Mapping the Circular Economy Ecosystem of Victoria

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Executive Summary

The aim of the research presented in this paper is to understand the current Circular Economy (CE) landscape in Victoria. Objectives arising were to identify the opportunities and gaps to be nurtured over the short term to support CE transition in the State of Victoria. This report represents a milestone point of the ecosystem mapping.

The research was underpinned by three main research steps: a desktop review, interviews with key stakeholders and a survey aimed at SMEs in Victoria. The desktop review highlighted that the socio-political tendency to measure policy outcomes, including a narrow set of waste related targets can have a negative influence on a systemic transition required to achieve circularity. The current focus on waste needs to be revisited to bring in step-change for systemic transition for CE. The existing policy targets also influence why CE is perceived to be a recycling strategy among non-experts.

Interviews showed that the focus is on recovery and recycling strategies with the primary consideration of waste resolution. A regulatory environment that is holistic in the approach to CE is critical. Businesses pay particular attention to financial sustainability in their R-frameworks, with recycling being the most commonly used R-prionciple. Alignment is vital between government, businesses, and the community to optimise CE interactions. Collaboration supports cross sectoral interconnections and nurtures the development of an ecosystem for circularity, when combined with knowledge, awareness, and education. The Sustainable Development Goals (SDGs) are well aligned to deliver on CE as some of the SDGs focus on resource efficiency, production and consumption practices, and associated environmental impacts.

The key insights from this research emphasise that currently Victoria has some CE engagement, but this is sporadic, and set in a largely linear economic system. There was no consistent understanding of CE among the stakeholders involved in this research. Focus is on end of pipe waste management focusing on recycling, rather than embracing a systemic approach and transition to CE paying attention to re-design, re-purpose and other such higher order R-principles. Some sectors of the state such as infrastructure are using recyclates, showcasing government as a good exemplar that can also influence private industry. Businesses are driven to proactively engage in CE/sustainability for ethical/moral underpinnings, however, financial sustainability is a necessary driver for both private and not for profit businesses. Bringing the technical, financial and social elements to formulate holistic CE solutions are needed, not just focusing on the technical. Clear CE metrics are needed, so policy, business and community share the same goals and can all be fully engaged.

1. Background and introduction

This report presents the first tranche of research undertaken for the Victorian Circular Activator (VCA). The VCA, funded by the Recycling Victoria Innovation Fund undertaking this research, is a product of a partnership formed between RMIT University, Circular Economy Victoria, Swinburne University, City of Melbourne and Planet Ark. The VCA is a physical space to link the existing virtual infrastructure of the Circular Economy Business Innovation Centre (CEBIC) in Victoria and aims to deliver CE outcomes. The aim of the ecosystem mapping undertaken for the VCA is to understand the current CE landscape within Victoria to identify opportunities and gaps that could be harnessed as the State transitions towards CE.

The research method underpinning this study is mixed methods: a combination of desktop research, interviews with key stakeholders and a survey targeted to SMEs. Ethics approval was sought from the University prior to embarking on the research project. A brief introduction to CE from a historical perspective is provided to set the scope for the definition of CE. This is followed by the scope of the research undertaken and a short description of the method adopted for the study. Then, the results are presented, corresponding to the three complementary research methods used. Finally, this report provides the discussion, recommendations for policy alignment, key inflection points between stakeholder and policy necessary for activating CE in Victoria. Future research work emanating from this project is also presented.

2. Circular Economy and its context within Victoria

This section provides a brief introduction to the theoretical and historical backgrounds of CE as a concept and how it has evolved over time. CE definitions for the purpose of this project are identified and the principles underpinning the concept are explained. The general awareness and understanding of CE within Australia and Victoria are also presented.

2.1 Circular Economy – definitions

The concept of CE within academic discourse has been around since the 1960's and was predominantly observed within the then new disciplines of Industrial Ecology and Ecological Economics. Since 2010, the concept has gained traction across industry and legislative authorities mainly due to the work conducted by the Ellen MacArthur Foundation, a charity based in the UK focusing on accelerating the transition to CE.

The underpinnings of CE are to minimize the use of virgin materials and to eliminate waste from value chains through different strategies such as smarter product use and manufacturing, extending product life and useful application of materials through multiple R principles such as "reduce, reuse, recycle, rethink, redesign, and recover" (Naidoo et al., 2021, Potting et al., 2017). CE has also been understood to reduce costs via the efficient use of resources and closed-loop processes. CE contributes to three pillars of sustainability (economic, environmental, and social development), and aids in achieving sustainable development goals (SDG), particularly "SDG6 (clean water and sanitation), SDG7 (affordable and clean energy), SDG8 (decent work and economic growth), SDG12 (responsible consumption and production), and SDG15 (life on land) (Schroeder et al., 2019). In other words, CE is aligned with sustainable development (Schöggl et al., 2020), even though the SDGs do not explicitly mention circularity (Iyer-Raniga and Huovila 2020).

CE can be integrated from the initial stages to the final stages of a production and consumption cycle to keep resources in use for as long as possible. Concepts like circular thinking, circular design, reverse logistics, circular business strategies and material regeneration play a part in these processes. Literature shows that the concept of CE has been applied at both sectoral levels (cross-cutting multiple sectors such as mining, construction, food, textiles, electronics) and regional levels in different countries.

Various definitions of CE currently exist because of the diverse disciplinary background of authors and their focus areas. A commonly accepted understanding of CE is that it provides an alternative to the conventional linear economy (of extraction, production, consumption, and final disposal) to a more

circular system. Although there is still a lack of an accepted definition of CE, it can be interpreted from three core principles of "design out waste and pollution, keep products and materials in use, and regenerate natural systems" (EMF, 2013a).

As a trending topic in both academic and industry fields, agreeing on a clear definition of CE for this study was vital. An initial review of literature was carried out to understand CE definitions from different sources of academic and industry publications and reports (Appendix 1). Two seminal works on CE definitions were identified as being the most relevant and holistic to guide the research presented in this paper. The final definitions of these two papers are complementary to each other although the process used to arrive at these definitions vary. Kirchherr et al. (2017) used a coding approach of 114 previous definitions, while Nobre and Tavares (2021) used a survey of experts within the field. They defined CE as:

"*an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers.*" (Kirchherr et al., 2017)

And

"an economic system that targets zero waste and pollution throughout materials lifecycles, from environment extraction to industrial transformation, and to final consumers, applying to all involved ecosystems. Upon its lifetime end, materials return to either an industrial process or, in case of a treated organic residual, safely back to the environment as in a natural regenerating cycle. It operates creating value at the macro, meso and micro levels and exploits to the fullest the sustainability nested concept. Used energy sources are clean and renewable. Resources use and consumption are efficient. Government agencies and responsible consumers play an active role ensuring correct system long-term operation." (Nobre and Tavares, 2021)

These two definitions were used in a complementary manner to define CE for the purpose of this project.

2.2 Adoption of CE in Australia

The South Australian Government can be credited to be the first mover in Circular Economy in Australia (Downes, 2019). In 2017, the SA Government commissioned research into the benefits of transitioning to a CE and dedicated Green Industries SA to progressing it. The interest and buy-in for a CE, both at national and state levels, have increased recently with challenges faced by the waste and recycling sectors. The Federal Parliaments' House of Representatives Standing Commitee on Industry - Innovation - Science and Resources (2020) adopted an inquiry into and to report on innovative solutions in Australia's waste management and recycling industries. The inquiry was initiated predominantly because of waste import bans from overseas, which resulted in a number of problems faced by the waste and recycling industries across Australia. The committee recommends that the Commonwealth Government in consultation with state and territory governments implement a pathway to a predominantly national circular economy.

Australian waste regulations are the responsibility of state and territory governments, with the federal government having legislative power over areas that affect the entire nation such as external affairs and international trade. With historical reliance of waste exports in Australia, national government policies on trade can have a major influence on waste management at state and territory levels. The overarching policy framework governing waste and resource recovery is the National Waste Policy (Commonwealth of Australia, 2018). The policy outlines roles and responsibilities for collective action by stakeholders and sets targets to be attained at a national level.

The National Waste Policy aims to provide a coordinated, national and common approach to tackling waste issues. This policy has been prepared together by the Australian Government, State and Territory governments and the Australian Local Government Association. The Policy states that it embodies a circular economy, although it includes only a limited number of CE principles relevant to waste, recycling and resource recovery. This highlights the gap in circular thinking at the federal level in Australia.

2.3 CE in Victoria

Impacts from the ban on imports of some waste categories from China led to issues in the waste and recycling sectors in Victoria. This forced practitioners and decision makers to consider different solutions and CE has been regarded as a response to these issues (Otter, 2018). The concept of CE within Victoria is synonymous with waste management and recycling, with much of the push for the State's drive towards CE originating as a solution to waste related issues (The State of Victoria,

2017). The foreword of the Statewide Waste and Resource Recovery Infrastructure Plan states that "increasing the recovery of waste will not only protect our environment, it builds an economy that is circular" (Sustainability Victoria, 2018).

With this drive towards transitioning Victoria to a CE, various policies and roadmaps have been unveiled by government agencies over the last half of the decade. The most significant of these is the Recycling Victoria policy (DELWP, 2020), which represents the Victorian Government's action plan to reform the state's waste and recycling system and transition to a circular economy. The Victorian government also passed the Circular Economy (Waste Reduction and Recycling) Act 2021, which is the overarching legislation for the establishment of a CE in Victoria.

An in-depth analysis of these policies was conducted as part of this project and is covered in Section 6 of this report.

3. Scope of the report

The VCA Project aims to map the CE landscape in Victoria and to create links with the existing digital infrastructure underpinning CE innovation for Victoria. The project creates practical support pathways for CE innovation by connecting businesses, entrepreneurs, researchers, government, and the community to transition to CE through the implementation of CE principles in different contexts of organisations and communities. The project aims to:

1. map the CE landscape across the state to identify opportunities and gaps
2. provide a lighthouse facility for business, government and community partners interested in CE innovation
3. strengthen and complement existing digital CE platforms by providing a physical hub, where stakeholders can come together to create impact
4. empower stakeholders across the economy to capture circular innovation benefits through structured programs and service offerings, focusing on awareness and training, networking, sharing best practices, incubating and accelerating innovative circular business models.

This report details the eco-system mapping that was carried out, which was the first objective of the broader VCA project.

The research objectives of the eco-system mapping project are:

1. to identify a list of critical actors and networks within the Victorian CE ecosystem
2. to understand the enablers and barriers to transition Victoria to a well-developed CE
3. to visually present/map the CE ecosystem
4. to propose recommendations to enable a systemic transition to a CE
5. to validate the developed ecosystem map
6. to develop a living platform for stakeholders to obtain information on the current CE landscape, opportunities for collaboration and business models

The scope of this report covers objectives 1 to 4.

4. Scope of analysis

The main objective of this report is to understand and present a systemic overview of the current CE landscape and how it is evolving within Victoria as outlined in Section 3 above. The research is based on the assumption that a linear and a circular economy are two extremes on a continuum, and a phased transition from the current predominantly linear economy is required to become fully circular.

An ecosystem is defined as a dynamic network of interconnected actors operating within a bounded geographical space (Auerswald and Dani, 2018). The actors and networks within the ecosystem were initially identified through a literature review and the interview process and were limited to actors that have an influence on the circular economy aspect of the economy. The geographic boundary of the ecosystem was determined to be the political boundary of the State of Victoria. Given the highly connected nature of business structures both nationally and globally, ecosystems are classified into a hierarchy of nested geographies of interacting networks (Bailey, 2009). Therefore, other influential national and global actors were considered for this analysis.

The report takes a holistic approach to understand the system and does not focus on a specific sector or industry. This birds-eye-view of the system helps to understand the differences across various sectors and networks within the system and allows for a deep dive into a specific sector or network in the future. Based on the CE definitions identified, this research aimed at understanding the workings of the ecosystem from both macro and micro perspectives. This was done by using two different research methods: interviews to understand the top-down macro level workings and a business survey for the micro bottom-up perspectives.

This report is based on research carried out over a 6-month period, since obtaining human research ethics approval in October 2021.

5. Research design

5.1 Theoretical framework

This research project is based on broad research paradigms from multiple disciplines such as industrial ecology, ecological economics and business economics. The CE ecosystem is assumed to be a complex adaptive system, which is characterized by complex behaviors that emerge as a result of nonlinear spatio-temporal interactions among a large number of components at different levels of organization (Chan, 2001). Economies have long been identified to be Complex Adaptive Systems (Levin, 1998), due to six properties that characterise any economy: dispersed interaction, the absence of a global controller, cross-cutting hierarchical organisation, continual adaptation, perpetual novelty, and far-from-equilibrium dynamics (Arthur, 2018). The analysis thus takes a systems thinking approach by focusing on the system as a whole and the relationships in them rather than analysing individual parts of a system separately.

The research methods and activities undertaken to achieve the objectives are detailed in Table 1.

Table 1 Research methods and outcomes

Objective	Method	Research activity	Outcome
1: Identify stakeholders and roles.	Desktop research	Review research and other sources to identify typical stakeholders, organizations, and factors in CE.	1.1 List of potential actors and networks connected to a CE.
	Desktop research	Identify relevant policies, processes, and stakeholders in the Victorian context	1.2 Systems map of CE Policy landscape
2: Understand drivers, challenges, enablers, and barriers	Desktop research	Understanding global enablers and barriers of CE.	2.1 List of potential enablers and barriers
	Stakeholder Interviews	Conduct interviews with key stakeholders (Industry bodies, regulatory authorities, government agencies etc.)	2.2 Stakeholder map, based on roles and relationships
	Industry Surveys	Conduct questionnaire survey with businesses/industry	2.3 Identify drivers, challenges, enablers, and barriers
3: Visually represent CE ecosystem	Desktop review / context analysis	Understand different methods to illustrate the CE ecosystem, categorisations, and taxonomies	3.1 List of possible methods

	Develop ecosystem map	Develop the ecosystem maps/illustrations for the Victorian CE landscape	3.2 Illustrations to mapping out the CE ecosystem
4: To propose recommendations	Systems analysis	Identify optimal intervention points and strategies	4.1 List of recommendations

The research plan for the project is illustrated in Figure 1. This report is based on the initial research carried out, which is illustrated in the top half of the figure (dashed box), while the next steps would be the validation of the findings and the ecosystem map.

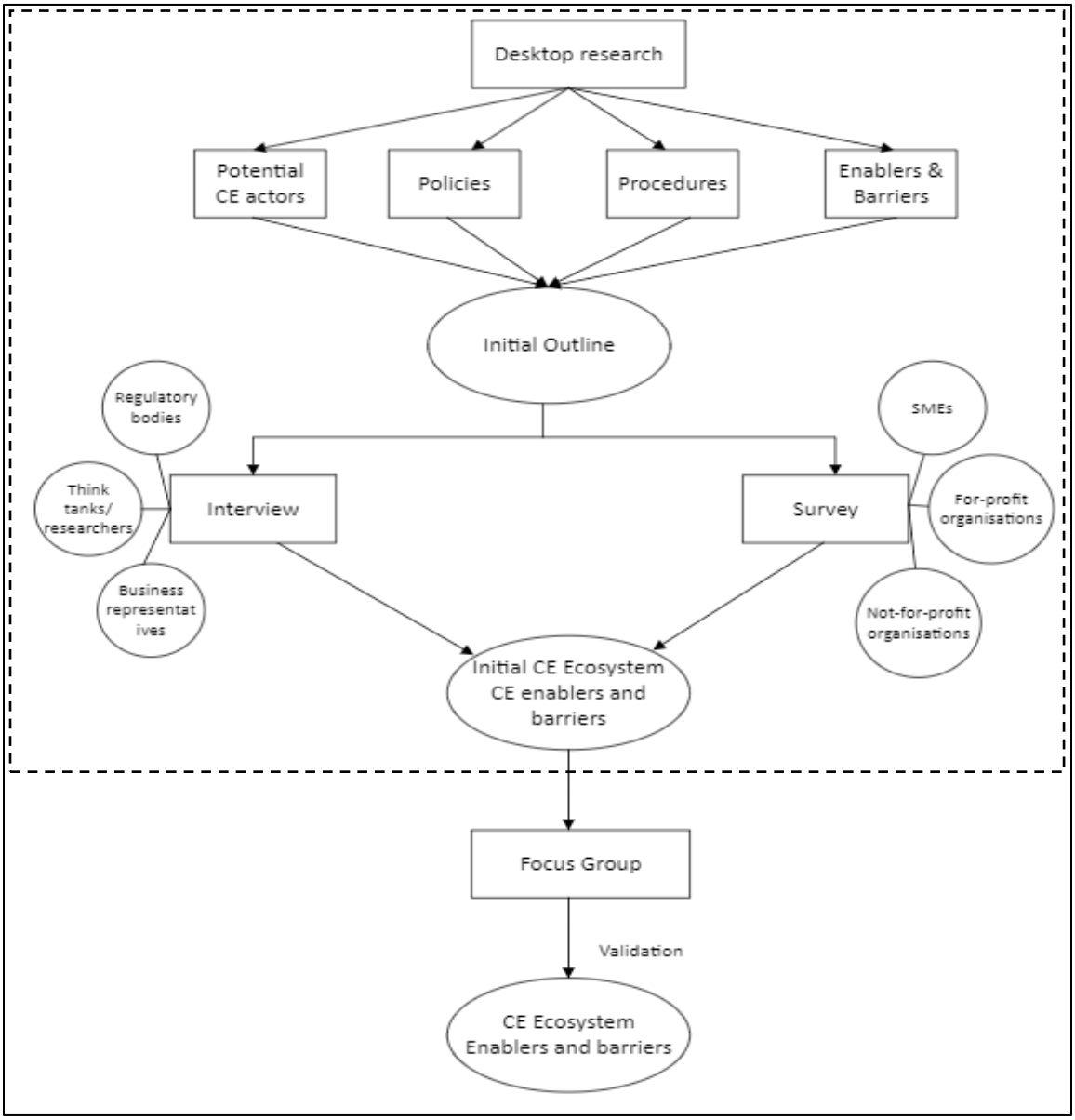

Figure 1 Research process undertaken

The following research methods and activities were designed to achieve the relevant objectives.

5.2 Desktop review

The research commenced with a desktop review of research publications, industry reports, regulations and policies. This step helped to achieve the following outcomes to: understand how CE has evolved in different regions and sectors at a state level and also how it links with the Federal policies, identify actors and networks connected to a Victorian CE (Outcomes 1.1 and 1.2), understand the regulatory and policy frameworks influencing CE within Victoria, indicate possible drivers, challenges, enablers and barriers in a Victorian context (Outcome 2.1) and identify a list of stakeholders to be recruited for interviews (Outcome 1.2). The review also included previous CE ecosystem mapping undertaken to understand pros and cons of such methods (Outcome 3.1), and to select the most suitable mapping methods for this research.

5.3 Interviews

The next research activity was to conduct initial stakeholder interviews with major actors within the Victorian CE landscape. These interviews aimed to capture how CE currently operates, identify significant influential factors and to identify drivers, challenges, enablers, and barriers from the stakeholders' viewpoints. The participants for the interviews were selected based on the list of actors identified through desktop research and included key actors within the Victorian CE such as government departments, councils, industry bodies and selected businesses. The participants were contacted through known networks of the research team and peer-to-peer recommendations using the snow-ball sampling technique.

The interview questions were designed as open-ended exploratory questions. This provided the opportunity for the research team to dig deeper into specific areas of drivers, challenges, enablers and barriers. Semi-structured interviews were used with a clear theme for the list of questions. The questions followed a logical flow: understanding of CE within the organisation, internal drivers and challenges faced when moving towards a CE, external enablers and barriers and changes required for Victoria to transition to a CE (refer to Appendix 2 for Interview questions).

The interviews provided the opportunity to get an in-depth understanding of certain individual perspectives of the CE landscape, that collectively provided a refined view of the current CE ecosystem that was theorised from the literature study and desktop research. The interviews also provided real-life information and up to date methods on CE operations and highlighted some key drivers/enablers/barriers (either reinforcing or contradicting assumptions from literature study and

desktop research). The interviews were also used to analyse gaps between the policy level procedures set out in recycling and CE strategies and the real-life implementation as appropriate.

