Are Australian Construction and Demolition Waste Management Research Efforts Coherent with Policy Targets?

R. A. A. Dilogini, G. Karunasena, N. Udawatta, and C. Liu

Abstract Australia's 2022 National Waste Report states that between 2016 and 2021, the generation of construction and demolition waste (CDW) grew from 23.4 to 29 million tonnes, making up 38% of all waste generated in the nation. The National Waste Policy Action Plan aims to increase the CDW recycling rate to 80% by 2030 to minimize waste as one of the key priorities. In this context, CDW sector-specific endeavours during the recent past are vital understanding to achieve the set policy priorities. Thus, the chapter aims to investigate whether current construction and demolition waste management (CDWM) research efforts in Australia are coherent with policy targets. A systematic literature review was conducted and the study utilized 126 research outputs published in Web of Science and Scopus databases to achieve this. The PRISMA methodology was employed with imposing year restrictions from 2019 to 2023. Additionally, the study referred to the federal and state/territory-level policy documents to review the policy targets concerning CDWM. The findings revealed that research has been conducted on five major themes: management practices, recycling and upcycling, circular economy, stakeholder behaviour, and technology advancements. However, most current practices are not fully aligned with national and state policy targets. To enhance alignment and effectiveness, further research should focus on integrating policy objectives and addressing existing gaps in practice. These findings will provide a valuable assessment of the current state of CDWM research efforts and serve as a roadmap for researchers and industry practitioners to achieve the policy targets.

1 Introduction

In the 2020/21 period, Australia produced around 75.8 million tonnes of waste, with building and demolition materials making up about 25.1 million tonnes of that total (Department of Climate Change, Energy, the Environment and Water [DCCEEW],

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N. Domingo et al. (eds.), *Global Net Zero Carbon Practices in Construction*, Green Energy and Technology, https://doi.org/10.1007/978-981-96-3853-6_9

2022). The sheer scale and consequences of construction and demolition waste (CDW) are quite concerning [17], capturing growing attention on a global scale [40]. These significant challenges primarily arise from the construction industry's heavy reliance on conventional building methods and a linear economic model, which operates on a "take, make, dispose" principle ([4, 12, 13]; Illankoon and Vithanage 2023).

The rise in construction and demolition waste (CDW) in Australia is largely attributed to rapid urbanization and the expansion of the construction industry, which have together led to an increase in waste generation [33]. Disposing of these materials in landfills presents serious environmental risks, including soil contamination, water pollution, and greenhouse gas emissions, stemming from the breakdown of organic materials and the leaching of chemicals [40]. Additionally, CDW constitutes a significant portion of the waste sent to landfills, highlighting inefficiencies in the current waste management practices.

In Australia, efforts to manage construction and demolition waste (CDW) more sustainably have centred on boosting recycling and resource recovery rates. Nevertheless, despite these initiatives, the country has fallen short of its recycling targets, with the recycling rate for CDW not meeting the ambitious goals outlined by government policies [1]. There is also an increasing awareness of the necessity to move away from a linear economy model towards a circular economy approach, which focuses on maximizing the use of materials through practices like recycling, reuse, and sustainable design [4, 13]. This transition is vital not only for reducing the environmental impacts of waste but also for conserving natural resources and fostering economic growth [2].

Despite extensive research on various aspects of CDWM, a critical gap remains in evaluating whether these efforts align with the policy objectives set by government authorities. Recent reviews have highlighted that while many studies focus on technological advancements and stakeholder behaviour, there is a limited assessment of how well these practices align with national- or state-level waste management policies [37, 43]. Addressing this gap is crucial for ensuring that research efforts contribute effectively to achieving policy goals and improving waste management practices across the construction industry in Australia.

Therefore, this chapter aims to investigate whether current CDWM efforts in Australia are coherent with policy targets. To achieve this aim, the chapter will: (1) examine the research efforts conducted in Australia over the last 5 years, (2) analyse policy targets set by federal and state-level governments, (3) identify gaps in the current literature regarding policy coherence, and (4) provide recommendations for future research and policy development to enhance the alignment of CDWM practices towards sustainability.

2 Literature Review

Construction and demolition waste (CDW) in Australia presents a major environmental and economic challenge, contributing significantly to the nation's total waste stream [10, 32]. The volume of CDW has consistently increased over the years, largely due to the rise in urban development and construction activities. Recent statistics show that Australia generated about 75.8 million tonnes of waste during the 2020/21 financial year, with construction and demolition materials accounting for 25.1 million tonnes of this total [10, 40].

