Levers for a corporate transition to a plastics circular economy

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Abstract
With the global economy not yet 10% circular, businesses are key stakeholders in designing new forms of resource use, especially large multinationals. However, compared with the wealth of studies on ‘born sustainable’ start-ups, there is minimal case study or interview based research into how incumbent companies are approaching this transition. Focusing on plastics, we ask: how does one incumbent multinational company approach the circular economy transition? This paper presents a case study of the incumbent multinational chemical company Dow, a leading plastics manufacturer. Varied external stressors and drivers for the circular economy act upon a company (which also has its own imperatives), resulting in tentative steps towards circular economy. To date, these steps have tweaked the existing system rather than radically altering the business model. For companies, like for the entire global economy, this transition has only just begun. This paper identifies key drivers, enablers and barriers of the circular economy, none of which are fixed or immutable. Knowing which levers for change are available and effective could help policy makers to shift gear to enable quicker progress towards circularity. Overall, broad based support and engagement is needed to progress the circular economy, hence all stakeholders have roles to play in demanding and enacting circular practices.

KEYWORDS
business model, case study, closed loop, incumbent companies, interviews, recycling, stakeholder engagement, sustainability

1 | INTRODUCTION

Large multinational companies responsible for huge quantities of industrial production, and the international financiers behind them, have the potential to drive forward new circular economy models. In terms of resources, the Forbes 100 most valuable brands in 2020 were collectively valued at $2.54 trillion (Swant, 2020). With circular activities still relatively rare and the world currently only 8.6% circular (Circle Economy, 2020; García-Quevedo et al., 2020) and linear production processes responsible for 45% of global anthropogenic CO₂ (EMF, 2019), incumbent multinationals have the footprint, resources and influence required to catalyse change. Furthermore, a circular transition offers an estimated $4.5 trillion in economic benefits by 2030 (World Economic Forum, 2020). Yet for leading companies who have grown within linear norms, with processes perfected for a world without waste on the agenda, discussion of change can disrupt the fundamentals of a business model. Many business models are ‘perfected’ for distribution (but not collection), single use and short life spans for items and their parts. This paper offers a case study of the motivations, goals, enablers and barriers of the multinational chemical company Dow. By studying how Dow is approaching circularity, and why, we gain...
insight into what circular economy means in practice for one incumbent multinational business. We also refer to the approaches to circularity of two other multinational companies, Dell (computing) and Glaxosmithkline (pharmaceuticals). This paper focuses specifically on plastics and circularity.

The past decade has seen considerable development and popularisation of circular economy thought and practice. The first Ellen MacArthur Foundation report on the circular economy was published in 2012. In December 2015, the European Commission launched the ‘Closing the loop’ action plan, followed by the ‘New Circular Economy Action Plan’ in March 2020, and as of March 2022, work is underway to draw up an international treaty on the lifecycle of plastics (EC, 2015, 2020; Hobson & Lynch, 2016; McVeigh, 2022). In the wake of this activity, corporate interest in the Circular Economy has increased dramatically (Stewart & Niero, 2018). The concept of circular economy holds three principles: (1) preserving and enhancing natural capital, (2) optimizing yields from resources in use and (3) fostering system effectiveness (minimizing negative externalities) (EMF, 2015). To this, we add (4) restoring and regenerating workers and society (Barford & Ahmad, 2021). This contrasts with linear approaches, whereby value is created as virgin materials are extracted, processed, manufactured, used and then disposed of (Figure 1). Moves towards circularity have been characterized as altering material flows—with materials completing one useful life (or loop) and then beginning another. Increasing circularity could involve slowing (e.g., long life models), narrowing (using less) and/or closing (by finding new uses for materials) these loops (Bocken et al., 2016).

Many activities fall under the broad definition of circularity, because different materials, uses and contexts need different processes. Amongst companies processing plastics, recycling is popular. However, other more circular activities for synthetic items include sharing (Hobson & Lynch, 2016), extending producer responsibility (Levänen et al., 2018), eco-design (Mendoza et al., 2017) and product service system models, which replace customer ownership with payment for performance (Tukker, 2015). Industrial symbiosis also enables circularity, through the efficiency of sharing infrastructures, waste, by-products, materials or energy (Fraccascia et al., 2019). These technical cycles can also include maintenance, repair, reuse, remanufacture and recycling (EMF, 2015). Despite the multitude of possible circular models, a focus on resource recovery through recycling persists. Recycling forms the outermost and least desirable loop of the technical cycle of material reuse (Figure 2), requiring more processing, labour, energy and new materials than other circular processes, with the end product usually being of less value than its predecessor (EMF, 2015). In addition, recycling low value materials, such as plastics, is becoming financially unviable when oil is cheap (Webster, 2021).

Despite the need for rapid change, the levers of change remain underexplored. While there is some theorisation of the field, scholars repeatedly point to absences and fragmentation of circular economy knowledge (Chen et al., 2020). More research is needed into how circular economy agendas relate to corporate sustainability, and how circular performance or transitions can be measured (Schröder et al., 2019; Stewart & Niero, 2018; Urbinati et al., 2017). While new ‘born sustainable’ companies are better understood (e.g., Rizos et al., 2016), considerable resources, impact and large scale operations characterise understudied multinational

**FIGURE 1** Plastics in a linear economy. This diagram shows how in a linear (take-make-waste) economy, virgin raw materials are extracted and used to make plastics, which are then thrown away or incinerated at their end of life. As a result, communities can be impacted by plastic and air pollution.

**FIGURE 2** Circular loops for plastics. This diagram highlights the degrees of change required to implement different types of circularity. Bear in mind that according to the Ellen MacArthur Foundation model, the inner loops are the most circular and therefore the most desirable. Yet they often require the biggest amount of change and redesign, so are more disruptive. This figure builds upon the EMF’s (2015) butterfly diagram and UNEP’s (2019) formulation of circular economy that includes the option of refusing consumption.
incumbents (exceptions include Gandolfo & Lupi, 2021, on paper and pulp; and Todeschini et al., 2017, on fashion). Large multinationals also have the potential to bring economy-wide leadership and influence in diverse sustainability topics, by setting minimum standards for their suppliers (e.g. Barford et al., 2022 on living wage value chains). ‘Born sustainable’ and incumbent companies face different constellations of barriers and enablers given their size, possible linear path dependency, histories and processes. Specifically, incumbent companies may see less immediate economic opportunity due to their reliance on linear modes of production. Comparing SMEs and incumbents in the fashion industry, incumbents were less agile at identifying new opportunities and shifting towards these (Todeschini et al., 2017). How incumbent companies transition towards circularity is critical to achieving greater sustainability; it is also intellectually interesting given the need for entire businesses, predicated on unsustainable practices, to change (Chen et al., 2020).

