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Waste Management in Australia Is an Environmental Crisis: What Needs to Change so Adaptive Governance Can Help?

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Abstract: Research suggests that strengthening cooperation between governments is required to support improved policy outcomes. Despite established cooperative agreements between the levels of government in Australia, a lack of urgency and consistency continues to drive unsustainable approaches toward waste management practices. Adaptive governance has emerged as a potential approach for addressing complexity, with multiple actors collaborating in the design and implementation of challenging environmental issues. The main findings of this research highlight key challenges in multilevel systems and reforms required to establish institutional arrangements that support key adaptive governance enablers in the context of cooperative approaches to waste management.

Keywords: waste management; circular economy; multilevel system; Australia; cooperation

1. Introduction

In late 2017 China banned international imports of recycled materials with controls over the acceptance of paper and plastics and stringent contamination controls on waste [1]. Other developing countries such as Malaysia, Vietnam, Thailand and India soon followed with similar bans in 2018–2019. As with other developed countries, including Canada, France, Spain and the US, the bans raised important policy challenges in Australia as governments and private waste contractors had become reliant on exporting waste as a key component of existing waste management practices. As a result of the bans, waste management is in crisis and has higher priority on the political agenda for the Australian Government (Commonwealth), as well as state and municipal governments [2]. In responding to the crisis, the Commonwealth Environment Minister declared, "We think it's urgent and important, and we want to tackle the supply and the demand side. We want to work co-operatively with the states" [3]. Waste management is a complex issue in multilevel systems as it involves cooperative interactions between different levels of government and key stakeholders on policy issues that involve aspects of "public health, environmental concerns, and resource value, with relatively recent additions of climate change and inclusivity" [4]. In May 2019, waste management became a federal election issue, with the result that the Commonwealth established Australia's first Assistant Minister for Waste Reduction and Environmental Management as clear indication of its intention to take a stronger leadership role in waste management policy and recycling [5].

Despite the statements of intent since the 1990s, the Commonwealth and state governments have largely failed to pursue effective cooperation for implementing sustainable practices in the management of waste [1,6,7]. Collaboration across jurisdictions in multilevel systems is recognition that the role of government extends beyond its own specific responsibilities and "incorporates what it can do with other stakeholders to serve the collective interest" [8]. Wanna et al. argue that "government functions with an impact that once was merely local (such as waste management) now have much

wider impacts, making a much more coordinated or national approach necessary" [9]. The complexity and the 'wicked' nature of waste issues with their cross-cutting characteristics, and international obligations, means that effective policy action "involves the national government seeking more efficient and effective delivery of environmental outcomes while strengthening partnerships with state and local governments and industry to protect the environment" [10]. In considering how to establish effective cooperative arrangements Fels argues "we need to consider how we translate collaborative engagement (inter agency relations, community engagement, collaborative experiments) into more effective outcomes, better public policies and better use of community and government resources" [11]. "Successful collaboration requires an appreciation of the responsibilities and contributions" of all relevant stakeholders [12]. Scholarly research suggests further work is needed to identify how to "create and maintain collaborative networks that are able to address challenging problems, and that are flexible and adaptable to changes, yet stable enough to facilitate the development of mutual trust and shared commitment" [13].

The environmental management literature has a long-standing interest in analysing ways to improve cooperation between stakeholders on environmental issues. Recent research has endorsed the value of adaptive governance principles to support cooperative approaches through many policy areas [14–16]. A large component of the literature tends to fall under examinations of implementation issues in practice revealed through case studies that examine transition to adaptive approaches. These show mixed success and highlight obstacles based on contextual issues and on the ground complexities [17,18]. In addition, reviews of the case study literature reveal common threads to the conceptual and practical challenge illustrated through the operationalisation of adaptive approaches [19]. The literature also raises a number of important challenges that need some consideration when assessing the potential of adaptive governance to transform existing policy and governance arrangements [16,20,21]. This paper builds upon these various approaches and draws attention to what Plummer [22] identifies as the processes necessary to "make governance operational and emphasizes collaboration among diverse actors, functions across scales and levels, and fosters learning through quality data with iterative feedback". Of relevance to multilevel systems is the view that adaptive governance promotes networks across and between multiple organisational levels essential for sharing power and responsibility among stakeholders of both government and non-government organisations [23]. Importantly, for waste management issues in Australia, adaptive governance involves "policy and legislation which prepares for uncertainty by using novel approaches to learning and experimentation within institutional processes" [24]. Learning is crucial to adaptive governance and to public policy processes generally as it respects feedback based on evidence, thereby building knowledge and initiating innovation to support policy change [24,25]. Researchers recognise the value of such approaches to waste management. Petts [26] claims the "application of deliberative processes to such complex problems as waste management, whether at the national, regional or local levels, requires an adaptive approach to the application of methods".