Over time, the management of CDW in Australia has evolved, shifting gradually from traditional disposal methods like landfilling to more sustainable approaches focused on recycling and resource recovery [32]. Initially, waste management heavily relied on landfills due to their lower cost and ease of use [17]. However, growing awareness of the environmental impacts and concerns over resource depletion have prompted a move towards recycling and reuse, although the outcomes have been mixed. The current recycling rate for CDW in Australia stands at roughly 67%, which indicates some progress but also underscores the need for further improvement to meet leading international standards [19, 32].

CDWM practices in Australia exhibit significant regional differences, shaped by local regulations, economic factors, and the availability of infrastructure [24]. In some regions, developing more advanced recycling facilities and waste processing technologies has led to higher recovery rates for materials like concrete and metals [20]. Conversely, other areas struggle with inadequate infrastructure and a lack of economic incentives, resulting in a heavier dependence on traditional waste disposal methods [24, 46].

The impact of construction and demolition waste (CDW) goes beyond waste management difficulties, influencing environmental quality and public health. When CDW accumulates in landfills, it can lead to soil and groundwater contamination, especially if hazardous substances like asbestos and heavy metals are not properly handled [18, 42]. Additionally, the anaerobic breakdown of organic materials in CDW releases greenhouse gases such as methane and carbon dioxide, which contribute to climate change [15, 44]. The construction sector, a major producer of CDW, is also a significant source of greenhouse gas emissions, with construction activities making up a large part of Australia's total carbon footprint ([14]; Oberle et al. 2019). Economically, CDW presents a substantial burden due to disposal costs and the failure to utilize potentially valuable materials. Research suggests that up to 75% of CDW materials could be recovered or repurposed, but current practices fall short of this potential due to a range of regulatory, market, and behavioural barriers [11, 30]. For example, market dynamics often do not support the use of recycled materials because of concerns about quality and the competitive pricing of virgin materials [19, 28]. Additionally, the construction industry's traditional preferences and reluctance to adopt new materials or methods have slowed the shift towards more sustainable CDWM practices [25, 26]. Socially, CDW impacts include public health risks, traffic congestion due to construction activities, and increased pressure

on waste management systems in urban areas [36]. As urban expansion and population growth continue to drive up waste production, it is clear that without more effective management strategies, the challenges posed by CDW are likely to become even more severe in the future [8, 9].

To effectively tackle the significant challenges associated with construction and demolition waste (CDW), it is essential to implement strong policy frameworks that encourage sustainable waste management practices. Recognizing the importance of comprehensive strategies, Australian federal and state governments have introduced a range of policies and action plans aimed at reducing CDW and boosting recycling and reuse rates within the construction sector. These policies set ambitious waste reduction targets and aim to align industry practices with broader environmental sustainability goals [1, 2, 23, 31, 39].

Over the years, several national and state-level policies have been introduced to encourage sustainable practices and meet ambitious recycling and waste reduction goals. On a national scale, the Australian Government has articulated its objectives through key documents like the National Waste Policy Action Plan (2019), which aims to raise the construction and demolition (C&D) recycling rate from 51 to 75% by 2025 [1]. The National Waste Reports (2022) offer detailed data on waste generation and highlight the progress and challenges in achieving these goals (Department of Agriculture, Water and the Environment 2022). Additionally, the National Strategy for Waste and Recycling (2018) underscores the importance of adopting a circular economy and enhancing recycling infrastructure to reduce reliance on landfills [2]. At the state and territory level, individual waste management plans align with these national policies while being tailored to address local needs.

As shown in Table 1, both national- and state-level policies are focused on increasing recycling rates and reducing the environmental impact of construction and demolition waste (CDW). These policies demonstrate a commitment to a circular economy approach, which treats waste not as a problem but as a valuable resource to be reused and recycled. However, as researchers have pointed out, the effectiveness of these strategies relies heavily on successful implementation, ongoing monitoring, and strong collaboration among stakeholders (Morris 2021; Thompson and Harris 2020).

