Barriers to the Circular Economy in Australia and the European Union (EU): A comparative mixed methods review.

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Abstract

After the disruptions to international flows of low-grade recycling in 2018, jurisdictions like Australia are placing increased priority on transitioning to a more sustainable, circular economy (CE). In other jurisdictions, like the EU, CE has been a sustained focus for decades. However, even with this substantial body of evidence and practice, little is known about how barriers to CE vary across contexts, particularly at the level of business firm uptake of CE practices. We don't know if the current state of knowledge translates well to the Australian context. This paper analyses evidence

from the EU and Australia to assess similarities and differences in the EU and Australian experience of barriers, particularly those which apply to business, with a view to identifying priorities for behavioural public policy interventions. We progressively contextualise results from Australia – including interviews with policymakers and NGOs, and a rapid 'review of reviews'; with research from Europe examining implementation barriers to CE. We found common immediate barriers of organisational hesitancy, uncertain consumer demand, collaboration, and linear value chains, which were superficially similar in both contexts. However, barriers in technology and regulation influenced business in Australia and the EU differently. This we attribute partly to a fundamental difference of emphasis in Australia that we summarise as waste and recycling as 'industry'; versus a possible change to it being an 'essential service'. We present what are likely to be fruitful areas for behavioural public policy experiments trials in Australia to facilitate business adoption of CE practices. This paper provides further insight to policymakers and researchers in both contexts interested in changing business practices towards a more circular economy, and build an international evidence-informed dialogue, grounded in specific contexts.

Keywords: business, policy, behaviour, circular economy, sustainable consumption,

1. Introduction

The roots of circular economy (CE) as an umbrella concept are diverse and go back to at least the 1960s (Blomsma and Brennan, 2017). Practice and policy experimentation, particularly in the EU, goes back at least as long (Remmen, 2019). Even so, while CE remains attractive to governments, businesses, NGOs and researchers, its definition is contested and confused (Kirchherr et al., 2017). An adequately representative definition adopted for this paper is: "an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes" (Kirchherr et al., 2017).

Such a system not only promises the benefits of easing the burden on global ecosystems but, for business entities, can also deliver commercial value through cost savings and innovation with the design and development of new materials, products, systems, technology, and business models.

Despite such clear motivations for firms to adopt CE business models and policy makers to facilitate them, global progress towards a CE is ambiguous. By one recent assessment, the extent of circularity in the global economy decreased between 2019 and 2020 (de Wit et al., 2020). This can be attributed to the continuing impact of a wide range of barriers to CE, which have been identified in a substantial body of research, much of it in the EU context (Araujo Galvão et al., 2018; de Jesus and Mendonça, 2018; de Wit et al., 2020; Tura et al., 2019). Countries around the world are looking to this body of research and practical examples from the EU (Araujo Galvão et al., 2018; McDowall et al., 2017) for insights into the barriers, drivers and successful policy frameworks to transition to a more circular economy.

However, overcoming barriers to global and national progress is hampered by a lack of understanding how barriers apply in different contexts, and how they interact across contexts. We don't know which barriers apply in different settings, their relationships, and their relative importance. What has become clear from existing scholarship, as we show, is that many of the barriers accrue around interdependencies between consumers, businesses and government that cannot be treated in isolation and that interact at multiple temporal and spatial scales. These relationships are systemic in their own right, and mean both supply and demand side considerations, working across borders, are shaping the behaviour and decisions of key actors, and need to be addressed simultaneously.

This is not just an academic issue. After China substantially tightened its tolerance of contamination in comingled recycling imports in 2018, the resulting chaos in Australian municipal recycling substantially boosted engagement with CE locally. Figure 1 is a causal influence systems map (to be

read right to left) created by policymakers in 2017, prior to the project driving this paper, but also used to frame its research agenda.
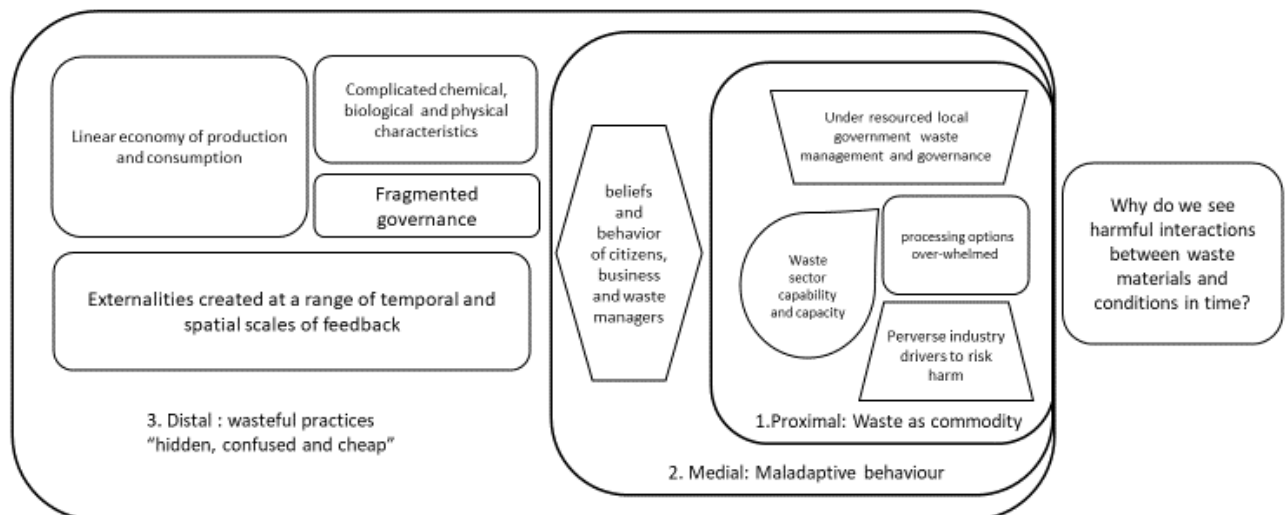

Figure 1: A causal influence map of waste policy problems in Australia (abstracted from Clarke, 2018).

We will further discuss this figure in the Discussion, but for now we note this map started with understanding why there were problems like stockpile fires of recyclable material, and ended up critiquing the linear economic model. With disruption of the low quality, low price recycling export option for Australia, the events of 2017-18 impacted as much as 99% of Australia's household recyclable material. Many councils that previously were being paid by private companies to take recyclables are now being asked by the same companies to pay for the service to continue (Downes, 2018; Planet Ark, 2018; Ritchie and Cocks, 2018; Topsfield, 2018). In the meantime, stockpiled recyclables within suburban areas accumulated material and a number caught fire, exposing large populations to poor air quality. Resultingly, many tonnes of material were diverted to landfill to reduce the risk of further fires (Whish-Wilson, 2018).

Since then, most state government agencies have developed and/or implemented CE policies (e.g. DELWP, 2019; EPA NSW, 2019; Green Industries SA, 2020), and the updated National Waste Policy explicitly references circular economy principles and ideas (DoEE, 2018), after last being updated in 2012. Up until now, policy frameworks that focused on the circularity of Australian domestic

consumption have relied on relatively light product stewardship regimes and global recycling exports

and commodity markets to drive 'shallow' circularity (Downes, 2018; Henry et al., 2019; Kirchherr et

al., 2017), in a market driven and 'light touch' policy framework (Greber, 2016).

1.1 Australian and European exchanges in the global context

Beyond Australia, other jurisdictions, including the EU are also having to rapidly adapt to these

disruptions. Although EU jurisdictions relied less on low grade recycling exports, disruptions have

caused re-evaluation of arrangements there also. Bi-lateral policy coordination and learning

between the EU and Australia is occurring as a result (Tamma, 2018; Whish-Wilson, 2018 para. 5.51).

Amongst other responses, federal funding for a multi-million dollar agreement with an Australian

NGO to support an MoU with the Dutch government has been released, to transfer the Netherlands

circular business hotspot concept to the Australian context "with the aim of accelerating bilateral

cooperation in the circular economy space" (WMR, 2019). The aim is to create "a platform in

Australia that inspires and facilitates the collaboration and networking necessary for our transition

to a circular economy" (Planet Ark, 2020). Similarly, the Victorian state government is establishing a

Business Innovation Centre to progress its circular economy goals for business (DELWP, 2019), and

Green Industries South Australia has been promoting industrial ecology and circular economy

principles for decades (Green Industries SA, 2020, 2017).

But how translatable is research into barriers to CE transitions, and what does this suggest about the

transferability of successful policy and program interventions? While both sides of the comparison

are high material intensity economies within a highly interdependent global economy, there are

important differences. In per capita material footprint measures, Australian GDP per capita is the

14th most materially intensive in the world (ABS, 2018; Wiedmann et al., 2015), which is slightly

lower than Greece (13th), and higher than Slovakia (15th), Switzerland (16th), Malta (17th), Finland

18th), Ireland (19th) and Austria (20th). Notably, the Netherlands is at 26th place (Wiedmann et al.,

2015).

Australia and the EU are also somewhat interdependent in the circularity of their economies. The EU is Australia's second largest trade partner, with the top five exports to the EU consisting of ores, minerals and food, and the top five imports from the EU being land and air vehicles, machinery and medicines/pharmaceuticals (DFAT, 2020a, 2020b). This is significant because the material intensity of end point consumption is driven by upstream global networks of production. Circularity improvements at one end of the value chain require changes at the other – i.e. a whole system process (Wiedmann et al., 2020, 2015). Meanwhile more than two-thirds of the Australian export economy is represented by virgin resources sent to China, Japan and the EU (RBA, 2020). In short, CE outcomes in the EU thus at least partially affect the material intensity of end point consumption in Australia, and the Australian economy similarly effects the performance of other countries in the region, EU and globally (Boxall et al., 2019; Eltham, 2010; Garnaut, 2019; Wiedmann et al., 2015). Noting the interdependencies of the global economy, further progress towards circular economy will depend on future leadership overcoming barriers, especially at the national level (de Wit et al., 2020).

1.2 Purpose and research questions

Given these differences and the current policy exchange around business adoption of CE practices, it is salutary to remember successful policy translation is messy, and depends on learning and experimentation, with processes of hybridity, synthesis, adaptation and localisation (Stone, 2017). While direct comparison of policies across contexts can be insightful and interesting (e.g. McDowall et al., 2017), we believe this can usefully be preceded by an analysis of understood, and implicit, contextual features motivating and influencing policy design and implementation. Considering how barriers to business adoption of CE practices across contexts vary, and their systemic interdependencies, is an important foundation to such analysis. We are not aware of any existing papers considering differences in barriers to adoption of CE practices by business between Australia and the EU.

By 'CE practices' of business we essentially we refer to (in principle) empirically observable organisational actions by a business entity, purposefully acting to change their operations and production of goods and services, with the purpose of increasingly circularity, as defined in the opening paragraph of this paper (see Konietzko et al., 2020 for a comprehensive list of relevant actions). Conversely, broader commitments of principle and strategy etc, are at best precursors to adoption of CE practices and are not strictly in scope. However, as we show in the Results, this distinction can become blurred in terms of their application to efforts to influence the broader business context and linear supply chains.

Our central research questions for this paper are:

1) "How do barriers to business adoption of CE practices differ between the EU and Australian contexts?" and consequently;

2) "What differences in barriers, and associated potential gaps in research, or its translation, are therefore priorities for learning and policy experimentation in facilitating business uptake of CE practices in Australia?"

Question 2 reflects an applied purpose of this project, which is to inform a follow on study (forthcoming) that conducts an experiment in translation between the two contexts of a method to promote circular business practice innovation, as part of a behavioural public policy research collaboration (BWA, 2020).

Understanding the translatability of research into barriers across multiple contexts is valuable in deepening understanding of, and how to accelerate, the slow rate of transition to a CE. The claimed outcomes of CE imply clear benefits and incentives for businesses to adopt CE practices and business models (Henry et al., 2019). However, combinations of barriers across different scales has meant that business uptake of CE thinking, approaches and models remains in its early stages, even in relatively mature contexts like the EU (Kirchherr et al., 2017). Further, both contexts have experienced disruption of global low grade recycling flows. This potentially reveals systemic

dynamics and vulnerabilities in the established regime, which increases policymakers' receptiveness to emerging niche innovations (Turnheim and Geels, 2013). Indeed: "The concept of the Circular Economy is not new, but rather, Australia has never had the correct mix of drivers and opportunities and these are aligning now" (Boxall et al., 2019, p. 44). Investigating what barriers apply, and interact, across Australia and the EU, especially after a disruption, could be insightful, and influential analytically, as we explain, via the logic of 'progressive contextualisation' (Vayda, 1996).

In Section 2 we introduce the theory and analytical concepts framing this paper. Section 3 describes methods including a review of 33 systematic and narrative literature reviews, and interviews of key stakeholders. In Section Four, we progressively contextualise key barriers, comparing across contexts at each step. Section 5 discusses the broader significance of these findings for research and policy, with a particular focus on 'interesting difference'. This includes indicating what are likely to be fruitful areas for behavioural public policy trials in Australia to facilitate business adoption of CE practices, and which may in turn be valuable to replicate and compare in the EU at a later stage.

2. Theory and analytical framework

In this section we synthesise the theory behind the material thus far and explain how we apply it to addressing the paper's goals. In particular we highlight the systemic significance of barriers, the analytical framework of progressive contextualisation, and its application to behavioural public policy.

2.1 The significance of barriers in systems

Systems thinking has considerable application to the task of understanding and transforming the immensely complex relationships between consumers, businesses and broader contexts bound up in sustainable production and consumption (O'Rourke and Lollo, 2015) . In particular, the notion of barriers, or constraints, has particular significance in complex systems thinking. Dyball et al (2005) suggest a complex adaptive system is defined by its constraints, or barriers, because it is:

…composed of discernible parts (elements, agents) that interact to constrain each other's behaviour. It is these mutual constraints, operating between the parts of the system, that limit the range of behaviours available to the system as a whole – thus give rise to its 'emergent' (or synergistic) properties… the characteristics (or lawful) behaviour of the system arises from the internally-generated (endogenous) forces imposed on parts of the system by (other) parts of the system

*(*after Newell and Wasson 2002: p. 4, in Dyball, Beavis, and Kaufman 2005*).*

Meadow's prioritised list of system change 'leverage points' is one heuristic for identifying which constraining relationships might be most impactful in order to transform complicated human environmental systems (Meadows, 1999). Interventions across the system of a given circular economic context, arguably, have the potential to not only influence business adoption of CE practices, but potentially, transform paradigms and mindsets, restructure information flows, and change feedback loops. Simultaneously, if they fail to do this, they risk focusing on relatively low impact leverage points such as rules and incentives (Meadows and Wright, 2008).

We place a high importance on understanding actors' reflections and explanations for their decisions and behaviour in context. Contexts includes both the 'hard' of technical, economic and biophysical, and the 'soft' of human interactions. Understanding the decisions and behaviour of actual people in context is central to understanding broader social, economic and environmental systems framing a given situation, particularly in conditions of complexity, uncertainty and rapid change (Checkland and Scholes, 1999; Vayda, 1983). This can include the interplay of internal, interpersonal and contextual drivers and barriers affecting their actions (Bögel and Upham, 2018). Importantly, trying to understand 'behaviour in context' can be achieved by progressively contextualising observed and self-explained behaviour in increasingly scaled contexts (Vayda, 1983).

From this point of view, exploring the significance of barriers across two linked systems of production and consumption – and two linked geographies and economies in the EU and Australia –

can help us to understand how different elements combine to drive emergent circularity in both contexts. 'Progressive contextualisation' is a useful analytic technique with which to do this.