Currently there is no academic research that directly explores the facets of adaptive governance in the context of waste management in Australia. There is considerable interest by both scholars and practitioners in developing new institutional models to facilitate adaptive governance [23]. In building knowledge to support arguments for transition we must identify the opportunities and challenges within existing institutional arrangements that serve to support or constrain adoption of adaptive approaches to governance. This analysis will concentrate on current arrangements for waste management between the three levels of government. The research focus examines the policy and processes established by Australian institutions to support cooperation and collaboration over waste management, evaluates the extent to which these institutional arrangements support stakeholder consultation and participation in decision making, and examines the how institutional structures allow for policy learning thus contributing to cooperation towards policy change needed to support adaptive governance.

2. Method

A systematic review of the literature on adaptive management, adaptive governance, resource management, environment policy and waste management in Australia was the starting point for this project. This form of review allows for a structured process for collection and analysis of the current data on these topics in the light of the research question. Search terms used to identify key documents were based on terminology distilled from the literature. The approach allows the important ideas to be discovered by focusing terms mainly on policy documents in order to explore the trends across a specific issue over a significant and relevant period of time. The selected documents were produced between 1990 and 2020 and provide a comprehensive coverage of waste policy and help to highlight the key factors shaping change in term of development and implementation of policy. The key political actors on which this analysis is based include Commonwealth, state and local governments, industry groups (including those involved with recycling, retailing, packaging, manufacturing and landfill operators). Institutional factors were also examined, including government agencies, Commonwealth and state policy instruments, and government and industry agreements. Analysis focuses on parliamentary inquiries conducted in 2008 and 2020 related to waste and recycling. Documents include submissions from manufacturing, waste industry representatives, retailing and minister's statements including those from joint ministerial councils with an interest in waste, government and industry technical reports discussing waste policy that focus on current trends in waste management. The analytical framework informed an open coding scheme to help ensure additional emergent themes were identified [27]. The schema was refined using constant comparative thematic analysis. The final interpretation of events and decisions was cross-checked with key documents and reports presented throughout the paper.

This research recognises, importantly, that "policy problems cannot be solved, or policy responses studied in isolation" [28]. Relationships between stakeholders are fundamental to examinations of the potential for cooperation. Kay and Baker [29] show that examination of "relationships connecting states, companies, civil society organizations, and individuals as a policymaking system as well as analysis of their mutual influences" will help clarify details needed for examining the challenges posed by adaptive governance. By bringing together evidence from a range of sources, including policy documents, government reports, non-government reports and submissions, survey analysis and academic research, the paper highlights the need for a reconceptualization regarding the governance of waste management in Australia. The final discussion section will draw conclusions from the analysis for advancing adaptive governance as an option to facilitate cooperation and identify strategic directions for decision makers in Australia to strengthen sustainability aspects of waste management policy. The main findings illustrate key challenges to reforms required to establish new institutional models that support key enablers of adaptive approaches in the context of cooperative arrangements to promote waste management practices that support sustainability.

3. Adaptive Governance

Adaptive governance emerged in the early 2000s drawing inspiration from adaptive management and collaborative ecosystem management [30]. The distinctiveness of adaptive governance is its aim to expand the focus from the "management of ecosystems towards addressing the complexity of 'broader social contexts within which people make decisions and share power" [21]. Figure 1 depicts this broader scope as outlined by Steelman [31]. With an institutional approach adaptive management becomes nested in an adaptive governance system of constitutional rules that determine who can participate in policy making and the governance structures determining interaction. Collective rules affect the policy and management decisions that determine the operational rules [31]. Adaptive governance expands the focus of adaptive management to consider the "broader contextual social and institutional processes influencing environmental management, with a particular emphasis on social learning, collaboration and co-management" [19]. These are critical factors for policy reform in multilevel systems where different levels of government take responsibility for different policy areas and/or for different aspects of shared policy responsibilities.

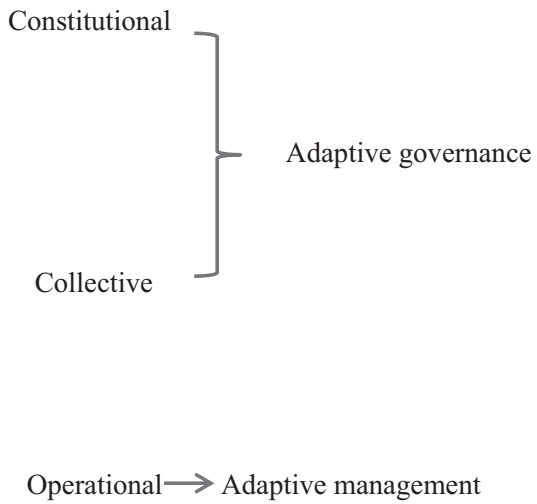

Figure 1. Institutional approach to adaptive management and adaptive governance.

