mainstream flows. Convolved contracts (across waste haulers with similar pick up points) are a solution to the small scale of novel waste stream; when volumes are too small for a single waste hauler, they may pick up waste for each other and drop it at a more convenient point for the other.</li> <li>• ContainerCo struggles to assure feedstock given legal classification of different types of waste.</li> </ul>
2.4 Building loyalty and commitment: Demonstrating leadership; effectively communicating; recognizing non-economic factors, values and culture	
2.4.a Inducing shifts in customer behaviour	<ul style="list-style-type: none"> <li>• Leadership of BSFs' founders is demonstrated at public events such as conferences (FoodCo, HeatCo); HeatCo estimates that up to 20%-30% of the founder's time is devoted to this type of communication.</li> <li>• Communication to consumers involves unidirectional information flow (e.g., advertisements and blogs), but also active engagement of the customer through social media, events and workshops. PhoneCo for example hosted urban mining workshops around the country and at a music festival.</li> <li>• “For us the part of gathering the material and correctly directing it to the recycling part is almost as an excuse to have this conversation with the consumer.” (CycleCo)</li> <li>• “I think last year was a great year. We managed to exceed our expectations and our customers' expectations by not only giving them a service that is let us say, technically good. But also, we managed to empower them to be involved in this new more sustainable way of looking at the world.” (CycleCo)</li> <li>• In a circular economy, the different users along the life cycle of resources have to connected, reason why FoodCo decided to focus on regional rather than national networks, so that food donors had a clearer idea about the recipients of the food, and vice versa, recipients of food would feel more responsible for a correct treatment of the received food: “The human element will make both parties feel more responsible and respectful of the other.” (FoodCo)</li> </ul>
2.4.b Managing attractiveness to build commitment	<ul style="list-style-type: none"> <li>• BSFs have difficulties to be an attractive partner to suppliers, given the small volumes during start-up.</li> <li>• LightCo was lucky to come at the right time across a top supplier that had just liberated capacity.</li> <li>• ContainerCo could not produce because they could not find an adequate and interested parts manufacturer.</li> <li>• PhoneCo was initially obliged to work with a less developed smart phone assembler, because the best ones only worked with the bigger customers: As a relatively small player we need to be able to outsmart the bigger players every single day. This is what keeps us on top of our game... For example, to overcome this, we sometimes piggyback on the orders of a larger customer who can drive the required volumes for specific materials.... And the more we order, the more leverage we get (for prices, lead times and more) when it's time to negotiate with suppliers. It's much easier when we keep the supply lines running more or less on a continuing basis. (PhoneCo)</li> </ul>
3.1 Decentralization and near decomposability: Adopting loosely coupled structures; embracing open innovation; developing integration and coordination skills	
3.1.a Managing tensions between stakeholders	<ul style="list-style-type: none"> <li>• Different actors have different agendas and speed of change, leading to tensions.</li> <li>• FoodCo complains that media efforts go to consumers that are easier to mobilize, whereas upstream changes would be more impactful.</li> <li>• Food charities are not in the business of dealing with food waste, they are in the business of feeding people. So they only want to accept and care only to deal with what they can use to donate to others. They do not want to receive a big load that they have to then pick through and put some in the composter, so that was our dream. (FoodCo)</li> </ul>
3.1.b Selecting and retaining talent	<ul style="list-style-type: none"> <li>• An important selection criterion for all new employees is that they have sustainability in their DNA.</li> <li>• Employees should be able to deal with the tensions across stakeholders. For example, PhoneCo hires a new managing director after 4 years of its inception, who has to lead the firm through scale up.</li> </ul>
3.2 Governance: Achieving incentive alignment; minimizing agency issues; checking strategic malfeasance; blocking rent dissipation	