3 Research Methodology

The research methodology for this study is based on a systematic literature review (SLR) aimed at evaluating how well construction and demolition waste management (CDWM) efforts align with national standards and policy objectives in Australia. An SLR was selected as the main research design because it offers a thorough overview of existing research on CDWM, identifies key themes, and evaluates the degree to which these studies conform to government policies. Systematic literature reviews are particularly effective for synthesizing findings from multiple studies, providing a

Table 1 Summary of Australian federal and state/territory waste management policies

Federal level policies			
Policy	M or V	Purpose of the Policy	Targets Related to CDWM
National Waste Policy Action Plan (2019)	V	To provide a national framework for waste management and resource recovery, promoting a circular economy	Increase the recycling rate for construction and demolition (C&D) waste from 51 to 80% by 2030
National Strategy for Waste and Recycling (2018)	V	To establish a national approach to waste management and recycling, focusing on reducing reliance on landfills	No specific target for CDWM but aims to minimize overall waste and increase recycling rates
National Waste Reports (2022)	V	To provide comprehensive data and insights on waste generation, recovery, and disposal across Australia	No specific CDWM target; serves as a monitoring and reporting tool to track progress towards waste reduction and recycling goals

State/Territory-level policies				
State/Territory	Policy	M or V	Purpose of the Policy	Targets Related to CDWM
New South Wales	Waste and Sustainable Materials Strategy 2041	M	To drive a shift towards sustainable material, use and circular economy practices in NSW, with a focus on waste reduction and recycling	Divert 80% of CDW from landfills by 2030; achieve a 50% reduction in the per capita waste generation rate by 2030
Victoria	Recycling Victoria: A New Economy (2020)	M	To reduce waste and increase recycling rates by transforming Victoria's waste and recycling systems	Reduce CDW waste to landfill by 15% by 2025; recover 80% of waste materials, including CDW, by 2030
Queensland	Waste Management and Resource Recovery Strategy (2019)	M	To promote resource recovery and waste avoidance, and minimize waste sent to landfill	Achieve a recycling rate of 75% for all waste types, including CDW, by 2050
South Australia	Waste Strategy 2020–2025	M	To guide waste management practices towards reducing waste to landfill and increasing resource recovery	Achieve a recycling rate of 90% for CDW by 2025
Western Australia	Waste Avoidance and Resource Recovery Strategy 2030	M	To provide a strategic framework for waste avoidance, recovery, and sustainable waste management	Recover 75% of waste materials, including CDW, by 2030; reduce waste generation by 20% per capita by 2030

(continued)

Table 1 (continued)

Tasmania	Waste Action Plan 2019	V	To provide a framework for waste management and resource recovery, focusing on reducing waste to landfill and increasing recycling	No specific CDWM target; aims to reduce overall waste and increase recycling rates
Australian Capital Territory (ACT)	ACT Waste Management Strategy 2011–2025	M	To achieve a carbon–neutral waste sector and enhance resource recovery	Achieve 90% resource recovery by 2025 for C&D waste
Northern Territory (NT)	Northern Territory Waste Management Strategy 2015–2025	V	To reduce waste sent to landfill and improve recycling practices	Increase recycling and resource recovery rates to 50% by 2025

(M: Mandatory; V: Voluntary)
Source ([1, 2, 23, 39]; Department of Agriculture, Water and the Environment 2022; Morris 2021; Thompson and Harris 2020)

critical assessment of the current knowledge base, and identifying gaps that require further investigation [38].

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework was employed to guide the data extraction and screening processes, ensuring a systematic and transparent approach to selecting studies. This framework includes several stages—identification, screening, eligibility, and inclusion—that help refine study selection and enhance the reliability of the review process [21]. To gather relevant data, a structured search was conducted using Web of Science and Scopus, two of the most comprehensive academic databases available. Keywords such as "construction and demolition waste," "construction and demolition debris," "C&D waste," "CDW," and "C&D debris" were used to broadly capture literature relevant to the research objectives. The search was limited to publications from 2019 to 2023 to ensure that the analysis was aligned with recent policy developments in CDWM in Australia. This timeframe was selected because many national and state-level policy targets, such as those outlined in the National Waste Policy Action Plan (2019) and various state strategies, were designed to address contemporary and future waste management challenges. By focusing on studies published within this period, the review ensures that the findings are closely related to current policy goals, providing a clearer picture of the alignment between research efforts and government priorities. Initially, 434 articles were identified from Scopus and 332 from Web of Science. After applying a predefined set of inclusion and exclusion criteria, 126 research outputs were selected for this study. Studies were included if they focused on any CDWM practices in Australia, were published in peer-reviewed journals, conferences, or official government reports, and were in English. This approach ensured the quality and credibility of the findings.