Adaptive strategies assert requirements of "collaboration among heterogeneous actors with diverse interests, institutions that are flexible and nested across scales and levels, and analytic deliberation that develops understanding through multiple knowledge systems; builds trust through repeated interactions; and fosters learning and adaptive and continuous feedback through continuous feedback" [32]. Chaffin et al. [20] recommended identifying the "barriers within existing institutions to adoption and implementation of adaptive governance". They ask whether there are common "targeted interventions or legal reforms that can be pursued to support the emergence of adaptive governance" [20]. Karpouzoglou et al. support the utilisation of different theoretical perspectives to examine important features such as "power and politics, inclusion and equity, short term and long-term change, the relationship between public policy and adaptive governance" [21]. Olsson et al. [18] stress the importance of leadership in preparing systems for transforming governance regimes by navigating the transition and charting a new direction for management. Adaptive governance requires "experimentation and monitoring; with debate about the results at the core of political decision-making, the institutional arrangements and norms would need to promote deliberation and learning; and policy would have provisions for change and flexibility" [33]. Embedding adaptive management would still "need to uphold democratic governance requirements of legitimacy and accountability" [33]. Adaptive governance takes learning as a core value and acknowledges the inability to predefine and control each factor relevant to a policy decision. When learning is a central concept there is more leniency towards improvements and adaptations to changing circumstances [15]. Supportive conditions for learning include knowledge of the "particular skills and learning needed to facilitate action, relationship building based on trust, and access knowledge and communication networks" [23].

The question of how to integrate adaptive approaches into existing institutional governance arrangement has concerned researchers as they challenge traditional bureaucratic governance systems that "frequently epitomise the antithesis of adaptive procedures" [34]. It is important to understand the "dynamics and inter-related drivers in current governing institutional contexts which support or constrain adaptive approaches" [35]. Enabling aspects of adaptive governance include collaboration between stakeholders over different scales, and polycentric decision-making systems, to support policy learning [36]. Policy 'windows of opportunity' are also important as they can be a catalyst to initiate governments to commit to policy change [37,38]. Adaptive responses to these windows include "flexible pathways, shifts in frames of reference, the restructuring of norms, beliefs, values and regulatory frameworks" [24]. Others see leadership as a key enabler supporting and facilitating opportunities for shifting to adaptive approaches [34,39]. Key individuals promote "network development between and across institutions and organisations, encourage knowledge sharing, build trust, and help transform organisations through organisational and social learning" [23,25].

Adaptive governance seems relevant for multilevel systems like Australia as it seeks to integrate an adaptive approach across the political process, institutional arrangements and "policy aspects of governance, with implications for legitimacy and accountability" [33]. Yet, despite its apparent relevance, in the context of previous and existing attempts to cooperate and collaborate over waste management policy, it seems highly unlikely that adaptive governance, notwithstanding its virtues, will be possible as it seemingly demands a level of commitment yet to be demonstrated by the key policy actors. In that regard it does not seem to fit with Australian experience which appears antithetical to adaptive approaches to support cooperation. Yet, there is no comprehensive examination of cooperation between different levels of government for sustainable waste management in the policy literature, so there is no intellectual lucidity on this issue. In order to deepen our understanding of the context of waste management in Australia, as a multilevel system, the next section analyses the attempts by Australian governments to cooperate and collaborate on the implementation of waste management policy for the past three decades.

4. Cooperation in Waste Management in Australia

Similar to other multilevel systems, the management of waste in Australia is "primarily the responsibility of state and territory governments which regulate and manage waste in accordance with their respective legislation, policies and programs" [40]. The Commonwealth is responsible for national legislation, strategies and policy frameworks that reflect obligations under international agreements. Strategies to establish consistency through collaboration have existed since 1992 when the Commonwealth brokered two intergovernmental agreements that responded to problems of inconsistent approaches to waste policy by state and local governments. The first agreement, National Strategy on Ecologically Sustainable Development, was adopted by the Council of Australian Governments (COAG). The key objective aimed to "develop a common approach to waste management programs between various jurisdictions" [41]. In reflecting similar approaches in other countries at the time, a national target of "50 per cent reduction by the year 2000 in waste going to landfill (as well as a number of material-specific recycling targets)" was also adopted as part of the second 1992 agreement on National Waste Minimisation and Recycling Strategy [42].