Table 2 Information of interview participants

Code	Type of organisation	Industry/sector
P1	Industry Association	Waste and resource recovery
P2	Government	Infrastructure
P3	Government	Environment
P4	Local Council	Waste and resource recovery
P5	Business	Construction
P6	Government	Waste and resource recovery
P7	Not for profit	Second-hand markets
P8	Not for profit	Circular Economy
P9	Government	Infrastructure
P10	Not for profit	Packaging
P11	Not for profit	Waste and resource recovery
P12	Local Council	Waste and resource recovery
P13	Government	Design
P14	Government	Environment
P15	Business	Second-hand markets
P16	Government	Business and economics
P17	Government	Waste and resource recovery
P18	Government	Waste and resource recovery
P19	Government	Education
P20	Industry Association	Business and economics
C1	Business	Construction
C2	Business	Construction
C3	Business	Construction

The interview questions were initially structured to identify Political, Economic, Social, and Technological (PEST) factors. PEST was considered an appropriate method as most factors identified in the initial literature review were categorized according to them. The analysis of the interviews showed that environmental factors were an important consideration, especially as a driver for CE activities. Therefore, factors identified through the interviews were categorized based on the Social, Technological, Economic, Environmental and Political (STEEP) factors. Thematic analysis based on the STEEP factors was conducted to identify the major drivers, enablers, barriers and challenges under each category.

5.4 Questionnaire survey

In addition to understanding the key drivers, enablers and barriers identified through the interviews, it was vital to understand how businesses operating within Victoria influence the CE landscape. While the interviews focused on understanding the macro-level operations of the CE ecosystem, the survey intended to gain micro level understanding of business actions related to CE. In order to gain these insights a questionnaire survey was deployed among businesses operating within Victoria to understand their priorities and value systems. The survey helped to gain bottom-up insights on the ecosystem while the interviews focused more on the top-down actions.

The main objectives of the survey were:

- to understand current business practices related to CE
- to identify internal and external drivers for these practices
- to identify challenges to transition to a CE from a business/industry perspective
- to understand what strategies could drive CE transition in the business sector
- to understand the level of awareness of CE within businesses.

The questionnaire survey was designed as a business-oriented survey, with consultation from Business and Economics experts, for it to be easily understood by the business community and to increase participation. The questionnaire was 10-15 minutes in length and was available to be completed online. The survey aimed to receive responses from a wide range of businesses based on their size, industry sector etc. so that comparisons across them could be carried out. The survey was disseminated through industry networks of the project partners and researchers. The questionnaire survey was available online for three and half months and responses received during this time period were collated for analysis (refer to Appendix 3 for the questionnaire).

5.5 Developing the ecosystem map

The outputs from the previous research methods (list of stakeholders and factors, list of enablers and barriers, results from the survey and responses from interviews) were merged to visually illustrate the current CE ecosystem. This process involved actor-network analysis to determine strong and weak links enabling CE production and consumption patterns (Niero et al., 2021). Techniques such as brainstorming, and mind mapping were used to frame and define influential factors and to understand the inter-relationships between factors. The ecosystem was mapped on an interactive mapping tool (Kumu), which would ultimately be a visible, transparent, and actionable platform. The developed

ecosystem maps would be validated as the next steps of the research, through focus group sessions with stakeholders identified from the interviews and questionnaire survey.

The findings of the research are discussed based on the three levels of analysis of an ecosystem: macro, meso and micro. These three levels were identified in the CE definitions as level within the economy that CE operates in (see Section 2.1). For this research, the macro level was defined as the national and state level, meso as industrial regions, individual industry sectors and local government regions, while micro encompassed firms and consumers. The three levels of analysis helped in framing recommendations and conclusions targeting these levels.

6. Regulatory analysis

This section presents the findings of the regulatory and policy review that was conducted at the initial stage of this project.

6.1. List of critical actors

The initial desktop research enabled to develop a list of the major actors within the CE ecosystem in Victoria. This list of actors were mainly government bodies, not-for-profit organizations, industry and professional bodies and think-tanks who were involved in influencing the CE transition. This list of actors (Appendix 4) was used to identify policies and regulations within Victoria, and also to recruit participants for the interviews. The list was continually updated throughout the project and relevant actors were added based on responses from interview participants and cross references from policies. As the focus of the interviews were on the macro-level relationships between networks and large institutions, participants from peak industry bodies were selected instead of individual business firms.

The critical actors within the Victorian CE ecosystem were identified to be environment and sustainability related government agencies. These agencies operate at federal, state and local government levels in creating policies and strategies that are instrumental in shaping Victoria's transition to circularity. Although micro level actions from businesses were seen to take place independently and before any government lead CE strategies were implemented, the government actions aided in increasing awareness of CE and increasing the participation of a wider group of micro level actors.

6.2. Regulatory review

A policy and regulatory review of national and state circular economy policies and other relevant government documents were carried out. This review included legislative instruments such as Acts, policy documents such as government policies, strategic plans, and guidelines which influence Victoria to move towards a CE. Content analysis was conducted to identify relationships between different regulatory documents as well as the areas covered in the regulatory system. Table 3 presents the documents that were identified to be influential for a CE.

Table 3 Regulatory literature analysed

Organisation	Organisation type	Literature	Type of literature
Department of Agriculture, Water and Environment	Federal Government	National waste Policy	Policy
Department of Agriculture, Water and Environment	Federal Government	National waste Policy Action Plan	Strategy
Department of Environment Land Water and Planning	State Government	Recycling Victoria A new economy	Policy
Department of Treasury and Finance (MTIA)	State Government	Recycled First	Policy
CSIRO	Federal Government	A circular economy roadmap for plastics, tyres, glass and paper in Australia	Roadmap
Parliament of Australia	Federal Government	Recycling and Waste Reduction Act 2020	Regulation
City of Ballarat	Local government	Circular Ballarat Framework	Roadmap
Government of Victoria	State Government	Tackling plastic pollution (Statewide ban of single-use plastics)	Policy
Parliament of Australia	Federal Government	Recycling and Waste Reduction (Product Stewardship—Accreditation of Voluntary Arrangements) Rules 2020	Regulation
Parliament of Australia	Federal Government	Recycling and Waste Reduction (Consequential and Transitional Provisions) Act 2020	Regulation
City of Melbourne	Local government	Waste and Resource Recovery Strategy 2030	Strategy
Department of Treasury and Finance (OPV)	State Government	Sustainable Investment Guidelines	Guidelines
Department of Environment Land Water and Planning	State Government	Recycling Industry Strategic Plan	Roadmap
Department of Jobs Precincts and Regions	State Government	State of discovery: Mineral resources strategy 2018–2023	Strategy
Parliament of Victoria	State Government	Environment Protection Act 2017 (No. 51)	Regulation
Sustainability Victoria	State Government	Statewide Waste and Resource Recovery Infrastructure Plan	Strategy
Waste and Resource Recovery Groups	State Government	Regional Waste and Resource Recovery Implementation Plans	Strategy

Department of Environment Land Water and Planning	State Government	Integrated Water Management Framework for Victoria	Strategy
Melbourne Water	State Government	Melbourne Sewerage Strategy	Strategy
Department of Agriculture, Water and Environment	Federal Government	National Plastics Plan 2021	Policy
Sustainability Victoria	State Government	The Path to Half: Solutions to halve Victoria's food waste by 2030	Report
Parliament of Victoria	State Government	Circular Economy (Waste reduction and Recycling) Bill 2021	Bills
Dept of Agriculture, Water and Environment	Federal Government	Australasian Recycling label	Program
Parliament of Victoria	State Government	Environment Protection Regulations 2021	Regulation
Department of Economic Development, Jobs, Transport and Resource	State Government	Helping Victoria Grow: Extractive Resource Strategy	Strategy
Barwon South West WRR Group	State Government	Barwon South West Waste and Resource Recovery Implementation Plan	Strategy
Gippsland WRR Group	State Government	Gippsland Waste and Resource Recovery Implementation Plan	Strategy
Goulburn Valley WRR Group	State Government	Goulburn Valley Waste and Resource Recovery Implementation Plan	Strategy
Grampians Central West WRR Group	State Government	Grampians Central West Waste and Resource Recovery Implementation Plan	Strategy
Loddon Mallee WRR Group	State Government	Loddon Mallee Waste and Resource Recovery Implementation Plan	Strategy
Metropolitan WRR Group	State Government	Metropolitan Waste and Resource Recovery Implementation Plan	Strategy
North East WRR Group	State Government	North East Waste and Resource Recovery Implementation Plan	Strategy
Government of Australia	Federal Government	Recycling and Clean Energy: National Manufacturing Priority Road Map	Roadmap
City of Greater Geelong	Local government	Environment strategy 2020-2030	Strategy

Parliament of Victoria	State Government	Planning and Environment Act 1987	Regulation
Parliament of Victoria	State Government	Sustainability Victoria Act 2005	Regulation
Parliament of Victoria	State Government	Transport Integration Act 2010	Regulation
Parliament of Victoria	State Government	Local Government Act 1989	Regulation
Parliament of Victoria	State Government	Climate Change Act 2017	Regulation
Department of Environment Land Water and Planning	State Government	Victorian waste to energy framework	Framework
Department of Jobs Precincts and Regions	State Government	Advancing Victorian Manufacturing A blueprint for the future	Strategy

The major findings from the desk top review are presented below.

6.2.1. Alignment of government policy targets between federal and state level

An analysis of the desktop research revealed that there was hierarchical alignment of the different CE and waste related policies across the different levels of government. Measurable targets at both national and state levels focus on waste reduction and waste avoidance. Victorian waste diversion targets have an alignment with the federal waste diversion targets. The Victorian per capita waste reduction target is more ambitious than the national target, illustrating that Victoria aims to be a leader in driving down waste generation.

Table 4 National and state policy targets

	National target	State target
Waste export	Ban the export of waste plastic, paper, glass and tyres, commencing in the second half of 2020	
Waste reduction	Reduce total waste generated in Australia by 10% per person by 2030	Cut total waste generation by 15% per capita by 2030.
Waste diversion	80% average resource recovery rate from all waste streams following the waste hierarchy by 2030	Divert 80% of waste from landfill by 2030, and an interim target of 72% by 2025.
	Halve the amount of organic waste sent to landfill by 2030	Halve the volume of organic material going to landfill between 2020 and 2030, with an interim target of 20%t reduction by 2025. Ensure every Victorian household has access to food and garden

		organic waste recycling services or local composting by 2030.
Use of recylate	Significantly increase the use of recycled content by governments and industry	
Waste avoidance	Phase out problematic and unnecessary plastics by 2025	
Data and policy	Make comprehensive, economy-wide and timely data publicly available to support better consumer, investment and policy decisions	

A key target driving waste reduction is the national target to reduce waste generated by 10% per person by 2030. However, the action plan states that the definition of per person will be "informed by analysis of any potential unintended impacts on waste reduction initiatives from growth in construction and infrastructure developments". This indicates that the national waste reduction target focuses mainly on MSW rather than broader waste generation. It should be noted that although per capita waste generation in Australia declined by 3.3% between 2007 and 2020, C&D waste increased by 32% on a per capita basis (Pickin et al., 2020). Given that Victoria's waste related targets, are intended to compliment the national government targets, it could be assumed that the State targets are more focused on MSW rather than total waste generated.

The Recycling Victoria Policy identifies the role that increased construction and infrastructure can play on the total amount of waste generated. Although no state target exists for the use of recylate in government projects, the Recycled First Policy of the Major Transport Infrastructure Authority focuses on increasing the use of recyclate in government infrastructure projects. This shows the hierarchical nature of the waste policies across different levels of government.

The national waste targets are based on the 2018 National Waste Report (Pickin et al., 2018). Analysis of this report shows that some waste items like end-of-life vehicles (ELV), are not specifically addressed. Comparison of annual waste generation in Australia with other OECD countries shows that total waste in UK and Norway include ELVs. The ELV management in Australia is driven by economic mechanisms, with no existing national legislation related to ELV disposal (Soo et al., 2017). This exemplifies that defining and scoping what is included in the definition of waste is important for target setting processes.

Targets are not the broadest or top elements in the policy hierarchy as all aspects covered in a policy cannot be tangibly measured or expressed as targets. However, given the socio-political tendency to measure policy outcomes through quantifiable targets, including a narrow set of waste related targets in policies can have a negative influence on a systemic transition required to achieve circularity. These targets can also influence why CE is perceived to be a recycling strategy among non-experts as explained in more detail in latter parts of this report.

6.2.2 Waste crisis is the main policy driver

The drivers for developing most governmental CE policies were identified to be the broader waste management crisis experienced across Australia. This mainly stemmed from the waste import bans especially from China and other resulting issues, like stock piling of recyclables and waste management companies closing down. The policy goals, therefore, mainly focus on reducing the amount of waste going to landfill and reducing the reliance on foreign markets to process waste. The waste export bans for selected waste categories will force increased local processing of waste. The need for increased local processing of waste and the use of recyclate within the Australian economy could shift the focus from conventional waste management to more circular approaches. This can be beneficial in getting initial traction of the move towards a CE. However, continued and increased use of recyclate in local manufacturing will only be a sustainable solution if manufacturing capacity within the state is expanded.

6.2.3 Uneven weighting between CE principles

The focus of the policies and targets were analysed against the 3 common CE principles and the R principles of the waste hierarchy. The 3 CE principles are:

- Eliminate waste and pollution (design out waste)
- Circulate products and materials (at their highest value)
- Regenerate nature

Assessing the CE policies against these principles show that there is an uneven focus of the policies across them, with a high focus on circulating materials. Although, the CE principles mentioned above like eliminating/designing out waste, circulating products and regenerating nature have been identified as key principles within these policies, clear targets or strategies to achieve such goals are not specified in the policies.

Assessing the policies against the R principles shows that the focus is recycling and recovery, which are lower order waste strategies as defined by Potting et al, (2007). These strategies focus on the useful application of materials. If Victoria is to transition to a more CE, then targets to eliminate waste and extend product life need to be included. A glaring point is that Victoria's CE Act is named as Circular Economy (Waste reduction and recycling) Act, which shows the focus of CE legislation is on end-of-pipe solutions for waste. Possible reasons for this uneven weighting between CE principles were uncovered through the interviews and is explained in Section 7.2.

This review highlighted that most policies are aimed at moving towards a Recycling Economy rather than a CE. A recycling economy is defined as a system where waste is systematically collected, processed and re-used at the national level and is characterized by design for recycling principles, reverse distribution and manufacturing based on recycled material (Balkau, 2005). Although recycling economies have significant benefits at a local level, they are only a step change move away from a typical linear economy. Such solutions tend to ignore negative impacts arising from global production systems, supply chains and consumption patterns, which need to be considered in a more mature CE.

6.2.4 Incorporating wider economic and environmental targets

Although all CE policies identify the wider economic and environmental benefits of moving to a CE, targets or metrics to measure such benefits have not been identified. The Recycling Victoria (RV) policy as well as the Circular Economy Act have aims of transitioning to a CE. RV states that moving to a CE enables economic growth and job creation. However, economic growth is typically measured through the narrow lens of GDP, which identifies growth as the increase in production and consumption. GDP is thus a metric suited to measure the size of a linear economy and not that of one which is circular. An effort to measure benefits or impacts of a CE through linear economic models is contradictory. However, given that GDP is a widely used metric across the socio-political landscape, using this metric to create buy-in for the CE concept may have short-term benefits. The inclusion of economic benefits such as employment opportunities and increased per capita income could be metrics that could be used in future iterations of the policies.

Another policy level target that could be included is carbon emission related targets. Although the CE policies identify that moving to a CE has benefits of reduced carbon emissions no measurable targets related GHG emissions were set. The emission reductions are to be achieved through the diversion of organic waste from landfill rather than reduced production and consumption. Given that better management of production and consumption systems could result in lower carbon emissions, CE

strategies could be used as a major driving force for State level carbon targets set out by the Climate Change Act 2017. Inclusion of carbon emission metrics, especially embodied (scope 2&3) emissions and those related to wider production and consumption within the economy could also enable to increase higher level R strategies, which focus on keeping products in use for longer.

The definition of waste in the Environment Protection Act 2017, includes "matter, including solid, liquid, gaseous or radioactive matter, that is deposited, discharged, emitted or disposed of into the environment in a manner that alters the environment; a greenhouse gas substance emitted or discharged into the environment". However, the focus of the waste and CE policies are mainly on solid waste, with little mention about liquid waste or greenhouse gases. With increased public awareness on global warming, the use of GHG emissions as a standard metric to assess environmental impacts has increased. Therefore, including greenhouse gas reduction within CE and waste policies can also enable higher acceptance of these policies across the socio-political spectrum.

6.2.5. Opportunities for government policies

The regulatory review demonstrated that other related government policies covering climate change, water and sewerage could be aligned and integrated together with CE policies. These different policies are fragmented across different agencies while implementation of them is uncoordinated. A barrier to aligning them would be the segregated nature of the government entities overseeing these areas (Melbourne Water, Recycling Victoria etc.) and the different acts that regulate them (Circular Economy; Water; Climate Change Act etc.). It also shows the opportunity to increase the cooperation amongst different levels of government (federal, state and territories) as well as state departments, local government authorities (LGAs) to work beyond environmental portfolio and considerations.

Besides easing the burden of the waste crisis, other socio-economic benefits of CE need to be highlighted in CE policies. One such example is the financial benefits of using recyclate, which can cost lower than virgin material, in manufacturing processes. Such substitution of material reduces the mining of virgin materials leading to the reduction of environmental impacts and the longer use of such virgin resources in applications where recyclate use is not feasible. It also contributes to the equality in resources access for subsequent generations which is highlighted in the aims of CE and sustainability. In addition, CE policies need to stimulate broader CE principles such as designed-led products that consider the entire life cycle of the product in design. Inclusion of such aspects within CE policies will provide the full view of CE and enable a more holistic transition of business and communities to circularity.

7. Interview results

This section presents the findings of the interviews carried out as part of the study. Two separate analyses were carried out: to identify the broader understanding of CE and to identify the major enablers and barriers within the ecosystem to move towards CE.

7.1. Understanding of CE

The responses from the participants on their organisation's and the wider society's understanding of CE were compared with the two definitions of CE used for this project (see Section 2.1). The coding was carried out in an inductive manner based on core principles and aims of CE. As participants were not asked to define CE but to explain what CE means within their organisations, arriving at a clear definition based on verbatim responses to this question was contentious. To address this issue, participant responses throughout the interview were analysed for cues regarding their understanding of the CE concept (Kircher et al., 2017).

The broader understanding of CE was assessed against four criteria identified within the definitions: systems perspective, R principles, processes, and the aims of CE. Table 5 shows how the interview findings compare against the academic definitions of CE. The responses from interviewees focused on waste and recycling. Some participants were able to describe CE aligning with CE academic definitions. However, it is clear that their descriptions were affected by the context of their organisation's mission and vision. Some organisations understood their position and role in the CE supply chain and highlighted their contributions to CE transition. They noted the partnerships that they had and the benefits that they received from these collaborations. They also pointed out the limitations that they were looking forwards to changing in their operation.

Comparing the systems' perspective, it was identified that CE was understood to be a concept covering the waste system or at its very broadest, encompassing the industrial system. This was in contrast to the academic definitions which consider CE being a much broader economic system. Differences in the R principles were also evident through the interviews. CE was understood to be focusing on lower order R principles like recycling and recovery, which look at the useful application of materials. A more developed definition, however, focuses on higher order principles from refuse to recover, with a recent move towards regenerating natural systems. Figure 2 shows the main R principles that are understood to be part of CE.

