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Opportunities from Waste Management and Resource Recovery and the Circular Economy for Indigenous Communities and Businesses in Urban and Regional Areas in Western Australia

(Project Report, April 2026)

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(NESP2 SC&W Hub IP5.02.04 Project Report, April 2026)

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SC&W Hub IP5.2.04 Project Report April 2026

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Table of Contents

List of Tables

List of Figures

List of Acronyms

Abbreviated form	Full form
AIATSIS	Australian Institute of Aboriginal and Torres Strait Islander Studies
APCO	The Australian Packaging Covenant Organisation
ATR	Aboriginal Terms of Reference
ATR	Aboriginal Terms of Reference
CAS	Centre for Aboriginal Studies
CE	Circular Economy
CfAT	Centre for Appropriate Technology
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPSIR	Driver-Pressure-State-Impact-Response
DWER	Department of Water and Environmental Regulation
FISH	Foundation for Indigenous Sustainable Health
ICIP	Indigenous Cultural and Intellectual Property
NESP	National Environmental Science Program
NHMRC	National Health and Medical Research Council
SC&W Hub	Sustainable Communities and Waste Hub
SDGs	Sustainable Development Goals
WARRRL	Western Australia Return Recycle Renew Limited

Executive Summary

This summary presents the background, key findings, and proposed implementation pathways of the NESP2 project (IP5.02.04). Full details of the project "***Opportunities from Waste Management and Resource Recovery and the Circular Economy for Indigenous Communities and Businesses in Urban and Regional Areas in Western Australia*** (2022–2025)" are provided in the body of the report. The project aims to identify and support practical, culturally appropriate circular economy (CE) solutions for Indigenous communities and businesses, with a focus on managing waste, recovering resources, and creating economic and employment opportunities. The research follows a protocol informed by Aboriginal Terms of Reference (ATR), supporting culturally sensitive and ethical engagement with participating communities. Relationship- and trust-building have been central to identifying suitable communities and conducting yarning circles to explore local waste challenges and community-driven solutions. The Whadjuk Noongar community in Armadale has been identified as a key partner. The study also conducted five business case studies to understand the circular economy opportunities within the communities and businesses. As a community-led Indigenous project, this study adopts an exploratory approach to present community aspirations and insights drawn from observations during the yarning sessions. The following sections present the key findings and observations:

(I) Yarning circles in the Whadjuk Noongar community in WA

The project aimed to understand the Aboriginal perspectives on waste, foster an inclusive and collaborative approach to addressing waste issues, and explore opportunities for a circular economy.

(a) Key findings of the yarning circles with the Whadjuk Noongar community in Western Australia

- **Traditional perspectives on waste:** Historically, Whadjuk Noongar culture embodied a deep connection to and respect for the land ("Caring for Country"), with practices such as taking only what was needed – no excess -, seasonal relocation – leaving behind only memories -, and resourceful use and repurposing of materials and food scraps. These deeply rooted cultural practices generated minimal, if any, disruption to the natural environment and instead contributed to its regeneration. Thus, Aboriginal perspectives do not recognise "waste" as separate from the ecosystem; all materials are considered part of a continuous, regenerative cycle.

(b) Key issues and challenges of waste in Aboriginal communities

- **Impact of colonisation and modernisation:** Colonisation introduced new regulations that disrupted traditional kinship models, impacting the transmission of Aboriginal teachings and knowledge, including practices of caring for the land. This disruption, combined with modern lifestyles characterised by increased consumption and a growing disconnection from the land, has contributed to significant waste generation.

Participants highlighted the detrimental impacts of land clearing and the broader shift towards prioritising profit over environmental care.

- **Key waste concerns:** The yarning circles identified several key waste-related challenges. These included complex and challenging waste streams (e.g., construction debris, tyres, e-waste, and packaging) and inadequate waste management infrastructure, particularly in rural areas, leading to potential health hazards. Participants also noted a disconnection between existing regulations and Aboriginal knowledge of caring for Country, as well as insufficient community awareness around household waste management (e.g., why certain items are not eligible for kerbside waste collection or how to deliver items to recycling centres). Additionally, current educational approaches do not emphasise caring for Country. Illegal dumping and littering in bushlands were significant concerns, closely linked to the lack of an effective monitoring system.

(c) Key insights based on community yarning sessions

- The transmission of Aboriginal knowledge can take two main forms: **localised (place-based contexts)**, which involves sharing and practising Aboriginal land values and knowledge within the community; and systemic, which integrates these bodies of knowledge into the broader, modern education system.
- To instil **care for the land**, it is essential to understand the land and its significance, and initiatives should also be targeted at schools.
- Transmitting knowledge to Aboriginal kids through a dual-purpose program: caring for the bush (e.g. picking up litter) and learning bushcraft (e.g. around the waterways, catching a fish or a maroon).
- Councils could complement their **education and awareness-raising programs** focusing on the proper disposal of waste products, particularly hard-to-dispose items that are not eligible for collection through the kerbside system, such as tyres, mattresses, e-waste, or white goods. Or even better, their programs could also focus on community education that teaches how to recycle, repurpose or upcycle these items.
- **Explore community-led business models** for managing challenging waste streams, such as mattress disposal, to reduce illegal dumping and generate local employment. Councils could contract these services to Aboriginal initiatives, ensuring economic and environmental benefits remain within the community.
- There should be more **advertising and campaigns** everywhere, highlighting what needs to be done to reduce waste, emphasising both the negative impact of waste and the positive outcomes of proper waste management.
- Participants recommended using **social media** for various purposes, **including raising awareness** about waste issues, educating others, and enhancing **communication** within and between community members.

- Genuine **collaborations and partnerships** are needed between multiple and **multi-level agencies** to create meaningful employment and support new or small businesses within communities.
- **Enable more people- and place-based policies**. Participants called for factoring in Aboriginal knowledge in policies, as it will reconcile them with the natural environment. A suggestion on this matter was to carry out consultancies with (Aboriginal) people who have knowledge of Country.
- Funding could be provided for initiatives such as Bunnings-led training programs to support community vegetable gardening, including free starter kits to reduce cost barriers. **Co-learning with family** was seen as a way to build engagement and skills.
- Partnerships between councils, local organisations, and major supermarkets were recommended to redirect food waste to communities.

(II) Business case studies - circular economy solutions for Indigenous communities and businesses

This section of the report presents findings from five business case studies that exemplify circular economy principles within regional and Indigenous communities and businesses in Australia.

a) Key findings of the business case studies:

The table below provides an overview of the business and its contributions to the circular economy.

Case Study	Overview	Key Circular Economy Contributions
Remote Op Shop Project *(NT & WA)* *(Non-Indigenous Owned)*	Redistributes donated goods to remote Aboriginal communities to improve access to essentials and reduce textile waste.	Diverts textile waste from landfill Builds a local enterprise Enables digital reuse networks
Deadly Denim *(WA)*	Repurposes second-hand denim with Aboriginal artwork; runs workshops in prisons, hospitals, and communities.	Extends textile lifespan Promotes ethical fashion Diverts fashion waste
Taurus Mats *(QLD)* *(Non-Indigenous)*	Upcycles tyres into livestock mats and trains communities in tyre reuse.	Diverts tyres from landfill Provides rural economic opportunities Reduces virgin farming inputs
Containers for Change – FISH *(WA)(NFP, Indigenous Board members)*	Aboriginal-run container refund scheme supporting community reinvestment.	Diverts beverage containers from the landfill Embeds CE practices and awareness in the community culture
Kindling the Spirit – Biochar *(WA)*	Uses wood waste to produce biochar via traditional and scientific knowledge; involves youth training.	Converts biomass waste into a value-added product Sequesters carbon Restores soils and land health (nature regeneration)

Apart from the Remote OpShop, the majority of businesses are small in scale, organically developed, and typically led by a single individual. They face a common set of challenges, including limited funding, logistical and resource constraints, insufficient staffing, underdeveloped or ad hoc supply chains, unregulated dumping, and waste collection issues. Among the five businesses featured in this report, the Remote OpShop stands out as the most established and expansive.

The case study business directly and indirectly serves multiple Aboriginal communities, such as the Whadjuk Noongar Community and Nukenbar Community in Western Australia, the Jilkminggan Community in the Northern Territory, and the Gubbi Gubbi (or Kabi Kabi) Community in Queensland.

b) Key insights based on business case studies

- **Engaging with Aboriginal communities** to identify local, area-specific waste-related issues and priorities is essential for effectively developing and implementing relevant policies and programs at all levels.
- **Community support is vital** for the success of any initiative in Aboriginal communities. A key strength of the businesses highlighted was their **integration of local cultural elements into their repurposing efforts**, ensuring that the initiatives are meaningful and culturally grounded.
- **Partnerships and collaborations are key**. Strong support networks between community businesses often help boost business owners' confidence and resilience.
- **Social media and digital platforms** have been effectively utilised for promotion, engagement, marketing, and item sales, playing a key role in increasing visibility and connecting with broader audiences. Emerging businesses could benefit from adopting similar approaches.
- **Promoting skill-sharing and capacity building empowers communities.** Most business case studies incorporate training, skill development, and vocational or educational activities into their programs. This has **empowered communities** to engage in sustainable practices and develop local circular economy initiatives.
- The **business case studies** can be seen as **local pilots** that help **create and retain value** from otherwise discarded items. These initiatives highlight the **potential** of establishing **regional waste processing hubs**, run by local communities in Western Australia, Northern Territory and Queensland, for the collection, sorting, and processing of various waste streams, thereby strengthening local **repurposing and recycling operations.**
- Developing a **platform to connect Indigenous-led circular economy initiatives** across Australia could facilitate **knowledge sharing**, **mentorship and collaboration.**
- **Introducing targeted funding and grant programs can support the development and scaling of** Aboriginal businesses focused on circular economy initiatives.

(III) Limitations of the study

This study is based on a small number of participants engaged through yarning sessions and field visits and therefore reflects context-specific insights rather than statistically representative findings. Participation was influenced by cultural, social, and logistical factors, meaning the results capture the perspectives of those present rather than the full diversity of Aboriginal communities.

Additional limitations include the focus on Aboriginal communities (excluding Torres Strait Islander groups), challenges in translating Indigenous knowledge into scalable policy and business practices, and reliance on qualitative, self-reported data. As an exploratory, place-based study, the findings provide valuable initial insights but require further validation through broader and longitudinal research to inform wider application.

1 Project Brief

The project “IP5.02.04: Opportunities from Waste Management and Resource Recovery and the Circular Economy for Indigenous Communities and Businesses in Urban and Regional Areas in Western Australia" is a multi-year project. The project aimed to explore Opportunities from Waste Management and Resource Recovery and the Circular Economy for Indigenous Communities and Businesses in Urban and Regional Areas in Western Australia. Thus, the project sets the following key objectives:

- identify suitable Aboriginal communities in Western Australia (WA)
- engage in a process to identify the magnitude and characteristics of the local waste problem, and
- explore potential opportunities for managing waste, recovering resources, and creating economic and employment opportunities.

An appropriate research protocol, informed by the Aboriginal Terms of Reference (ATR), has been followed to involve Aboriginal communities in this study. This study is often time-consuming and requires trust and relationship building, as well as acceptance by the Aboriginal community once the reciprocity of the key benefits of the research and communities has been realised.

1.1 Research Team and Co-Design Approach

This project was co-designed with the Whadjuk Noongar community by the research team comprising Indigenous and non-Indigenous researchers. The research team includes three Indigenous researchers: Frederick Yasso, Director of the Centre for Aboriginal Studies; Beck Barlow, Lecturer and Creative Practitioner; and Jodie Clarke, Yarning Facilitatior, Champion Centre, along with non-Indigenous researchers, Ana Maria (Circular Economy PhD Candidate), Shaouli Shahid (Expert of Indigenous Community Engagement) and Atiq Zaman (Project Lead and Circular Economy Expert).

The project methodology was developed collaboratively with community members and Indigenous researchers, guided by the Aboriginal Terms of Reference (ATR) and grounded in the principles of trust, reciprocity, and relationship-building.

This approach reflects the project's recognition that meaningful engagement with Aboriginal communities is inherently time-consuming and inseparable from establishing genuine reciprocity regarding the benefits of the research. The methodology developed and applied in this project — integrating Indigenous-engaged co-design with waste management and circular economy research — represents a valuable and replicable knowledge product in its own right, and the team intends to publish this work to advance an emerging methodology for Indigenous-engaged research more broadly.

2 Identified Aboriginal Communities in Western Australia

It is crucial to approach the research process in Aboriginal communities with respect, cultural sensitivity, and a commitment to ethical practices. Thus, the researchers in the study approached various Aboriginal groups in WA as part of a trust-building exercise, guided by Indigenous Facilitators from both the Sustainable Communities and Waste Hub and the Resilient Landscape Hub.

In Phase 1, the research focuses on addressing challenging waste issues in Aboriginal communities in Western Australia. The term “Aboriginal” refers to the First Nations peoples of mainland Australia. The term ‘Indigenous’ is used when referring to Indigenous peoples of Australia in general, including the Torres Strait Islander peoples. However, the study doesn’t consider Torres Strait Islander people, also referred to as First Nations people. In Phase 1, the Whadjuk Noongar community was considered. For Phase 2, the businesses operated and provided services to multiple Aboriginal communities in WA and beyond, including the Whadjuk Noongar Community in WA, the Nukenbar Community in WA, the Jilkminggan Community in the Northern Territory, and the Gubbi Gubbi (or Kabi Kabi) Community in Queensland.

Thus, the singular form of community is used to refer to a specific community in the report, whereas the plural form of communities is used to refer to broader multi-community contexts.

As part of the relationship- and trust-building processes with Aboriginal communities, the researchers listened to their perspectives. Clearly, they communicated the research's potential benefits to them. They also sought ways to reciprocate and benefit the community, such as sharing research findings in a culturally appropriate manner, providing feedback on outcomes, and supporting community capacity building.

To identify appropriate Aboriginal communities, the team collaborated with the Champions Centre, a gathering place for Aboriginal peoples and the agencies supporting Aboriginal families and communities. The Champions Centre offers an inclusive, neutral environment that promotes healing for various groups within the local area, facilitates reconciliation, builds bridges for families, shares knowledge, and connects with the Armadale community to foster hope and opportunities.

Armadale Council has an approximate area of 560 km² with a population of 97,705 (The City of Armadale, 2024) and comprises the suburbs of Armadale, Bedfordale, Brookdale, Camillo, Champion Lakes, Forrestdale, Harrisdale, Haynes, Hilbert, Karragullen, Kelmscott, Lesley, Mount Nasura, Mount Richon, Piara Waters, Roleystone, Seville Grove and Wungong.

The Swan-Canning area has been identified as a potential location in Western Australia. The Swan Canning Catchment area covers around 2090km^2, which is part of the Swan Avon

Catchment System (126,000km^2)[1]. The Swan Canning Catchment area in Western Australia is home to several Aboriginal communities. According to the Swan Canning River Protection Strategy 2015-2030, there are at least 10 Aboriginal communities living within the Swan Canning Catchment area. These communities are Whadjuk Noongar, Yued Noongar, Ballardong Noongar, Gnaala Karla Booja, Pindjarup, Wiilman, Wardandi, Bibbulmun, Mineng, and Ballardong.

2.1 Whadjuk Noongar community

Whadjuk is the name of the dialectal group from the Perth area. Whadjuk is situated south of Yued and north of the Pinjarup dialectal groups, as shown in Figure 1 (Noongarculture, n.d.). The Whadjuk Noongar community was identified as a suitable and representative Aboriginal community, based on interest expressed by local Aboriginal communities and its potential to collaborate with the research project. The Whadjuk people are the traditional custodians of the Swan River plains, and their Country is now overlaid by the greater metropolitan area of Perth. The Noongar people have resided in the south-west corner of Western Australia for at least 45,000 years.

Figure 1: Map of the Whadjuk region in Western Australia
(adapted from Noongarculture, n.d.)

The Noongar community comprises several language groups, including the Whadjuk. For countless generations, the Whadjuk Noongar have responsibly managed the coast. Noongar people have traditionally lived in extended family groups and cared for their Country through cultural ceremonies such as song, dance, and the controlled use of fire (Smyth, 2004).

[1] https://www.dbca.wa.gov.au/management/swan-canning-riverpark/swan-river-trust

3 Literature Review: Identified Waste Management Issues in the Aboriginal Communities

3.1 Introduction

Urban, regional, and remote Australian communities, including Aboriginal communities, have been grappling with finding sustainable solutions for waste management and the recovery and reuse of materials and resources (Regional and Remote Australia Working Group (R&RAWG), 2013). This ongoing problem is a result of several challenges, including a lack of infrastructure (such as local landfills and recycling facilities), long distances and poor road conditions to appropriate waste facilities, limited or non-existent waste collection services, a lack of end-markets for recyclables, and high staff turnover (Salim, Jackson, Stewart, & Beal, 2023). Factors such as the increase in tourism activities and technological innovations, which intensify the consumption of electronic equipment, have exacerbated the waste management issue (Salim et al., 2023).

While there are numerous factors at play, and the long-term consequences of environmental and human health impacts on these communities have yet to be fully understood and studied, it can be asserted that unsustainable waste management practices have adverse effects on the environment and human health (Melody et al., 2016; Seemann, 2017; Zaman & Ahsan, 2019). Additionally, ineffective and insufficient waste management, characteristic of linear economies (take-make-dispose), fails to recover resources from waste (Zaman & Ahsan, 2019), resulting in materials and products not being kept in the system for longer periods at their highest value.

Consequently, there is a clear opportunity to introduce circular economy practices, which can help retain product value, promote local job creation, eliminate waste and pollution, and ultimately improve the local environment and human health. There are several frameworks, such as industrial ecology and the 3R approach (Reduce, Reuse, Recycle), that can address waste issues. However, this report will focus on applying circular economy approaches, as they are underpinned by industrial ecology and 3R principles (Bocken et al., 2016; Kirchherr et al., 2017).

The scope of this study was Indigenous Aboriginal communities living in Western Australia, including regional and remote areas of Western Australia (WA). According to the 2021 census, 71.3% of the Australian population lived in capital cities, while the remaining 32.7% resided in (very) remote and (inner and outer) regional areas (Commonwealth of Australia, 2022a). A notable characteristic of remote and outer regional areas is that they are predominantly populated by Australia's Indigenous communities (APCO, 2020b). In WA, just over half of Aboriginal and Torres Strait Islander people lived outside of Greater Perth (52.6%), while non-Indigenous people accounted for only 18.6% (Commonwealth of Australia, 2022b).

The isolated nature of Australian Indigenous communities means that they handle their own waste but lack the capacity to effectively manage it (CfAT, 2021). A 2008 survey of First Nations people in WA revealed that most communities (71.1%) relied on dug trenches or pits for rubbish disposal (Melody et al., 2016). Additionally, 14.5% of communities reported a high or excessive level of waste around the community (Melody et al., 2016).

Aboriginal Australians also experience a much higher burden of disease compared to non-Aboriginal peoples, which may have roots in several determinants, including behavioural and social disadvantages, the lingering effects of colonialism, and disconnection from the land (King et al., 2009; Melody et al., 2016). While all these factors are important to acknowledge, this study primarily focuses on the physical environment and waste management practices.

This report aimed to provide information on identified waste management issues and subsequent circular economy practices and solutions among Indigenous communities in Australia. The findings of this report were gathered through yarning circles with relevant Aboriginal members. In addition, the findings were validated through a dedicated feedback session to understand the community's priorities for addressing the waste problem. Furthermore, possible pathways for next steps and future research, including the best approach to engaging with Indigenous peoples in this research, are outlined.

3.2 Materials and methods

The Driver-Pressure-State-Impact-Response (DPSIR) framework (as shown in Figure 2) is used since it is appropriate for environmental management and policy development (EEA, 2003). The DPSIR framework was developed by the European Environmental Agency in 1999 (Carr et al., 2007). The DPSIR framework identifies the relationships between different components that influence environmental change and the subsequent human responses.

The DPSIR framework consists of the following components (EEA, 2003):

- Driver: The driver represents the underlying forces and activities that contribute to environmental change. These drivers can be social, economic, political, or technological factors that place pressure on the environment. Examples of drivers include population growth, industrialisation, and changes in consumption patterns (Carr et al., 2007).
- Pressure: The pressure component represents the direct impacts or stresses exerted on the environment as a result of the drivers. Pressures can include pollution, habitat destruction, resource extraction, or climate change. These pressures have the potential to alter the state of the environment (Bowen & Riley, 2003).
- State: The state component refers to the current condition or state of the environment. It includes the physical, chemical, and biological characteristics of ecosystems and their components. The state can be measured using various indicators, such as air and water quality, biodiversity levels, and land-use patterns.
- Impact: The impact component represents the consequences or effects of environmental change on human well-being, ecosystems, and natural resources. Impacts can be both positive and negative, occurring at different scales and

timeframes. Examples of impacts include the loss of biodiversity, degradation of ecosystem services, or negative health effects on human populations.

- Response: The response component encompasses the actions and measures taken to address or mitigate the identified environmental impacts. Responses can include policy interventions, regulations, management strategies, or technological innovations. The goal of the response is to reduce pressures, improve the state of the environment, and enhance human well-being.

The DPSIR framework (hereafter DPSIR) has been applied for the evaluation of sustainable development initiatives to better understand barriers and drivers to achieve sustainability (Carr et al., 2007) and was built upon several other frameworks to report on various sustainability-related aspects (Bowen & Riley, 2003), including remote community waste management (Salim et al., 2023). DPSIR is a means of categorising particular environmental challenges to identify appropriate responses and to disseminate information related to the challenges identified (Carr et al., 2007). DPSIR simplifies the cause-and-effect relationship between environmental factors and socio-economic aspects (Salim et al., 2023). This allows for better communication between researchers and relevant stakeholders, such as remote communities, about complex environmental issues, namely waste management (Spanò et al., 2017).

