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The place of waste: Changing business value for the circular economy

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Abstract

Traditionally, wasted resources are considered a burden that imposes a cost on organizations. However, ecological sustainability principles underpinning the linked discourses of industrial ecology and the Circular Economy conceptualize waste as intrinsically valuable. Our research identified exemplar business organizations that had each changed their business models to resolve the tension of waste as a burden and/or resource. Synthesizing these cases, we found these organizations applied systems thinking to reframe their product and service offerings and developed material circular flows in their business models. Analysis of how our exemplar organizations changed their business models to tackle pressing sustainability issues and to resolve the burden–resource tension show that the focus of change is on reconceptualizing their understanding of the role of waste in the value chain of their products and services. This altered understanding of waste as a resource across their value networks initiated negotiations with their existing suppliers to also modify their supply chain practices.

KEYWORDS

circular economy, ecological sustainability, supply chains, sustainability business model, waste

1 | INTRODUCTION

Unsustainable levels of consumption and population growth (Gerland et al., 2014) are leading to overconsumption of resources. Human activity has already exceeded the safe operating levels of several Earth System processes (Rockström et al., 2009; Steffen et al., 2011), with recent indications that four of the planetary boundaries have already been breached: land use change, loss of biosphere integrity, climate change and an overload on the nitrogen and phosphorous biogeochemical cycles. This evidence supports the view that biospheric limits constrain the continuation of excessive resource consumption and waste and that socioeconomic systems must change to operate within the biospheric parameters (Meadows, Meadows, & Randers, 1972). Such logic of biospheric limits underpins various sustainability discourses, linked by their shared focus on the question of “how to maintain a stable pool of resources into the indefinite future” (Arias-Maldonado, 2013, p. 431; Daly, 1991).

As businesses attempt to redesign their processes to reflect a renewed societal awareness of our dependence on natural systems

for survival, a systemic tension arises. Acceptance of the logic that natural resources are limited must be balanced with the dominant logic that successful business performance requires growth, with value added at each stage of a production cycle. This paper explores that tension by examining how businesses respond to resource limits and waste. Considering the place of waste has a long tradition in the sustainability literature and various frameworks have been developed that operationalize a circular flow. These include Cradle to Cradle (McDonough & Braungart, 2002) and industrial ecology (Frosch & Gallopoulos, 1989). More recently, the Circular Economy approach has synthesized concepts from these existing works, while placing emphasis on the role of business from a systems perspective. The Circular Economy has been conceptualized as a system that is restorative by design with a core strategic focus on reframing and reorganizing material, information and energy flows to achieve greater resource efficiency by the reuse, remanufacture and recycling of materials. Its key premise is that waste minimization can act as a new source of value for business. Despite increasing prominence in policy (EU, 2014) and advocacy circles (EMF, 2012), the discipline of management

studies has not critically assessed the implications of the Circular Economy. In this paper, we examine the following research question: How do organizations reframe waste as being a source of value in a Circular Economy?

The paper proceeds as follows. Our literature review draws on relevant concepts from systems thinking and sustainable business models to highlight the gap in sustainability theory regarding the valuing of waste in business strategies and operations. Empirical cases of business organizations that have each commenced to change their business models to mitigate waste are analyzed. Our findings show that the focus of change in the organizations that engage with Circular Economy principles is on reconceptualizing their understanding and mapping of the value chain of their products and services. This altered understanding relies on approaching waste as a resource across value networks and then negotiating with their existing supply chains to either modify their supply chain practices or to simply change the products they procure leaving existing arrangements in place. In doing this we argue that the tension created by "limits to growth" is reduced and possibly eliminated.

2 | PLACE OF WASTE

Waste, broadly defined, is any nonvalue-added process or physical material occurring in business practices and services. Dominant waste management strategies, such as Total Quality Management (TQM), Lean Production and Six Sigma (Dahlgard & Dahlgard-Park, 2006), aim to minimize waste through reducing lead times, increasing quality, decreasing production costs and mitigating waste in business processes. Such approaches encompass techniques for people management, workplace culture, management practices and information sharing allowing firms to consider and manage intangible wastes (Prajogo & McDermott, 2005). These systems are modeled on a linear "take-make-consume and dispose" logic that assumes abundance, continual availability and cheap disposal of resources. Waste is considered a burden in the attainment of operational efficiencies.

However, increasingly products are made from secondary raw materials and redundant materials, previously considered waste, which are reconceptualized for continued value creation as resources to be "re-used, repaired, refurbished and recycled" (Fischer et al., 2015). Revaluing waste as a resource in this way requires action of more than one firm, as the outputs from one firm may become the inputs for another. This highlights the integral role of systemic change in operationalizing and coordinating value creation throughout the supply chain.

Enabling such systemic change requires the adoption and development of systems thinking as a key competency for managers as they attempt to move business organizations toward sustainability (Wiek, Withycombe, & Redman, 2011). Systems thinking places businesses as just one element in a wider whole, a member of a network of organizational forms that can be defined and understood as a web/webs of interdependence (Senge, 2006). Through a sustainability perspective, systems thinking is a conceptual foundation, whereby business and industrial systems are nested and contained within societal and ecological systems (Bansal & Song, 2017). The sustainability

perspective enables firms to analyze complex problems across multiple interacting subsystems, to reframe the impacts and responsibilities of their activities and behaviors beyond their organizational boundaries, and to include consideration of biospheric limits across their supply/value chains.

