



# Embedding a Circular Economy through Local Government in Gippsland: A Case Study, Utilising Smart Specialisation Methodology

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## Abstract

In 2017, the ageing Hazelwood coal-fired power station in Gippsland (Australia), finally—and abruptly, closed. The Latrobe Valley Authority (LVA), funded by the Victorian State Government was then established to assist redundant workers and develop a long-term approach to transitioning towards a more sustainable regional economy and socially cohesive community. To enable this, the LVA adopted and implemented a methodology made popular in the European Union of the ‘Smart Specialisation Strategy’ (S3), bringing together practitioners from government, business, research and education, and the wider local community (known as the ‘quadruple helix’) to co-design a shared vision for the region’s future prosperity. With Australia declaring its commitment to and the Victorian government developing policy support for a Circular Economy (CE), the LVA funded a research project in 2022 to facilitate a ‘place-based’ approach to implementing a CE business model across Gippsland. Based on interviews and workshops conducted in the period 2022–23 with key regional stakeholders, as well as on the analysis of secondary sources, this paper provides an overview of the experience utilising the S3 methodology to explore the implementation of CE in a regional setting, historically dominated by natural resource-based industries, that is now undergoing multiple economic transitions, including cessation of coal-fired power generation, oil and gas extraction and native timber harvesting. Significant barriers identified include: poor understanding of broader opportunities embedded in systemic notions of S3 and CE, siloed structure of local government authorities (both within or between councils), difficulty in promoting alignment and cooperation at all levels between a diverse range of stakeholders, lack of policy coordination and support for business innovation, together with the absence of financial incentives or regulatory mechanisms to change behaviour from a linear to CE. Despite improved intentions in policy settings around intentionality of CE practices and other initiatives being progressed simultaneously with this work, CE in Gippsland (and Victoria more broadly) and its implementation continue to be narrowly focussed on recycling and waste management, where there are clear pressures in stock-piling of waste and limitations on landfill expansion. Regional approaches to implementation of circular economy are limited in Australia, with the exception of exemplars such as Geelong, Barwon South West, and Bega. However, there are currently no examples of utilising S3 methodology to implement CE in a regional setting. Here we identify current barriers and provide recommendations on how to overcome these

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with the engagement of a diverse range of stakeholders across Gippsland from agribusiness, regional planning, local governments, small and medium enterprises, utilising S3 methodology, to enable systemic changes towards CE models to be implemented region-wide. This study documents the journey so far for Gippsland, where the transition from traditional extractive industry provides the opportunity to embed more sustainable practices moving forward.

**Keywords** Circular economy · Smart specialisation strategy (S3) · Local government · Gippsland · Transition

## Introduction

Gippsland is a region known for its primary production, such as brown coal mining, power generation, forestry and agriculture, as well as natural beauty from the forests to the coast, providing rich biodiversity and significant tourism destinations. Located in the south-east corner of Victoria, it represents almost one fifth of the State in geographic area (41,556 km<sup>2</sup>), however with a population of under 300,000 people across six local government areas [16]. Currently, the three largest employing industries are health care and social assistance, construction, and education and training (*ibid*, p.2). The LVA was established by the Victorian Government in 2017, in the wake of the disruption caused by the sudden closure of the Hazelwood coal-fired power station, one of the major industries and employment providers in the region. The LVA's remit was initially to assist with the re-employment of power station workers. However, with the transition to a clean economy, including closure of the remaining three coal-fired power stations and the cessation of native timber harvesting, this expanded to work with local government authorities (LGAs), industries and communities to reshape a strong and resilient future for the Gippsland region [27]. The *Gippsland 2035: Latrobe Valley and Gippsland Transition Plan* also reflects the regional commitment towards a net zero economy while positioning Gippsland as a circular economy leader [40].

To do this, the LVA adopted the ‘Smart Specialisation Strategy’ (S3), which has achieved significant outcomes in the European Union (European [20]). The S3 approach, in fact, became one of the backbones of the European Union (EU) regional development policy, a fundamental constituent of the EU’s Cohesion Policy [17]. In Australia, S3 methodology was first applied in the Hunter Valley in New South Wales [57] The S3 brings together government, business, research and education and the wider local community, referred to as the “quadruple helix” to co-design a shared vision for the region’s future prosperity, environmental sustainability, and social wellbeing, particularly in regions undergoing significant economic transition. It is an inclusive process of place-based ‘entrepreneurial discovery’ which involves in-depth analysis to identify the potential for connections within and between industry sectors that can define and drive competitive advantage, attract investment and foster activities which add sustainable value, productivity and employment [22]. The approach draws on extensive experience, and proven success, in Europe which demonstrates that regions with dynamic, place-based innovation systems are more resilient in the face of economic, social and environmental disruption and transition (Interreg [32]).

Transforming regional economies, while reducing their long-term dependency on natural resource extraction, is of great relevance for Gippsland. This is even more

important considering that Australia has the lowest level of manufacturing self-sufficiency of any OECD country [77]. Poor infrastructure, skill shortages, resource dependence, lack of access to finance and political uncertainties, are some of the barriers to business innovation in Australia, with a greater impact on Small and Medium-sized Enterprises (SMEs) in regional areas [37]. At the same time, there are fewer universities, research and technology centres in regional areas and rates of higher education attainment in these regions are comparatively low, as opposed to capital cities [24]. There is currently only one university campus in Gippsland and its main strengths are in nursing and education, leading to lower education attainment in key areas of innovation. In 2018, a research titled *State of the Art Review of Smart Specialisation in Europe* was published becoming one of the ‘foundation’ documents to inform the commencement of the S3 process in Gippsland ([GS3]; [71]). The document highlighted that, due to the weakness of existing networks and linkages in the Australian context, the adoption of an integrated, systemic approach to innovation system development, such as S3, was strongly relevant to regions (like Gippsland) seeking to accelerate the re-engineering of their economies (*ibid*, p. 3).