Data from the literature review and document analysis were examined using thematic analysis to identify recurring themes and trends in CDWM research. This method allows for systematically categorizing data into themes, providing a deeper understanding of the dominant trends and gaps in the existing literature (Braun and Clarke 2006). Alongside the systematic literature review, a content analysis of government documents was conducted to contextualize the study within the relevant policy framework. Key documents were scrutinized to identify policy objectives, targets, and strategies related to CDWM, as outlined in Table 1. These policies were selected based on their relevance to CDWM and their influence on shaping waste management practices and sustainability targets. Content analysis enabled a thorough examination of these documents, helping to identify overarching themes and assess how well the research aligns with policy goals (Bowen 2009). Analysing policy documents was crucial for understanding the regulatory framework governing CDWM in Australia and evaluating whether current research efforts support or diverge from these objectives. The identified themes were cross-referenced with policy objectives outlined in government documents to determine the alignment between research findings and policy goals, highlighting areas where further integration is necessary. The alignment of these studies was categorized into three levels: fully aligned, partially aligned, and not aligned with the goals set by national- and state-level policies. Fully Aligned articles directly support the specific objectives outlined in government policies, providing comprehensive evidence and recommendations that closely match policy goals. Partially aligned articles address some aspects of the policies but do not fully meet all the objectives or only relate tangentially to policy goals. These articles may cover certain components of the policies but lack a thorough engagement with the policy frameworks, offering limited relevance to the intended outcomes. In contrast, not aligned articles are those that do not address the policy targets at all.

4 Findings and Discussion

The findings and discussion of this chapter are divided into two main sections to provide a comprehensive analysis of the current state of CDWM research in Australia and its alignment with government policies.

4.1 Overview of Research Conducted in Six Key Areas

Research on construction and demolition waste management (CDWM) in Australia has been extensive and diverse, exploring a range of thematic areas. The systematic literature review identified five key areas of focus: management practices, recycling and upcycling, circular economy, stakeholder behaviour, and technological advancement, as illustrated in Fig. 1.

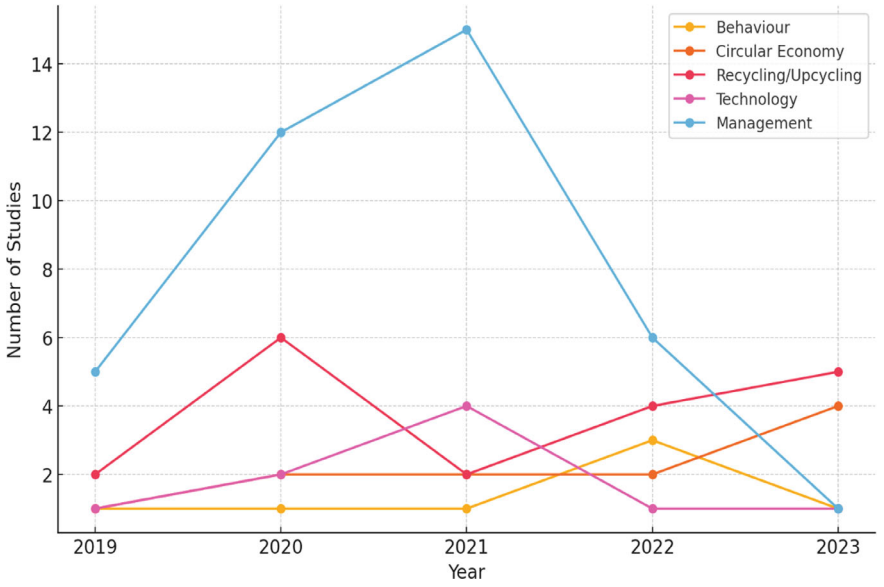

Fig. 1 Number of research over time for each theme (2019–2023)

4.2 Management Practices

Research on management practices in construction and demolition waste (CDW) management has steadily increased, reflecting a concerted effort to improve how waste is handled at different stages of the project lifecycle [17, 32]. Effective practices, such as on-site sorting and implementing comprehensive waste management plans, have been shown to significantly reduce the amount of waste sent to landfills, especially in regions where regulatory enforcement is strict [17]. However, there are still notable disparities in the application of these practices across different regions and sectors, with some areas continuing to rely on traditional methods like landfilling, which are not aligned with sustainability goals [32]. These inconsistencies underscore the need for more uniform guidelines and stronger enforcement mechanisms to ensure the widespread adoption of effective waste management strategies throughout Australia.