A further distinction is drawn between closed and open production systems, where the former is self-contained and not influenced by its environment, whereas the environment for an open system is an important determinant of its behavior (Carter, Martin, Mayblin, & Munday, 1984). Closed systems and value chains create value locally (Guide, Harrison, & Van Wassenhove, 2003), whereas open supply chains create value throughout the networked system of which they are part. In open chains waste flows are revalued as resources. Greater value capture is possible either by leveraging new ideas from internal and external sources or by using a firm's key asset, resource or position not only in that organization's own operations but also in other companies and businesses (Chesbrough, 2010, 2012). Such processes are reliant on the development of strategically oriented relationships with key stakeholders (particularly customers, suppliers and partners) directed toward development of circular loops designed through "ecosystem thinking" (Tsvetkova & Gustafsson, 2012). To facilitate a circular flow beyond the usual operational processes organizations must consider how to operationalize their activities and organizational routines, engage in collaborative arrangements with their stakeholders, as well as how they will appropriate value for all stakeholders involved (Teecce, 2007).

Even so, this shift to an open supply chain strategy, is focused on the design of effective production processes regarding operational efficiency in the industrial production and consumption systems. The Circular Economy seeks to operationalize such innovative open supply chain approaches within a broadened sustainability systems perspective to include restorative flows within and between biological and industrial systems.

2.1 | Placing waste in a circular flow

Sustainability systems perspectives may be interpreted along a weak-strong continuum and conceptualized through typologies or developmental frameworks (Benn, Dunphy, & Griffiths, 2014; Figge, Hahn, Schaltegger, & Wagner, 2002; Maon, Lindgreen, & Swaen, 2009; Schaltegger, Freund, & Hansen, 2012; Van Tulder, Verbeke, & Strange, 2014; Winn & Angell, 2000). Benn et al. (2014), for example, suggest a six-phase model, ranging from rejection, through nonresponsiveness, compliance, efficiency, strategic proactivity to the final phase of the ideal sustainable organization (Figure 1). The three highest phases align with three different ways of framing waste in business. Efficiency approaches are concerned with wasted human and physical resources and focus on cost minimization. Proactive or strategic sustainability approaches integrate sustainability into core business logic and attempt to constructively engage with hostile or apathetic stakeholders, demotivated employees, redundant operations and lost market share. At the ideal stage, the business organization is contributing back to society while actively engaged in rebuilding ecological and social capital. Systems thinking applies differentially along this phase model continuum. At earlier stages such as efficiency, the systems approach may be functionalist and life cycle focused (Porter

Adapted From Benn et al., 2014

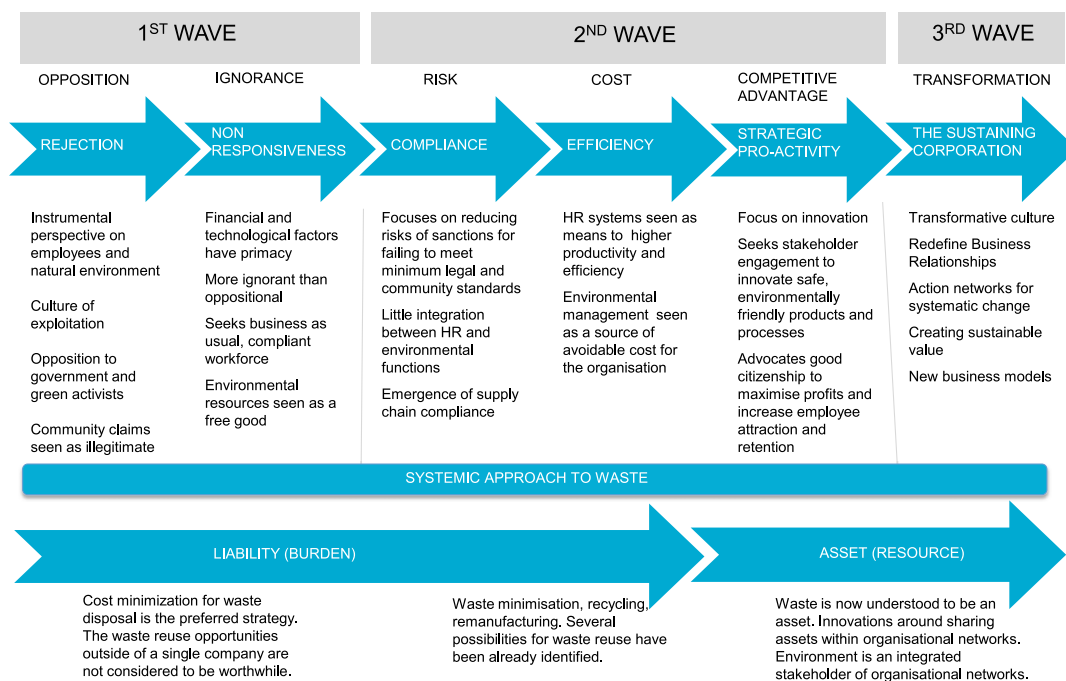


FIGURE 1 Phase model—approach to waste [Colour figure can be viewed at wileyonlinelibrary.com]

& Córdoba, 2009). Further along the spectrum interpretive approaches become evident as managers engage in meaning-making with stakeholders to address the complexity of interacting socioecological systems (Ostrom, 2009).