The first inquiry into cooperation over waste management at the national level was undertaken by the Australian Productivity Commission (PC) in 2006. The Commonwealth acknowledged the potential for resource efficiencies that could be "optimised to improve economic, environmental and social outcomes" [6]. In accordance with the recommendations of the PC (2006), the Commonwealth maintained a non-regulatory hands-off approach, as it regarded waste a matter for the states. It did however see its role as one of supporting "cooperation between jurisdictions to establish environmentally responsible waste management practices, work with industry to bear responsibility for product supply and consumption in the supply chain, develop a nationally consistent and comprehensive data base on waste and re-use of materials that would contribute to evidence-based decision making" [43]. The Commonwealth recognised the benefits experienced by other countries in applying the 3Rs approach (reduce, reuse, recycle) to waste management and was open to promoting market-based approaches on a national scale. The PC examined "opportunities throughout the product life cycle to prevent and/or minimise waste generation by promoting resource recovery and resource efficient [6]. The PC recognised the benefits of cooperative approaches between governments and argued the Commonwealth "should play a leadership role in facilitating (relevant) reforms, and where appropriate, developing sound, nationally consistent waste management policies" [6]. A review of the research literature since the release of the PC report shows a lack of academic engagement with the issue of intergovernmental cooperation on waste issues, and instead a focus on technical and engineering aspects of landfill and the importance of government policy in reducing food waste [44]. Governments did not raise the issue of cooperation again until the Commonwealth initiated establishment of the National Waste Policy in 2009 (NWP), to "set a clear direction ... toward producing less waste for disposal, and managing waste as a resource to deliver economic, environmental and social benefits" [45].

The Commonwealth argued the lack of an effective coordinated approach had resulted in inconsistent "approaches to waste at the state level that created perverse and unintended consequences that only a national approach led by the Commonwealth could resolve" [45]. There was agreement between the Commonwealth and state governments the NWP provided the "basis for strong collaboration among stakeholders to deliver effective approaches to national waste issues" [46].

Following the election of the conservative LNP federal government in 2013 the implementation of the NWP was largely ignored. The views expressed by local governments and industry are that the Commonwealth and state governments have largely failed to fully pursue the aims for more cooperative approaches that support consistent outcomes agreed to in the NWP [7]. The National Waste Report 2016 revealed that "waste volumes continued to increase with Australia generating 64 million tonnes (Mt) of waste in 2014–15, sending 54% to recycling, 4% to energy recovery and 42% to disposal in landfill and incineration" [47]. In 2019, the National Waste and Recycling Industry Council (NWRIC) highlighted the lack of cooperation between the states and the Commonwealth had produced differentials in waste levies that reinforced a preference for landfill and contributed to illegal dumping in the environment [48]. State governments were also accused of distributing less than 10% of the AUD 2.7 billion collected nationally from waste levies to developing recycling infrastructure [49]. As a result of a failure to support a national recycling industry throughout the 2000s Australia became increasingly dependent on exporting recycled materials, particularly paper, cardboard and plastics. Reports revealed that 73% of paper and cardboard collected was being exported to South East Asian countries such as Malaysia and Vietnam, with 29% of this going to China [47]. Plastics were also exported, with 89% exported to these countries, with 36% to China [47]. Government reports and representatives of the recycling industry argued that, due to a lack of public investment, Australia was "vulnerable to volatility in global markets and did not have a diversified and sustainable recycling sector to meet current and future demands for services" [28,50]. As a result of this policy failure the Australian recycling industry in 2020 is smaller than in 2005 [51].

In late 2018 the Commonwealth released a discussion paper with the aim of updating the NWP. State governments were also reviewing their waste policies as a result of the crisis and responded by providing financial support to the recycling industry (QLD AUD 100 m, Victoria AUD 47 m, NSW AUD 337 m), with a "focus on energy and electricity supply either through methane from landfill or steam from incineration" [52]. Such a view fits with the ongoing debate on waste management where the focus is on diversion rather than aversion and prevention [53]. The focus on "waste as an industry implies waste diversion is the preferred option and helps support the objectives of vested interests seeking to expand economic opportunities on recycling, landfill and energy" [28]. At the November 2019 COAG meeting Environment Ministers reached agreements that have been described as 'limp' due to lack of commitment to the 3Rs as evidenced through avoiding waste and reducing waste going to landfill [54]. The Commonwealth announced new National Waste Policy in December 2018 that provides a basis for collaboration among stakeholders to address national waste issues based largely on the original 1992 intergovernmental agreement to "avoid the generation of waste, reduce the amount of waste for disposal, and manage waste as a resource to deliver economic, environmental and social benefits until 2030" [55]. Research released by the Commonwealth shows that in 2017–2018, largely as a result of the import bans in China and Malaysia, only 9.4% of plastic was recycled in Australia, in 2018 governments and industry committed to increasing that rate to 70% by 2025 through the APC using voluntary measures [56]. In order to achieve this target Australia will need to increase its plastic reprocessing by up to 400% [51]. At the time of writing there was no detailed policy action plan outlining how this will be achieved. What is clear from the Australian experience is that new approaches to intergovernmental cooperation must be identified if more sustainable management of waste is to be implemented. In mid 2020 the Commonwealth released the Recycling and Waste Reduction Bill as a proposal for a legislated national industry framework to manage waste and recycling. At the time of writing the bill was in its discussion phase and both government and industry stakeholders were generally supportive of the Commonwealth's intentions to take a leadership role in waste management. There were however calls

for further consultation and cooperation. Submissions from the recycling industry called for 'greater coordination of waste and recycling infrastructure planning across all levels of government' [57]. The Senate Committee reviewing the bill argued there was evidence for ongoing consultation and coordination between stakeholders in the implementation of the proposed legislation particularly for the transition from voluntary to mandatory waste management measures [58]. Only time will tell if the Commonwealth is serious about coordinating with stakeholders by strengthening the intentions of the bill in future legislation.

