

Navigating circular economy adoption: a service ecosystem perspective

Alexandria M. Gain

UQ Business School, The University of Queensland, Brisbane, Australia

Roderick J. Brodie

Faculty of Business and Economics, University of Auckland Business School, Auckland, New Zealand

Joya A. Kemper

*UC Business School, University of Canterbury, Christchurch, New Zealand and
Faculty of Business and Economics, The University of Auckland, Auckland, New Zealand*

Claudia Gonzalez-Arcos

School of Management, Pontificia Universidad Catolica de Chile, Santiago, Chile, and

Macarena Tabilo and Ellen Derbyshire

UQ Business School, The University of Queensland, Brisbane, Australia

Abstract

Purpose – This article develops a novel conceptual framework to explain the processes facilitating a system-wide transition towards the circular economy (CE). The framework aims to provide CE scholars, practitioners, and policymakers with a deeper understanding of how to navigate the complex government-led initiatives aiming to facilitate a large-scale transition from a linear to a circular economy.

Design/methodology/approach – The framework is developed from a review of scholarly research on circular service ecosystems (CSEs) and service ecosystem dynamics to identify and conceptualize the processes facilitating CE adoption. This framework is illustrated using the example of Australian government initiatives aimed at reducing food waste.

Findings – The Circular Service Ecosystem Adoption framework and illustrative case identify the key processes that facilitate CE adoption. Specifically, the framework shows how CSEs evolve through dynamic states (from reproducing a linear economy paradigm to transitioning to a circular economy paradigm). CSE adoption is facilitated by mobilizing driving processes of evolution towards CSE and managing its inhibitors.

Originality/value – An understanding of CE adoption is advanced by unpacking the role of service ecosystems and their dynamics. The framework illustrates how CE adoption occurs through a dynamic, evolutionary process underscored by a shift from a linear to a circular economy paradigm in the service ecosystem. The role of government initiatives is emphasized as a catalyst, facilitating grounded and scalable impact.

Keywords Circular economy, Linear economy, Service ecosystems, Service ecosystem dynamics, Food waste

Paper type Conceptual paper



1. Introduction

Over the past two decades, the circular economy (CE) has received increasing attention from governments, organizations, scholars, and other stakeholders as a pathway for greater sustainability [1]. One of the most comprehensive CE initiatives to date has been undertaken by the Ellen MacArthur Foundation, established in 2013. They contrast the “take-make-dispose” linear economy, where we take resources from the Earth, make products from them, and eventually discard them as waste, to a circular one, where the end-of-life concept is replaced with restoration or regeneration, and the idea of “waste” no longer exists (Ellen MacArthur Foundation, 2013). Other well-known initiatives to support a CE include extended producer responsibility (EPR) schemes, such as the EU’s Packaging and Packaging Waste Regulation, which “prevent and reduce packaging waste, including through more reuse and refill systems” (European Commission, 2025). It is recognized that transitioning to a CE creates opportunities for economic and environmental synergies by decoupling economic growth from virgin resource inputs and drives systemic change across all sectors of the economy (Ellen MacArthur Foundation, 2013).

Despite growing interest in a CE, the latest Global Circularity Report reveals global circularity is still declining, from 9.1% in 2018 to 6.9% in 2024 (as of the latest available data; Circle Economy, 2025). This lack of progress has led many stakeholders to become disillusioned; with the transition to a CE essentially becoming stuck between the narratives of utopia, where CE is viewed as a solution to many sustainability challenges, and paralysis, where barriers prevent stakeholders from committing significant resources to a CE (Bocken *et al.*, 2025). Consequently, achieving a system-wide transition to a CE, henceforth referred to as CE adoption, remains a key challenge (Hetherington *et al.*, 2024; Mubarik *et al.*, 2024).

Influential CE scholars emphasize the need for a systemic perspective to understand the transformation required for CE adoption (e.g. Ghisellini *et al.*, 2016; Sönnichsen *et al.*, 2025). However, the complexity of CE systems is widely recognized as a barrier (Feldman *et al.*, 2024; Fehrer *et al.*, 2024; Sönnichsen *et al.*, 2025). Underpinning this complexity is the notion that CE adoption involves change across multiple, interconnected systems (social, technical, natural, and economic), involving deeply interconnected components (institutions, resources, and practices) and interactions among diverse actors (Bicket, 2020). For example, the EU’s revised Packaging and Packaging Waste Regulation (PPWR) aims for full recyclability of packaging by 2030. However, discrepancies in national standards, fragmented recycling infrastructure, and inadequate enforcement have undermined actors’ implementation efforts, resulting in persistent levels of packaging waste and significant landfilling or incineration, despite regulatory efforts (EBB, European Environmental Bureau, 2025). The complexity of CE adoption is exacerbated by the long timeframes for change and the non-linear nature of transitions (Bicket, 2020).

These conditions present challenges for governments, organizations, and scholars seeking to drive CE adoption (Bicket, 2020), including unclear implementation pathways and gaps in technical expertise (Feldman *et al.*, 2024), as well as the need to redesign service encounters within this evolving context (Sönnichsen *et al.*, 2025). Hence, the purpose of this article is to explore how to navigate CE adoption within complex and dynamic socio-economic systems. CE adoption presents a multifaceted challenge, requiring not only technical support but also coordinated action amongst diverse actors, adaptive institutional arrangements, and a shift in value orientations and value co-creation practices (Fehrer *et al.*, 2024). To navigate such complexity, it is fundamental to move from studying isolated system components to analyzing how the system behaves as a whole, including “the dynamic behavior of the system arising from its interacting parts and its propensity to change over time” (Bicket, 2020, p. 146). Thus, a dynamic behavioral perspective on CE adoption can be particularly valuable for understanding the “learning, adapting, and evolving properties” of the socio-economic system (Beirão *et al.*, 2017, pp. 229–230). While scholars increasingly recognize the importance of a dynamic approach to studying CE transitions (e.g. Bocken *et al.*, 2025; Bojovic *et al.*, 2025; Fehrer *et al.*, 2024), current research is yet to provide a comprehensive understanding of the processes

through which CE adoption unfolds within complex and dynamic socio-economic systems (Bocken *et al.*, 2025).

This article draws on a dynamic perspective of service ecosystems (As'ad *et al.*, 2024; Beirão *et al.*, 2017) and an S-D logic-informed conceptualization of circular service ecosystems (CSE) (Fehrer *et al.*, 2024) to explore how multiple market actors interact to co-create circular value and influence each other over time. Such theoretical perspectives allow us to focus on the interdependencies and emergent behavioral patterns that occur in large-scale transitions towards a CE. This article contributes to CE research by identifying the role of service ecosystem dynamics in facilitating CE adoption, with a particular focus on government-led initiatives that enable large-scale transitions. A Circular Service Ecosystem Adoption Framework is developed, providing a structured yet flexible lens for analyzing and guiding CE adoption. Specifically, it unpacks key processes – including a paradigm shift, evolution across dynamic states, mobilizing drivers, and managing inhibitors – that support transitions to a CSE. The framework advances service research by connecting CE research with service ecosystem dynamics, supporting CE scholars, practitioners, and policymakers to navigate CE adoption within complex and dynamic socio-economic systems.

The article proceeds as follows. First, the literature on circular service ecosystems and service ecosystem dynamics is reviewed to identify the key processes facilitating CE adoption. This review informs the development of the conceptual framework and theoretical propositions. In the next section, the framework is illustrated using an example of Australian government initiatives aimed at reducing food waste. The article concludes with a discussion of the implications of the framework for CE scholars, practitioners, and policymakers.

2. Literature review

2.1 Circular service ecosystems (CSEs)

Over the past two decades, work examining a CE from an ecosystem perspective has proliferated (Ghisellini *et al.*, 2016; Hossain *et al.*, 2024). Across this work, the CE concept has its roots in Industrial Ecology (Ghisellini *et al.*, 2016), focusing on designing closed-loop processes that operate as closely as possible to the cyclical nature of natural ecosystems, where waste serves as an input (Erkman, 1997). However, a key criticism of many “ecosystem” perspectives is their inability to effectively capture the complexities involved in transitions towards a CE, which are embedded in economic and societal institutional change processes (Fehrer *et al.*, 2024). The transition towards a CE requires changes in the technical and industrial production of goods to mimic natural ecosystems, such as changes in labor, infrastructure, and technology. However, to transform the production system, a coordinated approach among diverse actors, shifts in institutional arrangements, as well as value orientations and value co-creation practices, is needed (Fehrer *et al.*, 2024). Service scholars increasingly recognize the relevance of a service ecosystems perspective in exploring these complexities (e.g. Fehrer *et al.*, 2024; Fehrer and Bove, 2022); that is, a perspective that examines “relatively self-contained, self-adjusting system[s] of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange” (Vargo and Lusch, 2016, pp. 10–11). An overview and definitions of relevant terms adopted in the service ecosystems literature and conceptual framework are included in the Appendix.