A recent addition to phase and stage models has been proposed by Bocken, de Pauw, Bakker, and van der Grinten (2016) to capture business model strategies along a different continuum spanning two broad categories from slowing loops (pursuing incremental efficiency approaches) through to closing loops (designing processes to model circular flows). The Circular Economy model, interpreted as a series of restorative and regenerative industrial and biological systems (Hobson, 2016), attempts to eliminate waste being produced at a rate far beyond what can be absorbed or recycled by the Earth's ecological systems (WWF, 2014). Fundamentally the Circular Economy model encapsulates the tension between limits and growth advocating for a shift from linear to circular patterns of resource use and management. Long established sustainability principles such as Cradle to Cradle (Braungart, McDonough, & Bollinger, 2007; McDonough & Braungart, 2002) and industrial ecology (Frosch & Gallopoulos, 1989) are being reconfigured through this lens. The growing prominence of Circular Economy frameworks and their associated discourses (Brennan, Tennant, & Blomsma, 2015) reflect increasing interest in more specific guiding principles of maintaining sustainable economic systems through keeping the added value in products as long as possible (European Commission, 2015). Key to this shift in thinking and practice is the elimination of waste through transforming it conceptually and materially into a new resource stock. As Hobson (2016) argues, we need to go beyond incremental efficiency and implement transformative change that enables us to keep valuable materials in circular flows through systemic feedback loops.

Business processes that enable transition from linear to circular flows move away from dominant business models that derive value

capture by “generating profits from selling artefacts” to sustainable business models “generating profits from the flow of materials and products over time” (Bocken et al., 2016, p. 3), which in turn impacts their interaction with stakeholders across their supply chains. A long-held critique has been that sustainable business models are overly focused on value capture and incremental gains obtained from efficient usage of materials and energy, representing a “weak sustainability” discourse (Neumayer, 2010). Circular business models may represent a transformative shift as they are founded on circular flows and value capture created by conceptualizing waste as a resource (see Bocken et al., 2016; Hobson, 2016) and hence are more consistent with a “strong sustainability” discourse and open supply networks.

Another important difference between weak and strong sustainability approaches concerns the “substitutability paradigm” (Boos & Holm-Müller, 2012, p. 147). Weak sustainability argues that different forms of capital are substitutable and only the total capital stock is important to maintain (Boos & Holm-Müller, 2012). In contrast, strong sustainability claims natural capital cannot be substituted by manufactured capital (Davies, 2013) and are more emphatic on the need for a balanced relationship between social and environmental systems (Arias-Maldonado, 2013). Given this definitional diffuseness, sustainability discourse has been accused of arbitrariness, therefore losing its action guiding power (Christen & Schmidt, 2012). These accusations have been extended to phase or stage models, which have been criticized as being over-linear given the range, complexity and diversity of the factors contributing to sustainability performance (Kolk & Mauser, 2002; Schaefer & Harvey, 1998). However, they are not intended as a series of rigid boxes and have proved a useful means of assessing progress along the weak–strong sustainability continuum. The sustainability discourse and models discussed above provide a framework to guide our analysis of case organizations, to understand how organizations reframe waste as a source of value in a Circular Economy.

3 | METHOD

In this section we introduce the narrative inquiry methodology (Clandinin & Rosiek, 2007; Gill, 2001) used in this research and provide details of the case organizations.

To address our research question of how do organizations reframe waste as being a source of value in a Circular Economy, we investigated how organizations responded to diverse pressures to reduce waste in their production processes. Our approach used narrative inquiry (Clandinin & Rosiek, 2007; Gill, 2001) to investigate the meanings and interpretations the organizational decision-makers we interviewed enacted in their new business models that arose as a result of addressing these pressures.

Social systems are understood as meaning-making structures that comprise highly networked “multiple dialogic relationships” (Gill, 2001, p. 335). The purpose of narrative inquiry is to reconstruct the meaning of change processes that individuals and groups undergo. For Gill, narrative inquiry is also a method for exploring systemic change within social systems, which are conceptualized as systems of communication.

People tell stories that both constitute and represent them in relation to their situations, where their “narratives provide meaning by describing and creating a relationship between ideas which we act on” (Hansen, 2006, p. 1049). “Narrative Inquiry embraces narrative as both a method and phenomena of study [and] involves the reconstruction of a person's experience in relationship to the other and to a social milieu” (Pinnegar & Daynes, 2007, p. 5). Narrative inquiry allows an inquirer to appreciate how people make sense of their situations and environments through representing reality through narrative (Hansen, 2006).

The case organizations were chosen from a wider project exploring how Australian organizations approached waste. The spectrum of cases investigated in this wider project spanned those organizations that approach waste as a cost through to organizations that reconceived waste as a resource.

From this dataset, purposive sampling (Silverman, 2000, p. 104) was used to locate and select case organizations self-described as in some way implementing circular flows in their operations to help reframe their problem with waste through reuse, recycling or remanufacturing.

Eight interviews were carried out to investigate the conceptualization and adoption of circular flows within the business operations of each selected case organization. The individuals selected from these organizations (Table 1) participating in this round of interviews were predominantly responsible for the implementation and management of the circular flow strategies in their operational processes. Three (CL, CT, SI) are organizations that operate in the waste management sector and five (FC, DH, CD, IS, AR) are companies across a range of industry sectors.

Semistructured interviews approximately 1 hr in duration were conducted with each case participant. Direct questions (Table 2) were asked regarding the operational processes they had developed and implemented regarding waste, the specific strategies they had used to enable those processes to be implemented and barriers they had encountered.