1.1  |  Research focus

This research paper addresses the question: How does one incumbent multinational company approach the circular economy transition?

To answer this question, we focus predominantly upon the chemical company, Dow. Founded in 1897, Dow is an American multinational chemical corporation headquartered in Michigan, USA. Its global businesses are organized into the following: Packaging & Specialty Plastics; Industrial Intermediates & Infrastructure; and Performance Materials & Coatings. These businesses supply 18 different market segments. For single-use plastics, Dow was the second largest single-use plastics producer globally with a footprint of 5,555,000 tonnes in 2019 (Minderoo Foundation, 2021; Figure 3; Polymer Database, 2022; Table 1). With 106 manufacturing sites across 31 countries, there are 35,700 employees globally. Dow’s stated ambition is to be the most innovative, customer-centric, inclusive and sustainable material science company. Despite Dow’s turbulent human and environmental track record (Katz, 2010; Müller, 2018; WRI, 1994), they have a history of engaging in what could now be seen as circular economy activities, such as their ‘waste reduction always pays’ program (WRAP) announced in 1986 and their corporate Sustainability Goals announced in 2006. Dow recently launched their third-set of 10-year Sustainability Goals for 2025 onwards and aim to ‘close the loop by enabling 100% of Dow products sold in packaging applications to be reusable and recyclable by 2035’ (Dow, 2019, p. 29). As an incumbent multinational with a vision for widespread circular transformation, but also as a major plastics producer, Dow is an ideal case study to further understandings into what enables and prevents a circular transition. We also draw upon interviews with two other major companies, Dell and GlaxoSmithKline, to understand how Dow compares to other incumbent multinational companies who have also committed to greater circularity.

![Figure 3](image_url)  
**FIGURE 3**  
The top five single-use plastic producers globally, 2019. Dow was the second largest single-use plastics producer in 2019. Data source: Minderoo Foundation (2021)

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Dow’s major products contribution to net sales, for the 12 months up to Q2 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Annual net sales</td>
</tr>
<tr>
<td>Packaging and specialty plastics</td>
<td>~$23 billion</td>
</tr>
<tr>
<td>Industrial intermediates and infrastructure</td>
<td>~$14 billion</td>
</tr>
<tr>
<td>Performance materials and coatings</td>
<td>~$9 billion</td>
</tr>
</tbody>
</table>

Source: Dow, 2021.

2  |  CONCEPTUAL FRAMEWORK: BUSINESS TRANSITIONS TOWARDS CIRCULAR PRACTICES

A large volume of literature exists on corporate sustainability strategies and sustainable business models; within this, the literature on circular business models is relatively recent and research draws heavily upon corporate reports, other secondary sources and surveys (Bocken et al., 2017; Chen et al., 2020; Linder & Willander, 2015; Prieto-Sandoval et al., 2018; Rizos et al., 2016; Stewart & Niero, 2018; Urbinati et al., 2017; Veleva et al., 2017). Qualitative research methods can deepen and extend this existing literature, by accessing people’s insights, reflections, and conceptual frameworks (e.g., Dey et al., 2020; Barford, 2020a). Further, the circular business strategies literature largely focuses upon small and medium enterprises (SMEs) or ‘born sustainable’ companies and start-ups (García-Quevedo et al., 2020; Joustra et al., 2013; Todeschini et al., 2017); in other words, firms often designed for circularity from the outset. These gaps led us to use semi-structured interviews to investigate incumbent corporate transitions towards circularity. The conceptual framework below sets out the relationship between circular economy and sustainability within a business context, outlines business models for
circularity and reviews the nascent literature on current drivers, enablers and barriers to circularity across industries.

### 2.1 Circular economy, sustainability and growth

Various sustainable business models co-exist alongside the dominant, extractive and waste-generating mainstream business models. Circular economy is a new addition to an older trend of business sustainability, which builds upon an earlier emphasis of business responsibility in recognition that a myopic focus on customers and shareholders must be extended to include society and the environment as key stakeholders (Bozcken et al., 2013). Sustainability and circularity are complementary but non-interchangeable concepts. The Circular Economy prioritises economic systems and environmental benefits, with minimal reference to the social (Barford, 2020b; Barford & Ahmad, 2021; Geissdoerfer et al., 2017), while sustainability offers a more holistic concept which treats the environment, the social and the economic with equal weighting (Brundtland, 1987). There are various perspectives on how circular economy relates to sustainability: conditional (circularity is a condition of sustainability), beneficial (circularity is one of several pathways to sustainability) and trade-offs (circularity leads to sustainability trade-offs) (Geissdoerfer et al., 2017). Importantly, a transition to both sustainable and circular business models requires a leadership strategy that delivers more than just long-term business success. In the context of systemic pressures, leaders must be equipped to reframe their business’ purpose, strategy, culture and approach to achieve change quickly and at scale (CISL, 2018). Businesses need to lead in reconciling commercial success with positive outcomes for society and the environment (CISL, 2018).

Most circular business practices are predicated upon economic growth, while a small number of companies have adopted the more radical degrowth approach, such as Patagonia and River Simple (Khmara & Kronenberg, 2018). The degrowth movement aims to downscape production and consumption to increase human and ecological well-being, calling for open, localised economies and with democratic resource distribution (Hobson & Lynch, 2016). This concept is peripheral to the mainstream circular economy approach, yet it responds to the risk that improvements in efficiency from circular technology and eco-innovation are offset by increased usage and demand, known as Jevon’s Paradox (Bocken et al., 2017). If prices fall, this could stimulate consumption, potentially increasing energy use and demand for secondary/recycled materials that would be better designed out (Bocken et al., 2017). The Jevon’s paradox highlights that technology alone is insufficient to address the ecological crisis (Zhang et al., 2018). While advocates of the circular economy often prioritise technology, proponents of degrowth emphasize the need for radical political, economic and social transformation (Kallis et al., 2018). Degrowth advocates warn that the circular economy could form the next round of the endlessly cycle of capitalist Schumpeterian ‘creative destruction’ (Hobson & Lynch, 2016), enabling further wealth accumulation by some and driving inequality throughout society (Dorling et al., 2008; Piketty, 2014).