To apply a service ecosystems perspective to CE adoption, this article builds on Fehrer *et al.*'s (2024) conceptualization of circular service ecosystems (CSE), defined as “ideal types of service ecosystems, regenerative and embedded within nature, where (material, intellectual, digital and financial) resources flow seamlessly within and between nested systems without creating any waste or leakage” (p. 8). As proposed by Fehrer *et al.* (2024), these ecosystems possess three key components. First, an S-D logic foundation adds a meta-narrative of value co-creation, focusing on circularity in a service ecosystem that naturally reflects a CE. In a CSE, value creation is equated with “decoupling resource depletion from service exchange by

adopting a strong sustainability approach [and focusing] on the (re)generation of economic viability, ecological integrity, and social equality through actors' collaborative efforts and collective resource integration" (Fehrer *et al.*, 2024, p. 8).

Second, CSEs require institutions and institutional arrangements aligned with circular service exchange (Fehrer *et al.*, 2024). Institutions, defined as "humanly devised . . . integrable resources that are continually assembled and reassembled to provide structural properties we understand as social context," are key to "complex and interrelated resource-integration . . . activities in nested and overlapping ecosystems organized around shared purposes" (Vargo and Lusch, 2016, p. 17). From a CSE perspective, examples of supportive institutional arrangements include a supportive regulatory environment (e.g. emissions trading schemes and subsidies), directive strategies and plans (e.g. EU Green Deal), and company missions (e.g. IKEA Circular Product Design Guide).

Third, the complex, multi-actor, multi-layered, and iterative process of CSE value co-creation is dynamic and not a fixed state (Fehrer *et al.*, 2024); thus, it is fundamentally emergent (Vargo *et al.*, 2023). Individual components of CSE (i.e. actors, resource-integrating practices, and institutional arrangements) continuously react, receive feedback, and adapt between and within system levels, resulting in emergence. Emergence refers to "the phenomenon of new properties arising in the ecosystem" (Polese *et al.*, 2021, p. 27). These new properties include novel outcomes, such as new resources, value, institutional arrangements, and practices, arising from relationships among ecosystem components, resulting in the emergence of new ecosystems (Polese *et al.*, 2021; Vargo *et al.*, 2023).

2.2 Towards a dynamic perspective of circular service ecosystems

Embracing a dynamic, behavioral perspective on service ecosystems is valuable for understanding and navigating the complexities of system-wide transitions and emergence in the context of CE adoption (As'ad *et al.*, 2024; Fehrer *et al.*, 2024). Yet, despite its relevance, literature on service ecosystem dynamics is still in the early stages (Frow *et al.*, 2016), and research investigating the interplay between sustainable service ecosystems, such as circular service ecosystems, and service ecosystem dynamics is even less developed (As'ad *et al.*, 2024). Following the lead of influential CE service research offering conceptual contributions (e.g. Verleye *et al.*, 2023), this article adopted a systematic approach to review the relevant literature and develop a conceptual theory synthesis (Jaakkola, 2020). Details of the systematic search process are provided in Figure 1, which includes the search terms, databases, inclusion and exclusion criteria, and the number of articles identified at each stage.

The literature search aimed to retrieve articles that investigated the topic of service ecosystem dynamics and how they unfold. An initial search of the terms "dynamic*" AND "service ecosystem*" AND "circular economy" OR "circularity" only returned two results (date of search: 05.07.2024). Thus, the search terms were broadened to include all articles that included the terms "dynamic*" AND "service ecosystem*" in the title, keywords, and abstract, not only those related to a CE context. This enabled the identification of a comprehensive set of articles that explored the key components of service ecosystem dynamics, which could then be applied to understand the processes supporting CE adoption. Two members of the research team screened the titles and abstracts of the identified articles ($n = 151$), and included those that explicitly focused on dynamics in service ecosystems ($n = 47$). The full texts of these articles were then assessed for their eligibility by providing sufficient insights from an S-D logic perspective and clearly defining the dynamics of service ecosystems, which resulted in 25 relevant articles. The authors included one additional article (Fehrer *et al.*, 2024), which was identified through the review process, but was not captured in the search due to the absence of the term "dynamics" in the title, abstract, and keywords. The included articles ($n = 26$) were analyzed according to the concept (i.e. term) they used to describe service ecosystem dynamics, the definition or description of service ecosystem dynamics, method, context, and key findings about the components comprising service

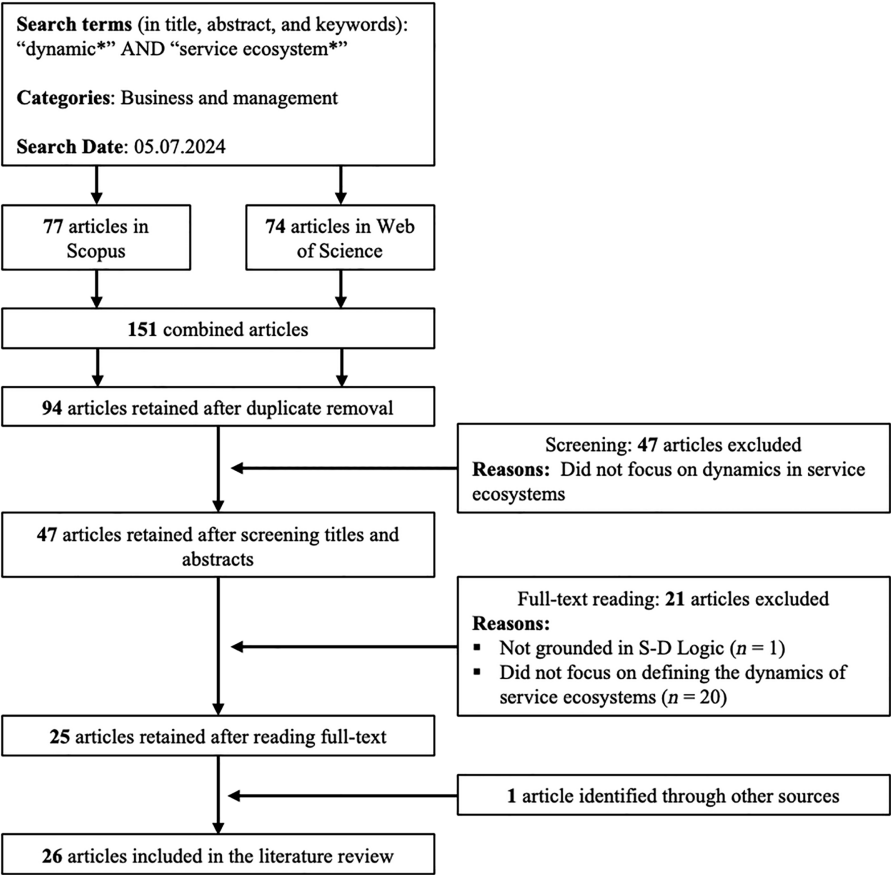


Figure 1. Systematic literature review. Source: Authors’ own work

ecosystem dynamics arising from presented explanations and conceptual frameworks (see Table 1 for a summary). The individual components comprising service ecosystem dynamics were then grouped into themes, which were discussed and refined by all team members across several meetings.

Integrating perspectives across the literature, four processes shaping service ecosystem dynamics were identified: (1) transitioning processes, (2) self-adjustment processes, (3) driving processes, and (4) inhibiting processes, which are discussed as follows.

First, service ecosystems transition to new or different ecosystem states over time (As’ad et al., 2024; Brodie et al., 2021), evolving over a series of value co-creation episodes, which have been termed “evolutionary pathways” (Beckett, 2023). Service scholars often focus on transitions to improve value co-creation outcomes (Beirão et al., 2017), shifting from initial to improved ecosystem states (Brodie et al., 2021). Emergent properties (i.e. ecosystem structures, concepts, and qualities generated through emergent processes; Vargo et al., 2023) provide opportunities for service ecosystems to transition from one state to another by serving as “tipping points” (Beckett, 2023). That is, emergent properties creating mutual value for actors in a service ecosystem stabilize and become the new system state (Fehrer et al., 2024; Vargo et al., 2023). While emergence describes how ecosystems develop into new orders, transitions refer to shifts from one ecosystem state (i.e. emergent property) to another.