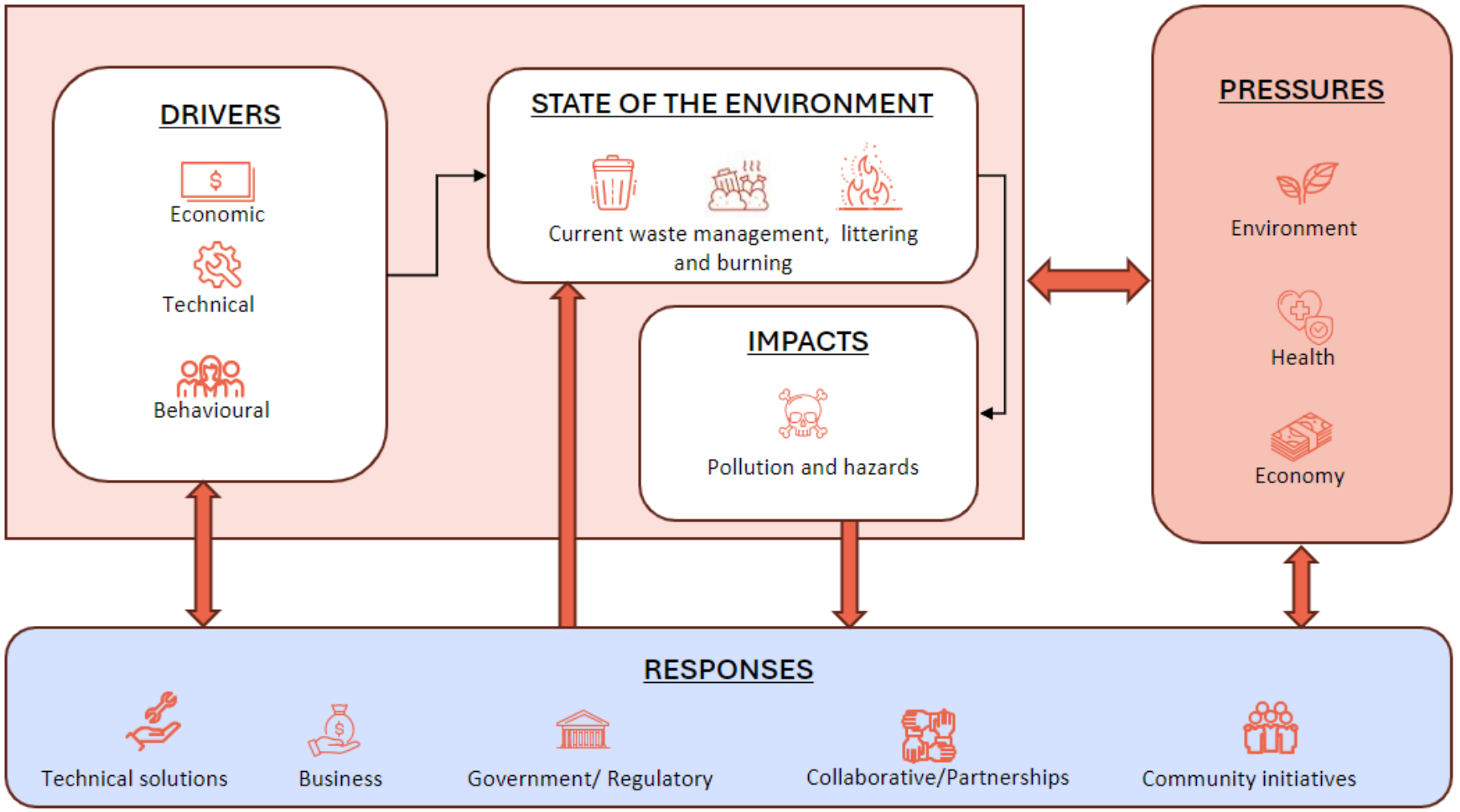

Figure 2. DPSIR Framework: Driver-Pressure-State-Impact-Response in waste-related issues (adapted from Salim et al. 2023 and Carr et al. 2007)

3.2.1. Search string criteria

Academic articles and grey literature (e.g. government and Indigenous institutions reports) were collected from Scopus, Web of Science, and Google Scholar using the following search strings logic "Waste" OR "waste management" AND "Australia" AND "regions" OR "regional" OR "remote" OR "rural" AND "Aboriginal*" OR "Aboriginal communities" "Indigenous" OR "Indigenous communities" OR "remote communities" OR "First Nations" AND "issues" AND "circular" OR "circular economy". Where AND was used as a condition for a specific scope, OR was used for similar terminologies like waste, OR waste management, etc. Additional criteria included only English-language publications and only data on solid waste management.

3.3 Results and discussion based on the literature review

The waste management problems and circular economy solutions identified in the literature review among Australian Aboriginal communities are presented below using the DPSIR framework. While waste management issues are primarily described in the Drivers, State, and Impacts sections, circular economy enablers and practices are outlined in the Pressure and Response sections, respectively.

3.3.1. Drivers of the waste management challenges and solutions

It is evident that different drivers are acting upon waste management challenges and their solutions. Driving forces can be classified into three broad categories: economic, physical or tangible, and non-physical or non-tangible.

3.3.1.1 Economic drivers

Several economic drivers have been identified in unsustainable waste management practices among Australian remote groups. Low to very little access to end markets for recyclables, mainly glass and some plastic products, is a common denominator in outer regional and remote areas (APCO, 2020; R&RAWG, 2013). Waste transportation poses a significant cost barrier (APCO, 2020), which is why waste collection in remote areas is scarce. The cost of waste collection for remote and outer regional areas in Australia is high due to operating on smaller scales, assisting low population densities, with low volumes of waste generation, and having to travel long distances (APCO, 2020). Consequently, waste management in these communities is low-cost, generating poor economies of scale.

3.3.1.2 Physical or tangible drivers

The unique characteristics of remote Aboriginal communities in Western Australia, such as geographic isolation and limited waste transportation options, contribute to significant waste management challenges. These physical drivers have a profound impact on waste generation,

collection, and disposal practices, necessitating tailored approaches to address waste issues effectively (R&RAWG, 2013; Seemann, 2017).

Many Aboriginal communities are situated in remote regions, far from major urban centres and established waste management infrastructure. The vast distances and rugged terrain pose significant logistical challenges for transporting waste to appropriate treatment or disposal facilities. The remote location often restricts access to waste management services, making it difficult and costly to establish reliable waste collection systems.

Limited waste transportation options exacerbate the waste issues faced by remote communities in Western Australia. The lack of efficient, cost-effective transportation infrastructure limits the movement of waste to suitable disposal sites or recycling facilities. In some cases, waste must be transported long distances, which increases costs and logistical complexities. In addition, poor road conditions between the communities and waste facilities also represent a significant driver to the waste management issues in isolated communities (Crawford et al., 2017). Even if there are recycling facilities, they are usually hard to access or accept only a limited array of materials. Often, the closest recycling facilities are very far from the communities and travelling to them is cost-prohibitive (Crawford et al., 2017). As a result, waste is sent to landfills if there is access to one, ends up in dumpsites, or is burned.

3.3.1.3 Non-physical or non-tangible drivers

These drivers include a lack of or limited waste data that allows for a better assessment of waste management practices and opportunities in the community (NACCHO, 2020). For example, there is a lack of data about composting practices in Aboriginal and remote communities (Seemann, 2017). There is also a human resources driver; there are difficulties in recruiting and retaining qualified staff, which hinders the implementation of waste management improvement initiatives, such as data collection and operation of new infrastructure (technical know-how)(Salim et al., 2023; Seemann, 2017). Similarly, transitions into new local administrations may affect stakeholder communication in already established programs if there are no contingency plans in place to anticipate changes in policy, administration, staff and funding (R&RAWG, 2013). Such plans are especially essential given the remote communities' dynamic and changing policy nature (R&RAWG, 2013).

3.3.2. Pressures on finding solutions

In the study, pressures can be seen as circular-economy facilitators because they enable and drive actions to address waste issues in remote communities. Governments in Australia are actively collaborating with Aboriginal and Torres Strait Islander communities in remote areas to overcome the significant disparities that Aboriginal communities face. The efforts to improve outcomes for Aboriginal and Torres Strait Islander peoples in remote Australia encompass various key areas. This involves supporting economic development and creating employment opportunities to improve socio-economic conditions in these communities. Furthermore, there is a focus on investing in critical infrastructure, such as housing and essential amenities, to improve living standards and quality of life. In fact, according to the National Indigenous Infrastructure Guide, Aboriginal and Torres Strait Islander communities require waste management infrastructure at two levels: the household and the community (CfAT, 2021).

These efforts represent pressure factors driving improvements in waste management systems in remote Australia.

Another key pressure indicator is the global imperative on governments to find solutions to combat climate change and respond to the Sustainable Development Goals (SDGs). On this note, there is an increasing call from political figures, non-governmental organisations, and local communities to address the environmental challenges arising from the growing waste issue, particularly in areas facing water supply difficulties (Salim et al., 2023). In Australia, the Regional and Remote Australia Working Group is one of seven working groups established to promote the implementation of the National Waste Policy tailored for remote and regional communities (R&RAWG, 2013).

3.3.3. State of the waste management challenges

There is a notable pattern of illegal dumping and increased landfill waste (including recyclable items such as cans and plastic bottles) amongst remote communities. When landfill facilities are unavailable, and there isn't a waste management infrastructure in place, illegal dumping is the most practised solution to deal with household waste in remote communities (Salim et al., 2023). Some other communities have access to landfill disposal; however, maintaining landfill systems in remote communities has proven challenging (Salim et al., 2023). Remote landfills are less likely to be monitored and maintained. (Seemann, 2017). Studies have shown that in the case of WA, landfills in remote areas are poorly located due to being upwind of the community, having poor soil foundations, and lacking satisfactory containment (Seemann, 2017). The Western Australian Environmental Health Needs Survey 2008 revealed that about 65% of Indigenous communities studied had dumpsites that lacked appropriate fencing (Seemann, 2017).

When rubbish tips are full or non-existent, Indigenous communities opt for burying their waste or burning it (HealthInfoNet, n.d.). Waste burning is a common practice amongst remote Indigenous communities. The 1999 Community Housing and Infrastructure Needs Survey (CHINS) found that waste was incinerated as a primary disposal method in almost 10% of the Australian Aboriginal communities studied. This is especially the case where there are inadequate or irregular waste collection services (Seemann, 2017) (A driver mentioned above). There is also small-scale incineration occurring in some Australian Indigenous communities, where 200-litre drums are used as combustion units (Seemann, 2017). Although many governing bodies are starting to ban this practice due to health and safety reasons (CfAT, 2021).

3.3.4. Impacts of waste management practices

The impacts of unsustainable waste management practices include environmental and human health impacts. Environmental impacts included groundwater and soil contamination, and air pollution. Uncontrolled landfill management and illegal dumping result in land pollution (Salim et al., 2023). Air pollution is predominantly caused by open burning, which is a common practice in remote communities. Although the literature places less emphasis on habitat loss, it should be noted that land-based ecological damage can also contribute to the loss of land

biodiversity (Salim et al., 2023). In addition, groundwater and marine pollution arise from litter and leachate run-off.

In terms of human health, many hazards are associated with unsustainable solid waste management practices. Exposure to these hazards may cause health issues. Hazards can be biological, chemical, physical or indirect (Seemann, 2017). Biological hazards involve human pathogens that can be easily found in solid waste (e.g., bacteria and viruses). Chemical hazards include chemicals in waste streams which can be hazardous (e.g. heavy metals and volatile organic compounds). Physical hazards include sharp objects and particulate matter materials that can be harmful (e.g. clinical waste and construction and demolition waste). Indirect hazards come from pests and disease vectors which thrive in solid waste, including mosquitoes.

3.3.5. Responses against the identified waste management issues

The Australian National Waste Policy Action Plan 2019 prioritises improving access to waste collection and recycling services for people living in regional and remote areas (APCO, 2020a). This has been a significant factor driving change in waste management practices in regional and remote communities, and the process is ongoing. However, it is important to note that the National Waste Policy Action Plan lacks specific attention to waste management in Aboriginal communities. Therefore, there is a need to prioritise waste management strategies and action plans that specifically cater to Aboriginal communities in remote Australia.

According to the Centre for Appropriate Technology (CfAT), an Australian Indigenous organisation based in Alice Springs, Northern Territory, there is a nationwide trend towards reducing solid waste disposal, which involves constructing large regional landfills rather than small, remote, and often uncontrolled landfill sites. This initiative aims to increase resource recovery by implementing larger, well-designed engineering operations that incorporate better environmental controls (CfAT, 2021). Additionally, several smaller rural locations are beginning to develop transfer stations. Transfer stations play a crucial role as they provide a centralised location for bringing together different types of recyclables and waste materials, enabling better collection, sorting, and management of waste (CfAT, 2021).

In regional and remote Australia, mechanical recycling technologies are employed to treat packaging waste, including cardboard, glass, and various types of polymer plastics (APCO, 2020). Simple technology composting systems are also found in some remote communities, often associated with small-scale food production (APCO, 2020a).

However, the case studies analysed indicate that while there have been several initiatives to improve waste collection, sorting, and the initial stages of waste processing (such as baling and crushing), there are fewer programs in place for source separation, advanced processing (such as flaking), and developing end-markets (APCO, 2020b).

Figure 3 provides an overview of the driving forces, the current state of the environment, and the impacts of waste management issues in remote communities in Australia. The figure also illustrates the pressure factors and responses to waste problems identified from the literature review.

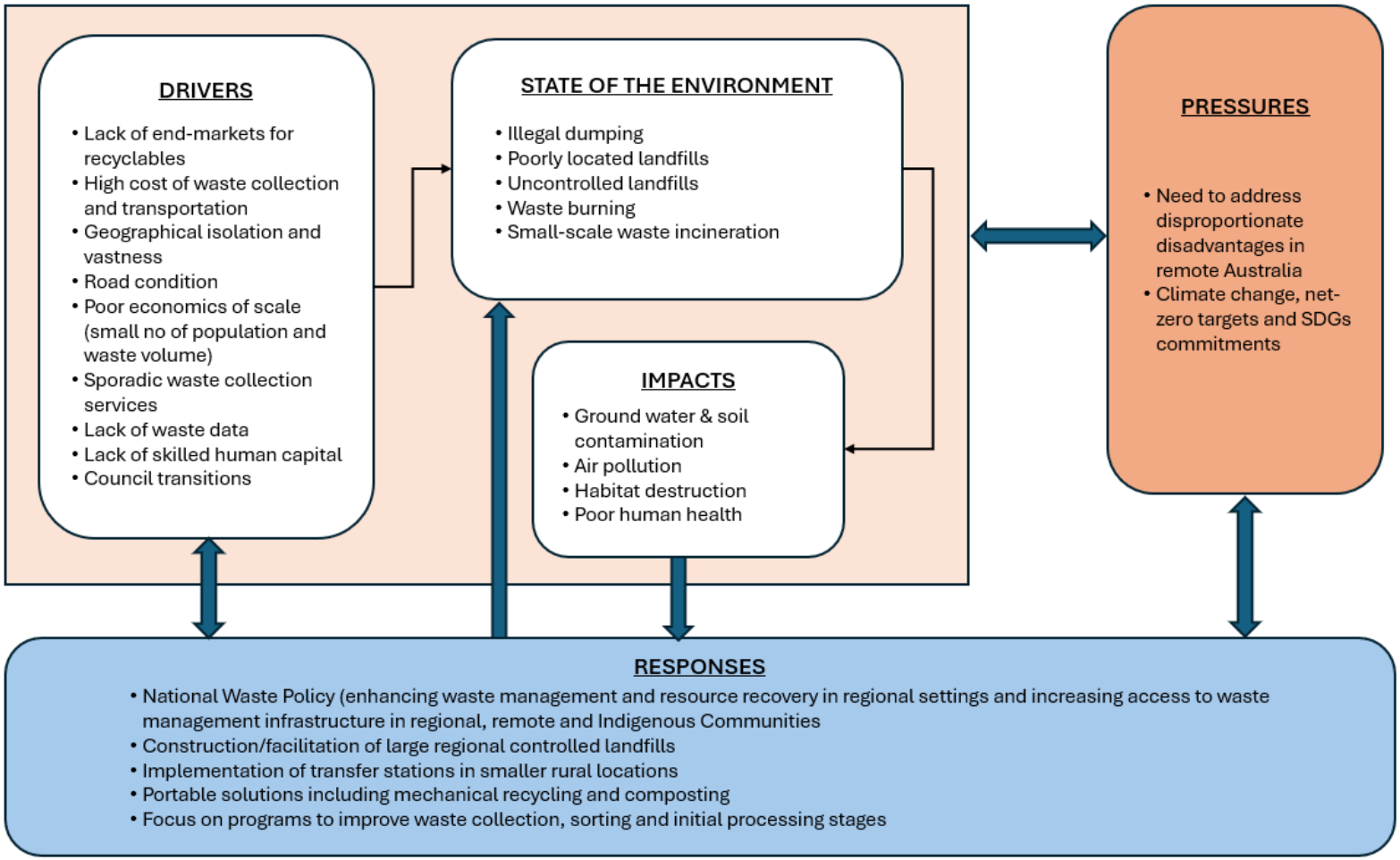

Figure 3. DPSIR findings for the waste issues in remote communities (adapted from Salim et al., 2023 and Carr et al., 2007).

Waste management issues in Indigenous communities in regional and remote Australia present significant challenges. Using the DPSIR Framework, this report categorises these problems and identifies circular economy solutions. Drivers include economic, physical, and non-physical factors, such as limited infrastructure and long distances to waste facilities. Pressures stem from efforts to address disparities and meet climate goals. Environmental states in these communities are characterised by illegal dumping and waste burning, leading to pollution and health hazards. Implementing circular economy practices can improve these conditions by creating local jobs and retaining product value.

Despite some progress, comprehensive programs for source separation and end-market development still need to be designed and implemented. Effective solutions require local-scale DPSIR assessments and community-specific approaches. Future steps include the Aboriginal community consultations through yarning circles to discuss waste management issues and circular economy solutions.

4 The Aboriginal Terms of Reference and Ethical Consideration

4.1 The Aboriginal Terms of Reference in the context of the waste management project

As Indigenous community practitioners and allies, we are dedicated to Indigenous peoples taking control over their own lives, enhancing well-being, and fostering positive social change. We strive to ensure that Indigenous voices are at the forefront of all activities and are incorporated into every decision related to the project. Our approach is guided by community members, respecting their pace and preferences. We seek to understand and honour Indigenous ways of being, knowing, and doing, while recognising the diversity among Indigenous peoples and acknowledging that we cannot represent an Indigenous viewpoint on our own.

The following Core Values and Principles form the foundation of the Aboriginal Terms of Reference (ATR) concept and have guided us throughout this research:

Core Values

- The worth and validity of contemporary Indigenous culture(s)
- The right of expression of Indigenous realities
- Self-determination and self-management
- The right of Indigenous groups to work and make decisions within their own cultural terms
- Indigenous control
- Positive social change
- Social justice
- The recognition and acceptance of Indigenous diversity
- Reconciliation of competing interests between Indigenous people
- The worth of the group

Principles

The ATR concept includes a conscious commitment to:

1. Acknowledging that the authority for the construction of Indigenous meanings and knowledge rests with Indigenous peoples.
2. Acknowledging that Indigenous peoples have the right to have those things that are valued to be fully considered in any interactions.
3. Ensuring that Indigenous worldviews are considered in all negotiations or dealings that impact Indigenous peoples.
4. Recognising the diverse experiences, understandings and ways of life (in Indigenous societies) that reflect contemporary Indigenous culture in the application of ATR

5. Ensuring that the views and perceptions of the critical reference group are reflected in any process of validating and evaluating the extent to which ATR have been taken into account.
6. Negotiating within and between Indigenous group(s) to establish appropriate processes to consider and determine the criteria for meeting cultural imperatives, social needs and priorities.
7. Addressing issues in a specific and defined context, thus acknowledging that the appropriateness of the outcomes achieved is issue-specific and context-bound

4.1.1 How will we get an Indigenous viewpoint on a particular issue?

When involving Indigenous peoples in this project, we aimed to do so in locally appropriate ways and with consideration of local customs. We also aimed to reinforce the importance of starting where the community is at, ensuring the community remains central to the process. To consciously work towards incorporating an Indigenous viewpoint, we were guided by the ATR framework developed by Oxenham (1999), which comprises four dimensions. These dimensions were considered effective for framing an issue, allowing for a thorough analysis and understanding that incorporates the relevant community's or group's perspective.

The idea is to identify and place the issue or problem at the centre of the framework, then use each dimension to gather information and analyse it. The following are the definitions of each of the dimensions in the context of this waste management project:

- **Cultural elements**

This dimension encompasses the group's and practitioners' attention to cultural matters that may influence the issue. It helps to consider the impact of the local Indigenous culture on this issue, and vice versa. It is a way of scanning all the cultural aspects of the issue under discussion.

- **Experiences**

This dimension demands that the group and the practitioner consider and identify the community's experiences around waste-related issues, both past and present. It attempts to build a picture of how the present has been shaped by several factors that were beyond the control of the communities.

- **Understanding**

This dimension focuses on the community's current understanding of the issue and possible future ways to address it. What opinions does the community have on the issue?

What knowledge do they have on the issue? What internal and external factors need to be considered, and so on?

- **Aspirations**

This dimension shows what the group wants to achieve; it asks the group to state upfront what they want to see as the outcomes or the goals concerning the issue being discussed or analysed. It allows the community and critical reference group members to clearly identify their visions of "what they want" for the issue in the future.