In more recent years, following global climate agreements and state and federal policy changes, a broad range of stakeholders around the world and in Australia have become increasingly focused on opportunities around the implementation of circular economy (CE). In the EU, the smart specialisation approach is becoming a key instrument for identifying regions’ opportunities for growth, development, and circular economy [62]. This current project, funded through the LVA but driven by One Gippsland, an organisation which constitutes the six local government authorities within the region, as well as peak bodies of major industries, has identified CE as the key area to focus the application of S3 design thinking. We will refer to it herein as CE-GS3, which stands for *Circular Economy – Gippsland Smart Specialisation Strategy*. The implementation of circular economic principles was seen not only as a way to transcend the traditional take-make-dispose economic model, keeping natural resources in circulation, but also to create new economic opportunities and employment, and also significant environmental co-benefits in the region, in view of the various transitions currently in progress (e.g. energy, native timber harvesting, agriculture). Local government authorities in Gippsland (and Australia more broadly) exercise considerable responsibilities for waste management and hence it was unsurprising that this was chosen as the focus area to apply S3 methodology.

Key principles that underpin CE and S3 are similarly based on the interaction and collaboration between researchers (basic and applied), entrepreneurial innovators, policy makers and civil society, to stimulate a societally desirable systemic change. Here we present the CE-GS3 project as a case study to examine how S3 methodology can be applied to promote the sustainable and diversified re-industrialisation of regional areas, through establishing a CE. Driving economic, social, and environmental value is particularly important in a time of significant and multi-faceted regional economic (re)specialisation, diversification, and path creation (e.g. [45, 50]). Here we highlight opportunities and challenges in utilising the S3 methodology within a regional multi-level governance setting, while providing an overview of CE and its implementation in Gippsland, the impact of engagement activities, and recommendations for future development. There is currently minimal research on CE [30, 44, 46] or S3 in Australia [70, 73], and even less regarding their adoption in regional areas [2, 25, 75]). This study addresses critical issues related to S3 and CE in the context of regional and local governance.

## Circular Economy in Australia and Victoria

Human development over the past century has been fuelled largely by rapid and accelerating dependency on natural resources, with the extraction and processing of raw material being responsible for about 50 per cent of global greenhouse gas (GHG) emissions and over 90 per cent of global water stress and land-use-related biodiversity loss [21]. About 20 per cent of these GHG emissions are caused by the extraction and processing of metals and non-metallic minerals [54]. These emissions can only partially be abated by energy technology solutions. Without business and policy model changes, resource use will more than double from current levels to 190 billion tonnes by 2060 and far exceed our planetary boundaries (*ibid*). This is where the intersection of net-zero emissions and a circular economy has become an essential component of the effort to reduce carbon emissions [8]. With the global population now over 8 billion and predicted to be 9.7 billion in 2050 [68], humans are using more resources than the planet can provide. The earth's raw materials are not limitless. In this context, CE has emerged as part of the solution to help meet the Paris climate goal (of no more than 2 °C of global warming) by 2030 [72]—one in which products, services and systems are designed to maximise their value and minimise waste. A CE is widely understood as an important aspiration for communities and economies across the world, and a necessity for many.

There is, however, no common or shared understanding of what a 'CE' is, exactly how it would function, what the shared benefits would be, or even how it might be achieved within a modern capitalist, consumerist society (note: many societies have been functioning within a CE for millennia [39];). The concept of CE has a wide range of meanings, adopted by various stakeholders, and often applied from different perspectives, which has led to some confusion and potential barrier to implementation. For instance, an article published in 2017 by Kirchherr, Reike, and Hekkert, identified and analysed 114 circular economy definitions. Their findings indicate that the circular economy is most frequently depicted as a combination of reduce, reuse and recycle activities, whereas it is oftentimes not highlighted that CE necessitates a holistic systemic shift, "instead of a bit of twisting of the status quo to ensure its impact" [35], p. 229). The history of this concept is deeply connected to the history of 'sustainable development', with different definitions sharing "the basic concept of decoupling of natural resource extraction and use from economic output, having increased resource efficiency as a major outcome" [9]. There is also a widespread belief that the CE is just about getting better at diverting materials from landfill, though it goes much further than this. It is rather about designing waste out of products and processes in the first place, or indeed re-used as a raw material for making new products [76].

It is generally recognised that Australia has a recycling and waste management problem, which also relates to its large land area, compared to the population base [52]. The Organisation for Economic Co-operation and Development's (OECD) most recent *Environment at a Glance* publication indicated that Australia was ranked fifth of all OECD countries for generating the most municipal waste per capita. Although about half the waste generated is being recycled, the continued growth in economic output has meant that the volume of waste going into landfill is actually on the rise (*ibid*, p. 5). Up until recently, Australia sent much of its waste overseas to over 100 countries as a cheaper alternative to local recycling, with China a major destination for this waste [53]. The three main categories of these exports are recyclable materials, like metals, paper and cardboard, and plastics. Concerns in recent years about recycling efforts was brought into focus by China's decision to ban the import of foreign solid waste from

January 2018. These initial restrictions were expanded in January 2021, accelerating exports to other destinations, especially to Indonesia and Malaysia [12]. These changes coincided with a growing interest in CE in Australia. This is significant in the last several years, particularly in response to international developments in waste management, energy consumption, and overall resource uses, but also to an increasing environmental awareness in the general population and decrease in availability and social license for landfill sites.