Table 5 Comparison of academic definition of CE against common understanding based on interview findings

	Interview findings	Academic definitions
Aims	Sustainability focus: economic, environmental and social	Environmental, social and economic prosperity
Systems perspective	Waste / industrial system	Economic system
R Principles	Focus on R8 (recycle) and R9 (recover); useful application of materials.	R9 (Recover) - R0 (Refuse) move towards regenerate
Processes	Focus on production and consumption, less on extraction	Entire production system; extraction, production, consumption and disposal

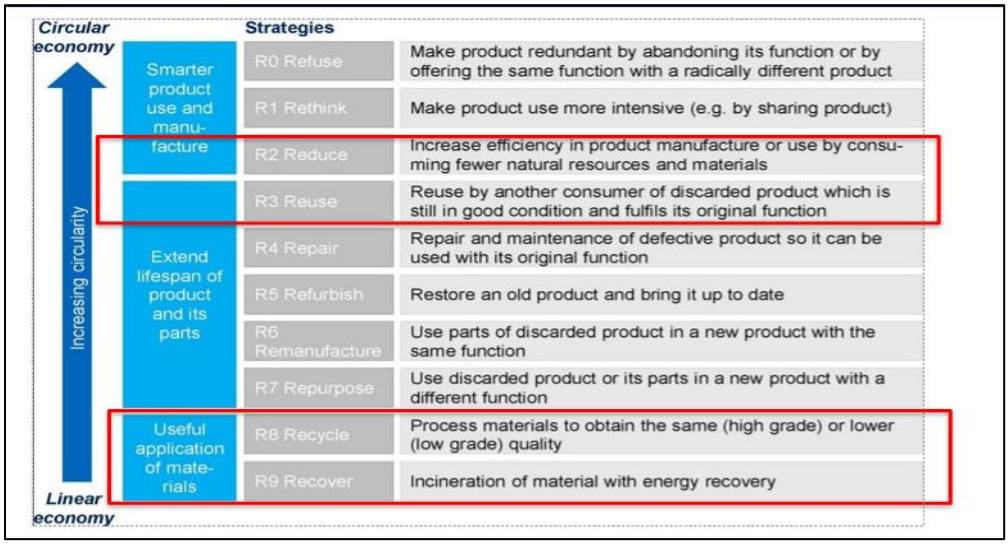

Figure 2 Main R principles that are focused on

Source: Adapted from (Potting et al., 2017)

There was more commonality with the processes involved and the aims of CE. The interviews illustrated that the processes mainly focused on production and consumption with a lack of focus on extraction. This may be a result of the initial understanding of CE to be more of a waste systems approach, given the current milieu in Victoria within which this discourse is situated. However, there was consistency with the final aim of CE being understood as achieving sustainable outcomes. Interestingly, a participant noted that sustainability should not be the final outcome, but that it should be regeneration, as sustainability is the bare minimum requirement to support future generations of humans on the planet.

The interviews demonstrate that there are a wide range of CE interpretations. It was learnt that although CE may not be fully understood by non-experts, awareness of the CE concept is increasing.

However, there is still a gap in CE principles implemented. Recycling and recovering, as well as reducing and reusing outweigh other R-principles (see Figure 2). It shows an opportunity to apply more CE principles to oganisations, such as design-led products and regeneration. It is also necessary to have a common understanding of CE amongst businesses and communities which can be improved throughout government policies and education programs.

7.2. CE drivers, challenges, enablers, and barriers

This section presents the main drivers, challenges, enablers and barriers of CE identified through the interviews. The terms drivers and challenges are used in the historical sense to understand what factors drove the selected organisations to implement CE strategies and what challenges they faced in such a situation. Enablers and barriers are more forward-looking and aim to understand what factors could help propel a move towards CE and what could impede it. There were overlaps between enablers and barriers, as they are two sides of the same coin. Some factors if implemented could be considered an enabler, while the lack of it could be considered a barrier.

The interplay between these factors is illustrated in Figure 3.

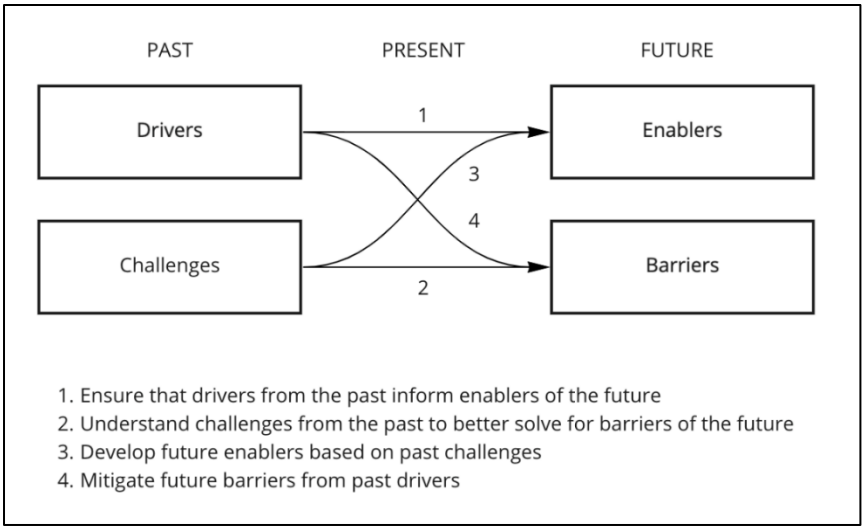

Figure 3 The relationship between drivers, challenges, enablers and barriers

The interview questions were initially structured to identify Political, Economic, Social, and Technological (PEST) factors. The interview responses were analysed and showed that environmental factors were also an important consideration, especially as a driver for CE activities. The factors identified through the interviews were categorized based on the Social, Technological, Economic, Environmental and Political (STEEP) method for analysis.

Thematic analysis was employed to identify and analyse patterns of meanings from participant responses to CE drivers, challenges, enablers and barriers. Interview recordings and transcripts were analysed to identify factors under the five broad STEEP categories. These factors were then grouped into broader themes for a more in-depth thematic analysis to be conducted. A total of 276 factors were identified from interviews across all STEEP categories and were organised and clustered into 73 themes. The findings from this thematic analysis are presented below. The figures below show the major factors and number of respondents who identified each factor.

7.2.1. CE Drivers

The key drivers for organisations to take the initial step towards CE were waste related issues (waste strategy, waste management and generally, the waste crisis), market considerations (business mindset, leadership and market growth) and financial benefits (business sustainability and commercial viability). Other factors such as education, regulatory environment and financial support were also identified by participants.

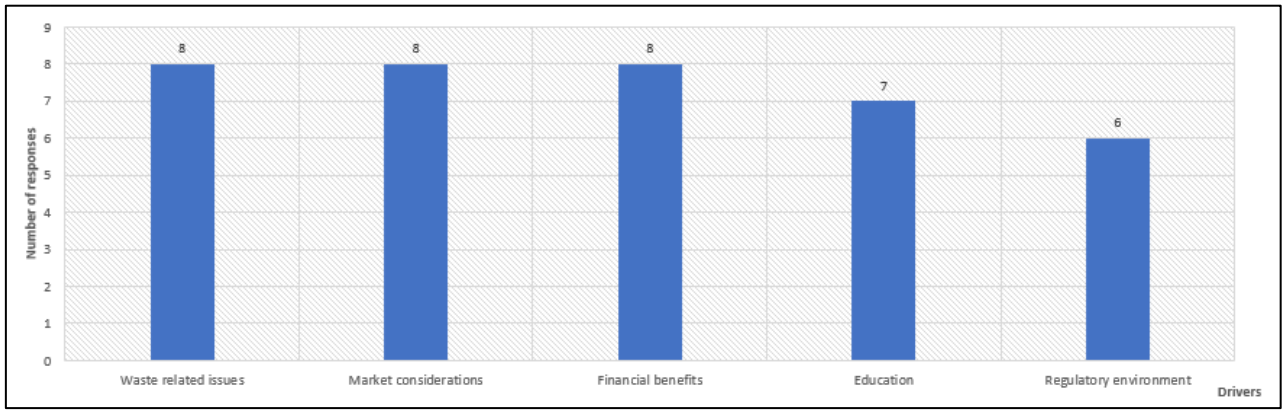

Figure 4 Top CE drivers within Victoria

a. Waste related issues

A number of interviewees reported waste related issues being a key driver to embark on the CE journey. The waste crisis as a major driver was identified mostly by government organisations which resulted in a government lead strategy to transition Victoria to a CE. The main waste related issues were the waste import bans by Asian countries, stock piling of recyclables and recyclers closing operations. Government policies such as Recycling Victoria, the Recycled First Policy and related legislation (CE Act 2021), were cited as results of this. Participants mentioned that there were multiple drivers at a macro-level but the intensification of the waste crisis led to its expedited adoption.

"*...there was a crisis in Victoria's waste sector with international forces beyond our control, particularly China's national sword policy… This crisis… determined some of the timing.*" - P3

b. Market considerations

Interviewees underlined that market consideration was another key driver for moving towards CE. There were market opportunities for incorporating circular business models, especially for businesses that were well established and used advanced technologies to aid them in this transition. Participants mentioned that Australia historically has had a good market for second-hand goods, through op-shops and the collection of used goods left out for council collection, showing that CE aspects have been a part of the Australian culture.

"*Shifted away from saying second hand to using pre-loved and unwanted so the items have had greater value. [It helps] to reduce the stigma of being second-hand*" - P15.

Participants mentioned that there was a social stigma around reuse and recycled markets and there was market opportunity once marketing and advertising identified these issues. Based on P15's response, the organisation is in CE transition and is involved in the recycling and reuse aspects of the CE. This organisation aims to increase market share through "breaking down the stigma around second-hand products" by using terms of "preloved or unwanted" rather than second-hand or reuse.

" *[The organisation] has been a leader in a lot of sustainability areas throughout the years.... so [jt could be] a driver to transition to CE.*" - P12.

c. Financial benefits

Many interviewees noted that financial benefits are a driver for CE transition. These interviewees were mostly business sector/industry participants and emphasised that these benefits were mostly from cost differences between virgin materials and recycled materials.

"*The whole process started with recycling of asphalt and there are environmental benefits of that, the biggest one being is that you don't have to import bitumen from overseas… It means you don't have to mine oil and don't have to process it in Singapore, don't have to ship it back to Australia and transport on roads. That's the biggest carbon saver for us and it also saves us money.... So if we can reuse other materials that are a lot cheaper than virgin materials … it saves money.... that was probably one of the main drivers.*" - P5

The interviews also showed that social or community organisations whose primary motive was social benefit, incorporated CE related activities due to the financial benefits they posed. It could be

identified that CE related activities will not be carried out even if it was a core organisation activity currently if it did not have a financial benefit.

7.2.2. CE challenges

The interviewees were asked what challenges their organisation faced in moving towards CE. The main challenges identified by participants were clustered around three main themes: lack of awareness on CE, financial issues, and organisational structure.

Figure 5 Top CE challenges identified

a. Lack of understanding of CE

A number of interviewees admitted that the lack of understanding of CE was an initial challenge to move away from the linear economy. The lack of knowledge on CE principles and its benefits, was seen to negatively impact on internal leadership and mindset required to develop any CE strategies in an organisation.

Participants highlighted that improving organisation's CE awareness could increase organizational capability for creating the environment that favoured the CE transition.

"*it's really about educating the whole [organization] and having that capability uplift.... There can be good understanding… at the officer level [but not so much] at the executive level*" - P4

The lack of understanding of the CE concept was identified to have a limiting effect on the scope of the CE policies and strategies that were developed. As the broader understanding of CE was thought to be "*recycling plus*" this was identified as a reason for the focus of CE related regulations was on recycling of materials.

"*It's immature, in the sense that our approach to circular economy is still right at the bottom of… the waste hierarchy… We're still talking about recycling, and we're still talking about… having different bins [for waste separation]*" – P4

b. Financial viability

Interviewees noted that financial issues were another challenge that they faced when deciding to incorporate circular business models. Financial issues were primarily around the short-term financial viability of circular business practices, even though it was understood that the same practices may have a longer-term return on investment. This issue was highlighted by both for-profit as well as not-for-profit organisations. It was understood that all organisations, even those that don't have a profit motive, will adopt an initiative only if it is financially viable.

"*Our organization is a very commercial organization. Our executive is really focused on outcomes that are not strictly about... the services that we offer. There's a lot of other attention that they pay to running the organisation as a business*" - P4

And

"*So why should you become a circular economy, and framing that in terms of…. not because you like the environment and want to be good in the world, but in terms of viability and long term cost. And how can you in the long term, deliver services to the community when you understand that you need… to shift your understanding of supply chains and design, and end of life use so that you can achieve better return on investment.*" - P4.

c. Organisational structure

Interviewees mentioned that conventional organisational structures werecone of the challenges as this factor highly impacted the organisational changes required to developing strategies and goals. The siloed organisational structure was understood to inhibit broader organisational level change that was sometimes required to move towards circularity. Such bureaucracies were identified mainly within government organisations, where each department would have separate and sometimes competing objectives. As discussed in section 6.2, these competing priorities within government bodies were seen as one reason for some CE policies being narrowly focused on recycling and resource recovery.

"*that's a mind [set] shift, isn't it?... I wouldn't say it's widespread yet because people need convincing that it's going to make economic sense*" - P8

7.2.3. CE enablers

All participants described that the regulatory environment plays an enabling role to operationalize CE, while collaboration was identified by more than half the responses as an enabler.

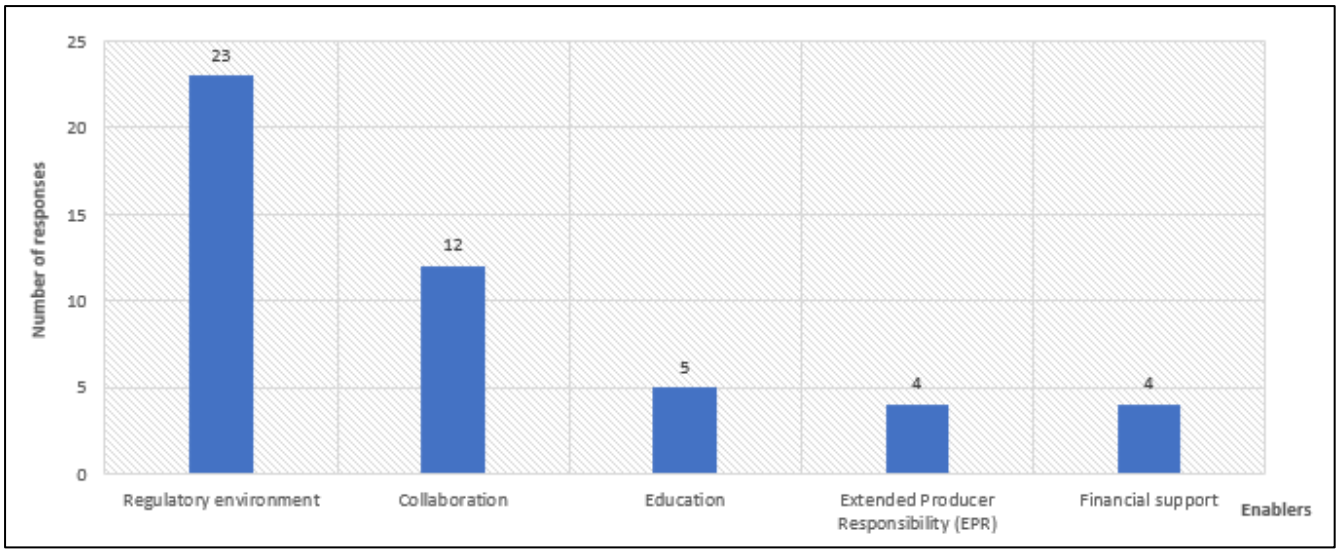

Figure 6 Top CE enablers identified

a. Regulatory environment

The most important enabler identified by all participants was the regulatory environment. Interviewees clearly identified the Recycling Victoria policy together with other national and state regulations like the product stewardship program and Circular Economy Act which could be considered a force to systemically move Victoria towards CE. Victorian CE policy was seen to aid wider organisational buy-in both within government organisations and in private entities. Actors who wanted to make changes within agencies viewed the CE policy as a top-down enabler to obtain the support of others, who are typically considered laggards.

"*This circular economy [act] and the new authority will help this. Bringing together those sort of clusters, but in a more localized way where there's smaller facilities dotted around the place will really support that localization of processing [and] manufacturing opportunities that doesn't exist at the moment, but the industry is really moving towards that*." - P12

"*If certain parameters are laid down, the stronger and broader they can be, the more everyone has to play by the rules*" - P17.

Regulations were seen as an important method to drive the entire system as it was understood that actors who have a willingness to move towards CE would do so, even without regulations. Participants

mentioned that the regulatory instruments can have a wider reach, which will enable a more systemic transition.

"*If you don't have the regulation, then it's all pushed by... the biggest players [who] are international companies. All those international companies are set up in Europe. [They] have strong laws, they're not just going to change [how things are done] in [Europe], they are going to change the entire model [globally]. So, we are going to get it, but it's going to take time.*" - P18

Regulations, standards and guidelines were seen to have a strong impact in enabling a systemic transition from linear economy to circular economy. It plays an important role to bring the correct orientations and instructions to businesses and communities to achieve the stated goals rather than letting the standards be decided by businesses or market players. Such standards and guidelines were assisted in setting the minimum boundaries for the market, which would not happen if simply left to market forces. Regulations thus can be used as an early intervention strategy to shift thinking of the system and to guide the organisations towards an optimal CE.

b. Collaboration

The next factor identified by a majority of the participants to be an enabler for CE transition was collaboration. They described that collaboration could support businesses in different phases of supply chains to achieve CE targets.

"*Collaboration is probably one of the formulas for success.... We're a charity which means that we can get funding.... but we take a partnership approach to everything whether it is our supply chain, customers ... We've codesigned supply chain arrangements with customers so that it best meets customers' needs. We're solving a business problem, so we need to collaborate with them and codesign with them.*" - P11.

Collaboration was identified as a key enabler both across government entities and between business entities. Information sharing across these entities was identified to be of importance. Government sector participants highlighted how a whole-of-government approach when developing regulations helped in creating the required momentum at an early stage.

"*so lots of departments had views on what our circular economy and waste strategy should be, and all of them were aired out... [The process needs] to build that kind of momentum and support within government for circular economy.*" P4

7.2.4. CE barriers

The key barriers that were identified by participants were the lack of specific guidelines, negative perception of CE and financial challenges. These barriers are discussed in more detail below.

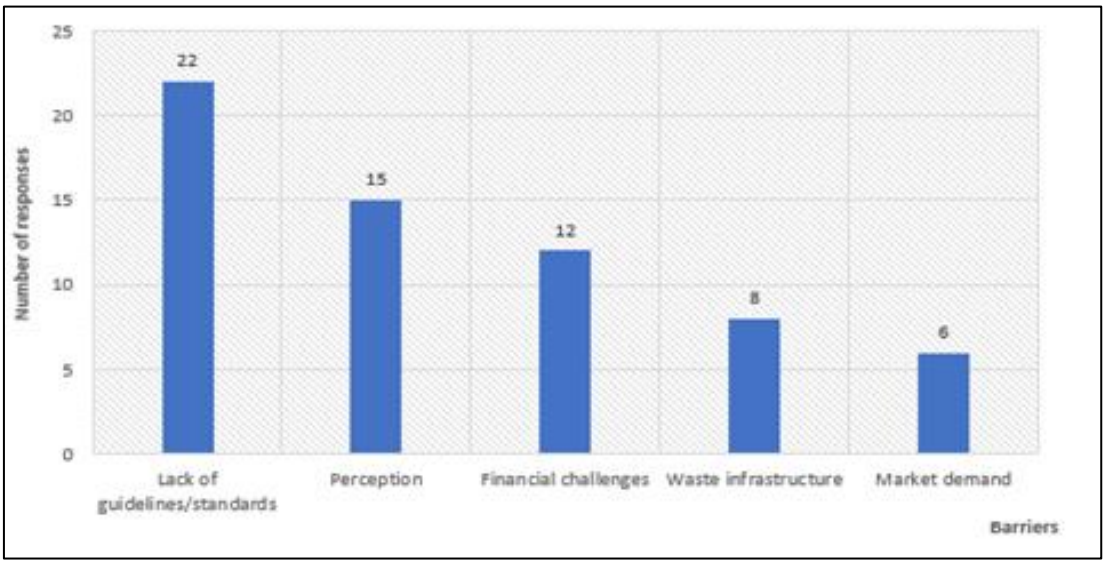

Figure 7 Top CE barriers identified

a. Lack of specific guidelines/standards

Although government policy positions were seen as an enabler, the lack of prescriptive guidelines and standards was considered a barrier. As the targets within policies were waste oriented, this was seen as a barrier to incorporate more holistic CE actions. Some interviewees noted that some standards were "old" and unable to capture changes made through a transition to CE overtime, especially with the use of recycled materials in the construction industry.

"*[There is a] need to reform and update [regulations] for reflecting more performance based rather than prescriptive [standards]*" - P2

"*Recycled asphalt lacks specification standards*" - C3

Interviewees also mentioned that regulatory instruments can have unintended consequences. The increase in the waste (landfill) levy was pointed out by some, who mentioned that this caused an increase in illegal dumping and contamination of recyclables. Such unintended consequences can impact the financial viability of businesses who need to deal with them. Other examples of legislation that was seen to have unintended consequences were ban of e-waste going to landfills and waste export bans.