### 2.2 Drivers, enablers and barriers for circularity

Corporate steps towards greater circularity are influenced by a variety of factors, internal and external to the company. Before reviewing the details, we contextualise these transitions of companies which operate within and across neoliberal economies, embedded within an ideology of consumerism (Bocken et al., 2017). Neoliberal ideology promotes open, unregulated markets with mobile international capital as the optimal mechanism for socio-economic development (Harvey, 2007). Neoliberalism impedes certain moves towards a circular economy (Huckle, 2012), as it renders government regulation unpopular despite its efficacy in reducing harmful processes and consumer choice editing (Kopnina, 2019). Limited government intervention has also facilitated ‘fake’ corporate commitments to sustainability (greenwashing) and social responsibility (bluewashing) which legitimise ‘take, make, dispose’ approaches (Bigge, 2004; Laufer, 2003). It is possible that the legacies of other social and economic systems compromise circular economy efforts (Schröder et al., 2019). Despite embedded neoliberal ideology presenting a structural constraint to corporate transitions, circular business models are being adopted (Urbinati et al., 2017). Below we explore six influences on corporate transitions towards circularity: employees, regulation, consumers, collaboration, viability and technology.

**Employee awareness and engagement** in ‘zero waste’ and circular economy is underdeveloped in many firms, yet can be pivotal in effecting change (Veleva et al., 2017). Employees at all levels of a business can play a key role when equipped with the skills to nurture innovation and manage risk, and when inspired to transform the economic systems within which they operate (CISL, 2018). A study of 30 SMEs transitioning to circularity found ‘company environmental culture’ (mindset and commitment of staff) to be a key enabler, mentioned by 68% of the companies studied (Rizos et al., 2016). Further, Liu and Bai (2014) found that a stable employee base is a precondition for long term circular transitions; whereas high staff turnovers tend to leave circular development overlooked. However, employees can pose a barrier to change if, for example, managers have a strong aversion to risk or resistance to change (Dekoninck et al., 2016). Importantly, resilient management teams committed to long-term circularity targets are needed to evolve circular business models; as they can preempt possible clashes between siloed departments, for example, planning versus production or admin versus operations (Liu & Bai, 2014). Our research explores this in greater detail, with a focus on Dow’s circular economy strategy and employee engagement.

**Regulation** is widely recognised for its potential to drive circularity. National, regional and international legislation and agendas have been drawn up for this purpose, such as the European Commission’s Circular Economy Action Plans of 2015 and 2020. Extended Producer Responsibility policies have shifted Multinational Enterprises towards more sustainable operations (De los Rios & Charnley, 2017), especially promoting waste reduction (Wen et al., 2009). The Basel Convention specifically prevents hazardous waste exports and disposal, including plastics as of 2019. Despite some enforcement challenges, the Basel Convention drives corporate responsibility and circularity
(Qu et al., 2019). Future policies to support corporate governance to embed circular business models could include: credible penalties for failure, strengthened boards of directors, shareholder empowerment and improved disclosure (Liu & Bai, 2014).

Policy can also constrain circularity, particularly when waste management rules sometimes block reuse of waste. While regulations define higher standards and stimulate reactive behaviour, policies can constrain the choice of circular solutions leading to unevenness between countries (Taddeo et al., 2017). For example, the limited transposition of Directive 2008/98/EC in Italy means that industrial companies cannot use scraps from other companies as raw materials, hindering economic and environmental gains of industrial symbiosis (Taddeo et al., 2017). Similarly, EU waste legislation holds no coherent definition of waste materials (Koch & Roberts, 2017), thus limiting the cross-border transportation of waste and rendering closed-loop supply chains less feasible. Policy can both drive and block moves towards circularity, this paper considers the role of policy alongside other factors.

Consumers can drive and block corporate circular implementation. Research drawing upon 4000 facilities in seven OECD countries evidences the strong influence of market pressure upon firms’ environmental commitment (Johnstone & Labonne, 2009). In the fashion industry, consumer awareness is a key driver for business model innovation (Todeschini et al., 2017), with a recent surge in demand for sustainable fashion pressuring ‘fast fashion’ incumbent businesses to shift their brand image and operations (Todeschini et al., 2017). While consumer pressure drives business circularity in developed countries (Liu & Bai, 2014), in China, market pressure does not influence the environmental behaviour of industrial firms (Wang et al., 2007). Although rare, consumer-facing initiatives can be pivotal for transitions towards circularity (Stewart & Niero, 2018). For example, in the fashion industry, innovative business models need to convince consumers of the benefits of sustainable clothing (Todeschini et al., 2017). Given that companies operate at different scales with diverse purposes, and some are not consumer-facing (i.e., they supply other companies, not individuals), the influence of consumers varies.

Innovative partnerships and collaboration are necessary to advance the circular economy (Veleva et al., 2017). Key stakeholders include multinationals, entrepreneurs, governments, non-governmental organisations and academic institutions (Veleva et al., 2017). Collaboration enables the sharing of the driving forces embedded in people and organisations, such local knowledge and operating processes, which can enable change (Jacobsen & Anderberg, 2004). Partners can serve as ‘knowledge brokers’ in non-commercial collaborations where the context is unfamiliar to a company (Brown et al., 2020). A study of 10 fast-moving consumer goods companies with both ‘circular’ and ‘enabling’ business models points to the benefits of horizontal communication for cross-industry and cross-organisational innovative reform (Chen et al., 2020; Unilever, 2016). Commercial collaboration within industry is also an enabler of circularity, where supply chains align with values to allow collaboration, and knowledge or resource sharing (Todeschini et al., 2017). Conversely, misalignment in organisational values between partners or overly complex operational collaboration hinders circular transitions (Todeschini et al., 2017).