TABLE 1 Case organisation profile

Company	Participant	Business purpose/size
CL	National Sales and Marketing Manager	Waste management Provides service eliminating waste from restaurant food packaging National
CT	Managing Director	Waste management Collects and processes used toner cartridges for reuse or repurposing National
SI	Senior Business Development Manager	Waste management Waste recycler Multinational
FC	Eco Manufacturing Operations Manager	Office equipment production and distribution—multinational Provider/supplier of printers and photocopiers Multinational
DH	General Manager	Logistics—management and delivery Provides warehousing and logistics services Multinational
CD	Managing Director	Dairy Dairy products manufacturer Local
IS	Managing Director	Office Textile manufacturer National
AR	Sustainability Manager	Steel production and distribution Steel manufacturer National

TABLE 2 Interview questions

Would you please describe your operations here, where you source your materials and where your final products are sent.
In your current operation what is recycled and what is thrown away?
What are the challenges you face regarding the elimination of waste from your operations?
If you were to view waste as a resource how would this change be reflected in your operations and practices?
What in your view would be needed to change current waste management and recycling practices?

The interviews were fully transcribed and thematic analysis of the transcripts incorporating elements of a grounded approach (Charmaz, 2000) occurred in two stages. Firstly, drawing on Template Analysis (King, 1998), a code map was generated (Figure 2) based on analysis of themes from the research field notes. Using this code map, transcripts were individually and concurrently coded by three researchers. The coding was not line-by-line coding, but more akin to selective or focused coding, spanning variable amounts of data (Charmaz, 2000, p. 516). The aim of the coding was to identify how organizations were approaching sustainability in their operations, specifically in relation to the management of waste.

The second stage of analysis was more theoretically informed to further categorize how participants had conceptualized or “placed waste” in their production processes and their general sustainability approach. This process involved identification of higher-order themes that emerged during the first stage of our analysis. Through the use of these higher-order themes we identified three organizing narratives that frame discussion of these findings:

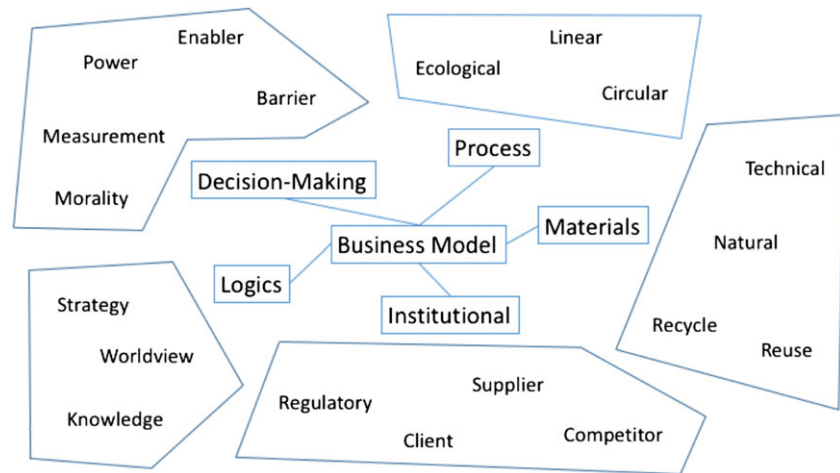


FIGURE 2 Concept map [Colour figure can be viewed at wileyonlinelibrary.com]

- waste becomes a resource,
- disruptive innovation and
- obligation to nature.

4 | FINDINGS

Each of our case organizations shares the common sustainability goal to create and maintain a balanced relationship between social and environmental systems. This goal was not always articulated explicitly with regard to sustainability or more specifically to environmental impact. While the aims of each organization included the elimination of waste each had developed a different approach to achieve this outcome. Table 3 summarizes our case organizations' approach to waste. SI and DH, for example, frame their operations in the language of socially responsible practice in contrast to the explicit claims of FC, CD and IS to design and implement business processes to eliminate negative environmental impact.

Each organization noted that waste in its various forms offered important additional value to their business practices. All case organizations viewed waste in all its forms as a burden on their business activities and routines, and often as a burden on their clients' business activities and routines. At its basic level, waste was viewed as an impost or cost on current business processes and, in this sense, any energy or material waste reduction or elimination was understood to be good business practice according to current models of operation. The rationale of considering waste as a burden underpins many of the current efficiency frameworks businesses follow, for example, TQM and Lean approaches (Benn et al., 2014; Schaltegger et al., 2012) and also reflects business practices, such as extending product value or encouraging sufficiency that characterize business model strategies for slowing loops (Bocken et al., 2016).

A counterpoint to understanding waste as a burden was the reconceptualization of waste as a resource. Such reconceptualization incorporating the influences of Circular Economy (Andersen, 2007) and industrial ecology (Frosch & Gallopoulos, 1989) on their business practices aligns more closely with the circular flow characterizing the sustainable business phase of Benn et al.'s (2014) strategic proactivity and Bocken et al.'s (2016) business model strategies for closing loops. For example, AR, FC, CT and CD redesigned their business practices to

better align with the life cycle of their products and services. In each case the redesign of their business models reframed waste from a burden to a resource in their value networks:

- AR focusing on the life cycle of construction steel as an iterative loop and introducing electric arc furnaces to process this recycled steel
- FC focusing on refurbishing and remanufacturing to extend the life cycle of their equipment
- CT focusing on refurbishing and remanufacturing toner cartridges and at the end of their life disassembling them into new value streams
- CD changing farming practices to follow natural nutrient cycles, such as composting of organic matter to improve soil nourishment.

A strategically proactive approach to circular flows incorporates a systems approach to revalue waste as a resource beyond the operational activities of the individual organization. For example:

- CT created a new role that became part of all their original equipment manufacturer (OEM) business models. This role took responsibility for collecting and then sorting toner cartridges into those able to be remanufactured and those that they would process for other recycling streams.
- IS worked with research centers and wool producers to design their ethical wool products and then created new structures that supported and promoted organic wool through all steps of the value chain.
- FC extended their proactive approach to collaborating and sharing ideas with members throughout their value chain, to improving the quality of materials and supplies necessary for their remanufacturing production processes.