"*Sometimes the unintended consequences of some policies can hurt charities. For example, the E waste ban in Victoria… What that led to was people dumping E waste on charities. And then we've got it and it's like, well, what do we do with it?*" - P7

b. General perception of CE being synonymous with waste

The common understanding that CE relates to a waste management strategy and the negative social perceptions around waste were identified to be a key barrier. Participants mentioned that there is a disconnect between understanding of CE among sustainability experts in contrast to practitioners and decision makers within other sectors. This was a major barrier to moving towards a more systemic economic wide transition that is necessary.

"*I think the biggest barrier is going to be really changing people's view from waste to... Circular [economy principles which are] …. more about product and design and move up the hierarchy [towards] repair and longevity*." - P12

As described in section 6.1 the common understanding of CE was seen as "recycling plus", which limits the move from lower order recycling and resource recovery to higher order strategies like redesigning products and creating new business models. Increased education and awareness on CE both within organisations and for the general public was understood to be a good strategy to overcome these barriers.

"*A lot of the time, the barrier is knowledge... the understanding of how you can use some wasted resource and change your feedstock and produce the same type of materials that meet specifications is not completely understood by businesses.... Using soft plastics for asphalt or construction is not something that everyone knows or that everybody has the money to invest in research to make that change.... They want to get on their jobs and not lose their markets or …. just keep going the way that it is.*" - P18

c. Financial challenges

Responding to the CE barriers, interviewees underlined that financial viability was essential for CE initiatives. Although grants and funding are available for businesses and communities to apply for, some issues relating to time considerations, lack of awareness on funding opportunities and limited access were seen to be challenges.

"*A lot of the [grants and funding] are only open for a very short amount of time … that could be improved … by the time [businesses] find it, it is only few days left.*" - P20

Current investment analysis tools used by businesses were also identified to be a barrier in implementing circularity. It was pointed out that most investment analysis tools were based on linear economic thinking and unable to show CE contributions in the project feasibility hence these tools were not catered to assess circular business models. Therefore, businesses are required to come up with innovative techniques to prove the financial viability of some circular business practices.

"*Projects go through business case stages which inform the budget.... if the business case design is like a reference design and isn't undertaken with lateral opportunities, then the budget won't meet [the purpose] …. therefore, it is important [for it] to be embedded early on*." - P13

The financial outlay required for embarking on CE was mainly obtained from grant funding and balance sheet funding. As a result, it was mainly orgnisations that could access such funding that were able to take an initial step towards CE. Involving financial institutions like the banking sector through innovative financing options, like those seen for climate financing, could be a considerable way to overcome some of these challenges.

7.3. Matrix of CE drivers, challenges, enablers, and barriers

STEEP factor analysis was used to categorise the drivers, challenges, enablers and barriers identified through the interviews. The categorisation of factors helped to identify which factors can be focused on by different organisations to enable a smooth transition to CE. The STEEP matrix can also be used by decision makers to develop varied intervention strategies targeting these different categories.

Based on the matrix, it can be seen that the major influential factors of CE are not solely technical aspects. Most of the significant factors identified fall under economics and political categorisation, as CE is also responding to the economic milieu. Regulatory factors were identified to be cross cutting across challenges, drivers, enablers and barriers. This finding aligns with the desktop review, which found that Victoria's transitions towards CE was driven mainly by the waste management regulations and policies with the aim of resolving the issue of a waste crisis. The Victorian government at various levels have put more effort to transitioning Victoria to being more circular using different approaches of regulatory mechanisms as well as grants and funding.

Table 6 STEEP Matrix of CE drivers, challenges, enablers and barriers based on interviewee responses

	Drivers	Challenges	Enablers	Barriers
Social	• Increased employment	• Lack of understanding of CE	• Reputation as a leader within society • Increased awareness of CE and the need to act • Collaboration across entities	• Social attitude towards waste • COVID impact on consumption patterns • Perception of CE being synonymous with waste • Resistance to change
Technology	• Lack of local recycling infrastructure leading to increased government investments	• Linear supply chains and infrastructure •	• Circular design techniques	• Lack of collaboration between manufacturers and recyclers • Archaic waste and recycling infrastructure
Economic (including financial)	• Increase in GDP due to circular activities • Financial benefits of circular business models	• Lack of financial viability • Financial and economics systems that are inherently linear • Conventional organisational structures	• Market demand for recycled products • Government financial support for businesses	• Lack of financial viability of circular business models
Environment (Including sustainability/ ESG/CSR)	• Waste crisis within Victoria • Potential environmental and sustainability benefits		• GHG Emission reduction potential through CE	
Political (including regulatory)	• Government priority as shown in government policies	• Higher order CE principles are not fully covered in policy targets.	• Industry standards and guidelines	• Lack of an accepted metric/indicator to measure CE

8. Survey results

This section presents the results of the survey conducted for business entities with the objective of identifying the main organisational drivers, enablers and barriers for them to move to more circular business practices. The survey is a bottom-up approach for comprehending business drivers in the context of CE transition and aimed to obtain information from a wide range of businesses. The survey was available online for 3.5 months from mid-November 2021 to March 2022 and was distributed using different channels. A total of 157 responses were recorded during this period, of which 33 responses were excluded from analysis as respondents were not owners or managers of a business in Victoria.

8.1. Participant information

Of those respondents who were employees, the majority (64%) were senior managers within the business. More than 80% of the respondents had at least over a year of experience while over 45% had more than 3 years' experience within the business, which meant that they would have a relatively good understanding of the business drivers.

8.2. Organisational background

A very diverse range of businesses took part in the survey. A majority of the businesses were Pty Ltd companies with others being mainly sole proprietorships or partnerships. The number of publicly listed companies taking part in the survey was limited probably due to their national presence.

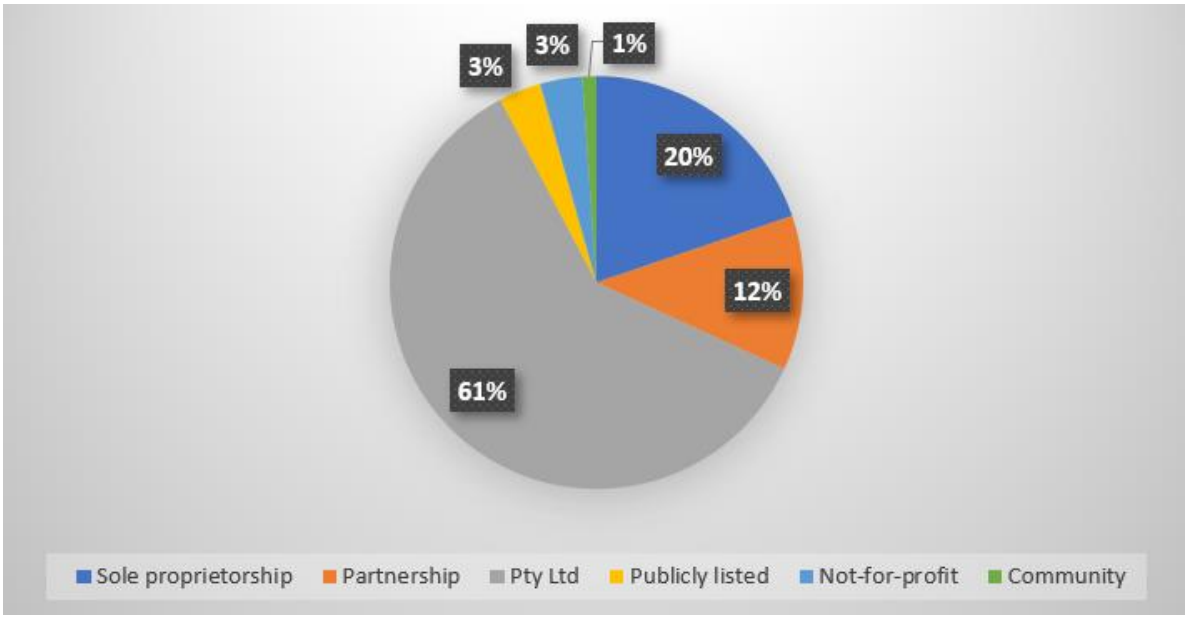

Figure 8 Breakdown of survey respondent based on business type

Table 7 Respondents industry sector

Industry sector	Percentage of responses
Manufacturing	21.43%
Retail Trade	17.86%
Accommodation and Food Services	9.52%
Construction	7.14%
Electricity, Gas, Water and Waste Services	4.76%
Wholesale Trade	4.76%
Public Administration and Safety	2.38%
Education and Training	2.38%
Other Services	2.38%
Agriculture, Forestry and Fishing	1.19%
Information Media and Telecommunications	1.19%
Financial and Insurance Services	1.19%
Administrative and Support Services	1.19%
Health Care and Social Assistance	1.19%
Arts and Recreation Services	1.19%

Most of the organisations were within the manufacturing sector (21%), retail trade and accommodation and food services accounted for 18% and 10% of the responses respectively. These responses reflect the current business diversity in Victoria which is very strong on manufacturing industry and retail.

Over 3/4 of the responses were from SME's with organizations employing less than 20 employees and earning an annual revenue of less than AUD 10 million. Large businesses employing more than 200 employees and earning an annual revenue of above AUD 250 million accounted for less than 10% of the responses. However, given that the majority of the businesses in Victoria are SME's this sample was considered representative of the entire business population (Business Victoria, 2019).

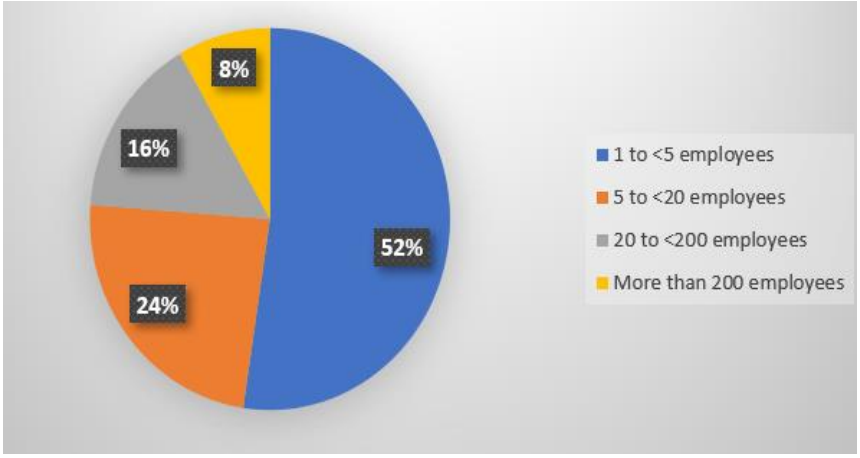

Figure 9 Number of employees

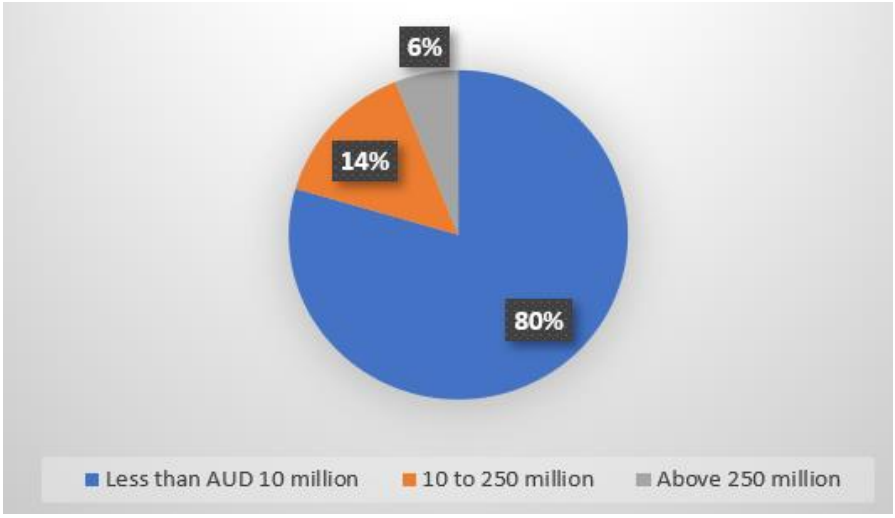

Figure 10 Annual Turnover

8.3. Individual drivers and motivations

The major drivers and motivations for starting a business or to be employed in this business were identified through the survey. Two separate questions for business owners and employees in management positions were provided. For business owners, participants were asked about the motivation that made them start their business.

"Desire to own my own business" was the highest factor selected by 57% of the respondents. The next factors were "Expertise in the area" and "Make a difference to society" at 43.33% and 41.67% of respondents respectively. The lowest factor selected by participants was "Inherited from family or previous owner" at only 1.67% of participants. This shows that businesses were driven by clear motivations by owners rather than inheriting the business historically.

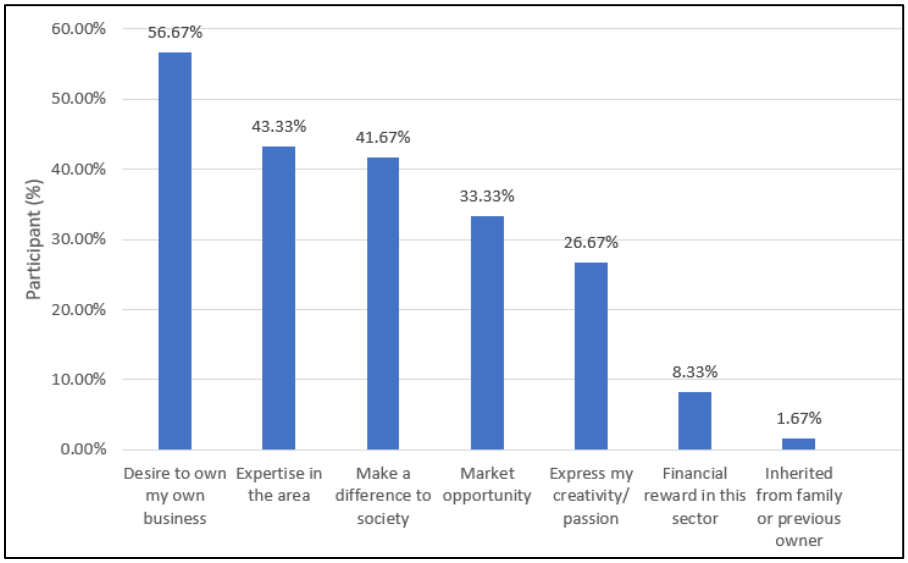

Figure 11 Motivation to start the business

For employees in management positions "This organisation or industry aligns with my passion/values" was the most selected factor (57.14% of respondents). The other common factors that were chosen were "expertise in management or operation, technical expertise in this sector and personal challenges", 28.57% for each of these options. It could be seen that employees tended to select the business they work in based on how it aligns with their values, while for owners, it was mostly about having autonomy and owning their own business.

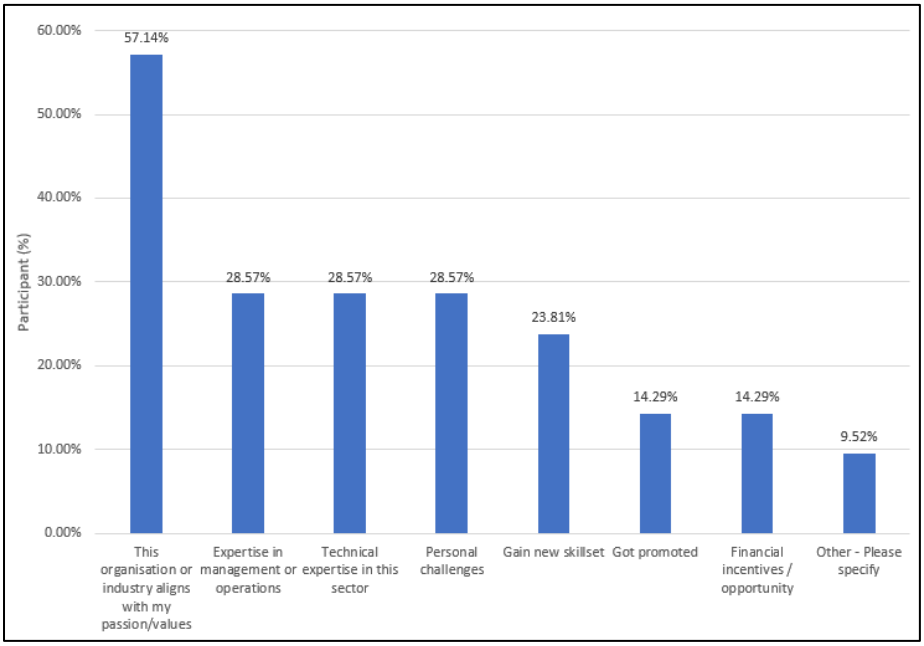

Figure 12 Motivation to take current role

8.4. Business objectives in an organisation

Survey participants were asked about the major organisational objectives to understand the main driving forces for businesses. Participants were provided with a list of potential objectives, where they could select multiple objectives relevant to their organisation. Participants were then asked to rank the selected objectives. The rankings were used to calculate a rank sum score, which ranked the objectives based on all participant responses and rankings. A higher rank sum score means that the given objective was selected and ranked the highest.

Interestingly, the top three objectives are Sustainability impact (2.92 rank sum score), Financial return (2.42 rank sum score) and Customer satisfaction (2.12 rank sum score). Although sustainability impact was ranked highest, it should be noted that the type of organisations responding to the survey may have been those which have a higher affinity towards sustainability. The next three objectives were financial return, customer satisfaction and product quality. The high rank of financial return as a business objective resonates with the interview findings that financial viability was a key factor driving circular business models. If circular models are to be widely accepted showing their viability through current financial tools will be necessary and perhaps, become the key platform for businesses to consider changing to practices supporting transitions to CE.

Another method would be a customer-driven approach as customer satisfaction was also a key driver. It could be inferred that if customer demand for more circular products or services was available, businesses would invariably adopt such practices.

The lowest ranked objectives were Corporate social responsibility (0.51 rank sum score), Shareholder returns (0.44 rank sum score) and Exploit market opportunity (0.40 rank sum score). The low rank of shareholder returns as opposed to the high rank of financial return was identified. This may be mainly due to the low number of publicly listed companies responding to the survey. All the publicly listed companies gave a rank of 2 or 3 to shareholder return emphasizing that financial returns were an important consideration.

Table 8 Major business objectives

Objective	Rank sum score	Rank
Sustainability impact	2.91	1
Financial return	2.42	2
Customer satisfaction	2.12	3
Product or service quality	1.82	4
Social or Community impact	1.63	5
Product or service innovation	1.31	6
Create employment opportunities	0.71	7
Market share: growth or retention	0.57	8
Create a positive work culture	0.54	9
Corporate social responsibility	0.51	10
Shareholder returns	0.44	11
Exploit market opportunity	0.40	12

8.5. Considerations of CE or environmental sustainability in an organisation

The survey asked participants if their organisations considered CE or environmental sustainability in business decision making. 35.33% of participants noted that they considered CE and environmental sustainability in most cases while just over 5% of participants responded that the organisations did not consider environmental impacts at all or that they were unsure about it (see Figure 12).

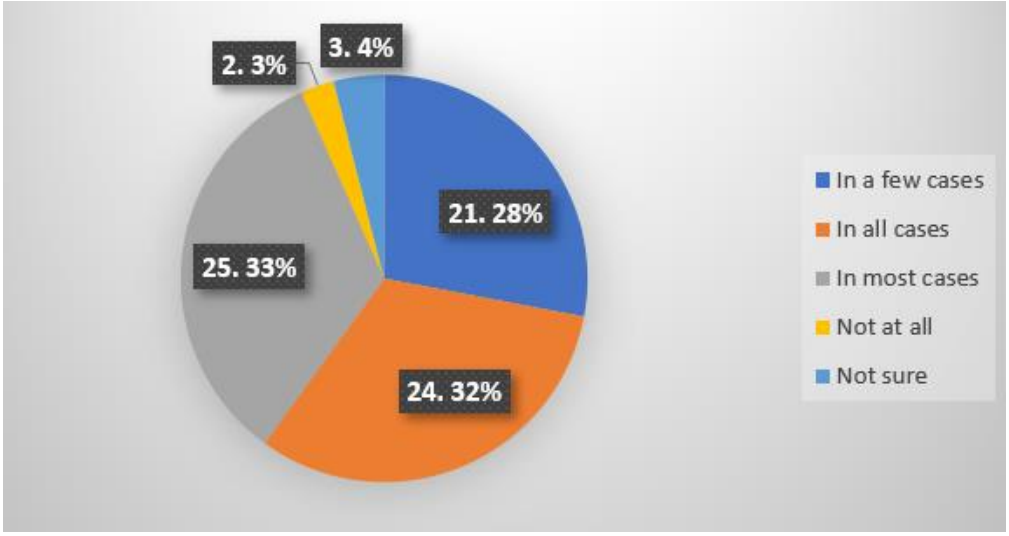

Figure 13 How often are environmental impacts considered in business decisions

More than half the respondents mentioned that the organisation has a specific environmental or CE related strategy. Such policies were seen to focus mainly on eliminating or reducing waste and carbon-

emissions. This shows that although most organisations may not have a clear environmental related strategy, environmental impacts are considered in operational decision making.