Table 1. Summary of the service ecosystem dynamics literature

Author(s) (Year)	Concept	Definition/ description	Research context	Key components of service ecosystem dynamics
As'ad et al. (2024)	Service ecosystem dynamics	"Behavioral patterns of service ecosystems over time" (p. 160)	Conceptual	Service ecosystem dynamics: (1) reproduction (i.e. existing institutional arrangements are re-enacted); (2) reconfiguration (i.e. instability and institutionalized change of rules and norms), and (3) transition (i.e. behavioral patterns and perceptions the ecosystem is new/different) Explanatory dimensions: Alternating dominance of adaptation and coordination in self-adjustment processes and leverage of intervention points
Beckett (2023)	Sustainable development goal realization dynamics	Co-creating value via affordable innovation and diffusion, a "complex adaptive process" (p. 141)	Case study (Affordable energy transitions)	Evolutionary pathways to realize goals develop over time Value co-creation via innovation development and diffusion Interactions among multiple ecosystem actors Learning at different evolutionary stages Emergence associated with 'tipping points'
Beirão et al. (2017)	Dynamics of value cocreation in service ecosystems	Service ecosystems' "learning, adapting, and evolving properties" (pp. 229–230)	Case study (Health care)	Value co-creation factors enabling dynamic resource integration Value co-creation outcomes (e.g. population well-being) Dynamic, simultaneous, and interdependent interactions among multiple actors Exchanges within nested systems influencing each other and resource integration
Brodie et al. (2021)	Dynamics of a healthcare system	A complex multi-actor, multilayered, dynamic and interactive process of value cocreation	Conceptual with illustrative case (Health care)	Shifting from an initial to an improved ecosystem state Drivers of ecosystem practices (ultimately resulting in an improved state) Moderators of ecosystem practices supporting or disrupting ecosystem wellbeing
Brozovic and Tregua (2020)	Service ecosystems flexibility	"The ability of service ecosystems to adjust to changes" (p. 1)	Case study (Museum)	Flexibility of actors and their interactions, resource integration, service exchange, and institutions
Carida et al. (2022)	Service ecosystem dynamics	Systemic dynamism, multi-actor value co-creation, and emergence	Case study (Hospitality and tourism)	Service ecosystem orchestration supporting value creation Resource orchestration as a coordination mechanism for resource integration

(continued)

Table 1. Continued

Author(s) (Year)	Concept	Definition/ description	Research context	Key components of service ecosystem dynamics
Chandler <i>et al.</i> (2019)	Emergence of innovation	A process by which an idea may disturb, create, or maintain institutions in a service ecosystem	Case study (Internet-of-Things)	Plasticity, including fluidity (i.e. capacity to take form/be molded) and stability (i.e. capacity to retain form) Institutional reconciliation (i.e. actors adapt to or converge ideas) Reconciling institutional dissonance and stabilization
Fehrer and Bove (2022)	Complex adaptive systems	Systems that “emerge and change over time” (p. 490)	Conceptual	Positive and negative feedback loops Actors can influence feedback loops to change and stabilize service ecosystems
Fehrer <i>et al.</i> (2024)	Circular service ecosystem transitions	“Distinctive features of value co-creation processes, institutional arrangements, and dynamisms [are] inherent to service ecosystem transitions” (p. 8)	Empirical (Analysis of blog posts)	Three key components of circular service ecosystem transitions: (1) emergent properties, (2) processes of de- and re-institutionalization, and (3) reflexivity and intentional shaping Transitions comprise three phases: (1) ad hoc novel outcomes emerge, incumbent institutions stabilize, and niches are shaped; (2) novel patterns emerge, new institutions stabilize, and network structures are shaped; (3) new orders and structures emerge, and path dependencies redirect emerging new institutions to the status quo, and circular representations and norms are shaped
Finsterwalder and Kuppelwiesser (2020)	Service ecosystem transformational capability	Ability to adapt/change to altered or new requirements and, if necessary, reconfigure via new actor and resource combinations	Conceptual	Balancing challenges and resources within and across system levels to achieve equilibrium Achieving equilibrium via new actor and resource combinations Adapting to critical incidents Establishing safe value co-creation spheres which ensure the boundaries of behavior are clear
Finsterwalder and Tombs (2021)	Relational and regenerative service ecosystem	A transformational capability to balance resources and challenges within and across ecosystem levels to achieve equilibria and wellbeing via regenerative cycles of reciprocity	Conceptual	Key factors to maintaining a state of well-being and equilibrium via a long-term, cyclical perspective harmonizing challenges and resources, include i. Reciprocity: rebalancing with positive acts ii. Retaliation: negative reciprocity iii. Restorative justice: repairing a negative instance (e.g. act or tension) through the mutual involvement of all actors iv. Psychological ownership: sense of possession over personal and ecosystem wellbeing

(continued)

Table 1. Continued

Author(s) (Year)	Concept	Definition/ description	Research context	Key components of service ecosystem dynamics
Frow et al. (2016)	Dynamic service ecosystem	An ecosystem's "ability to adapt to changes in the environment" (p. 26)	Conceptual	Co-creation practices, such as providing an ecosystem with a shared language and shaping actors' mental models, shape a dynamic service ecosystem and occur through diverse actor relationships
Kijima et al. (2016)	Systemic innovation model of service ecosystem	"A complex system that follows the adaptive cycle [...] that accounts for both stability and change" (p. 56)	Conceptual	Value co-creation cycles Adaptive transitions: Adjustments in response to internal and external changes Phase transitions: Qualitatively different states and significant shifts in ecosystem structure Coevolution: Paradigmatic shifts occur due to bottom-up and top-down innovation drivers
Meynhardt et al. (2016)	Dynamics of service ecosystem evolution	"Mechanisms of self-organising, complex, and adaptive systems" (p. 2982)	Conceptual	Self-organization when equilibrium/stability is challenged Fluctuations among subsystems influencing emergences Emergences depending on existing internal parameters Self-organization following nonlinear dynamics caused by feedback loops Phase transitions from one stable state to another New orders realized after establishing emergence as an order parameter Chaotic process outcomes not predictable beyond the short term System development understood based on developmental history
Nenonen et al. (2018)	Service ecosystem change	Emerging and going through profound changes over time	Empirical (Primary sector)	Dynamic capabilities, including sensing opportunities and influencing institutions, applied to conduct institutional work
Nuutinen et al. (2024)	Co-evolution in service ecosystems	"System-based features of constant dynamism and evolution" (p. 79).	Empirical (Forestry and smart building sectors)	Three characteristics enhancing resource integration of actors in service ecosystems to co-evolve - Accomplishment: Shared area of mastery with practices focused on new or better value. - Attractiveness: Providing a nexus of practices that invite participation from new actors - Actionability: Collaboration and continuously "doing and getting done" (p. 91)

(continued)

Table 1. Continued

Author(s) (Year)	Concept	Definition/ description	Research context	Key components of service ecosystem dynamics
Polese et al. (2021)	Service ecosystem dynamics	Emergence, phase transitions, and their interrelationships	Conceptual	Phase transition: “large-scale step change” when an ecosystem is dislodged from a state of stability into de-institutionalization and re- institutionalization (p. 29) Emergence: “phenomenon of new properties arising” (p. 27)
Sebastiani and Anzivino (2022)	Service ecosystem evolution	The process of an ecosystem emerging and developing	Empirical (Health care)	Drivers of evolution i. Actor empowerment: Promoting solutions to empower actors to contribute to outcomes. ii. Actor-network engagement: Collaborative relationships and new interactions iii. Resource reconfiguration: Changing and reshaping the implementation of resources Inhibitors of evolution i. Inter- and intra-actor misalignment: Lack of mutual understanding and common worldview. ii. Resource myopia: Short-sighted use of technological resources iii. Platformisation gap: : Lack of a “virtual context” or network coordinating actors
Simmonds et al. (2018)	Change and stability in service ecosystems	The characteristics of conflict, change and evolution in social-economic systems	Conceptual	Three periods evident in morphogenetic cycles i. Structural conditioning, including structure formation, including constraints and enablements. ii. Social interaction, including actor interactions through resource integration within structures iii. Structural elaboration/ reproduction, including the influence on the state of the system’s structure, and the respective change and stability within, forming the next cycle’s context

(continued)

Author(s) (Year)	Concept	Definition/ description	Research context	Key components of service ecosystem dynamics
Skylar <i>et al.</i> (2019)	Service ecosystem transformation	The nature of change and ability to reconfigure resource integration patterns within the ecosystem	Empirical (Digital solutions – Maritime)	Digital transformation is key to service ecosystem transformation by increasing - The importance of digital technology in mediating actor interactions - The number and importance of interactions among actors with weak ties - Complexity of resource integration patterns - Actors' ability to effectively navigate this complexity
Taillard <i>et al.</i> (2016)	Service ecosystem dynamics	“Processes by which the macro level emerges from the micro and meso levels (i.e. upward movement and causation) and, in turn, how the macro level provides feedback to and influences the micro and meso levels (i.e. downward movement and causation” (p. 2978)	Conceptual with illustrative case (Non- profit organization)	Five levels of emergence based on a social emergence paradigm - Individual level: properties of individual actors such as their intentions, agency, and attitudes. - Interaction level: interactions among actors such as conversations and negotiations - Ephemeral emergent: structure – such as roles and interactional frame-to levels <i>i</i> and <i>ii</i> - Stable emergents: social properties such as shared intentions, norms, and rules - Social structure: formalized institutional arrangements (e.g. contracts and laws) Key factors facilitating emergence in service ecosystems include - Shared intentions and collective agency. - Continuous feedback loops between two complementary processes: an upward process towards greater interdependence and downward process toward greater individual commitment
Tronvoll and Edvardson (2024)	Dynamic service ecosystems	The “emergent qualities of complex, adaptive systems” (p. 60)	Conceptual	Key features based on a recursive philosophical perspective - A systemic, adaptive and entangled ontological perspective. - An evolving and complex analytical framework - Institutions and intersubjectivity determined by interdependencies between structure and agency - Value (re)created by actors through institutional arrangements in an evolving environment