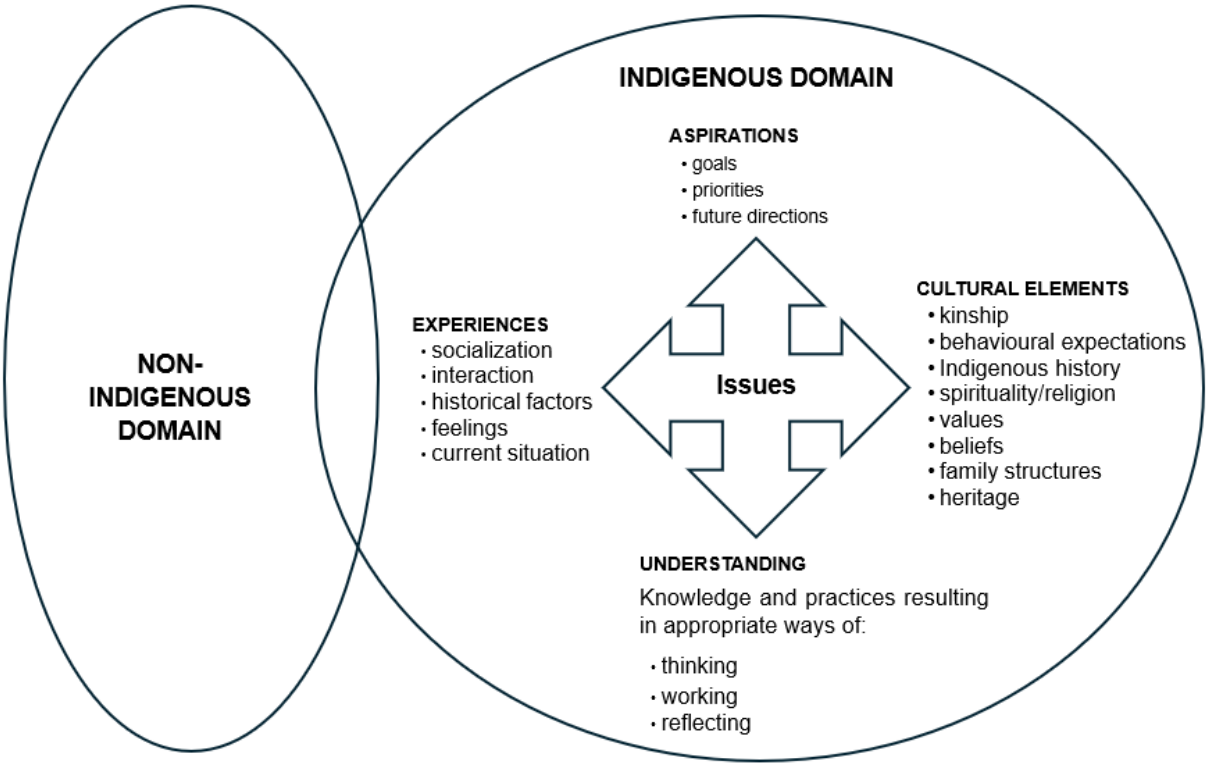

Figure 4: Aboriginal Terms of Reference (ATR) Framework

4.2 Ethical considerations

After securing the ethics approval from the Curtin University Human Research Ethics Committee (HREC), the data were collected through yarning circles. With permission, the yarning sessions were audio-recorded and transcribed to ensure the data could be interpreted and analysed accurately. In transcribing the data, people were de-identified so that the paper document could not reveal anyone's identity. The audio recordings were stored in a password-protected computer and are only available to project investigators. The data and transcripts are securely stored, along with other data, as required by law.

The following six Aboriginal and Torres Strait Islander values are considered relevant to research ethics and are recommended to be taken into account when conducting research involving Aboriginal and Torres Strait Islander peoples to protect their welfare and rights. The researcher went through the "Guidelines for Ethical Conduct in Aboriginal and Torres Strait Islander Health Research" published in 2018 by the National Health and Medical Research Council (NHMRC) and demonstrated their commitment to these values in the following ways (NHMRC, 2018):

> **Spirit and integrity** refer to showing respect for the richness and diversity of Aboriginal and Torres Strait Islander peoples' cultural inheritance across past, present, and future generations, and for the links that bind generations together, which require researchers' behavioural and perceived integrity. The research recruited Noongar community members from different areas who reside in Noongar *Boodja* (Noongar Country). The research team brought a range of skills and experience to the conduct of the proposed research. All Chief Investigators that played major roles in this research project and were aware of the cultural

sensitivities, ethical implications, and the need for personal integrity when undertaking research of this type. Aboriginal and Torres Strait Islander investigators were always looking after and monitoring adherence to the ATR principles.

Cultural continuity contributes to a sense of strong, shared, and enduring individual and collective identities and includes maintaining bonds and relationships among people and between people and their environment. This research project sought to explore and understand the community's perspectives on the waste products the Whadjuk Noongar community is dealing with and their impact. Aboriginal engagement and respect for Aboriginal views and experiences are at the centre of this project, which aimed to generate meaningful and effective strategies for communities to address these issues.

Equity affirms Aboriginal and Torres Strait Islander peoples' right to be different and thus entails respecting these differences while performing research. This principle was demonstrated by valuing and specifically exploring Aboriginal perspectives, knowledge and preferences to inform the research outcomes. It is also reflected in the willingness to increase active Aboriginal involvement and support associated with the research. The aim of the research was to explore Aboriginal perspectives and involve Aboriginal co-researchers to ensure that findings are reported in a way that respects Aboriginal values and does not inadvertently contribute to discrimination or derision of Aboriginal Australians.

Reciprocity entails including and recognising participants' contributions and, in return, delivering research outcomes that benefit the communities or individuals. The benefit should be valued by Aboriginal individuals and communities. This principle was demonstrated in the following way:

- links clearly to national and international Indigenous issues related to waste and waste management.
- the willingness of researchers to modify the proposal and research design to reflect feedback during information gathering and data analysis.
- adopt a flexible research design for any type of changes required to accommodate during the whole research process; and
- the engagement of service providers and organisations to ensure that the acquired knowledge is applied in practice.

Respect for individual and collective culture, and acknowledgement of the right of Indigenous Australians to hold different values, norms and aspirations, are critical to the research process. This is also fundamental to having a sustainable research relationship between participants and researchers. Exploration of Aboriginal perspectives and experiences, understandings and cultural preferences that may influence the Aboriginal programs targeting young Aboriginal peoples was central to the research. The Aboriginal co-investigators, ongoing consultation and feedback with community organisations, such as the Champion Centre, and with Aboriginal participants and stakeholders of this research project guided the establishment of respectful research relationships between participants and researchers.

Responsibility was demonstrated in the proposed research through a clear intent to do no harm and to minimise any foreseeable risks, and through accountability to Aboriginal stakeholders. The research process included adequate, transparent consultation; opportunities for feedback during the development and conduct of the research; and the timely distribution of research findings in an accurate, appropriate, and understandable way.

These strategies allow for ongoing advice and review and minimise the likelihood of unintended consequences arising from the research process.

4.2.1. AIATSIS Code of Ethics for Aboriginal and Torres Strait Islander research

As part of the NESP2 program's requirement, the project considered the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Code of Ethics while collaborating with the Aboriginal community in Western Australia. The AIATSIS Code respects Aboriginal and Torres Strait Islander values and worldviews, acknowledging the wisdom and diversity of Indigenous knowledge systems (AIATSIS, 2020).

The AIATSIS research ethics framework is structured around four principles:

1. Indigenous self-determination
2. Indigenous leadership
3. Impact and value
4. Sustainability and accountability.

Principle 1: Indigenous self-determination is fundamental to all research conducted in Australia, according to the AIATSIS Code of Ethics. It emphasises the recognition and respect for Aboriginal and Torres Strait Islander peoples' right to make decisions that affect Aboriginal peoples' lives, cultures, and lands. The project actively involved Aboriginal communities through a co-design process, allowing the communities to determine the direction, priorities, and outcomes of waste management initiatives within their own communities. Meaningful engagement, consultation, and collaboration empowered these communities to lead in shaping sustainable waste management practices aligned with their unique cultural, environmental, and socio-economic needs, fostering genuine partnerships and enhancing the overall effectiveness and sustainability of waste management efforts. Aboriginal co-investigators were leading the consultations and the co-design process.

Principle 2: Indigenous leadership is another crucial aspect highlighted by the AIATSIS Code of Ethics. It stresses the significance of recognising and supporting Indigenous leadership throughout the project's development and implementation. By involving Indigenous leaders, knowledge holders, and community representatives in the co-design process, the project ensured that their expertise and cultural insights guided decision-making. Drawing on traditional knowledge and practices, Aboriginal leaders and Elders in the project were playing a pivotal role in effectively addressing waste-related challenges. The project explored opportunities for mutual learning for Indigenous and non-Indigenous researchers, leaders (such as Elders), and community representatives to uphold and foster Indigenous leadership and enhance their skills and capacity while addressing community waste issues. Aboriginal co-investigators were leading the whole consultation process.

Principle 3: Impact and value are essential considerations in Aboriginal and Torres Strait Islander research. The project recognised and respected the potential impacts of waste management initiatives on Aboriginal communities and their cultural heritage. It placed great value on ensuring that waste management practices align with community values and aspirations and are sustainable and socially responsible. Engaging with community members, Elders, and knowledge holders, the project assesses the potential benefits and risks of waste management interventions to achieve positive and meaningful outcomes for Aboriginal communities. By considering the long-term value and impacts of their actions, the project aimed to foster mutual respect, understanding, and enduring relationships built on trust and reciprocity. The project informed the design of a contextually relevant

and sustainable circular economy opportunities by ensuring community engagement and participation. Community participation will ensure practical solutions to overcome challenges and maximise the benefits of circular practices. The observed findings are more contextually appropriate and better aligned with the community's aspirations and values. The study findings helped understand the potential employment opportunities in the communities (including the Wadjuk Noongar community and other Aboriginal communities served by the business case studies).

Principle 4: Sustainability and accountability are paramount in the project's approach to waste management initiatives. It strongly emphasises environmentally sustainable and culturally appropriate practices, taking into account their long-term impacts on Aboriginal communities and their lands. Incorporating traditional ecological knowledge and practices, the project aimed to foster waste management solutions that harmonise with the natural environment and respect the interconnectedness of all living beings. Moreover, the project remained accountable to the communities it serves, continuously sought their input, feedback, and consent throughout the project's lifecycle. This commitment to sustainability and accountability aimed to establish a lasting legacy of responsible waste management practices that empower and benefit Aboriginal communities for generations to come.

As shown in Figure 5, each principle entails responsibilities across various aspects of research collaboration, data collection, and research integrity.

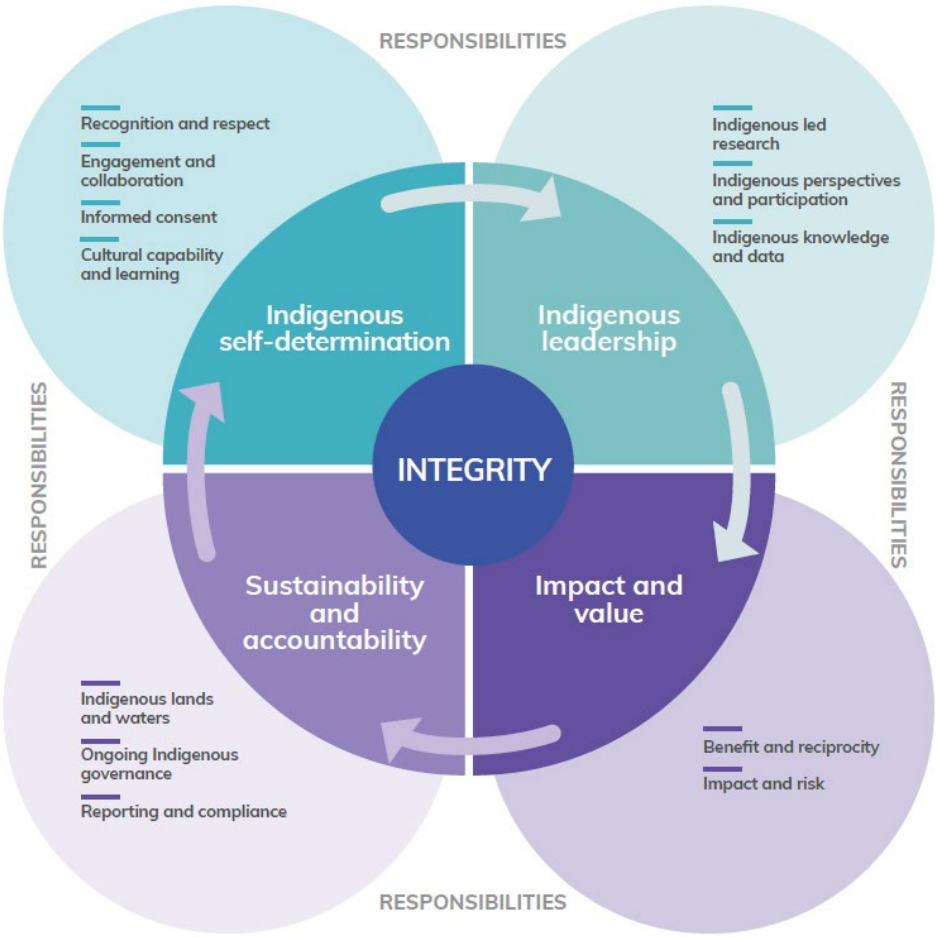

Figure 5. Responsibilities attached to the consideration of the AIATSIS Code of Ethics (AIATSIS, 2020)

4.2.2. Ethics protocol and potential ICIP risks

The research was conducted in accordance with the appropriate research ethics protocol. The research team secured ethics approval to conduct yarning sessions with the Aboriginal community, representatives, and businesses. The ethics approval number is HRE2023-0517.

To ensure and protect the privacy of the participants, the project objectives, the yearning circle process, and the nature of the data to be collected during the yearning circle were discussed and explained to the participants, and written consent was obtained. In addition, permission was sought to take photographs during the yarning sessions and field visits and to use those images for promotional materials.

There are potential risks to sharing Aboriginal knowledge and intellectual property during the yarning sessions; thus, the research team ensured the reports were validated, addressed any Indigenous Cultural and Intellectual Property (ICIP) concerns, and used images (identified in the images) and data during the post-data-collection phase. The draft reports (Phase 1 and Phase 2) were sent to participants for review, validation, and modification where needed. Based on the feedback and suggestions, the final report was revised and improved. Therefore, this report (Phase 1 and Phase 2) poses no ICIP or business risks, nor does it affect their livelihoods.

5 Yarning Circles Activities within the Whadjuk Noongar Community in WA

The project conducted yarning circles as part of the community consultation process to understand Aboriginal perspectives on waste and to adopt an inclusive, collaborative approach to addressing waste issues and fostering a circular economy. Phase 1 of the yarning circle activities aimed to foster inclusivity and collaboration by drawing from the rich perspectives and knowledge of the Aboriginal community members.

5.1 Phase 1: Yarning circles on waste challenges encountered by the Whadjuk Noongar community

The yarning circles with the Whadjuk Noongar Community in Armadale, WA, were designed to cover the following three aspects:

- Explore waste problems and impacts
- Identify solutions and opportunities
- Feedback and validation session

Explore waste problems and impacts: By engaging participants in discussions, the yarning circles provided a platform for understanding the diverse waste problems that individuals and community members face. This exploration included a deeper examination of the impacts of waste on the community, including its effects on waterways, landscapes, and the broader environment. By acknowledging and understanding these issues, the community can collectively address them.

Identify solutions and opportunities: The yarning circles provided participants with an opportunity to share their unique insights and experiences on potential solutions to waste issues. Both individual—and community-level opportunities for addressing waste problems and implementing sustainable practices were discussed. It was envisaged that this process would empower the community to contribute their perspectives and actively participate in finding practical solutions.

Feedback and validation of the preliminary findings: The yarning circles served as a forum to gather valuable feedback from the community on the synthesised report summarising the community consultation findings. This feedback ensures that the report accurately reflects the perspectives shared during the yarning circles and integrates any additional insights from the community. It enhances the authenticity and credibility of the final report.

Table 1. The completed Phase 1 yarning circles activities (2023-2024)

Aspects	Yarning objectives	Expected outcomes	No of participants
Explore Waste Problems and Impacts	Understanding the notion of waste through the Aboriginal perspectives	Perspectives on waste and materials in the Aboriginal community.	6 participants, including Elders, community representatives
	Waste problems and impacts on individuals, community and surroundings (waterways, landscape, etc.)	Key waste management challenges	6 participants, including Elders, community representatives
Identify Solutions and Opportunities	Possible solutions and opportunities (individual and community level)	Possible solutions suggested by the Aboriginal community members	3 participants, including Elders, community representatives[2]
	Possible solutions and opportunities at various levels (community, government)	Solutions discussion (various levels – community, government)	5 participants, including Elders, community representatives
Feedback and validation session	Seeking feedback on the preliminary findings	Validation of the preliminary findings	6 participants, including Elders, community representatives

A series of 5 yarning sessions was conducted to address various aspects of the issues at hand. The Aboriginal investigators in the project mainly facilitated the sessions. The initial sessions (1 and 2) focused on delving into the intricate complexities of waste problems, while sessions 3 and 4 were dedicated to brainstorming and identifying potential solutions. The final session was reserved for gathering feedback and validating the insights gained throughout the process.

[2]*Participation in this session was reduced due to the timing of the national referendum period.*

Figure 6. Illegal burning of hazardous waste (picture taken during the field visit)

These yarning sessions unearthed a multitude of pressing challenges related to littering and illegal dumping in the bushlands. Consequently, two additional site visits were organised to gain a more comprehensive understanding. These visits enabled firsthand exploration and immersion in the waste-related issues plaguing the bushlands, supplementing the insights gained from the yarning sessions.

Figure 7. Illegal dumping was identified during the field visit

5.2 Phase 1: Yarning circles on waste challenges encountered by the Whadjuk Noongar Youth Group

The Elders' group recommended organising yarning circles with young Aboriginal community members to discuss waste-related issues and gather their perspectives on how to understand and approach waste problems. As part of the community-led co-design approach to prioritising community feedback and translating it into actions, two yarning circles were held to explore how young people perceive waste challenges in their communities and identify potential solutions and opportunities they envision.

5.3 Phase 2: Case study with businesses

As part of the second phase of the project, "yarning" sessions were conducted with the owner and selected staff members of small businesses in Aboriginal and rural/remote communities (in Western Australia, Northern Territory and Queensland) to share their experiences in setting up their businesses, as well as their thoughts, challenges, needs, and lessons learned. We further discussed the opportunities to create a circular economy that emphasises restorative, regenerative practices and eliminates waste. The goal was for others to benefit from these insights and apply similar practices in their own communities. An effort was made to represent a range of rural, remote, and urban areas in the study; however, because few community-level businesses focus on recycling and repurposing waste, purposive sampling was used to select participants. A few of the businesses were owned by non-Aboriginal individuals, but they have been actively working within various rural Aboriginal communities.

6 Findings from the Yarning Circles with the Aboriginal Community in WA

6.1 The notion of waste in the Aboriginal community

In modern times, we consume more than we need, resulting in waste as a by-product of our lifestyle. The enduring existence of Aboriginal history and culture over thousands of years is due to the Aboriginal peoples' careful stewardship of nature, land, and the environment. When participants were asked to recall how waste was perceived and managed before the modern era, they affirmed that **in the past, Aboriginal practices were always focused on caring for Country, with minimal to no impact on the environment**.

Aboriginal culture is based on caring for the country in that human's care for the country as a part of the Country and not separated from it (Suchet-Pearson et al., 2013). This reciprocal relationship or kinship between people and the land meant that **people would take from nature what they needed**; it was a day-by-day living. One of the Elders explained, *"So the care for the land was always on top and taking what you needed, and never really taking more than what you needed"* (Elder Participant, Yarning Session 1, 2023). This ethos underscores a deep-rooted respect for the land, recognising it as a provider of essential resources to be cherished and preserved for future generations. It embodies a way of life that is mindful, conscientious, and in harmonious coexistence with the natural world—a timeless wisdom that transcends generations and serves as a guiding principle for responsible stewardship of our planet.

When participants were asked about any cultural or ancestral teachings or stories, one of them said, *"Yes, we did. We were told to take what you need, only always leave some for the next person. Leave only your footprints"*. Participants mentioned Aboriginal peoples used to consume seasonal, locally available food: *"But God as kids, that's all we ate… We were never given lunch. We just went and found a tree, an apple tree or an orange tree and a local tree"* (Participant, Yarning Session 1, 2023).

The profound connection between Aboriginal people and the land is epitomised in seasonal relocations, a practice deeply rooted in respect for nature and sustainability. Aboriginal peoples moved with the seasons, transitioning from one place to another with a profound understanding of their role as custodians of the land. Leaving behind only memories, community members embraced a lifestyle of minimal impact, ensuring that human presence did not disrupt the delicate balance of ecosystems. In doing so, Aboriginal peoples preserved the integrity of the environment and fostered regrowth and renewal, allowing nature to flourish in their wake. This timeless practice of harmonious coexistence exemplifies a profound reverence for the interconnectedness of all living beings and serves as a poignant reminder of the wisdom inherent in Indigenous cultures, locally and globally.

In early times, resourcefulness was the core practice. Several participants mentioned that reusing was part of the daily lives of Aboriginal peoples back in the day. Family and community members

would reuse food or any other items. For example, seasonal veggies and fruits or regrowing food scraps in the garden. One of the participants indicated, ***"Every element of our food…. I remember every element of our food was reused"***. The participant also reflected on how they used to repurpose many other things, for example, *recycling clothing and making toys out of things; the milkman, the only time you recycled stuff cause he came and collected the bottles and they reused them; the old ... kin cans. ...We used to make lights out of them.*

Oral tradition is a key educational component amongst the Aboriginal community. **Ancestral Aboriginal teaching was transmitted through stories**: *"Those sorts of things (bushcraft, animal knowledge) are built into old stories"... "So there's there was always things that were passed down from mother to daughter, from mother to son, from father to daughter, from father to son, about how you live your life, how you walk in your life. All of those types of things*" (Elder Participant, Yarning Session 1, 2023)

Knowledge is also hidden in language. One essential approach to accessing knowledge within the Aboriginal community is how Aboriginal peoples perceive knowledge in general. In **Aboriginal cultures knowledge is not power; it is responsibility and its use determines if the person can access more knowledge from the Elders**: *"It's what you do with the knowledge and how you use it and how you put it into practice will determine whether you get more knowledge, so Elders will go… they'll teach you so much"* (Aboriginal Elder, Yarning Session 1, 2023). This relational value and this relational ontology of the Country have been highlighted by Russell et al. (2020) In the Ngukurr community in the Southeast Arnhem Land.