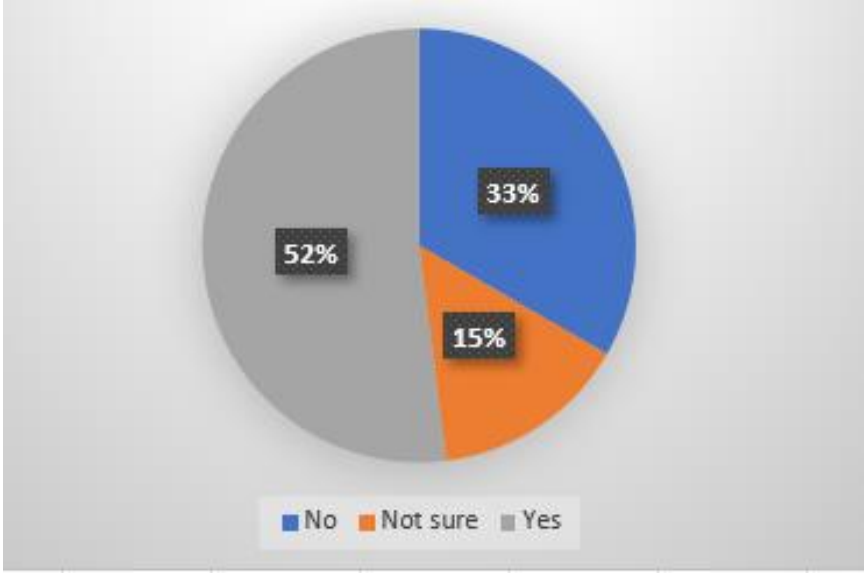

Figure 14 Use of organisational environmental strategies/policies

8.6. Taking CE or environmental sustainability related actions

The most common environmental actions adopted by businesses were recycling of waste and reducing energy or water use within business operations. Although recycling was selected as the most common action, it can be deduced from the responses that the term recycling may have been understood loosely to mean separation of waste rather than technical recycling operations or focusing on other forms of waste processing. The reason for this is that only 21.88% of the organisations that selected this option were manufacturing organisations, while the vast majority were service sector organisations. Technology innovations and redesigning products or processes featured at the lower end of environmental actions. Based on these responses it could be argued that organisations are mostly involved in lower order waste recovery strategies.

Table 9 Environmental actions taken within the organisation

No	CE/environmental sustainability actions	% of participants
1	Recycling / Upcycling waste	68.57%
2	Reducing energy or water use	65.71%
3	Using recycled materials or products	55.71%
4	Use of recyclable or compostable packaging	52.86%
5	Repurposing / reusing / extending product life / durability	48.57%
6	Reducing carbon emissions	42.86%
7	Develop sustainability and / or circular economy strategy / policy	40.00%
8	Technology innovations	40.00%
9	Redesigning products and processes to be less material intensive	34.29%
10	Redesigning products to be recyclable	25.71%
11	None of them	2.86%

8.7. Drivers for implementing CE/environmental sustainability initiatives

In the survey, participants were asked what drives their organisation to implement these initiatives. Amongst 17 drivers provided, the top three factors were “The right thing to do” (4.33 rank sum score), “Climate/social conscience” (2.99 rank sum score) and “Entrepreneurial/business opportunities” (2.09 rank sum score). It could be seen that moral or ethical obligations were the main driving force for implementing sustainability initiatives. Typical market-related drivers like financial return, industry trends and marketing were ranked lower. This was in contrast to the general business drivers identified earlier which saw financial return as a major business driver.

Table 10 Drivers to implement CE/environmental sustainability actions

Drivers	Rank sum score	Rank
The right thing to do	4.33	1
Climate / social conscience	2.99	2
Entrepreneurial / business opportunities	2.09	3
Business strategy / organisational policies	1.96	4
Leadership / strategic commitment	1.95	5
Client or customer demand	1.70	6
Part of business objectives	1.52	7
Corporate social responsibility (CSR) / Environmental social governance (ESG)	1.45	8
Part of the product / service model of the business	1.45	9
Technological opportunities / Innovation	0.94	10
Government policies / regulations	0.83	11
Financial return	0.76	12
Keep up with industry trends	0.42	13
Supply chain imperatives / Reverse logistics	0.36	14
Marketing	0.30	15
Employees' request	0.13	16

8.8. Future CE and Environment related initiatives that are planned

Survey participants were asked what future actions would be taken in the next 1-2 years in their organisation regarding CE or environmental sustainability. The highest selected responses were reducing energy or water use and improving awareness on environmental sustainability. More than half of the businesses that were currently implementing actions identified that future actions will revolve around developing company policies related to sustainability or CE. This illustrates that companies are taking action even without clearly documented company policies.

Table 11 Environmental actions that will be implemented in the near future

Future actions towards CE or environmental sustainability	Percentage of responses	Ranking
Reducing energy or water use	60.87%	1
Improving environmental sustainability / circular economy awareness	60.87%	2
Develop sustainability and/or circular economy strategy/policy	52.17%	3
Using recycled materials or products	49.28%	4
Recycling/upcycling waste	47.83%	5
Repurposing / re-using / extending product life / durability	40.58%	6
Use of recyclable or compostable packaging	37.68%	7
Redesigning products or processes to be less material intensive	36.23%	8
Redesigning products to be recyclable	30.43%	9

8.9. Barriers for implementing CE/environmental sustainability initiatives

Besides the drivers, participants were also asked about barriers faced in implementing CE or environmental sustainability practices. The most significant barrier was "Upfront costs/financial considerations", which had a rank sum score 3 times that of the second ranked barrier. The second ranked barrier, lack of viable business models could also be closely linked to financial considerations. This illustrates that even though the main driver for implementing sustainability actions was not financial return, if such actions were not financially viable businesses may be reluctant to implement them. One participant also mentioned that a barrier related to lack of viable business models was implementing circular designs in a linear economy, highlighting the barrier faced as a result of current economic models.

Other barriers included supply chain related factors (infrastructure and networks and limited coordination across supply chains), and customer related factors (lack of customer demand and customer resistance to change). As customer satisfaction and product and service quality were identified as major business drivers, customer-related impacts may also drive businesses to implement more circular practices.

Table 12 Barriers for implementing environmental actions

Barriers	Rank sum score	Rank
Upfront costs / financial considerations	5.22	1
Lack of viable business models	1.85	2
Infrastructure and networks	1.58	3
Lack of customer demand	1.26	4
Limited coordination across supply chain	1.09	5
External / customer resistance to change	1.05	6
Industry guidelines / standards	0.89	7
Too complicated	0.79	8
Lack of awareness internally within the organisation	0.61	9
Circular economy/ environmental sustainability is not core business	0.59	10
Lack of interest	0.42	11
Internal resistance to change	0.27	12

8.10. Enablers for implementing CE/environmental sustainability initiatives

Considering enablers for the CE/environmental sustainability implementation, the survey asked participants to indicate factors that enable this implementation. Based on the results, the most important enabler was financial incentives (80% of participants). The next important enablers were business collaboration to close the loop (60% of participants) and relevant regulations (55.38% of

participants). The most insignificant enabler was better enforcement of regulations (29.23% of participants).

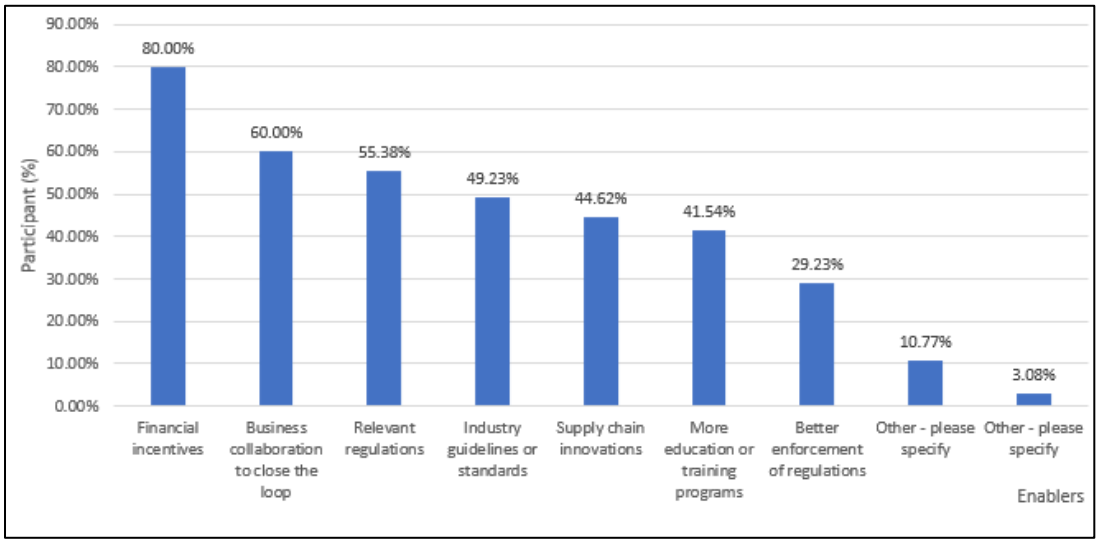

Figure 15 Enablers to implement CE/environmental sustainability initiatives

8.11. CE/environmental sustainability journey in an organisation

The survey aimed to understand CE journeys in Victorian businesses with the question of "How far along the journey of CE or environmental sustainability is your organisation?". Interestingly, 40% of organisations claimed they were "Progressing well" while only 11% of organisations stated they had "Not started yet". In addition, 12% of organisations professed they were "An industry leader".

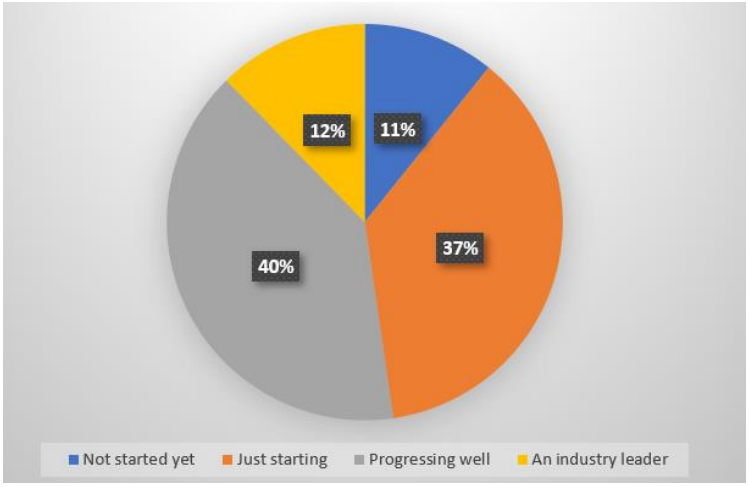

Figure 16 CE/environmental sustainability journey within the organisation

8.12. Environmental issues relevant for individual businesses

The next section highlighted environmental issues that organisations deemed to be relevant to their industry or business. Nine environmental issues were provided in the survey for participants to select and rank based on their importance. Waste management was the highest ranked environmental issue, while energy use and climate change followed next. It was identified that the focus of the survey may have had an influence on some of these selections. However, given that energy use and climate change ranked highly, awareness on how CE related actions could mitigate energy and GHG related issues could help business managers and owners to take further environmental actions.

The least important issue was identified to be biodiversity and ecology. The lack of importance given to this issue may also be a reason why regeneration of natural ecosystems was not considered a vital aspect of the CE.

Table 13 Environmental issues relevant for businesses

Environmental issues	Rank sum score	Rank
Waste management	3.28	1
Energy use	1.96	2
Climate change	1.55	3
Resource extraction / material use	1.26	4
Carbon emissions	0.86	5
Water use	0.68	6
Water pollution	0.50	7
Air pollution	0.20	8
Biodiversity and ecology	0.15	9

8.13. Optional survey section – CE and businesses

The questionnaire also included an optional section for participants to respond specifically on CE related aspects within the business. The objective was to identify the level of CE knowledge within business and CE strategies adopted. A vast majority of the respondents to this section mentioned that they were knowledgeable about CE. This was not surprising since most participants taking this optional section were assumed to be those who understand CE at least to some degree. Although CE knowledge of the participants was at a high level (as asserted by them), the adoption of CE practices was not as high. Just over 50% of the organisations had adopted CE related practices. However, it was identified that there was similarity between those respondents who said their organisations were somewhat knowledgeable and those that had somewhat implemented such practices.

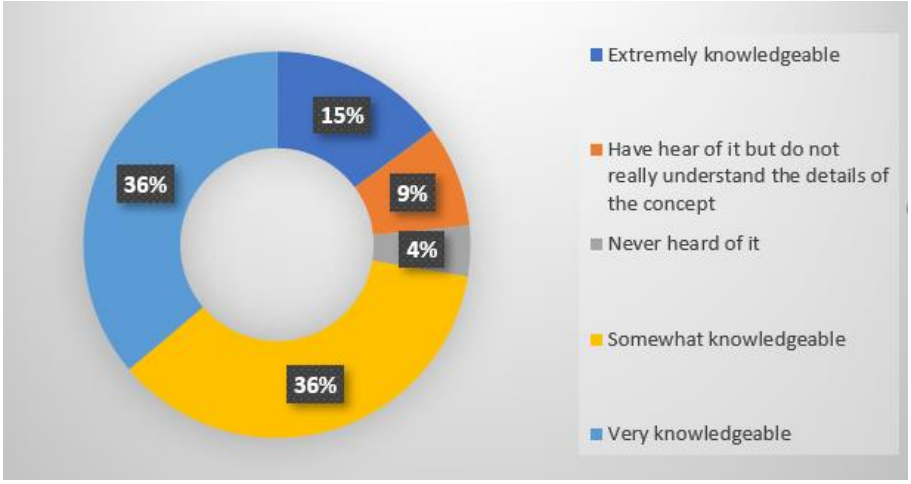

Figure 17 Respondents' knowledge on CE

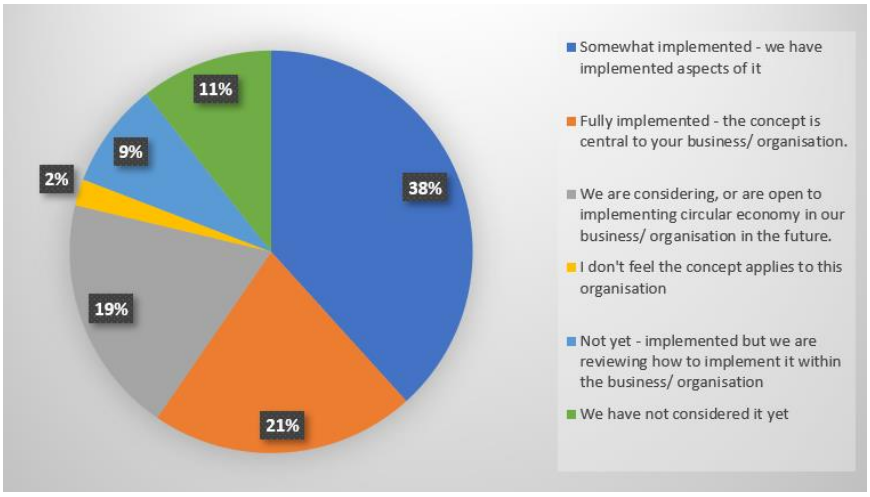

Figure 18 Implementation of CE principles in the organisation

8.13.1. Understanding of CE

In order to glean respondents understanding of CE and how it has been implemented in their organisations they were asked to select at least three words that best described CE related practices within their organisation and then rank them according to the importance of the selected words to CE business strategy within the organisation. The highest ranked words that were linked to business CE strategies were identified to be sustainability and environmental sustainability. While considered together with the interview findings it could be posited that CE was being used to achieve sustainability related outcomes.

The next most important aspects were closing the loop and recycling, illustrating that recycling and resource recovery were synonymous with CE. Participants were also allowed to provide words of their

own. Some participants used words like systemic, dynamic and socio-economic, which shows that they saw CE as a more holistic systemic concept.

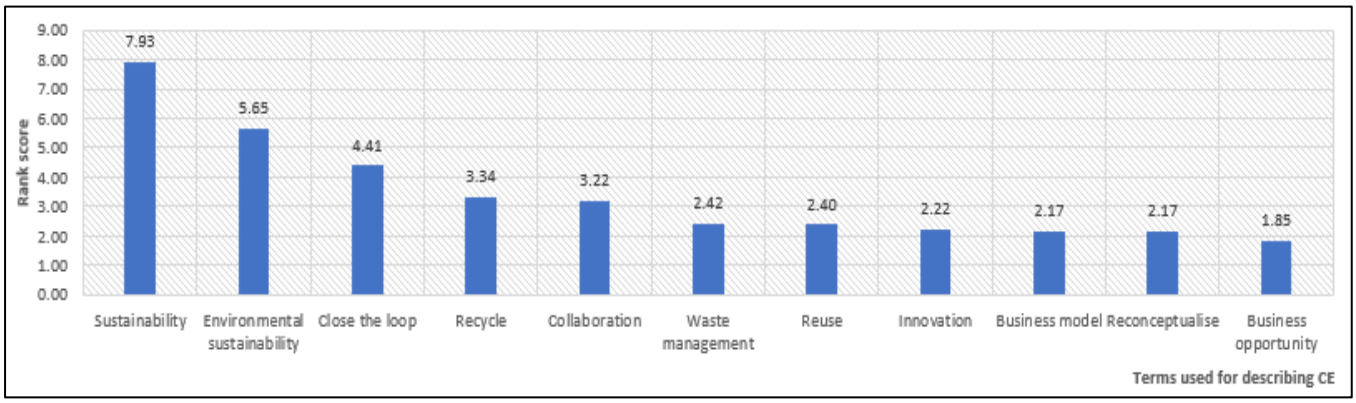

Figure 19 Common terms that best describe CE within the organisation

8.13.2. Organisational CE strategy

Participants were asked about the existence and maturity of CE strategies and awareness in their organisation. Five options were provided for participants to select. 31% of participants noted that CE strategy was "Very advanced – CE as the core of organisational business" while 15% of participants stated that it was "Advanced - More than 50% of employees are aware of CE". There was still a high percentage of participants who reported that "CE is still new and hasn't been applied in the organisation yet", at 20% of participants.

Although over 45% of the responses mentioned that the awareness of CE was very high (CE as the core of the business and more than half of the employees are aware), only 21% of the businesses had fully implemented the concept within the organisation. This shows that there is still opportunity for implementing circular business strategies within organisations that are highly committed to such goals.

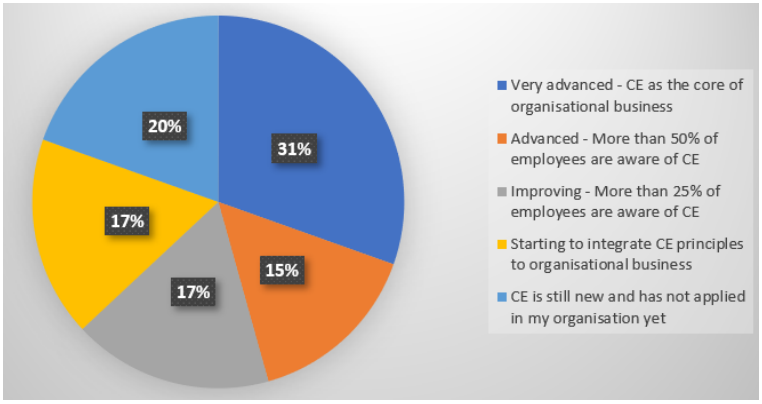

Figure 20 Implementation of CE within the organization

8.13.3. Organisational changes for CE transitions

Responding to the question of "What changes has your organisation made to move towards CE?", the top three organisational changes were "Engaging in partnerships or networks that promote CE" (61.70% of participants), "Educating staff about CE" (53.19% of participants) and "Using information about CE in communication with existing and/or future customers" (48.94% of participants).