2.2 Progressive contextualisation

Simply put, this analytical concept urges: *starting with a focus on concrete human actions and/or their concrete environmental consequences as the object of study and then tracing the threads of causal influence upon these outward* (Vayda, 1996, p. 16). This avoids unwarranted assumptions about the stability and purposiveness of units or systems that come with more deductively framed long-term, expensive projects, rigid frameworks and traditional disciplinary framed approaches. It depends on principles of 'a-rationality', comparative knowledge of contexts, and focusing on surprising and interesting differences (Vayda, 1983).

2.2.1   Recognising behaviour as 'a-rational'

By 'a-rational' we refer to recognising the decisions and actions of actors as inherently reasonable adaptations to context, even if they are potentially individually irrational, or collectively harmful or anti-social ('maladaptive') in broader frames of analysis – such as temporal, spatial and whole of community or population scales (Boyden, 2016; Ostrom, 2015). While Vayda himself calls this 'the principle of rationality' (Vayda, 1983), we interpret this as recognising that people experience their own actions as 'a-rational', which: *"connotes situational behaviour without* (necessarily) *the conscious analytical division of situations into parts, and evaluation according to context independent rules"* (after Flyvbjerg and Sampson, 2011, p. 22). We as researchers can then consider behaviour against broader contexts in a rational analytical mode, i.e. in the third person. However, this is a qualitative jump, which is methodologically and conceptually challenging, and highlights the need for multi-method, interdisciplinary and reflexive approaches to researching such phenomena (Bammer, 2013; Bammer et al., 2019; Flyvbjerg and Sampson, 2011), which we believe Vayda's methodological approach aims to support.

2.2.2   Comparative knowledge of context

We apply the principle of comparative knowledge of contexts by linking knowledge of barriers to adoption of CE practices across two related contexts. As such, integrating comparative knowledge of barriers across related contexts alludes to the systemic and scaled nature of relationships involved (O'Rourke and Lollo, 2015), which, as we noted, is significant when considering how the barriers interact, and the implications of tackling them.

Specifically, we relate the results of our literature review and interviews to comparable, if different, research rooted in the EU context, similarly based on a literature review and in depth interviews (plus a follow-up prioritisation survey) in (Kirchherr et al., 2018). Importantly, our inductively derived literature review themes (see Results) align well with Kirchherr et al's synthesis of four super categories of a total of 15 barriers (summarised in Figure 2 and addressed in detail in Results). Kirchher et al (2018) argue these can be considered hierarchically nested, mutually interacting, and potentially leading to chain reactions (Kirchherr et al., 2018 p. 267). We have thus translated their analysis into a hierarchically nested model, based on the categories of barriers identified in the literature, and their relative priority in the assessment of businesses and policy makers in the EU (Kirchherr et al., 2018), in Figure 2. Later, we update it with similarities and differences in barriers in

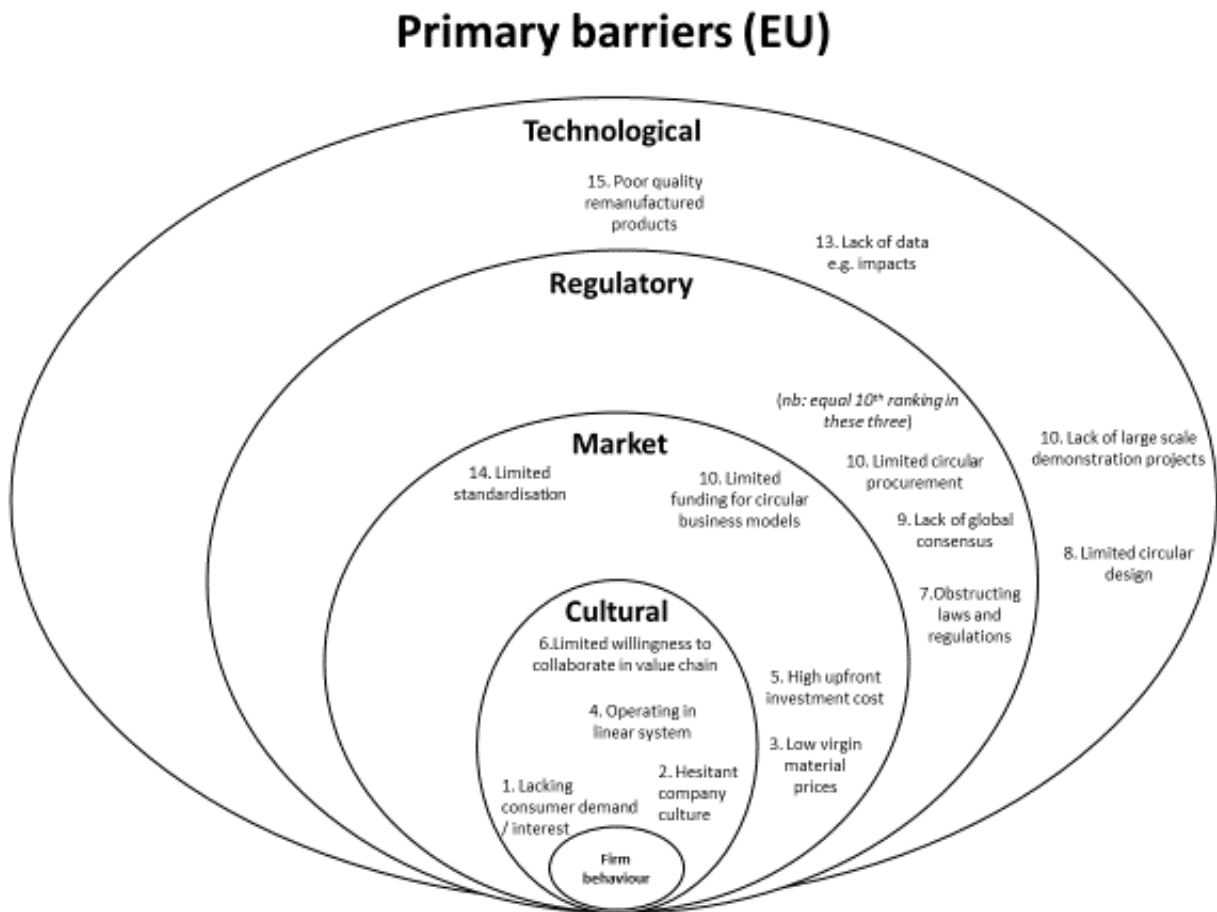Australia with the EU in a second iteration (see Figure 3, p. 32).

Primary barriers (EU)

Technological

15. Poor quality remanufactured products

13. Lack of data e.g. impacts

Regulatory

(nb: equal 10ᵗʰ ranking in these three)

10. Limited circular procurement

10. Lack of large scale demonstration projects

Market

14. Limited standardisation

10. Limited funding for circular business models

9. Lack of global consensus

8. Limited circular design

7. Obstructing laws and regulations

Cultural

6. Limited willingness to collaborate in value chain

5. High upfront investment cost

4. Operating in linear system

3. Low virgin material prices

1. Lacking consumer demand / interest

2. Hesitant company culture

Firm behaviour

Figure 2 Nested barriers influencing firm adoption of CE practices, as seen as most pressing by EU stakeholders (after Kirchherr et al., 2018).

Systems perspectives highlight the complex interdependencies between the decisions and behaviour of actors across the system of production and consumption (Bögel and Upham, 2018; de Jesus and Mendonça, 2018; Ghisellini et al., 2016; O'Rourke and Lollo, 2015; Wastling et al., 2018). In defining these categories and their hierarchical nesting, Kircher et al (2018, p.266) note literature suggesting the importance of distinguishing between 'hard' (i.e. technical and economic) and 'soft' (institutional practices and values) barriers impeding the implementation of CE as systemic innovation. We suggest that linking analysis of these dimensions is critical, and argue below that exploring behaviour and decisions in context offers this potential.

2.2.3 Pursuing difference and surprise

Surprise is the guide to where important differences in comparative contextual knowledge may exist, and is a non-prescriptive, interdisciplinary invitation to explore the significance of the surprising insight (Vayda, 1983, p. 274). In this project, the EU specific framework provides an indication of which barriers might be expected to be most directly affecting firm behaviour in the EU, and provides a basis for comparison of our own results in Australia. This is important because we action the principle of *pursuing surprising difference* by progressively considering barriers that appear to apply most directly to business adoption of CE practices, and progressively stepping 'up' in scales of barriers. Then, at each step, we also explore how experiences of these barriers appear to differ in the Australian and EU context. Where differences appear, we focus our analysis on exploring their implications.

2.3 Application in a behavioural public policy frame

This project took place in the context of a collaboration applying behavioural public policy tools to shared problems between Australian agencies (BWA, 2020). The implications of our comparative analysis of behaviour in context has direct application to an increasingly significant policy narrative, adopted by over 250 governments worldwide (Afif et al., 2019; Oliver, 2015; Ruggeri, 2019). Behavioural public policy is contested and rapidly evolving but, at its most valid and robust (re: Meadow's systemic intervention points), it fundamentally involves adopting a behavioural lens in a pluralistic, interdisciplinary and non-deterministic way across the policy process (Ewert, 2020; Feitsma, 2019). Simply put, this perspective seeks to critically apply evidence and theory informed insights to optimise the impact of policy on the behaviour of key actors. Not only the behaviour of consumers and businesses, but also that of public administrators, stakeholder interest groups and activists are potentially in scope (Ewert, 2020). In its expanded, contested form at least, it is well suited to responding to complex problems that involve behavioural and systemic structural dimensions, including the transformation of unsustainable systems of production and consumption (Baum and Gross, 2017; Ewert, 2020; O'Rourke and Lollo, 2015; Wiedmann et al., 2020), although

not without controversy and caveats (see forthcoming paper based on Kaufman et al., 2019). As we progressively contextualise each layer of barriers, and identify surprising differences, we also relate them to literature and research from a behavioural public policy perspective. In this way, analysis of barriers can begin to suggest what behavioural public policy tools might be indicated.[1]

While there is emerging CE literature examining the contribution of specific behaviour changes to CE outcomes (O'Rourke and Lollo, 2015; Wastling et al., 2018), the scale of analysis of behaviour and decisions tyically stops at the level of whole populations and sectors (Brown et al., 2019; de Jesus et al., 2016; Govindan and Hasanagic, 2018; Rosa et al., 2019; Salim et al., 2019; Tura et al., 2019). Better understanding the internal, interpersonal and contextual influences of attitudes, beliefs and behaviour of key actors could substantially advance understanding of transitions in socio-technical systems (Upham et al., 2019), including we suggest, that of the circular economy.

3. Methods

Two primary methods were used to address the research questions:

1. stakeholder interviews

2. rapid evidence review of literature

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[1] For example, where role models and business cases are lacking, persuasive and encouraging interventions (e.g. celebrating high performing companies) may be indicated, which have been labelled 'hugs', while targeted deterrence and disincentives for poor behaviour are 'smacks' (French and Gordon, 2015). Protective regulatory interventions preventing harms by private entities have been called 'budges' (Oliver, 2013), (Oliver, 2015) – arguably product stewardship schemes emphasising designing 'out' maladaptive consumption choices reflect this principle. More individual focused coercive interventions are labelled 'shoves' – for your own (or collective) good, even if you don't want to – (Oliver, 2015) e.g. banning single use plastics. Behavioural science also provides support for a distinct family of non-fiscal and non-coercive interventions: "boosts." Here the objective is to foster people's competence to make their own choices—that is, to exercise their own agency. (Hertwig and Grüne-Yanoff, 2017). Ecolabel schemes may be an example, if well designed and supported (Coglianese and Nash, 2016; forthcoming based on Kaufman et al., 2020a).

3.1 Stakeholder interviews

We conducted a stakeholder interview project to identify common barriers and understand the practice and policy context (Spencer et al., 2003). The stakeholder interviews involved:

1. **Identifying relevant individuals.**

A range of policy, business and NGO participants were sought, since the CE has been argued to be a "multi-actor [concept]" (de Jesus and Mendonça, 2018, p.85). We built a judgement sample for this work, which is a non-random sample of respondents selected by the researchers and our policy partners based on our and their knowledge on the topic under investigation, with additional snow ball recruitment, via recommendations by initial interviewees (three of the final interviews) (Babbie, 2020) . Over 30 Australian candidates were initially identified amongst policy and NGO practitioners with experience in CE policy, and particularly engaging business.

2. Conducting semi-structured interviews with relevant individuals.

This resulted in 17 interviews from a range of government, business and non-government bodies -
see

Table 1, an overall 53% participation rate. This included some interviews for a related project, exploring the role ecolabels could play in influencing business and consumer behaviour change towards CE outcomes. Although we analysed both for this paper, the strict participation rate is 30%, including only those interviewed purely for their perspective on broader CE and business insights (i.e. 10 CE & business interviewees, 7 with additional insights on product stewardship and labelling schemes). Note that in the Australian governance context, the national government has limited heads of power (primarily security, trade, international agreements), while the states manage most major services and policy areas (Althaus et al., 2018).

Table 1: Australian interviewee organisation types, roles and perspective

Organisation type	Role	Perspective
National Department (x2)	Policy	Economic analysis; Labelling and product stewardship schemes
State Department	Policy	Business engagement in CE
State Department	Policy	Sustainable business and regional development
State Department	Policy	Product Stewardship
State Agency	Program design and implementation	Circular Economy
State Agency (x2)	Regulator	Waste Regulatory Reform
State Agency	Regulator	Business recycling
State Agency	Program design and implementation	Facilitating on-ground CE business projects on a state basis
State Agency	Program design and implementation	Green industry facilitation and engagement, including establishing a state business hub.
Business and industry non government organisation (BINGO)	Peak body and think tank	Sustainable business representation
Quasi-autonomous non-government organisation (QUANGO) (x2)	Program design and implementation	Community and business education and engagement with circular economy, including state-based business hub host.
Quasi-autonomous non-government organisation (QUANGO) / business Co-regulatory body	Program design and implementation	Existing recyclability label and business programs promoting recyclability.
Non-government organisation (NGO)	Program design and implementation	Existing environmental label with some CE characteristics
Consultancy (x2)	Policy and program design, and stakeholder engagement.	Circular Economy thought leadership and advisory, overseas policies/programs to support business adoption of CE, labelling schemes and regulations.

Before conducting the interviews, an interview guide was designed with questions aimed at probing

the familiarity of each interviewee with the CE concept, perceived barriers to CE implementation and

possible ways to overcome them (see appendices, p. 58). Interviews lasted between 45 and 60 min

on average and were carried out face-to-face as well as via telephone and videocalls. Anonymity was

ensured in reporting since we believe that this approach helped us gain more trust and, thus, obtain additional insights (Babbie, 2020).

3. Reviewing interviews and relevant documents recommended by interviewees.

Semi-structured interviews meant the majority of interviewees answered the same set of questions. Interviews were transcribed by a third-party service, and annotated by the interviewer. We identified key themes by their prominence and frequency in response to each question. Thematic analysis (Braun and Clarke, 2006) was used to identify qualitative themes in interviewees' responses to each question, and in documents and resources they further provided (Spencer et al., 2003). This included nominating 'key barriers' as priorities, as well as more general observations.

3.2 Rapid review of literature

Complimenting the interviews, we conducted a rapid evidence review to identify barriers to business adoption of CE practices. The review in full will be presented in a forthcoming standalone paper, thus we primarily draw high level findings as applied to the interviews for the current paper.