A common unifying sustainability objective was the goal to divert waste from landfill. Waste, both conceptually and materially, takes on new meaning for evaluating business practices and shaping business decisions, and these can be interpreted on a continuum whereby waste is considered as a burden and/or a resource. Conceptualizing organizational approaches to waste along a burden–resource continuum (Figure 1) highlights a tension in business model design

TABLE 3 Case organizations by core business focus and circular cycle

Company; principal organizing narratives: description of circular flow	Illustrative quote
<p>CT—waste becomes a resource; disruptive innovation</p> <ul style="list-style-type: none"> evaluated the life cycle of their product (toner cartridges) and created a different relationship between the OEM and the waste collectors. waste collector now an essential part of the toner provision process for all providers (OEMs). used toner cartridges collected and processed for recycling or remanufacturing. this cycle continues until the toner cartridge is damaged and unsuitable for refilling, it is then shredded into its constituent components, each sold as raw materials for other industrial processes. 	<p><i>All those metals and all those plastics... they're sold as commodities and what we've worked hard on is material separate technologies to make them pure enough to be classified as commodities</i></p>
<p>CL—waste becomes a resource; disruptive innovation; obligation to nature</p> <ul style="list-style-type: none"> focuses on eliminating waste including all food and packaging from restaurant and cafeteria practices. position themselves as the manager responsible for the life cycle processes from ordering products and services through to the disposal of wastes from their clients' operations. solutions involve: <ul style="list-style-type: none"> installation of bio-digesters to create compost from food waste, then provided to farms or market gardeners. reducing excess and inappropriate packaging of food and encouraging providers to use less packaging and packaging that is compostable or recyclable. 	<p><i>That is always our goal. If we can find something that is one, not cost prohibitive two, good for the environment and three, make us some profit which is sustainability in its rawest form, we will as long as the client's up for it. With all of our clients we're constantly putting suggestions to them about what they could do differently... it's their decisions, but for me our philosophy is to get businesses to zero waste and that comes back to controlling the inputs.</i></p>
<p>FC—waste becomes a resource; disruptive innovation; obligation to nature</p> <ul style="list-style-type: none"> Well-established remanufacturing procedures in place. Remanufacture has helped FC redesign their new machines for better maintenance but it has caused problems internally as there are now two conflicting strategies: <ul style="list-style-type: none"> the traditional—the sale of new machines dominates and the circular—the sale of remanufactured machines increasingly competes with their new machines for market share. industrial symbiosis strategy implemented by FC has successfully created a new and highly collaborative supply chain designed to prioritize reevaluation of waste 	<p><i>I think wastage is a big issue that we can tackle... do something about all of this stuff that ends up in the waste stream but if it doesn't go there in the first place that's an even better approach</i></p>
<p>DH—waste becomes a resource</p> <ul style="list-style-type: none"> outsources selected operations of organizations to manage the warehousing of products at a cheaper and more convenient rate through leveraging their logistics operations and expertise. offer advice on reducing packaging and improvements to handling of the goods they manage with the aim of saving costs for their clients through better waste management practices. coordination of government-sponsored product stewardship scheme for e-waste (National Government Product Stewardship Programme, 2016). Oversee the collection of this material and its transportation to recycling services in Australia or overseas. 	<p><i>The internal waste minimization is cost minimization, and there's the benefit of the whole corporate social responsibility. So that's a side benefit, but at the end of the day we're judging how we go in that space by the amount of waste we divert from landfill and then the financial benefits from doing that.</i></p>
<p>SI—waste becomes a resource</p> <ul style="list-style-type: none"> assembles e-waste into raw material streams which are sent offshore for remanufacture. rescues metal and other materials for recycling from household and industry waste streams. operations require scale, will not handle products that are potentially dangerous to handle and need specialized processing. coordination of government-sponsored product stewardship scheme for e-waste. Oversee the collection of this material and its transportation to recycling services in Australia or overseas. 	<p><i>The reality of waste, and this is the reality that everybody needs to understand, is that unless there's an inherent value in what you're processing, people won't go to process it</i></p>
<p>IS—waste becomes a resource; disruptive innovation; obligation to nature</p> <ul style="list-style-type: none"> business model is to set up a green value chain that starts with the producers of their raw materials. involves agreements with farmers to provide organic wool, which is then spun and processed according to an ethical and organic standard they developed. green value chain involved changing wool broking and processing practices to ensure that their wool retained its organic status. still use synthetic materials in certain situations, for example in specific hospital applications, but as the technology improves and allows them to recycle these fabrics they are progressively increasing their biodegradable footprint. 	<p><i>We realized that we could do a lot more in our supply chain than just simply buy wool which we thought was good, we realized we could ask for the mills to use ethical wool, a specification we created. That was I suppose our way of imposing our will on the supply chain. We wanted to also support those farmers who in reality are the real environmentalists.</i></p>
<p>CD—waste becomes a resource; disruptive innovation; obligation to nature</p> <ul style="list-style-type: none"> traditional farm and dairy manufacture structure with a different value set that guides decision-making and practices. 	<p><i>—That purpose statement you see on the wall over there, we did that 11 years ago and it's to provide the most healthy and environmentally sustainable dairy products in New South Wales. That's what we've been doing for 10 years..</i></p>

(Continues)

TABLE 3 (Continued)