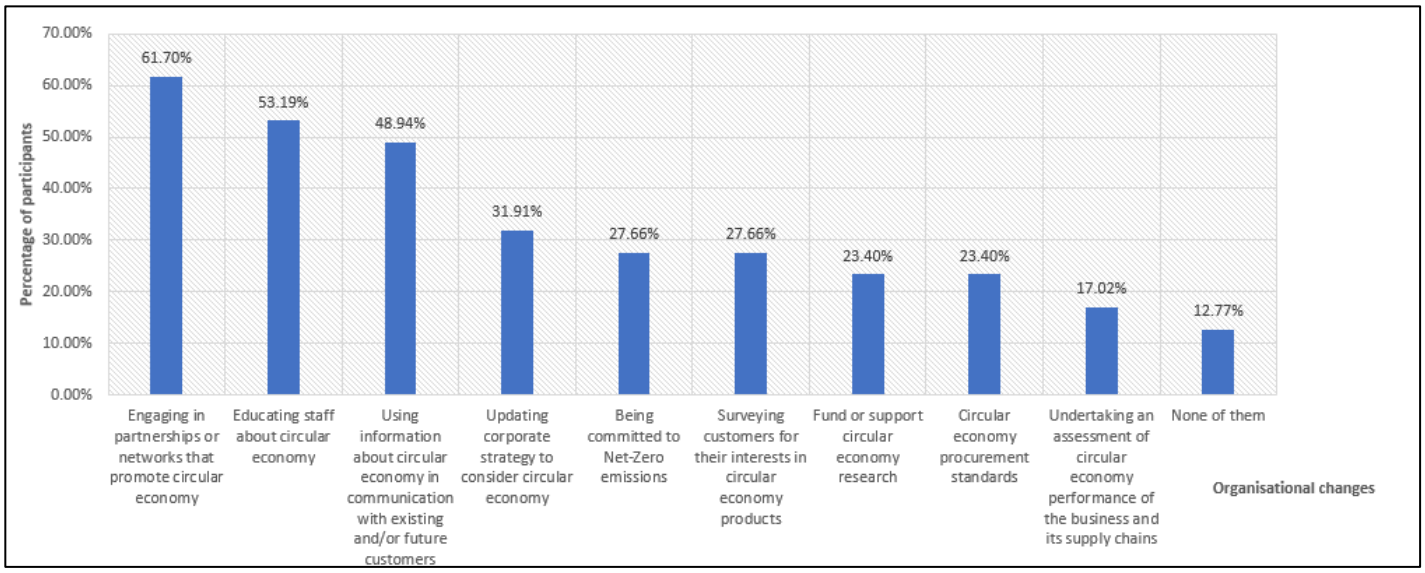

Figure 21 Organisational changes to move towards CE

These responses illustrate that even for organisations that see the core of their business to be circular, they are still at a very early stages of implementation. Most of the initial work involved building awareness across stakeholders and developing partnerships.

8.13.4. Organizational role

Participants were asked to select or fill in the role their organisation plays within the CE ecosystem. A supply chain role was selected the highest (25.58%). The next ones identified were Facilitator (23.26%) and Enabler (20. 93%).

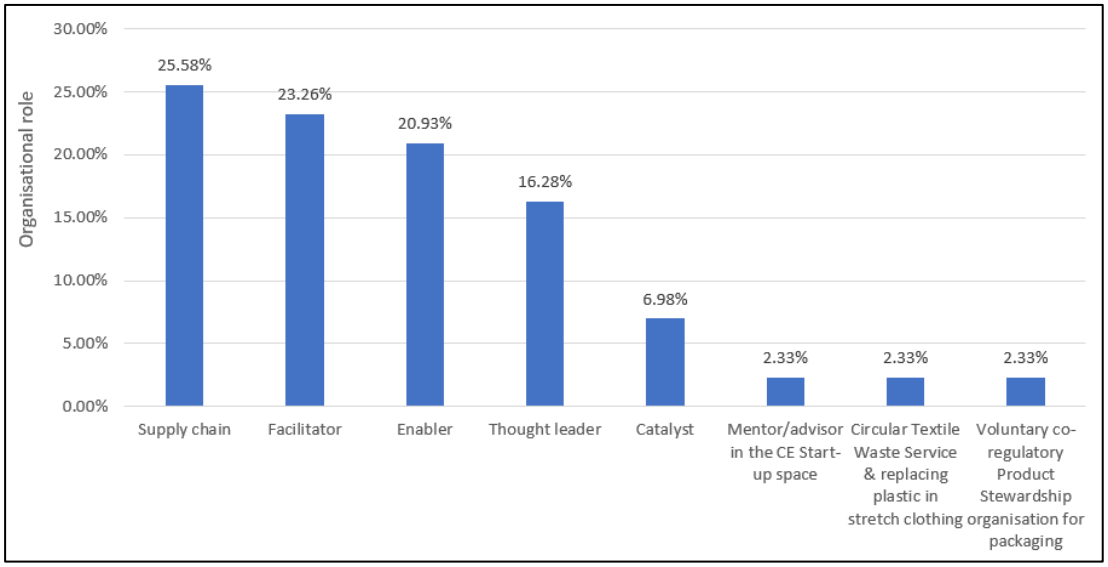

Figure 22 Organisations role within the CE ecosystem

8.13.5. CE policies to influence organisation

It is undeniable that CE policies play an important role in driving CE transition. Amongst various policies, participants noted that "Recycling and waste reduction Act 2020" is the most important policy to impact their organisation (51.16% of participants). "National waste policy: less waste, more resource 2018 Commonwealth of Australia" and "Recycling Victoria: A new economy, Feb 2020, DELWP" (DELWP, 2020) were the next important policies (46.51% and 44.19% of participants, respectively). However, 35% of the participants mentioned that none of these policies had an impact on their business.

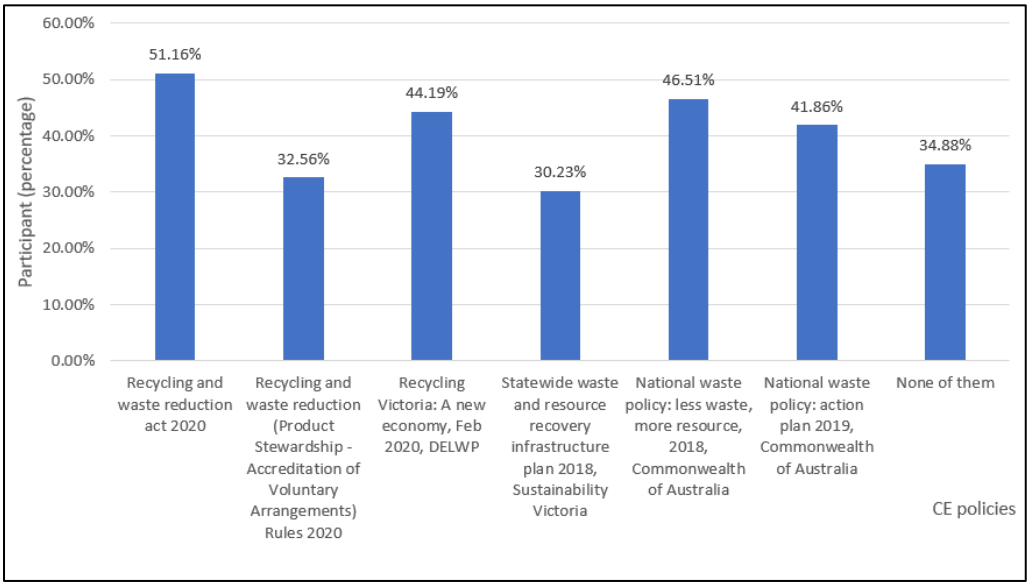

Figure 23 Major policies that influence CE within the organisation

8.14. STEEP matrix of CE drivers, enablers and barriers based on survey results

STEEP analysis method was used to cluster drivers, enablers and barriers from business perspective based on survey results. This step aimed to understand and highlight the main factors that businesses needed to consider in developing their strategic plans to move towards CE.

The STEEP matrix illustrates that most of factors were in the categories of economic, social and political. Financial viability was the main factor underlined by businesses across drivers, enablers, and barriers. Collaboration was also considered either an enabler or barrier for businesses to move towards CE. Financial viability and collaboration can be considered the key to unlocking CE in the whole value chain. The findings of surveys align with findings of desktop research and interviews in terms of enablers, barriers and drivers for businesses in their CE transition.

Table 14 STEEP matrix for top five drivers, enablers and barriers based on survey results

	Drivers	**Enablers**	**Barriers**
Social	• Social conscience	• Business collaboration to close the loop	• Lack of customer demand • Limited coordination across supply chain
Technology		• Supply chain innovations	• Infrastructure
Economic (incl financial and market)	• Entrepreneurial/ business opportunities	• Financial incentives	• Upfront Costs/Financial consideration • Lack of viable business models
Environment (Incl sustainability /ESG/CSR)	• Moral / Climate conscience	•	
Political (incl regulatory)	• Business strategy/organizational policies • Leadership/strategic commitment	• Relevant regulations • Industry guideline or standards	

9. Mapping the CE Ecosystem

This section presents the outcomes of the final mapping exercises conducted based on findings from triangulation of the regulatory analysis, stakeholder interviews and the business survey. The Victorian CE Ecosystem is illustrated using three key maps: a causal loop diagram, a stakeholder map and a regulatory map.

9.1 Causal Loop Diagram

Causal Loop Diagrams (CLD) are used in systems thinking to represent a dynamic system's causal structure and how different variables are linked (Schaffernicht, 2010). A CLD consists of variables and links between the variables that identify how variables are causally linked to each other. The causal links are depicted with arrows showing the direction of causality and symbols to show their polarity. The polarity is presented with (+) or (-) signs representing the relationship of the two variables (Figure 24).

A total of 49 key factors influencing the CE ecosystem identified during the research were included in the CLD. Although more than 49 factors and themes were identified, some of the factors were combined to aid in a clear CLD. Each of the factors are presented as a node within Fig 24, while the relationships between them are presented with arrows, showing the causality. The light blue lines (depicted with a +) show factors that have a positive causal relationship, while light red lines (-) show a negative relationship.

The ecosystem could be analysed based on the significant factors within the system, by identifying the factors that have high interlinks with others. Analysing the nodes within the CLD showed that a few factors were highly interlinked, illustrating that they were highly influential factors within the system. These factors are explained in more detail below.

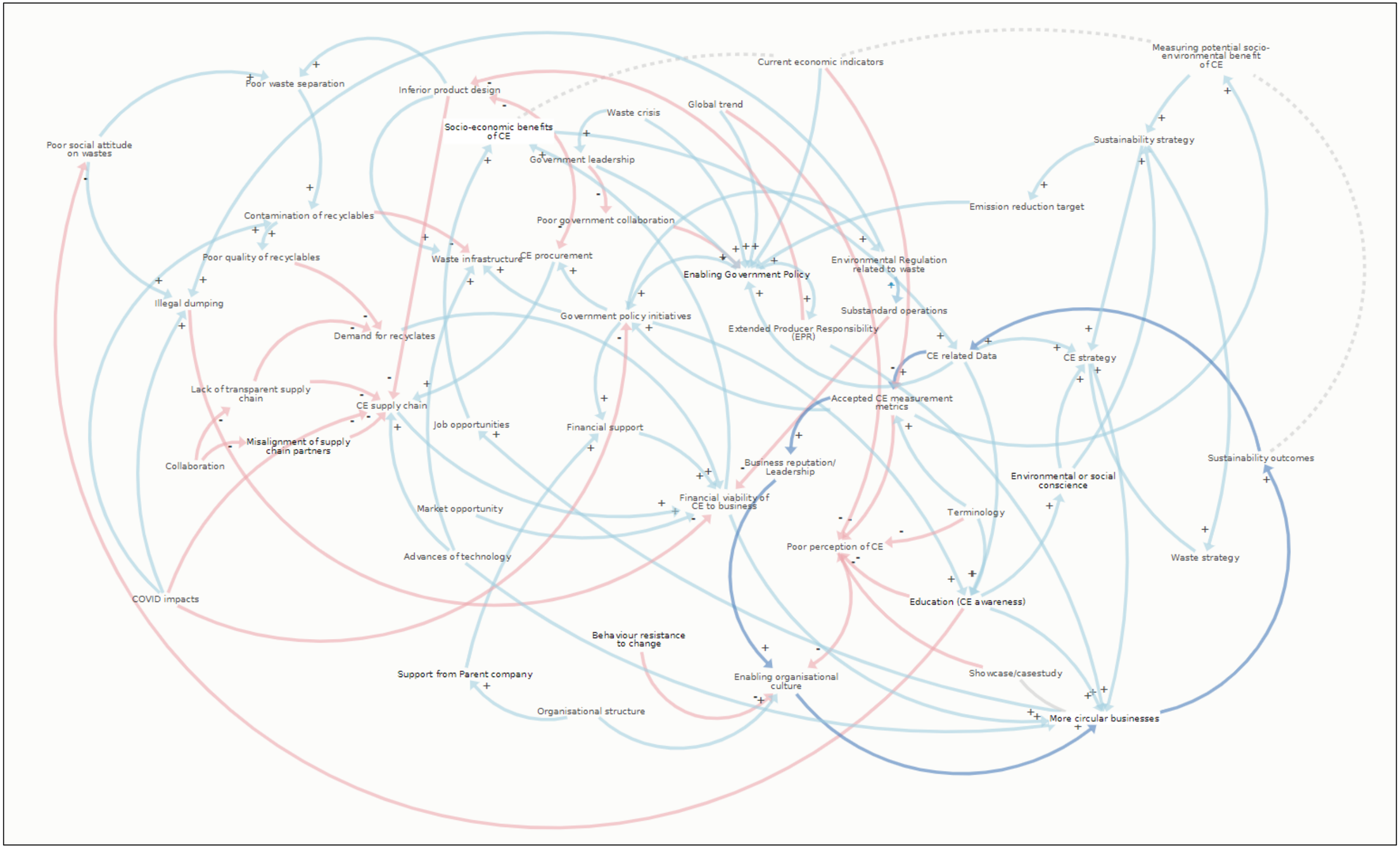

Figure 24 Causal loop diagram of factors influencing Victorian CE ecosystem

9.1.1 Enabling government policies

The node “enabling government policies” depict the government policies that positively influence the system to transition to CE. This node has the highest number of interlinks (9). Most of the interlinks are inward arrows that show that there are multiple factors influencing how policies are developed. CE related policies were seen to be influenced by a broad range of factors ranging from global trends to other government (national, state, local) policies and targets. Government agencies could harness these different factors to develop more effective policies and strategies. The driving factors can be selected based on the socio-political outlook at the time, which will give more social credibility to the policies.

9.1.2 Financial viability of CE and more circular businesses

More circular business was another node that was highly interlinked. There were eight other factors influencing this node, it created positive sustainability and employment outcomes. Financial viability of CE business models was the most influential factor. This was identified both in the interviews as well as the business survey. CE Supply chains were identified as a major influencing factor for the financial viability of CE business models.

9.1.3 Reinforcing feedback loops

The CLD illustrated a reinforcing feedback loop within the system. A reinforcing or positive feedback loop occurs when an initial positive relationship results in a further reinforcement of the cycles. The reinforcing feedback loop was identified between the variables; more circular businesses, sustainability outcomes, CE related data, accepted CE metrics, business leadership, and enabling organisational culture leading back to more circular businesses. As this positive feedback loop results in a move towards intervention at one of the nodes, can have multiplier benefits in propelling the system towards CE. Improving access to CE related data and developing CE measurement metrics was identified as appropriate intervention strategies within this feedback loop.

9.1.4 Shocks to the system

Covid19 was identified as a shock to the system, which had a negative impact on the move towards circularity. Changes in consumption patterns led to increases in contamination of municipal waste and was identified as a factor contributing to illegal dumping. Covid also had impacts on supply chains, which sometimes resulted in less circular practices as manufacturers had to rely on whatever materials they could find to substitute materials due to supply chain problems. This highlighted that the system was not mature enough to be resilient to external shocks to the system and gravitated towards a more

linear economy in such situations. In some instances, due to the supply chain problems, materials that were less desirable (from environmental considerations, for instance) were substituted.

9.2 Stakeholder map

A stakeholder map identifying the different types of actors within the system and their interrelationships was developed. The actors identified at the initial stage of the research were grouped into separate categories based on their role within the ecosystem. This level of categorization helped in differentiating actors based on their roles rather than the organisation they are affiliated to, as it was identified that different departments within the same organisation could have different, and at times opposing roles. Fig 25 shows the stakeholder map with nodes representing the actor groups and arrows showing the relationship between actor groups.

It is evident from the stakeholder map that the major actors within the CE ecosystem are waste and resources related actors. A major actor group identified within this system are the waste collectors, who represent organisations that collect and transport material for recovery or disposal. Households are also seen to play a major role in the system as they consume products and generate waste.

Analysing the stakeholder types shows that there is a lack of involvement of typical financial and economic actors, such as banks, financial service organisations and insurance companies. Financial flows are a critical aspect within any economic system and is considered a necessity for a developed economic system to operate. The lack of financial actors within the current CE ecosystem exemplifies that it is still at a very early stage of maturity.

The stakeholder relationships map shows that there is no connection between manufacturers who design and produce goods and local councils who are ultimately responsible for its disposal at end-of-life. The linear economic model assumes responsibility of production, consumption and disposal lies with manufacturers, consumers and local authorities respectively. This disconnect can lead to challenges of managing novel materials and products, especially those with composite materials that cannot be easily sorted or recycled within the current waste infrastructure. Such examples include composites like tetra pack and packaging materials such as polystyrene. The indirect relationships that aid in more circular design tend to originate from sustainability departments at state or national level, which mostly focus on providing funding and support for manufacturing businesses.

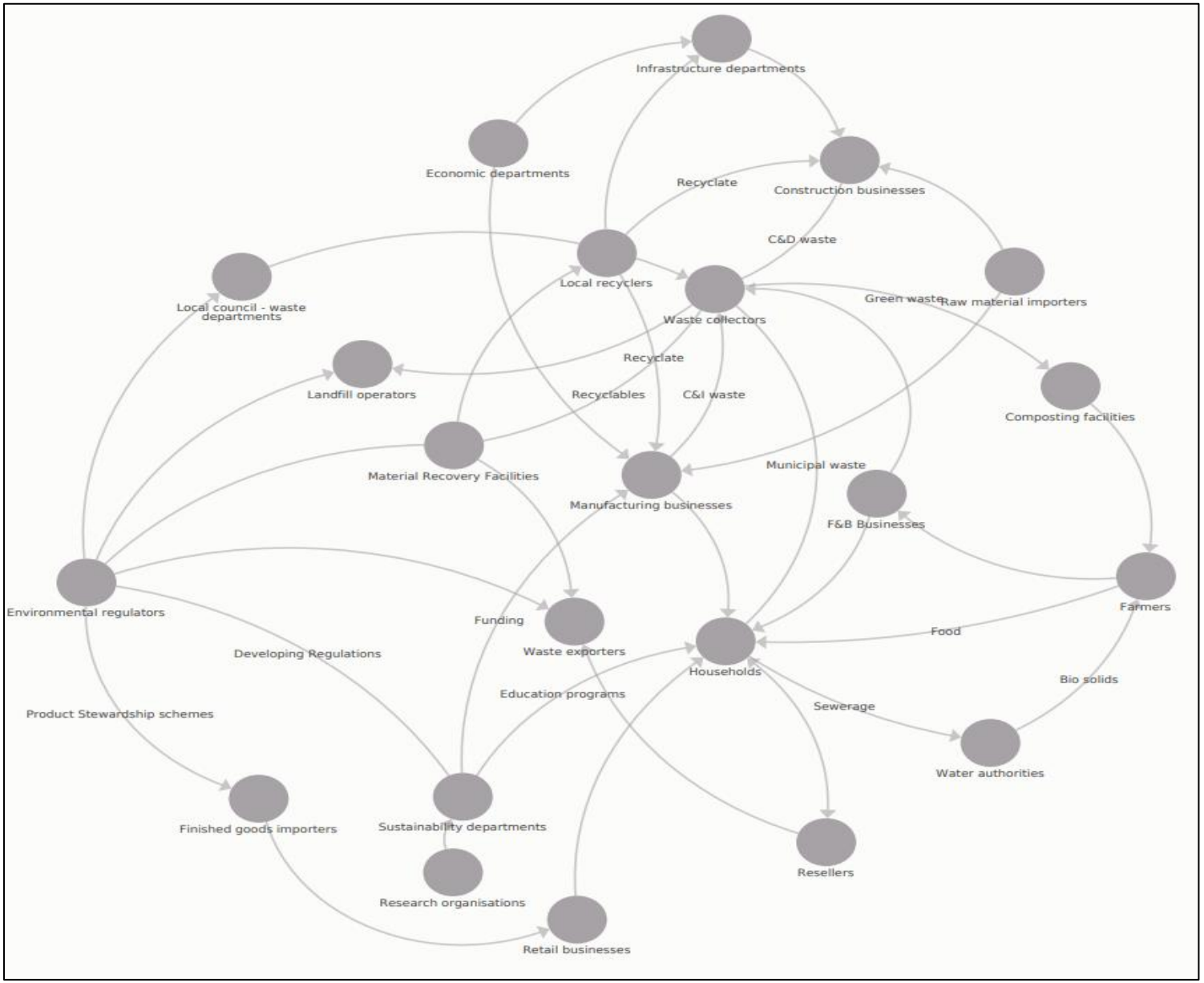

Figure 25 Stakeholder relationship map

The stakeholder map also aided in identifying external pressures to the local CE ecosystem. This was mainly from the import of materials and products that lacked regulatory oversight, which is typically not the case for local manufacturers. Product stewardship schemes and extended product responsibility schemes at the national level were identified as a method to reduce such external pressures on the system. However, these schemes were mostly voluntary, opt-in programs for importers and lacked universal binding.