On a federal level, it was the 2018 *National Waste Policy* signalling the shift away from a linear to a more circular approach, with businesses and governments recognising the opportunities waste materials provide (Department of Climate Change, Energy, the Environment and Water [14]). In 2023, a Circular Economy Ministerial Advisory Group was also established with the role to advise government on the opportunities, challenges, and actions to develop Australia's CE [15]. CSIRO, Australia's national science agency, has been exploring research pathways in support of a CE, with an objective of reducing total waste generated in Australia by 10 per cent per person by [10]. However direct investment or regulatory intervention mechanisms have thus far been minimal, leaving CE adoption largely voluntary. On a state level, established under the *Sustainability Victoria Act 2005* as a statutory authority, Sustainability Victoria (SV) has been playing a pivotal role in accelerating Victoria's transition to a circular and climate-resilient economy. In 2020, *Recycling Victoria: A new economy* was released as the state's circular economy policy and action plan to reform Victorian waste and recycling system over the next decade [63]. In December 2021, the *Circular Economy (Waste Reduction and Recycling) Act 2021* [64] was passed by Parliament, providing the foundation for Victoria's transition to a sustainable and thriving circular economy. The Act is very progressive for its focus on the entire life cycle of products and materials, the creation of an integrated decision-making process, and the community involvement in decisions, policies, programs, and processes relating to the CE. However much of the policy approaches are aspirational, rather than regulatory or incentivised.

Efforts towards a CE led the launch of several initiatives and policy measures. The Geelong Future Economy Precinct [11], the Regional Innovation for a Circular Economy [58] in the Barwon South West, and the Bega Circular Valley group [3] in New South Wales are all good examples of projects supporting the delivery of circularity in regional Australia. None of these initiatives utilise an S3 approach explicitly. As for the Gippsland region, in October 2022, the *Regional Circular Economy Plan (RCEP) Gippsland* developed by the Department of Environment, Land, Water and Planning (now DEECA) established Gippsland's own priorities to 2030 for a sustainable and thriving circular economy [65]. 51 organisations contributed to the Gippsland RCEP, including local government, the waste and resource recovery industry, businesses and business associations, manufacturers, social enterprise, research and education institutions, and the Victorian Government. This document is presented as a collection of aspirations and priorities, leaving the rest to the initiative of individual stakeholders. As stated in the RCEP itself, "this is a strategic document, not a plan with set actions for individual participants to report on" (ibid, p. 4). Where the RCEP, for instance, talks about the fact that "everyone has a role to play in a circular economy" (ibid, p. 16), it does not specify how that would happen, nor describe future actionable objectives (i.e. solutions to be formulated, synergies to be supported, financial resources, guidance that government agencies will be providing to different stakeholders, level and type of involvement that will be granted in the development and implementation of the necessary policy changes). Without clear policy guidance – or incentives, this presents clear challenges to moving forward.

Taken together, all these policy measures and aspirations mentioned represent an increase in focus on CE initiatives that may offer significant opportunities in Victoria, especially for regional economies. However, ensuring these opportunities are seized, that they benefit communities as a whole, and are genuinely transformative, is still far from assured [1]. On top of that, there is little public awareness of CE in Australia or examples to draw from [46], compared with countries in the European Union, for example, where CE principles have been embedded for over a decade, gaining momentum as a policy concept since 2013 in the efforts to reconcile environmental and economic policy objectives [38]. A recent review of scientific publications and academic literatures found that only 45 articles were published in Australia between 2014–2021 on CE [30]. In Victoria, a study conducted by Iyer-Raniga, Gajanayake, and Ho [33] shows that although the state has a level of engagement with CE, this is sporadic, and set in a largely linear economic system. In particular, with regulations and policies still lacking to provide a comprehensive approach and broader concept of CE, the above-mentioned research suggests that state authorities should drive the systemic change required to achieve CE targets (*Ibid.*, p. 62).

## Research Methodology

### Methodology

Conducting qualitative data analysis is one of the most important stages of the smart specialisation strategy [56]. Based on in-depth interviews and workshops with quadruple helix representatives, our aim was to unearth more information and evidence about the economic, innovative and scientific potentials of CE in the strategic domains of Gippsland. Following the principles of the grounded theory approach [26], in this paper will present a case study about the implementation of CE design thinking utilising S3 in a regional setting of Gippsland, Australia, an area undergoing multiple significant economic transitions. This choice is justified by the novelty of the research topics under investigation (CE and S3 in Australia and, more specifically, in regional settings) and the infancy stage in which they are currently, as well as the imperative of the issues, highlighted by recent policy development. On the one hand, the case study place-based approach is “useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context” [59], p. 1). A grounded theory approach, on the other hand, is a qualitative research methodology that is appropriate when little is known about a phenomenon. It is exploratory in nature and attempts to create conceptual theory through building inductive analysis from the data collected, based on observations and interviews with real subjects [7].

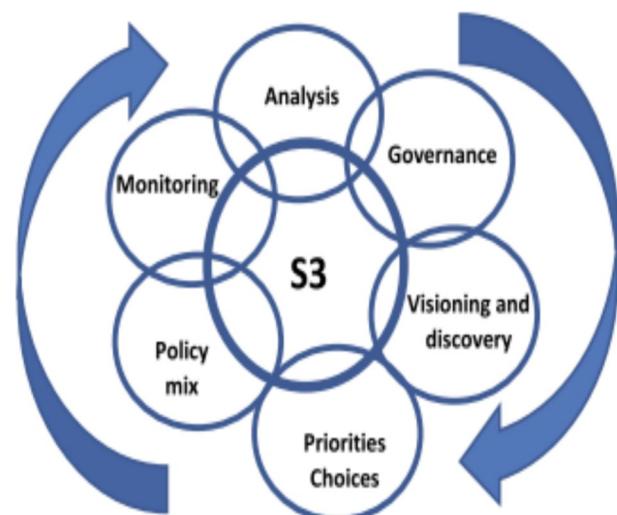
The authors were part of an academic Research Team from RMIT University, the University of Melbourne, and Federation University which was contracted by the LVA to implement the S3 methodology to develop a CE strategy in Gippsland. The adopted methodology also mixed phenomenological enquiry with Participatory Action Research (PAR). Our goal was to seek an ‘insider’s account of the phenomenon under investigation and to develop an understanding of it along with the participants themselves [28]. Within this context, the S3 methodology, involves co-design of its defining elements (i.e. regional assets and competitive advantage), to provide a framework for understanding a place’s unique knowledge-based assets, expertise and strengths, while connecting the local context with evolving national and international economic activities and value chains (European