Company; principal organizing narratives: description of circular flow	Illustrative quote
<ul style="list-style-type: none"> • farming practice is now organic and they look to work with organizations such as CL to obtain compost to replace urea, an industrially produced fertilizer. • experimenting with their own nutrient production and returning some of their farmland back to precolonial bushland. • dairy emerged because they challenged the big grocery retail monopoly that is forcing farmers to provide milk at prices below the cost of production. • production process involves recycled packaging, the use of renewable energy and the diversion of waste heat from their machinery to sterilize milk. 	
<p>AR-waste becomes a resource</p> <ul style="list-style-type: none"> • three main divisions: mining, steel and a mining consumables business. • invested in electric arc furnaces some 20 years ago to process scrap steel, which they source from building and manufacturing sites. • would like to process more recycled steel but still need to create new steel from iron ore to meet increasing market demand. • type of scrap steel they require only becomes available in the quantities they need in a mature construction market where demolition of older buildings becomes part of the cycle—they are currently recycling some 90% of construction steel coming from demolition and industry 	<p><i>In our company we've obviously got a few steelmaking mills and scrap, there's a mix of iron ore based and there's scrap based... about 62% of our steel made... comes from scrap.</i></p>

between linear logic applied to a business process where waste is understood to be a burden and therefore needs to be eliminated materially and where waste, reframed as a resource, is now understood to have value as an input into a new process.

SI's business model aims to collect raw materials in the form of waste and where the volume of raw materials is sufficient then they will also invest in technology and processes that can extract valuable raw materials from what they term as "fines." An example provided was the capability of extracting gold from crematorium ash in Germany. In Australia, the volume of waste is too small for SI to invest in such extraction processes and their focus is on recycling:

In Australia, we are a recycler for the manufacturers. .. for local government, we purchase commodities from our competitors . . . from other sources, we are one of the five approved co-regulatory authorities under the Product Stewardship Act.

DH's business model reflects their strategy to outsource the management of their clients' logistics functions. Clients include a national grocery retailer and national office equipment retailer. As an outsourcer, DH has direct control over all operational processes and the key driver for them is cost minimization through reducing their waste streams coupled with investigating in how they can then derive an income from the diverted waste:

We're very focussed on that relationship with the customer of how we give them best service . . . as an outcome of that we have internal waste streams, and then we look at how we minimise the costs of those waste streams, because at the end of the day that will then flow back to that customer because we'll charge them for our waste stream . . . and in the internal waste minimisation it's . . . working out how we can divert more from landfill for each of the sites . . . so once you start diverting from landfill, it's then how you maximise your return from that diversion.

In this sense SI and DH are collection agents in the early stages of a potential circular supply chain. Shifting perspective toward the other polarity of our continuum we have CT, FC and CD in which there is an explicit shift in their business practices to approaching waste as a resource.

CT, from its inception, has designed its operations to model circular flows to ensure that their resources, imaging supplies from a broad cross section of OEMs, are not discarded at any stage:

... my passion is that these non-renewable resources, anything that's oil derived is non-renewable, anything that's mineral derived is a non-renewable resource . . . reusing these resources over and over again is my passion, it's kind of like my life's work . . . here's the interesting thing with [CT], we've built a business that is by its nature the more profit we make, the more non-renewable resources we've diverted from landfill.

FC is recognized as an industry leader in remanufacture and recycling of its products and its operations are cited widely as exemplary models to emulate. To maximize the renewal cycle for its products FC has put in place processes and controls that allow them to monitor and direct the processes of their suppliers to ensure that resource utilization is maximized and wastage is eliminated:

Yeah, I mean reverse logistics and the return of used components and equipment is just a natural part of what we do as a business these days.

The maturation of their application of circularity has now been incorporated into the design of their equipment, which has resulted in further reduction of waste and improved reusability:

I think the focus is can we do more to separate those out and get more high value add out of what we do and for us that leap in value add is remanufacturing rather than recycling, so actually reusing the components rather than reusing the materials.

CD's business model reflects the impact of two different intersecting perturbations, the first ecological and the second commercial. The ecological crisis reflected declining productivity of their farmland, which meant escalating costs for fertilizers with little or no increase in yields. The solution to this was to adopt organic farming practices and this has seen yields increase and costs decrease. The second crisis has been the downward pressure on milk prices, which resulted in CD creating a dairy so that they now had full control over production and processing of milk. The operation of the dairy processing took on the circular flow principles of organic farming and the business is constantly reviewing its processes to ensure waste becomes a resource. For example, the heat from their generator is captured and used to pasteurize their milk. What they are now focusing on is to close the nutrient cycle from their farm to the city:

... you know, what I want is the food compost, the food waste, because here, I send a lot of nutrients into Sydney in the form of milk and yoghurt and cream and I get nothing out of Sydney except some money . . . I want the same loop which I have on the farm, with Sydney.

To eliminate waste conceptually and materially, CT and FC have used industrial ecology principles to transform their products and services and CD has applied organic farming principles to pasture and animal management and then to its dairy operations. The business models of these three organizations reflect significant progress each has made to transcend the systemic tension confronting organizations negotiating the burden–resource continuum.

5 | DISCUSSION

As each of our case organizations reframed waste as a source of value in their business models, three themes were identified that encapsulate how their practices evolved: an ethical responsibility to the natural environment, a systems perspective of their web of interrelationships and the need to disturb the equilibrium of existing economic systems to secure value from their newly acquired resources, their waste. Existing sustainability business model frameworks address the concepts underpinning each of these themes independently; they generally do not treat them as critically interdependent. For example, where extant models do take a systems perspective, the dominant approach to nature is on the extractive value the environment provides for human production and consumption systems, thereby separating natural and human systems. In our case organizations, the obligation to nature is different: nature is not approached for its extractive value but treated as a participant to collaborate with and not the dissociated object of human social impact. To operationalize such an approach, participants had to disrupt the status quo. We have uncovered a critical interdependence of these themes in how business decisions are formed. What we have observed is the nascent rise of the Circular Economy as an implicit and emergent property of the resolution of tensions between growth and biospheric limits.