(continued)

Table 1. Continued

Author(s) (Year)	Concept	Definition/ description	Research context	Key components of service ecosystem dynamics
Tuominen et al. (2020)	Change in service ecosystems	“Processes of institutional change” (p. 575) and involves “complex and evolutionary [processes], involving multiple actors and sub- processes” (p. 576)	Conceptual	Assemblages of institutions conditioning ecosystems Value co-creation practices understood as collective routines Change activities, including practice- based change (i.e. actors introduce new resources and perform routines differently) and planned change (i.e. intentional change projects) Dialectical process, including cycles of change activities opposing or building on one another, with solutions emerging when contradictions are resolved Actors’ coordination of dialectics of institutional change
Vargo et al. (2023)	Emergence in service ecosystems	“A phenomenon that arises from the relationships among existing system’s elements but that is qualitatively different from and irreducible to them” (p. 3)	Conceptual	Different dynamics contribute to emergent outcomes in service ecosystems, including - First-order: Novel outcomes from ad-hoc resource integration and service exchange. - Second-order: Patterns from recurrent resource integration and service-for-service exchange - Third-order: Ecosystem properties resulting from reactively reproduced resource integration and service-for- service exchange - Fourth-order: Envisioned ecosystem properties resulting from reflexively shaped resource integration and service-for- service exchange
Vargo et al. (2020)	Complex adaptive systems	Systems that “interact with their environments, are subject to resulting feedback effects, evolve over time, and adaptively adjust” (p. 528)	Conceptual	Diffusion in innovation that evolves over time and contributes to the evolution and change of broader sociotechnical structures
Vellesalu et al. (2023)	Dynamics of service ecosystems	“Stability of and changes to the system” (p. 3)	Empirical (Circular product development)	Key factors contributing to change in the ecosystem include - Interdependencies between institutional re-configuration patterns. - Interrelatedness between different ecosystem levels (micro, meso, and macro) and different levels impacting one another with influencing actors’ ideation of value co-creation opportunities

Source(s): Authors’ own work

According to [As'ad et al. \(2024\)](#), three different states, or behavioral patterns, characterize service ecosystem dynamics over time, including: (1) *reproduction* where “existing institutional arrangements are re-enacted” (p. 170); (2) *reconfiguration* involving institutionalized change of rules and norms” (p. 171), and (3) *transition*, “a disrupting, shifting behavioral pattern” where the ecosystem is inter-subjectively viewed as “qualitatively new” (p. 172). These behavioral patterns provide opportunities for service ecosystems to transition from initial to improved value outcomes over time.

Second, self-adjustment processes enable service ecosystems to regulate themselves and adapt to changing conditions ([As'ad et al., 2024](#)). Self-adjustment refers to “the system’s ability to structure and restructure itself, generate new structure, and learn” ([As'ad et al., 2024](#), p. 164). These processes depend on the alternating dominance of positive and negative feedback loops ([Meynhardt et al., 2016](#); [Vargo et al., 2020](#)). While negative feedback loops “promote stability”, positive feedback loops “drive change” and play a crucial role in facilitating transitions to new ecosystem states by stimulating episodes of de- and re-institutionalization, guiding emergence ([Fehrer et al., 2024](#), p. 53). Thus, self-adjustment processes play a vital role in supporting transitions to and stabilization of dynamic states.

Third, the potential to influence transitions of service ecosystems towards desired states is recognized throughout the literature. Despite different terms used to describe this phenomenon – such as orchestration ([Carida et al., 2022](#)), intentional shaping ([Fehrer et al., 2024](#)), and change activities ([Tuominen et al., 2020](#)) – each shares the view that actors’ “shared intentionality can be leveraged to actively shape service ecosystems” ([Fehrer et al., 2024](#), p. 5). According to [As'ad et al. \(2024\)](#), transitions towards new ecosystem states can be supported by leveraging *intervention points*, including resource stocks and flows, the system’s structure or rules, and a shared purpose and worldview.

The literature review finds that many drivers identified in prior research align with the intervention points identified by [As'ad et al. \(2024\)](#). For instance, introducing new resources (i.e. leveraging resource stocks and flows) was crucial in initiating changes within the service ecosystem. This recognizes the importance of innovation development and diffusion supported by multi-actor interactions within and across ecosystem levels ([Beckett, 2023](#); [Vargo et al., 2020](#)) and value co-creation practices ([Brodie et al., 2021](#); [Frow et al., 2016](#)), such as those facilitating resource access, sharing, recombination, monitoring, and governance ([Beirão et al., 2017](#)). At the same time, the structure or rules of the system ([As'ad et al., 2024](#)) facilitate change by “making, breaking, and maintaining the institutional rules of resource integration” ([Vellesalu et al., 2023](#), p. 8), while a shared purpose or worldview ([As'ad et al., 2024](#)) establishes a shared language ([Frow et al., 2016](#)), shared intentions, and collective agency ([Taillard et al., 2016](#)).

Fourth, the review revealed limited scholarly attention to the barriers to ecosystem transitions. Nevertheless, several noteworthy exceptions (e.g. [Brodie et al., 2021](#); [Sebastiani and Anzivino, 2022](#); [Tuominen et al., 2020](#)) provide insights into inhibiting factors related to how intervention points are leveraged. For instance, [Brodie et al. \(2021\)](#) highlight how the misuse of system resources can destroy value and lead to adverse outcomes. At the same time, [Sebastiani and Anzivino \(2022\)](#) argue that a “lack of mutual understanding and common worldviews” (p. 2043) can inhibit the development of service ecosystems. When actors lack a common language, they cannot understand each other, and it becomes difficult not only to maintain connections but also to envision and act on shared transitions ([Sebastiani and Anzivino, 2022](#)). Another key inhibiting factor pertains to the challenges that arise when change efforts at different levels of the service ecosystem are not mutually supportive and oppose one another, for example, when routines are disrupted at one level, but new versions are not accepted at another ([Tuominen et al., 2020](#)).

3. Circular service ecosystem adoption framework

The proposed conceptual framework aims to provide an understanding of how to support and navigate CE adoption within complex and dynamic systems. Conceptual frameworks organize

and clarify key constructs and their interrelationships (Lindgreen *et al.*, 2021), and “graphically or in a narrative form,” offer a structured way to showcase complex phenomena (Miles and Huberman, 1994, p. 18). The steps to develop the framework followed established guidelines for building a conceptual framework, including the selection and mapping of relevant literature, extraction of core concepts, thematic categorization, integration, synthesis, iterative refinement, and validation (Jabareen, 2009).

The conceptual framework was built on the meta-theoretical foundations of service ecosystems (Vargo, 2021), incorporating insights gained from the literature on service ecosystem dynamics. The authors reviewed and categorized key concepts, then collaborated through multiple iterative cycles to integrate, synthesize, and structure them into a conceptual framework. Feedback was received from academic workshops, enhancing the validity and relevance of the framework. Figure 2 presents the Circular Service Ecosystem Adoption Framework.

In this framework, CE is based on a systemic view (Fehrer *et al.*, 2024) and is thus nested within service ecosystems comprising different levels of aggregation, including micro, meso, and macro levels (Vargo and Lusch, 2016). The framework draws on Brodie *et al.* (2021) to define each level, conceptualizing the micro level as interactions among individual actors (e.g. public citizens and service employees), the meso level as interactions among aggregates of actors (e.g. intraorganizational actors), and the macro level as the higher level of aggregation (e.g. governmental actors). The natural environment is treated as the external ecosystem, rather than nested within the service ecosystem, to allow for an explicit focus on the social and economic factors that impact CE adoption.

Four theoretical propositions describe the Circular Service Ecosystem Adoption Framework. The propositions highlight the importance of (1) a paradigm shift from a linear to a CE worldview, (2) CSE evolution from initial to improved ecosystem states (comprising self-adjustment processes and behavioral patterns of reproduction, reconfiguration and transition); (3) mobilizing drivers of CSE evolution (including service ecosystem orchestration and intervention points); and (4) managing inhibitors of CSE evolution (including misalignment among intervention points and co-existing states at different ecosystem levels).