3.2.a Aligning internal incentives	<ul style="list-style-type: none"> <li>• BSFs claim to have employees with sustainability genes in their DNA, and as such it is easier to align the business mission with employee expectations and necessities. CompostCo does not offer incentives to their sales force as all employees should always work to the maximum of their possibilities.</li> <li>• HeatCo on the other hand, regrets that despite their desire to offer full-time jobs to interested persons, at times they can only offer part-time jobs because of cash flow restrictions of the company. This makes alignment of incentives more difficult.</li> </ul>



Microfoundations	Representative data
3.2.b Aligning external incentives	<ul style="list-style-type: none"> <li>• CompostCo has local personnel in Asia to develop and control suppliers' compliance. Nonetheless, they more recently decided to onshore production Tier 1 in order to increase collaboration and control over their supply chain, including both Tier 1 but also Tier 2 nodes.</li> <li>• PhoneCo incorporates design so it can directly influence and develop Tier 2 suppliers, and as such improve working conditions along the whole supply chain: "One of the learnings we took away is that we can have high ambitions, but in order to achieve them we need to have a common ground and aligned views on how to get there together with our supplier." (PhoneCo)</li> <li>• The solution of HousingCo implies industrial production of elements of housing, a JIT delivery of those elements to the building site and subsequent fast assembly of the house on-site. Consequently, the incentives of builders change: "Builders earn money by not innovating. If we reduce the construction time through our solution, we are reducing their margin. But I try to explain to them: with the same bank loan - which is their bottleneck - with this new technology you might see your income per project reduced to half but you will do the double amount of projects. Therefore, you will have a better rotation of capital and you will manage more projects. But until they see it, they will not believe it." (HousingCo)</li> </ul>
3.2.c Communicating transparently to multiple stakeholders	<ul style="list-style-type: none"> <li>• Most BSFs have websites with extensive information on all relevant aspects of the BSF in particular and their industry context in general.</li> <li>• Blogs by BSFs' employees inform about achievements but also on what has not been achieved.</li> </ul>
3.3 Cospecialization: Managing strategic fit so that asset combinations are value enhancing	
3.3.a Combining assets along the chain	<ul style="list-style-type: none"> <li>• CompostCo established a new internal figure to help smaller customers closing the loop and assure that their waste is composted an industrial facility, but also builds upon the services of an external partner for bigger more industrial customers.</li> <li>• BeanCo also established a new internal figure to help closing loops between suppliers of feedstock, waste management companies, and themselves.</li> <li>• FoodCo invests money in the customers' (charities) capabilities to receive food under the right conditions.</li> </ul>
3.3.b Advocating change	<ul style="list-style-type: none"> <li>• Ongoing management of a complex web of relationships with suppliers, legislators, customers, NGO, banks, charities, in order to raise awareness and sense of urgency to change towards more sustainable practices (BeanCo, HeatCo, FoodCo, ContainerCo, CompostCo, PhoneCo, HousingCo, CycleCo).</li> <li>• Founders involved in campaigning for the sustainability transition (CycleCo, FoodCo, HeatCo, PhoneCo)</li> </ul>
3.4 Knowledge management: Learning; knowledge transfer; know-how integration; achieving know-how and IP protection	
3.4.a Measuring impact	<ul style="list-style-type: none"> <li>• An impact map shows relations between activities to outcomes and long-term impact (PhoneCo).</li> <li>• The broader the scope of influence required, the more actors involved in the target impact.</li> </ul>
3.4.b Combining multiple roles	<ul style="list-style-type: none"> <li>• Given the limited size and flat structure of the BSFs, employees are involved in multiple projects.</li> <li>• The founder of LightCo has to manage his business but is also closely involved in customer projects: "I am really passionate about saying 'hey customers I notice this is a problem and you know what, we fixed it'. And I was involved in every single conversation." (LightCo)</li> </ul>
3.4.c Data-driven learning on the eco-system	<ul style="list-style-type: none"> <li>• Eco-systems of learning: "So by having a cluster of companies many of which are physically close to each other, we are able to have on-going conversations about what are the right technologies, what are the right industries to be in, and what are other people seeing, what are we seeing, sharing data. Again, if you share you get. So on the business side, that's been really, really valuable." (3DPrintCo)</li> <li>• WaterCo mines the consumption data of its customers, which allows to innovate the solution offered.</li> </ul>