6.2 Identified waste issues and challenges

After analysing transcripts of each yarning session through thematic analysis, the study broadly identified the following issues and challenges of waste in the Aboriginal community:

- Impact of colonisation
- Modern lifestyle
- Challenging waste stream
- Lack of infrastructure and monitoring
- Lack of awareness and education

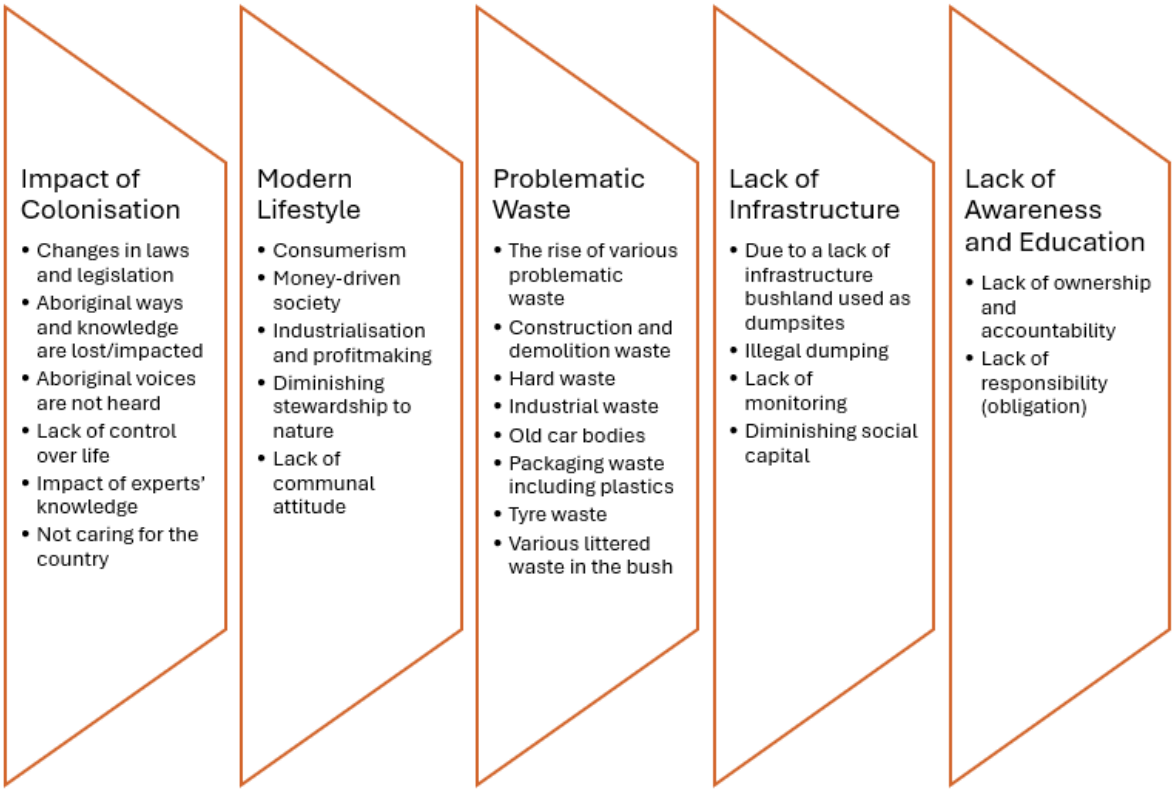

Figure 8. The key issues identified during the yarning sessions.

6.2.1 Impact of colonisation

The colonisation of Australia had profound impacts on Indigenous communities, affecting Indigenous social, cultural, economic, and physical landscapes. In particular, imposing new laws, regulations, and policy changes severely impacted livelihoods, and yarning circle participants shared their experiences of these changes. For example, policy changes have dismantled traditional kinship models for raising children, where Indigenous knowledge used to be passed down to younger generations. "They've lost that ability to do so, *we are reaping the rewards of the policy that changed. That's why we've got kids turning around and saying I don't need to listen to you. Well, within the hierarchy of kinship models, yes, you do mate, you know, because that's, that's kind of lost in a sense"* (Yarning Session 2, 2023)

Such disconnection between generations has led to cultural changes. Participants indicated that these changes play a vital role in how a community, or an individual, is expected to behave. That is not limited to environmental issues. This comment elegantly exposes this idea, *"It's not just about the sustainability. It's not just about climate change or anything here as fundamental rules and regulations that we don't have anymore. Because I'm one of those kids who did get clipped around the ear and all the rest of it, so that we knew right from wrong, whereas the kids don't understand it. So, although it's not a subject now, it is a subject matter. We can break it all down. Because if you want people to care for the Country, you want people to be respectful…People have to be taught how to put forward, so it goes back to that familial sort of spice again, with parents being able to*

teach their children right from wrong and how to be respectful of the bushland. So, it becomes another sort of layer on that is a cultural dimension" (Yarning Session 2, 2023)

Fear of kids being taken away from their families, stigma around Aboriginal styles of parenting and discrimination against the Aboriginal community play a critical role in how parents deal with their children, for example. The following comment highlights how some families can be fearful about trying to teach traditional ways in this era of new laws and legislation: *"Legislation or yeah, I suppose. Like if you have a can, for instance, you, my mum, used to cut the top of the can off, and we used to put a plant in there. And if you cut your finger, so be it. Who cares type thing, you know. But these days we're so driven by … If I don't even know what the word is care or, you know, don't let your child get hurt and you know don't do this and don't do that. So for us, for instance, we can't go and take hands that we get here, take the lids off and put the plant in because the child might cut their fingers, whereas our parents.... don't let your children get hurt. Mm-hmm. Safety safe. Safety, health and safety"* (Yarning Session 2, 2023).

6.2.2 Modern lifestyle

Industrialisation has had a significant impact globally, including on Indigenous communities. Modern lifestyles lead people to wasteful outcomes. These days, people are mostly *"stuck in one place"*, which hinders seasonal migration and associated practices such as leaving nothing behind but memories. Participants agreed that they've also gotten caught up in the world we live in, which is too fast-paced and disposable. For example, the habits of regrowing and replanting food got lost once moved to a space where there was no option to do so (e.g., open space, garden). *"So, perhaps it has just sort of changed because of the area where I was at, you know, because of what I've moved into, and I must admit, I haven't picked that up again. Yeah. I'm living in a place where. I can do that now…And why aren't I doing it? I don't know…"*. This means that if there are no enabling environments, even sustainable practices such as the care for the land amongst the Aboriginal community can get lost through the cracks. The following comment highlights how Bushland has been destroyed to build houses, roads, etc., *"Like all these new housing projects, and they're just clearing all the bush and you know, you, you can't go and pick the wildflowers, but they can destroy whole blocks and blocks of land to build houses. They need to ensure that there's a green corridor that runs through all these new developments would be very short from the green lawn" (*Yarning Session 2, 2023).

Another reason why people are not looking after the Country as they did before modern times is that society these days is mostly money-driven rather than value or land-driven. Prioritising profit over land care has led to many of the current waste problems, including illegal dumping. Participants also expressed that in some cases, the community is left out when a new project in the area is done, and they do not benefit from such projects; one of the Yarning participants indicated: *"Money generated from business within the community should go back to the community"*. They also admitted to feeling that even though some initiatives are conducted under the Aboriginal banner, these are more targeted at improving corporate image, ignoring the real importance of the Country and its preservation. A participant commented on this regard: *"If we've got corporations here (in Armadale) that need to have that sustainability report. They must be corporately responsible and put money back into the community."*

6.2.3 Challenging waste streams and their impacts

Industrialisation and modern lifestyles also generate waste, which is more complex and challenging to recycle and recover resources from. One of the effects of modern lifestyles is that people buy and use more things than they know how to dispose of, even with the collection systems in place in different councils. During the yarning sessions, community members reflected that *"People tend to stack up at their places items that they can't get rid of because they don't go in any of the kerbside bins (e.g., TVs, asbestos, old fencing, used oil)"*. This is compounded by the fact that we, as a society, consume a lot of goods; in this regard, they said, *"We just keep using stuff"* (Yarning Session *2, 2023)*

Other challenging waste streams repeatedly mentioned during the sessions included construction debris such as cement, brick, and asbestos (construction and demolition waste); old car bodies, mattresses, tyres, electronic waste, farming sprays, white goods, old furniture, clothing, and packaging of all sorts. Packaging waste was often discussed. Participants indicated that it is more affordable to purchase packaged items, thereby generating copious amounts of packaging waste.

Individuals participating in the yarning sessions noted a sense of hopelessness in many rural Aboriginal communities regarding how waste is handled. Participants underscored that there are various reasons for this situation, namely, a lack of employment opportunities, infrastructure, and awareness and education. A participant pointed out that the state of the environment in these rural Aboriginal communities is a health hazard: *"They were just with rubbish tips for themselves. It's like, how do you tolerate living like this, and you know, it's squalor."*

Not only do health issues, such as skin, respiratory, and heart problems, arise when waste is not properly managed, but Yarning members also pointed out that waste has affected them in other ways, such as preventing access to areas of cultural significance.

Unlawful waste disposal was a topic that was frequently raised across all Yarning sessions. Participants indicated that around Perth, all kinds of rubbish began to appear, specifically in natural parks and rivers. Given the importance of this matter to the members of the Aboriginal community who attended the yarning sessions, two field trips were arranged to see it firsthand. The photographs below show some of the waste found during the field visits.

Figure 9. Illegal waste dumping and burning in the bushlands

The photos were taken during the site visits at the outskirts of Jarrahdale State Forest and near Albany Highway. Hazardous waste, construction and demolition waste, electrical waste, etc. were seen. There were several trails which made it easier for illegal dumping to occur.

6.2.4 Lack of infrastructure and monitoring

The lack of infrastructure and the lack of appropriate systems are also major challenges in waste management. The participants pointed out that not only is the physical infrastructure, such as waste collection, bins, trucks, sorting facilities, etc., important, but an effective system or soft infrastructure is also needed. For example, most illegal dumping and littering in the bushlands occur due to a lack of a proper monitoring system. In addition, the lack of serious consequences or penalties is also the reason for the lack of litter reduction. *"Our roads are atrocious with tyres… absolutely atrocious. Because you see truck loads of tyres just chucked off the side of the road and that's even in our metropolitan area here, not just out in our not just out in our forest. And that's even here in our metropolitan area on the bloody at back at Gosnells over there. How many times I've seen truckloads of tyres there? It's not. It's not funny...."* (Yarning Session 4, 2023).

Another key points the group raised is that there is no continuous funding for initiatives that benefit the community and the environment, which has proven challenging. It may be caused by institutional or governance changes. This hampers the viability of such initiatives.

6.2.5 Lack of awareness and education

The current education curriculum and overall system do not focus on or instil the importance of caring for the land. For the Aboriginal community, the avenues and scope of education and knowledge sharing from within the core family have been shifted due to the impact of colonisation. Mainstream educators and scientists do not consider Aboriginal knowledge about land and environment as valid and important. *"Plants, animals and knowledge taken from the older people about where this stuff came from, not from science and that… It didn't come from there originally. It came from just normal people trying to better life for themselves and you know, like I think we're talking about we're going to get back to this voice. ... Trust me"* (Yarning Session 4, 2023).

Aboriginal participants highlighted that the change in parenting has been one of the factors that has affected the way Aboriginal knowledge is transmitted, and this has brought about changes in how the young generations in Aboriginal communities deal with waste, *"People have lost their link to the Country. So, it's not in their heart anymore, and especially not Aboriginal people. They see we throw it (waste) out in the forest or just throw it out. And it disappears from my side, so I don't have to deal with that. Aboriginal people do exactly the same type of thing"* (Yarning Session 4, 2023). Another comment that highlights the relationship between Aboriginal education and skills with the lack of waste ownership: *"Young generations (Aboriginal peoples) they would really create a lot of rubbish for themselves …. There are many of reasons for this: money comes easily, A lot of skills haven't been passed down..."*(Yarning Session 4, 2023)

The Yarning group agreed that many regulations do not promote care for the land in ways aligned with Aboriginal wisdom. They manifested that while many regulations do strive to improve the Australian environment, including Aboriginal land and cultural knowledge would help foster this endeavour. Careful attention must be paid to this, as the participants indicated that it is hard to homogenise different kinds of knowledge that are deeply rooted in context or place. Such types of knowledge include Western science, Aboriginal knowledge, and knowledge across different Aboriginal groups. A participant explained: *"It is a different environment, a different Country… different knowledge...Australia is vastly different, and our culture is built around land".* This suggests that regulations should account for land diversity and the specific contexts on which Aboriginal culture and knowledge hinge.

6.3 Solutions identified during the yarning sessions

The yarning sessions also provide insights into how the community approaches solutions as they discuss the identified issues. Although participants identified several waste-related challenges in earlier sessions, the proposed solutions do not always directly address each issue. This is because the community-led yarning sessions often moved away from structured objectives and followed an organic, spontaneous co-development process guided by participants. While this reflects the strengths of participatory approaches, it may also be considered a limitation in terms of aligning discussions with predefined research outcomes, despite the researchers' best efforts.

Based on the preliminary analysis, this report puts the solutions under the following thematic approaches:

- Aboriginal ways

- Education and training
- Community-driven initiatives
- Inter-agency collaboration and
- Amendment of laws and policies
- Waste management improvement through community education

6.3.1 Aboriginal ways

It was evident during almost all yarning sessions that there is **an urgent need to rejuvenate Aboriginal Ways, since these practices are deeply rooted in a connection to land and nature, as well as in a wealth of ecological knowledge for understanding** local ecosystems, biodiversity, and seasonal cycles. In addition, the cultural revitalisation of Indigenous communities preserves heritage and traditions, which have been diminishing since colonisation.

Community-led initiatives for waste clean-up, such as Clean Up Australia, were highly valued in discussing positive memories related to waste around the community. Along these lines, a general sentiment was the necessity to train and employ Aboriginal peoples in environmental services and business. For example, Aboriginal rangers could watch for illegal rubbish dumping (one of the problems found during the yarning sessions): *'I have been talking about employing rangers, but those rangers have specific duties, but they need to put those little cameras on'* (Yarning Session 5, 2023).

Several conversations and quotes in the yarning sessions 5 and 6 reflect deeply entrenched and culturally ingrained values that can guide actions towards finding solutions to waste issues in communities. For example, *"My dad always used to say, 'leave the place cleaner than what you found it.'"* This underscores the principle of leaving a positive environmental impact and ensuring sustainable practices. *"Traditionally, there wouldn't have been waste. So, the care for the land was always on top, taking on what you always needed and never really taking more than what you needed."* This reflects the traditional Indigenous practices of minimising waste and taking only what is necessary from the land, emphasising sustainable resource use. *"Australia is vastly different, and our culture is built around land."* This points to Indigenous Australians' deep cultural connection with the land, highlighting that their environmental practices are integral to their cultural identity and heritage. These quotes collectively argue for a return to traditional practices of environmental care, sustainable resource use, and the land's cultural significance in fostering a healthier, more sustainable future.

6.3.2 Education and training

On the topic of caring for the land, participants noted that people will only care for something when they truly care about it. The care for the land in Aboriginal cultures is understood as having a significance or connection to it: *"Caring for the Country means we care for animals and then, therefore, we have a why."*. Learning about the land will promote such why. In particular, there is a significant opportunity to integrate education, focusing on fostering a deeper connection to the land.

An organisation could engage the community by initiating programs that educate and raise awareness about the importance of understanding and appreciating the Country, as a participant conveyed: *"so you see an opportunity especially to the combine the education and trying to get people to focus on looking at the Country, right, an opportunity for an Aboriginal organisation to start teaching community about it"* (Yarning Session 5). The group delved more into this point. This organisation should be able to impart knowledge through various avenues and approaches.

Transmitting knowledge to Aboriginal kids through a dual-purpose program: caring for the bush (e.g. picking up litter) and learning bushcraft (e.g. around the waterways, how to catch a fish or a maroon). One of the Yarning members recalled: *"In the old days, we used to have that inherent knowledge".*

There are two levels of education needed around land care, which promotes environmentally friendly practices, including proper management of end-of-life products:

i) localised or referred to as *"how do we walk again?"* by one of the participants. This approach involves going back to those times when *"things were a little bit simpler, and everybody played a role in the community"*. Another participant added, *"it's always been part of our culture to make sure that you care for the land. And I think we need to start bringing that back into educating our model"* (Yarning Session 5, 2023). One participant also mentioned that, *"Skills and rules about how you live your life and sort out that process is gone. So maybe it is around from that localised level that education around our youth in making sure that they understand where they sit in"* (Yarning Session 6, 2023).
The aforementioned programs, such as caring for the bush and learning bushcraft, would support the localised-based education model.
ii) Systemic. Education within the existing system is crucial. It is essential to empower young individuals and elevate their status and *"put them on the map"*. Education and scholarship opportunities, can enable young individuals to contribute to and lead (family) businesses. Implementing both localised and systemic education approaches for the next generation will allow them to *"jump through the hoops"* or to navigate through the various challenges faced in the system that today's children live in while maintaining their cultural roots (caring for the Country).

6.3.3 Community-driven business initiatives

In terms of business initiative opportunities that benefit the community, the group considered challenging waste materials as an enabler for business development. 'Any kind of benefits should go to the community' and should involve 'caring for the Country, which is related to local businesses, education benefits, etc.' This matter was often discussed by using mattresses as an example. Currently, mattresses must be dropped off at allocated centres, and people delivering them must pay a fee. For the purposes of this example, the fee is usually around $70. An alternative handling process for end-of-life mattresses began to take shape across the Yarning sessions. The initial step is to approach the Council with a proposal to handle mattress disposal differently. Instead of individuals being charged for mattress disposal, a contract could be set in place to manage all mattress disposal for the Council. By offering a service in which mattresses are collected, dismantled, and disposed of at a lower fee (e.g., $1 per mattress), illegal dumping is prevented, saving the Council resources on managing this issue. This same approach could be studied for other types of items illegally disposed of.

Participants also put forward community education on how to be able to recycle or repurpose or upcycle items that are not eligible for collection through the kerbside system (e.g., white goods): *"I didn't realise that people go through white goods and get copper out".* They agreed that upcycled

items can be a good replacement for new items (e.g., repurposing drums of washing machines as a set of draws). Once people understand how these items can be repurposed, they will be interested in picking them up, which could instil community-led businesses. This was a grassroots initiative in the past; participants provided an example of someone who did this on their own. The person eventually ended up doing this as it was a full-time job, and the demand was too high. As a result, this activity was suspended. However, this shows that there might be an untapped opportunity for the community to seize.

6.3.4 Inter-agency collaboration

Partnerships were also discussed during the yarning sessions as a crucial factor to consider in facilitating positive outcomes for the Aboriginal community. " *But I think it's that that comment I didn't see and local councils partner with our local Aboriginal and on open organizations, there's an opportunity there or employment and small business so that our people can find an employment and maybe start their own"* (Yarning Session 6, 2023).

It was emphasised that clear roles and responsibilities needed to be outlined and that Aboriginal people should also be allowed to have managerial roles: *"if you're gonna get the partnerships need to be really defined as to who has what say in those types of business management roles in, I mean, black cladding is rampant in the communities anyway, whether it is way up north to lay down South, but actually making sure that people are employed and also people are employed within that management space as well" (Yarning Session6, 2023)*

Another comment highlighted the importance of including Aboriginal people in business management:" as *far as these businesses are concerned, you know you don't just have a non-Aboriginal person managing and contracting all these Aboriginal people to go and do the work for them. I didn't see local councils partner with our local Aboriginal and on open organisations; there's an opportunity there for employment and small business so that our people can find employment and maybe start their own" (Yarning Session 6, 2023)*

These points underscore the need for partnerships that foster genuine collaborations and empower Aboriginal people. Job opportunities and the growth of small businesses could result from local councils engaging with Aboriginal organisations. Hence, the partnerships can deliver meaningful employment and support new or small businesses within Aboriginal communities.

6.3.5 Amendment of laws and policies

A sentiment shared by the yarning participants in relation to regulations was that they are disconnected from ancestral and Aboriginal knowledge of the Country and the land. Participants called for factoring in this knowledge in policies as it will reconcile them with the natural environment. A suggestion on this matter was: *'An option is to carry out consultancies with (Aboriginal) people who have knowledge of the Country'*. 'This will enable more people and place-based policies.

Accounts of how Aboriginal peoples cared for the land highlighted practices that highly resonate with circular economy interventions. A circular economy provides a path to achieving sustainability and moving beyond the current 'take-make-waste' system. It strives for resource efficiency and for keeping the value of materials for as long as possible while minimising waste. At an operational level, a circular economy can be implemented by applying the R-framework. The framework uses resource management strategies such as reduce, reuse, recycle, among others. Aboriginal practices entail a similar approach to managing land resources.

For example, they would preserve seasonal food so it could be consumed off-season, *'I remember watching my mum can every piece of fruit and vegetable… you know you've got peaches in a season that you couldn't get peaches, and you've got plums in a season that you couldn't get plums'*.

This practice certainly helped reduce food waste, as seasonal food supplies were preserved rather than left to decay. On the same topic of food, participants reflected (Yarning Session 6): *'There was nothing really thrown away, was there? So, every element of our food, I think this is what I remember: every element of our food was reused'*.

Reusing practices would also include non-biological materials, when we used to use clothes… so when the baby, you know, grew out of nappies, they were passed on or they were used for cleaning rags. Hmm…. Yeah, multi-purpose'. Repair activities used to be prioritised: 'these days you go out and buy something new …It just doesn't happen that sort of repair that was happening on the way you know, you stitch up a hole'. Upcycling, a form of high-value recycling, was also ingrained in the culture: *"We would like you said about the milk tins. We'll use them. We'll make our own toys….punch a hole and put the wire in there. Your little roller with our own toys. Make our toys out of it. Or even wood" (Yarning Session 6).*

The Circular Economy Ministerial Advisory Group (the Advisory Group) previously recommended developing a National Circular Economy Framework to guide Australia's transition, including recognising the role of First Nations knowledge systems (DCCEEW, 2024). This recommendation has now been realised through the establishment of Australia's Circular Economy Framework (December 2024) by the Department of Climate Change, Energy, the Environment and Water (DCCEEW). The Framework acknowledges that the transition to a circular economy is not only an environmental and economic opportunity but also a pathway to honour and integrate the deep knowledge systems of Aboriginal and Torres Strait Islander peoples, whose practices—such as caring for Country, minimising waste, and sustaining ecosystems—have embodied circular principles for tens of thousands of years.