Rapid reviews are an emerging method of efficiently synthesising evidence in policy where a broad overview of research evidence is required within a short timeframe (Wright and Bragge, 2018). They apply structured decision making processes (the STARR protocol) with policymakers that increases the chances of mutual understanding between reviewers and review commissioners on the scope, review questions and limitations of the review (Pandor et al., 2019). Rapid reviews are different to 'traditional' systematic reviews, which aim to identify all primary studies or trials pertaining to a particular intervention and can take years to complete depending on scoping choices. Rapid reviews can be completed in a short time frame because they are an "overview of reviews" – that is, they focus on identifying and summarising existing systematic reviews, reports or other consolidated information on a topic. The rapid review trades specificity and detail for speed, hence its name (Khangura et al., 2012). However, like systematic reviews, rapid reviews follow transparent,

scientific, and reproducible methods. When comparing findings from both types of reviews, in health policy at least, these have shown a great deal of overlap (Tricco et al., 2017; Watt et al., 2008).

The motivating question for this review was: *what barriers influence the adoption of CE business practices?* Ideally the review would be restricted to papers that specifically investigated barriers for Australian businesses. However, initial searches revealed that there was almost no review-level evidence investigating CE in the Australian context (for example, see Boxall et al., 2019). Indeed, many reviews didn't identify a specific geographic context.

The complete search strategy, including PRISMA flow diagram, is reported in the complimentary materials to this paper. In brief, we searched *Scopus, ProQuest Environmental Sciences Collection*, and *Business Source Complete* databases for review papers published since 2000 with combinations of **circular economy** (topic term, e.g., resource recovery, industrial ecology) and **transitions** (behaviour term, e.g., adoption, innovation). As we were interested in evidence relevant to the specific Australian context, we included only reviews that investigated CE barriers in high-income countries comparable to Australia, with a focus on businesses. A total of 8,207 unique records were returned from the searches, all of which were title/abstract screened in duplicate by a team of reviewers. Then, 125 records underwent further full-text screening in duplicate by a team of reviewers. Finally, 33 records were extracted and assessed for quality using AMSTAR (for systematic reviews) or SANRA (for narrative reviews). Higher quality reviews were given more weight in our interpretation of the included records (see appendices). In terms of the quality of the included studies, the systematic reviews rated poorly based on AMSTAR. This was mainly due to the study authors not being transparent in their reporting, for example, not measuring bias risk in included studies, not considering this bias risk in their conclusions, and not presenting a list of excluded studies. Due to the high risk of bias for these studies, we initially held a low level of confidence in their overall findings. However, the presence of overlapping findings between studies (i.e. two or more reviews reporting the same result) reinstated some confidence. Low scores may also reflect

the broad and multidisciplinary nature of literature on CE (see Discussion). Encouragingly, narrative reviews that were appraised using SANRA typically rated highly, providing a stronger level of confidence in their findings.

4. Results

In this section, we progressively contextualise barriers to the uptake of CE business practices in Australia and the EU, with the goal of identifying surprising differences, and analyse the implications of each from the perspective of behavioural public policy. We compare the relative priority of barriers in each category across the two contexts, as indicated by stakeholders. Note that at the level of analysis we are using here, comparing with the EU context, we found a high level of correspondence between our literature review themes (appendices, and forthcoming publication) and stakeholder interviews. As a result, we report the barriers found in both together in the below tables, but highlight in red italics where a potentially interesting difference occurs. The primary focus however is on identifying interesting differences between these combined insights into Australian barriers and the EU results, which drives the main structure and reporting of this section.

4.1 Cultural barriers

As shown below, consumer awareness and interest, company culture, and operating within a linear system are all significant cultural barriers identified as similarly important in both the EU and Australian contexts. However, variations of emphasis and their link to broader contextual scales suggest some important differences in how they apply.

4.1.1 Consumer awareness and interest

Concerns about a lack of consumer demand and interest (

Table 2) are prominent across our Australian interviewees (identified as a 'key barrier' by 60% of respondents and a key literature theme) and EU sources (ranked 1st overall).

In both contexts, there is recognition of the barrier to sustainable consumption and adoption of CE behaviour changes (Wastling et al., 2018) posed by consumption oriented marketing, i.e. 'the competition' posed by commercial marketing (Bocken and Short, 2016; French and Gordon, 2015; Groening et al., 2018; Saari et al., 2018). And, where consumers are thinking about circularity characteristics, the concern is that they are largely negative perceptions, and an unwillingness to pay premium prices, for those without strong existing green beliefs – something born out in literature on green marketing and consumption (e.g. Groening et al., 2018)

Less evident is awareness of the impact of unconscious habits of consumption and everyday life (O'Rourke and Lollo, 2015; Verplanken and Wood, 2006). Here self-aware and reportable 'a-rational' motivations and explanations for decisions may be entirely eclipsed by unconsidered habits and routines, making many 'go to' policy interventions irrelevant, to the extent they fail to disrupt habits and top of mind decision making – as is noted by interviewee C1 below - (Michalek et al., 2019; Redmond et al., 2016).

We argue later that it is noteworthy that the potential of, and need for, increased business to business and government procurement was more prominent in the Australian sources (see also interview A1 in

Table 4

Table 2). The Australian evidence also indicates the influence of beliefs driven by broader 'hard system' Technological and Regulatory barriers discussed next, such as concerns about price and quality, trust in assurance schemes, and lack of procurement, whereas the EU research reports more concerns about 'soft' system Cultural issues, such as marketing driven and shifting consumer preferences.

Table 2: Comparison of AU and EU evidence of cultural barriers - consumer demand/interest.

CULTURAL: Consumer demand/interest	
AU BARRIERS	**EU BARRIERS (as reported in Kirchherr et al 2018)**
Primary barriers • Not enough (perceived) demand for end products from Business to Business and Government • Consumer concerns related to the quality and durability of recycled, repaired, repurposed items (as well as any negative stigma associated with them). Interviewees more likely to associate with organisational consumers than mass market. • An unwillingness to pay the (perceived) higher prices for such goods and services. • A distrust of the CE credentials of products (including a lack of accurate measures and indicators that convey such information to the consumer). • *(Primarily in literature) Strong existing consumption habits / unwilling or unaware of need for change.*	Primary barrier: • a lack of consumer interest and awareness (1) Framed largely as mass-market consumers: ranked as 2 by both business and policy respondents, but overall 1 **EU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"customers prefer new products", "they change their minds too quickly (to want durable products)"* **AU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"(environmental performance via a label) is only considered after they've already made a decision about the brand and the product. It's kind of like a reassurance for them, it's just another tick against their justification…"* *(Interview C1)*

4.1.2 Company Culture – organisational hesitancy

Here too there is also a strong degree of overlap in priority between our Australian and EU sources (Table 3). However, where the EU sources emphasise risk aversion and a lack of innovation, Australian interviewees discussed additional explanations such as a lack of capability and capacity, possibly indicating this is a greater barrier in Australia (especially in light of views on Technological barriers, below). The later section on Market barriers also suggests high external barriers such as access to finance, and upfront costs, plus distance from foreign ownership, could contribute to this perception.

It may be significant that our literature review highlights a lack of environmental / socially responsible culture in organisations as a barrier, which appears less prominent to business and policy interviewees in both contexts – indicating published research places a higher significance on this barrier than interviewees. Kirchherr et al's (2018) finding of a 'CE/ Corporate Social Responsibility (CSR) bubble that must be transcended to mainstream CE may be relevant here – a lack of a supportive culture outside the bubble could partly explain it, and judging from the relative

ranking of EU business to policy stakeholders, government in particular may be mainly talking to the converted. Similarly, interviewee A3 (Table 3) highlights that part of the issue is that 'bubbles' occur within organisations, and change advocates need the resources, skills and knowledge to both make the technical and business case for change, and effectively promote and manage it, which is a demanding mix. Further, the notion of 'inertia' and 'hesitancy' may also be related to the business version of habits – organisational routines, which similarly require different interventions than traditional policies trying to influence rational business decision making (Redmond et al., 2016).

Table 3: Comparison of AU and EU evidence of cultural barriers - organisational hesitancy

CULTURAL: Hesitant company culture	
AU BARRIERS	**EU BARRIERS (as reported in Kirchherr et al 2018)**
Primary barriers (Interviews): • Inertia (including internal fear/resistance to change of either leaders OR workers), and where current model is working well (e.g. construction, resources). • Lack of knowledge of opportunities, potential input streams, potential partners, technologies. • Lack of knowledge of how to conduct assessment of opportunities and construct business cases. • Others: • Risk aversion to changing current business processes that have a track-record of "working" (combined with unknown returns of adopting CE business models within highly competitive business markets). • Concerns with just getting basic resource recovery right (e.g. high landfill, stockpiles, etc) plus SMEs still just trying to get a handle on recycling. • Unwillingness to experiment or pilot new initiatives (or only willing to do so at an incremental rather than a radical level). • Lack of innovative/disruptive/entrepreneurial spirit. • Poor environmental/social culture within businesses (e.g., where business does not see waste, environmental pollution, and resource scarcity as pressing concerns) (Lit only).	Primary barrier: • hesitant company culture (2) • CE not as mainstream as is typically assumed by proponents in policy and business, largely limited to SD and CSR roles, and other Divisions are not as engaged. • Ranked as number 1 by business respondents, and 7th by policymakers. **AU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"when the advocate is an individual with a …entrepreneurial, environmental, visionary (approach), who then has to convince others in the biz…If advocate is mid-low level, they need senior management support -- business case can help influence Execs, but when it's the leaders who want to drive the change, then they often face challenges in getting staff to change behaviours, and there's specific needs for messaging and behaviour change to get and keep people on board, and get them to change … So sometimes apathy, misunderstanding, fear can undermine ability to make changes" (Interviewee A3).*

4.1.3 Operating in a linear system / lack of collaboration in value chain

Linear supply and value chains are a key barrier in both contexts, exacerbated by a lack of willingness to collaborate to transform them (

Table 4). However, in Australian interviews, there is a sense of the path dependence of existing arrangements – unless a supply chain is already operating in an inherently circular manner (i.e. serendipitous industrial ecology in feedstocks), significant barriers of quality assurance, brand risk, scale, and contractual and logistics coordination challenges are experienced. If such drivers also apply in the EU setting, they may well help explain perceptions of conservatism and unwillingness to collaborate in the value chain.

It is perhaps also noteworthy that scale of activity and distance are mentioned in the Australian evidence but not the EU – while in land area, the EU28 countries are in fact slightly larger than Australia, the scale of population and economic activity is also substantially denser. There is also a sense in interviews across all three culture themes that an element of path dependence with incumbent business models and supply chains of economic activity in Australia may reflect the 'two speed economy'(Mazzarol, 2011; Newton, 2012) - strong primary production and resource extraction on the one hand, and high consumption / services on the other. Conceivably, this could leave business innovators without much feeling of agency in influencing collective patterns of production and consumption in the middle (O'Rourke and Lollo, 2015).

Table 4: Comparison of AU and EU evidence of cultural barriers - operating in a linear system.

CULTURAL: Operating in a linear system / lack of collaboration in value chains	
AU BARRIERS	**EU BARRIERS (as reported in Kirchherr et al 2018)**
Primary barriers: • Lack of, or difficulty obtaining, standards / quality assurance of 'circulated' materials/products to mitigate concerns / risks / stigma • Difficulty in reaching scale (e.g. smaller manufacturing industries, large distances between, etc). • Businesses without large reliance on resources or other supply chain risks. Other barriers: • Impacts on brand image if other business in the supply chain do not perform (leading to mistrust within the supply chain). • Availability (and credentials of) potential supply chain partners. • Competing goals of different businesses, and intellectual property concerns with third-party access to products. • Existing activities are actually circular but don't need to be labelled as such to be justified (i.e. resource efficiency, recovery, reuse) (e.g. motor vehicles, second-hand consumer goods, etc). Businesses who can incorporate waste products (often single, clean streams) back into own value stream (e.g. Viridian glass, mining/resources, agriculture). • The need to create additional coordination, contracting, licensing, communication and distribution processes and channels within the supply chain.	Primary barriers: • Operating in a linear business model (4) "Our supply chain is very conservative" • Limited willingness to collaborate in value chain (6) Other barriers: • Limited standardisation (14) • 'Lacking ability to deliver high quality remanufactured products' (15) last **EU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"Our supply chain is very conservative. If you talk about CE, these players only glance at you with a question mark in their eyes."* --- **AU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"there's a lack of demand, lots of supply… there has to be some better communication of quality as well. …you're building, you're building trust in both. Only if the material is there and suppliers of reasonable quality, it has a relevant market."* (Interview A1)

4.3 Market barriers

Market barriers are relatively high priority in both the EU and Australia (

Table 5), with comparative price advantage for virgin materials, access to finance and high upfront

costs identified as key barriers by Australian interviewees, and ranked 3 and 5 of 15 priority barriers

in the EU.

It is perhaps significant that upfront investment and barriers to entry, especially for small to medium
enterprises (SMEs) are more prominent in the Australian barriers. Interviewee A2 (

Table 5) suggests that enough important Australian investors are so aligned with incumbent political economic regimes (i.e. virgin resource extraction, commodities) that they are prioritising non-financial outcomes over clear market signals that, rationally, would see increased investment and support for CE innovations in supply and value chains. Costs involved in retrofitting and adapting existing capital plants is mentioned in the Australian interviews, but less prominent in the EU results. Again, market and customer base scale are mentioned in Australia, and not in the EU results. This may be for similar reasons as discussed above re: scale and distance. Also, in the EU, CE more broadly is strongly tied up in nations of national innovation and productivity, whereas this is less of a theme in the Australian interviews.

Table 5: Comparison of AU and EU evidence of market barriers

MARKET	
AU BARRIERS	**EU BARRIERS (as reported in Kirchherr et al 2018)**
Primary barriers: • SMEs are time-poor and very cost driven, don't have time to explore/assess, nor capital for investments, and finance is hard to access. • Barriers to market entry, including general start-up barriers, lack of capital / customer base / scale for economic viability, plus: • Initial higher costs of circular vs linear virgin material offerings (unlevel playing field). • Lack of data and evidence that demonstrate compelling business cases for CE business models. Other barriers: • Costs of industrial ecology: retrofitting existing development due to constrained footprint and distance to new developments (greenfield much easier to develop). • A growing driver: Resource scarcity / increasing commodity prices. • Businesses lack of resources/capital for high upfront/investment costs (especially when compared to more linear business models). • The availability and low costs of virgin materials (creating unfair competition), longer return on investment timeframes (putting the business at risk). • Costs associated with greater administrative burdens resulting from engaging in horizontal and vertical CE business relationships simultaneously. • Costs associated with the separation, recycling and repair of materials (which are exacerbated by product designs and collection services that do not facilitate such processes).	Primary barriers • Low virgin material prices (3) (1 for policy, 4 for bus) (which probably flows on to consumer demand, and business engagement with CE) • High upfront investment (5) • Other • Limited funding for CE business models (10) **EU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"There is still a need for several [CE business model] learning curves".* The interviewee further stated that *"the first one that will invest in learning will probably lose money and only the second mover will earn a fortune. Hence, many people are now waiting for each other".* **AU INTERVIEWEES ILLUSTRATIVE QUOTE:** "(there is) *institutional reticence to forces of change (not just circular change). Because non-financial risk has become more important than financial risk, then this is actually shoring up access to capital and securing of social licence to operate* (for incumbent business models). (This is) *very important where incubation is necessary across a value chain, particularly for medium & small business which are part of large business value chains. Policy is necessary to ensure protection and no adverse outcomes for SMEs, and ensuring that business is given tools and signals to invest. Because investment only comes once it's clear there will be a marketplace." (Interviewee A2)*

4.5 Regulatory barriers

There are greater differences between views on regulatory barriers in Australia and the EU (

Table 6). Tensions between Australian notions of waste and recycling being a largely market driven activity, versus European models of it being a publicly managed service or asset plays out in views on regulatory barriers.