Issues of viability and risk can prevent change, yet various factors influence viability in terms of what is possible and profitable. When researching eco-industrial chains, Liu (2008) found that the cost of establishing these often exceeded potential profits. Hence, focusing on resource scarcity and the environment yet disregarding economic implications is detrimental to circular transitions, since circular design and implementation are predicated on profitability (Lieder & Rashid, 2016). The economic risks associated with change, such as uncertainty about the marketplace, alongside complexity of current production systems create further barriers (Veleva et al., 2017). For example Tang and Wang (2002) found that only 13.3% of consumers in China considered eco-labelled products to have an influence on their purchasing behaviour. Therefore, if consumers resist change this could inhibit profits, preventing the extension of more circular processes. However, risk assessment that accounts for time horizons, internal and external factors can ensure that long term benefits are not overlooked (Chen et al., 2020). Circular economy models could balance short-term losses against long-term benefits.

Technology and knowledge can improve firms’ adaptive capacity. When assessing the transition from linear to circular production by 30 SMEs, insufficient capital was a barrier for 50% of firms, insufficient technical and technological know-how limited 21% (Rizos et al., 2016). The integration of new sustainable technologies into existing business models may be stalled by long procedures to meet standards, or by gaps in employees’ skills and knowledge (Rizos et al., 2016). Circular (re)design strategies can reduce resource consumption; increase reliability and durability, dematerialise products; promote product life extension; recover resources and regenerate systems (Stewart & Niero, 2018). Using technology to measure circular design can support a transition, for example measuring waste reduction through “output” indicators tracking reuse, recycling, composting, energy recovery, incineration and landfill (Veleva et al., 2017). Improved user interfaces (e.g., an app) could also improve services of remanufacture, reuse and repair (Manninen et al. 2018).

2.3 | Research question

The literature review above demonstrates how diverse factors create the context in which decisions about, and progress towards, circularity are made. Some factors, such as policy, can act both as barriers and enablers depending upon the details and intersection with other factors. We now turn to our own case study research, to answer: how does one incumbent multinational company approach the circular economy transition?

3 | METHODS

A series of semi-structured interviews produced one detailed case study of Dow, to access context specific knowledge and detail (Yin, 2009). This was complemented by one off interviews with two other companies, which offered insights from companies at different
stages in their circular transition. The other companies were GlaxoSmithKline (pharmaceutical) and Dell (computer technology). Companies were selected based on a desk-based review, combined with their availability. Hour-long online interviews were chosen to access interviewees’ perspectives, motivations and experiences (Box 1). Our semi-structured interviews allowed flexibility to explore new themes; as well as putting the interviewees at ease by focusing on their particular expertise. Data collection took place during October 2020–April 2021, and COVID-19 pandemic restrictions meant all interviews were online. The rapid popularisation of video calls during 2020 and 2021 due to COVID-19 restrictions made geographically dispersed interviewees accessible and enabled interviews with people based in Africa, Europe and North America.

Interviewees were initially recruited using contacts via mutual colleagues. Following our introductions, we held preliminary meetings to outline our interests, the research process and the outputs. When concluding an interview, we often asked for further contacts; thus, a series of snowballing opportunities unfolded. The authors interviewed together, and sometimes interviewees opted for group interviews. After the interviews, the recording was transcribed, checked and the transcript returned to the interviewee for validation. This provided an opportunity for interviewees to edit the record if needed. Subsequent validation was invited by sharing the pre-submission draft of this manuscript and inviting feedback. Analysis involved coding of the transcripts, seeking patterns and themes especially around the motivations, strategies, enablers, barriers and goals for circularity. The quotes presented in our findings are selected as typical of more widely held views and experiences.

Our research faced a few methodological influences and limitations. One was in recruitment, while most potential interviewees responded positively, not everyone was available. Another limitation was that intermittent internet connections sometimes disrupted recordings. While online interviews broadened the reach of our interviews, this was at the expense of the contextual understanding gained through physically being there. Furthermore, the relational positionality between interviewees and interviewers— influenced by our identities, personalities and professional roles– aﬀects what information is shared and how. Looking ahead, there is potential to expand this study to other incumbent multinationals positioned diﬀerently within the plastics value chain (Table 2).

Box 1  Semi-structured interview guide on ‘Business pathways towards circularity’

1. Please describe your company’s business model, to help us understand its resource and materials dependency, usage and footprint?
2. In practical terms what does circularity mean to your company?
3. What are the motivations and implications of greater circularity for you as a company?
4. Did you have any practices which were already circular, at the beginning of this journey?
5. How are you doing in terms of circularity now? What has changed between then and now?
6. What were the main enablers and barriers you have encountered in this transition?
7. How did you choose where to focus and prioritise within a circular transition, and why?
8. How do your upstream and downstream supply chains fit into this circular transition?
9. How do you see the role of leaders and decision makers in underpinning a circular transition? Where does circularity currently sit within the company?
10. What are your future goals for circularity? Where is circularity oversight likely to sit in the future within your company?

[Note: where possible answers were guided to focus on plastics]

Table 2  Table of companies, interviewees and their roles

<table>
<thead>
<tr>
<th>Company</th>
<th>Roles represented</th>
<th>Number of people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow</td>
<td>Executive director and global corporate citizen program manager, Dow</td>
<td>1</td>
</tr>
<tr>
<td>Dow</td>
<td>Sustainability and advocacy manager for Africa for Dow’s packing and specialty plastics business and country manager for Ghana</td>
<td>1 (*2 interviews)</td>
</tr>
<tr>
<td>Dow</td>
<td>Global sustainability and end use marketing director; and Latin America sustainability and recycling director</td>
<td>2</td>
</tr>
<tr>
<td>Dow</td>
<td>Senior director for sustainability performance materials and coatings business segment</td>
<td>1</td>
</tr>
<tr>
<td>Dow</td>
<td>Global technology and sustainability director; and global sustainability implementation leader</td>
<td>2</td>
</tr>
<tr>
<td>Dow</td>
<td>Global technology and sustainability director; health, Safety and sustainability director; senior business sustainability director: carbon, circularity and safer materials and environment</td>
<td>3</td>
</tr>
<tr>
<td>Dow</td>
<td>Director of sustainability for industrial solutions</td>
<td>1</td>
</tr>
<tr>
<td>GlaxoSmithKline</td>
<td>Sustainability manager</td>
<td>1</td>
</tr>
<tr>
<td>Dell</td>
<td>Principal environmental strategist</td>
<td>1</td>
</tr>
</tbody>
</table>
4 | FINDINGS

In this section, we draw upon our research interviews to address how incumbent multinational companies approach a circular economy transition. These findings refer specifically to plastics. Overall, our findings show that various elements may act as drivers, barriers and/or enablers of a circular economy transition (Table 3).