[19]). The S3 methodology has previously been employed in Gippsland, through the LVA and RMIT and Melbourne Universities to address the economic transition away from coal-fired power generation and also presently, native timber harvesting [13], and so participant were somewhat familiar with this approach. The S3 process is made of six key stages (as shown in Fig. 1 below), which require high standards for continuous and active stakeholder participation.

The S3 has a bottom-up approach as it works with the stakeholders in place, to produce social and economic benefits to the region [43]. This process can be briefly summarised as follows. It commences with a Regional Context Analysis (RCA), which is a rigorous assessment of the evidence that aims to identify the assets and knowledge which can support innovation opportunities and potential challenges in a region [73]. This helps to establish inclusive and collaborative governance arrangements with a diverse range of stakeholders from the “quadruple helix”. The qualitative mapping phase culminates in the stakeholder dialog in the entrepreneurial discovery process (EDP) which provides a framework within which to make choices and explore regional potentials for innovation. Consequently, innovation working groups (IWGs) are established for each of the innovation opportunities identified to enable more clear definition of the proposal through development of business cases to attract funding. Finally, reiterative processes of evaluation, monitoring and learning, which are embedded from the outset, allow for ongoing adaptation and refinement of the strategy [69]. Linkages established with regional networks, national and international institutions, together with public events and conference presentations have further profiled the Gippsland approach to regional innovation and development to policy-makers and practitioners nationally and internationally.

However, this study is not without limitations. The aim of this paper was specifically to provide an account of the implementation of CE in Gippsland by using the S3 methodology. Within this context, prioritisation is no longer the exclusive role of the state planner (top down) but involves an interactive process in which the private sector is involved in discovering and producing new activities, with the government providing conditions for these to happen, assessing potential and empowering those actors most capable of realizing the potentials [51]. While S3 highlights the bottom-up nature of voluntary participation,

**Fig. 1** The S3 process



the paper did not place the Gippsland experience in the debate about voluntary measures to bring societal change. Also, the Authors did not conduct a comparative analysis between the S3 and other potential approaches to move from a linear economy to a CE. These represent possible directions for future analysis.

## Literature Review

A structured review of two streams of literature: CE and S3, in Australia, Victoria, and Gippsland respectively was undertaken, providing a theoretical foundation for the study. This background analysis was used to develop the research questions and prompts, later used during the consultation process with key stakeholders. Although the theoretical framing was not the key motivation for this applied research, examples are drawn from the literature to compare to the Gippsland experience. Criteria of inclusion considered in this study comprise the year of publication (between 2017 and 2023),<sup>1</sup> the geographical location, keywords, and language. The analysis began by searching relevant articles in Scopus database using the following key words: “circular economy”, “smart specialisation”, “Australia”, “Victoria”, “Gippsland”. The initial level of analysis was intended to capture all the papers discussing any of the selected keywords.

At this stage, we employed three search strings: “CE”, “S3”, and a combination of “CE and S3”. The first search string, which identified published articles related to “CE” in “Australia”, and/or “Victoria”, and/or “Gippsland” yielded 134 publications. Of these, 14 were conducted in Victoria. None of the identified articles made any reference to Gippsland. The second search string helped to identify articles related to “S3” in “Australia”, and/or “Victoria”, and/or “Gippsland”. This search yielded 7 articles, of which 5 were conducted in Victoria, and more specifically in Gippsland. Finally, we also used a combination of the previous two search strings, CE and S3. However, this third search string did not produce any results, indicating that the debates on CE and S3 in Australia are treated separately in academic literature. The identification stage yielded a total number of 141 distinct.

All the articles were subsequently screened for relevance based on the following criteria: keywords must appear in titles or keywords or abstract; written in English; published between 2017 and 2023; excluded highly technical disciplines and articles narrowly focused on a single topic (e.g. waste management, urban planning, build environment, SMEs and their challenges in implementing CE) with no systemic, cross-sectoral, and trans-local collaboration patterns. We followed the same extraction process for the three search strings. The initial pool of papers identified was filtered further to remove duplications. After the screening process, only 44 articles (38 on CE and 6 on S3) that met the selection criteria were reviewed. We further excluded articles that made no reference to the implementation of CE and S3, or did not appear to have any explicit implications for these topics, or did not acknowledge the systemic foundations of CE and S3, or had no reference to regional contexts in transition. Following this phase, we were left with 19 articles that matched our inclusion criteria. Of these, 13 on CE and 6 on S3. None of the articles we screened dealt with both CE and S3.

<sup>1</sup> The years 2017 and 2023 were chosen because of their relevance to this research project. In 2017 the S3 approach was first introduced and adopted in Gippsland to stimulate its regional development. In 2022 the LVA funded this project with the goal to investigate innovative opportunities around CE in the region and 2023 is when the research team presented a fully business proposal to them.