AU interviewees typically described regulations as a key barrier to post-consumer CE markets, particularly planning and permitting schemes affecting development and land use conflicts for activities supporting CE, such as sorting and reprocessing activities. Concerns with harmonisation start from local government up to states and territories, and nationally. In some cases, overcautious local regulation has seen locally developed technologies proven and scaled up overseas (Boxall et al., 2019, p. 25). Secondly, there was a perception of policy makers placing a higher value on preventing health and environment harms than pursuing innovation, economic and employment benefits, leading to a cautious approach to regulation of activities like transporting, treating and re-classifying materials and waste streams for beneficial uses. The need for an appropriate balance was acknowledged by some government interviewees (exemplified by interviewee A4,

Table *6*), who saw opportunities for cooperative regulatory reform to remove (unnecessary) regulatory barriers.

Table 6: Comparison of AU and EU evidence of regulatory barriers

REGULATORY	
AU BARRIERS	**EU BARRIERS (as reported in Kirchherr et al 2018)**
Primary barriers: • Regulations that constrain development (e.g. planning constraints particularly near residential areas, heritage) • Outdated restrictions in procurement policies (e.g. road surfaces specifications - waste/hazard reg) Other barriers: • Regulations creating market distortions in favour of linear systems. • Lack of policy harmonisation (different regulations in different jurisdictions). • Lack of understanding of how regulations hinder, constrain, divert or otherwise influence innovative circular approaches (both understanding at individual business level, and across whole sectors/economy). • Legislation, regulation, taxes and incentives that continue to favour linear business models (creating an uneven playing field). • Greater administrative burden/red-tape linked to CE/green business activities (e.g., the reuse of waste). • The absence or the slow development of industry standards by government (where the government is often behind the developments and innovations taking place in the business sector).	NB = only middle ranked. • Obstructing laws and regulations (7 of 15) • The need for changes in current laws and regulations is also perceived as more important by policymakers, who rank the barrier 'Obstructing laws and regulations' in the fifth place, compared to businesses, who place it only in the seventh place. • Other barriers: • Lack of global consensus (9) / cross border movements • Limited circular procurement (10) • a lack of synergistic governmental interventions to accelerate the transition towards a circular economy **EU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"We want to recycle our Bakelite that is waste, and we found a company in Belgium that can do this, but we are not allowed to transport this Bakelite across the border"* --- **AU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"Well, I think government needs to set the right operating environment in terms of regulations and requirements, minimum standards and so on. And government also needs to provide support where the changes that need to be made, will not happen… I think it was the Netherlands had this smart regulation programme where they were… working with businesses to identify regulations that were stopping them from progressing, or being able to do these things and then actively working to reduce those regulatory barriers."* (Interviewee A4).

4.6 Technology barriers

Stronger differences occur in views on technological barriers (Table 7). It appears that a key difference is a relative lack of working, scalable, examples in Australia (and to a degree, lack of knowledge of those that exist (e.g. Boxall et al., 2019; King et al., 2020), which was described as a primary barrier by Australian interviewees. Similarly, the lack of business case capability and impact data would seem to feed strongly into organisational and market barriers above: re making strong cases for innovation, and the investment it needs. Interviewee A5 (Table 7) highlights this is a barrier for government support and also leadership. Associated challenges include scale up and

commercialisation for research and development, and financial, regulatory and geographical barriers

for industry to demonstrate technology in Australia.

Table 7: Comparison of AU and EU evidence of technological barriers.

TECHNOLOGICAL	
AU BARRIERS	**EU BARRIERS (as reported in Kirchherr et al 2018)**
Primary barriers: • Lack of working examples, scalable innovations etc e.g. that can be easily presented as part of a business case. • Lack of technical skills, knowledge and information to design, develop and implement CE business activities. Other barriers: • Lack of infrastructure to support roll out of CE models, e.g. resource recovery infrastructure at scale; technology and communications networks. • Lack of research & development around specific uses for currently undervalued material streams (e.g. e-waste). • Absence of information-sharing platforms describing potential input streams, partners, and technologies. • Decentralised settlements and populations contribute to a lack of infrastructure and innovation to support the roll-out of CE business models at scale (e.g., equipment for collecting, sorting, processing, and recovering material). • Low levels of technical expertise within private and public institutions (e.g., resource recovery infrastructure, CE product design and business models). • Challenges of integrating innovations and technological solutions across multiple businesses in the supply chain.	Not a single technological barrier is ranked among the most pressing. Other barriers: • Limited circular design (8) • Too few large-scale demonstration projects (10) • Lack of data, e.g. on impacts (13) **AU INTERVIEWEES ILLUSTRATIVE QUOTE:** *"…(we need) a more nuanced understanding… spend a dollar on circular economy initiatives, you are potentially investing in a waste reduction, climate transition, original job creation, manufacturing and agriculture. …. it's just a, sensible, rational investment". (Interviewee A5)*

5. Discussion

The previous section has identified barriers to business adoption of CE practices (our first research question), and identified potentially significant differences between the two contexts. After briefly summarising what we feel are the most interesting differences between the two contexts (below), we will be in a position to consider their implications for our second research question: identifying fruitful areas for intervention, and therefore broader implications for research, policy and practice. Prior to this, we also note the following limitations.

5.1 Limitations

We acknowledge differences in levels of detail and aggregation across our three main evidence sources for this analysis. Our relatively in-depth knowledge of the Australian context via interviews is complemented by the results of the rapid evidence review, which in turn draws on relatively high level and summative insights from the EU research we use in the process of progressive contextualisation. While we feel this integration has generated useful insights, it is likely that important differences in detail and nuance have been missed. We hope and intend that subsequent empirical research by us as outlined above, and as may be complemented by others interested in these findings will identify and explore such details where they are significant.

In comparing stakeholders' views of priority barriers, while we did ask Australian participants to nominate 'key barriers' and conducted thematic analysis of these, an important difference to note between the Australian interviews and EU research is that the former did not occur at sufficient scale to conduct a quantitative ranking survey with a representative group of policymakers, businesses and NGOs. Subsequent research would valuably compare a quantitative ranking of EU participants of barriers with quantitative ranking by Australian participants.

Regarding the rapid review of existing literature, we note the relatively low Q.A. scores of reviews noted in our method section may also reflect different norms and practices of reviewing literature and conducting research, and perhaps fundamentally levels of investment in systematic research, between evidence informed health policy (the origin of rapid review's favoured quality standards),

and the multi-disciplinary fields examining CE. Taken at face value, this also reflects opportunities to improve the quality of review level evidence in CE literature, a need that has also been noted in other research (de Jesus et al., 2016; Kirchherr et al., 2017).

We also acknowledge that in terms of identifying barriers and drivers of individual and business behaviour, a wider pool of literature likely has relevant and valid insights, and indeed may provide greater detail on these than we found in our rapid review. For instance, literature on barriers to eco-design, lean manufacturing, cleaner production, and likely innovation in general. We focused on CE for scope reasons, but would welcome and invite responses and further contributions from these and related literatures.

5.2 Identified differences

To focus the discussion of differences identified via progressive contextualisation, we have updated information presented in Figure 1 – EU Barriers, with a combined figure – Figure 3 – Barriers in the Australian and EU context. Here we 'rank' the Australian experience of barriers to aid the discussion, but note that unlike the EU study, this is largely the authors judgement, if derived from our thematic analysis, as opposed to what we would regard as preferable ranking by businesses and policymakers via survey as was conducted in the EU study.
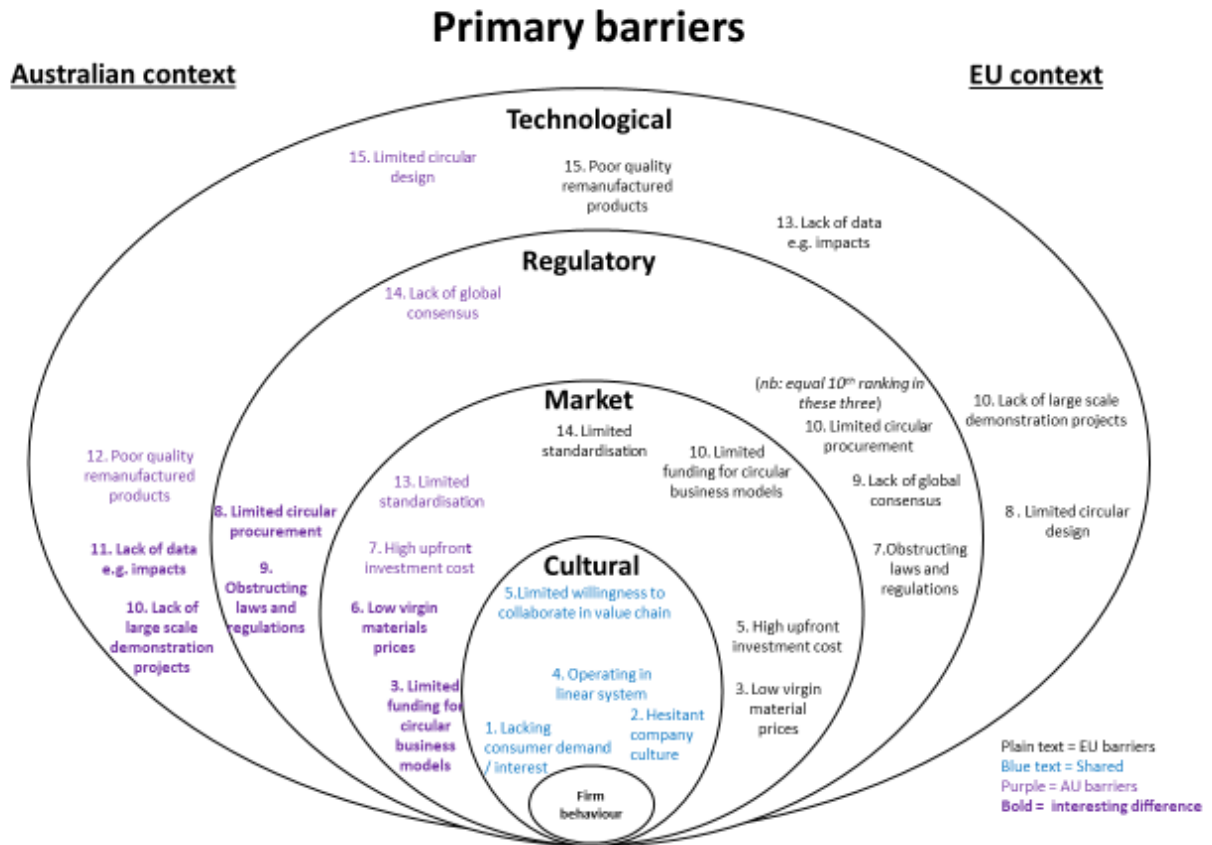
Primary barriers

Australian context   EU context

Technological

15. Limited circular design

15. Poor quality remanufactured products

13. Lack of data e.g. impacts

Regulatory

14. Lack of global consensus

Market

(nb: equal 10th ranking in these three)

10. Lack of large scale demonstration projects

14. Limited standardisation

10. Limited funding for circular business models

10. Limited circular procurement

9. Lack of global consensus

8. Limited circular design

12. Poor quality remanufactured products

13. Limited standardisation

7.Obstructing laws and regulations

8. Limited circular procurement

11. Lack of data e.g. impacts

9. Obstructing laws and regulations

7. High upfront investment cost

Cultural

5.Limited willingness to collaborate in value chain

5. High upfront investment cost

10. Lack of large scale demonstration projects

6. Low virgin materials prices

4. Operating in linear system

3. Low virgin material prices

3. Limited funding for circular business models

1. Lacking consumer demand / interest

2. Hesitant company culture

Firm behaviour

Plain text = EU barriers
Blue text = Shared
Purple = AU barriers
Bold = interesting difference

Figure 3: Barriers to business adoption of circular economy practices in the Australia and the EU.

While there is relatively strong correspondence in the 'soft system' cultural barriers across the two contexts, we feel the differences there allude to important differences that come out in more detail in the below discussion of market, regulatory and technological barriers, particularly those highlighted in bold in Figure 3.

5.2.1 The significance of differences in market barriers

The significance of virgin material prices, the availability of investment, and high upfront costs, play out in very different ways in the two contexts. Judging from the trade relationship outlined in the introduction, Australian imports at least partly contribute to the low virgin materials prices in the EU. Australian business managers are also likely to be part of vertically integrated supply chains. Foreign ownership is a significant element of the Australian economy. In 2015, 743 of the top 2,000

companies were foreign owned, with the stock of European Union 28 (EU) direct investment in Australia valued at $157.6 billion (21.4 per cent share of total direct investment) (DFAT, 2015).

At the same time, Australia's sensitivity to virgin material prices in terms of business CE practices is probably more driven by commodities competing with Australian post-consumer recyclables (e.g. paper, aluminium, plastics) (Greber, 2016). This dual relationship highlights that while recycling, and higher order circularity, can be understood as a pro-social good, for example because it contributes to protecting the environment, or innovation, it has a dual nature as commodity market (Minter, 2013). This in turn, has important implications for the focus of regulation and technological innovation (below).

Given recent events, and the underlying market structure, it is not surprising that the focus of CE policy dialogue in Australia is substantially on Australia's domestic post-consumer recyclables and waste markets (DELWP, 2019; DoEE, 2018; Downes, 2018; Ghisellini et al., 2016). This is distinct from its primary extraction market (dominant) and much smaller manufacturing and agriculture markets (Garnaut, 2019; RBA, 2020). This relative emphasis between pre- and post-consumer contributions may partially explain why Australia is in the 50th percentile of performance in countries committed to the Sustainable Development Goals on SDG 12: responsible consumption and production (Sachs et al., 2018). Domestic consumption and production, and its waste streams, are relatively small compared to Australia's broader contribution to material footprint impacts of the global economy (Wiedmann et al., 2015).

5.2.2   The significance of differences in regulatory, policy and technological barriers

To the extent that regulatory barriers and the lack of procurement leadership are more prominent in Australian views of barriers to CE than in the EU (see

Table 6, Table 7), this may reflect the lack of governance in addressing disfunctions in Australian waste and recycling we noted in the Introduction (recall Figure 1 on p. 4, now updated at Figure 4, below). In particular, an overall pre-occupation with recycling as a commodity market, and a focus onpost-consumer circularity (as opposed to the full '10Rs' for example (Reike et al., 2018)). Arguably, whereas there has been an element of central planning and policy in the EU for some time for CE, until recently, Australia has taken a strongly market driven approach to waste and the recycling industry in particular. Environmental economists have noted that the aspirations of policy goals for recycling in many developed countries typically exceed what would be purely economically rational, based on present commodity values, although most acknowledge difficulty in costing in broader environmental, social and distributed economic benefits (Briguglio, 2016; Dahlen and Lagerkvist, 2010; Grazhdani, 2016; Lakhan, 2015).

Conversely, no technology related barriers ranked as amongst the most pressing barriers in the EU study (Table 7). This may represent the relative maturity of research and development, and particularly the accessibility of working models and business cases across the two contexts. But, it is also an opportunity. In particular:

> Australia is lagging the rest of the world in waste innovation and technology development. There is an opportunity to 'leap frog' the pathway other nations have taken in adopting Circular Economy practices and policies by learning from global examples and projects. This turns Australia's slow start into an advantage (Boxall et al., 2019, p. 44).

Considered in light of the EU, this is arguably attributable to a lack of public investment and relatively undemanding product stewardship regimes on the one hand, and financial institutions' relative conservatism on the other (re: Interviewee A2,

Table 5, p. 26). This in turn we associate with the notion of 'a waste and recycling industry as market' problematic outlined above. I.e. in what was a largely market driven context focused on post-consumer recycling, it would appear that Australian business and industry have struggled to develop or translate, and implement, parallel technological innovations that have occurred in the EU. If necessity is the mother of invention, the previous status quo of largely offshore porcessing of recycling, and profitable primary extraction industries under little local pressure to become more circular, have likely limited the necessity.