5.1 | Obligation to nature

Each organization had active sustainability policies in place that provided conceptual principles for design and implementation of their business models. While recognizing waste reduction in their operations was important to limit and potentially eliminate damage to the natural environment, their approaches spanned the business model continuum (Bocken et al., 2016) from slowing loops, the focus of SI and DH, through to closing loops, exemplified by CT and CD. Diverting waste from landfill was a common goal that was both symbolic and tangible and provided an explicit measure of the success of their sustainability implementation.

Three organizations—CL, IS and CD—explicitly recognized the importance of nature in shaping their business models, while for the others the influence of nature was implied in their sustainability policies. These three organizations shared a direct link to nature through agriculture. For CL, it was the use of a farm, owned by the CEO, to demonstrate how waste food should be incorporated into agriculture's nutrient cycle, thereby closing the loop from city to farm. For IS, their requirement to source wool that met their ethical standards created a value chain grounded in farmers following sound environmental and ethical animal husbandry practices. For CD, the adoption of organic farming practices started the process, which then informed the design of their milk processing operations. An important aspect of facilitating the redesign of the CD business model was the adoption of systems thinking, which the Managing Director formally learnt through an agricultural course when he went back to university. Recognizing this inextricable connection to nature in business model design is an indication of a strong sustainability perspective underpinning a transition to a Circular Economy approach informed by systems thinking.

5.2 | Waste becomes a resource—Revaluating waste from a systems perspective

Our discovery of the waste burden–resource continuum provides a more nuanced understanding of how organizations resolve tensions of managing waste. In part the resolution of the tension is dependent on the application of systems thinking. Hahn, Pinkse, Preuss, and Figge (2015) label such an approach as an “integrative” view of influences upon the strategy of corporate sustainability. In our examples, the greater the adoption and application of integrative systems thinking on business activities, the greater the reduction on the negative ecological impact of business processes. Application of integrative systems thinking also underpinned a shift toward open supply chains moving away from conventional linear models to network models including service value networks (Roos & Agarwal, 2015) and extending the conventional boundaries of an organization to include the value chains for their product and service offerings (Agarwal & Selen, 2009, 2011). Integrative systems thinking is a useful way to revalue the place of waste in business processes because it repositions the boundaries of an organization's span of control, its relationships and interactions, to retain ownership of and responsibility to correct problems that may otherwise be externalized to government, other organizations and the natural environment. In this sense the business model comprises more than the sum of its directly controlled operations and

the relationships with its suppliers and customers. Therefore, we have demonstrated how reconfiguring a “place for waste” through a circular flow can address the tension between how a business captures and creates broader economic value for its stakeholders (Brea-Solís, Casadesus-Masanell, & Grifell-Tatjé, 2015; Schaltegger et al., 2012) and the requirements for wider systemic change.

Relationships between the various organizations and their networks highlight the emergence of the interconnected patchwork of associations that indicate a nascent Circular Economy in Australia. The shift in logic from conceptualizing waste as a burden to a resource requires reframing of the problem context as complex, to include other actors in a wider network of business relationships and a change in worldview, a shift that Ison (2010) describes as learning from the experience of engaging in systems practice. While systems thinking has long underpinned any understanding of how sustainability might be implemented, it has mostly been interpreted through functionalist approaches such as life cycle analysis relating to material and energy flows, as in the literature of industrial ecology (e.g., Graedel, 1996; Stahel, 1983). As set out in Figure 3 this approach to systems thinking is associated with the efficiency phase of sustainability.

Porter and Córdoba (2009) argue that other dimensions of systems thinking, such as interpretative and complex adaptive systems, can enable a shift to a more strategic and “strong” form of sustainability. Our findings provide evidence of how this is enabled through integrated approaches that explicitly acknowledge nature as interconnected with human production and consumption systems, thereby enabling the revaluation of waste as a resource and hence disrupting dominant business models where nature is externalized. Such revaluation of waste can be understood as providing our case organizations with a purpose, which Stacey (1996) argues is a fundamental characteristic of a complex adaptive system that differentiates it from a deterministic system. Interpretative approaches to systems thinking were evident in the focus by some organizations on stakeholder consultation, and in a complex and adaptive systems approach evident in others in their implementation of a new ecosystem for their business by creating a new set of internal rules and organizing an

ensemble of independent agents using network-based arrangements for exchanging information leading to bottom-up change. These characteristics of complex adaptive systems may also be applied to the disruptive innovation processes undertaken by CL, IS, CD, CT and FC.

Our case findings regarding how business values waste led us to propose an articulation of the weak–strong sustainability continuum that revolves around the difference between efficiency and strategic sustainability approaches to the valuation and conceptualization of waste and the application of new processes modeling circular flows. Figure 3 lends support to those critics of the simple phase models of sustainable business as it highlights how one organization (such as FC) can be in both efficiency and strategy phases at the same time, applying integrative systems thinking as they selectively draw on functionalist, interpretive or complex adaptive systems logic to solve interrelated business problems to meet their operational goals.

Overall, we propose that integrative systems thinking is a precondition to transition away from the dominant acceptance that waste as it occurs in business processes is something that must be discarded as it has no intrinsic value to recognizing that waste can have value within a system and as a value resource to other organizations. This requires a structural change in current business models to connect to other supply chains where their waste is now considered a resource.