The following section utilises dimensions of the key enablers for adaptive governance including cooperation and collaboration between levels of government, meaningful consultation with stakeholders as key policy actors, and linking science and decision making through data and monitoring for policy learning [16,24]. The approach is intended to reveal the extent of the challenges for implementing adaptive governance as framework to strengthen cooperation through development and implementation of sustainable approaches to waste management in a multilevel system.

5. Enabling Adaptive Approaches

5.1. Cooperation and Collaboration

Experience in Australia suggests intergovernmental collaboration over waste management will be challenging as it requires considerable commitment from three levels of government—the Commonwealth government, six state and two territory governments and 600 local authorities. Adding to the challenges for multilevel systems is the requirement for "consistency in collaboration and communication across the planning, operational, monitoring, and maintenance stages of governance" [16]. At the institutional level, attempts at vertical collaboration have been undermined by a lack of horizontal coordination between state governments that has resulted in a "complex patchwork of approaches with a variety of policies and legal instruments" [45]. One of the central arguments of adaptive governance is that exclusion of actors from the decision making and governance processes can have negative impacts on communities [30]. This is particularly important in Australia where local governments argue they lack the resources to implement many waste policies imposed by the Commonwealth and state governments. As an example, a group of 10 local governments in the NSW Hunter region have been arguing for the Commonwealth and state governments to cooperate in establishing a consistent waste levy that could help prevent problems they experience such as illegal dumping and the interstate transfer of waste materials [3]. Adaptive governance solutions to such issues include the co-designing of proposed approaches that facilitate mutual benefits for stakeholders thus helping to ensure multi scale support needed for governance implementation [16]. In a clear example of a reluctance to adopt co-design principles COAG proposals to ban the export of plastics in 2020 are being criticised by academics and industry groups as 'over-emphasis on both the waste and resource recovery industry and local government collecting and funding this service' [54,59]. Unfortunately, in conducting its own inquiry, the Commonwealth has failed to demonstrate a willingness to collaborate by not taking account for the work already underway at the state level on solutions to recycling issues [60]. Perhaps more significantly there is also an underlying assumption by the Commonwealth that policy should continue to focus on initiatives that fail to consider 'interventions in the entire supply chain in Australia including packaging design, material selection, recycled content' [59]. Steelman (2016) argues the 'practice of adaptive governance requires a fundamental re-thinking of the basic assumptions underlying how a problem and its alternatives are approached, defined, promoted, implemented and evaluated while including the relevant stakeholders in each phase of the process. The current response to the waste management crisis shows that it has not been taken as a policy window for comprehensive change as Australian governments are committed to uncoordinated incremental changes to existing policies over a more comprehensive policies that reflect the 3R principles.

5.2. Stakeholder Consultation

The waste management policy community in Australia consists of stakeholders from both public and private sectors. The main government actors are state and federal environment ministers working through a joint council, the Meeting of Environment Ministers (MEM). "These Ministers meet as needed to discuss strategic issues and cross-government actions to improve Australia's environment" (including waste) [47]. Most state and territory governments have established Environment Protection Agencies. The regulatory authorities focus on environmental issues, including the management of waste. Local governments have responsibilities for waste collection, landfill disposal and recycling. Food and packaging are the domain of private sector operators such as the Food and Grocery Council, the Packaging Council and the Retail Grocers Association [28]. Organisations such as the National Waste and Recycling Industry Council, the Australian Council of Recycling, the Australian Landfill Association, the Waste Management Association of Australia (WMAA), and the Australian Sustainable Business Group represent the interests of waste processors in public consultation with government. Powerful stakeholders in the retailing, packaging and food industry support self-regulation and voluntary agreements. They worked in conjunction with the conservative Liberal National Party (LNP) and state environment ministers to establish the *Australian Packaging Covenant* (APC) in 1999 as a voluntary agreement to support avoidance, recovery, reuse and recycling of packaging materials. The APC provides a vehicle for industry to control access by other stakeholders to waste management policy. The Commonwealth supports the representation of manufacturing and retail interests in the policy process through the APC. The Australian Packaging Covenant Organisation Ltd [56] manages the APC and focuses on strategies to promote outcomes that "industry is better able than governments to deliver" [50].