There is an evident pre-occupation of Australian policymakers (and R&D scientists) engaged with CE with transforming lower order post-consumer waste hierarchy activities, particularly recycling, to make recycled material markets economically viable (Whish-Wilson, 2018)). For example, the conclusions reached at a recent symposium on progressing CE in Australia:

> Changes to (Australian) policy, legislation and frameworks, (particularly, tightening of permissions to dispose and discharge is needed to further internalise the costs of materials becoming 'waste') can directly influence and promote the development of innovative processes for waste management, engage small-to-medium enterprises in this industry and help to create new markets for secondary materials recovered from wastes. These, in turn, also encourage domestic reprocessing and reuse of secondary materials onshore in Australia, resulting in economic and environmental benefits (Boxall et al., 2019, p. 25).

This contrasts with a not insignificant, but overall middling priority put to regulatory barriers in the EU research. These differences in emphasis may well reflect the relative maturity of EU policies supporting CE – perhaps obvious barriers in the EU, such as sharing materials across jurisdictions are increasingly addressed, so more systemic regulatory barriers to business innovation are more prominent, while in Australia, cross-jurisdictional harmonisation at the national level is only emerging, and red tape and perverse incentives still exist. And so, perhaps addressing systemic regulatory barriers to innovation are just on the horizon. At one level at least, it would appear that in Australia regulation is conceived as a barrier to market activity, whereas in the EU, while it remains a middle order issue, policymakers were more concerned about it (ranked 5) than businesses (ranked 7). National leadership in circular economy has been announced as a priority for the Australian Government (DoEE, 2019), which may see resolution of some of these issues.

5.3 Promising interventions

Returning to our system map of causal drivers of problems in the waste system in Australia (Figure 1), and updated Figure 4, p. 36), the analysis in the previous sections suggest that a relative lack of visibility and attention to broader externalities in markets, regulation and technological innovation arguably contributes to maladaptive patterns of behaviour both in consumption and production driving waste industry outcomes (Figure 4). Specifically, barriers most directly framing business engagement with CE practices discussed at 4.1, particularly consumer awareness (

Table 2, p. 21), organisational hesitancy (Table 3, p. 22), and the lack of collaboration in transforming a linear system (

Table 4, p. 24) are framed by distal 'hard system' factors such as market structures (4.2,

Table 5), and the complicated nature of waste materials and environmental interactions fragmented

governance (4.4) and poor data and technical knowledge (4.6) . From this point of view, the need for

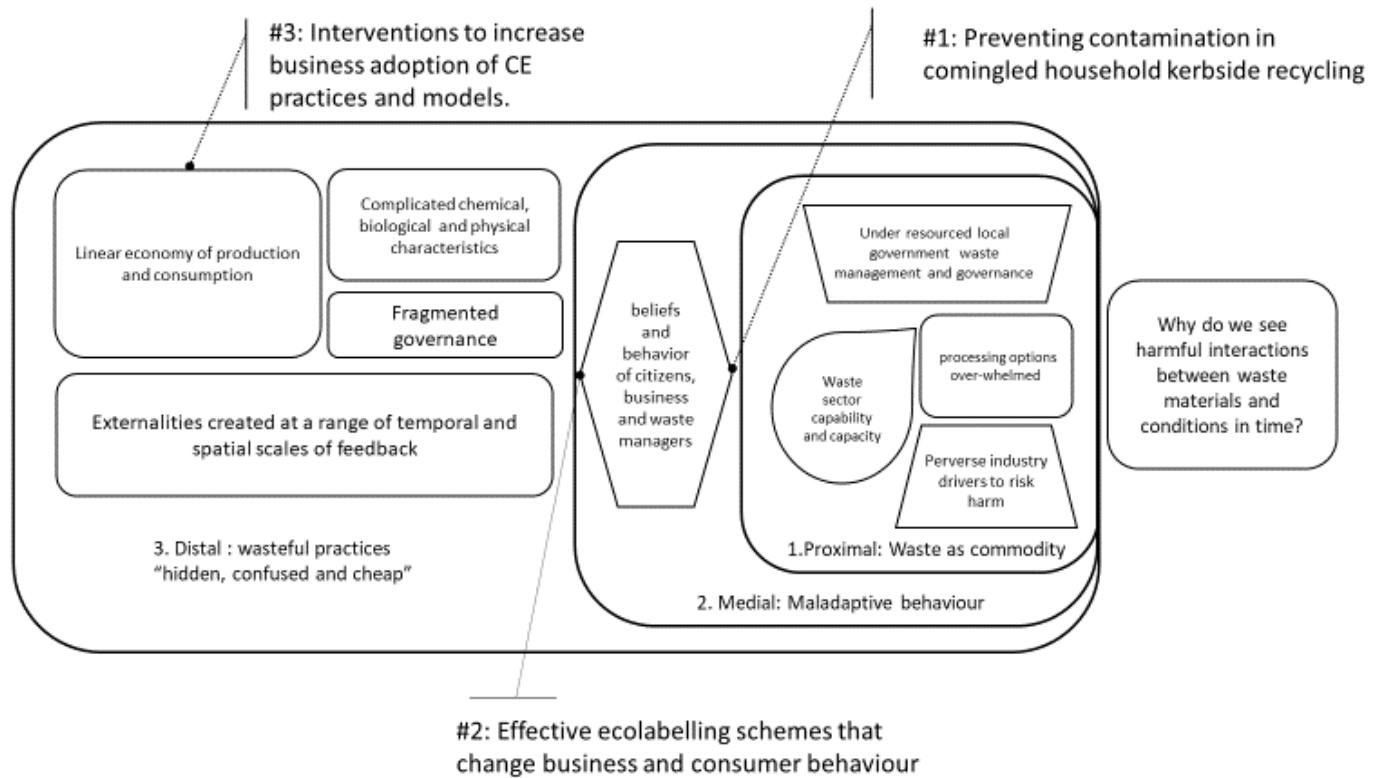multiple points of intervention in the system to help change it is evident.

Figure 4: Potentially fruitful points of intervention for behavioural public policy experiments in the Australian waste system.

5.3.1   Interventions in the 'soft system'

Our analysis of barriers in Australia and the EU, and interesting differences between them as we

progressively contextualise the Australian drivers of business adoption of CE practices, suggest some

behavioural public policy interventions (below) and broader system intervention options. Note that

the rationale and focus for the recycling contamination intervention, while relevant, is reported

elsewhere for brevity - forthcoming based on (Kaufman et al., 2020b).

1. Overcoming barriers of company culture, collaboration and operating in a linear system

2. Building consumer demand and interest

5.3.2.   Overcoming barriers of company culture, collaboration and the linear system

Our analysis of business adoption of CE practices suggests that "soft" cultural barriers such as organisational inertia, and lack of collaborative capacity to transform the linear system are significant barriers. But they also suggest that adopting many CE practices first requires significant change in surrounding business models and ecosystems, so treating individual organisations as the unit of behaviour change is insufficient to achieve a transition to the CE. The findings of the review and interviews for this paper informed the choice of an intervention trail to be reported in a forthcoming paper (based on Saeri and Kaufman, 2020).

Here we collaborate with EU researchers Baldasarre, Brown and Koneitzko, who developed the 'circular strategies' toolkit (Brown et al., 2019; Konietzko et al., 2020). We evaluate an innovation ideation workshop series, aiming to support organisational behaviour change and collaboration in the Australian textile, clothing and footwear ecosystem. The forthcoming paper will investigate the utility of the approach for overcoming barriers to business adoption of CE practices, investigate the role of 'collaborative capacity' in facilitating this, and explore the implications for scaling and extending the approach in some of the emerging business CE engagement hubs establishing in Australia. While the focus is on the immediate 'soft system' barriers, we believe it will also provide a useful heuristic for intersections with the 'hard' system barriers discussed below (Section 5.4).

5.1.3 Building interest and demand for CE products and services

While much of the literature on sustainable consumption and CE has focused on aspects of acceptance of products with recycled or remanufactured content, reduced toxicity and other "green product" characteristics, more extensive definitions of CE practices and business models require more of consumers (Wastling et al., 2018). For example, as reported at ERSCP 2019 (Segalàs and Lazzarini, 2019) "closing the loop" in many products require customers to take responsibility for returning items to correct locations (e.g., collection points, trade-ins), while leasing and repair-friendly items and services require a level of care and stewardship of products well beyond

traditional consumer-producer relationships (e.g. Bugaboo trialled pram leasing and found real challenges with the cleanliness and condition of prams returned back to them, while Mobike fines bicycle renters who trash their rented bicycles). Businesses identifying with "sufficiency" and even "degrowth" movements may ask their customers to "buy less" (but retain a focus on the products they offer) and/or contribute their own labour and creativity to the development, marketing and lifecycle of their products. While the above trial suggests some interventions that could encourage / support businesses to offer the above new models / approaches to the market; it also begs the question of what can both government and business do to make consumers more likely to not only purchase such items, but engage in post-purchase actions such as the above?

We set out to answer some of these questions in a second intervention trial drawing on this paper's analysis and related research, reported in a forthcoming paper (based on Klemm and Kaufman, 2020). The main goal of this research is to inform Australian CE policy through exploring the potential for new CE-specific labelling schemes (or expansion of existing schemes); and investigating consumers' awareness of, and trust in, existing eco-labelling schemes in the Australian market. This trial experiments with different CE relevant attributes, and their level, in product choices simulated in a conjoint choice based analysis experiment, as well as a national survey gauging broader beliefs, behaviours and environmental values and identity (Klemm and Kaufman, 2020).

5.4 Promising 'hard' system interventions

The above focus on behavioural public policy is not to downplay the significance of broader policy and structural change; indeed, it shows why it is so needed. The mix of demand and supply side considerations indicate that governments have relevant policy and regulatory tools at their disposal. Similarly, financial institutions need to play their role, and taxes, subsidies, procurement policies, and grant funding can all directly influence the previously mentioned drivers and barriers. There is, however, also a critical role for information sharing and knowledge translation, among business to business platforms and to consumers and other stakeholders to legitimise CE values, objectives and

address any concerns on how CE products and services can also complement (rather than conflict with) other consumer and business values.

Promising policy interventions on the organisational and consumer side also depend on addressing various structural, economic and market barriers to support innovation, entrepreneurship and experimentation in CE initiatives, and addressing known regulatory barriers and trust shortfalls (e.g., CE procurement policies, product labelling schemes, taxes/subsidies). At the same time, it is debatable if substantial investment in technological R&D is a good use of resources in Australia, at least without a focus on leveraging the 'late adopter' advantage (Boxall et al., 2019). Such efforts should focus on correcting a lack of CE knowledge translation and application, including from other jurisdictions that have already invested substantially - e.g., the EU directed €30 billion to technological R&D in its last Horizon 2020 funding round, much it to CE related engineering innovation (Kirchherr et al., 2018). Further, while CE oriented early adopter 'start ups' and innovators certainly exist in Australia, there is a similar need to "break the bubble" of CE enthusiasm occurring among small cohorts of sustainable business and corporate social responsibility communities, and engage the wider business community, and most significantly, the primary resource extraction sector, at least to take it beyond essentially non-additional industrial ecology circularity.

The results of our trial into stimulating collaboration and innovation across business ecosystems, especially intersections with 'hard system' barriers, should have applications to incubators and networks, sharing platforms, peer to peer learning and targeted incentives and support, all possible endeavours to support CE transitions (for both SMEs and larger businesses). Developments like the Australian–Netherlands MoU supporting a CE Hub (hosted by Planet Ark) are promising, as well as the commercialisation and upscaling of the former CSIRO CE sharing platform "ASPIRE" (King et al., 2020), and the continued activity of longer running networks such as ReVamp (hosted by Australia Post) and the Business Environment Network, but it is hard to see how these will successfully engage

and change the behemoth of Australia's resource extraction industries by following the EU model without adaptation, hybridity and learning (after Stone, 2017).

6. Conclusions

Using stakeholder interviews, a review of literature, and analysis via progressive contextualisation of EU research, this paper firstly aimed to identify significant barriers to business firms adopting CE business practices in Australia, as well as interventions that might support them to do so. From there it aimed to understand differences in these between EU and Australia, and then identify gaps in knowledge in an Australian context that are candidates for follow-up trials and research.

While, superficially, there are similarities in 'cultural' barriers and their prominence across the two contexts, further contextualisation in 'hard' system barriers suggests fundamental differences. This must be considered in attempting policy transfer across the contexts. Most centrally, contrasting views on barriers suggests that how a given jurisdictional context conceptualises the economy, how it should work, and what outcomes it is accountable for has material impacts. Arguably, CE has successfully internalised costs generated by the transformation of virgin materials into products, into waste. Certainly, such internalisation can happen via shared public-private investment and market policy tools, and not just regulation, but the case for government action in Australia, and elsewhere, to support a CE is well established in the reviewed evidence.

The comparative analysis above indicates that once a major policy commitment has been made (e.g., the EU Circular Economy Action Plan 2015 and subsequent initiatives), there are active roles governments can play at multiple levels to reduce barriers, maximise drivers and, given the size and volume of economic activity driven by government decisions, stimulate both demand and supply. While in many areas of CE, business innovators have moved first, governments have the policy and regulatory tools to support the adoption of CE approaches while also building trust in CE goods and services (e.g., through mandated eco-labelling schemes, facilitating business innovation, and making

desired citizen behaviours such as recycling more straightforward). Arguably at least some of the differences reported above are attributable to the existence of a strong central policy platform in the EU. Others are likely due to fundamental differences in the respective regions' roles and engagement in the global economy. Given that transitioning to a circular economy requires bridging such differences, we hope that in addition to the further research we outline, others are interested in developing and investigating these themes alongside us.

References

ABS, 2018. Australian Environmental-Economic Accounts (No. 4655.0). Australian Bureau of Statistics.

Afif, Z., Islan, W.W., Calvo-Gonzalez, O., Dalton, A.G., 2019. Behavioral Science Around the World: Profiles of 10 Countries (an eMBeD brief). World Bank Group, Washington, D.C.

Althaus, C., Bridgman, P., Davis, G., 2018. The Australian policy handbook: a practical guide to the policy-making process, 6th edition. ed. Allen & Unwin, Sydney Melbourne Auckland London.

Araujo Galvão, G.D., De Nadae, J., Clemente, D.H., Chinen, G., De Carvalho, M.M., 2018. Circular Economy: Overview of Barriers 73, 79–85. https://doi.org/10.1016/j.procir.2018.04.011

Babbie, E.R., 2020. Practice of Social Research. CENGAGE LEARNING, S.l.

Bammer, G., 2013. Disciplining Interdisciplinarity. ANU Press. https://doi.org/10.22459/DI.01.2013

Bammer, G., Mitchell, C., Elford, W., Dumaresq, D., van Kerkhoff, L., Small, B., Hall, V.K., Kaufman, S., Browne, C., Brown, V.A., Blessington, L., 2019. A Rich Mosaic of Impact: Julie Thompson Klein's Scholarly Influence in Australia and New Zealand. Issues Interdiscip. Stud. 37, 143–168.