5.3 | Disruptive innovation—Structural enablers and constraints

Disruptive innovation is an important process these organizations undertook to change their business practices and was a necessary step for each of them to achieve the efficiency phase of sustainability business practices. Building on their efficiency foundations several organizations in this group radically reimagined their business processes and the innovations they applied created changes well beyond their organizational boundaries, resulting in new business ecosystems. In pursuing disruptive innovation, they reinvented their business models (Johnson, Christensen, & Kagermann, 2008) and in so doing changed

Sustainable Business Phase	Strategic Proactivity	<ul style="list-style-type: none"> -Renewable energy based innovations CD - exploring conversion of methane to replace diesel and also investigating other energy sources -Innovations around sharing assets - Innovations around product reuse CT 	<ul style="list-style-type: none"> -Radical transparency about social/ environmental impacts -Resource Stewardship <p>SI, DH - part of the stewardship program set up by govt CL - implicit in their strategy to get their client base redesigning their processes to eliminate waste</p>	<p>Open innovation platforms</p> <ul style="list-style-type: none"> -Collaborative approaches to learning, sourcing, production, lobbying <p>FC</p> <p>IS – EthEco wool products promoted and supported organic wool through all steps of the value chain</p>
	Efficiency	<p>Re-cycle, remanufacturing</p> <p>FC - all 3</p> <p>AR, SI, IS, CL - recycle and remanufacturing</p> <p>CT – recycle and remanufacturing as part of a new supply chain</p> <p>CD - recycling in the dairy</p>	<p>Stakeholder education/ awareness</p> <p>FC, CL, CT, IS</p>	<p>Flexible working models to reduce resource use</p> <p>FC, CL</p>
		Functionalist: Life cycle thinking	Interpretative: Iterative cycles of learning and dialogue	Complex adaptive systems: emergence and bottom up change
Systems Approach				

FIGURE 3 Categorization of circular flow framing of “waste” according to sustainable business phases [Colour figure can be viewed at wileyonlinelibrary.com]

their industry practices. FC in Australia remanufactured old equipment that their customers replaced and this extended the life of their products and also changed the rules of operation of suppliers within their supply chain. CT similarly reimagined their business and created a new operational procedure for recycling of toner cartridges. They are now looking to other areas where they can apply their skills in disruptive redesign of business processes to eliminate the concept of waste. SI were an early pioneer in recycling metals, having identified the metals waste stream as a lucrative source of raw material long before recycling was fashionable or even considered important.

The barriers to rehabilitating waste our case organizations face are predominantly institutional. At its most basic level the disruptive innovation practices they pursued sought to overturn established industry practices. For example, Benn et al. (2014) highlighted that collective action and collaboration between the various stakeholders in the steel industry along a supply chain has the potential to be a win-win situation for the environment and for the competitiveness of an industry sector while moving toward a stewardship approach to their product across its life cycle. Many of the participants in our study commented on the need to sell new products rather than refurbished as consumers considered the latter to be of inferior quality. One consequence of consumer behavior for them is that recycling volumes, given the population in Australia and its associated levels of consumption, are too low. This means that waste targeted for recycling is now shipped overseas as there is little or no industry to take up these raw materials. These experiences of our case organizations reinforce the views of critics that the Circular Economy model, to adequately overcome sociopolitical barriers that restrict systemic flows—the logics of consumption, for example the preference for novelty and its complement, spurning of reuse—requires a radical transformation of the current economic order (Gregson, Crang, Fuller, & Holmes, 2015).

6 | CONCLUSION

Synthesizing these cases, we found these organizations applied systems thinking to reframe their product and service offerings and developed material circular flows in their business models that supported foundations for the emergence of a Circular Economy. This enabled the value of the services and products they were selling to be improved/increased (Hearn & Pace, 2006). The value is based on ecological understanding of their operational network.

The ecological sustainability principles underpinning the linked discourses of systems thinking and the Circular Economy conceptualized waste as a resource, viewed as intrinsically valuable. Systems thinking enabled organizations to operate within the tension of understanding the place of waste, as both a burden and a resource (Chertow & Ehrenfeld, 2012). Waste conceptualized as a burden within the system was simultaneously viewed as a resource as it strategically became a new income-generating stream because firms identified new agents or products in their production and consumption systems for which this waste was now a valuable resource. The reconceptualization of waste as a resource triggered explicit strategies of disruptive innovation to existing supply chains in several of our case

organizations that consolidated the implementation of their new business models based on Circular Economy logic and in one instance created a new recycling standard of practice for their industry.

While our research did not undertake a longitudinal study, our findings highlight the disruptive role that reconceptualizing the place of waste as a resource in generating economic rent plays on the growth of the firms and subsequently the business models of our case organizations. When new business models incorporating circular flows emerged, the place of waste, conceptually and empirically, shifted from burden to resource, thereby stimulating creative redesign of organizational practices. As waste became a resource, materials were valued for their recyclability, usability and restorative capacity, moving the organizing narratives closer to the strong sustainability discourses that are precursors to the emergence of a Circular Economy. As our research involved a small sample of case organizations, we did not attempt to claim any broadly applicable findings. We do consider that there are similarities across these organizations that warrant deeper study.

In summing up, while our research concentrated on the physical material that organizations work with, analysis of the business models of our case organizations reveals the materiality of the social processes and activities of organizations. Investigating the norms and values of the ethical frames that influence decision-making shaping such organizational processes and activities concerning waste was not an aim of our research. However, the organizing narrative “obligation to nature” reflects a moral shift in the social relationship between our case organizations and the ecological systems upon which they depend. This role of moral obligations regarding the place of waste is an area for future investigation regarding the social dimension of the Circular Economy.

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