Local governments and recycling groups argue the APC has been ineffective in improving recycling. There have been calls for mandatory product stewardship requirements for manufacturers to reduce landfill rates by providing products that can be recycled or breakdown (Senate Inquiry 2018). Current voluntary measures reinforce the end-of-pipe focus that has so far failed to improve product design for better environmental outcomes. Government and non-government stakeholders have been promoting extended producer responsibility measures as a means of improving sustainable approaches to waste management. Academics from different disciplines have supported advocacy efforts with arguments on different aspects of the waste management process. MacKenzie [61] proposes "governments introduce tax incentives to support the expansion of recycling infrastructure and undertake regulatory interventions to penalise producers using non-recyclable packaging and incentivise retailers to sell goods in recyclable packaging". Clarke and McCabe [62] argue for "better utilisation of the resources available through the waste stream, for example methane for energy". Without the introduction of stronger regulatory measures Thornton [63] argues there are few incentives to improve recycling in Australia. So far, there has been resistance by industry groups, against mandatory approaches, as they believe "voluntary agreements have been the norm and their preferred regulatory approach" [64].

Central to adaptive governance is social capital, or base levels of trust, familiarity and goodwill between actors, built up over time. Trust between stakeholders emerges through processes of interaction and negotiation over practical disagreements and appropriate management actions. Literature on both "small-scale and large-scale collective action dilemmas shows that trust is a key aspect for increasing collective action. Actors are more likely to find cooperative solutions to problems if they trust each other" [65]. This is particularly relevant for the implementation of waste policy. Recycling programmes need both the government's initiation and residents' cooperation [66]. In the case of commitment to recycling, citizens as key stakeholders are more willing to make individual sacrifices if they believe that the state will carry out its side of the bargain, for example take care of individual contributions by providing well-functioning infrastructure for recycling. Findings from recent research suggest that "institutional quality is linked to reported recycling behavior, and both institutional trust and generalized trust are also correlated with reported recycling behaviour" [67].

At the state level there have been mixed efforts to support community engagement with waste policy. Perhaps the most ambitious is that of the Victorian state government's seven regional waste management groups across the state, and one metropolitan area covering the state capital, Melbourne, with the objective of engaging the community in the development of waste and recovery priorities [68]. The expectation has been to ensure waste management plans help to achieve the goals of the state infrastructure plan and an integrated statewide system. Local governments recognize that even where legislation requires greater consultation and engagement with communities, some elected councillors and senior staff are still coming to grips with what this means for their roles in decision making [69]. Again, constitutional and institutional factors of a multilevel system are at play here as consultation and public engagement can be a major challenge in local councils that are under-resourced, due to constraints on their revenue raising capacity and limited regulatory responsibilities. As a result, many local governments are unsure about how to manage engagement, and perhaps apprehensive of raising expectations by engaging in dialogue with the public.

5.3. Data Collection and Policy Learning

Stakeholder access to good quality information concerning the nature and scope of policy problems and various potential solutions is a central concern to advocates of adaptive governance [20,70,71]. Arguments supporting evidence-based policy emphasise these observations; "good information and sound analytical capacity are vital for understanding past experiences with programme interventions; for drawing on what works and why; and for analyzing and costing future options" [72]. The availability of "high-quality and detailed waste data is critical to evaluating policies that aim to decrease waste production and promote economy-wide dematerialization" [73]. Like evidence-based policy and performance management literature, Sharma Wallace et al. [16] argue that evidence from adaptive governance cases "supports the value placed on good quality information and reveals the importance of early and ongoing data collection and analysis from a variety of formal and informal sources". Consistent monitoring of both "base problem indicators and social-ecological outcomes was found to be crucial for long-term governance success" [74].

There has been ongoing recognition of the need for standard comparable data on waste to establish a baseline and monitor progress of new initiatives. The original Australian Waste Minimisation Strategy 1992 recognised the "absence of information on the extent, types and sources of waste" [75], and a lack of information on the appropriate waste minimisation and recycling technologies and practices. The introduction of the National Waste Policy in 2009 established an agreement between all governments to "develop comprehensive data on waste and re-use of materials to assess performance and inform policy". Being in a position to develop, assess and reassess data to more appropriately match specific contexts is fundamental for adaptive approaches. "Experimental learning in adaptive governance outcomes, which indicates the potential of small-scale successes to lead to wider governance efforts and support" is also a key aspect of AG [16]. Such policy learning potential is limited in the current Australian context until data management issues can be resolved. Reports produced for the DEE show that "not all states and territories have the quality of data required across the full scope of waste categories, source streams and fates to build a national picture" [47]. In these cases, a best estimate is made, often using data from other states and territories. For example, "the composition of waste to landfill is not known or estimated in several states and territories, so compositional data is applied from states where it is estimated" [50].