Importantly, the Framework emphasises the need for genuine partnerships with First Nations peoples, ensuring they are integral to decision-making, design, and implementation processes. This includes embedding Indigenous knowledge systems into policy, practice, and innovation, while aligning actions with the National Agreement on Closing the Gap to ensure equitable access to circular economy opportunities and benefits. In practice, this requires prioritising co-designed initiatives, Indigenous-led enterprises, and culturally grounded approaches to resource management, supported through meaningful partnerships, consultancies, and community-led programs to deliver a just and inclusive circular economy transition in Australia.

Indigenous practices emphasise the efficient use of resources, ensuring that nothing is wasted and that resources are harvested in ways that allow for regeneration. This contrasts sharply with the extractive and often wasteful practices of industrial societies. Rejuvenating these methods can lead to more sustainable use of resources, reduce waste, and promote circular economy principles. For example, traditional fire management practices, which involve controlled burns to reduce fuel loads and promote new growth, can prevent large-scale wildfires and maintain healthy landscapes. However, over time, restricting fire bans not only limits the prevention of such incidents but also exacerbates other issues, including waste.

6.3.6 Waste management improvement

Some of the suggestions to improve household waste management practices were based on community education, as the information provided by city councils was lacking in some respects. Providing clearer explanations or justifications for why certain items are not eligible for kerbside waste collection will facilitate better understanding and compliance among people. In addition, further clarification is needed on how to deliver items to the recycling centres (e.g., cut-in-half mattresses

are rubbish; entire mattresses are not). More clarity is also needed on the fate of returned containers through take-back schemes: *"... There needs to be more work around that, but that's too big an issue for us as grassroots to deal with.".*

Another interesting point raised concerned utility bills. Learning how to read the bills may help reduce the cost of living and, eventually, waste (carbon footprint). Some other initiatives, such as delivering waste-prevention education, were also mentioned; for example, teaching how to preserve food as in the old days (baby potatoes in vinegar) can help reduce food waste and could be a potential business model.

A key clarification regarding end-of-life waste management was raised during the sessions. Waste items, such as used plastic bottles or tyres, should be managed in a way that they "don't cause grief' to the planet and to people". Such clarification entails that any initiative to address waste should always consider its environmental effects and, among other things, assess which rebound effects may arise. Notably, the three previous business initiatives would address illegal waste disposal, a key issue identified during the yarning sessions and field trips.

6.4 Yarning circles with youth group

6.4.1 Waste problems

At the request of the Elders community group in the Armadale area, two yarning sessions were conducted with young Aboriginal community members. When asked about what they consider to be 'waste' and when they become a problem in their community, the young participants expanded beyond just physical waste products. They pointed out **water waste and even fuel waste** as significant concerns. One participant mentioned, *"some people just driving car for the sake of driving (and to address this issue) these days a lot of people are carpooling together, riding their bikes, etc".*

Among various waste products, they highlighted **green waste, product packaging, and general waste** within the community, such as **cans, bottles, nappies, bags, and clothing. Food waste**, both at home and in commercial settings, was also highlighted. **Hard waste** becomes the 'bulk rubbish' that are being left at the side of the road has been mentioned as a problem. 'Slashed up cars' was mentioned as well:*"What is being wasted? Plastic through to clothing... Plastic is bad for the environment. Food... kind of when you waste food... it's an ongoing subject... it's like you waste food... when you are wasting food, you kind of need to buy more; so you are wasting money as well. Clothing – where do they go? I know I take them to OpShops to recycle them, but many don't know"*

Some participants pointed out that these waste products not only create problems within the community but also negatively impact the environment, which can directly affect health through water and air pollution, harm wildlife that may consume the waste, clog drains, and lead to other issues.

Participants also explored the reasons behind the waste that remains untouched and becomes a growing issue. They highlighted **a lack of motivation among young families or community members** to make the extra effort to take waste to recycling centres. Young families, in particular, are often overwhelmed by their daily lives and the demands of caring for young children, leaving little time to consider recycling issues.

Participants highlighted how, historically, people from previous generations were more creative. Young participants expressed admiration for their Elders and parents, praising them for being able to recycle many of the items they used in their daily lives.

"Like how historically people used to make quilts. Yeah. And they used to cut up all of their old clothes and make quilts for the winter. But there was always that material would make sure that there was a response to it".

"Ohh, you know, that was such and such as. Church. Or remember when Dad or Mum did this and I was wearing that. So, there's a connection between something.... my mum's a big hoarder and we just can't throw them out even if we don't use them just because they've been made for you and you know the amount of hours that went into it".

Young participants emphasised that many **people in the Aboriginal community lack stable housing and basic necessities.** They may face lifelong struggles. Moreover, the impact of the 'Stolen Generation' has left many parents and children without the privilege of living with their own families or raising their children themselves. This means that parents and Elders may not have the opportunity to teach young people essential skills, such as growing and cooking their own food, repurposing used items, and recycling clothes. *""Like, where's our grandma? She's. She's a lot like that. Like, you know, she'll use whatever she has in her cupboard. She'll make it stretch, like she'll cook her pasta and use it or whatever. Or her rice or whatever it is. But in our household, like. No, not really.Yeah, I'll just go to the just go to shop and buy more. That's OK. Can't be bothered."*

Participants also expressed regret that, due to current consumerist trends and practices, they do not recognise the importance of learning those skills from people in **previous generations.** They mentioned that clothes and many other items are so cheap to buy at places like Kmart or Ikea, which leads people not to really bother with recycling. One participant said,

"I'm horrible. Like if there's clothes or something that's dirty like. I've been sitting there all closing Mum's laundry. I'm like, Nah, just stack. All of them, get rid of it and she's like, no, you can go through it. You know, you can. Save some, like I've said that you. just chuck it away... It is generally we are like that and living in that kind of time. I think we destroy things so.I remember being in the era when Kmart started and it became cheaper to buy the clothes than make them, because everything was made when I was growing up...Clothing, yeah. And it's kind of like that, you know. You get a $4.00 towel. so its cheaper to throw a dirty towel out and buy a new one."

Some participants also expressed concerns about the **poor quality of goods produced today**, which is forcing people to make more frequent purchases. as they said, *"I'm trying to say like breakable, like back in the day when they used to make Chest of drawers, you couldn't break them unless you had a hammer, whereas today you can go to IKEA and get something that you know is relatively cheap but can be broken quite easily."*

However, the participants also acknowledged that the situation has been changing due to the rising cost of living, driven by long-term inflation. **The cost of recycling discourages people from thinking about recycling**, especially bulk items,

"But the tips are expensive to go for. The fee for some people, especially if you don't have vouchers or you can or you're not with homes West. Where you can apply for some vouchers or what not and then especially with if you get like... the bins, Chuck out bins at the front of the house. You can't

Chuck mattresses in them as well. So, then you're gonna have to take it to the tip or whatever. And then that's like $50 each mattress or whatnot."

The **lack of availability of facilities/ bin for the disposal of household waste** often creates barriers for people when it comes to getting rid of items like toys, cutlery, and more. Participants shared experiences of keeping discarded items in the back of their cars for months, only to eventually throw them in the bin. The **fast-paced lifestyle** of today's world is another major challenge.

Some participants spoke about their **knowledge gap**, with limited awareness of the environmental harm caused by waste. If people are not interested or don't have access to education in understanding the impact of waste on the environment, they are unlikely to take action to address it.

6.4.2 Solutions to address the waste problem and resources needed

During the first yarning session with the young group, participants were initially shy, and a couple of dominant voices mainly led the discussion. By the end of the session, the participants agreed that they wanted some time to reflect on the questions, issues, and potential solutions, and to come back to brainstorm ideas in smaller groups in the next yarning session. As researchers, we followed their suggestions, which proved highly effective. In the yarning session II, the larger group was divided into four small groups, each with three participants. They were given three questions to discuss, along with A3 papers and coloured pens to document their thoughts. The facilitator left the room so that the participants could be comfortable and open with each other. At the end of the discussion, each group presented its findings to the larger group. The presentations were audio-recorded, and the data were analysed thematically. This section primarily focuses on identifying solutions to waste problems and exploring the resources needed to address those issues.

- **Social media**

Participants recommended using social media for various purposes, including raising awareness about waste issues, educating others, and enhancing communication within and between community members. They suggested creating local community social media groups on platforms like Facebook to improve collaboration and facilitate discussions. Young participants in particular discussed using platforms such as Twitter, Instagram, and Facebook. They recommended creating short, personalised videos, infographics, and posters to effectively raise awareness and share important information. These digital tools can help engage a wider audience and encourage more active participation in waste management efforts.

- **Community-targeted initiatives**

Participants said that community members could carpool to reduce fuel waste and minimise their environmental impact. They were also suggesting an app or a social media community page to facilitate carpooling.

Participants advocated for i**ncreased community-based funding** to establish vegetable gardens in communities, enabling local vegetable production. They also emphasised **the need for training on composting, starting gardens, and other related skills.** It was suggested that programs should be designed to be **both child- and adult-friendly.** One group proposed that these sessions could include communal meals, where community members can gather to have lunch together or even prepare meals using vegetables from the patches. One participant mentioned, *"School curriculum to*

actually change to reflect child and adult inclusive projects. If a program was friendly for both myself and my daughter, that would have been so much fun."

Another participant suggested that **Bunnings could receive funding to take the initiative in providing training to community members**, helping them to start and maintain vegetable patches. Funding for projects like this is needed. "If there was funding for Bunnings to do like veggie patch starter kits... if you are not really that interested in doing something, you would not want to spend your money on it, *especially everything is so pricy these days. So, if there were free veggie patch starter kits or something... that would be great. Then, if you learn together with your child and your partner and if you are interested in it, you would work together to grow vegetables in the garden"*

Another suggestion to address green and food waste was that **local community organisations or the Council can partner with companies, like Coles, Woolworths, Aldi, etc on collecting food waste from those big supermarkets and giving back to the community.** For example, Champion Centre, in partnership with Coles and Aldi, distributes food to the local community. It is beyond imagination how much food would have been wasted had they not been collected and redistributed among community members.

- **Council initiatives**

Participants emphasised the **local Council's role and responsibility** in addressing waste-related issues. Their suggestions included allocating more bins throughout the community to prevent overflow and reduce roadside bulk rubbish. They also proposed that **the Council establish a recycling point in the community at no cost** and make tip passes more affordable for residents.

The Council could engage young people by establishing **youth programs** focused on waste-related activities. One suggestion was to create a state program where people collect water bottles, and as an incentive, they receive 10c for each bottle they bring in. The program could include variations, with something different each month to keep it interesting. The incentive could be increased to 50c per bottle, as a higher reward might encourage more participation. Given the rising cost of living, it's important that such initiatives adapt to remain appealing and motivating for the community.

The Council should also take the initiative **to educate and raise awareness** about the proper disposal of waste products, such as tyres, mattresses, green waste, and white goods. Participants mentioned that while many people know mattresses cannot be disposed of at regular tips, they are not sure how to dispose of them properly. Providing clear instructions and guidance on how to dispose of different materials would be helpful for the community.

- **Education and knowledge sharing**

One of the groups identified nappies and other baby products as a challenging waste stream. As a potential solution, they suggested that **antenatal education in hospitals** could include teaching on how to recycle certain items, which would be beneficial. This information could be integrated into their sessions. One person mentioned, *"When you have the kids, you do not want to go and seek information. But if it's there available, then it would be very beneficial"* (Yarning Session 4, 2023).

Education is key in addressing waste issues within the community. Participants said *"We, as adults, don't really have time to learn all about this stuff and then teach our next generations. We don't see that much happening in the high schools. Primary schools do an okay job in including information on environmental issues but not in the high schools. People have to learn what bad it*

does to the environment. Maybe after they learn they can teach their subsequent generation. Even sorting out the waste should be taught at that school level" (Yarning Session 5 2023).

At the household level, everyone should make an effort to educate each other about waste and waste products. However, in order to do this effectively, it's important that they have **access to reliable information.**

There should be more **advertising and campaigns** everywhere, highlighting what needs to be done to reduce waste—emphasising both the negative impact of waste and the positive outcomes of proper waste management.

One of the workshop groups placed extra emphasis on the impact of waste on wildlife and the environment, particularly highlighting the connection between waste and polluted waters. Wildlife shelters often go out to clean polluted water and rescue affected wildlife. In addition to their conservation efforts, these shelters also repurpose unused blankets and towels that people no longer need or have thrown away because they need laundering. Volunteers play a significant role in this process, supporting these efforts and reducing waste by giving these items a second life. This highlights how education around waste management can also encourage more sustainable practices within the community, benefiting both the environment and wildlife.

7 Possible Circular Economy Solutions for Businesses

7.1 Case study 1: Remote Op Shop

7.1.1 Case study context and background

The Remote Op Shop Project was founded by Tanya Egerton in 2016 in response to the challenges faced by the remote Aboriginal community in accessing affordable clothing and household goods. The project emerged organically when a group of women from the Jilkminggan community (in the Northern Territory, as pointed out in Figure 10) expressed dissatisfaction with their assigned work-for-the-dole program and sought to establish their own art centre. Through a collaborative planning process, the idea of an op shop was born to generate funds for the art centre while addressing the pressing issue of limited retail access in remote areas.

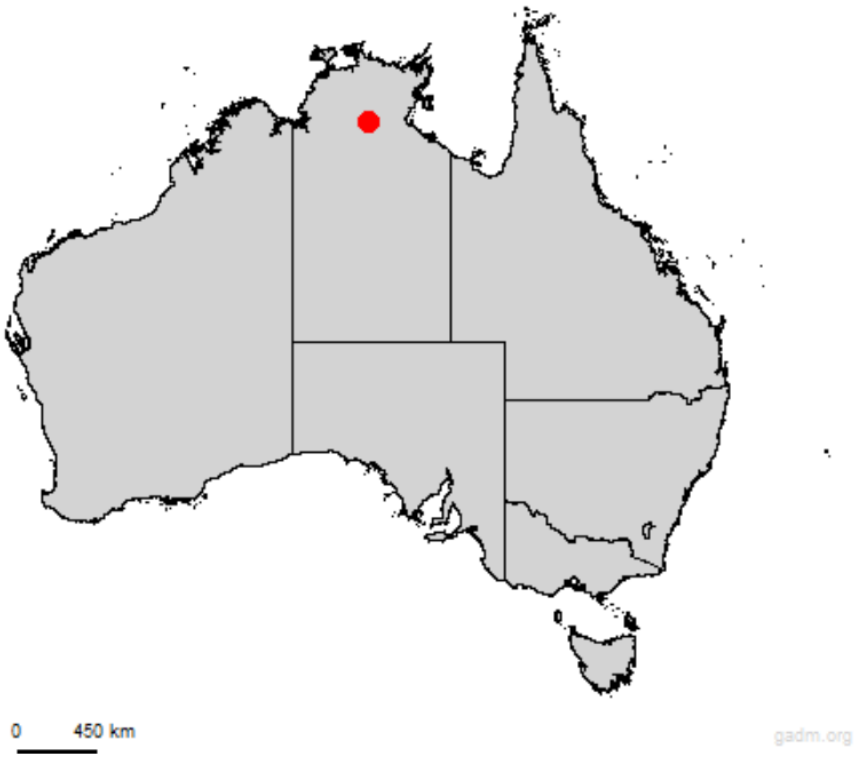

Figure 10. Location of the Jilkminggan community in the Northern Territory (GADM, 2018)

What started as a small initiative quickly gained traction when Tanya's social media call for donations went viral, resulting in 700 boxes of clothing being delivered to the region. Despite initial logistical hurdles, the women successfully launched their community op shop, raising $10,000 within the first

two months. This income enabled them to incorporate their own art centre and acquire necessary supplies.

Eight years later, the Remote Op Shop Project has expanded to over 30 remote communities, primarily in Western Australia and the Northern Territory. These op shops vary in scale, from pop-up stalls at community events to containerised retail models with Starlink internet and solar power, fostering local enterprise and autonomy.

7.1.2 Company/Organisation overview

Name: Remote Op Shop Project

Founder: Tanya Egerton

Founded: 2016

Location: Operates across 30+ remote communities in Western Australia and the Northern Territory

Size: Community-driven initiative with a strong online presence (40,000+ Facebook members) facilitating donations and support.

Core Business proposition: Sustainable community-driven op shops providing affordable clothing and household goods while supporting local enterprises and cultural initiatives.

Figure 11. The Jilkminggan community-led Op Shop Business

(Image supplied by Tanya Egerton with permission)

7.1.3 Challenges addressed

The Remote Op Shop Project tackles several key challenges affecting the remote Aboriginal community:

- Limited Access to Affordable Goods: The high cost of living in remote areas means essential items are significantly marked up ($3 towel in urban areas costs $30 in remote stores).
- Waste Management Deficiencies: Remote communities often lack formal recycling and waste management infrastructure, leading to illegal dumping, unmanaged landfill sites, and toxic waste contamination of waterways.
- Limited Economic Opportunities: By fostering community-led enterprises, the project creates employment and economic agency for women.
- Lack of Infrastructure: Some communities lack storage and retail spaces for donated goods, prompting the establishment of a warehouse hub in Darwin for better distribution and storage management.

7.1.4 Identified challenges and lessons learned

a) Identified challenges:

- Funding Constraints: While some government funding (e.g., $65,000 for a containerised op shop) has been secured, the overall costs remain high (approximately $200,000 needed for infrastructure development).
- Infrastructure Limitations: Remote communities often lack storage and retail spaces, prompting the need for a Darwin-based warehouse hub to improve logistics.
- Waste Management Issues:
    - Unregulated dumping and burning of waste in some communities due to inadequate waste disposal services.
    - Scattered, makeshift landfills leading to environmental hazards.
- Sustainability of Operations: The project has relied heavily on volunteers and donations, raising concerns about long-term scalability and funding stability.

b) **Lessons learned:**

- Empowerment is as Important as Employment: While the project creates jobs, its greater impact lies in fostering autonomy and community resilience.
- Digital Connectivity Enhances Circular Solutions: The Facebook-driven donation model proves that technology can bridge geographic barriers and facilitate sustainable resource redistribution.
- Community-Driven Models Foster Cultural and Economic Resilience:
    - By allowing communities to manage their own second-hand markets, they redefine value, reduce waste, and foster self-sufficiency.
    - Cultural innovation (e.g., repurposing car parts for community art) aligns waste management with Indigenous storytelling and identity.

7.1.5 Circular economy innovation and consideration

Although the community-driven op shops aim to provide affordable clothing and household goods while supporting local enterprises and cultural initiatives, their operations and activities, both directly and indirectly, support circular economy (CE) principles, particularly by emphasising waste reduction, resource recovery, and the repurposing of textiles in remote communities. Second-hand clothing donations form the backbone of the initiative, preventing textile waste while providing communities with essential goods. The model also supports social and economic empowerment, as communities independently manage their op shops and decide on the distribution of resources.

The project further extends CE principles by integrating local cultural elements into reuse initiatives. For example, in Balgo, community members repurpose discarded car bonnets as wayfinding signs and community art installations, reinforcing cultural expression and waste valorisation.

Core CE Principles Implemented:

- Extending Product Value: The project extends the lifespan of clothing and household goods by redistributing reused items to communities in need, reducing waste.
- Closed-loop Local Systems: Communities self-manage donations and sales, ensuring goods remain in circulation within the local economy.
- Waste Valorisation: Repurposing discarded materials (e.g., old car bonnets turned into community signage and artwork).

Innovations and Best Practices:

- Innovative Recycling and Repurposing:
    - Car bonnets repurposed into community wayfinding signs and art installations.
    - Community-driven sorting and upcycling of clothing donations.
- Community-Led Model:
    - Women in the communities take ownership of their local op shops, ensuring autonomy and sustainability.
    - The project supports the establishment of community-based enterprises beyond just clothing retail.
- Leveraging Digital Solutions:
    - A 40,000-member Facebook community enables direct communication between donors and recipients, streamlining donations and eliminating unnecessary shipping.

7.1.6 Summary findings and observations

The Remote Op Shop Project exemplifies circular economy principles, particularly in addressing socioeconomic inequities, waste reduction, and community-driven sustainability. Leveraging reuse, local ownership, and digital engagement provides a scalable, innovative model for remote communities worldwide seeking to enhance economic resilience through circular practices.

However, addressing funding and infrastructure challenges remains key to sustaining and expanding this impact in the long term.

7.2 Case Study 2: Deadly Denim

7.2.1 Case study context and background

Deadly Denim was established in 2018 by Ms Beck Barlow. It started with Beck being interested in OP shopping for clothes for herself. In early 2010, she turned an old caravan and an old truck into a vintage clothing - second-hand clothing store. She always liked buying second-hand clothes and reselling them. She wanted to create a sustainable alternative to showcase Aboriginal art in a different way, through sewing a piece on the back of a denim jacket like a walking canvas! The idea was always going to buy the jackets second-hand from old shops. That's how that part of reusing textiles emerged as a business.

Figure 12. Picture of the Recycled Denim Jackets
Source: Beck Barlow.

In 2018, Beck attended Black Coffee, a grassroots Indigenous business networking and gathering platform held in regions across Australia each month. Originating in Queensland and now across Australia, the goal of the Black Coffee movement is to provide a platform to connect micro and small business owners. They organised their social meet-ups, and Beck went with an Auntie who runs Noongar tours. She was just beginning to create her business, too.

At the time, Amanda Healy from clothing brand Kirikin was running the Black coffee sessions. All attendees had some type of business idea or a small or established business. Around six women attended the coffee meet-up in the city, where they were told about the Curtin Ignition program. Amanda shared information about the Ignition program, including scholarship application paperwork. The Ignition program was an intensive, 12-hour-a-day, seven-day-a-week entrepreneurship course for startups.

That is where they developed their business ideas and learned the skills to pitch those ideas to a panel of investors. As Beck said: Beck always knew about sustainability and waste, and was always interested in second-hand shopping. "*Undertaking the ignition course was my introduction to researching facts around the fashion industries environmental impact. So that's when I decided using recycle denim has actually got all of this attached to it as well, it's not just about the price point .*" Beck was highly praiseworthy about the Curtin University course, as it introduced her to business research. They offer the course once a year, usually in August, and it is for everyone. That course introduced practical business steps, such as creating a logo and obtaining an Australian Business Number (ABN). She made an appointment to meet with Indigenous Business Australia, a government entity that provides support to Aboriginal businesses to enhance their economic development opportunities. This is how the business started from its inception to an operating business.