Baum, C.M., Gross, C., 2017. Sustainability policy as if people mattered: developing a framework for environmentally significant behavioral change. J. Bioeconomics 19, 53–95. https://doi.org/10.1007/s10818-016-9238-3

Blomsma, F., Brennan, G., 2017. The Emergence of Circular Economy: A New Framing Around Prolonging Resource Productivity. J. Ind. Ecol. 21, 603–614. https://doi.org/10.1111/jiec.12603

Bocken, N.M.P., Short, S.W., 2016. Towards a sufficiency-driven business model: Experiences and opportunities. Environ. Innov. Soc. Transit. 18, 41–61. https://doi.org/10.1016/j.eist.2015.07.010

Bögel, P.M., Upham, P., 2018. Role of psychology in sociotechnical transitions studies: Review in relation to consumption and technology acceptance. Environ. Innov. Soc. Transit. 28, 122–136. https://doi.org/10.1016/j.eist.2018.01.002

Boxall, N., King, S., Kaksonen, A., Bruckard, W., Roberts, D., 2019. Waste Innovation for a Circular Economy (Technical Report No. EP195506), CSIRO Cutting Edge Science and Engineering Symposium. Commonwealth Science and Industry Research Organisation, Australia.

Boyden, S., 2016. The Bionarrative, 1st ed. ANU Press. https://doi.org/10.22459/B.08.2016

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3, 77–101. https://doi.org/10.1191/1478088706qp063oa

Briguglio, M., 2016. Household Cooperation in Waste Management: Initial Conditions and Intervention. J. Econ. Surv. 30, 497–525. https://doi.org/10.1111/joes.12156

Brown, P., Bocken, N., Balkenende, R., 2019. Why do companies pursue collaborative circular oriented innovation? Sustain. Switz. 11. https://doi.org/10.3390/su11030635

BWA, 2020. Waste and Circular Economy Collaboration. URL https://www.behaviourworksaustralia.org/waste-collaboration/ (accessed 10.21.20).

Clarke, J., 2018. EPA problem solving workshop report: Waste. Minds at Work on behalf of the Victorian Government Department of Land, Water, Planning and Environment, EPA Victoria and Sustainability Victoria, Melbourne, Australia.

Coglianese, C., Nash, J., 2016. Motivating Without Mandates: The Role of Voluntary Programs in Environmental Governance. Fac. Scholarsh. Penn Law.

Dahlen, L., Lagerkvist, A., 2010. Evaluation of recycling programmes in household waste collection systems. Waste Manag. Res. 28, 577–586. http://dx.doi.org/10.1177/0734242X09341193

de Jesus, A., Antunes, P., Santos, R., Mendonça, S., 2016. Eco-innovation in the transition to a circular economy: An analytical literature review. J. Clean. Prod. 172, 2999–3018. https://doi.org/10.1016/j.jclepro.2017.11.111

de Jesus, A., Mendonça, S., 2018. Lost in Transition? Drivers and Barriers in the Eco-innovation Road to the Circular Economy. Ecol. Econ. 145, 75–89. https://doi.org/10.1016/j.ecolecon.2017.08.001

de Wit, M., Hoogzaad, J., Daniels, C. von, 2020. The circularity gap report 2020 (No. 3). Circle Economy, Platform for Accelerating the Circular Economy, World Resources Institute.

DELWP, 2019. A circular economy for Victoria [WWW Document]. Environment. URL https://www.environment.vic.gov.au/sustainability/circulareconomy (accessed 8.5.19).

DFAT, 2020a. European Union brief [WWW Document]. Dep. Foreign Aff. Trade. URL http://dfat.gov.au/geo/europe/european-union/Pages/european-union-brief.aspx (accessed 1.26.20).

DFAT, 2020b. Australia-EU trade statistics [WWW Document]. Dep. Foreign Aff. Trade. URL http://dfat.gov.au/about-us/publications/trade-investment/business-envoy/Pages/january-2018/australia-eu-trade-statistics.aspx (accessed 1.26.20).

DFAT, 2015. Economic activity of majority foreign owned business in Australia, Economic Analysis Branch, Investment and Economic Division. Australian Government Department of Foreign Affairs and Trade, Canberra.

DoEE, 2019. Department of the Environment and Energy Corporate Plan 2019–20. Australian Government Department of Environment and Energy.

DoEE, 2018. National Waste Policy [WWW Document]. Dep. Environ. Energy. URL http://www.environment.gov.au/ (accessed 1.17.20).

Downes, J., 2018. China's recycling "ban" throws Australia into a very messy waste crisis [WWW Document]. The Conversation. URL http://theconversation.com/chinas-recycling-ban-throws-australia-into-a-very-messy-waste-crisis-95522 (accessed 1.23.19).

Dyball, R., Beavis, S., Kaufman, S., 2005. Complex adaptive systems: constructing mental models, in: Keen, M., Brown, V.A., Dyball, R. (Eds.), Social Learning in Environmental Management: Towards a Sustainable Future. Earthscan, London ; Sterling, VA, pp. 41–59.

Eltham, B., 2010. Australia's green economic potential (No. 10), CPD Occaisonal Papers. Centre for Policy Development, Sydney.

EPA NSW, 2019. NSW Circular Economy Policy. Government of New South Wales, Environment Protection Authority of NSW, Sydney, NSW, Australia.

Ewert, B., 2020. Moving beyond the obsession with nudging individual behaviour: Towards a broader understanding of Behavioural Public Policy. Public Policy Adm. 35, 337–360. https://doi.org/10.1177/0952076719889090

Feitsma, J., 2019. Brokering behaviour change: the work of behavioural insights experts in government. Policy Polit. 47, 37–56. https://doi.org/10.1332/030557318X15174915040678

Flyvbjerg, B., Sampson, S., 2011. Making social science matter: why social inquiry fails and how it can succeed again, 13. printing. ed. Cambridge Univ. Press, Cambridge.

French, J., Gordon, R., 2015. Strategic social marketing. SAGE Publications Ltd, London.

Garnaut, R., 2019. Superpower: Australia's low-carbon opportunity.

Ghisellini, P., Cialani, C., Ulgiati, S., 2016. A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. J. Clean. Prod. 114, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007

Govindan, K., Hasanagic, M., 2018. A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. Int. J. Prod. Res. 56, 278–311. https://doi.org/10.1080/00207543.2017.1402141

Grazhdani, D., 2016. Assessing the variables affecting on the rate of solid waste generation and recycling: An empirical analysis in Prespa Park. Waste Manag. 48, 3–13. https://doi.org/10.1016/j.wasman.2015.09.028

Greber, 2016. Commodity price slump makes recycling uneconomical [WWW Document]. Aust. Financ. Rev. URL https://www.afr.com/news/economy/commodity-price-slump-makes-recycling-uneconomical-20160416-go80qv (accessed 2.22.19).

Green Industries SA, 2020. Circular Economy [WWW Document]. URL
https://www.greenindustries.sa.gov.au/circular-economy (accessed 1.26.20).

Green Industries SA, 2017. Benefits of a circular economy in South Australia: Summary Report.
Government of South Australia, Green Industries SA.

Groening, C., Sarkis, J., Zhu, Q., 2018. Green marketing consumer-level theory review: A
compendium of applied theories and further research directions. J. Clean. Prod. 172, 1848–
1866. https://doi.org/10.1016/j.jclepro.2017.12.002

Henry, M., Bauwens, T., Hekkert, M., Kirchherr, J., 2019. A Typology of Circular Start-Ups – An
Analysis of 128 Circular Business Models. J. Clean. Prod. 118528.
https://doi.org/10.1016/j.jclepro.2019.118528

Hertwig, R., Grüne-Yanoff, T., 2017. Nudging and Boosting: Steering or Empowering Good Decisions.
Perspect. Psychol. Sci. 12, 973–986. https://doi.org/10.1177/1745691617702496

Kaufman, S., Curtis, J., Borg, K., Meis-Harris, J., Bragge, P., Downes, J., 2020a. Effectiveness of
product labelling schemes on influencing circular economy policy outcomes: A rapid
evidence review. Behav. Aust. Monash Univ.

Kaufman, S., Meis-Harris, J., Spanno, M., Downes, J., 2020b. What 'works' behaviorally to reduce
contamination of recycling at the kerbside (a rapid evidence and practice review). BWA
Waste and CE collaboration, BehaviourWorks Australia, Monash Sustainable Development
Institute, Monash University., Melbourne, Australia.

Kaufman, S., Saeri, A., Raven, R., Malekpour, S., Smith, L., 2019. Behaviour in transitions: a literature
review., in: Proceedings. Presented at the 10th International Sustainability Transitions
Conference, Carleton University, Ottawa, Canada.

Khangura, S., Konnyu, K., Cushman, R., Grimshaw, J., Moher, D., 2012. Evidence summaries: the
evolution of a rapid review approach. Syst. Rev. 1. https://doi.org/10.1186/2046-4053-1-10

King, S., Lusher, D., Hopkins, J., Simpson, G.W., 2020. Industrial symbiosis in Australia: The social
relations of making contact in a matchmaking marketplace for SMEs. J. Clean. Prod. 270,
122146. https://doi.org/10.1016/j.jclepro.2020.122146

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., Hekkert, M.,
2018. Barriers to the Circular Economy: Evidence From the European Union (EU). Ecol. Econ.
150, 264–272. https://doi.org/10.1016/j.ecolecon.2018.04.028

Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: An analysis of 114
definitions. Resour. Conserv. Recycl. 127, 221–232.
https://doi.org/10.1016/j.resconrec.2017.09.005

Klemm, C., Kaufman, S., 2020. Can circular economy policy leverage eco-labels?: trial research initial
report, A report from the BWA Waste and Circular Economy Collaboration. BehaviourWorks
Australia, Monash Sustainable Development Institute, Monash University, Melbourne,
Australia.

Konietzko, J., Bocken, N., Hultink, E.J., 2020. A Tool to Analyze, Ideate and Develop Circular
Innovation Ecosystems. Sustainability 12, 417. https://doi.org/10.3390/su12010417

Lakhan, C., 2015. Diversion, but at what cost? the economic challenges of recycling in Ontario.
Resour. Conserv. Recycl. 95, 133–142. https://doi.org/10.1016/j.resconrec.2014.12.007

Laszlo, E., Laszlo, A., 1997. The Contribution of the Systems Sciences to the Humanities. Syst. Res.
Behav. Sci. 14, 5–19. https://doi.org/10.1002/(SICI)1099-1743(199701/02)14:1<5::AID-
SRES150>3.0.CO;2-M

Mazzarol, T., 2011. Australia's two speed economy - who wins, who loses? The Conversation.

McDonald, D., Bammer, G., Deane, P., 2009. Research integration using dialogue methods. ANU E
Press, Acton, A.C.T.

McDowall, W., Geng, Y., Huang, B., Barteková, E., Bleischwitz, R., Türkeli, S., Kemp, R., Doménech, T.,
2017. Circular Economy Policies in China and Europe. J. Ind. Ecol. 21, 651–661.
https://doi.org/10.1111/jiec.12597

Meadows, D., 1999. Leverage Points: Places to Intervene in a System. Acad. Syst. Change. URL http://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/ (accessed 7.13.18).

Meadows, D.H., Wright, D., 2008. Thinking in systems: a primer. Chelsea Green Pub, White River Junction, Vt.

Michalek, G., Thronicker, I., Yildiz, Ö., Schwarze, R., 2019. Habitually green: integrating the concept of habit into the design of pro-environmental interventions at the workplace. Nachhalt. Sustain. Manag. Forum. https://doi.org/10.1007/s00550-019-00487-9

Midgley, G., 2014. Systems thinking: four key skills. Integr. Implement. Sci. URL https://i2s.anu.edu.au/resources/systems-thinking-four-key-skills (accessed 12.5.19).

Midgley, G., 2000. Systemic Intervention Philosophy, Methodology, and Practice. Springer US, Boston, MA.

Minter, A., 2013. Junkyard planet: travels in the billion-dollar trash trade, First U.S. Edition. ed. Bloomsbury Press, New York.

Newell, B., Wasson, R., 2002. Social System vs Solar System: Why Policy Makers Need History, in: Castelein, S., Otte, A. (Eds.), Conflict and Cooperation Related to International Water Resources: Historical Perspectives, UNESCO Document. UNESCO, Grenoble, pp. 3–17.

Newton, P.W., 2012. Liveable and Sustainable? Socio-Technical Challenges for Twenty-First-Century Cities. J. Urban Technol. 19, 81–102. https://doi.org/10.1080/10630732.2012.626703

Oliver, A., 2015. Nudging, Shoving, and Budging: Behavioural Economic-Informed Policy. Public Adm. 93, 700–714. https://doi.org/10.1111/padm.12165

Oliver, A., 2013. From Nudging to Budging: Using Behavioural Economics to Inform Public Sector Policy. J. Soc. Policy 42, 685–700. https://doi.org/10.1017/S0047279413000299

O'Rourke, D., Lollo, N., 2015. Transforming Consumption: From Decoupling, to Behavior Change, to System Changes for Sustainable Consumption. Annu. Rev. Environ. Resour. 40, 233–259. https://doi.org/10.1146/annurev-environ-102014-021224

Ostrom, E., 2015. Governing the Commons. Cambridge University Press.

Pandor, A., Kaltenthaler, E., Martyn-St James, M., Wong, R., Cooper, K., Dimairo, M., O'Cathain, A., Campbell, F., Booth, A., 2019. Delphi consensus reached to produce a decision tool for SelecTing Approaches for Rapid Reviews (STARR). J. Clin. Epidemiol. 114, 22–29. https://doi.org/10.1016/j.jclinepi.2019.06.005

Planet Ark, 2020. National Circular Economy Hub [WWW Document]. URL https://circulareconomyhub.org.au/ (accessed 1.23.20).

Planet Ark, 2018. From waste war to recycling reboot: national recycling week 2018 report [WWW Document]. URL https://recyclingnearyou.com.au/nationalrecyclingweek/research/2018/ (accessed 1.7.19).

RBA, 2020. Composition of the Australian Economy Snapshot | Education [WWW Document]. Reserve Bank Aust. URL https://www.rba.gov.au/education/resources/snapshots/economy-composition-snapshot/index.html (accessed 10.21.20).

Redmond, J., Cox, J.W., Curtis, J., Kirk-Brown, A., Walker, B., 2016. Beyond business as usual: how (and why) the habit discontinuity hypothesis can inform SME engagement in environmental sustainability practices. Australas. J. Environ. Manag. 23, 426–442. https://doi.org/10.1080/14486563.2016.1188424

Reike, D., Vermeulen, W.J.V., Witjes, S., 2018. The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. Resour. Conserv. Recycl., Sustainable Resource Management and the Circular Economy 135, 246–264. https://doi.org/10.1016/j.resconrec.2017.08.027

Remmen, A., 2019. The roots of circular economy: from cleaner production over eco-design to sustainable business models, in: Segalàs, J., Lazzarini, B. (Eds.), Circular Europe for

Sustainability: Design, Production and Consumption, PROCEEDINGS of the 19th European Roundtable for Sustainable Consumption and Production. Barcelona, Spain, p. 262.

Ritchie, M., Cocks, D., 2018. CDS and China's National Sword, in: Waste Summit. Presented at the National Wase Exhibition, Melbourne.

Rosa, P., Sassanelli, C., Terzi, S., 2019. Circular Business Models versus circular benefits: An assessment in the waste from Electrical and Electronic Equipments sector. J. Clean. Prod. 231, 940–952. https://doi.org/10.1016/j.jclepro.2019.05.310

Ruggeri, K., 2019. Behavioral insights for public policy: concepts and cases.

Saari, U.A., Fritz, M.M.C., Mäkinen, S.J., Baumgartner, R.J., 2018. Designing Green Marketing Across Industries: A Conceptual Framework and Implications for Consumers and Transdisciplinary Research, in: Leal Filho, W. (Ed.), Handbook of Sustainability Science and Research, World Sustainability Series. Springer International Publishing, Cham, pp. 581–596. https://doi.org/10.1007/978-3-319-63007-6_36

Sachs, J., Kroll, C., Schmidt, G., Lafortune, G., Fuller, G., 2018. SDG Index and dashboards report 2018: country profiles editions. Bertelsmann Stiftung and Sustainable Development Solutions Network, New York.