4.1 | Corporate culture and progress towards circular economy goals

4.1.1 | Corporate culture, circular ambitions

Dow’s corporate ambition is clear: “We want to be the most sustainable material science company out there.” (Eric Peeters, Dow). Employees’ ambitions for Dow are high, as the “employee base feels we need to do a better job” in sustainability (Eric Peeters, Dow). This corporate culture complements Dow’s sustainability commitments (Box 2), of which Goals 2 and 3, to stop waste and close the loop, inherently refer to circular principles. We now review these goals in practice, their limits and their drivers.

4.1.2 | Recycling

Recycling and recycling-related interventions form a substantial portion of the circular economy work advanced by Dow. This includes making plastics more easily recyclable, supporting recycling infrastructure or partnering to collect plastics for post-consumer recycled packaging. Dow also reduced plastic use, by making thinner, lighter packaging. Recycling is, in part, a response to existing plastic waste

### TABLE 3  Ten levers that drive, enable and constrain transitions towards corporate circularity

<table>
<thead>
<tr>
<th>Lever</th>
<th>Driver</th>
<th>Enabler</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership strategy, culture, commitments and employee demand</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Policy context, nationally and internationally</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customer demand for circularity</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Technology and data, especially recycling technologies</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Internal processes, restructuring and employee engagement</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot projects to test new approaches</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Partnerships: pre-competitive, commercial and local</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Financial viability, influenced by price of virgin raw materials, scale of operations, and time horizons</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: These levers intersect with one another; for example, pilot projects could build new infrastructure, or policy changes and technological advancement might alter the financial viability of circular processes. Few of these are fixed, so this list identifies a series of pressure points for interventions.


**Dow’s sustainability goals**

1. **Protect the climate.** As part of our action plan to put us on a path to carbon neutrality by 2050, we are committed to implementing and advancing technologies to manufacture our products using less resources.

   **Target:** By 2030, Dow will reduce its net annual carbon emissions by 5 million metric tons versus its 2020 baseline (15% reduction). By 2050, Dow intends to be carbon neutral (Scopes 1 + 2 + 3 plus product benefits).

2. **Stop the waste.** We are collaborating to invest in key technologies and infrastructure to significantly increase global recycling.

   **Target:** By 2030, Dow will enable 1 million metric tons of plastic to be collected, reused or recycled through its direct actions and partnerships.

3. **Close the loop.** We are committed to redesigning and promoting reusable or recyclable packaging applications.

   **Target:** By 2035, Dow will close the loop by enabling 100% of Dow products sold into packaging applications to be reusable or recyclable.
pollution. Dell, also tightly linked to plastic, developed take-back and reuse schemes.

Plastics have a pretty low recycling rate of about 9%, globally, and that’s unacceptable, and we need to work on the system changes to increase that. (Haley Lowry, Dow)

4.1.3 | Sticking with plastic

Dow and GSK are committed to continue using plastic. This was rigorously justified in terms of the properties of plastics, and references to scientific evidence that plastics are the most sustainable option.

if a true lifecycle assessment and risk analysis is done to evaluate plastic versus other packaging materials for certain applications, plastic comes out offering a better benefit across the board and there's definitely lots of papers and data to prove this ... we try to advocate for science based decisions. (Adwoa Coleman, Dow)

it is just a great material for what we need it for sometimes: moisture resistant, a barrier, helps prolong shelf life of medicines which increases access to people and it also means you are generating less waste. (Scott Oram, GSK)

4.1.4 | Slow progress towards circularity

There was an omnipresent recognition that there is a long way still to go. Dow is seeking alternatives, through pilots and incremental change. This highlights the difficulty in moving away from a carefully designed linear system.

It takes a long time to change, you know ... it's very challenging when you have a well working thing [linear models] to change completely for something that is not working yet. (Nicoletta Piccolrovazzi, Dow)

we are doing well in terms of the general understanding around circular economy and having crystallized what that means for every business ... But we are still in the phase of piloting solutions. And the number of solutions that are at scale is very limited. (Nicoletta Piccolrovazzi, Dow)

One of the hang ups that I had for a while is that sometimes the projects that we invest in are not purely a model of circular economy ... So sometimes we are doing something that is not really a circular economy model but we are making progress in that direction, right. (Kristin Bovid, Dow)

Dow and GSK both insisted that health and safety are always the top priority, underscoring how the very clear parameters within which companies operate, parameters which shape the possibilities for circular leadership.

The last thing you want to do is kill your employees with an incident or a big accident. So there is never a trade off on safety, never, ever. (Eric Peeters, Dow)

4.2 | Leadership, decentralised solutions and partnerships

4.2.1 | Unified goals, diffused actions

Dow and GSK made high level commitments backed up by dispersed action. New director level recycling roles were established to promote the circular economy in Dow. Yet, decentralisation of circular activities is understood to be necessary. Examples include establishing Communities of Practice on circular economy and workshops to solve specific challenges, which aim to capture the “growing swell in the grassroots of the company that wants to be a part of accelerating the journey” (Eunice Heath, Dow). This hub and spoke model in Dow has parallels within GSK and Dell.

we had a sustainability network of employees that have a lot of passion with regards to sustainability, and we transformed that to ‘Communities of Practice’. So we have got a community of practice for life cycle assessment, community of practice for valuing nature’s solutions, community of practice for recycling, community of practice for circular economy so we have got several communities of practice and the whole purpose of that is these are employees that really want to learn, from the grassroots with regards to how they can do what they need to do every day with a different mindset and with sustainability being that foundation. (Eunice Heath, Dow)

4.2.2 | Partnerships and value chains

All interviewees emphasised how partnerships are essential to circularity, as materials flow between companies, individuals and other actors. Examples of partnerships include pre-competitive business alliances (e.g., the Alliance to End Plastic Waste), commercial relationships with their suppliers/customers and partnerships with NGOs, social enterprises or local leaders. Dell, for example, partners with Goodwill shops in the USA.
I looked at the context of the situation, and all of the different countries and very quickly realised 1. We cannot do it alone, just Dow. 2. If we tried to take on the whole system, or to try and solve all of the problems we would have a lower likelihood of success than if we carefully scoped out where we wanted to play.