By conducting a review of the literature from the past six years we identified a lack of systemic approach in the way either CE and S3 principles are implemented across Australia, and Gippsland more specifically. The limited literature and practice related to CE, for instance, seems to point towards its understanding in terms of waste management and recycling (e.g. [1, 31]). CE's link to social capital values was also weak, with no mention of its impact on the development of the society, social equity, human well-being, and future generations. CE should rather be understood as a fundamental systemic change, recognising the importance of the economy needing to work effectively at all scales – for big and small businesses, for organisations and individuals, globally and locally [18]. To achieve a systemic realignment of business, regulatory, and societal practices, Moglia et al. [48] highlighted the importance of intermediaries, such as CE hubs, for knowledge sharing, networking, and collaboration. Also, as Melles [46] pointed out, local and regional governments, community organizations, and other “smaller” socio-political actors, is where the potential for innovative change is possible, although these actors are bound by financial, regulatory, and other political limits established by state and federal actors.

Similar considerations can be formulated regarding the S3 in Australia, with literature only related to the Gippsland experience and no focus on the creation of innovation ecosystems, to enable the social economic sustainability of regions going through multiple transitions. Among the available studies on S3 with a focus on non-urban regions, Murphy et al. [49]’s findings are supportive of smart specialisation policies. According to them, S3 “may be an effective means of promoting regional employment through policies that do not seek to pick winners, but rather seek to promote market efficiency and commit the emergence of new and viable industry sectors to the spontaneous development of new processes by entrepreneurs who are free to pursue their own best interests” (p. 141). Other studies, instead, raised some criticism regarding the application of S3 in peripheral locations. More specifically Weller and Rainnie [74] argued that the S3 approach was applied to an “artificial territory” (Gippsland), moving away from an earlier model of local development under the auspices of local governments. According to Weller and Rainnie [74], in the hope of creating regions comparable with OECD and EU regions, the GS3 project “has overlooked local arrangements that arguably were already smartly integrating local and global knowledge” (p. 309). The present study provides an important contribution in the direction of establishing robust conceptual frameworks around the creation of a regional CE using the S3 methodology, while laying the groundwork for future studies in this field of research.

## Participant Recruitment, Interviews and Data Analysis

The qualitative analysis was focused mainly on semi-structured interviews and workshops with key stakeholders, supplemented by desk research of existing literature relevant to this study. Such analysis was challenging in the Australian context, where, unlike in Europe, there is no established architecture for the kind of place-based data collection that underpins European S3 processes [73]. Between July and August 2022, 1–1 interviews were conducted with 42 stakeholders in Victorian CE transition (Local Government 8, State Government 6, Businesses 15, Community Organisations 8, Research and Education 5). These key actors were selected because of their practical experience/expertise or organisational mandate around CE. Our aim was to gather the participants’ view around five main research questions, as shown in Table 1.

Participants were initially recommended by the LVA, with additions coming from Gippsland six LGAs. Word-of-mouth and snowballing were also methods that were used

**Table 1** Research Questions

CE
What is the understanding of CE amongst key representatives from the “quadruple helix” in Gippsland?
Are there any distinct examples of circular economy initiatives in Gippsland, that you are aware of?
How do they see Gippsland transitioning from a linear to a circular economy? What steps are involved in the process?
What are the barriers, challenges, and enablers to effective implementation of CE principles in Gippsland (and Victoria/Australia more broadly)?
What could the government (local, state, federal) do to support this transition?

to recruit more participants throughout the project life span. Ethics approval was granted prior to the data collection process. Participation in the interviews was voluntary and taking part in the interview implied informed consent. Data collected from interviews was transcribed and coded into separate themes. The interviews had a duration of 45–60 min around the five main questions. Each interview was transcribed through Microsoft Teams. To uncover emerging themes, a thematic analysis method was implemented [6]. Recurrent words/concepts were classified into abstracted subcategories to interpret similarities in the data while identifying key themes. Data was organised and coded to allow the key themes, both derived from the literature and emerging from the dataset, to be easily retrieved at a later stage. To be noted that the aim of our qualitative analysis was to bring meaning to the CE context in Gippsland presenting it in the form of a storyline. In the next sections, we summarise the data, showing the process that led a diverse range of stakeholders to invest their time and resources in identifying and developing a CE Hub as the best innovation opportunity for the region.

During the following months, from September 2022 until June 2023, EDP and IWG workshops were conducted involving the initial sample of stakeholders together with new participants that became aware of the CE-GS3 project through snowball recruitment and had expertise relevant to the areas being explored through each IWG. This process allowed us to assess the networking capabilities of a diverse range of regional stakeholders around the topic of CE utilising the S3 approach. A total number of ten workshops (EDP and IWG) were conducted since the inception of the project: three of them took place online via Microsoft Teams, while the rest were hosted in turn by each of the six LGAs in Gippsland (see Supplementary Data – Table 2 Meeting List). An average of 28 stakeholders attended these meetings with a balanced distribution across the four categories of the quadruple helix (see Supplementary Data – Table 3 Participants Engagement). To uphold the privacy and confidentiality of all interview information, the comments made by individual participants were deidentified and collated and used to inform the various stages.