4.3 Recycling and Upcycling

Research on recycling and upcycling has highlighted the vital role of material recovery in reducing the environmental impact of construction activities [28, 29]. Advanced recycling technologies, such as automated sorting systems, have shown considerable promise in boosting the recovery rates of valuable materials from

construction and demolition waste (CDW) [29]. However, despite these technological advancements, high recycling costs and the low market value of recycled materials pose significant economic challenges to widespread adoption [28]. Many recycling initiatives struggle to achieve economic viability, revealing a disconnect between the potential of recycling technologies and their practical implementation. This situation underscores the need for economic incentives and policies that could foster more favourable market conditions for recycled and upcycled products.

4.4 Circular Economy

Interest in circular economy principles has increased in recent years, with a growing number of studies examining how to integrate these principles into construction and demolition waste management (CDWM) to enhance resource efficiency and sustainability [6]. Strategies such as designing for deconstruction, reusing materials, and implementing closed-loop recycling have been explored to minimize waste and maximize resource use. Projects that incorporate circular economy principles have shown significant potential in reducing waste generation and improving sustainability outcomes (Ogunmakinde et al. 2023). However, the adoption of these practices remains uneven across the industry, largely due to a lack of awareness, expertise, and incentives. This gap between the theoretical understanding of circular economy principles and their practical application suggests a need for more applied research and stronger incentives to encourage broader industry adoption [6].

4.5 Stakeholder Behaviour

The role of stakeholder behaviour in the adoption of sustainable construction and demolition waste management (CDWM) practices has become a significant area of research in recent years, underscoring the critical impact of attitudes, perceptions, and economic factors on decision-making processes [34, 41]. Studies have pointed to resistance to change and a lack of awareness among stakeholders, such as construction firms and waste management companies, as primary obstacles to adopting sustainable practices [41]. Additionally, economic disincentives, including the perceived high costs of sustainable materials and methods, further deter stakeholders from fully embracing CDWM strategies [34]. Overcoming these behavioural barriers is essential for enhancing the effectiveness of CDWM initiatives and ensuring greater compliance with sustainability goals. This effort requires targeted strategies to increase awareness, provide education and training, and develop economic incentives that make sustainable choices more appealing to stakeholders.

Table 2 Summary of alignment of research articles across these themes with government policies

Theme	Fully aligned (%)	Partially aligned (%)	Not aligned (%)
Management practices	22.73	54.55	22.73
Recycling and upcycling	32.35	47.06	20.59
Circular economy	30.77	53.85	15.38
Stakeholder behaviour	22.22	55.56	22.22
Technological advancement	58.82	29.41	11.76

5 Technological Advancement

Research on technological advancements in CDWM has seen a significant increase, particularly in recent years, highlighting a growing interest in developing and implementing innovative technologies to enhance waste sorting, recycling, and material recovery processes [17, 34]. Technologies such as Building Information Modelling (BIM) and smart waste management systems have shown the potential to improve waste tracking and minimize material loss, thereby enhancing CDWM efficiency and effectiveness [17]. Despite these technological innovations, their adoption remains limited due to high costs and a lack of technical expertise within the industry [34]. To fully realize the benefits of technological advancements, there is a need for greater support in the form of government incentives and industry training programmes, which can help overcome these barriers and facilitate broader adoption.

5.1 Alignment of Research with Government Policies

To evaluate how well research aligns with government policies on construction and demolition waste management (CDWM) in Australia, the following analysis categorizes studies into various themes. Each theme represents a key area of focus within CDWM, emphasizing different aspects of waste management practices and their correspondence with policy objectives. The alignment categories—fully aligned, partially aligned, and not aligned—were determined through a frequency analysis of 126 articles published over the past five years. Below is a summary of the alignment for each theme, followed by a detailed breakdown in Table 2.

6 Management Practices and Policy Alignment

Research on CDWM practices in Australia has highlighted several strategies, including on-site sorting, comprehensive waste management plans, and strict adherence to regulatory compliance, as crucial for enhancing waste management outcomes

[17, 32]. While these strategies have achieved some success, their alignment with government policies has shown considerable variation.