External pressure was also identified with waste exporters. This issue was highlighted within the interviews as well, where participants mentioned that waste exports to countries that do not have good regulatory frameworks relating to waste disposal can have a detrimental impact on the local waste processing industry. Although, waste export bans by the commonwealth government were enacted this only covers a few types of waste categories and the state level involvement is limited.

9.3 Regulatory map

Relevant regulations that were identified and analysed in the regulatory analysis stage were mapped to understand their alignment. The objective of this mapping was to identify relationships across the regulatory instruments and how they align with each other. The regulatory instruments used to analyse were published, publicly available documents and included Parliamentary Acts and regulations, Government Policies, strategies and guidelines (Figure 26).

The nodes in the diagram show the relevant regulatory documents while arrows represent how regulations are connected. Solid lines represent a clear cascading alignment between nodes, where policies are developed to meet strategic requirements of higher order regulations. Dashed lines represent an influential role that regulations have on other nodes.

As the focus of the mapping was on CE related instruments, many of the state-level policies have a clear alignment with each other and with national level priorities. This illustrates that clear national targets can directly influence state-level policies, which will be a driver towards CE. It was identified that accepted state or national level priorities were set, cascading them across the different state institutions was easier. This was mainly due to the credibility of the need to act.

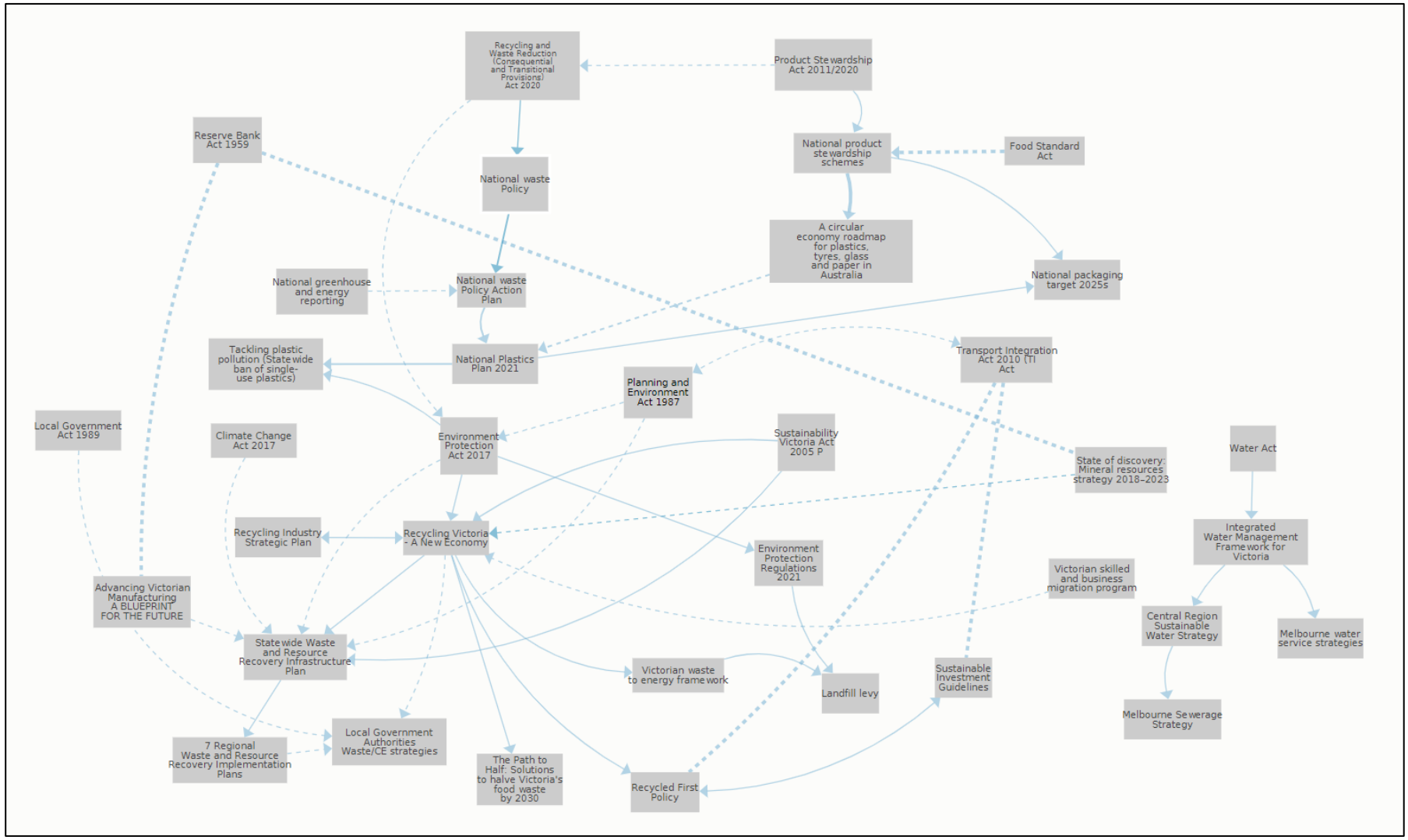

Figure 26 Regulatory map of CE related regulations

Although a top-down cascading of strategies was seen from the national level to the State level, this was not obvious when moving down to the local government levels. Some CE strategies within councils took a more mature, holistic approach to CE. However, this was not the case across all local government authorities (LGA's) and a lot of variations were seen across them. The local government policies in mature jurisdictions were seen to be a more bottom-up driven policy, driven mainly through community demand for sustainable solutions. Another reason is also that councils are responsible for the managing of municipal waste and residents see that as one, if not the most important, services that councils provide. As such councils with more environmentally conscious constituents have been driven to embark on a CE journey.

Analysing state level policies showed that economic policies can have a detrimental effect on CE policies (shown in red arrows). For example, one of the key targets of the Mineral Resources Strategy (Government of Victoria, 2018) is "One million metres drilled by June 2023". As minimising the extraction of virgin resources is a vital aspect within a CE, such policies that promote the extraction of resources can have a negative impact on moving towards circularity. Similarly, a key focus of the Victorian State Budget and at a national level, the Reserve Bank Act is the promotion of economic growth. Economic growth, measured through GDP, thus promotes the continuous increase in production and consumption, which is opposed to circular thinking, unless it is decoupled through the use of products and materials already in the system as opposed to virgin materials for production and consumption.

The regulatory map also illustrates there is a lack of connection between some complementary regulations. The CE related regulatory instruments focus mainly on the solid waste aspect, while there is no clear alignment with regulations focusing on climate change and water (waste-water). Therefore, there is a clear opportunity to align other complimentary regulations with CE regulations.

10. Discussion

The key enablers, barriers, drivers and challenges identified through the research are summarised in Table 15. How these factors influence the macro, meso and micro levels within the eco system have been identified. This level of categorisation helps decision makers to develop appropriate actions targeting the different levels of the economy.

The top barriers, enablers, drivers, and challenges have been described in macro, meso, and micro levels to comprehend the impacts of these factors to specific levels of state governments as well as businesses and communities. By doing so, the CE story can be clearly understood in Victoria. CE was preferred to resolve the issue of waste crisis. Indeed, regulations and policies focused on waste reduction and waste management. These regulations and policies limit other aspects of CE and impact perceptions related to CE amongst businesses and communities.

Macro levels should focus on regulations and policies to lead businesses and communities to a broader concept of CE as well as various approaches to implement CE principles in their businesses. Macro levels also need to capture CE practices in businesses and use them as case studies to demonstrate or show possibilities of CE in practice to businesses and communities.

For market demand, macro levels can use the culture of secondhand businesses which have been in Australian cultures for long time to increase market demand for CE products such as recycled materials and products. They need to focus on breaking down social sigma regarding the term of recycled or reused by other terms that can be workable to customers.

From the micro level, the most crucial factors for businesses and communities are collaboration and financial viability. They need more physical platform to develop collaboration and explore opportunities to work on shared goals in CE implementation. In addition, financial viability is essential for them to adopt CE initiatives and start it in the initial stage.

Table 15 Summary of enablers, barriers, drivers, and challenges

	MACRO (state level)	MESO (industrial regions, sectors and local government regions)	MICRO (businesses and consumers)
ENABLERS: factors that may assist the transition to CE			
State level CE Policies	• CE policies signify to other government authorities that CE is a state government priority and enables CE related actions across government. • State policies to drive systemic change to achieve CE targets.	• Aids in increased adoption of resource recovery and recycling practices within the infrastructure sector.	• Funding mechanisms support businesses to initiate circular business models.
Collaboration	• Whole-of-government approach can help in setting higher level targets and broader CE implementation.	• Collaboration between LGA's, recycling and manufacturing sectors can reduce non-recyclable materials.	• Collaboration across supply chains and different businesses industry sectors
BARRIERS: factors that can hinder the transition to CE			
Lack of specific guidelines/standards	• Regulations and policies providing a comprehensive approach and broader concept of CE are still lacking in Victoria. This becomes a barrier to implementing CE principles in different businesses as they inhibit business actions and innovation.	• Industry/sector specific guidelines tend to be outdated and not consider new technological developments that aid in CE transition.	• Businesses taking individual actions in their self-interest and based on their personal knowledge can inhibit meso and macro level synergies.
Lack of systems perspective in developing policies	• Unintended consequences of policies can have a negative effect in other areas.		
Understanding of CE as a concept	• The macro-level systemic change required for CE transition is limited as CE is understood to be	• CE innovation in industrial zones / regional parks is limited	• Businesses and communities perceive CE as waste management, which causes a roadblock for them

	a business (micro) or sector specific (meso) concept. • CE is championed by engineers and sustainability professionals not economists		to think incorporate solutions for higher order principles of CE. • CE perceptions amongst sustainability experts, practitioners and decision makers are disconnected. Their perceptions are too fragmented and limited, not providing a full picture of CE.
Financial challenges	• Involvement of financial sector is limited, which results in limited financing opportunitites for circular business investments	• Investment analysis is still based on linear thinking and lack of investment analysis tools to support businesses to evaluate project feasibility. It is difficult to demonstrate financial viability when managing the project budget.	• Financial viability of CE actions is a key barrier. Businesses need financial support for CE initiatives, but currently financial support is mostly from government funding and grants, which limit the number of businesses to avail the funds.
DRIVERS: factors that have pushed current actions around CE			
Waste related issues	• Waste crisis caused from waste import bans by Asian countries, stock piling of recyclables and recyclers closing operations. To resolve this issue, Australian government and Victorian government refer to CE and focusing on CE strategies to drive businesses and communities towards CE.		
Financial benefits			• Businesses have financial benefits from the cost difference between virgin materials and recycled materials. • There has historically been a viable market for second-hand or reuse

			goods exist in Australia. This led to businesses pursuing related options in this sector.
Moral / ethical behaviour			• Circular business models are adopted as a result of the moral/ethical mindset of businesses
CHALLENGES: factors that have inhibited the adoption of CE related actions			
Lack of awareness on CE	• Lack of awareness is affected by the scope of CE policies and strategies. CE is commonly understood as "recycling plus", which has been a focus of CE policies.	• Awareness between local government levels and businesses has not supported higher order opportunities such as repurpose, remanufacture, etc.	• Organisational level CE awareness is important as it impacts internal leadership and mindset in developing CE strategies in an organisation. It also causes behaviour resistance in any change an organisation espouses from a CE perspective. • Most businesses are still operating with waste as a by- product rather than thinking about using waste as a resource to explore opportunities.
Financial viability			• Viability of circular business practices are decided based on short-term financial viability. It is a challenge for businesses to adopt CE initiatives in their business operation.
Organisational structure	• Bureaucratic structure amongst departments and agencies can be a challenge to CE transition. As every department has its own objectives, it impacts overall CE policies. This has resulted in a narrow focus on recycling and resource recovery only.		• Organisational structure impacts the organisational change to be required for CE strategies. Needs to be driven from top down due to the financial outlay required.

The research demonstrates the alignment between government levels and businesses through the alignment of desktop research, interviews, and surveys results regarding CE, CE principles and CE implementation. Desktop research showed CE underlined waste management and reduction due to the waste crisis. Interviews showed that the focus was on the recovery and recycling strategies with the primary consideration of waste resolution. Surveys also reported the same results that businesses underscored recycle and reduce in their CE strategies.

Collaborations need to be developed amongst different government levels and businesses. CE is not happening in one place or one country. It needs to be mainstream, which brings benefits and fairness amongst different generations, across different sectors and countries, hence alignment across scales is critical. Businesses and communities need to collaborate to create synergy benefits and CE practices. There is a need to have more cooperation in supply chains, where they can explore different approaches to use R principles of CE, or they can mine waste resources to other businesses, run different cycles in their business and gradually close the loops. CE improves collaboration and interconnections amongst numerous factors within an organisation and between an organisation and its ecosystem. The numerous factors include supply chain, circular business models, life cycles of products and materials, innovative technologies, organisational structure, and the like (Nair et al. 2017).

Perceptions, awareness and education related to CE need to be dramatically improved since these factors are either enablers or barriers to CE transition. Awareness and perception are crucial for the CE movement when getting consistent support from grassroot levels through their understanding and mindset to shift linear economy to circular economy. Otherwise, these factors become a major barrier to hampering this movement due to behavior resistance.

Education plays a vital role in enhancing CE perceptions and awareness. The confusion of CE as well as CE and sustainability still exists. 80% of interviewees mentioned education was one of key roles in CE transition. 4% of questionnaire participants noted that they haven't heard about CE. Thus, education may be used to bridge this gap. However, there is still a lack of CE education programs in the school or university systems in Victoria while these CE programs have been developed in different universities across different countries such as Netherlands (Kirchherr and Laura, 2019), Spain (Bugallo-Rodriguez and Vega-Marcote, 2020) and UK (Mendoza et al. 2019).

The regulatory environment is vital in transitioning towards CE. As in the desktop research, the regulations and policies related to CE have been reviewed. 100% of interviewees highlighted

regulatory environment was necessary for systemic changes in businesses and communities. Surves results also showed that regulations and policies were crucial for business movement away from linear economy. However, regulations and policies related to CE need to be updated to support CE principles, such as standards of recycled materials or guidance for food and green waste. It needs to also support the higher orders of the R-frameworks commencing with refuse.

As CE aligns with and promotes sustainable development goals, CE can be embraced through sustainability approaches which have been developed in Victoria for many years. Through survey results, it is an opportunity to use a solid understanding of sustainability from businesses to support CE understanding in businesses. Further, it can support CE through a planned strategic approach of vision and implementation.

Key insights from the research so far:

1. There doesn't seem to be a systemic transition to a CE, but rather a move towards implementing and enabling circular business models within an inherently linear economic system.
2. Current policy targets don't include upstream interventions for redesigning/rethinking production and consumption models. Focus is on end-of-pipe waste solutions which accept inefficiencies in linear economies.
3. The common understanding of CE at a micro or meso level is resource efficiency concept rather than an economic system. This limits broader economic transition.
4. Practical applications of higher order R principles in business are commonly about using recyclate within the manufacturing process and not redesigning the need for the product itself in the first place. Circular business models (not just recycling/recovery models) are still a fringe concept.
5. Although CE is theoretically an economic concept, it is championed by engineers and sustainability professionals/agencies focusing on technical solutions. Important factors within any economic system such as resource use, finance, and economic planning are handled by other agencies whose priorities may not align with sustainability agencies. Hence, technical and social/regulatory enablers need to be brought together.
6. No commonly accepted metric is available to measure circularity, especially at a macro-level. This hampers its acceptance and adoption as a priority policy target and gives business a clear direction to focus on.

7. There is significant action around use of recyclate in the infrastructure sector. Given the high visibility the infrastructure sector receives, this can increase awareness of the use of recyclate in products.
8. Business actions toward sustainability are driven for an ethical / moral reason to act. The financial viability of such actions are an important justification for both for profit and not-for profit organisations. In other words, financial sustainability is a must for transitioning to a CE.

11. Recommendations

11.1 Macro-level recommendations

The regulatory environment was seen to be a major influencing factor both as a source of credible government commitment as well as for setting standards and guidelines for CE activities. The need for improving the current regulations was identified as a way to propel the CE transition. The following factors could be considered when improving regulations; regulations need to be more of a guidance and standardisation rather than enforcement related and holistic regulations that are applicable across the economy need to be developed. This needs to be done with industry and whole-of-government consultation

The disconnected nature of environmental policies is seen to be a regulatory barrier for maturity of CE. Policy makers need to collaborate across the different agencies to align CE policies with water, energy and carbon emission policies.

The unintended consequences of policies need to be looked into when developing regulatory instruments. For example, with increased investment in recycling infrastructure if CE policies lead to reduced consumption and waste generation, this may leave recycling infrastructure idle. So holistic system level thinking is required when developing CE policies and piece meal approaches targeting only specific CE concepts may not be ideal.

A major barrier that needs to be overcome is the lack of conceptual understanding of CE. If CE is understood simply as a revamped recycling strategy and not as an economic system, the regulations and policies that are developed will have limited benefits. The understanding of CE needs to improve mainly among a cross section of government policy makers, which will lead to better holistic policies being developed.

The lack of an acceptable indicator to measure circularity is another major gap that needs to be addressed. Such an indicator needs to be quantifiable and widely accepted. Such an indicator could be a macro level indicator like GDP which is a metric to measure linear economic development or

and one that cuts across micro and macro levels such as GHG emissions. A single metric would make circularity easy to comprehend for non-experts and to measure progress.

If CE is to be developed into a mature economic system, the involvement of financial institutions within the ecosystem needs to be encouraged. This can help in more financial capital moving into the CE system which can spur investments and business activities. A barrier for this is that current investment appraisal methods are more suited for measuring linear economy and business models. Local governments can support experimentation engaging businesses through low interest loans/or sharing risks. Governments can also make use of fiscal instruments such as taxes and levies to incentivise circular products. For example, state level taxes for the use/manufacture of non-recyclable products and packaging can encourage more innovation in the design space. Tax incentives such as taxing the use of virgin resources will support secondhand markets.

11.2 Meso-level recommendations

The development of sector specific standards and guidelines relating to circularity would help specific sectors to move to more circular business. This could be in the form of specifying standards and guidelines for the use of recycled material, minimum level of recycled content within products or standard metrics to measure circularity. The infrastructure sector could be a good starting point for such actions, given the level of government and industry work being carried out currently.

Sector level involvement in the transition to CE needs to be developed. This could be done at the national level through product stewardship schemes, mandating extended producer responsibility, or at state level through the collaboration of industry with local and state government authorities who are responsible for disposing end-of-life products. Such schemes can bridge the disconnect between the responsibility of production, consumption and disposal stages of a product.

Projects that enable industrial symbiosis within local government areas and industrial districts could be formulated. Such projects can help policy makers to identify practical challenges in expanding circular systems from meso to macro level. They can also help build awareness among firms and consumers on systemic circular economy models, without relying on isolated circular business activities. Industrial parks can explore small scale or localized solutions beyond singular businesses to precinct-based solutions. Local hubs can be used as opportunities for repairs supporting jobs.

