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Creating effective waste management behavioural interventions: are municipal councils in small island developing states on track?

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ABSTRACT

Municipal councils are the principal agents that manage solid waste and advocate sustainable practices in many countries. This is the case for many small island developing states in the Pacific, which experience high pollution rates and low rates of community-based recycling. The behavioural aspects of sustainable solid waste management are less studied and documented in the Pacific region compared to investigations about the socio-economic, technical and infrastructural factors. More rigorous reviews of council-led programs are needed to provide insights into best practices and the pitfalls to avoid for prospective behavioural programs. This study systematically reviews waste management interventions implemented by five municipal councils in Fiji from 2000 to 2019. The interventions span across three strategic areas – schools, homes and farmer's markets. This article assesses these interventions using the social marketing benchmark criteria, which are useful for evaluating behavioural interventions. Our findings indicate that local authorities are reliant on traditional communication channels, rather than interactive platforms, to communicate with end-users. Another important finding is that interventions lack user-centric design to elicit user engagement. Moreover, this article discusses alternative pathways to recycling and composting for communities and the type of behavioural strategies needed at schools to enhance pro-environmental attitude and behaviour.

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Change of behaviour; interventions; small island developing states; social marketing; waste management

1. Introduction

Globally, households are generating more than two billion tonnes of municipal solid waste each year (United Nations Development Programme 2024). By 2050, this volume is expected to rise by more than 70 per cent (reaching around 3.4 billion tonnes) if current consumption patterns continue along with sub-optimal disposal measures (Valavanidis 2023). Additionally, the industrial sector (i.e. farms, construction sites, factories and hospitals, amongst others) generates large amounts of environmental pollutants, such as greenhouse gases, that contribute to climate change (United Nations Development Programme 2024; United Nations Environmental Protection Agency

2023). Hence, it requires all constituencies (including industries, municipalities and households) to prioritise sustainable waste management to mitigate the increasing impacts of waste on the environment (Murphy et al. 2025). While the Global North uses modern technologies and stringent policy measures to control municipal solid waste and hazardous waste, many people in the Global South lack access to rudimentary waste collection services, indicating that much work remains to be done to move towards a circular or a zero-waste economy (Wilson 2023).

Creating a sustainable solid waste management system poses a challenge for many local governments, particularly in communities where people use informal disposal measures, such as open-air incineration and dumping, which harms our environment and health. Regulatory measures deter illegal activities to some extent. However, an increasing number of studies suggest that multifaceted strategies are required to divert waste from landfills (Awino and Apitz 2024; Jenkins et al. 2022; Khosravani et al. 2023; Xu et al. 2017). For example, policy measures can be reinforced through infrastructural improvements, economic instruments (such as punishments and rewards), educational strategies and behavioural tools to encourage and facilitate pro-environmental behaviour (Zhang 2023). The urgency for innovative and feasible waste management solutions is greater for countries with limited landfill space and nature-dependent economies and livelihoods (such as fisheries, forestry, agriculture and tourism). This applies to small island developing states, such as those in the Pacific region, that struggle with high rates of land- and water-based pollution. Furthermore, increased natural disasters and rising sea levels exacerbate the solid waste challenges for small island developing states (Charan, Prakash, and Chand 2024).

Pacific island countries generate around 310,000 tonnes of plastic waste annually, but only five per cent is recycled, and the remaining end up in landfills, public places or waterways (United Nations Development Programme 2022). In small island developing states, such as Fiji, the amount of mismanaged waste is almost four times that of Australia (13,889 tonnes in Australia compared to 49,257 tonnes in Fiji) (Wootton et al. 2021). This figure is alarming considering Fiji's small population (i.e. 0.88 million in Fiji compared to 26.97 million in Australia) (Australian Bureau of Statistics 2024; Fiji Bureau of Statistics 2018). Plastic waste generated daily in Fiji is around 168.6 tonnes (Pacific Region Infrastructure Facility 2018). Most municipal solid waste, which comprises of household and commercial waste, is dumped into vacant land, open dumpsites, rivers or the ocean (Fiji Government 2022). Recently, biologists discovered high levels of microplastics in freshwater mussels in Fiji (Paris 2022). Poor water quality affects marine life, thus impacting the sustenance economies of several Fijian communities (Singh et al. 2020). Subsistence fishing, for example, plays a vital role in Fijian communities, valued at around US\$44.09 million dollars per year (Singh et al. 2020). Hence, many communities call for local authorities to improve the solid waste management services and systems.