A small but significant portion of studies are fully aligned with government policies, showcasing practices that directly support policy objectives by adhering to regulatory standards and promoting effective waste management. For instance, Kabirifar et al. [17] examined the impact of stringent waste management regulations on recycling rates and landfill reduction. Their findings align closely with the National Waste Policy Action Plan (2019), which sets explicit targets for waste reduction and increased recycling through standardized management practices. The study demonstrates that comprehensive waste management strategies, including strict regulatory compliance, can effectively divert waste and support the policy's goals. Similarly, Nguyen et al. [22] explored the implementation of structured waste management plans that successfully reduced waste generation and improved recycling rates. This study aligns with the NSW Waste and Sustainable Materials Strategy 2041, which emphasizes the importance of uniform waste management practices across regions to achieve consistent recycling and waste reduction targets. Wilson and Chen (2020) also found that regions with robust regulatory frameworks and enforcement achieved higher compliance with recycling targets, aligning well with the objectives of the Victorian Government's Recycling Victoria: A New Economy (2020). The majority of studies fall into the partially aligned category, indicating that they address some aspects of policy requirements but do not fully meet all objectives. For example, [32] highlighted significant inconsistencies in the application of waste management practices across different regions in Australia. While the study acknowledges the importance of regulatory compliance and effective waste management strategies, it also reveals a lack of standardization, which falls short of the policy objectives aimed at achieving uniform waste management practices nationwide. Similarly, Thompson and Harris (2022) investigated regional differences in the enforcement of waste management regulations. Although some regions adopt practices that align with state policies, others continue to rely on less effective methods, indicating partial compliance with policy targets that aim for standardized waste management practices. Wang et al. [40] examined local waste management practices and found that while some localities have adopted strategies aligned with state policies, others have not fully integrated these approaches, resulting in partial alignment with policy objectives. Additionally, Patel et al. [27] studied local government initiatives in promoting waste management practices, suggesting that while some initiatives align with policy goals of reducing waste and increasing recycling, others lack the comprehensive approach needed to fully meet these targets. This indicates that while efforts are being made, they are not consistently applied across all regions or sectors. A smaller but notable portion of studies is not aligned with government policies, often focusing on traditional or outdated methods that do not support current policy objectives. For example, Ceschi et al. [8] focused on traditional waste disposal methods, such as landfilling, without considering more innovative management practices that align with policy goals. This study does not align with the National Waste Policy Action Plan (2019), which aims to reduce landfill use and promote recycling and resource recovery. Similarly, Jones and Clark (2023) analysed the continuation of outdated waste practices in

several regions, which directly contradicts the policy goals of reducing landfill dependency and promoting recycling set by both federal and state policies. The study's emphasis on maintaining traditional practices without integrating new strategies for waste reduction and recycling highlights a clear misalignment with policy objectives. Brown et al. [7] examined basic waste management practices without referencing the need for standardized and improved systems advocated by policy targets. Their focus on minimal compliance and the absence of innovative approaches results in a lack of alignment with the objectives set out in strategies like Recycling Victoria: A New Economy (2020).

7 Recycling and Upcycling and Policy Alignment

Research in the area of recycling and upcycling has explored advancements in technologies, such as automated sorting systems and advanced material recovery facilities, as well as the economic challenges associated with these practices [28, 29]. The National Waste Policy Action Plan (2019) and the Queensland Waste Management and Resource Recovery Strategy (2019) have established specific targets to increase recycling rates, aiming for a 75% recycling rate by 2025 [1, 31].

Studies that are fully aligned with government policies typically focus on technological advancements that directly support policy objectives to enhance recycling rates. For example, Foster et al. [11] analysed the implementation of advanced material recovery facilities in several Australian states, demonstrating how these facilities contribute to achieving the 75% recycling target by improving the efficiency and quality of material recovery processes. This research aligns closely with policy goals by directly supporting the enhancement of recycling infrastructure, a key component of the National Waste Policy Action Plan (2019). Similarly, Poon [29] investigated the use of automated sorting technologies in recycling facilities, showing significant improvements in material recovery rates and reduced contamination levels. This study aligns with policy objectives by illustrating how technological innovations can meet recycling targets and enhance overall recycling efficiency. Another fully aligned study by Lee et al. (2022) focused on the adoption of closed-loop recycling systems in the construction sector, highlighting how these systems reduce waste and promote material reuse, directly supporting the goals set by the Queensland Waste Management and Resource Recovery Strategy (2019). The majority of studies fall into the partially aligned category, meaning they address some aspects of recycling policies but do not fully encompass all policy targets or consider the economic and operational challenges. For instance, Smith and Nguyen (2020) investigated the potential of automated sorting systems to increase recycling rates but did not fully account for the economic feasibility or market development strategies necessary for widespread adoption. This indicates alignment with technological objectives but lacks a comprehensive approach that integrates economic considerations and market dynamics, which are critical for policy success. Similarly, Polyportis et al. [28] examined the economic barriers to recycling, such as high processing costs