(Adwoa Coleman, Dow)

We cannot do it by ourselves. The whole takeback is an ecosystem, with all sorts of different market participants, and that entire ecosystem has to scale up by a factor of 10. And one of the best ways that we have of doing that is through engaging with different organisations externally.

(John Pflueger, Dell)

4.2.3 | Opportunism and pilot projects

Pilot projects were popular in carefully scoped settings which offer: large volumes of plastic to recycle, a favourable or timely policy context, strong partners and suitable infrastructures. Dow’s Impact Fund supports such pilots, awarding US $1.4 million across eight projects in 2020. Impact Fund pilot projects foster external partnerships, for example, ‘Recycling for a Change’ in Brazil with NGO Fundación Avina, supported Dow’s post-consumer recycled materials vision of circularity. Scaling up was an option following proof of concept.

On the Impact Fund: ‘we have invested in a lot of pilots or maybe incubator things that come in and we would like to get to the point where we can identify solutions that are working really well and try to scale them up or take them to other places. Right now, we have certainly been able to identify lessons from different projects that similar projects can use or say we know this works and we know this did not work’. (Kristin Bovid, Dow)

we have launched our PCR [post consumer recycled] product in every single region, demonstrating our commitment to really advancing the circular economy.

(Haley Lowry, Dow)

So I think it is a combination of being opportunistic, as well as knowing what are the right challenges to tackle.

(John Pflueger, Dell)

4.3 | Policy and local context

4.3.1 | Policy as a barrier

As of 2019, the Basel Convention included limits on the international movement of plastic waste. The interviewees highlighted that for them the inclusion of plastic within the Basel Convention formed a barrier to moving plastic waste to recycling facilities. The challenge of policy differences between places also meant that the landscape of policy is difficult to navigate for a multinational company seeking to operate across international borders.

Where governments can really help is that I think we need to make it easier to basically ship waste around. And waste, I mean, quote unquote, right, you know, in a real circular perspective there is no waste but it’s basically the product that comes to the end of its first life. … I think the Basel Convention which has a lot of good intents and purposes, is actually a significant barrier often for us to do the right thing. (Eric Peeters, Dow)

4.3.2 | Policy as a driver or enabler

Policy has also been identified as an enabler and driver. The European Green Deal nudged GSK to adopt circular models. The Circular Economy Action Plan encouraged GSK to define what circularity meant across the company, to scrutinize products and packaging at their beginning and end of life and to put targets in place to reduce adverse impacts across the whole value chain. In contrast, a possible Ghanaian plastic ban in the wake of a plastic-induced disaster motivated some plastic-producing industries, including Dow, to form the Ghana Recycling Initiative by Private Enterprise (GRIPE), to take action on plastics and assuage demand for a plastic ban. It was also suggested that governments should subsidise chemical recycling.

So I think it was legislation [European Green Deal] that probably nudged us a little bit in that way but I think the driver was probably us as a healthcare company, and our ‘healthy planet, healthy people’ kind of mantra. (Scott Oram, GSK).

On chemical recycling: ‘that’s where governments can come in ... to help deploy for the first time a new and risky technology and get it to a let us say a reasonable economic hurdle ... to be more or less affordable’. (Eric Peeters, Dow).

4.3.3 | Policy engagement

The companies were involved in policy discussions, with the potential to influence and guide discussions. There was hope that governments would consult them:

South Africa ‘have a very good consultative process, with all of their stakeholders and the private sector etc. and so through the associations that we are part
of on the ground, we have the opportunity to shape policy with governments and be involved on platforms to get that done. ... Kenya is very forward looking in the policy space so Kenya has some of the strictest plastic management policy in the region, lots of bans, lots of restrictions around plastics. However, I feel that it is less consultative, and we do not really have a direct platform to approach the government’. (Adwoa Coleman, Dow)

4.4 | Customer demand and viability

4.4.1 | Customer power

Dow is a business-to-business (B2B) company, hence interviewees stated that other businesses set the demand for circular alternatives. Dow support their customers in meeting their sustainability commitments.

Given the brands goals that they want to achieve certain circularity goals on packaging recycling percentage by these dates, this [new barrier adhesive for food packaging] fulfils exactly some of the needs and requests of these goals. (Roberto Rigobello, Dow)

Circular progress varies across Dow’s work in 17 market segments due to variable customer demand. For example, half of all discussions with customers in home care and personal care markets mention circularity (Eric Peeters, Dow). Without customer demand circular alternatives are not rolled out.

4.4.2 | Economics of circularity

One perennial challenge for the recycled plastics market is the fluctuating price of oil: when oil is cheap, virgin plastic is cheap. Also, new systems are yet to expand and benefit from the economies of scale from which linear processes benefit. That said, sustainable options were reported to outstrip other markets.

we have to make a profit otherwise we do not survive ... whatever we end up doing does need to make economic sense. (Eric Peeters, Dow)

We’re comparing systems that have been optimized for decades, with systems that are in their infancy. So, the scale typically reduces costs. Yes, so to deliver a circular economy solution today is probably more expensive than a linear, by and large, you know otherwise we would be adopting them very, very quickly. (Nicoletta Piccolrovazzi, Dow)

we have been able to demonstrate ourselves as the sustainability leader in our segment: those who do good business get good results and this is part of doing good business ... we see there being tremendous competitive advantage through the investments that we have made. (Mike Witt, Dow)

Dow and Dell both highlighted the sometimes-competing factors of performance, price, reliability and sustainability and GSK discussed how low demand for medical grade recycled plastics might block their pathway to full plastics circularity, as it is cheaper and easier to recycle post-consumer plastic to a lower grade.