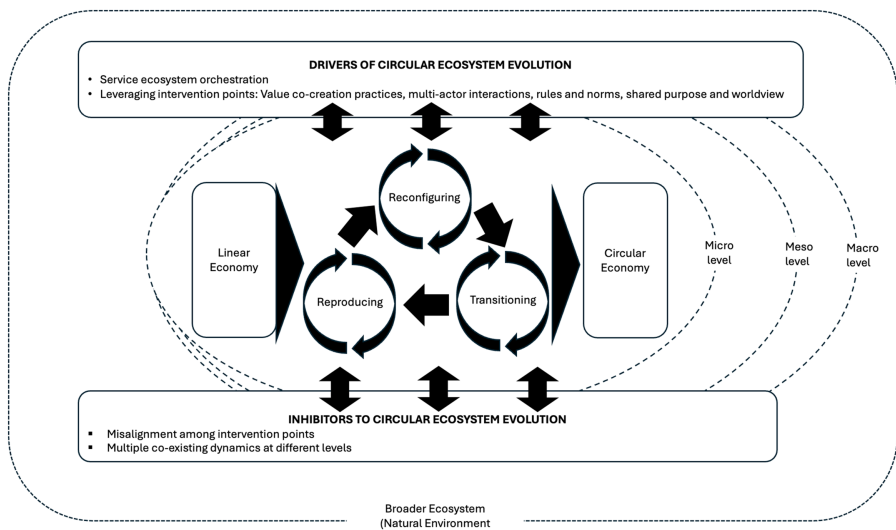


Figure 2. Circular Service Ecosystem Adoption framework. Source: Authors’ own work

Addressing sustainability challenges, such as climate change, biodiversity, and a CE requires a shift in worldview (Fehrer *et al.*, 2024; van Egmond and de Vries, 2011). Current ecological overshoots occur due to a mismatch between current assumptions and goals (e.g. continuous economic growth) and the natural environment (e.g. limited resources; Toth and Szigeti, 2016). Ecological overshoots remain (Richardson *et al.*, 2023), and the time to keep global warming to 1.5 degrees is rapidly declining (IPCC, 2023). Despite several rounds of climate negotiations and scientific backing for our current trajectory towards 3.5+ degrees of warming, there have been incremental changes to policy and practices (IPCC, 2023). These have only addressed the symptoms of ecological overshoot, such as climate change, rather than the underlying causes (e.g. overproduction, consumption, and fossil fuel usage; Merz *et al.*, 2023). Moreover, the United Nations Development Goals are not likely to meet their 2030 targets (UN, 2024). Advocates, including the Club of Rome, call for a rethinking of our current economic system (Club of Rome, 2025).

Consequently, a paradigm shift is crucial to facilitating CSE adoption. This entails reevaluating and reconceptualizing prevailing economic models in the service ecosystem (Fehrer *et al.*, 2024), which includes addressing assumptions (e.g. waste is normal and invaluable), goals (e.g. accumulation of material objectives assigns status), relationships (e.g. competition is replaced with cooperation and collaboration), and connection (e.g. nature-human). A shift to a CE paradigm requires a change in mental models from a linear “take-make-dispose” economy to a CE, where we eliminate waste, circulate materials and resources (at their highest value), and mimic the regenerative processes of nature (Ellen MacArthur Foundation, 2013). It is agreed that the foundations of a CE should be based on a systemic view (Vargo, 2021), one that recognizes the importance of “encompassing broad sets of actors [...] who mutually contribute to, and benefit from, circular value cocreation” (Fehrer *et al.*, 2024, p. 51).

Proposition 2. CSE adoption requires evolution across dynamic states, facilitating transitions from one ecosystem state to another.

Service ecosystems are dynamic and evolving (As’ad *et al.*, 2024; Beirão *et al.*, 2017). Recurrent interactions between multiple actors involved in processes of sensing and learning generate synergy (Meynhardt *et al.*, 2016), enabling the ecosystem to learn from experience, adapt, and respond. The dynamic and iterative process of resource integration and value co-creation with multiple actors in a multi-layered system can lead to both positive and adverse outcomes for the ecosystem (e.g. Beirão *et al.*, 2017). Transitions to and stabilization of new and improved ecosystem states occur through the alternating dominance of adaptation and coordination in self-adjustment processes at different levels of the service ecosystem (As’ad *et al.*, 2024; Fehrer and Bove, 2022; Meynhardt *et al.*, 2016; Vargo *et al.*, 2020).

Service ecosystem evolution occurs as service ecosystems transition from initial to improved ecosystem states over time (Brodie *et al.*, 2021), underpinned by shifts in “the behavioral patterns of service ecosystems over time (As’ad *et al.*, 2024, p. 160) and the stabilization of behavioral patterns serving as “tipping points” (Beckett, 2023). Drawing on As’ad *et al.* (2024), circular service ecosystem (CSE) evolution is conceptualized as a process of progressing from an initial state of *reproducing* a linear paradigm to improved states of *reconfiguring* towards a CE and *transitioning* to a CE worldview. As such, the second proposition highlights that CSE adoption depends on transitions from initial to improved dynamic states (i.e. CSE evolution). While emergence describes the process by which ecosystems develop into new orders (i.e. ecosystem states), evolution describes transitions from one ecosystem state (i.e. an emergent property) to another.

Proposition 3. CSE adoption requires mobilizing driving processes that facilitate the evolution towards CSE, including service orchestration and leveraging intervention points.

The third proposition suggests that there are key drivers that play a fundamental role in CSE adoption, including service orchestration and leveraging intervention points.

CSE evolution can be facilitated through the intentional efforts of actors (e.g. [Carida et al., 2022](#); [Tuominen et al., 2020](#)). Intentional orchestration of circular service ecosystems requires actors to coordinate “service activities and processes that preserve, extend, and (re)generate resources and related service systems” ([Karpen et al., 2023](#), p. 56). At the same time, intentional efforts of actors can be orchestrated to leverage intervention points facilitating service ecosystem transitions, including: (1) resource stocks and flows (e.g. introducing new resources via innovation development; [Beckett, 2023](#)) and facilitating value co-creation practices (e.g. [Frow et al., 2016](#)), (2) institutional rules of resource integration (e.g. [Vellesalu et al., 2023](#)), and (3) a shared purpose (e.g. [Taillard et al., 2016](#)). For CSE adoption, this can involve creating novel circular solutions, designs, products, and business models ([Karpen et al., 2023](#)), supply chain governance and industry standards ([Fehrer et al., 2024](#)), and negotiating and agreeing on shared goals for circularity ([Fehrer et al., 2024](#)).

Proposition 4. CSE adoption requires managing inhibiting processes that constrain service ecosystem evolution (including misalignment within and across intervention points and among dynamic states across service ecosystem levels).

While the previous proposition focuses on drivers facilitating transitions towards CSE, inhibitors are not simply the absence of these facilitators. Rather, they constitute distinct processes that can independently and actively constrain ecosystem evolution ([Joachim et al., 2018](#)). These inhibiting processes often co-exist with facilitating ones, generating tensions that influence the pace and direction of CSE transitions ([Chouk and Mani, 2019](#)). Two key inhibiting factors are identified from the literature review.

First, misalignment within and across intervention points, i.e. incongruency among the defining components comprising an intervention point, can hinder transitions to improved CSE states. Such misalignments occur, for example, when resource stocks and flows are not synchronized with the rules of the system (e.g. misuse of system resources; [Brodie et al., 2021](#)) or when shared worldviews are lacking (e.g. insufficient mutual understanding; [Sebastiani and Anzivino, 2022](#)). Examples highlighted by Sebastiani and Anzivino include “resource myopia”, where the “short-sighted use of technological resources” (p. 2043) highlights a lack of understanding of resources, their use and implications (i.e. misalignment between resources and shared purpose), and a “platformization gap,” where the lack of a “virtual context,” in which actors are coordinated and share the same worldviews (p. 2044) highlights a misalignment between resource flows (i.e. facilitating resource integration) and a shared worldview.

Second, misalignment among the dynamic states of different ecosystem levels inhibits ecosystem evolution. According to [As’ad et al. \(2024\)](#), multiple co-existing dynamics can occur at different ecosystem levels. This has noteworthy considerations given the interrelatedness between different ecosystem levels where “different levels impact one another when influencing actors’ ideation of value co-creation opportunities” ([Vellesalu et al., 2023](#), p. 8). For instance, macro-level practices such as the creation and maintenance of public research funding and the development of industry standards enable the meso-level (e.g. industry) and micro-level (e.g. individual companies) to co-create value opportunities through involvement in research projects ([Vellesalu et al., 2023](#)). Nevertheless, as [Tuominen et al. \(2020\)](#) note, resolving opposing change activities can generate new pathways for alignment, suggesting that inhibitors, while constraining, can also trigger adaptive reconfigurations of the service ecosystem.