Figure 13. A Refurbished Denim Dress
Source: Beck Barlow.

Initially, no funding was available. At the time of establishing the business, Beck was a single parent receiving Centrelink support and studying midwifery online. She took leave from her course, and with limited financial resources.

To start with, she made 20 jackets and went to CinefestOZ, an Indigenous Film Festival that occurs every year in Busselton. All of the jackets were sold, and she had encouraging feedback from all young Indigenous filmmakers, inspiring her to create more. She produced new jackets and took them on a three-month road trip to Tasmania with her kids in a small camper. In Tasmania, she had a stall at the Falls festival and sold a couple of jackets. She also gifted a jacket to Maggie Beer at her farm as they loved watching her cooking show. The jacket had dilly bag artwork from Injalak Art Centre, which Maggie shared on her social media channels.

After returning to Perth, Amanda Healy and Beck took part in the Perth Fashion Show. While she had never thought of fashion runways before, the show proved to be a valuable experience. Following this, she decided to collaborate with three different Indigenous design artists, offering royalties and drafting some contracts. However, she quickly realised that in the first year, there was

no profit or access to funding, making it a slow year or two. During this time, the project remained very much a passion project.

Another aspect that has **worked well and that Beck enjoyed within her business was the workshops** (Figure 14). The business went from making a jacket to selling, and to actually going out to the community and teaching others how to make their own. The first one Beck did with her good friend, Marissa Verma, who owned a business called Bindi Bindi Dreaming. Marissa did a lot of catering and Bush Tucker. So, Marissa and Beck decided to do a workshop together at Langford Aboriginal Centre. During the first workshop, half the group was cooking with Marissa, and the other half was sewing a jacket with Beck. Then they swapped over. Although it was a bit chaotic, people loved it. Beck did a few of those with her. While doing that, she started fine-tuning the workshop ideas as she thought that engaging with the community was a truly valuable business initiative. She also went to women's refuges. Since then, the workshops have become a huge part of Deadly Denim.

They also delivered workshops for incarcerated women, which were well received. When facilitating workshops, Beck brings the sewing machines, jackets, fabrics, and other required materials, and everyone makes their own jacket. Recently, she delivered a sewing workshop to the Southwest Aboriginal Medical Service in Bunbury, Western Australia. They have an Aboriginal women's group that meets every week. Beck provides denim jackets from op shops, fabrics, sewing machines, and everything that the participants needed when participating in a workshop That's a big part of what the business does. It's giving the participants a hands-on education experience of what they can do with recycled garments or from their own wardrobe clothes. It also introduces the skill of sewing and the concept of painting or printing their own artwork onto Calico for their own sewing projects.

Figure 14. Deadly Denim workshop session

Beck was working as an Aboriginal Liaison at a maternity hospital last year and facilitated sewing activities there. Women come down to Perth from remote and regional communities and can stay in

the hospital up to 10 weeks at a time, intending to have a baby or postnatally, the baby could be in the Neonatal Intensive Care Unit (NICU). The hospital had a little craft room where they sewed.

7.2.2 Company/Organisation overview

Name: Deadly Denim

Founder: Beck Barlow

Founded: 2018

Location: Operates in Perth, Western Australia

Size: The business is mainly run by one person, Beck Barlow.

Core Business proposition: Recycling Denim jackets and refurbishing them to make a new product, and delivering workshops

7.2.3 Strengths/Positives

Some of the strengths that Beck identified are discussed below:

In answering the question of the strengths, Beck responded that she is big on skill sharing, so she really wants to collaborate with other Deadly Denim yoga practitioners. She works with women coming out of prison. They meet on Mondays, do activities and share the knowledge and the skills with the people, hoping that people will start something of similar interests.

Beck also spoke about how she **feels lucky to spend time and reciprocate support with other Aboriginal women in business**, *"There's a few of us and we're so supportive of each other like… always sharing opportunities, always sharing our experiences and our journeys. I think it's been a huge part of the business's success. We're doing different (businesses), so my main group that I talk to a lot, some are weaving, some are full-time artists. Others are food-based businesses. Basically, a really supportive group of women becoming not only support but mentors for each other?"*

The biggest strength behind the Aboriginal businesses is that *"its not just about financial growth it's the community around the brand people that follow the label recently, I travelled to a very remote community to deliver a week of sewing workshops and I put a post on Deadly Denim Facebook page for sewing machine donations to gift to the high school…."*

Beck envisions having a mobile studio to deliver to remote and regional communities. The studio would have industrial machines inside a bus or van, with solar panels and an awning for outdoor creative practice.

Beck is powerful **on ethics**, and she **has certain reservations about working and collaborating with other businesses, for example, those that use child labourers, fast fashion,** and so on.

Figure 15. Deadly Denim products
Source: Beck Barlow

7.2.4 Identified challenges and lessons learned

1. **Funding constraints:** The biggest challenge is funding. It's been a challenge all along. It costs a lot of money just to be a designer on a runway. There's a designer fee you pay, and other associated costs.
2. **Unplanned growth:** At one point, Deadly Denim grew too quickly without the planning in place and the infrastructure. It generated many unforeseen issues. That was definitely a learning curve.
3. **Custom order:** Another challenge was that Beck once started taking custom orders. She was trying to meet people's jacket choices in terms of colour, size, etc. Then she found out that she could not keep up with sourcing. When she started, she wrote to a few op shops, including Good Sammy, and asked them to set aside jackets for her to buy. However, that was not a long-term, sustainable solution. She still has one op shop in Shenton Park, and they keep the jackets for her.
4. **Quality control:** Another problem is quality control. After going through all the jackets. there's only about 70% that's usable out of what they collect due to stains.
5. **Quality product:** Jackets require, just like doing a panel on the back, a specific type of panel. If it doesn't have that, it's much more time-consuming and intricate to place the artwork in other areas.
6. **Appropriate logistics:** Although Beck thought about opportunities to expand her business, and she had attended a few different networking events, logistics became an issue as Deadly Denim is only a one-person business. Beck said: *"I had been given a business card from someone from Coles, and I had thought about liaising with them and putting a recycled denim*

collection into stores. However, travelling store to store and collecting, sorting, and washing the pieces would be a full workload."

7. **Balance between two worlds:** The label is very much a small social enterprise, and Deadly Denim is very much based on the values of working with the community. Negotiating, sitting and balancing between two worlds has been a challenge. Being a single parent with financial responsibilities was challenging. Having to work in a guaranteed-paying job, which affected the business, limited the time she could allocate to growing it. You either just go for it and put everything into it, or you work a paid job and then do what you can in your spare time.

7.2.5 Opportunities

Beck is trying new approaches to address supply challenges. For example, they have branched out a bit and are making dresses from recycled clothing (Figure 13). Beck is encouraging other people to do other things when she is teaching people, as Beck said, *"I definitely say to workshop attendees, I don't encourage them to go home and just sew onto jackets. It is more about sharing the concept for reworking/re-designing … This is what you can do with any clothing. Anything that has something that allows you to sew fabric within a panel or a yoke. I'll just point out to them, and I'll show them like visuals. Sometimes I'll have a photo of a skirt or a dress showing reworking pockets or full garments and so on."*

Beck is called to deliver training sessions by government departments, Aboriginal women's groups, and Further Education (TAFE) and other organisations, which is very encouraging.

In general, Beck receives a lot of interest from the Deadly Denim community, and they often offer to send her jeans. However, Beck prefers to check before buying anything to make sure the quality is good. That is why she is not accepting donations. She also thinks such donations would add an additional burden to her existing loads. But she would support the idea of an Aboriginal-run textile hub in Perth, where people can connect and access various services, similar to what Beck has done in her workshops.

Not all Aboriginal designers use culture in their designs. They want to do their own thing. For example, Beck said, *"… I have a young friend who's done three years in fashion. She does not use any Aboriginal artwork in her clothing. And I think it's really interesting that consumers kind of demand that. She is still an Aboriginal designer, using Aboriginal art is not what makes it an Aboriginal design or designer, it's an interesting discussion."*

7.2.6 Circular economy innovation and considerations

Deadly Denim is a one-person-run business that strongly aligns with circular economy (CE) principles through its focus on repurposing textiles. With the right support, the project has the potential to expand significantly, creating job opportunities not only in production but also in training, social and economic empowerment, and the promotion of art and local artists. The community has shown strong interest in the unique items produced by Deadly Denim (Figure 15), highlighting its growing impact and relevance.

Core CE Principles Implemented:

- Extending Product Value: The project extends the lifespan of clothing by reusing and upcycling, redistributing refurbished items to the market and reducing textile waste.

- Waste Valorisation: Repurposing discarded materials and creating added-value products (e.g., old jeans and jackets turned into a new piece of textile using Aboriginal artwork).

Identify Innovations and Best Practices

- Innovative Recycling and Repurposing:
    - Community-driven initiatives of collecting Denim products and repurposing them.
    - With due support, this business has huge potential to grow and support the recycling community.
- Community-Led Model:
    - Women in the communities take ownership of this initiative, ensuring autonomy, creativity and authenticity.
    - The project may support the establishment of community-based enterprises beyond just Denim products.
- Leveraging Digital Solutions:
    - Currently 5,700 followers on Facebook. 160000 on the Instagram community enables direct communication between donors and recipients, streamlining donations and eliminating unnecessary shipping.

7.2.7 Summary findings and observations

Deadly Denim exemplifies the application of circular economy principles, particularly through its focus on repurposing waste and promoting community-driven initiatives that foster skills development and job creation. As a potentially scalable and innovative model, it offers valuable insights for broader community implementation. Nonetheless, the long-term sustainability and expansion of the initiative are contingent upon addressing critical challenges related to funding, supply, human resources, and the complexities of supply chain and logistics management.

7.3 Case Study 3: Taurus Mats

7.3.1 Case study context and background

Tyres are one of the most rigid and most resilient materials. Engineered from discarded tyres, Taurus Mats provide a simple, cost-effective solution to protect your livestock and reduce your environmental footprint. Founded in 2018 by Owen Henry, Taurus Mats was inspired by visits to several large cattle enterprises and firsthand experience of the benefits of woven tyre mats. The only option at the time for these mats was to import them from America. Drawing on experience gained in the agricultural equipment business and years of handling cattle, Owen decided to customise the technology and produce woven tyre mats locally in Australia.

With funding assistance from Tyre Stewardship Australia, Taurus Mats was formed to develop a solution involving low-energy upcycling of Australian scrap tyres. The use of mats means that, for hoofed animals such as cattle, slip-and-fall injuries are considerably reduced. Not only are injuries reduced, but, most importantly, the animal's overall well-being is improved by the comfort underfoot and the increased traction. The reduction in dust, abrasion, bruising and stress levels leads to

healthier animals. By caring for their animals and improving livestock handling, farmers ultimately benefit from cost savings.

Figure 16. Discarded tyres
(Taurus Mats, 2021)

Today, Taurus Mats is Australia's only woven tyre mat manufacturer. By providing high-quality "tyre tough" mats, Taurus Mats addresses two big issues – the humane treatment of cattle and the utilisation of the ever-growing stockpile of scrap tyres.

Owen lives with his family on a small farm at Yandina Creek on Queensland's Sunshine Coast and does all the processing from his own property. Owen grew up on a dairy farm, where he was always keen to use the resources available to him. That is how his journey started. He was determined to make something out of the tyres as he always thought of them as a resource that could be modified to make many things.

Although he never set out to be a tyre recycler, he ended up going down that route. Before this, he was working for an agricultural supplier. But he had always had an interest in waste products and spent a lot of time just mucking around with stuff. Sometimes he failed, but sometimes he had success. Owen said, *"I have spent a lot of time and energy to show people the process. When you are on that pathway, you need to figure out who's who in the zoo and just understand the industry a little bit better."* Owen believes that the way forward should be to go for options like low-carbon generated products.

7.3.2 Company/Organisation overview

Name: Taurus Mats

Founder: Owen Henry

Founded: 2018

Location: Yandina Creek on Queensland's Sunshine Coast

Size: Small Business

Core Business proposition: Recycling and repurposing tyres to customise the technology and produce woven tyre mats locally in Australia. Taurus Mats specialises in transforming end-of-life tyres—a major source of waste—into valuable, durable products. This is either performed from their SE Qld base or remotely using a transportable, sustainable process.

Business activity:

- Taurus Mats also provide training programs. The delivery of training programs enables remote communities to repurpose old tyres on Country, establishing self-sustaining micro-businesses.
- Repurposing is done locally, and the resulting mats are used locally. This minimises the vast emissions and costs associated with transporting bulky waste tyres to major recycling centres.

The process has been successfully demonstrated through several projects across remote Western Australia (WA), Western Queensland, and the Northern Territory, proving its feasibility as a transportable operation. The multipurpose matting has many different applications in the civil and agricultural sectors, with a cost of around AUD 80 per square meter.

7.3.3 Strengths/ facilitating factors

- Taurus Mats provide a non-slip surface that protects the livestock from slip, trip and fall injury and fatalities.
- The matting prevents erosion around high livestock traffic areas such as water troughs and feeding areas. This matting not only reduces hoof injuries but also saves time and money by filling in the holes.
- The mats are also helpful on difficult boat ramps.
- The mining industry utilises the durable rubber/steel composition of the matting to withstand traffic from cars, trucks and tracked machinery. It is also used as a blasting mat to prevent fly rock, minimise air blast, and suppress dust.
- Taurus Mats tyre tough matting offers erosion control and soil stabilisation solutions across a wide range of soil and substrate types. High-velocity water flow is reduced by the uneven shape of the mats and the soil beneath them, both of which are protected by the tyre rubber.
- The matting can be custom-made to protect truck and Ute trays from just about anything that can be thrown at it. Nothing comes close to the adaptability, durability, traction and strength of the woven tyre mat.

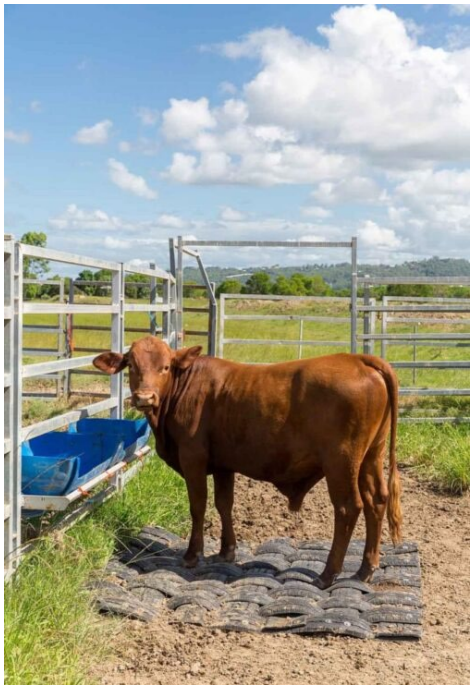

Figure 17. Livestock on tyre matting
(Taurus Mats, 2021)

7.3.4 Identified challenges and lessons learned

- The **actual shredding of the tyre process** can be a barrier. Tyres are a tough material. Responsible tyre recycling is expensive and energy-intensive, relying on heavy machinery. To be economical, these recycling plants need massive volumes of tyres, so they're usually in major cities. For instance, tyres from Alice Springs face a roughly 3000 km round trip to be processed in Adelaide.
- Most recyclers use a 30-ton Tana Shark shredder (costing $1.5 million) and a feeder excavator. This setup costs around $10,000 per hour to operate (excluding transport) and consumes 140 litres of diesel per hour. This makes tyre processing incredibly expensive and generates substantial emissions, particularly impacting regional Australia.
- In essence, profitable tyre recycling demands large volumes, requiring tyres to be transported to city-based plants. This process is fuel-intensive, highly polluting, and extremely costly. Consequently, remote Australia faces a significant tyre waste crisis. The high transport costs and sparse populations lead to harmful practices like illegal dumping and burning.
- **Marketing and sales** are another challenging area that Owen has identified. No matter how good the product is, Owen said, “at the end of the day you've just got to get it through to people in their way.”.
- **Funding** for heavy and expensive equipment is a challenge.
- Taurus Mats is a business operated by a non-Indigenous individual; however, it has garnered interest from remote Aboriginal communities seeking to learn and adapt the model within their own contexts. The community Elders (Yandina Creek) have expressed enthusiasm for the initiative, while also raising concerns about the logistical challenges of day-to-day operations after completing training. Owen has expressed a willingness to provide both training and product

support, but emphasises that **ongoing implementation must be community-led, in alignment with local cultural protocols and governance structures**.

- Maintaining the website and managing online promotion have presented ongoing challenges, particularly during periods of technical failure. Previously, a staff member was designated to oversee this aspect of the business; however, due to inadequate performance in fulfilling these responsibilities, the expected support was not delivered. As a result, Owen is now considering acquiring the necessary skills himself to ensure the website's stability and reduce reliance on external or underperforming personnel.
- **Ongoing promotion and marketing efforts remain essential yet challenging.** Owen noted that while initial expressions of interest from potential customers or investors are common, there is often a noticeable decline in engagement when it comes to making actual purchases or financial commitments. This gap between interest and action highlights the need for more effective strategies to convert interest into tangible support.

7.3.5 Opportunities

- This project can make significant contributions to **roads and infrastructure**. Owen is happy to trial it in communities where he believes there will be many discarded tyres. It would probably be suited to resource-rich areas where many tyres are consumed or discarded, for example, areas with ongoing mining and gas operations.
- This industry will create **opportunities for jobs** in the communities. Taurus Mats also offer training to upskill people. It may be for a weeklong course, delivered every six months, and they can have up to 10 people in those trainings. It is best to use local resources and infrastructure rather than uprooting people for such trainings.
- Growing global concern regarding environmental sustainability is driving increased efforts to recycle and reuse resources. Taurus Mats is committed to environmentally friendly products through sustainable manufacturing processes. The tyre-derived matting embodies a circular economy model by integrating waste management with reuse, recycling and responsible reprocessing activities; thereby reducing emissions and promoting efficient use of natural resources, including energy, water and materials.
- Tyres endure a vast range of surfaces and conditions during their practical life. Through re-engineering the hard-wearing, durable properties of tyres, Taurus Mats have been able to turn a wide range of long-term waste into a valuable resource. Upcycling locally sourced tyres using our low-energy manufacturing process yields a substantially lower carbon footprint than conventional tyre recycling processes.

Figure 18. Feedlot mat
(Taurus Mats, 2021b)

7.3.6 Circular economy innovation and considerations

Taurus Mats adheres to the principles of CE by focusing on recycling and repurposing tyres - a significant waste challenge identified by local communities, who have long struggled with tyre disposal. The company addresses this issue by investing in innovation, infrastructure and skill development. With the proper support, the project has the potential to expand and create job opportunities in production, training, and social and economic empowerment.

Core CE Principles Implemented:

- Extending Resource Value: The project captures the residual value of end-of-life tyres by recycling and converting them into new, functional products, returning otherwise wasted resources to the market.
- Waste Valorisation: Repurposing discarded materials into added-value products (e.g., waste tyres turned into tyre mats, vehicle tray mat protection, feedlot mats, blasting mats, traffic mats).

Innovations and Best Practices:

- Innovative Recycling and Repurposing:
    - With due support, this business has the potential to grow and support the recycling community.
    - Taurus mats provide a simple solution to cost-effectively protect the livestock and handle livestock in high traffic areas and reduce environmental impact.
    - This refurbished product is highly durable and can be installed very easily. They are portable, easy to manage, and versatile products.

- Social Benefits: Communities can be trained, and community members can take ownership of this initiative, ensuring autonomy, creativity and authenticity.

7.3.7 Summary findings and observations

Founded in 2018 by Owen Henry, Taurus Mats exemplifies the practical application of circular economy principles, with a strong focus on tyre repurposing, innovation, infrastructure development, and skills training. With adequate promotion and support, the initiative has the potential to inspire community-led efforts in tyre collection, processing, skills development, and job creation. As a scalable and forward-thinking model, Taurus Mats provides valuable insights for broader community adoption, including within Indigenous communities. However, the long-term sustainability and growth of the initiative depend on overcoming key challenges, particularly securing funding, building human capacity, maintaining digital platforms (e.g., the Taurus Mats website), and promoting and marketing the initiative.

7.4 Case study 4: containers for change

7.4.1 Case study context and background

Each year, Western Australians buy more than 1.45 billion 10c drink containers. Hundreds of millions of those containers are littered or end up in general waste bins. Containers for Change helps encourage more Western Australians to collect and return these containers, providing a 10-cent refund per container recycled. Containers for Change particularly targets commonly littered beverage containers, including plastic and glass bottles, as well as drink cartons, cans, and pouches. They want to keep these 10c containers out of general waste and help the community.

Foundation for Indigenous Sustainable Health (FISH) aims to provide opportunities for First Nations people to share their wisdom and insights with the broader community. This teaches people how to connect and care for each other and for the Country, whilst simultaneously closing the gap and breaking generational cycles of poverty, trauma, and engagement with the justice system. FISH was established in 2010. FISH opened an Outback Store Social Enterprise in Fitzroy Crossing in November 2022, focusing on training and employing local people, with revenue from the store going back into community initiatives to bring positive, long-term, sustainable change. FISH Outback Stores sell a wide range of outdoor products, from clothing, hats, and footwear to cattle station and camping accessories, guitars, and other outback supplies. The store also provides essential day-to-day items such as white goods, phones, electronics, toys, books, and Manchester goods. When you purchase from any of FISH's Social Enterprises, you know that your purchase is going directly back to artists, authors, and local businesses and making a difference to Indigenous Communities throughout Australia.

Alongside their retail shop, FISH has set up a Containers for Change refund point. Containers for Change was originally established and run by an organisation called WA Return Renew Recycle Ltd (WARRRL). The mission of the Container for Change program is to

- Empower communities with the knowledge and motivation to easily recycle.

- Provide a refund point network that is safe, stable, efficient, widely accessible, and financially sustainable.
- Build a culture that recognises and celebrates the positive impact of Containers for Change.