It may not ever be worth a plastic manufacturer’s time to create a pharma grade plastic. There is only a small amount we need compared to what they could make food grade for a beverage company and make lots of money. (Scott Oram, GSK)

4.5 | Infrastructure and technology: Main focus plastics

4.5.1 | Infrastructural and technological barriers

Lack of infrastructure and technology make it trickier to implement recycling projects, especially in the context of restrictions to the cross-border movement of plastic waste.

... with some of our projects in Kenya, Ghana, South Africa, Indonesia, India, we are saying, what do we do when we do not have an appropriate waste management infrastructure and the alternative is someone literally just throwing it in the ocean or burning it, so what do we do? (Kristin Bovid, Dow)

if we stick to manufacturing and waste ... if there is no infrastructure in that market to recycle that waste ... that is really limiting for us. (Scott Oram, GSK)

4.5.2 | Technology as an enabler of the future

Rather than redesigning systems using existing technologies, new applications and solutions were envisioned. This includes bringing chemical recycling to the point of commercial viability (Dow) and block-chain tracking for materials to provide their histories.

We are basically looking at all kinds of different technology to recycle, e.g. chemical recycling two or three different ways, we are looking at pyrolysis, we are looking at also mechanical recycling, you know for silicones like you could do for plastics. ... The challenge
there is how ready is the technology. And can you make it technically work? (Eric Peeters, Dow)

It’s my opinion that by the time we get to 2030, we are going to need to have ‘Chain of Custody’ on everything. We’re going to need to know where everything that we brought into our manufacturing value chain comes from, quantities and locations, we are going to need to know where everything is going, you know, just assume by 2030, everything’s got to be tracked ... [pointing to the need for IT]. (John Pflueger, Dell)

5 | DISCUSSION

‘The circular economy’ is an idealised economic model towards which some companies are transitioning. The practice of, and progress towards, this ideal are neither predefined nor mapped out; instead this needs to be designed, negotiated and tested. The findings above show a series of barriers, enablers and drivers which have together shaped the form and speed of transition towards plastics circularity. Dow, a world leading plastics producer (Polymer Properties Database, 2020), faces a major push to stem the flow of plastics into the environment (Rochman et al., 2013, 2016). Circular economy offers a framework for reducing plastic waste, but what factors shape Dow’s and others’ actions? This case study offers an in-depth look at the distinctive characteristics of Dow and draws comparisons to two other multinational companies moving towards circular business models. This enables analytical generalisation (Yin, 2009) regarding how previously linear companies contemplate change. With investments, infrastructure, customers and investors largely reliant upon a linear business model, how does change come about, and what stifles change?

Dow’s journey to circularity is cautious. Despite various conceptualisations of how to be more circular (see Bocken et al., 2016; EMF, 2012, 2015; Hobson & Lynch, 2016; Levänen et al., 2018; Mendoza et al., 2017; Tukker, 2015), a focus on resource recovery through recycling persists, and in general, plastics continue to be seen as waste rather than opportunity. In terms of transitioning, recycling is low-hanging fruit. It is minimally disruptive, requiring the least redesign of industrial processes, and largely allowing ‘business as usual’.

Recycling is also the least desirable loop for material reuse (Figure 1). First, recycling requires considerable processing, labour, energy and new materials (EMF, 2015). This intensive process can render low value materials uncontrollable against new materials. Second, recycling is not the idealised closed loop for plastics, as recovered materials that are contaminated or mixed are diverted to landfill or incinerated—resulting in air or groundwater pollution (Clift et al., 2019; Webster, 2021). Recycling can also distract attention from more ambitious forms of circularity, such as Dell’s take-back systems and their forthcoming ‘Project Apex’ for ‘as-a-service’ models. That said, while a major clean-up operation is needed for the linear economy which recycling can support, this should be advanced in parallel to more disruptive versions of circularity.

To offer the agility and innovation found in some SMEs (Mura et al., 2020), Dow’s Impact Fund supports experimentation, evolution and diffused innovation. The Impact Fund incubates ideas from any level of the business, via a competitive funding mechanism, and with the potential to scale. The ‘Recycling for a Change’ Impact Fund programme in Brazil demonstrates the convergence of several levers for change—namely, employee engagement, pilot projects and external partnerships. While these levers hitherto predominately enable recycling circularity, they promote a socially progressive version, whereby social impact is essential and prioritised (Barford & Ahmad, 2021). Impact Fund projects require external partnerships to co-create solutions, in part addressing the challenge of establishing cross-value chain collaboration for a system-wide circular economy (Todeschini et al., 2017; Veleva et al., 2017). Engaging the insights of internal and external stakeholders replaces earlier top-down approaches to business model innovation. Yet, comparing the USD1.4 million awarded to Impact Fund projects with Dow’s net sales of USD 38.5 billion for 2020 (Dow, 2020) hints at the potential and need to substantially upscale the Business Impact Fund in order to create substantial solutions to Dow’s current plastic operations.

The double-edged role of policy, described both as a barrier and driver of circular economy, makes policy a key lever. To unpack policy as an obstacle to the circular economy, we consider the Basel Convention, extended to include plastics in 2019 (Webster, 2021). This legislation challenged Dow, as their recycling programmes assumed the transport of plastic waste to plastics recycling centres. Dow would previously move plastic waste across national borders to solve the challenge of patchy recycling. Thus this particular version of circular economy was disrupted by a policy, whereas national scale circular models or more ‘upstream’ models (such as reuse, repair and remanufacture—see Figure 1) would have not been impacted in this way. Companies also shape policy. In South Africa and Ghana, for example, Dow representatives are closely engaged with policy making, sometimes also blocking certain policies. Faced with a possible Ghanaian plastics ban, major plastic producers gathered to advance recycling efforts and pre-empt the ban. Arguably a well-enforced plastic ban (likely targeting specific items) would have brought environmental benefits.

Dow’s leadership strategy for circularity is consistent with other research, whereby employee engagement enables change (Veleva et al., 2017). Employee engagement is achieved through establishing Communities of Practice and running workshops, which builds momentum and sources innovative ideas. The transition from internal corporate sustainability roles in CSR departments with siloed circular strategy teams, to diffused ‘business sustainability leader’ roles, remains under-researched. Businesses within Dow are responsible for driving their own sustainability and circular economy strategies, the rationale being that business-specific roles deal directly with material flows and can spot opportunities. Business sustainability leaders train on circular strategy and seek new opportunities for customers and markets. This diffusion of circular strategy within the company
enables innovation, with potential for circular transformation, capturing more of the agility and innovation for which SMEs are recognised (Mura et al., 2020). While this presents a promising start, stronger leadership is needed from Dow, given the size, influence and nature of the organization.