4. Illustrative case study

The context of large-scale government-led policy initiatives to reduce food waste in Australia was chosen as an illustrative case to provide a concrete example of the framework for researchers to visualize how the conceptual argument can be applied (Brodie *et al.*, 2021; Siggelkow, 2007). Specifically, the illustrative case served as a valuable tool for developing inferences (Siggelkow, 2007) and exploring avenues for theory-building and testing (Eisenhardt and Graebner, 2007).

Relevant information was collected on (1) Australia's food waste ecosystem structure, including the different levels, key actors, and governing rules and guidelines, and (2) initiatives and evidence of ecosystem dynamism such as documented changes, milestones, and events. To ensure the validity of data collection, information was gathered from several sources (Yin, 2009). Specifically, a four-step process was followed involving (1) an initial search of academic databases and Google Scholar, using keywords related to "food waste in Australia" and "food waste management Australia", (2) a search on Australian government, advisory bodies, and non-governmental organizations (NGO) reports on initiatives addressing food waste reduction strategies, (3) a refined website search, focusing on the key stakeholders operating at different levels of the food waste ecosystem, and (4) a search of recent media coverage on Factiva to capture the latest developments across Australia's food waste landscape. This information was used to trace Australia's transition towards circular food waste management practices.

4.1 Food waste in Australia

Australia generates approximately 7.6 million tonnes of food waste annually, equivalent to about 312 kg per person per year, with households accounting for almost one-third of the total (FIAL, 2021). This represents a substantial economic cost of more than AUD\$36.6 billion, accounting for approximately 3.5% of Australia's annual greenhouse gas emissions (FIAL, 2021). To address this challenge, various actors and initiatives across the ecosystem are engaging in efforts to reduce food waste in Australia (Table 2). This complex, multilevel system of diverse actors addressing food waste serves as a basis to illustrate the Circular Service Ecosystem Adoption Framework, as follows.

4.1.1 Shifting from a linear to a circular economy paradigm. A shift from a linear economy approach to food waste in Australia can be traced through policy initiatives and evolving governance and reporting frameworks advocating for circular transitions. For example, in 2017, the Australian Government launched the *National Food Waste Strategy*, which set the national goal of "halving Australia's food waste by 2030" (Commonwealth of Australia, 2017). This strategy emphasizes the importance of adopting a CE approach to "capture food waste as a resource so it is not sent to landfill" and "find solutions across the entire food system rather than continuing to operate within single, linear supply and consumption chains" (Commonwealth of Australia, 2017, p. 16).

Actions towards a circular food waste management transition were proposed in the *National Waste Policy Action Plan 2019* (Australian Government, 2019). Additionally, the 2018–19 *National Food Waste Baseline* was established to measure the amount of food waste generated and recovered in Australia annually, providing a baseline against which performance and progress could be assessed (FIAL, 2021). Central to these developments is an emphasis on shifting to a CE, requiring actors across all levels to reframe their view of "food waste"; not as an endpoint, but as a regenerative resource that "can be harnessed and returned to productive use, turned into compost to improve and fertilise soil, or rescued to provide food for people and animals" (Australian Government, 2019, p. 26), providing "significant additional value for food value chains" (FIAL, 2020a, p. 13).

4.1.2 Evolution to a circular service ecosystem. Differences in household food waste collection systems across Australian states provide an example of iterations from initial to improved CSE states. Specifically, Food Organics Garden Organics (FOGO) collection

Table 2. Food waste circularity in australia: relevant actors and milestones per level between 2017–2024

Level	Key actors	Key milestones
Micro	Australian residents Small business owners Local communities	2017 Foodbank Community Engagement 2018 Rise of Community Supported Agriculture and farm share programs (i.e. The orchards keeper) 2019 Community fridges (VIC, NSW) 2019 Rise of zero-waste initiatives (e.g. zero-waste Victoria) 2021 Emergence of food waste startups (e.g. Yume Food platform, Ripe Near me, ShareWaste)
Meso	NGOs (Foodbank Australia, End Food Waste Australia, Oz Harvest) Major supermarket chains (Woolworths, Coles, Aldi, IGA) Universities and Research Centers (CSIRO) Industry bodies (APCO)	2017–19 Woolworths and Coles Food Waste Programs 2018 Australian Packaging Covenant Organization (APCO) 2025 National Packaging Targets 2018 Fight Food Waste Cooperative Research Centre (FFWCRC) 2019 Stop Food Waste Australia Initiative 2020 Recycling and Waste Reduction Act 2020 National Farmers’ Federation Sustainability Roadmap 2021 The Australian Food Pact 2021 The voluntary commitment program 2021 National Circular Economy Roadmap 2023 End Food Waste Australia – merger and rebrand of FFWCRC and Save Food Australia
Macro	Australian Government, Department of Agriculture, Water and the Environment State Governments Local Councils	2017 National Food Waste Strategy 2018 MEM8s – Meeting of Environment Ministers 2019 National Waste Policy Action Plan 2020 National waste report 2020 Recycling and Waste Reduction Act 2021–2023: State-Level Circular Economy Strategies (NSW, VIC, SA) 2023 ACT Government’s Circular Economy Strategy

Note(s): References: [ACNC \(n.d.\)](#); [APCO \(2020\)](#), [Australian Government \(2017\)](#), [Fight Food Waste CRC \(2019\)](#), [Australian Government DCCEEW \(2018\)](#), [Australian Government DCCEEW \(2019\)](#), [Australian Government DCCEEW \(2020\)](#), [Blue Environment Pty Ltd. \(2020\)](#), [CEBIC \(2022\)](#), [CSIRO Futures \(2023\)](#), [Commonwealth of Australia \(2017\)](#), [Cushman \(2024\)](#), [EndFoodWaste Australia \(2023a\)](#), [FIAL \(2020b\)](#), [National Farmers Federation NFF \(2019\)](#), [Berry \(2023\)](#), [Thompson Reuters Foundation \(2019\)](#), [Vidler et al. \(2018\)](#), [Wilkes \(2019\)](#)

Source(s): Authors’ own work

systems across Australia consist of dedicated waste bins designed to divert organic waste from landfills and vary significantly (see [Table 3](#)), demonstrating different behavioral patterns of reproducing, reconfiguring, and transitioning across Australian states.

Reproducing the linear paradigm is evident in states without FOGO collection services. Food waste is typically disposed of within general household waste bins and directed to landfill ([The Department of Climate Change, Energy, the Environment and Water, and Blue Environment Pty Ltd, 2022](#)). For example, while the *Northern Territory Circular Economy Strategy 2022–2027* ([Northern Territory Government, 2022](#)) subscribed to a commitment to starting the Territory’s transition to a CE, specific targets and policies around food waste management remained exploratory (i.e. reproducing). Currently, they have no strategy for managing food waste across municipal solid waste streams ([Australian Government DCCEEW, 2023](#); [WMRR, 2021](#)); however, various stakeholders within the Northern Territory ecosystem support the inclusion of food and organics in the strategy and setting up a long-term FOGO system has been proposed ([Northern Territory Government, 2022](#)).

Table 3. CSE evolution in household FOGO collection systems across Australia

	Reproducing 2-Bin system (no FOGO)	Reconfiguring Piloting FOGO or action plans in place (% coverage)	Transitioning Established 3-bin system (% coverage)
Australia Capital Territory (ACT)		✓	
New South Wales (NSWs)		✓ (Partially rolled out, 36%)	
Northern Territory (NT)	✓ (Implementation plan in development)		
Queensland (QLD)		✓ (Trials in 2021–22 in 3 LGAs)	
South Australia (SA)			✓ (49%, established across Metro Adelaide and other parts of the state)
Tasmania (TAS)		✓ (31%, available in some LGAs but not compulsory)	
Victoria (VIC)			✓ (59%, across compulsory and non-compulsory services)
Western Australia (WA)		✓ (Partially rolled out, 12% with FOGO roll-out plan)	

Note(s): References: [Australian Government DCCEEW \(2023\)](#), [The Department of Climate Change, Energy, the Environment and Water, and Blue Environment Pty Ltd \(2022\)](#), [WMRR \(2021\)](#)

Source(s): Authors' own work

Reconfiguring is evident in states where action plans and pilots are in place to achieve *National Waste Policy Action Plan* and *National Food Waste Strategy* targets ([The Department of Climate Change, Energy, the Environment and Water, and Blue Environment Pty Ltd, 2022](#)). For instance, Queensland has begun to roll out FOGO collection systems ([Australian Government DCCEEW, 2023](#)), following Queensland Government-funded trials across local government areas (LGAs) and AUD\$90,000 allocated to ensure consistent auditing across the program in line with the *Queensland Organics Action Plan 2022–2023* ([State of Queensland, 2022](#)). Reconfiguring is further demonstrated as institutional change begins to occur through partial implementation of the three-bin system. For instance, in NSW, FOGO bins are rolled out across some LGAs (36% coverage; [Australian Government DCCEEW, 2023](#)), with an education campaign, *Scrap Together*, designed to teach communities about effectively using FOGO collection services ([Waste Management and Resource Recovery Association Australia, 2021](#)).