Figure 19. Containers for Change – Eligible containers
(Containers for Change, 2020)

FISH had been in discussion with WARRRL for a few years. They found the local provider in Fitzroy Crossing was not wanting to deliver the program anymore because it was quite complex. The number of compliance requirements that needed to be met was quite cumbersome and demanding.

Jason from FISH worked on the proposal and developed an entire Containers for Change depot from scratch within six weeks, investing directly into infrastructure collection containers.

7.4.2 Company/ Organisation overview

Name: Containers for Change as part of Foundation for Indigenous Sustainable Health (FISH)

Founder: WA Return Renew Recycle Ltd (WARRRL)

Founded: 2019

Location: Fitzroy Crossing

Size: Although it is a WA-wide initiative, this case study focuses on Fitzroy Crossing

Core Business proposition: FISH participates in the Containers for Change program, a scheme where individuals and organisations can earn a 10-cent refund for each eligible beverage container returned.

7.4.3 Strengths/positive aspects

- Although community members were not very familiar with what this program was trying to do, once the **purpose and motives were explained to them**, they liked the idea.

  "The cool part with some remote Aboriginal communities in the North West I have observed is they have this and thankfully it's still there it's like a 'chuck in' culture they all have like this centralised account they chuck into for certain things and their idea was well give us a bulk bags will fill them and will just get you to put funds into our bank account yeah yeah and everybody wins."

  When Jason was interviewed again to provide an update on their progress, he expressed optimism, highlighting **the increasingly positive feedback they have been receiving from community members** - particularly from younger individuals. This growing engagement from youth reflects a stronger sense of connection and interest in the initiatives being implemented, signalling that their efforts are resonating well within the community.
  "we've probably maybe 50% more capacity I think or processing volume now than we would have at the start of this game. So, I think as we've progressed, local people have started to sort of... The scheme is operating and fits for it. Again, we have a number of local super collectors which are basically containers for change enthusiasts that go out daily collecting containers from here, there and everywhere. And some of those are quite young…. Quite a young super collector workforce, getting around collecting things. So very cool."
- FISH only had to employ one person (locally) who can operate a pallet jack and sort the cans out. They want to keep this thing as simple and humanly as possible.
- In the first few days, they successfully processed 15,000 containers. One notable advantage was having the shed located next to the shop, which helped reduce operational costs. However, the greatest strength lies in the system's simplicity—it's designed so straightforwardly that anyone can walk in off the street and use a pallet with ease.
- Jason also recognizes the tangible impact this program is having, noting that it has significantly increased community awareness and influenced their practices around rubbish in the community. This shift suggests that the initiative is not only fostering engagement but also driving meaningful changes in how the community approaches its activities and priorities around waste.
  "Absolutely. Absolutely. From a local rubbish perspective as well, I've had quite a lot of exposure to Fitzroy Crossing over probably the last 10 years. And in times when the scheme wasn't in operation, you drive it to town and it wasn't really the greatest looking across the grass…. Areas in the middle of town you drive in there now because these super collectors are down there every morning, it's clear virtually all of the time. It's like this free waste management service. Now that's provided in town by these super collectors."
  Jason emphasized that the community's involvement in this initiative is not driven by financial gain. Instead, their motivation stems from a genuine desire to ensure that things are done correctly and to bring environmental safety. This commitment reflects a strong sense of responsibility from the community point of view.
  "… they get paid $0.10 a container but. But globally that's quite a low number. So the amount of interest we get locally is quite impressive considering that you know…. there is, there is some monetary aspect in it, but a lot of it is focused on recycling and, you know, doing the right thing."

- Jason said that they have just received their proper container infrastructure from Plain White, and it has been exciting to see it coming together. Once it is fully up and running, it is going to look incredible. Some people might think it looks a bit plain or dull, but if Jason said that anyone is into Tetris or enjoys seeing how systems are interconnected, they will appreciate how cleverly everything fits and works together. In a follow-up interview, Jason mentioned that they are working on implementing a new service agreement. The goal is to generate sufficient funds to cover administrative costs while also supporting the growth of other businesses—even if this sector does not become a major revenue source for FISH. Over the past few years, they have built strong relationships with a range of stakeholders who have the capacity to deliver this program. They want to be guided by the principles of Aboriginal protocols, which emphasise relationship-based approaches.

7.4.4 Identified challenges and lessons learned

Key challenges identified are discussed below:

- **Transport** is identified as one of the major challenges; however, WARRRL has committed to funding FISH to go to Nukenbar community. They have expressed the idea that once the team has got that going that will then fund Containers for Change to go to other places, too.
- Another big challenge is around managing refunds, as the current system needs individual customers to have their own number through a registration process using a technological interface, where users can set a preferred payment method. Jason observed that some Aboriginal communities in the North West have a centralised account where they pool money for shared purposes. Jason explained: "*Their idea was - give us bulk bags, will fill them, and will just get you to put funds into our bank account yeah and everybody wins."* Jason suggested that these existing community 'chucking in systems' – commonly used for funerals and cultural activities -, could provide an alternative for managing the Containers for Change refunds.
- To address this challenge, they have initiated discussions on leveraging individuals' CRN (Customer Reference Number), as it is something every person is familiar with. By using this known identifier, they aim to simplify processes and ensure smoother participation across the community.
- Ongoing **monthly risk assessments and stringent safety requirements** must be consistently checked and met to keep this initiative running smoothly. At times, the process is so rigorous that it can feel comparable to the safety protocols followed in the mining industry. For remote communities, these high standards can pose a significant barrier to setting up and sustaining such an initiative.
- Given the **vast geographical distances between remote communities in WA**, one of the key challenges has been effectively communicating when a new initiative or service becomes available. Jason has taken the opportunity to share this information during his visits to communities for other matters, helping to spread the word about the new Containers for Change facility. The response has been encouraging, with community members expressing interest and saying things like, "Oh, can we get on board with that?"
- Jason has also highlighted a logistical challenge. On a positive note, the program benefits from several 'super collectors' who gather bottles daily. However, accommodating these collected items can sometimes be difficult, even though FISH offers a range of solutions. For instance,

they provide a Dropbox where clients, particularly smaller ones, can conveniently deposit their containers. For the larger collectors, FISH provides a 'pseudo storeroom' at their depot where bottles can be dropped over the fence. However, these spaces fill up very quickly.

It does become a logistical issue, and when I think about it. So our depot has about 30 of the 1.2 by 1.2 steel industrial cages that we move around with the pallet Jack. In the last manifest collection we did, I think 20 of them were full.

So you're talking about a significant amount of containers in the yard waiting to be collected, and that can be, you know, six months' worth of stuff, like it can be really. Yeah, there's a pretty high turnover of containers."

- They have also faced staffing challenges, as Jason mentioned. *"It didn't really work out all that great from that employee's perspective. We employed a young Aboriginal woman to run the depot for a period. Of time. She kind of fell into the same sort of situation, so she needed to go home. She was originally from NSW, so she was from there. We sort of helped her get home…. It was really sad because we had a lot of things lined up for her to be able to do. And yeah, we just, we just didn't quite get there."*

  On the other hand, Jason shared that they recently welcomed a non-Indigenous volunteer who is highly educated and deeply passionate about contributing to community-based initiatives. To make the most of her enthusiasm and expertise, the team is actively working on designing and planning a program that aligns with her interests and accommodates her availability.

7.4.5 Circular economy innovation and considerations

The core CE principles that are addressed include:

- Extending Resource Value: The project captures the residual value of materials that would otherwise be discarded by collecting used beverage containers and feeding them back into recycling supply chains. The process of a bottle becoming another bottle can be as short as two weeks.
- Employment Opportunities: Benefits of this initiative are widespread, affecting all areas of life from the economy to the environment, including increased local employment and, when compared to processing new materials, significant reductions in both energy requirements and carbon dioxide emissions.
- Education and Skill Development: Lesson plans, student worksheets and a comprehensive education guide are among a range of new resources set to help the rollout of Containers for Change throughout WA schools.
- Community Involvement: This program creates an exciting opportunity for communities to support local groups, sporting clubs, and charities by donating their 10c refund. In our first year, $2.5 million in refunds was donated to Western Australian community groups and charities through Containers for Change.

7.4.6 Summary findings and observations

FISH is a participating organisation in the Containers for Change programme, which is a recycling scheme established to help keep Western Australia beautiful. Its primary goal is to empower communities by providing the knowledge and motivation needed to easily recycle. The program

provides a refund point network that is safe, stable, efficient, accessible and financially sustainable. By doing so, it helps accelerate recycling rates and reduce litter across the state, including remote Aboriginal communities. As part of this program, WA residents can return eligible empty containers for a 10-cent refund, which they can either keep or donate to a registered charity, community group, or not-for-profit organisation, such as FISH. Despite its many benefits, the scheme faces several challenges, particularly in remote areas, including managing and facilitating refunds, the vast distances between towns, transportation logistics, and effectively communicating when a new initiative or service becomes available.

7.5 Case study 5: biochar from wood waste

This case study intentionally focuses on an early-stage business concept rather than an established enterprise to capture the critical formative phase where ideas, values, and feasibility are first shaped. Examining the concept at this stage enables a deeper understanding of the unique challenges faced by business ideas emerging from Aboriginal communities, including barriers related to resources, governance, capacity, and market access before maturation.

Additionally, this early-stage lens provides valuable insight into how culturally grounded ideas evolve into potential enterprises, highlighting opportunities for meaningful partnerships, knowledge exchange, and co-development. It also allows exploration of emerging, context-specific opportunities—such as biochar production—while identifying the support mechanisms required to transition from concept to viable, community-led business.

7.5.1 Case study context and background

“Kindling the Spirit: Singing Down Carbon to Singing up Spirit” Project is a social enterprise concept and an early-stage business model shared by Elder Uncle Noel Nannup, who is Nullarbor-Yinjibarndi from his mother’s side and Wadjuk-Nyungar from his father’s side. He is considering implementing this in the Southwest of WA, His Country. The vision is to create a world where traditional and scientific knowledge systems work in harmony to address the climate crisis. It is becoming clear that climate change is uninsurable. The carbon-negative economy needs to become as big as the fossil fuel industry is today. Combustion is becoming a relic of last-century technology, and the circular economy is a flourishing industry. Biochar producers in Australia cannot keep pace with demand.

The biochar industry has the potential to use low-cost technologies to utilise forestry and agricultural residues, improve soil health, generate bioenergy, enhance agriculture, and feed multiple revenue streams. It is recognised as the world's largest negative-emission methodology and is the most significant acknowledgement of ancient technology. Traditional cultural practices have four pillars: a social order, a governance model, a six-season cycle and a totemic system. Additionally, places have their own stories, songs, dances, and art. Knowledge is transmitted through these cultural systems, which would remain latent in the land without human engagement.

This proposed project aims to provide biochar services using songs, dances, stories, and art to mitigate climate change and improve soil health. The project is rooted in Aboriginal ways, ready to roll out. It's perfect for setting up a fair-dinkum business where everyone's equal, with at least half of the workforce is First Nations people right through the ranks. Biochar can be produced on a small

scale in backyards or on a large scale by pyrolysis facilities operating continuously and producing several tonnes per hour. It can be applied as a soil amendment, stock feed, building material, or in various electrochemical applications. As a tool for ecosystem restoration, benefits include increased water and nutrient retention, stimulated microbial and mycorrhizal growth, and enhanced root growth.

This project will involve First Nations peoples at all levels of management and operations and will have two arms:

Commercial arm:

As part of this arm, the project will

- Produce high-quality biochar and wood vinegar from a sustainable feedstock source.

Social arm:

As part of this arm, the project will

- Run educational workshops for students, focusing on how to make and apply biochar in the backyard
- Extend this to forestry-based, large-scale programs and
- Run vocational programs connecting Indigenous adolescents and young adults to the biochar industry.

7.5.2 Company/Organisation overview (concept stage)

Name: Kindling the Spirit: Singing Down Carbon to Singing Up Spirit

Founder/Core Idea: Nyoongar Elder Uncle Noel Nannup, Australia

Location/Mob: Nyoongar people of the Southwest of Western Australia

Core Business proposition: Manufacturing biochar from wood waste and sharing Aboriginal knowledge and skills.

7.5.3 The value proposition

Figure 20 shows the multifaceted benefits of the proposed biochar business model, in which the business will operate as a social enterprise by producing biochar from both forestry and urban wood waste. In addition, the model offers cultural aspects, including sharing Aboriginal knowledge and skills through training and educational programs.

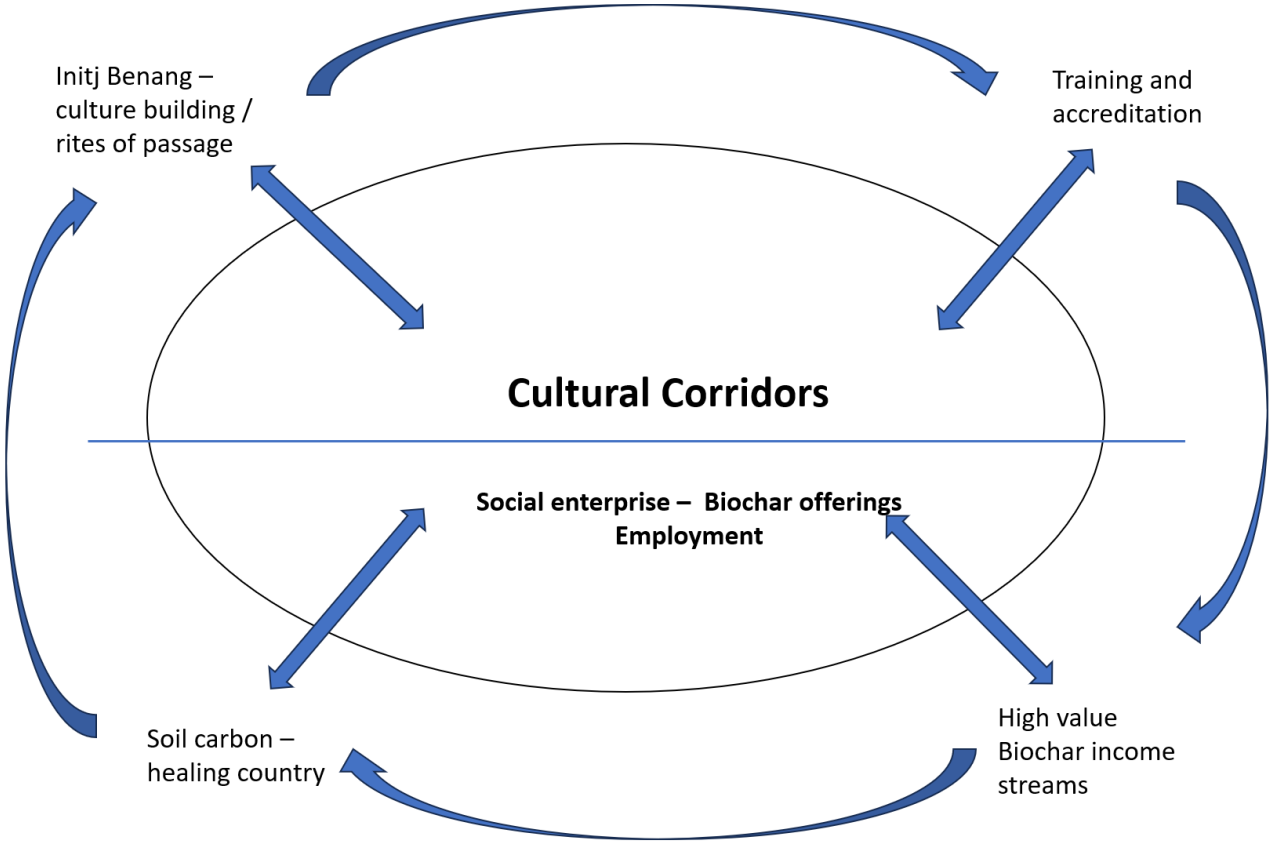

Figure 20. The value proposition of the biochar from the wood-waste business

The business offers various short-term, medium and long-term benefits as presented below:

- **Short term:** In the immediate future, the biochar project will enrich the community through educational workshops that blend cultural knowledge with practical environmental care. Training local leaders in both Aboriginal knowledge and Western scientific approaches will empower individuals within the community. Furthermore, direct action by schools and community groups to restore soil carbon and apply biochar to local green spaces will lead to visible improvements in these areas, fostering a sense of collective contribution and environmental stewardship.
- **Medium term:** Over the next few years, the project will deepen its impact by embedding the educational workshops and leadership training within the community's fabric. The introduction of festival programs held on Country will provide broader opportunities for education, skills development, and cultural immersion. Simultaneously, research and development into a biochar product line will lay the groundwork for potential economic opportunities and broader application of this soil-enhancing technology, further benefiting the community and environment.
- **Long term:** Looking ahead, the biochar project envisions expanding its reach to a catchment-wide level, amplifying the benefits of community workshops and leadership training across a larger geographical area. Participation in carbon-credit initiatives through large-scale biochar and soil-rehabilitation programs will generate environmental benefits and potential economic returns for the community. Establishing a biochar product line and expanding its market

presence will create sustainable economic opportunities while promoting widespread adoption of this environmentally sound practice.

7.5.4 Identified challenges and lessons learned

Several key challenges are anticipated for the initial phase of the "Kindling the Spirit" business idea. A fundamental prerequisite will be **establishing dependable and sustainable access to wood waste from both forestry operations and urban sources**. This will necessitate proactive engagement with potential feedstock suppliers, careful transportation logistics planning, and navigating any competitive pressures in the feedstock market.

Furthermore, while the project intends to utilise **accessible biochar production approaches grounded in Aboriginal knowledge, mainly for knowledge sharing and skills development, the Nyungar community will need to develop the required technical skills and potentially invest in the infrastructure to support both smaller community-based** pyrolysis units and larger-scale facilities. Initial lessons will involve a thorough evaluation and selection of appropriate technologies, the implementation of comprehensive training programs for community members on equipment operation and maintenance, and the systematic troubleshooting of any technical obstacles encountered during commercial production.

Building a viable market for the biochar product will also be critical to the enterprise's commercial sustainability. This will involve **effectively communicating the diverse benefits of biochar – whether as a soil amendment, animal feed supplement, or in other applications – to potential customers and establishing efficient distribution networks**. Early efforts will focus on conducting thorough market research, developing a strong brand identity, and cultivating relationships with prospective buyers across various sectors.

A unique and central challenge lies in the **authentic and respectful integration of the four pillars of traditional Nyungar cultural practices (social order, governance, the six-seasons cycle, and the totemic system) alongside the artistic expressions of song, dance, story, and art within the business's operational framework and educational programs**. Early lessons will undoubtedly emerge from the careful, considered processes of identifying meaningful, appropriate ways to weave these cultural elements into the project's activities, ensuring they genuinely contribute to the vision of harmonising traditional and scientific knowledge systems.

The project's commitment to **ensuring at least 50% participation by First Nations people across all levels and to** establishing a business founded on member equivalence presents a distinctive **governance challenge**. Initial efforts will likely focus on developing transparent and effective organisational structures, clearly defining roles and responsibilities, and establishing inclusive decision-making processes that balance the business's operational demands with the community's values of equity and collective ownership.

Finally, demonstrating the tangible social and environmental impact of the project, in terms of climate change mitigation, soil health improvement, and the achievement of its social objectives, will be crucial for **securing ongoing support and potential investment**. Early lessons will involve identifying relevant metrics to measure these impacts and developing clear, compelling

communication strategies to effectively share the project's successes and learnings with stakeholders.

7.5.5 Circular economy innovation and considerations

The idea inherently embodies several key circular economy principles. At its core lies a robust **waste-to-resource transformation** innovation that converts wood waste – a material often considered a disposal burden – into a valuable product, biochar, with various beneficial applications. This directly addresses the fundamental tenets of waste reduction and the efficient utilisation of resources. Furthermore, the project leverages the significant **carbon-negative potential** of biochar production and its application in soil. Recognised as a key method for carbon sequestration and nature regeneration, this aligns directly with the principles of a carbon-negative economy, positioning the initiative as a proactive contributor to climate change mitigation within a circular framework.

By prioritising the use of **local and regional material loops** for both sourcing wood waste and potentially serving local and regional markets for biochar, the project aims to create more localised and resilient supply chains. This approach minimises transportation emissions and fosters regional economic development, further strengthening its circular credentials. The transformation of wood waste into biochar and, potentially, wood vinegar represents **value-added biomass processing**. This moves beyond simple waste disposal, creating new economic opportunities and highlighting the potential of circular economy models to generate revenue streams from previously underutilised resources.

A particularly innovative aspect is the **integration of Traditional Ecological Knowledge**. Incorporating Aboriginal land management practices and ecological understanding offers unique insights into sustainable resource utilisation and ecosystem restoration, enriching the project's circular economy approach with a deep understanding of the local environment. The diverse potential applications of biochar, ranging from soil amendments and stock feed to building materials and electrochemical uses, indicate the potential for a **diversified product portfolio**. This adaptability can cater to diverse market demands and further optimise the utilisation of the biochar produced within a circular economy.

The core of this business idea is founded on a **social enterprise with a strong focus on local community and First Nations people's participation**, aligning with the broader goals of a just and equitable circular economy transition. This ensures that the environmental and economic benefits are coupled with positive social outcomes, taking into account the human dimension of sustainability within the circular model.

7.5.6 Summary findings and observations

Although the business is still in its early stages, it offers valuable circular bioeconomy solutions for the Aboriginal community. This project is important because it uses existing and proven technologies that can be replicated. It is based on traditional practices, ready to implement, and applicable at various scales. The project could be realised by forming an enterprise that comprises at least 50% First Nations people's participation at all levels of management and operations, and that values and actively engages the contribution of all members. Implementation will accompany education and

training, which integrates song, dance, story, and art to awaken consciousness, activate participation, and inspire practical action.

7.6 Cross-case analysis and circular business strategies

Based on the findings from the yarning sessions, participants from business organisations reported that they directly and indirectly provide services to multiple Aboriginal communities, including (but not limited to) the Whadjuk Noongar Community and the Ngunenbar Community in Western Australia, the Jilkminggan Community in the Northern Territory, and the Gubbi Gubbi (Kabi Kabi) Community in Queensland.