Reporting on waste and recycling has been an ongoing problem in Australia. Assessments by the DEE on developing new reporting methods for waste show that accurate reporting on recycling has been aspirational since the 1990s [50]. In reflecting the complexities evident in the multilevel nature of policy making different states have different views on what should be reported, while others, namely Queensland and Tasmania as well as the territories (ACT and NT) are in a position to only make estimates as to the recycling that occurs [50]. In 2018, the Commonwealth commissioned a review of

data collected by state and territory governments. Table 1 summarises the main inconsistencies in data that were regarded as preventing the production of timely and accurate data on waste and recycling.

Table 1. Summary of data inconsistencies across Australian jurisdictions (DEE 2018).

Issue	Details
1. recovery data and definitions	Significant concerns about data and variability in definitions applied in jurisdiction reporting. For example, in WA and NSW significant quantities of waste processed on site for recovery is overlooked.
2. Stream data and definitions	Recording waste from domestic sources is inconsistent Skip bins included in NSW but not SA, VIC and WA Neither ACT or QLD collect recycling data by waste stream
3. Materials and definitions	Soil is excluded from landfill data in most jurisdictions except VIC and WA Arguments that more details provided will increase uncertainty
4. Scope of waste included	Data on reuse through 'tip shops' only included in some jurisdictions. Patchy reporting on litter and illegal dumping Mining waste inconsistent across jurisdictions
5. Stockpiles	Little data available, limited by law in NSW but regulated in VIC.
6. Double counting	Asbestos included in both landfill data and hazardous waste data Hazardous organic waste included in in compost data in some states but not others Results could mean double counting
7. Other issues	Interjurisdictional transfers of non-hazardous waste poorly recorded Possibly missing waste to energy data as some states have co-burning in coal fired power stations.

The updated NWP released in December 2018 following negotiations between the Commonwealth and the states again focused on the importance of accurate and comparable data. Strategy 13 states governments will "Continue to support consumers and manufacturers to make more informed decisions by improving national data and reporting on material flows, wastes and recycling, including economic aspects and reporting indices" [55]. The associated NWP Action Plan sets target 7 that commits governments to "make comprehensive, economy-wide and timely data publicly available to support better consumer, investment and policy decisions" [76]. At the time of writing there is little clarity on what these objectives mean in terms of producing consistent data. The Commonwealth Department of Agriculture, Water and Environment is running an "experimental national waste account" that combines data from existing waste reports and ABS data in an "incremental process to improve our understanding of waste material flow and value" [77]. What is clear is that the information being gathered is of mixed quality and relevance, and largely influenced by an approach to waste that views it as a resource rather than the sustainability principles of the 3Rs approach that focuses on sustainability by reducing and recycling waste.

6. Discussion

The key factors highlighted in this paper for advancing adaptive governance are cooperation and collaboration between key stakeholders; the availability of good quality data relating to common goals and relevant indicators for policy learning. Following the analysis of government implementation of waste management policy, it seems there are number of fundamental challenges to the application of adaptive governance in Australia due largely to the multilevel characteristics of the Australian political system. This section outlines these challenges in the context of past and present intergovernmental institutional arrangements and process.

6.1. Cooperation Challenges

The first challenge is that despite widespread agreement between relevant stakeholders that a cooperative coordinated response to waste policy is required, challenges posed by institutional factors have been a constraint on implementation. Evidence shows there have been key agreements between the federal and state governments to cooperate in developing and implementing waste management systems that deliver sustainable outcomes. Despite national agreements the federal government has largely been unwilling to undertake serious action in cooperation with the states on regulating waste management, with waste volumes, waste levies and recycling rates varying between jurisdictions and accurate measurement of landfill.

Australian experience with recycling and the lack of stakeholder trust on waste management has been strongly influenced by constitutional and institutional factors. A willingness to coordinate and cooperate on the part of stakeholders is a critical foundation for enabling the application of adaptive governance in a multilevel system. There have been consistent calls for the Commonwealth to take a leadership role in facilitating (relevant) reforms, and where appropriate, "developing sound, nationally consistent waste management policies" [6,78]. A series of commissioned reports by the Department of Environment and Energy (DEE) emphasised the need greater cooperation to reduce the discrepancies between the states. Industry groups argue for the need for jurisdictions to cooperate in establishing market conditions to strengthen demand for recycled goods [47,50]. Despite the drafting of joint agreements, the implementation of waste policy has been managed on the basis of political imperatives and a reluctance by the Commonwealth to this leadership role in what has become an area of state responsibility that has been described as in crisis. In the past the Commonwealth has been quick to act in areas of traditional state responsibility to achieve its own ends. State governments however have traditionally been reluctant to cooperate and have resisted Commonwealth interventions when it does not suit their political purposes: waste thus appears to follow the pattern "established in areas of their responsibility including health, education, energy and transport" [79]. In terms of the potential benefits offered by adaptive governance the case evidence shows that without fundamental cooperation and coordination between levels of government and key stakeholders adaptive governance will struggle to survive as a method of policy development and implementation.