Transitioning towards a CE is evident in Australian states where FOGO collection services are widely established as part of kerbside collection, with a shared purpose for food waste recovery and a worldview of food waste as a valuable resource. For example, in Victoria, 59% of residents have access to a FOGO bin ([Australian Government DCCEEW, 2023](#)). Six LGAs in Victoria are developing a system to transform organic municipal and trade waste into dispatchable renewable energy and agricultural soil enhancers ([GHD, 2024](#)). According to Environment Victoria, “organic waste should be banned from disposal to landfill” ([Environment Victoria, 2016](#)). Similarly, South Australia has achieved 49% coverage of FOGO collection systems ([Australian Government DCCEEW, 2023](#)), supported by well-established markets and advanced composting facilities ([WMRR, 2021](#)).

4.1.3 Drivers of circular service ecosystem evolution. Since the *National Food Waste Strategy*, several key drivers have emerged to propel CSE evolution for food waste in

Australia, including intentional influencing efforts, collaboration, and investment in research and development (R&D). Intentional orchestration is evidenced through the efforts of government bodies, non-government organizations, and industry stakeholders. For example, the Australian Government launched a nationwide consumer behavior change campaign, *The Great Unwaste*, “uniting Australians to reduce their food waste” ([Australian Government DCCEEW, 2024](#)). Another notable example is the *Australian Food Pact*, a voluntary agreement launched in October 2021 that unites over 40 leading food businesses to reduce food waste collaboratively. Signatories commit to measuring and reporting their food waste, fostering transparency and accountability within the industry ([End Food Waste Australia, 2023a](#)). This initiative exemplifies the power of collective action in driving systemic change towards a circular food ecosystem in Australia.

At the same time, collaborative cross-sector partnerships facilitated by End Food Waste Australia are driving innovation and creating new value streams from food waste. This demonstrates an ability to engage in value co-creation practices and multi-actor interactions that facilitate CSE evolution. For instance, a partnership between Swinburne University of Technology and End Food Waste CRC guided by Sampano aims to reduce waste within the aquaculture industry by developing collagen from aquaculture by-products ([End Food Waste Australia, 2023b](#)). Trickle-down effects for new partnerships and R&D are also observed outside the program. For example, the collaboration between *Noumi* and the *Hunter Medical Research Institute* ([O’Brien and Bolton, 2024](#)) illustrates how value co-creation practices contribute to repurposing dairy industry by-products for pharmaceutical applications, transforming what was once considered surplus and destined to become waste into a valuable resource. The ripple effects of these ecosystem interactions extend throughout the food value chain, influencing behaviors and practices across multiple sectors (e.g. developing biodegradable packaging from banana plantation waste; [Gilbert, 2019](#)).

Finally, a shared worldview of how to achieve food waste reduction goals is evident in the vision outlined by *End Food Waste Australia*, previously *Fight Food Waste Cooperative Research Centre* (FFWCRC). They emphasize the importance of “building knowledge and capacity. Co-investment in research, innovation and the evidence base for action” to achieve an Australia without food waste ([Fight Food Waste Limited, 2023](#), p. 6). As of June 2023, End Food Waste Australia was facilitating 38 active R&D projects with a total value of \$14.5 million and 34 completed projects with a total value of \$4.8 million across their three industry-driven programs ([Fight Food Waste Limited, 2023](#)).

4.1.4 Inhibitors of circular service ecosystem evolution. The impact of cosmetic standards in food retail exemplifies how deeply embedded linear economy practices create barriers to CSE evolution. These inhibitors operate within and across multiple intervention points and ecosystem levels, creating barriers perpetuating a linear paradigm. For example, supermarkets’ continued cosmetic standards that replicate a linear paradigm (i.e. rules and norms of the system) are often misaligned with their commitments (i.e. shared purpose and worldview) to reducing food waste (e.g. “Odd Bunch” produce section), circular policy initiatives (e.g. National Food Waste Strategy), and worldviews of other actors (e.g. their desire to accept and consume imperfect produce).

Multiple co-existing dynamics within levels of the ecosystem are evident at the meso level, where, despite Australian farmers’ commitment to halve food waste by 2030 (*reconfiguring*), retailers often reject their fruit and vegetables due to not meeting specific cosmetic standards (*reproducing*), leading to significant food waste ([Hogan, 2023](#); [Scott, 2021](#)). At the same time, “farmers also feel that supermarkets are too strict on their screening of fruit and vegetables, with 40% of large farmers reporting that supermarkets will reject a whole pallet over one bad apple” ([Inside Small Business, 2023](#)). The retail sector has responded to criticisms with several initiatives, such as selling imperfect fruits and vegetables at discounted prices ([Courtney, 2024](#)).

Furthermore, multiple co-existing dynamics are evident across ecosystem levels. For instance, most Australians (76%) report a motivation to reduce the amount of food waste in

their household (reconfiguring at the micro level) (End Food Waste Australia, 2023c); however, retailers' practices of only offering visually "perfect" produce (reproducing at the meso level) have inadvertently created unrealistic consumer expectations for flawless fruits and vegetables (Hogan, 2023). This has far-reaching consequences as it leads consumers to reject or waste produce at home that doesn't meet these standards (Hogan, 2023).

5. Discussion

This article provides a novel contribution to CE research by integrating a dynamic perspective of service ecosystems to address the challenge of facilitating a system-wide transition towards the circular economy (CE). Specifically, the authors define the key processes facilitating circular service ecosystem (CSE) adoption – including a paradigm shift, evolution across dynamic ecosystem states, and mobilizing drivers and managing inhibitors of CSE evolution – which offers a valuable framework for analyzing how to navigate CE adoption over time. Four theoretical propositions corresponding to each of these processes provide a structured foundation for understanding CE adoption, offering opportunities for refinement, empirical testing, and application. Each of these propositions is summarized below, with its implications for future research, policy, and practice.

Paradigm shifts are essential for CSE adoption. The first proposition emphasizes that CSE adoption requires a shift from a linear economy worldview to a circular economy worldview among actors at all levels, including micro (individuals), meso (organizations), and macro (governments). While prior CE scholarship has identified the importance of transitioning from linear to circular models (Fehrer *et al.*, 2024), this article extends these discussions by highlighting the importance of establishing institutional rules for circular value co-creation in the ecosystem, including the shared language and shared intentions, on circular principles (As'ad *et al.*, 2024; Fehrer *et al.*, 2024).

The illustrative case in this article highlights government-led reframing of "waste" as a valuable resource, embracing a shift from a linear to circular perspective in the *National Food Waste Strategy*. The paradigm shift for CE adoption must not only view waste as valuable but also comprise an understanding of how our economic system can function within ecological boundaries (Richardson *et al.*, 2023) through collective understandings and coordinated changes among all societal actors. CE policymakers and practitioners must recognize the importance of narrative reframing and coordinate shared circular value propositions across sectors. For example, campaigns to redefine food waste must acknowledge these paradigm shifts and foster a shared understanding of circular value creation.

Future research should explore how paradigm shifts occur across levels (micro, meso, and macro) and contexts. Research could explore individual consumer, employee, and leadership mindsets (micro level), as well as how these interact across other ecosystem levels when facing CE transitions. For instance, studies can examine the different pathways and logics that emerge during CSE adoption. Scholars may also examine organizational and regional factors influencing paradigms, including organizational culture and indigenous CE perspectives. An example of this can be seen in *Circular Indigenomics*, which integrates Māori and other Indigenous perspectives of interconnection and regenerative resource management (Circular Indigenomics, 2024).

CSE adoption requires evolution across dynamic states. The second proposition contends that CSE adoption entails CSE evolution; that is, the process of progressing from one ecosystem state (i.e. an emergent property) to another. Integrating and extending on service research that recognizes the important role of emergence (Fehrer *et al.*, 2024; Vargo *et al.*, 2023), service ecosystem transitions (Brodie *et al.*, 2021; Polese *et al.*, 2021), and dynamic states (As'ad *et al.*, 2024) in contributing the service ecosystem dynamism, the Circular Service Ecosystem Adoption Framework highlights the need to facilitate transitions from initial dynamic states (i.e. reproducing a linear economy paradigm) to improved dynamic states (i.e. reconfiguring and transitioning to a CE paradigm) to support CSE adoption.

Evolution across dynamic states is observed in the illustrative case through the implementation of various food waste collection processes and infrastructure. For instance, *reproducing*, where waste is viewed as non-valuable and there is little to no adoption of a more circular waste management system, is evident in Australian regions without FOGO collection services. *Reconfiguring* can be observed in Australian regions where action plans and pilots are in place, yet an established food waste management system has not yet been established. *Transitioning* is evident in Australian regions where FOGO collection services and infrastructure are widely established, and there is a worldview of food waste as a valuable resource and a shared purpose for food waste recovery.