It is important to note that we have identified only a small number of Indigenous-owned businesses focusing on waste and recycling. Aside from the Remote OpShop, most are very small, organically developed, and often driven by a single individual. These businesses commonly face similar challenges, including limited funding, logistical and resource constraints, lack of manpower, underdeveloped and/or ad hoc supply chains, unregulated dumping, and issues related to waste collection. The Remote OpShop is the largest and most established among the five businesses featured here. Some of the key takeaways are mentioned below:

- Engaging with Aboriginal communities to identify local, area-specific waste-related issues and priorities is essential for effectively developing and implementing relevant policies and programs at all levels.
- Community support is vital for the success of any initiative in Aboriginal communities. A key strength highlighted among the businesses was their integration of local cultural elements into their repurposing efforts, ensuring that the initiatives are both meaningful and culturally grounded. Additionally, strong networks of support among community businesses often help boost business owners' confidence and resilience.
- Social media and digital platforms have been effectively utilised for promotion, engagement, marketing, and item sales, playing a key role in increasing visibility and connecting with wider audiences.
- Most of the businesses have incorporated training, skill development, skill-sharing and vocational or educational activities into their programs. This demonstrates a commitment not only to their own growth but also to building the capacity of future generations and creating meaningful job opportunities for them.
- Some of the business owners held strong ethical values and expressed concerns about collaborating with entities known to engage in practices such as child labour or fast fashion.

Table 2. Summary for the cross-case analysis of the businesses.

Aspect	Remote Op Shop	Deadly Denim	Taurus Mats	Containers for Change	BioChar from Wood Waste
Founder/ Initiator	Tanya Egerton	Beck Barlow	Owen Henry	WARRRL/FISH	Uncle Noel Nannup
Year Founded	2016	2018	2018	2019	Concept Stage
Location	Northern Territory & WA	Perth, WA	Sunshine Coast, QLD	Fitzroy Crossing, WA	Southwest WA
Core Business	Second-hand goods distribution	Repurposed denim fashion	Recycled tyre mats	Container recycling refunds	Biochar production & education
Challenges Addressed	Affordable goods, waste management, and economic opportunities	Textile waste, economic empowerment, and cultural representation	Tyre waste, livestock safety, and erosion	Beverage container waste, litter, and community employment	Climate change, soil health, and cultural integration
CE Principles Applied	Durability, reuse, waste valorisation, closed-loop systems	Textile reuse, waste valorisation, community-led model	Waste valorisation, durability, recycling	Reuse, recycling, local employment, waste-to-resource	Waste-to-resource, carbon sequestration, local circular loops
Innovations/ Best Practices	Community autonomy, digital donation platform, cultural upcycling	Workshops, cultural artwork integration, and recycled fashion	Customisable, durable mats, portable production, and training programs	Community-based refund systems, educational programs, and local job creation	Cultural integration, educational outreach, and carbon-negative tech
Strengths	Strong community model, empowerment, digital engagement	Strong community support, empowerment and unique product appeal	Product durability, versatility, and environmental benefits	Simplicity, high engagement, proven financial incentives	Cultural richness, scalability, and strong climate action potential
Challenges	Infrastructure, funding stability, logistical complexities	Funding constraints, supply logistics, and growth management	Funding, marketing, operational logistics	Transport logistics, compliance, and technological barriers	Feedstock supply, tech infrastructure, cultural integration
Opportunities for Expansion	Further infrastructure, broader community reach, and sustainable funding	Expansion into broader fashion markets, larger-scale recycling efforts	Wider industrial application, community-led operations in remote areas	Expansion to more remote communities, increased community engagement	Larger-scale biochar production, carbon credits market
Potential Impacts	Model for remote community resilience, significant environmental/social benefits	Scalable, sustainable fashion model, impactful community empowerment	Practical CE solution for tyre waste, high environmental & economic benefits	Effective, scalable recycling initiative, proven community benefits	Strong potential for impactful climate solutions, significant community benefits

8. Discussions and Conclusions

Waste management issues among Indigenous communities pose significant challenges. This report used the DPSIR Framework to categorise the waste management problems and circular economy solutions identified from the literature review. Drivers of waste problems include economic, physical, and non-physical factors, such as a lack of infrastructure, long distances to waste facilities, limited waste collection services, and inadequate end markets for recyclables. The identified pressure factors relate to the need to address significant disparities in remote Australia and to government commitments to combat climate change and realise the SDGs. Unsustainable practices have adverse impacts not only on the environment but also on human health.

Illegal dumping, uncontrolled landfills, and waste burning characterise the environmental state in communities with waste management issues. The identified impacts were groundwater and soil contamination, air pollution, habitat destruction, and hazards to human health. To address challenges identified through the drivers, state, and impacts, there is an opportunity to introduce circular economy practices that can retain product value, create local job opportunities, eliminate waste and pollution, and improve the local environment and human health. The solutions outlined are part of circular responses to the waste management issue in remote communities.

The literature review findings indicate that although there has been some progress in improving waste collection and waste transport, and in certain stages of waste reprocessing, there remains a lack of comprehensive programs to enhance source-to-source and end-market development. Better application of the DPSIR framework involves using it at local scales. This means that place-specific aspects, including knowledge and even perceptions, enable more effective assessments of the environment's state, thereby improving the quality of solutions.

The yarning sessions highlighted important cultural insights, notably the Aboriginal perspective that rejects the concept of waste altogether, viewing all materials as valuable and integral to a regenerative relationship with Country, unlike modern, economically driven societies, where waste becomes disconnected from the individual. The Aboriginal Way of Living emphasises that humans are deeply interconnected with their environment, promoting respect and care for land through reciprocal practices. Unfortunately, modern education systems and lifestyles have diminished this inherent responsibility for land management, as contemporary behaviours are shaped mainly by convenience, economics, and urban contexts rather than by cultural values and the stewardship of natural resources.

Furthermore, knowledge in Aboriginal communities is not just information but a responsibility, traditionally transmitted through oral storytelling. Restoring sustainable land-care practices requires reconnection to this knowledge system, fostering a deeper understanding and appreciation of the land and its role in community well-being. Such reconnection can bridge traditional Aboriginal knowledge and contemporary education systems, offering localised solutions grounded in cultural values. Participants identified that creating or re-establishing this connection through education and awareness on Country is critical in promoting sustainable waste management practices, which culturally appropriate and community-led business initiatives could effectively support.

Lastly, practical challenges such as illegal dumping, particularly of bulky items like mattresses, emerged prominently in discussions. Field observations during the yarning circles indicated that illegal disposal is facilitated by accessible yet secluded locations, highlighting significant environmental and community concerns. These practical findings from the yarns align closely with insights from the literature and are clearly reflected in the DSIPR models, which capture these challenges through an Aboriginal value-driven lens. Addressing such waste management issues effectively requires community empowerment through culturally informed solutions and greater awareness of traditional land stewardship practices, ultimately fostering sustainable behaviour change.

There are various key takeaways from the yarning sessions conducted, including:

- In Aboriginal culture, private ownership did not exist - everything was shared to maintain the balance within the ecosystem. As a result, excess was never an issue, and waste was not really something Aboriginal peoples are prone to managing naturally, as it was not created in the first place. On the contrary, the way Aboriginal peoples would move through and interact with the land would help regenerate it, allowing it to continue to provide sustenance for others. This is a sustainable approach in which Aboriginal peoples live in harmony with nature, driven by their love and respect for the Country.
- People do not own their waste as they used to; there are several reasons for this: the current education system is not enough to instil care for the land, society is mostly money-driven, commercial, and consumer-oriented rather than value- or land-driven (i.e., modern lifestyles).
- People's behaviours and habits are shaped by their context and surroundings. Loss of traditional kinship models and modern lifestyles have contributed to the erosion of traditional land-caring practices that are central to Aboriginal cultures.
- Knowledge is a responsibility in Aboriginal cultures. Oral traditions were the means by which knowledge was transmitted among Aboriginal communities.
- To instil care for the land, it is essential to understand it and its significance, and initiatives should be taken not only at the family and community levels but also at schools.
- There is a deep connection between the Country and Aboriginal peoples. Such connections can be fostered or created by learning about the land. As awareness and education on the land are required to create better waste management practices, including community-led business proliferation, imparting knowledge about the land becomes a priority.
- The transmission of Aboriginal knowledge can take two main forms: localised, which involves sharing and practising Aboriginal land values and knowledge within communities; and systemic, which integrates these knowledges into the broader, modern education system.
- Community-led business initiatives were proposed to address waste that is often illegally dumped, particularly mattresses, tyres, furniture, etc.

- Illegal dumping emerged as one of the key issues highlighted during the yarning circle discussions. Field trips further revealed how easy it is to dispose of waste unnoticed, with many accessible areas and side trails where people can drive in and dump rubbish without being detected.
- Insights from the yarning sessions align with the literature review's findings, particularly regarding waste issues. Pressures and responses stem from a more focused, Aboriginal value-driven perspective. This is better outlined in both DSIPR models (Figures 2 and 21).

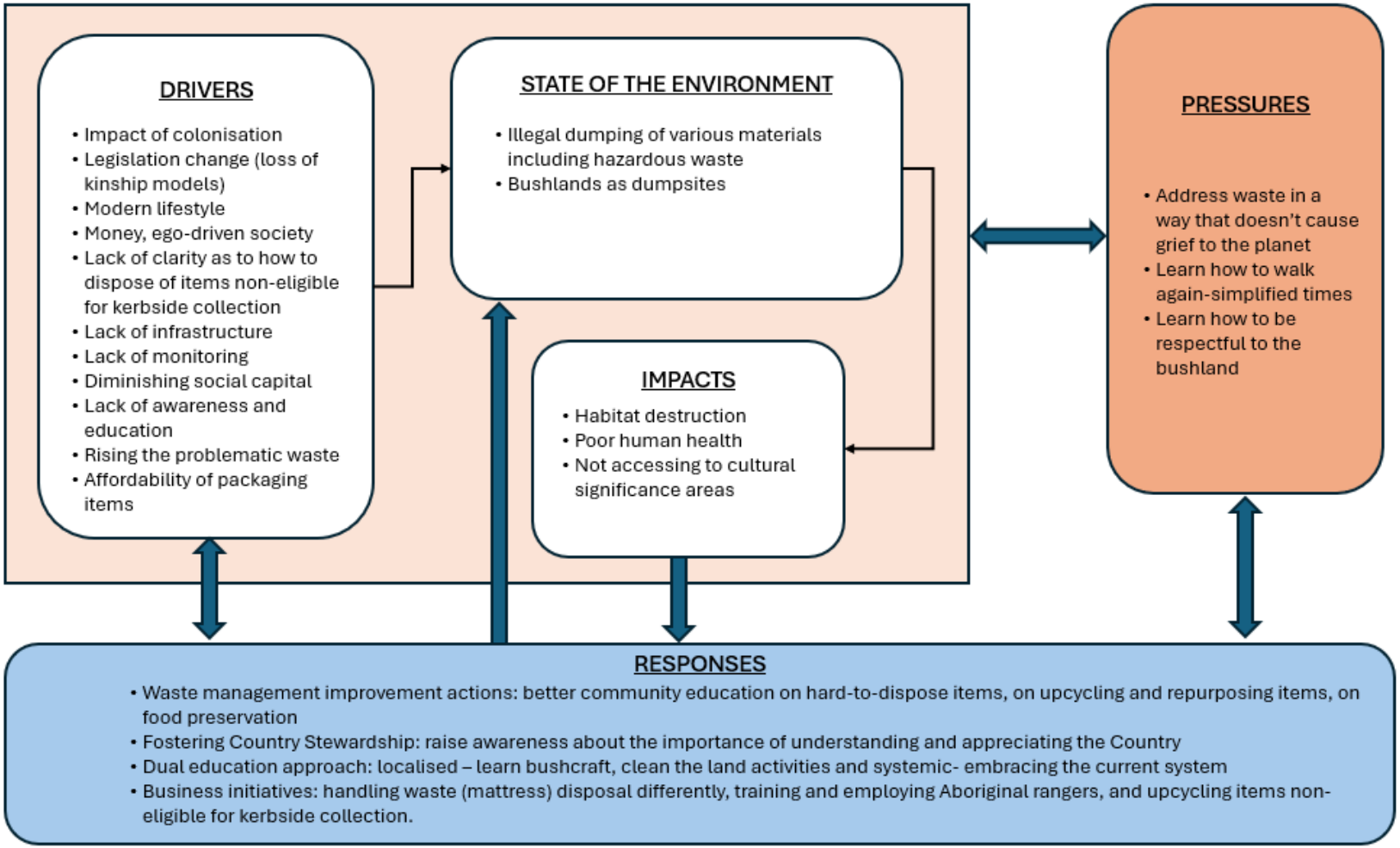

Figure 21. Yarning circles outcomes: (Driver-Pressure-State-Impact-Response)
Source: the authors.

8.1 Key findings to address waste issues

The rationale behind the project was to make DPSIR-based assessments place-specific by incorporating local knowledge, perspectives, and goals of key stakeholders—such as community groups, individuals, and financial supporters—into the planning, design, and implementation of initiatives (Carr et al., 2007). This approach involved consultations with the Aboriginal community Elders and young members through group discussions (yarning circles) to explore waste management issues, identify priorities, and discuss potential circular economy solutions.

This study acknowledges the importance of honouring Aboriginal cultural protocols in community consultations. In many Indigenous contexts, research is often viewed with distrust due to past practices where it was conducted inappropriately and without meaningful benefit to the communities involved. Historically, researchers have taken knowledge without consent or reciprocity, leading to a legacy of harm. Studies have shown that the absence of informed Indigenous consent can significantly affect the integrity and outcomes of research. (Fitzpatrick et al., 2017). The ATR framework guides this research project. Government bodies and relevant agencies should give thoughtful consideration to the findings. Community Elders and young people participated with genuine enthusiasm, openly and honestly sharing their perspectives. Their contributions deserve to be respected and valued. It is important to note that failing to consider on their input risks damaging trust and may hinder future engagement and collaboration with these communities.

The following are the key findings from the yarning circles and the business cases:

Family level findings:

- Families need to be informed, engaged and educated about the environmental issues, waste problems, and consequences. The programs should be catered for both adults and children so that the whole family can participate and learn together.
- Families can be taught simple strategies to recycle and refurbish. However, knowledge alone will not resolve the issue, and their small initiatives need to be supported by the Councils, local businesses, or organisations.

Community level findings:

- **Community-based funding must be increased** to enable the development and sustainability of community-led initiatives. Bunnings, for example, can be funded to provide training to the community members, helping them to start various community initiatives, such as vegetable gardens, composting, and other gardening skills.
- Community-led initiatives for waste clean-up, such as *Clean Up Australia*, were frequently highlighted as positive and meaningful experiences. These efforts reflect the value of collective responsibility and care for the Country. There is a clear need for **more Aboriginal peoples to be trained and employed** in environmental services and business.
- The way forward in fostering a healthier and more sustainable future is a return to traditional practices rooted in sustainable resource use, environmental stewardship, and a deep respect for the cultural significance of the land.

- **Social media** can serve as a powerful platform for promoting opportunities related to a sustainable future, facilitating education, and enhancing communication both within communities (intra-community) and between diverse groups (inter-community) and stakeholders.

Local government level findings:

- **More hands-on, localised approaches** to education can be developed and promoted.
- **Formal, system-wide education**—delivered through schools, universities, and other institutional frameworks—should play a pivotal role in driving this transformation by strengthening connections to Country. This involves teaching not only how to care for the land, but also why such care is important, incorporating the methods, meanings, and values that underpin these practices.
- **Local councils should play a pivotal role** in initiating and supporting local business opportunities that benefit the community. These initiatives should aim to generate employment, build skills, and contribute to families' socio-economic well-being while addressing local waste management issues.
- **Genuine collaborations and partnerships are needed between multiple and multi-level agencies** to have meaningful employment and support new or small businesses within the communities.
- A lot more advertising and campaigns are needed to reduce waste, emphasising both the negative impact of waste and the positive outcomes of proper waste management.

Federal government level findings:

- Accounts of how Aboriginal peoples have traditionally cared for the land reveal practices that closely align with the principles of a circular economy. These sustainable, regenerative approaches to resource use and environmental stewardship offer valuable insights for modern environmental policy. The findings indicate that, despite this alignment, current national-level policies, legislative settings, and **regulatory frameworks do not consistently embed Aboriginal knowledge systems and land management practices within mainstream environmental governance structures**.

It is also necessary to assess the viability of the business models suggested herein. Other considerations, such as logistics and necessary infrastructure, must also be considered. Importantly, while the community could lead this potential solution, future research should focus on developing business models that prioritise improved waste management practices while integrating Aboriginal culture, values and Country knowledge.

8.2 Key findings from businesses

- **Recognition for the need for a Dedicated Indigenous Circular Economy Business Network/Hub:** There is a need for a formal or informal network for Indigenous-led circular economy business initiatives in Australia. This proposed hub could facilitate business knowledge sharing, mentorship, collaboration, access to funding information, and collective advocacy. It could also host workshops, online forums, and networking events.

- **Targeted funding and grant programs:** Advocate for and develop specific funding streams and grant programs tailored to support Aboriginal circular economy businesses. These programs should consider the unique challenges faced by remote communities and early-stage enterprises, offering patient capital and culturally appropriate application processes.
- **Facilitate partnerships and collaborations:** Actively involve and facilitate partnerships between Aboriginal and non-Aboriginal organisations, governmental agencies, and research institutes and enable collaborations on circular economy solutions while addressing issues in regional and remote communities.
- **Invest in skills development and training:** Expand training programs that combine business skills with circular economy principles and culturally relevant practices. This could include workshops on sustainable design, waste management, upcycling techniques, digital marketing, and financial literacy.
- **Support infrastructure development:** Recognise the infrastructure limitations in remote communities and invest in solutions that support circular economy activities. This could include funding for storage facilities, processing equipment (like small-scale biochar pyrolysis units or textile upcycling machinery), and improved waste management systems.
- **Promote awareness and market access:** Develop campaigns to raise awareness about Aboriginal circular economy businesses and their products/services within broader markets. Facilitate access to online marketplaces, ethical sourcing platforms, and retail partnerships.
- **Champion policy and regulatory support:** Advocate for policies and regulations that support circular economy initiatives in remote Aboriginal communities, such as preferential procurement for sustainable and Indigenous-led businesses and streamlined permitting processes for environmentally beneficial activities.
- **Incorporate cultural values and practices:** Recognise and support the integration of traditional Aboriginal knowledge and cultural values into circular economy practices. This can lead to unique and culturally relevant solutions for waste management, resource utilisation, and environmental stewardship.

8.3 How findings from this report inform the next phase

The findings and observations presented herein play a critical role in informing the next phase of the project. Specifically, they provide:

Contextual Grounding: The findings offer a nuanced understanding of the cultural (e.g., Aboriginal deep connection to and respect for the land), and institutional conditions in which waste-related opportunities and challenges arise. This is essential to ensure that the plan developed to tackle waste issues in rural and remote Aboriginal communities is context-specific and avoids a one-size-fits-all approach.

Priority areas: The Ideas, suggestions and concerns raised during the yarning circles and the business case study analysis help shape focus areas (e.g., challenging waste streams, lack of infrastructure) to be addressed.

Barriers and Enablers: The observations shed light on potential drivers and constraints to consider when designing practical interventions, particularly those targeting the identified priority areas.

Stakeholder Mapping: The insights help identify which key actors (e.g., local councils, schools) should be engaged during the implementation phase and what roles they can play.

8.4 Limitations of the study

This study is based on participation from a limited number of individuals who attended the scheduled engagement activities. Across the yarning sessions and the validation workshop, participation ranged from 3 to 6 participants per session, including Elders and community representatives. Specifically:

- 6 participants contributed to discussions on waste perspectives and impacts;
- 3 participants attended the solutions-focused session (notably affected by the timing of the national referendum period);
- 5 participants engaged in broader solutions discussions;
- 6 participants participated in the feedback and validation session.

While these participants provided rich, experience-based insights, they represent those who were available and willing to attend on the day, rather than a statistically representative sample of the wider community or geographic region. Accordingly, the findings should be interpreted as context-specific and indicative, rather than generalisable to all Aboriginal communities or locations.

Therefore, participation levels were influenced by cultural, social, and logistical factors, including community calendars, mobility, competing commitments, and broader socio-political circumstances at the time of engagement. These dynamics are common in place-based and community-led research and form part of the contextual realities within which the study was conducted.

Another limitation of the study arises from the participatory nature of the yarning sessions. While these sessions generated valuable, community-led insights, discussions often took an organic, spontaneous direction rather than being strictly confined within the pre-defined research objectives. As a result, the proposed solutions did not always directly address the identified issues, potentially

affecting the consistency and comprehensiveness of the findings with respect to the study's intended outcomes.

Moreover, the study focuses on Aboriginal communities and excludes Torres Strait Islander groups. Additionally, translating oral traditions and nuanced cultural understandings into actionable policy or business practices poses challenges, as these are deeply tied to the particularities of local contexts and might not be readily scalable or universally applicable.

Another limitation arises from the gap between traditional Aboriginal knowledge systems and contemporary educational or economic frameworks. Integrating culturally driven practices into modern systems involves navigating complexities around governance, funding, and operational logistics, which could affect feasibility and effectiveness. Furthermore, the focus on specific waste management issues, such as illegal dumping of mattresses, may not encompass the broader spectrum of waste types or the associated complexities experienced in Aboriginal communities across Australia.

Relying on participant self-reported and observational data from field trips may introduce biases or omissions in understanding the underlying structural factors that influence waste management practices. Further empirical validation through broader quantitative research or longitudinal studies is necessary to strengthen these insights, confirm their relevance beyond the studied contexts, and effectively guide policy and practice toward circular-economy solutions.

In the case study analysis, five businesses were examined, all of which were directly or indirectly linked to Aboriginal communities. However, only two of the case study business owners or leads were identified as having an Aboriginal background, as very few Aboriginal people are involved with the waste-related business.

Overall, the findings presented here remain valid within the scope of an exploratory, place-based qualitative study. They should be viewed as an essential first step that highlights priorities, experiences, and locally grounded opportunities to guide subsequent stages of research, policy development, and implementation across Indigenous communities.

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