## Results

### Interview Insights

The initial stage of the CE-GS3 resulted in the development of a Regional Context Analysis Report [1]. As previously mentioned, this was informed by consultation with over 40 participants from across the quadruple helix, regarding their knowledge of CE activities

and opportunities in the Gippsland region. Although many of the interviewees responded in terms of immediate issues, such as limitations to landfill, lack of recycling facilities for materials such as silage wrap or surplus materials, such as bio-waste from forestry and agriculture, others presented more innovative opportunities, including spent chicken litter as feedstock for bioenergy production or seaweed cultivation on basal structures for off-shore wind turbines. Common definitions and priorities determined for CE in Gippsland by the interviewees included:

- 3R framework: reduce, reuse, recycle materials
- Use of waste for clean energy (including novel feedstock)
- Elimination or repurposing of waste
- Adoption of sustainable strategies, more broadly
- Need for community education around CE

What was apparent from the interviews was the primary focus on the problem of waste, rather than designing waste of systems, or repurposing waste products or potential economic benefit, thus minimising raw material usage. Most importantly, the appreciation of CE as a systemic change of approach was poorly understood. Another key gap was the lack of connection between resource usage and societal impact and other broader aspects of sustainability. Where the latter was concerned, the focus was mostly on the environmental and in some case, economic benefit (or deficit), with little acknowledgement of social equity – such as intergenerational equity. Another key aspect was the mixed ideas around of where the responsibility for implementation of CE should lie:

- with consumers' demand and/or willingness to pay for CE products;
- regulatory restrictions and policy incentivisation, such as costs or fines for waste, procurement policies prioritising CE, or grants and programs to embed CE;
- clearing of obstructions from regulators, including smoother approvals processes for CE initiatives (e.g. anaerobic digesters);
- or within individual businesses, encouraging entrepreneurship in CE.

Other key gaps included understanding of the breadth of CE and the potential economic benefit of embedding CE design thinking.

Given that this project was delivered through One Gippsland, who represent the six local councils of Gippsland, as well as select peak industry bodies, it was not surprising that minimising waste to landfill was a priority, as these facilities are administered by local governments in Victoria, and existing capacity for landfill is diminishing statewide. Several logistical and infrastructure issues were cited, including lack of high-quality sorting and recycling facilities, mixed quality of feedstock and the extensive distances across shires, frequently with low population basis. Transporting waste is expensive, particularly in view of elevating fuel costs. One suggestion was to offer specialist recovery and recycling centres for different waste streams across Gippsland and improved transportation (e.g. rail).

One of the key opportunities identified in numerous interviews was to repurpose waste into valuable products through utilising biomass generated from the timber and agricultural industries – two of the largest industries in Gippsland. Biomass is excess organic material that can be repurposed to a variety of uses including biofuel for heat and electricity generation, or biochar for soil remediation through pyrolysis [66]. The agricultural sector is supporting various CE initiatives, showcased through Agriculture Victoria's SmartFarm at Ellinbank, which has the ambitious target of being the world's first carbon-neutral dairy

farm [55]. Uptake of bioenergy is growing within the food and fibre sector, with examples including processing of effluent through anaerobic digestion, to utilising waste streams from production at the OPAL paper and packaging factory. Within this context, the Wellington Shire Council, in partnership with the Latrobe Valley Authority, has developed a framework (*Gippsland Bioenergy Development Framework*) to support industry to build capability in initiating, developing or investing in biomass to energy projects in Gippsland [60]. It should be noted that producing energy is at the low end of the value chain for biomass and higher end products, such as organic-based soil amelioration to further support the agricultural industry, should be considered first. However, given the transition in the energy industry away from coal-fired power, where generation for Victoria has been centred in Gippsland, it is not surprising that finding alternative energy sources is front of mind.

Several participants noted that the awareness and appetite for CE approaches was poor in Gippsland, with barriers including cost, reliability of supply of feedstock, lack of infrastructure or businesses providing CE initiatives, regulatory restrictions, lack of support and policy framework and lack of understanding of options and benefits. Currently there are few incentives to embedding CE approaches and a significant cost burden to implementation. Some solutions offered were to set up pilot projects or demonstration sites to increase literacy around CE and troubleshoot solutions. Increasing cost of waste disposal was another suggestion. However, collaborative approaches either at a shire or sector level were favoured to provide certainty and share learnings. Other incentives could be applied through procurement and grant processes, administered by council and State Government that stipulate demonstration of CE principles. It was acknowledged that a more systemic approach that prioritised private–public partnerships and place-based co-designed solutions was key to successful implementation.

## Workshops

For the next phase of the project, the findings of the Regional Context Analysis were shared with around 40 participants, with representation across all six shires and the quadruple-helix, at an Entrepreneurial Discovery Process workshop. This workshop was designed to take these findings and from this, identify key priorities for further development through a participatory co-designed process. From this, the following innovation opportunities were identified:

- Biomass Energy Co-location Hubs (Renewable Energy and Biomass)
- Cellulose to replace Single Use Plastic (SUPs)
- Gippsland Material Recovery Facility (GMRF)
- Gippsland Circular Economy Hub (GCEH)

These opportunities were then presented to the project control group who selected the GCEH as the initial priority project. Creating a GCEH was seen to have the most direct relevance to local governments and their role, as crucial in enabling businesses and educating broader society, including all stakeholders, about the importance of circular economy initiatives, as well as generating joint projects and shared outcomes. An Innovation Working Group (IWG) was then established from workshop participants and other identified key stakeholders to further develop this opportunity.

The role the IWG is to co-design the opportunity – in this case the GCEH – to then develop a business case to seek financial support for implementation of the project. The GCEH IWG saw the creation of a permanent hub, which is specifically dedicated to Gippsland transitioning towards a CE, as an opportunity to provide the region with a central focal point for CE enterprises, practice and knowledge sharing and act as an accelerator to innovation at all scales. The GCEH would bring together academics, industry practitioners, policy makers and civic society to deliver CE research, innovation, and value adding initiatives – as well as basic, user-friendly advice for community and business alike. Most importantly, the creation of a GCEH would support the adoption of a broader systemic approach underpinning CE that is currently missing, mainstreaming the CE approach holistically and harnessing interest and activity to build critical mass and shift the identity of Gippsland from resource extractive to regenerative and resource enhancing.