and market limitations. While acknowledging technological advancements, the study does not fully address broader policy objectives, like those in *Recycling Victoria: A New Economy* (2020), which include market development for recycled materials. Wang and Chen (2021) explored the challenges in adopting new recycling technologies, noting some alignment with state policies that encourage innovation but failing to cover the comprehensive economic incentives needed to support widespread adoption. These studies suggest that while there is some effort to align with policy objectives, significant gaps remain in addressing economic barriers and promoting broader market development for recycled materials. A smaller portion of studies is not aligned with government policies, as they fail to address policy objectives or consider the broader economic environment affecting the implementation of recycling practices. For example, Brown et al. [7] focused on the environmental benefits of recycling without addressing specific economic barriers, such as high processing costs and low market demand for recycled materials, which are crucial for achieving the policy targets set by the National Waste Policy Action Plan and other state strategies. This study does not align with policy objectives as it overlooks the critical economic and market-related barriers that impact the adoption of recycling practices. Similarly, Johnson and Davis (2022) examined general recycling practices without considering the economic or policy-driven incentives needed for advancing recycling technologies, failing to align with policy objectives that emphasize innovative recycling solutions. Another study by Thompson et al. [37] discussed recycling processes without integrating policy targets or addressing the need for economic incentives and market development, indicating a lack of alignment with the goals set by both federal and state policies.

8 Circular Economy and Policy Alignment

Research has examined the adoption of circular economy principles in construction and demolition waste management (CDWM), focusing on strategies such as designing for deconstruction, promoting material reuse, and implementing closed-loop recycling systems (Ogunmakinde et al. 2023; [6]). Government policies, including the National Strategy for Waste and Recycling (2018) and the NSW Waste and Sustainable Materials Strategy 2041, advocate for integrating circular economy practices to enhance resource efficiency and minimize waste generation [2, 23].

Studies fully aligned with government policies typically demonstrate the successful implementation of circular economy principles that meet policy objectives. For example, Thompson et al. (2021) explored buildings designed for deconstruction and material reuse, showing how these practices align with national objectives by reducing waste and increasing resource efficiency. This study directly supports policy goals by providing practical applications of circular economy strategies, which are crucial for reducing environmental impact and promoting sustainability in the construction sector. Similarly, Ogunmakinde et al. (2023) examined the

integration of circular economy principles in urban development projects, demonstrating how adopting strategies like material reuse and designing for deconstruction can help achieve the targets set by the National Strategy for Waste and Recycling (2018). Another fully aligned study by Kumar and Patel (2020) focused on closed-loop recycling systems in the construction industry, highlighting their effectiveness in minimizing waste and promoting the reuse of materials, aligning with the objectives of the NSW Waste and Sustainable Materials Strategy 2041. The majority of studies fall into the partially aligned category, indicating that they explore certain aspects of circular economy principles but do not fully cover all necessary strategies or align with the complete range of policy goals. For instance, [3] investigated the use of recycled materials in construction projects. While this research contributes to some policy objectives by promoting recycling, it does not fully address broader strategies such as closed-loop recycling or designing for deconstruction. This indicates partial alignment with government policies that advocate for a comprehensive approach to circular economy practices. Blomsma et al. [6] also explored circular strategies but primarily focused on recycling without fully integrating other key principles like material reuse or designing for deconstruction, which are essential components of a circular economy. Another partially aligned study by Singh et al. [35] looked at circular economy practices in waste management but did not consider the full life-cycle of construction materials, thus not fully supporting the holistic approach emphasized in policy frameworks. A smaller portion of studies is not aligned with government policies, as they overlook the directives promoting circular economy practices. For example, Johnson et al. [16] focused on conventional recycling methods without integrating essential circular economy principles, such as material reuse or deconstruction design. This misalignment indicates a significant gap in addressing the full spectrum of policy goals aimed at fostering sustainability through circular economy approaches. The study does not align with the NSW Waste and Sustainable Materials Strategy 2041, which emphasizes a more integrated approach to resource efficiency and waste minimization. Similarly, Anderson and White (2020) examined traditional recycling practices without considering circular economy strategies like designing for deconstruction, failing to align with the comprehensive policy goals set by the National Strategy for Waste and Recycling (2018). Another study by Martinez and Green (2022) focused on linear waste management practices without reference to the circular economy, demonstrating a lack of alignment with policy objectives that seek to promote sustainability through circular strategies.