Saeri, A., Kaufman, S., 2020. How can we help business to participate in the circular economy?: Initial trial findings., A report from the BWA Waste and Circular Economy Collaboration. BehaviourWorks Australia, Monash Sustainable Development Institute, Monash University, Melbourne, Australia.

Salim, H.K., Stewart, R.A., Sahin, O., Dudley, M., 2019. Drivers, barriers and enablers to end-of-life management of solar photovoltaic and battery energy storage systems: A systematic literature review. J. Clean. Prod. 211, 537–554. https://doi.org/10.1016/j.jclepro.2018.11.229

Segalàs, J., Lazzarini, B., 2019. Circular Europe for Sustainability: Design, Production and Consumption: Proceedings of the 19th European Roundtable for Sustainable Consumption and Production.

Spencer, L., Ritchie, J., Lewis, J., Dillon, L., 2003. Quality in Qualitative Evaluation: A framework for assessing research evidence. Government Chief Social Researcher's Office.

Stone, D., 2017. Understanding the transfer of policy failure: bricolage, experimentalism and translation. Policy Polit. 45, 55–70. https://doi.org/10.1332/030557316X14748914098041

Tamma, P., 2018. China's trash ban forces Europe to confront its waste problem [WWW Document]. POLITICO. URL https://www.politico.eu/article/europe-recycling-china-trash-ban-forces-europe-to-confront-its-waste-problem/ (accessed 1.29.20).

Topsfield, J., 2018. Australia to set national targets to reduce waste [WWW Document]. Syd. Morning Her. URL https://www.smh.com.au/politics/federal/australia-to-set-national-targets-to-reduce-waste-20180925-p505w5.html (accessed 9.26.18).

Tricco, A.C., Langlois, E.V., Straus, S.E., World Health Organization, Alliance for Health Policy and Systems Research, 2017. Rapid reviews to strengthen health policy and systems: a practical guide.

Tura, N., Hanski, J., Ahola, T., Ståhle, M., Piiparinen, S., Valkokari, P., 2019. Unlocking circular business: A framework of barriers and drivers. J. Clean. Prod. 212, 90–98. https://doi.org/10.1016/j.jclepro.2018.11.202

Turnheim, B., Geels, F.W., 2013. The destabilisation of existing regimes: Confronting a multi-dimensional framework with a case study of the British coal industry (1913–1967). Res. Policy 42, 1749–1767. https://doi.org/10.1016/j.respol.2013.04.009

Upham, P., Bögel, P., Johansen, K., 2019. Energy transitions and social psychology: a sociotechnical perspective, Routledge studies in energy transitions. Routledge, Abingdon, Oxon ; New York, NY.

Vayda, A.P., 1996. Methods and Explanations in the Study of Human Actions and their Environmental Effects. Centre for International Forestry Research and World Wide Fund for Nature, Jakarta, Indonesia.

Vayda, A.P., 1983. Progressive contextualization: Methods for research in human ecology. Hum. Ecol. 11, 265–281. https://doi.org/10.1007/BF00891376

Verplanken, B., Wood, W.M., 2006. Interventions to Break and Create Consumer Habits. https://doi.org/10.1509/jppm.25.1.90

Wastling, T., Charnley, F., Moreno, M., 2018. Design for Circular Behaviour: Considering Users in a Circular Economy. Sustain. Basel 10, 1743. http://dx.doi.org.ezproxy.lib.monash.edu.au/10.3390/su10061743

Watt, A., Cameron, A., Sturm, L., Lathlean, T., Babidge, W., Blamey, S., Facey, K., Hailey, D., Norderhaug, I., Maddern, G., 2008. Rapid versus full systematic reviews: validity in clinical practice? ANZ J. Surg. 78, 1037–1040. https://doi.org/10.1111/j.1445-2197.2008.04730.x

Whish-Wilson, P., 2018. Never waste a crisis: the Waste and recycling industry in Australia. Senate of the Parliament of Australia, Environment and Communications References Committee.

Wiedmann, T., Lenzen, M., Keyßer, L.T., Steinberger, J.K., 2020. Scientists' warning on affluence. Nat. Commun. 11, 3107. https://doi.org/10.1038/s41467-020-16941-y

Wiedmann, T., Schandl, H., Lenzen, M., Moran, D., Suh, S., West, J., Kanemoto, K., 2015. The material footprint of nations. Proc. Natl. Acad. Sci. 112, 6271–6276. https://doi.org/10.1073/pnas.1220362110

WMR, 2019. Dutch and Australian foundations sign circular economy MOU. Waste Manag. Rev.

Wright, B., Bragge, P., 2018. Interventions to promote healthy eating choices when dining out: A systematic review of reviews. Br. J. Health Psychol. 23, 278–295. https://doi.org/10.1111/bjhp.12285

Appendix A: Themes identified in the AU relevant literature review

As discussed in the main paper, the thematic categories identified inductively in the AU relevant evidence review are as follows. They align with the Kirchherr et al (2018) framework. Key barriers are set out in Table 3, and relate to: lack of consumer demand and interest, markets, organisational leadership/culture/routines, supply chains, government policies/regulation and technologies.

The barriers detail a multi-faceted and intertwined case for why businesses might not adopt CE practices. In the absence of supporting government policies and efficiencies (e.g., taxes/subsidies, procurement, administrative burdens), compelling business cases, supporting technologies, and trusted relationships (within the supply chain), businesses are likely to remain risk adverse to disrupting their business as usual practices. And even within businesses where leadership and culture may be predisposed to embark on CE-related endeavours, questions remain around investment costs in new infrastructure, processes, return on investment timelines, and whether there is enough consumer interest, demand and market penetration for CE products and services beyond existing trends in consumer decision-making.

Table 8: Key barriers identified across the reviewed studies

Lack of consumer demand and interest (Culture)	• Consumer concerns related to the quality and durability of recycled, repaired, repurposed items (as well as any negative stigma associated with them); • an unwillingness to pay the (perceived) higher prices for such goods and services; • a distrust of the CE credentials of products (including a lack of accurate measures and indicators that convey such information to the consumer); • a reluctance to breaking existing consumption habits. • This lack of consumer demand and interest was reported from both the consumer and business perspective.
Market	• Businesses lack of resources/capital for high upfront/investment costs (especially when compared to linear business models); • the availability and low costs of virgin materials (creating unfair competition); • longer return on investment timeframes (putting the business at risk); • costs associated with greater administrative burdens resulting from engaging in horizontal and vertical CE business relationships simultaneously; • costs associated with the separation, recycling and repair of materials (which are exacerbated by product designs and collection services that do not facilitate such processes). • Such barriers are of particular concerns and/or relevance to SMEs based on the reviewed studies.
Organisational leadership/ culture/ routines (Culture)	• Lack of knowledge on CE business opportunities, input streams, partners and technological innovations; • lack of data and evidence that demonstrate compelling business cases for CE business models; • risk aversion to changing current business processes that have a track-record of "working" (combined with unknown returns of adopting CE business models within highly competitive business markets); • poor environmental/social culture within businesses (e.g., where businesses do not see waste, environmental pollution, and resource scarcity as pressing concerns); • an unwillingness to experiment or pilot new initiatives (or only willing to do so at an incremental rather than a radical level).

Supply chain (Culture)	• Lack of standards, traceability and quality assurances (e.g., contamination) of "circulated" materials in the supply chain • ; impacts on brand image if other businesses in the supply chain do not perform (leading to mistrust within the supply chain); • availability (and credentials of) potential supply chain partners; • the need to create additional coordination, contracting, licensing, communication and distribution processes and channels within the supply chain; • competing goals of different businesses; intellectual property concerns with third-party access to products.
Government policies/regulation	• Legislation, regulation, taxes and incentives that continue to favour linear business models (creating an uneven playing field); • outdated procurement policies that do not support CE approaches; greater administrative burden/red-tape linked to CE/green business activities (e.g., the reuse of waste); • the absence or the slow development of industry standards by government (where the government is often behind the developments and innovations taking place in the business sector).
Technologies, research and development	• Absence of information-sharing platforms describing potential CE input streams, partners, and technologies; • lack of infrastructure and innovation to support the roll-out of CE business models at scale (e.g., equipment for collecting, sorting, processing, and recovering material); • low levels of technical expertise within private and public institutions (e.g., resource recovery infrastructure, • CE product design and business models); challenges of integrating innovations and technological solutions across multiple businesses in the supply chain.

This relates well to one of the largest recent studies relating literature and primary research

evidence on barriers to CE in the EU (Kirchherr et al., 2018). Its relevance is further validated

because we found this framework aligned with the inductively derived thematic results of our own

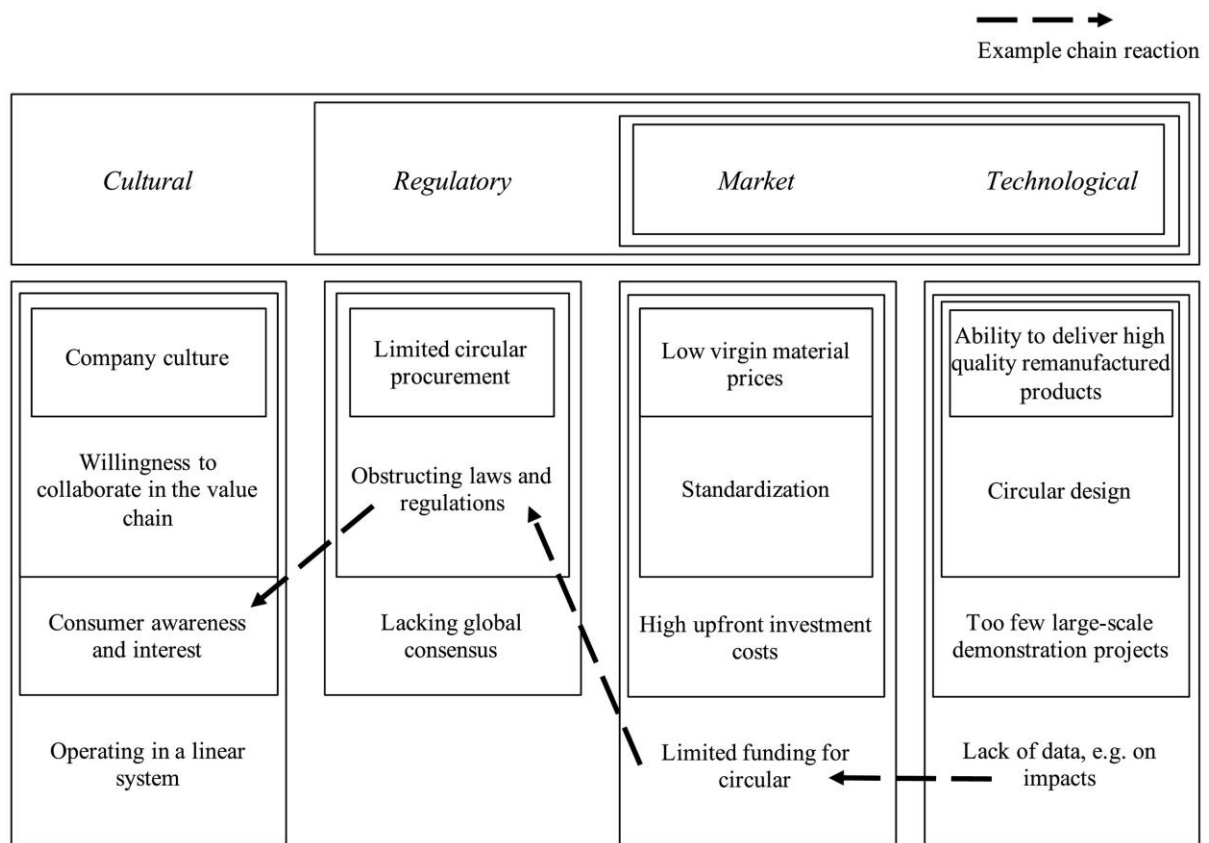rapid evidence review of global CE literature relevant to Australia

Figure 5: Integrated findings of literature and practice review of barriers to circular economy in the EU (Kirchherr et al., 2018)

Complimentary material to publication: Study methods

Background to the systems map

The research agenda for this project was informed by an existing systems map developed by 15 policy staff from multiple Australian government agencies across a series of three workshops in late 2017 and early 2018. They were seeking to understand recurring wicked problems in waste policy in Australia and ended up talking about CE, which as we expand in the discussion is significant.

What is commonly called systems thinking, research or approaches has diverse roots, and influences, and informs a wide range of inter and transdisciplinary methods for problem solving, integration and implementation (Bammer, 2013; Laszlo and Laszlo, 1997; McDonald et al., 2009).

For our purposes a "system" is:

> *Composed of discernible parts (elements, agents) that interact to constrain each other's behaviour. It is these mutual constraints, operating between the parts of the system, that limit the range of behaviours available to the system as a whole – thus give rise to its 'emergent' (or synergistic) properties... the characteristics (or lawful) behaviour of the system arises from the internally-generated (endogenous) forces imposed on parts of the system by (other) parts of the system* (Newell and Wasson, 2002: p. 4)*.

The original map (**Error! Reference source not found.**) was facilitated and analysed by a third party consultant, guiding participants through a process that continually prompts participants to ask "why does this problem exist?", with each iteration of questioning stepping back along chains of influence (Clarke, 2018) - for example, elements of the system at the root of a chain of causes, or which flow on to influence many other causes. In recognising both nested hierarchies of causality and paying particular attention to intervening in root rather than presenting causes of problems, the method draws on Meadow's arguments on systemic intervention (Meadows, 1999; Meadows and Wright, 2008).

Figure 6: System mapping workshop output (Clarke, 2018)

The initial raw output was analysed and clustered in terms of proximity of causation, leading to a number of categorical clusters, and identification of important boundaries (**Error! Reference source not found.**).

Figure 7: Categorical clusters of causal factors leading to harm in the waste industry (Clarke, 2018)

In our research agenda workshop in December 2018, we further engaged with the system map. Our process emulated key elements proposed by (Midgley, 2014):

1. **Exploring system boundaries** – understanding the inclusion, exclusion and marginalisation of stakeholders and the issues that concern them.

2. **Appreciating multiple perspectives** – how and why stakeholders frame issues in different ways is key to understanding systems and how to influence them.

3. **Mapping actors and relationships** – facilitating understanding networks of interconnections within and across systems. This was particularly evident in inter-jurisdictional discussions in the workshop.

4. **Thinking in terms of systems themselves** – reminding us that our behaviour change interventions sit within organised wholes, with properties that cannot be anticipated by analysing any one part of the system in isolation.

The final step underlies the importance of understanding behaviours and changing them in context throughout the process, and particularly in expecting and trying monitor and respond to unintended consequences and flow on effects from interventions (Midgley, 2014, after 2000).