An Action Plan that can support practitioners and stakeholders to establish shared goals and coordinate action towards a well-orchestrated CE transition in Gippsland will be critical to its success. A draft Business Proposal, designed to provide a comprehensive overview of how the GCEH could be structured, developed, and function in practice, was delivered to One Gippsland in June 2023. The first aim of the GCEH is about the creation of or growth of CE awareness, and the role of the hub itself, but also about mapping stakeholders' needs and challenges in becoming more circular. The second aim is about taking action. While building awareness, the GCEH would deliver specialised services and implement projects and activities that will boost the region's manufacturing capabilities, while enhancing a more sustainable and socially cohesive community. Another aim of GCEH is to influence political, economic and social policy. By showing what works in practice, by actively creating new innovation opportunities in circular terms, and by mobilising a range of stakeholders, the GCEH would be able to inform policy reforms and help defining priority areas, relevant to the Gippsland context.

## Discussion

Throughout the course of the project, various obstacles to engagement and adoption of CE became clear. What emerged is that there is no consistent understanding of CE among stakeholders, and the focus of CE policy and implementation continued to be end of the line waste management. This is in line with the findings of other recent studies which investigated CE awareness, drivers, challenges, enablers, and barriers across key stakeholders in Victoria (i.e. [31]). From conversations with LGA representatives, there was a limited knowledge regarding the systemic approach to CE, an institutional limited capacity of LGAs together with competing interests within and across municipalities. These issues were also recorded in a nation-wide study conducted by Tobin and Zaman [67]. While focusing on inter-municipal cooperative partnerships in waste management, the authors detected a culture of competitiveness between different city councils antithetical to sustainability. Although local councils are critical to sustainable practices (including waste management), they are forced into situations they have little control over [34]. Local governments in regional areas are extremely stretched, with one person often working across several portfolios. Time and mental energy to devote to such initiatives is hard won, unless specifically in a budgeted workplan. For CE to be most effective, various workstreams, including waste, sustainability, economic development, procurement, environmental management, maintenance, and community development all need to be considered, although

within local government, these tend to work in isolation. Therefore, decisions and resourcing need to be made at a higher level. The LVA or One Gippsland could play a key role as the ‘connector’, assisting stakeholders to comprehend the importance of the value proposition for the region.<sup>2</sup> However, funding schemes to support CE and other initiatives tend to be ad hoc, making large scale planning challenging. These can also often be competitive, rather than supporting regional initiatives. Support, clear policy signalling and investment needs to come from a higher level, such as state or federal government to enable this conversion of practice to embed a circular economy and attract private investment and innovation.

It should be stated that there were some challenges in finding ‘appropriate’ people to interview. As the project was led by One Gippsland, each of the six shire councils nominated a staff member to represent them on the project. This was the waste, environment and/or sustainability officer – due to common association of CE with these fields [47]. However, these participants had a narrow understanding of broader council operations. This is reflective of the somewhat siloed nature both within and between local government areas. After discussion, participation was broadened to include other portfolios such as economic development, as well as procurement and maintenance. Likewise, there were challenges in engaging members from private industry either due to lack of awareness of CE or unwillingness to give their time and intellectual property for free, without a clearer understanding of the long-term intent of the project. The education sector was also poorly represented, due to limited expertise in CE at the local university. Community sector representation generally came from local sustainability groups, who had a deeper understanding of CE but narrow remit for implementation.

Gippsland is an area with abundant space and natural resources and a skilled workforce. The principle of circular economy has slowly gained acceptance in the last few years in Australia, being applied to several industrial sectors like the agri-food sector, the mining and extraction sector [29]. Yet, the imperative to develop an embedded CE has not been at the forefront of people’s minds in Gippsland. Given the significant transitions the region is facing—in the energy, timber and agricultural industries, it is arguably the perfect time to embed a more sustainable way forward. There needs to be both barriers to continual waste production, or use of virgin materials and a much greater awareness of impact and opportunity to move to more effective practice. Although there is a growing awareness within the general community around our planetary boundaries, this has not appreciably moved to consumer sentiment and demand. There are some excellent education programs throughout Victoria at primary school level (e.g. Resource Smart), but these need to be promulgated throughout all the community and appropriately resourced to drive change. Specific awareness campaigns targeted at the local context to both demonstrate the need and alternative approaches will be required. As for industry to participate fully in CE, there needs to be a defined benefit. Some industries reported that early attempts to develop CE projects had been stifled due to regulatory processes, such as providing novel streams for waste recovery and repurposing. SMEs, in particular, which account for 90 per cent of all businesses in Australia, struggle more than larger organisations implementing CE principles, due to narrower margins [61].

<sup>2</sup> To be noted that at the time this article was under review the LVA has been actively helping to set up the Gippsland Circular Economy Hub. The LVA is currently organising regular forum events to facilitate a considered and informative discussion on Circular Economy [41].

Working with companies and regulators to address these challenges and develop a CE infrastructure and community of practice will be essential to greater adoption.

Another aspect that emerged from this research is a lack of awareness of existing waste streams – in particular, around the quality of waste streams that could be re-entered effectively into CE. This is causing some apprehension to adoption. As a matter of fact, waste is managed by different authorities (household-LGAs, industrial-State Government) challenging to get alignment or understand levers. On top of that, mistrust exists between State and local governments – particularly where State Government pulls a policy lever – with an intrinsic expectation which is for local governments to pay for the implementation. Regulation with blunt, one-size-fits-all policies stifling innovation, complexity of certification of new potential products, and obstructionist regulatory approaches were other barriers emerged from this project. Within a context that has been widely described as “Australia’s waste crisis” [42], government policies should encourage waste reduction and help businesses creating markets to re-purpose that waste profitably [25]. At the moment, though, “the policy levers that drive change in waste management in Australia come from national and state tiers of government and are still in their infancy” [4], p. 19). There is an opportunity here for the region to work collectively with the regulators to determine the best pathways forward. But regional local governments in Australia need encouragement and support through the right policy levers to improve resource recovery (*ibid*). Not surprisingly, as Lee [42] argues, circular economy is being only “used as a ‘pivot’ in economic policy away from neoliberalism in order to maintain business-as-usual for the waste industry” (p. 1718).