9 Stakeholder Behaviour and Policy Alignment

Research on stakeholder behaviour has highlighted the critical role of attitudes, perceptions, and economic considerations in shaping the adoption of sustainable waste management practices [34, 41]. Government policies, such as *Recycling Victoria: A New Economy* (2020) and the *Queensland Waste Management and*

Resource Recovery Strategy (2019), stress the importance of enhancing stakeholder engagement and compliance through education, awareness programmes, and economic incentives [31, 39].

Studies that are fully aligned with government policies typically demonstrate the successful application of circular economy principles to achieve policy objectives. For example, Thompson et al. (2021) detailed how buildings designed for deconstruction and material reuse align with national objectives by reducing waste and increasing resource efficiency. These findings directly support policy goals by offering practical applications of circular economy strategies that minimize environmental impact. In contrast, partially aligned studies often explore certain aspects of circular economy principles but do not fully cover all necessary strategies or align with the entire range of policy goals. For instance, [3] examined the use of recycled materials in construction but did not address broader strategies like closed-loop recycling or designing for deconstruction. While this research contributes to some policy objectives, it does not fully encompass the comprehensive approach advocated by government strategies for circular economy practices. Not aligned studies fail to consider policy directives that promote circular economy practices. Johnson et al. (2023) focused on conventional recycling methods without incorporating essential circular economy principles, such as material reuse or deconstruction design, which are emphasized in the *NSW Waste and Sustainable Materials Strategy 2041*. This lack of alignment indicates a significant gap in addressing the full spectrum of policy goals aimed at fostering sustainability through circular economy approaches.

10 Technological Advancements and Policy Alignment

Research on technological advancements in construction and demolition waste management (CDWM) has concentrated on innovations aimed at enhancing waste sorting, recycling, and material recovery processes [17, 34]. Government policies, such as the *National Waste Policy Action Plan* (2019) and *Recycling Victoria: A New Economy* (2020), advocate for the adoption of advanced technologies to improve waste management practices and efficiency [1, 39].

Studies fully aligned with government policies demonstrate a strong commitment to using advanced technologies to achieve policy goals. For instance, Nguyen et al. (2021) examined the use of automated waste sorting systems that significantly increase recycling rates and reduce contamination, directly supporting the objectives outlined in the *National Waste Policy Action Plan*. This research aligns closely with policy goals by providing practical technological solutions that enhance the efficiency and effectiveness of waste management. Partially aligned studies explore some technological innovations but do not fully address the conditions necessary for their widespread adoption. For example, Polyportis et al. [28] discussed the potential of new recycling technologies but did not delve into the economic and training requirements needed for broader implementation. While this research supports certain aspects of policy objectives, it lacks a comprehensive approach to overcoming the

barriers to technology adoption. Not aligned studies fail to consider the barriers to technology adoption or focus on aspects of waste management unrelated to technological advancements. For example, Zhang et al. [45] focused on the theoretical development of new waste treatment technologies without addressing the practical challenges of implementation, such as costs and technical expertise, which are crucial components highlighted in government policies. This gap indicates a lack of alignment with policy objectives that emphasize not only technological innovation but also the feasibility of widespread adoption.

11 Conclusion and Further Research

This study aims to assess how well research efforts in construction and demolition waste management (CDWM) in Australia align with policy targets. The research concentrated on five key thematic areas: management practices, recycling and upcycling, circular economy principles, stakeholder behaviour, and technological advancements. To guide future investigations and address the gaps identified in this chapter, specific areas for further research are suggested below for each theme:

- Management Practices: Future research should focus on developing best practices for standardized waste management across diverse regions. It could also investigate the impact of enhanced enforcement mechanisms and policy compliance on improving waste management outcomes.
- Recycling and Upcycling: Future studies should aim to integrate technological advancements with economic incentives and market development strategies to better align with policy objectives. Research could also explore the role of financial incentives in overcoming economic barriers to recycling.
- Circular Economy: Research should focus on creating clearer guidelines and incentives for implementing circular economy practices in construction. Further studies could examine the barriers to adoption and develop strategies to more effectively integrate circular economy principles into industry practices.
- Stakeholder Behaviour: Future research could target the development of strategies to shift stakeholder attitudes and perceptions towards sustainable practices. Studies might also explore the effectiveness of education and incentive programmes in fostering a culture of sustainability within the construction industry.
- Technological Advancement: Future research should concentrate on identifying ways to reduce the financial and technical barriers to technology adoption. Additionally, studies could investigate the effectiveness of government-funded training programmes and subsidies in promoting the uptake of advanced waste management technologies.

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