The initial system map was tagged with insights from over 40 different waste, circular economy and industrial ecology behaviour change projects completed in earlier initiatives (see **Error! Reference source not found.**), and analysed to identify likely fruitful points of intervention for cross-agency behavioural public policy experiments aiming to advance the transition to a circular economy.
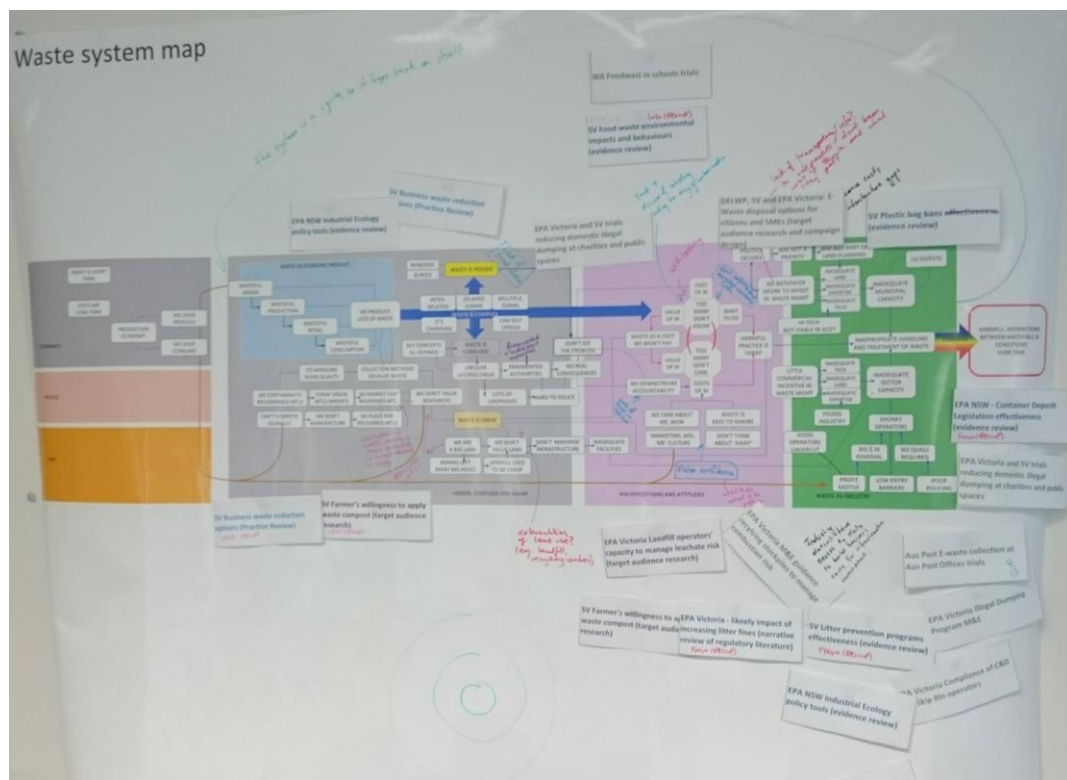

Figure 8: Tracking back from the current crisis to root causes and influences in waste and circular economy.

This informed the identification of behavioural experiments for policy as expanded upon in the discussion.

Rapid evidence review of literature

Informed by the systems mapping engagement in our research agenda workshop, a rapid review methodology was employed in a later phase of the research.

2.2.1 Search strategy

The following review questions guided this rapid review:

1. What drivers and barriers influence the adoption of CE business practices?

2. What is the effectiveness of interventions to promote adoption of CE business practices?

The CE definition that we applied for the purpose of this review was: *an economy in which the waste of materials and energy from production, use and discarding of products is either designed out or the materials kept in use for as long as possible within the economy, extracting the maximum value out of them and recovering them into new products/and/or resources at the end of their life. The aim is to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.* This definition was based on widely held and published elements and definitions of a CE, and input from our government partners (after Kirchherr et al., 2017).

Appendix 1 describes the search strategy that guided this review. Search terms (which were identified in collaboration with the government partners on this review project) included combinations of keywords (and associated synonyms <u>not</u> limited to the following) within three categories, comprising:

- **Circular economy** (<u>topic</u> search string): e.g., resource recovery, industrial ecology, industrial symbiosis, green economy, cradle to cradle.

- **Transition** (<u>behaviour</u> search string): e.g., adoption, innovation, transformation, disruption.

- **Business** (<u>population</u> search string): e.g., enterprise, firm, organisation.

Three databases were searched using these keywords to identify relevant studies: *Scopus, Proquest Environmental Sciences Collection*, and *Business Source Complete*. These databases were chosen for their large size and relevant disciplinary focus.

Broad searches with all terms were initially used and later narrowed by removing less relevant terms to improve the identification of the most relevant studies. This process also resulted in the population search string being removed, as it contributed to unmanageable yields (studies would instead later be screened for inclusion where the focus was on businesses). Forward and backward citation searching of the most relevant studies was completed to increase the chance that all relevant studies were found. Database and Google Scholar alerts were established to ensure articles published after searches were completed were also found.

2.2.2 Screening and selection

All studies were uploaded into the Covidence online software system for title, abstract and full text review. Studies were considered for inclusion if they:

1. were review-level studies (i.e., not primary studies)

2. described drivers, barriers and/or interventions in relation to the circular economy

3. focused on businesses

4. were from first-world countries comparable to Australia

5. were published since 2000.

2.2.3 Data extraction

Data extracted from relevant studies included: author name/s, date published, context (e.g., CE definitions, practices, geographical/industry setting), review type/questions, drivers/barriers, interventions, impact/benefits from the uptake of CE practices, policy learnings, and author

conclusions. All data is presented in tables in Appendix 2 and is synthesised and discussed in the following paragraphs.

2.2.4 Search results

Overall, 10,737 studies were identified using database searching and supplemental methods, which was reduced to 8,207 after removing duplicates. After screening titles and abstracts, 125 studies remained for full text review. The inclusion criteria were used to quickly screen studies and, if the inclusion criteria appeared satisfied, the entire article was read in detail to establish eligibility for review inclusion. After initial and detailed screening, 33 remained for inclusion in the final review (see Figure 1 over the page).

2.2.5 Quality appraisal

Quality appraisal involves assessing the risk of bias, and allows the ability to establish trustworthiness, or confidence, in the findings of the included reviews. Two quality assessment frameworks were used for this task:

- *A Measurement Tool to Assess Systematic Reviews* (AMSTAR)[2] - a tool that can be used to appraise the quality of systematic reviews and establish the level of confidence one should have in the findings from that systematic review.

- The *Scale for the Assessment of Narrative Review Articles* (SANRA)[3] - a brief critical appraisal tool for the assessment of non-systematic review articles.

Depending on the type of review of each study, each one was given a numerical score to allow for direct comparisons between reviews. This allowed the findings of each review to be classified based

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[2] Shea, B.J., Grimshaw, J.M., Wells, G.A., Boers, M., Andersson, N., Hamel, C., Porter, A.C., Tugwell, P., Moher, D. and Bouter, L.M., 2007. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC medical research methodology, 7(1), p.10.
[3] Baethge, C., Goldbeck-Wood, S., & Mertens, S. (2019). SANRA - A scale for the quality assessment of narrative review articles. *Research Integrity and Peer Review*, *4*, 5.

on the amount of confidence that should be had in their findings; the higher the confidence level

(and overall score), the more likely the study influenced the final conclusions made in this rapid

review. The risk of bias of all reviews informed the overall interpretation of the available evidence
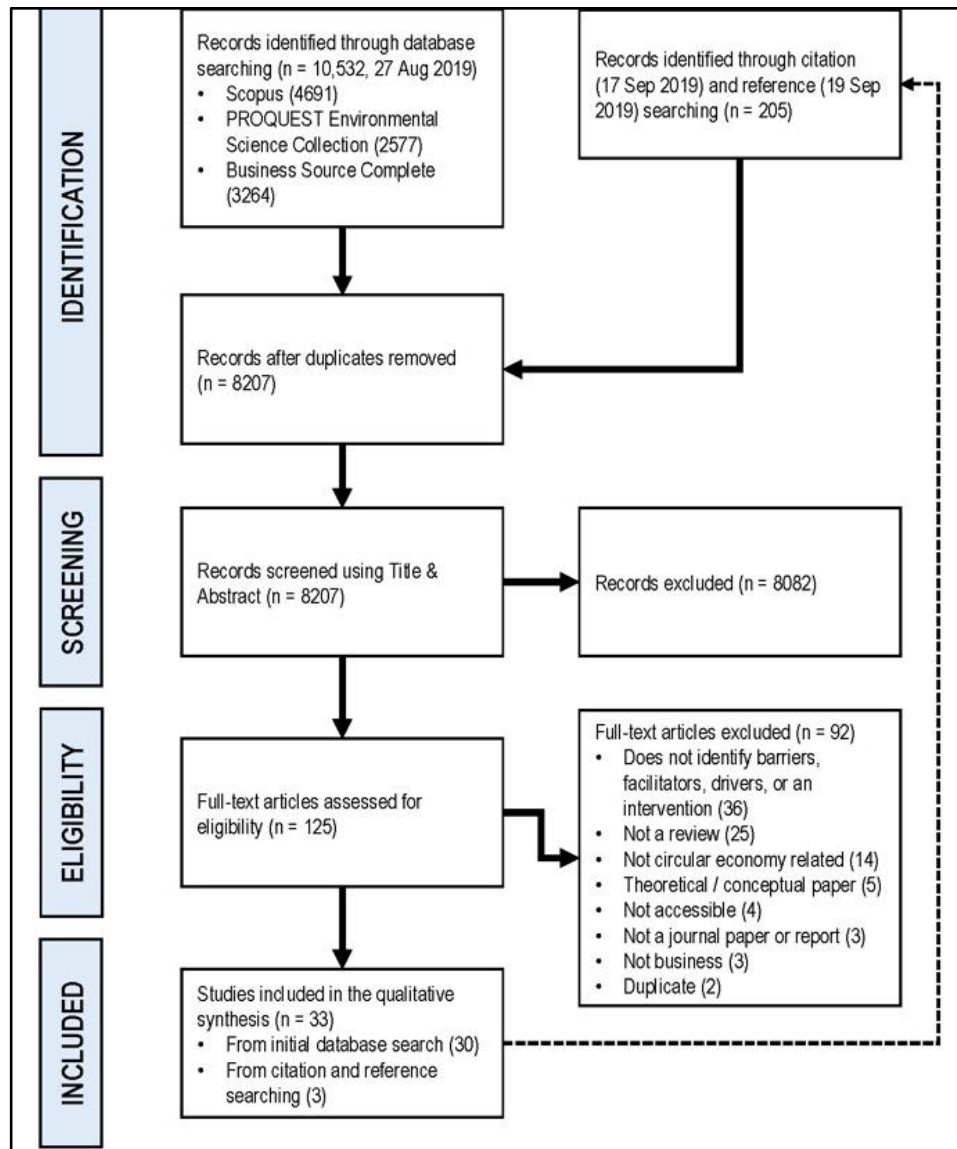
base.

Figure 9: PRISMA flow chart outlining the search process and inclusion of studies

**Waste Collaboration Interviews: Internal
INTERVIEW TEMPLATE**

Project 1: Business barriers to the circular economy

Organisation:	
Participant names:	
Date and time:	
Interviewer(s):	
Primary agency:	

<INTRO>

Confirm that we are recording.

Thanks for agreeing to participate in an interview.

Consent form received	☐ Yes	☐ No

YES: I've received your consent form, do you have any questions?
Just to confirm that we've asked to attribute your responses to your org, but we don't really have any plans to do so… this is internal scoping exercise, so encourage you to speak freely from your own experience, and welcome to indicate anything as being off the record.

NO: I haven't received your consent form yet, can I confirm the following… (read out form)
   I'll ask you to send through a signed form after the interview, but are you happy to proceed on that basis?

Verbal consent received	☐ Yes	☐ No

These interviews usually take 30-45mins to complete. Is there a particular time you have to finish?

Finish by:	

I'd like to start by asking some questions to understand your background and provide some context to your responses.

1. **What is your current position or role? What does it involve?**

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2.   What is your experience in the area of circular economy?

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Now for the main questions.

<INTERVIEW>

In this study, we are interested in understanding:

- where the opportunities are for business to participate in and transition to a circular economy,
- what are the barriers to businesses doing so
- what policy options are there for Government to help overcome these barriers and enable participation.

By circular economy we mean approaches that focus on keeping resources in use for as long as possible within the economy, extracting the maximum value out of them and recovering them into new products at the end of their life. Applying circular economy principles in Australia requires changes to product design, production, use and reuse, recycling and disposal. This includes encouraging innovation by promoting increased resource productivity.

3.   Based on your experience, what industry sectors and/or product categories *currently* adopt circular economy approaches *that go beyond traditional recycling*?

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      a.   What do these approaches "look like" in practice?

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      b.   Are these sectors/waste streams a priority for your organisation?

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      c.   What drivers/barriers influenced the uptake of these approaches?

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      d.   Are there opportunities to improve the uptake of these approaches?

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4. **Based on your experience, what industry sectors and/or product categories** *have the potential* **to adopt circular economy approaches (but currently do not)** *that go beyond traditional recycling*?

a. **What would these approaches "look like" in practice?**

b. **Are these sectors/waste streams a priority for your organisation?**

c. **What drivers/barriers need to be addressed to influence the uptake of these approaches?**

d. **Are there particular gaps in knowledge that have prevented the uptake of circular economy approaches?**

5. **Thinking about the industry sectors and/or product categories that** *have the potential* **to adopt circular economy approaches, what are some of the priority behaviours that you believe would need to change among different stakeholders? That is, "who would need to do what differently" to encourage the uptake of circular economy approaches?**

a. **Are there any influential networks/associations etc that need to be considered?**

6. **Based on your experience, are there particular interventions (programs/policies) that you believe need to be implemented to influence the uptake of circular economy approaches within these industry sectors and/or product categories?**

We have reached the end of our research questions. This is an opportunity for you to tell me any thoughts you had that you might not have had the chance to share with me earlier.

7. **Do you have anything else to add?**

Ok, just a couple of final wrap up questions

8. **Based on the questions I've asked you today, do you know of any existing research…relevant to the discussion?**

   a. **Is there anyone else internal to your agency, or external that you think we should interview for this study?**

Once we've completed these interviews and other preliminary research, our aim is to conduct behaviour change trials that explores the impact of different interventions to influence the uptake of circular economy approaches. To pilot these intervention trials, we are looking for delivery and implementation partners.

9. **Are there specific industry sectors, peak bodies or organisations that you believe would support and collaborate on such research? (Could you provide an introduction to these if needed?)**

Do you have any questions before we finish?

Thank you very much for your time and the information you provided. *Interview ceased.*

Coding frame used in interviews

Internal barriers businesses (n = frequency of mentions)	External barriers (n = frequency of mentions)
● Lack of knowledge of opportunities, potential input streams, potential partners, technologies (6) ● Inertia (including internal fear/resistance to change of either leaders OR workers), and where current model is working well (eg. construction, resources) (6) ● Lack of data / capacity to do business cases on transitions/evolutions (5) ● SMEs are time-poor and very cost driven, don't have time to explore/assess, nor capital for investments, and finance is hard to access (4) ● Concerns with just getting basic resource recovery right (eg. high landfill, stockpiles, etc) plus SMEs still just trying to get a handle on recycling (2) ● Lack of technical skills, knowledge and information to design, develop and implement CE business activities (1)	● Lack of, or difficulty obtaining, standards / quality assurance of 'circulated' materials/products to mitigate concerns / risks / stigma (5) ● Barriers to market entry, including general startup barriers, lack of capital / customer base / scale for economic viability, plus initial higher costs of circular vs linear offerings (unlevel playing field) (6) ● Regulations that constrain development (e.g. planning constraints particularly near residential areas, heritage) or other activities (e.g. waste/hazard reg), including outdated restrictions in procurement policies (e.g. roads) (4) ● Not enough (perceived) demand for end products (e.g. remade furniture, etc) due to inertia/innovation diffusion, quality concerns, higher costs (4) ● Costs of industrial ecology: retrofitting existing development due to constrained footprint and distance to new developments (greenfield much easier to develop) (1) ● Geographic and economic scale (e.g. smaller manufacturing industries, large distances between, etc) (1) ● Lack of policy harmonisation (different regulations in different jurisdictions) (1) ● Lack of infrastructure to support roll out of CE models, e.g. resource recovery infrastructure at scale; technology and communications networks (1) ● Limited awards recognition and certification systems, and limited recognition/value of systems (1)