6.2. Data Challenges

Despite recognition by governments of the importance of good quality data, the evidence base needed to support any proposed adaptive approaches remains fragmented with significant differences in the depth and quality of information between jurisdictions. Agreement between stakeholders is needed in such matters as a common definition of recycling, agreement on common measurement indicators and performance reporting [50]. State based data has developed using different methodologies and varying definitions. For example, there is no accurate data on exactly how many landfills exist, where they all are, or how large they are [80]. Similarly, there is no accurate data on how many recycling facilities there are in Australia, where they are, and what they are capable of sorting [63]. Across the jurisdictions there are differences in data that includes both scope and waste categories [81]. Currently, New South Wales is the only state to make "reporting of recycling data sets compulsory, other states rely on data volunteered by the waste industry" [81]. The adaptive governance framework presented in this paper reveals that the use of common data sets is integral to all parts of the policy making process and should be part of the strategic direction for improvements in waste management policy. Policy makers are in a better position to set objectives and to monitor progress when they have access to accurate data including measurement indicators to measure progress. Opportunities for policy learning, a critical element for adaptive governance, will be reduced as well as the willingness for experimentation which is needed when looking at possible solutions to a complex policy problem such as waste management.

6.3. Collaboration Challenges

Australian local governments are largely responsible for the implementation of waste and recycling policy by undertaking collection, processing and disposal. Despite their central role, local governments remain on the periphery of the decision-making process between the federal and state governments on policy action. As such they have not been recognised as legitimate partners in the waste management policy process. Institutional arrangements mean Australian local governments are subject to state government discretion. As an example, in 2019 the Queensland Government assessed the re-introduction of a levy on waste disposal. The Queensland Local Government Association was part of an Advisory Group to the state government, which is not a decision-making body but a reference group, to which individual local councils could make submissions. Prior to the consultation process the state government drafted its directions paper outlining the way the levy will operate and the how the results will be measured and reported. Australia's largest local government, Brisbane City Council (BCC) argued it was the "subject of decisions rather than a partner in the process" [82]. As a result of similar top down approaches by other state governments, local councils are forced into situations they have little control over and this contributes to higher levels of distrust and conflict [83]. Yet local governments are critical to sustainable waste practices as they provide recycling and landfill services either directly or in contractual arrangements with the private sector. Existing arrangements in this regard do not appear to be conducive to building trust between state governments and local governments that are fundamental to adaptive governance that requires trust between stakeholders for improving governance arrangements. Without taking key stakeholders, starting with local government, into partnership arrangements the trust needed for collaborative governance and policy learning required by adaptive approaches will provide significant challenges.

7. Conclusions

The Australian example highlights the considerable challenges researchers and policy makers in waste policy face with operationalisation of cooperative approaches in a multilevel system. Schmidt et al. [84] observed that adaptive approaches faced major obstacles such as lack of political will and policy clarity, have proven to be particularly relevant in the Australian context. Based on past experience and current practice there is no clear disposition to adaptive governance as a means of promoting cooperation and collaboration on waste management. This paper establishes that adaptive governance in the development and implementation of sustainable waste policy will require political will at each level of government to commit to a reconceptualization of waste that mixes top down and bottom up approaches that facilitate capacity building and the creation of demand side opportunities to shift to more sustainable approaches and improved waste management policy. Some argue that in order to provide a more integrated approach to waste infrastructure, "governments need to recognise that waste (and its proper management) delivers essential services like electricity or water" [80]. As a promising sign of change Infrastructure Australia advised COAG to identify a waste management strategy "coordinated between all levels of government and the market" as a 'High Priority Initiative' in 2020 [85]. Given the institutional challenges present in multilevel systems there is clearly a need to create a more positive approach to collaborative arrangements. The findings of this research show that important areas of focus need to be a leadership role by the federal government in supporting cooperation between jurisdictions in the implementation of the National Waste Policy. This has been recognised by key stakeholders since the original intergovernmental agreement in 1992. The release of the Recycling and Waste Reduction Bill in 2020 is a first step in this process and we are yet to see if the Commonwealth remains committed to the necessary reforms. Agreement to collaborate between jurisdictions as equal partners in implementing a national approach is also required for improvement is waste management and recycling. Establishing consistent approaches to data and the use of information could be a positive first step in this direction. Further research could also be directed towards identifying alternative governance models such as collaborative governance that may be appropriate to the challenges of the Australian system. By recognizing the essential mission of

waste policy improvements to governance could help steer agencies toward sustainable approaches that absorb bottom up initiatives and make them systemic, thereby contributing to a transformation to a culture of coordination and collaboration as the foundation for adopting adaptive governance based approaches. Without reforms to the current cooperative arrangements the management of waste in Australia will continue to experience the inefficiencies of the past. However, unlike in the past, jurisdictions will no longer be able hide their waste problems by shipping them to South East Asian countries.

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