To overcome these challenges and bottlenecks that might prevent local capabilities to be activated and exploited, most of the project’s participants saw the creation of a permanent CE hub in Gippsland as the best way to support the adoption of a broader systemic approach to the development of a CE. In the first instance, through building community and business literacy of CE and accessing up to date information on CE and assisting to develop a community of practice around CE in Gippsland. It could also pilot CE projects or highlight local success stories. Data gathering and monitoring would also be a critical component, to assess efficacy and outreach over time of implementation of CE practices throughout the region. The GCEH may also act as an enabler to collaboration across sector and provide advocacy for development of new CE initiatives and principles. Importantly, if the GCEH was facilitated through local government initiatives, including staff time or other resources, CE practices could then be embedded in the local council structure, across portfolios. The IWG identified the following key functions of the GCEH:

1. **Education** – information sharing, creating connections, interface to other platforms, storytelling (providing visibility to existing CE experiences in the region).
2. **Assistance** – advice, research, development connection to on the ground groups, start-up supports, council connect, funding & investment.
3. **Advocacy** – interaction with policy, politics, promoting, sourcing funding.

The final business proposal which was delivered by the IWG to One Gippsland establishes a roadmap showing how various stakeholders could contribute to achieving the CE objectives in a collaborative manner. However, despite IWG members have constructively worked on developing this document, getting their buy-in, either financial or in-kind, proved to be difficult.

## Conclusions

The S3 concept has been applied successfully to multiple regions across the EU, enabling them to increase their capacity to drive economic development in the long-term [75]. In a similar way, the CE-GS3 project aimed to work through local government with the communities across Gippsland to understand if the methodology could be applied to a regional area in Australia and develop an innovation approach specially tailored to the exploration and implementation of CE practices for the Gippsland region. The CE-GS3 initiative discussed in this paper focused specifically on the following key objectives:

- Increasing collaboration across industry, community, government, and academia in Gippsland;
- identifying and pursuing competitive advantage opportunities within Gippsland, implementing CE principles;
- reducing waste, conserving resources, introducing regenerative practices, and creating new economic opportunities for the region;
- understanding challenges to implementation;
- supporting better decision making through evidence-based analysis and further enhance multi-stakeholder engagement;
- creating the conditions for “societally desirable systemic changes” [23],
- developing business cases and feasibility studies in CE to attract investment.

Within this context, S3 has been promising a much more comprehensive perspective on innovation than the more typical focus on firms, clusters, and linkages with R&D centres, seeking to connect place-based innovation with the evolving pattern of transnational economic activity [71].

With a more specific focus on CE innovative practices, the GS3-CE project shows that together with a broad range of innovation opportunities in Gippsland, the lack of institutional capability and of cohesiveness amongst key agencies meant that any collaboration between industry, government, education/research, and community is still ad hoc and unsystematic [1]. Establishing circular economies at scale across Gippsland must address complexities surrounding this goal, such as transport and logistics, infrastructural limitations, competitive funding, and different priorities, just to name a few. Discussions about the CE can often be rather narrow and focus too much on practical actions (like closed loops, product service systems, business models [18];). A more holistic look at the system is thus needed and understanding how complex systems—like an economy and supply chain—operate is the first step towards creating better solutions for the region. Key to this change is the participation from a range of actors across society. The creation of a GCEH might be the first step towards the adoption of that broader systemic approach underpinning a CE that is currently missing, mainstreaming the CE approach holistically and bringing it to scale. Due to the limited research on the role of strategic planning to transition to a circular economy [5], this project is therefore relevant to investigate applications of the circular economy model from the perspective of local strategic planning. However, regulatory policy incentives and investment need to occur to build the CE infrastructure and ecosystem.

This research finds that, the focus of CE policy and implementation continues to be around recycling and waste management and the understanding of higher order opportunities are in their early development stages in Gippsland. A key element to embedding an effective regional CE and a ‘systems thinking’ mindset will be about establishing inter-municipal

cooperation arrangements. As theorised by Tobin and Zaman [67], shifting from intra-council to inter-council decision-making (not merely confined to the waste management domain), is conducive to regional cooperation, which might eventually morph into a sense of “regional identity” [36]. Ultimately, the need to design waste out of system, the increasing costs of raw materials globally, and a desire to increase local manufacturing may provide many opportunities for cross-regional and intersectoral collaboration and innovation. At the moment, though, collectively embracing a systemic approach and transition to a CE, in line with other regional transitions, such as in energy, forestry and agriculture, in alignment with the *Gippsland 2035: Latrobe Valley and Gippsland Transition Plan* (LVA, 2023), with attention to re-design, re-purposing and embedded sustainability, remain significant challenges for Gippsland. As stressed in previous studies as well [69, 70], the Gippsland CE-S3 project should be seen as a “work in progress”, whose outcomes are likely to be difficult to evaluate and definitively measure, given the wide range of co-evolutionary economic, social and policy-related factors. Besides, CE as a field of research is still in its infancy in Australia [61]. Nevertheless, the CE-S3 has exposed a wide variety of actors to the potential for embedding CE principles as the region moves through significant and coincident economic transitions.

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**Data Availability** The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

## Declarations

**Ethics Approval and Consent to Participate** Ethics approval was granted prior to the data collection process. Ethical review was undertaken by RMIT's Human Research Ethics Committee.

**Consent for Publication** Informed consent was obtained from all individual participants included in the study. The authors affirm that human research participants provided informed consent for publication.

**Competing Interests** The Authors declare no Competing Financial or Non-Financial Interests.

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