Facilitating CSE evolution has significant implications for the transition planning of CE policymakers and practitioners. It emphasizes the need to facilitate transitions across ecosystem states, for instance, by establishing specific and realistic phases of implementing circular initiatives. While research and roadmaps are presented by consultancies for corporate transition plans regarding climate change (e.g. Kouloukoui *et al.*, 2025), such planning of the CE hasn't gained the same traction (e.g. Lukkarinen *et al.*, 2023). Thus, planning, designing, and monitoring initiatives are imperative, particularly given that research has found that consumers can resist circular initiatives during reconfiguring states, for instance, in the context of plastic bans (Gonzalez-Arcos *et al.*, 2021). Practitioners, policymakers, and other stakeholders must work together to support this transition across states as it requires targeted investments in education, infrastructure, and coordination among actors.

CE scholars may also investigate the tipping points and triggers that enable movement between ecosystem states. Empirical research should further explore the phenomenon of CSE emergence, how CSEs develop to new orders, and delineating this from CSE evolution. Facilitating a shift from transitioning to reproducing a CSE deserves particular attention; specifically, where the service ecosystem transitions towards a state of reproducing a CE paradigm and behavioral patterns. This is the ultimate goal for re-enacting CSE institutional arrangements for widespread CE adoption. Future research should identify and clearly define goals and minimum standards for improved CSE states.

Orchestration and intervention points drive CSE evolution. The third proposition suggests that there are key drivers of CSE evolution that play a fundamental role in CSE adoption and should be mobilized, including service orchestration and leveraging intervention points. This proposition draws on prior research recognizing the importance of attracting actors to share their resources during collaborative interactions (Frow *et al.*, 2016) and leveraging value co-creation practices (Beirão *et al.*, 2017; Brodie *et al.*, 2021; Frow *et al.*, 2016) in contributing to dynamism within the service ecosystem. The Circular Service Ecosystem Adoption Framework emphasizes the need for ecosystem orchestrators to facilitate circular value co-creation practices and multi-actor interactions support transitions to a CE paradigm.

In the illustrative case, initiatives like the *Australian Food Pact* (voluntary agreement for industry) and *The Great Unwaste* (behavior change campaign) facilitate such collaboration and collective action, leading to innovation, reduced waste, and the creation of new value streams (leveraging resource stocks and flows). This highlights the need for CE policymakers and practitioners to facilitate orchestration, for instance, by creating opportunities for collaboration to encourage innovation. For instance, a shared purpose for reducing food waste through R&D and capacity-building is facilitated by *Fight Food Waste Limited* (2023). This has helped to enable change by setting the structure and rules of the system (As'ad *et al.*, 2024) and disseminating a shared worldview throughout the ecosystem, resulting in the creation of novel circular solutions (Karpen *et al.*, 2023) and helping to reinforce shared goals for circularity (Fehrer *et al.*, 2024). Consequently, CE practitioners, policymakers, and NGOs can find opportunities for collaboration and encourage the dissemination of a shared worldview among industry actors to minimize conflicting understandings and encourage drivers (e.g. shared purpose, novel circular solutions, designs, products, and business models).

This article further calls for research that unpacks how actors initiate and sustain orchestration efforts. While it is common to see motivators that span economic and environmental drivers,

social drivers are less discussed. Future research could clarify the roles and responsibilities of actors in service orchestration, identifying potential intervention points and pathways.

Inhibitors and misalignments constrain CSE evolution. The fourth proposition acknowledges the necessity of considering and managing inhibitors to CSE evolution. Within the extant service ecosystem dynamics literature, there has been limited scholarly attention to the barriers to ecosystem transitions (see [Brodie et al., 2021](#); [Sebastiani and Anzivino, 2022](#); [Tuominen et al., 2020](#) for noteworthy exceptions). Thus, the Circular Service Ecosystem Adoption framework provides an important contribution to CE research by providing insights into inhibiting factors related to how intervention points are leveraged and alignment is achieved across ecosystem levels. In particular, the misalignment between intervention points and co-existing dynamics at different levels.

In the illustrative case, there is a clear interaction between and within system levels that inhibits change towards a CSE. For example, retailers maintain strict cosmetic standards due to consumer demand, while consumer demand is reinforced by past and current retailer practices. This self-reinforcing cycle illustrates how transitioning to circular thinking requires simultaneous transformation at multiple ecosystem levels, challenging existing mindsets, practices, and relationships across the entire food retail system. For CE policymakers and practitioners, this case demonstrates that a successful transition to CSEs requires more than isolated initiatives or regulatory frameworks. It demands a fundamental assessment and restructuring of the relationships and expectations that currently reinforce linear thinking across all ecosystem levels. Additionally, policy development should incorporate flexibility to address regional and local variations, proactively planning for potential misalignments of dynamic states across service ecosystem levels. For example, while national governments may set ambitious goals, local municipalities often lack the necessary infrastructure, expertise, or supportive policies to effectively implement these objectives.

CE scholars could identify tensions that create misalignments, thereby furthering an understanding of these inhibitors and how to navigate them. Misalignment within and across intervention points needs to be further untangled to understand the constraints of CSE evolution. Particular attention should be given to the misuse of system resources due to a lack of awareness, knowledge, or capacity.

Overall, the Circular Service Ecosystem Adoption Framework and illustrative case study on food waste in Australia provide a nuanced perspective on CSE adoption. However, there are some limitations that can be addressed in future research. Although the case of food waste in Australia provides a concrete example of the framework, allowing readers to visualize the conceptual arguments applied, the framework's generalizability is restricted by the single-case focus and conceptual nature of the study. The Australian context and prevalence of FOGO systems may not be illustrative of food waste ecosystem structures in other countries. Future research would benefit from investigating other forms of food waste reduction and valorization initiatives. Additionally, while a review of the literature on circular service ecosystems and service ecosystem dynamics helped to identify the key processes facilitating CE adoption in the conceptual framework, further empirical work is needed to validate it. Thus, future research should apply, test, and refine the framework across different CE contexts (e.g. textiles, electronics, construction) and countries.

(The Appendix follows overleaf)

Appendix

Table A1. Glossary of key terms and definitions

Concept	Definition	Source(s)
Circular economy (CE) adoption	A large-scale, system-wide transition to a circular economy.	Hetherington et al. (2024) , Mubarik et al. (2024)
Circular service ecosystems (CSE)	“Ideal types of service ecosystems, regenerative, and embedded within nature, where (material, intellectual, digital, and financial) resources flow seamlessly within and between nested systems without creating any waste or leakage.”	Fehrer et al. (2024) , p. 49)
CSE adoption	<i>The adoption of a CE paradigm within a service ecosystem by evolving from initial to improved dynamic states (from behavioral patterns of reproducing and reconfiguring to transitioning) facilitated by mobilizing drivers and effectively managing inhibitors to CSE evolution</i>	The current Circular Service Ecosystem Framework
CSE evolution	The process of transitioning from initial to improved service ecosystem states (e.g. a linear to circular behavioral patterns) over a series of value co-creation episodes	Beckett (2023) , Brodie et al. (2021) , Kijima et al. (2016)
Drivers of CSE evolution	Factors that encourage and enable multiple actors to participate in CSE evolution	As’ad et al. (2024) , Beirão et al. (2017) , Brodie et al. (2021)
Emergence	The process of service ecosystems developing into new orders (i.e. a new entity with its own particular characteristics), where the phenomenon of new properties arising allow service ecosystems to adapt and transition	Fehrer et al. (2024) , Polese et al. (2021) , Vargo et al. (2023)
Inhibitors of CSE evolution	Factors that disrupt or create barriers to the process of CSE evolution	Sebastiani and Anzivino (2022)
CE Paradigm shift	A shift in the mental model (i.e. worldview) in the service ecosystem from a linear economy to a circular economy through the process of reevaluating and reconceptualizing prevailing economic models in the service ecosystem	Fehrer et al. (2024) , van Egmond and de Vries (2011)
Service ecosystem dynamics	“The behavioral patterns of service ecosystems over time”	As’ad et al. (2024) , p. 160)
Service ecosystem transitions	Shifts from one ecosystem state (i.e. emergent property) to another	Polese et al. (2021) , Meynhardt et al. (2016)
Source: Authors’ own work		

Note

1. The growing relevance of a CE is reflected in its interest and attention from various stakeholders. For instance, searching the term *circular economy* on Google reveals over 180 million results (as of 14 July 2025), with near exponential growth over the last five years. Scholarly work on a CE is also increasing, with more than 720,000 “circular economy” works published on Google Scholar (as of 14 July 2025), and approximately 200,000 published of these in the past five years. A search on Scopus returns over 46,500 academic works (as of 14 July 2025), with similar exponential yearly increases in the previous five years.

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Corresponding author

Alexandria M. Gain can be contacted at: a.gain@business.uq.edu.au