11.3 Micro-level recommendations

Shifting or developing ethical and moral conscience to include circular economic activities could drive more businesses and consumers to take part in the CE. “Doing the right thing” was considered a major

driver for businesses to embark on circular actions, as reported by the businesses surveyed in this research. A common understanding of this term could mean keeping the environment clean and separating waste. However, if this concept of doing the right thing was expanded to include a wider array of environmental conscientiousness, this could expedite the transition to CE.

12. Future work

The ecosystem map that was developed in the first phase of this research will be validated through follow-up interviews and focus group sessions with key actors identified during the interview stage. These sessions will include the participants from the initial set of interviews as well as a broader group of stakeholders. During these sessions participants will be able to provide feedback on any changes that are required to the map and to validate the major enablers and barriers that have been identified so far in this research. This feedback will be used to modify the map and to provide recommendations to practitioners as a final outcome of this project.

Developing an ecosystem platform: The validated ecosystem map will be plugged into the VCA website where it will be available for the public to use as a living platform. This platform will be developed so that visitors to the site can obtain information on the Victorian CE landscape, major actors (including links to their websites), relevant examples/case studies and similar examples of demonstrations in practice. It also supports developing collaborations across different sectors, moving away silo thinking to build up business partners and support the creation of a systemic response with CE responses to perturbations in the system.

The main focus of this research was on analyzing the ecosystem based on business, regulatory and infrastructure aspects. Future research needs to focus on the socio-cultural aspects of CE, with a focus on trying to understand consumption patterns, consumer behavior and what drives consumers to transition from typical linear economic consumption to circular.

Future research will also explore the dynamic relationships between positive (drivers and enablers) and negative (challenges and barriers) forces at the macro, meso, and micro levels. This will help to refine a lens to monitor the maturation of the Victoria CE ecosystem from a systems lens.

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APPENDICES

Appendix 1 – List of CE definitions reviewed

No	Definition of CE	Source
1	“The trainsition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised, is an essential constribution to the EU's efforts to develop a sustainable, low carbon, resource efficient and competitive economy".	(European Comission, 2015)
2	“an industrial system that is restorative or regenerative by intention and design. It replaces the “end-of-life” concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models”.	(EMF, 2013b)
3	"A generic term for the reducing, reusing and recycling activities conducted in the process of production, circulation ad consumption".	(CCICED, 2008)
4	“Circular economy strives to harmonise economy, environment, technologies and social approaches so as to promote a more harmonized use of natural resources as well as the implementation of a greener economy”.	(Ren et al., 2013)
5	Circular economy is described as a scientific development model where resources become products, and the products are designed in such a way that they can be fully recycled	(Yap, 2006)
6	Circular economy defines its mission as solving the problems from the perspective of reducing the material flux and making the material flow balanced between the ecosystem and the socioeconomic system.	(Liu et al., 2009).
7	Circular economy (CE) focuses on resource-productivity and eco-efficiency improvement in a comprehensive way, especially on the industrial structure optimization of new technology development and application, equipment renewal and management renovation	(Hu et al., 2011)

8	A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models	(EMF, 2020)
9	A circular economy is an industrial system focused on closing the loop for material and energy flows and contributing to long-term sustainability	(Geng et al., 2013)
10	The circular economy is what seeks to stretch the economic life of goods and materials by retrieving them from post-production consumer phases. This approach too valorizes closing loops but does so by imagining object ends in their design and by seeing ends as beginnings for new objects.	(Gregson et al., 2015)
11	Circular economy means to reuse, repair, refurbishing, and recycling of the existing materials and products; what was earlier considered to be waste becomes a resource.	(Jurgilevich et al., 2016)
12	The circular economy (CE) is viewed as a promising approach to help reduce our global sustainability pressures according to Ellen MacArthur Foundation and European Commission.	(Bocken et al., 2016)
13	Circular economy is defined as one in which the value of products, materials, and resources is maintained for as long as possible, minimizing waste and resource use.	(Malinauskaite et al., 2017)
14	The concept of closing material loops to preserve products, parts, and materials in the industrial system and extract their maximum utility.	(Zink and Geyer, 2017)
15	CE is an economic model wherein planning, resourcing, procurement, production, and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being.	(Murray et al., 2017b)
16	Circular economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling	(Geissdoerfer et al., 2017)

17	A circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times	(Cullen, 2017)
18	An economy is envisaged as having no net effect on the environment; rather it restores any damage done in resource acquisition, while ensuring little waste is generated throughout the production process and in the life history of the product	(Murray et al., 2017a)
20	Circular economy is an economy constructed from societal production-consumption systems that maximize the service produced from the linear nature-society-nature material and energy throughput flow. Circular economy limits the throughput flow to a level that nature tolerates and utilizes ecosystem cycles in economic cycles by respecting their natural reproduction rates	(Korhonen et al., 2018)
21	Circular Economy (CE) is an activity, set of process for reducing the material used in production and consumption, promoting material resilience, closing loops and exchange sustainability offering in such a way that maximize the ecological system.	(Awan et al., 2020)

Appendix 2 – Interview questions

RESEARCH PROJECT TITLE: RESEARCHING THE CLIMATE FOR TRANSITIONING TO A CIRCULAR ECONOMY

1. Would you please introduce yourself/ your organisation and department?

2. What is your understanding about Circular Economy?
2.1. What is the role your organisation plays, if at all, in the transition to CE?
2.2. Supply chain / Enabler / Catalyst / Thought leader / Facilitator

3. What are the main internal drivers of incorporating CE within your organisation?
3.1. Leadership/strategic commitment
3.2. Financial/ revenue streams
3.3. Sustainability/CSR/ESG
3.4. Efficiency / cost savings
3.5. Regulatory

4. What are the internal challenges your organisation faces moving towards a CE?

5. What are the external enablers for your organisations move towards CE?
5.1. Economic
5.2. Social
5.3. Technological
5.4. Regulatory
5.5. Collaborations

6. What are the external barriers for your organisations move towards a CE?
6.1. Economic
6.2. Social
6.3. Technological
6.4. Regulatory

7. What changes/developments would enable a systemic move towards a CE?
7.1. Economic
7.2. Social
7.3. Technological
7.4. Regulatory

8. Who are the other major actors we need to interview as part of this research?

9. Would you like to be involved in future research work on this project?

Appendix 3 – Questionnaire survey

QUESTIONNAIRE SURVEY

Dear participant,

Thank you for participating in this questionnaire survey!

The State of Victoria has announced its intention to transition towards a circular economy (CE). This transition necessitates the involvement of all stakeholders. However, limited research has been undertaken to understand the current CE landscape and the enablers and barriers for transitioning to CE. Funded by the Victorian Government, RMIT University researchers with other partners are addressing this critical knowledge gap with the research project: "Climate for transitioning to a circular economy".

This survey is a part of that research project and aims to obtain input from the Victorian business community, to gain a deeper understanding of business and industry practices, which will assist the State transition to a more circular economy. This anonymous survey is targeted at individuals owning, managing or operating businesses in Victoria and will take around 15-20 minutes to complete. Further information on this project and your participation in it, is available on the Participant Information Sheet (PIS).

Once again, thank you for taking the time to complete this survey.

PART I: GENERAL PARTICIPANT / BUSINESS INFORMATION

1. Are you an owner/manager of a business operating in Victoria?

Yes, I own a business,
Yes, I manage the operations of a business (CEO, COO, Manager and such senior position)
No, I don't manage/operate or own a business. (We would appreciate it if you could send this survey to the manager/owner of your business organization. Thank you for your time and your participation)

2. What is your position in the organization?

C-level executive (e.g. CEO, CFO, COO, Managing Director)
Non-executive director
Senior manager (e.g. General Manager, Head of a department)
Organisational support (e.g. Human resources)
Clerical or administrative (e.g. Personal assistant)
Other

3. How long have you been in this role? Choose an item.

4. How long approximately has the business been in operation? (Years)

5. What is the type of your business? Choose an item.

6. What industry classification does your business fall under?
   Choose an item.

7. How many employees work at your organization?
   - ☐ 1 to <5 employees
   - ☐ 5 to 20 employees
   - ☐ 20 to <200 employees
   - ☐ More than 200 employees

8. What is your annual business turnover?
   - ☐ Less than AUD 10 million
   - ☐ 10 to 250 million
   - ☐ Above 250 million

PART II: MOTIVATION AND BUSINESS OBJECTIVES

1. If owner – What made you start this particular business? (Tick all that apply)

☐ Desire to own my own business
☐ Market opportunity ☐ Expertise in the area
☐ Financial reward in this sector
☐ Make a difference to society
☐ Inherited from family or previous owner
☐ Express my creativity /passion
☐ Other – Please specify

2. If Manager – What made you take this role?

☐ Expertise in management or operations
☐ Technical expertise in this sector
☐ Got promoted
☐ Financial incentives/opportunity
☐ This organisation or industry aligns with my passion / values
☐ Personal challenges
☐ Gain new skillset
☐ Other – Please specify

3. What are the major objectives of the organisation? Please rank in order of importance.

Major objective	Ranking
Financial return	
Customer satisfaction	
Social or community impact	
Product or service quality	
Product or service Innovation	
Market Share: Growth or retention	
Shareholder returns	
Environmental sustainability impact	
Exploit market opportunity	
Create a positive work culture	
Corporate Social Responsibility	
Create employment opportunities	
Other (please specify……..)	

PART III: ENVIRONMENTAL SUSTAINABILITY AND CE PRACTICES IN YOUR ORGANSATION

1. Does the organisation consider any environmental sustainability or circular economy principles in the business operation?
Not at all
In a few cases
In most cases
In all cases
Not sure

2. Does the organisation have a specific environmental or circular economy strategy or policy? (Yes / No / Not sure)
If yes, please provide a brief description of what this policy covers?

2.1 Are environmental outcomes/performance/ circularity features part of the company KPIs/ annual report?

3. Please select all actions related to environmental sustainability or circular economy that your organization takes.
☐ Develop sustainability and/or CE strategy / policy
☐ Recycling/upcycling waste☐ Use of recyclable or compostable packaging
☐ Reducing energy or water use
☐ Reducing carbon emissions
☐ Using recycled material or products
☐ Redesigning products or processes to be less material intensive
☐ Redesigning products to be recyclable
☐ Repurposing / re-using / extending product life/durability
☐ Technology innovations
☐ Other (please specify)
☐ None

4. What are the main drivers for implementing these initiatives? (Choose all that apply). Also please rank the drivers based on their influence on your organisation from 1 to 5 (with 1 is the lowest and 5 is the highest).

Driver	Ranking
☐ Government Policies/ Regulations	Choose an item.
☐ Business strategy/ Organisational Policies	Choose an item.
☐ Entrepreneurial / business opportunities	Choose an item.
☐ Corporate Social Responsibility (CSR) / Environmental Social Governance (ESG)	Choose an item.
☐ Leadership/strategic commitment	Choose an item.
☐ Technological opportunities / Innovation	Choose an item.
☐ Part of business objectives	Choose an item.

☐ Financial return	Choose an item.
☐ Clients or customer demand	Choose an item.
☐ The right thing to do	Choose an item.
☐ Keep up with industry trends	Choose an item.
☐ Marketing	Choose an item.
☐ Employees request	Choose an item.
☐ Supply chain imperatives / Reverse logistics	Choose an item.
☐ Part of the product/service model of the business	Choose an item.
If other, please state below	
☐Climate / social conscience	Choose an item.
☐ ……	Choose an item.
☐ ……	Choose an item.
☐ ……	Choose an item.
☐ ……	Choose an item.

5. Are there any actions your organisation would like to take in the future (1-2 years) with regard to environmental sustainability?

☐ Develop sustainability and/or CE strategy / policy
☐ Recycling/upcycling waste
☐ Use of recyclable or compostable packaging
☐ Reducing energy or water use
☐ Reducing carbon emissions
☐ Using recycled material or products
☐ Redesigning products or processes to be less material intensive
☐ Redesigning products to be recyclable
☐ Repurposing / re-using / extending product life
☐ Improving environmental sustainability/ CE awareness.
☐Other (please specify)
None of them

If none, restructure question 6 to become:

6. What are the reasons for not taking any actions in the near future (same options – Rankings) or What are the main barriers for not implementing these initiatives yet? Ranking.

☐ Lack of viable business models
☐ Internal resistance to change
☐ External / customer resistance to change
☐ Upfront costs/Financial considerations
☐ Infrastructure and networks
☐ Industry guidelines/ standards
☐ Lack of customer demand
☐ Lack of awareness internally within the organisation
☐ Too complicated

☐ Lack of interest
☐ Limited coordination across supply chain
☐ CE/ environmental sustainability is not core business
☐ Other

7. What factors would enable your business to implement more/better CE strategies or environmental sustainability strategies?
☐ Relevant regulations
☐ Better enforcement of regulations
☐ More education or training programs
☐ Financial incentives
☐ Industry guidelines or standards
☐ Supply chain innovations
☐ Business collaboration to close the loop.
☐ Other (please specify) .

8. How far along the journey of CE or environmental sustainability is your organizationat currently?
☐ Not started yet
☐ Just starting
☐ Progressing well
☐ An industry leader

9. What are the major environmental issues relevant to your business/ industry? Please rank in order of importance.

Environmental issue	Ranking
Waste management	
Climate change	
Air pollution	
Resource extraction / material use	
Carbon emissions	
Energy use	
Water use	
Water pollution	
Biodiversity and ecology	
Other (please specify……)	

10. Would you like to answer a few more questions on the role of your organisation plays within a CE? If yes, please click the link to survey of circular economy practices within your organisation.

OPTIONAL SECTION

CIRCULAR ECONOMY PRACTICES WITHIN YOUR ORGANISATION

1. How knowledgeable would you say you are about the concept of the circular economy?
Extremely knowledgeable
Very knowledgeable
Somewhat knowledgeable
Have heard of it but do not really understand the details of the concept
Never heard of it

2. The circular economy follows the principles stated below:
- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems.

Based on this understanding, what stage would you say your business/organisation is at in terms of implementing circular economy models?

Fully implemented - the concept is central to our business/organisation
Somewhat implemented – we have implemented aspects of it
Not yet implemented but we are reviewing how to implement it within the business/organisation
We are considering, or are open to implementing circular economy in our business/organisation in the future
We have not considered it
I don't feel the concept applies to this organisation.

3. Please choose at least three words from the below figure for describing circular economy in your organisation?

4. Please rank these words based on their importance to CE strategy in your organisation?

5. If there are other words to describe CE in your organisation, please state here:

6. How advanced is your organization's CE strategy?

☐ Very advanced – CE as the core of organizational business
☐ Advanced – More than 50% of employees are aware of CE.
☐ Improving – More than 25% of employees are aware of CE
☐ Starting to integrate CE principles to organizational business.
☐ CE is still new and has not applied in my organization yet.

7. What changes have your organisation made to move towards CE?

☐ Updating corporate strategy to consider CE.
☐ Educating staff about CE
☐ Using information about CE in communication with existing and/or future customers.
☐ Being committed to Net-Zero emissions
☐ Undertaking an assessment of CE performance of the bussiness and its supply chains
☐ Surveying customers for their interests in CE products.
☐ Engaging in partnerships or networks that promote CE.
☐ Fund or support CE research.
☐ CE procurement standards.
☐ Other – please specify
☐ Other – please specify
☐ None of them

8. What is the role of your organisation amongst CE stakeholders?

☐ Supply chain
☐ Enabler
☐ Catalyst
☐ Thought leader
☐ Facilitator
☐ Other – Please specify

9. Please select any CE policies that influence your organisation. (Select all that apply)

☐ Recycling Victoria: A new economy, Feb 2020, DELWP
☐ Statewide Waste and Resource Recovery Infrastructure Plan 2018, Sustainability Victoria
☐ National Waste Policy: Less waste, more resources, 2018, Commonwealth of Australia
☐ National Waste Policy: Action plan 2019, Commonwealth of Australia
☐ Other – please specify
☐ None of them

PART IV: FINAL COMMENTS.

Thank you for participating in this survey. This research aims to identify the main drivers and challenges businesses face in Victoria transition to a Circular Economy.

Please provide us your email and phone number if you would like us to:

Share the findings of this survey with you? And/or

Participate in an interview of this research project? The interview is an opportunity for you to share your experience on your organisations' CE journey.

Appendix 4 – List of critical actors

Organisation	Type of stakeholder	Jurisdiction	Link
Agriculture Victoria	State Government	State	https://agriculture.vic.gov.au/about/our-role/agriculture-strategy
Australian Metal Recycling Industry Association Victoria	Industry Body	State	https://www.amria.com.au/
Barwon South West WRRG	Statutory authority	Regional	https://www.reduce-recycle.com.au/
CE Hub@RMIT	Research		https://www.rmit.edu.au/research/our-research/enabling-capability-platforms/urban-futures/circular-economy-hub
Charitable Recycling Australia	Industry Body	National	https://www.charitablerecycling.org.au/
Circular Economy Victoria	Not-for-profit	State	https://www.cev.org.au/about
CSIRO	Research	National	https://www.csiro.au/en/contact
Deakin Circular Economy Initiative	Research		https://www.deakin.edu.au/cei
Department of Agriculture, water and the Environment	Federal Government Department	National	https://www.environment.gov.au/
Department of Environment, Land, Water and Planning	State Government Department	State	https://www.delwp.vic.gov.au/

Department of Jobs, Precincts and Regions	State Government Department	State	https://djpr.vic.gov.au/
Department of Treasury and Finance	State Government Department	State	https://www.dtf.vic.gov.au/home
Development Victoria	State Government	State	https://www.development.vic.gov.au/contact
Environment Protection Authority	Statutory authority	State	https://www.epa.vic.gov.au/
Food Industry Association of Victoria (FIAV)	Industry Body	State	http://fiav.com.au/
Goulburn Valley WRRG	Statutory authority	Regional	https://www.gvwrrg.vic.gov.au/
Grampians Central West WRRG	Statutory authority	Regional	https://recyclingrevolution.com.au/
KPMG Australia	Business		https://home.kpmg/au/en/home/services/advisory/risk-consulting/climate-change-sustainability-services/circular-economy/circular-advantage.html
Local government professionals	Professional Body	State	https://www.lgpro.com/
Local government Victoria	State Government	State	https://www.localgovernment.vic.gov.au/what-we-do/local-government-victoria
Loddon Mallee WRRG	Statutory authority	Regional	https://lmwrrg.vic.gov.au/
Major Transport Infrastructure Authority	Statutory authority	State	https://bigbuild.vic.gov.au/__data/assets/pdf_file/0005/524174/NELP-EES-Attachment-I-Sustainability-approach.pdf
Melbourne Water	Statutory authority	State	https://www.melbournewater.com.au/

Metropolitan Waste and Resource Recovery Group	Statutory authority	Regional	https://mwrrg.vic.gov.au/
Monash Sustainable Development Institute	Research		https://www.monash.edu/msdi/initiatives/projects/circular-economy-textiles
Municipal Association of Victoria	Industry Body	State	https://www.mav.asn.au/
North East WRRG	Statutory authority	Regional	https://www.newrrg.vic.gov.au/
Office of Victorian Government Architect	State Government	State	ovga@ovga.vic.gov.au
Planet Ark	Not-for-profit	National	https://planetark.org/
Planning Victoria	State Government	State	https://www.planning.vic.gov.au/
Product Stewardship Centre of Excellence	Industry Body	National	https://stewardshipexcellence.com.au/
Resource Recovery Gippsland	Statutory authority	Regional	https://www.resourcerecoverygipps.vic.gov.au/
RICE	Not-for-profit	Regional	https://www.linkedin.com/company/regionalinnovationforacirculareconomy/about/
South East Melbourne Manufacturers Association	Industry Body	Regional	https://www.semma.com.au/

Sustainability Victoria	Statutory authority	State	https://www.sustainability.vic.gov.au/about-us/our-mission/our-strategies/statewide-waste-and-resource-recovery-infrastructure-plan-swrrip
Terra Cycle	Business		https://www.terracycle.com/en-AU/
The Australian Packaging Covenant (APCO)	Industry Org	National	https://apco.org.au/
Tourism Accommodation Australia (Victoria)	Industry Body	State	https://taavic.com.au/
Victoria Chamber of Commerce and Industry	Industry Body	State	https://www.victorianchamber.com.au/
Victoria Waste Management Association	Industry Body	State	https://www.vwma.com.au/
Victorian Local Governance Association	Industry Body	State	https://www.vlga.org.au/