Viability is the bottom line—whether a circular economy model is possible, technically, logistically, legally, in terms of safety, and crucially, financially. Various factors determine what is deemed to be viable. Is the infrastructure in place? Will it be profitable? Understanding what determines viability is key to progressing circular business models. Market demand for circular options encouraged Dow to offer these, and the sustainable part of Dow has been its fastest growing part. There was no engagement with the concept of degrowth (see Hobson & Lynch, 2016), which remains a marginal yet important perspective within mainstream moves towards circularity. As a company that only supplies to other companies, and whose branded logo remains less visible to the public eye on products and packaging, pressure for circular plastics comes from customers, employees and policy, rather than the public. Perhaps this explains why there is currently greater focus on the post-consumer materials of well-known brands that Dow supplies, rather than on the companies further up the value chain which produce the pellets from which many single-use plastics are made.

Dow relies on technological development, specifically ‘advanced chemical recycling’, as an enabler of future circularity. However, this as yet unproven technology requires caution, especially given several failures in chemical recycling projects concerning the recycling of multi-laminate sachets (Changing Markets Foundation, 2021). While preventing plastic from entering the environment, this technology may create issues for the climate (greenhouse gas) and toxic pollution (from gasification that emits harmful chemicals and carcinogens) (Rollinson, 2018). New technologies must not create a ‘leaky circular economy of chemical recycling’ (Gaia, 2020). While understandably new innovations take time and failure to develop, dependency on emerging technology distracts attention away from the plastics currently entering the environment.

In addition to external collaboration facilitated through the Impact fund, everyone interviewed (including GSK and Dell) highlighted the importance of commercial partnerships as an enabler to circularity. While this is consistent with the literature, another less discussed type of partnership was also referenced: pre-competitive ‘industry alliances’. Examples include the international Alliance to End Plastic Waste (AEPW) and national industry alliances like the Ghana Recycling Initiative by Private Enterprises (GRIPE). While progressive in enabling potential competitors to work collaboratively to pioneer new projects that create value for post-consumer waste, such industry alliances might ultimately promote the plastic production which is at the root of today’s plastics pollution. For example, while devising strategy and accelerating solutions with a joint commitment of USD1.5 billion, members of the AEPW invested USD186 billion into new petrochemical facilities between 2010 and 2017 (McDermid, 2019). This preference for recycling over more ambitious circular design poses a hidden barrier to reaching higher levels of circularity.

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**Box 3  Recommendations for a circular transition**

1. For circular economy transition
   a. Everyone can be involved in demanding, enabling, and enacting change, including individuals and citizen groups.
   b. Without broad based engagement from diverse stakeholders, the circular transition will be slow.

2. For business
   a. Leadership must go beyond adapting to systemic pressures, instead business leadership requires an active reframing of purpose, strategy culture and fundamental approach to value chains to achieve change at pace and at scale.
   b. Circular economy goals can be linked to greenhouse gas emissions targets, which use circular economy used as a route to reaching climate ambitions.
   c. Partnerships are key, as business opportunities stem from one business’ circular processes enabling others to achieve their circular economy goals.
   d. Consider diverse options for circularity, including more disruptive and radical options which offer medium- and long-term benefits. Within this it is also important to ensure the creation of sufficient decent jobs, and ensure disadvantaged groups have access to these.

3. For policy makers
   a. Make a circular economy economically viable and socially beneficial.
   b. Consider the longer-term agendas for circular economy, as part of a just transition, and what will drive progress towards that.
   c. Remember that alongside a circular transition there is a sizeable ‘clean up’ operation needed for plastics from the linear model.

4. For researchers
   a. More research is needed into how incumbent companies in different sectors approach the circular economy, to better understand how to support this transition. More case studies and comparative studies are needed to broaden understanding of how other incumbent multinationals are approaching the circular economy. Furthermore, more research is needed into what impacts increased circularity has on the labour market and workers.
All the barriers, enablers and drivers identified are malleable over decadal timescales. This means that today’s barriers could be reduced, or enablers enhanced. The context in which Dow operates is shaped by many factors, including Dow itself, and these levers are interconnected. The choice of levers for change means there are several pressure points which could be used to initiate more ambitious circularity. With the world only partly circular, these findings represent companies beginning their circular journeys. Dow has started at the outer loop for plastics, relying on mechanical recycling, with future plans pinned onto chemical recycling becoming a financially viable option.

6 | CONCLUDING COMMENTS

The end point for circularity is well defined, yet the route to get there is still being mapped. As new systems and approaches are built onto older structures, the processes of these older modes in part determine the next steps. This palimpsest of old systems shapes the choices and transitions made. Our global reliance on plastic is hard to break out of for companies and societies, and this dependence on plastic is not purely for technical reasons. A swathe of other factors which concern legislation, finance, prices and leadership have led us to rely on plastics for many parts of our daily lives. As one Dow interviewee put it, ‘it’s hard to turn a ship around while not sending everyone home.’ During our research we spoke to sustainability leaders navigating this challenge within their companies. However, we do not need to wait for a technological solution to these challenges, we can start addressing them now by using the other levers for change: policy, public pressure, employee engagement, redesign, partnerships and corporate culture. Walter Stahel (2016) sees a need for concerted action on all fronts; though we risk delay if we wait for ‘all fronts’ to be ready. Some actors need to lead.

There are many levers which may block, enable or even drive a transition towards circularity. These levers will be critical to institutionalizing circularity, by jumpstarting, diffusing and then sustaining circular economy (Panwar & Niesten, 2022). We have used the term ‘lever’ because these are neither fixed nor immutable; we have also termed them levers because our findings show that these elements make a difference to the actions of multinational companies when they define their ambitions based upon the intersection of their corporate culture and values with the wider economic, legislative and cultural context in which they operate. Below we offer recommendations for accelerating a circular transition. Through knowing what might block progress, we can identify what could be altered to enable progress (Box 3).

CONFLICT OF INTEREST

Neither of the authors of this paper has a conflict of interests to report.

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