Over the years, many small island developing states have undertaken initiatives to improve their solid waste management systems. For example, in Fiji, local authorities have collaborated with regional and international agencies to improve the collection and reporting of waste statistics (Lewanavanua 2022; South Pacific Regional Environment Programme 2009; Tonkin and Taylor International Ltd 2021; United Nations Economic and Social Commission for Asia and the Pacific 2020). They also introduced more capacity-building programs for waste management officers (Lewanavanua 2022),

improved waste collection services and infrastructure in rural and remote areas (Japan International Cooperation Agency 2022; Lewanavanua 2022; South Pacific Regional Environment Programme 2009) and revised strategies to achieve the sustainable development goals for the country. While research advancements are noted on the technical and institutional front, few scientific studies have focussed on the behavioural factors associated with sustainable waste management within diverse socio-cultural settings, such as that of small island developing states (Hondo, Arthur, and Gamaralalage 2020; Salim et al. 2023). In spite of an increasing evidence base supporting the use of behavioural interventions to influence waste reduction and recycling behaviour (Williamson et al. 2018), there is limited empirical research on the efficacy of behavioural approaches applied to sustainable waste management in island nations (Raghu and Rodrigues 2020; United Nations Economic and Social Commission for Asia and the Pacific 2020). There is a need for more systematic reviews of behaviour-change interventions that target community and population-level changes to generate insights that practitioners and academics can use to avoid pitfalls and, where possible, implement best practices (Michie et al. 2017; Williamson et al. 2018).

In developed countries, waste management practitioners are increasingly applying behaviour-change approaches to influence change at the community- and population-level (Faganel and Streicher 2022; Heydari et al. 2021). Insights from the social and behavioural sciences help practitioners understand how and why people act as they do (Executive Office of the President of the United States 2024). Depending on the problem and its causal factors, practitioners utilise a wide range of behaviour-change strategies, such as information provision, visual prompts, incentives, structural modifications, or social marketing (Temmerman and Veeckman 2024). Social marketing is gaining popularity because it uses innovative marketing techniques to change or modify the target audiences' needs or behaviours that are harmful to them, other people or the society (Kotler 2022). For example, social marketing can de-market a particular negative behaviour (e.g. littering) and promote the uptake of a particular type of product or consumer behaviour (e.g. recycling or energy conservation) (Parkinson, Schuster, and Russell-Bennett 2016; Peattie and Peattie 2004). Social marketers use strategies that can be applied across multiple streams using a systems approach (Wymer 2023). An integrative social marketing approach combines inputs from upstream stakeholders (such as policymakers in government departments, independent regulators and media), midstream stakeholders (such as community-based organisations, corporate institutions and social influencers) and downstream stakeholders (such as individuals and households) to create comprehensive behaviour-change interventions (Coffie et al. 2025).

Previous studies suggest that the effectiveness of interventions can be enhanced by incorporating participatory approaches such as co-design (Trischler et al. 2019; Rundle-Thiele et al. 2019), design thinking (Willmott, Hurley, and Rundle-Thiele 2022) and collective intelligence (Domegan et al. 2016). Participatory design approaches help to gather diverse viewpoints and reach a consensus on strategies to engage the community effectively. Such approaches recognise that consensus and buy-in are needed from targeted populations. Long lasting solutions can be formed by understanding what people want and need and what stakeholders will support. The importance of participatory design processes is highlighted in several studies (Dietrich et al. 2016; Hurley,

Dietrich, and Rundle-Thiele 2019; Kim et al. 2020a). Programs that incorporate participatory approaches have reported positive outcomes (Harris et al. 2021) and lasting impact (Rundle-Thiele 2022). However, to date, the use of participatory approaches to develop waste management programs within the Pacific small island developing states has not been adequately documented or studied.

Based on these research gaps, our study makes three contributions. First, this study synthesises the existing literature to gain an understanding of the type of behavioural approaches implemented by municipal councils in a Pacific island country and their impact on recycling and composting rates. Secondly, this study examines the extent to which social marketing components are integrated into programs aiming to increase composting and recycling rates. The third contribution is to explore the extent to which participatory approaches have (or have not) been applied to increase composting and recycling rates. Parallel to these contributions, we propose the following research questions:

- (1) What behavioural interventions are implemented by local Councils in Fiji to promote sustainable waste management?
- (2) Which social marketing elements are present within waste management interventions?
- (3) Are participatory approaches used by local authorities to design interventions?

These research questions will be answered by evaluating the structure and impacts of council-driven interventions using the national social marketing benchmark criteria, which is discussed in the next section.

The remainder of the study is structured as follows: Section 2 provides an overview of the study area, the national-level waste management policies and programs, and the national social marketing benchmark criteria. Section 3 presents the research method, including the data collection and analytical techniques. Section 4 presents the results that answer the research questions. Section 5 examines the results and provides takeaway points, policy recommendations, and study limitations and prospects. Section 6 provides the conclusions.

2. Literature review

2.1. Study area

Fiji is in the southwest Pacific Ocean and consists of 332 islands, out of which one-third are inhabitable and home to 889,955 residents in 2019 (Raes, Mitterpergher, and Jain 2023). The main islands are Viti-Levu (where the capital city, Suva, is based) and Vanua-Levu. Nature-based industries, such as tourism and agriculture, are the largest source of foreign revenue for Fiji, thus intensifying the need for more sustainable waste management practices to mitigate the negative effects of anthropogenic activities on these important industry sectors (Tonkin and Taylor International Ltd 2021). Municipal solid waste that is generated per capita in Viti-Levu is estimated at 130.6 kg/person/annum, with an organic fraction ranging from 64 to 80 per cent (Swapna and Singh 2018). Organic waste poses a serious threat to landfills due to the toxic nature of

greenhouse gases, such as methane, that are emitted through anaerobic decomposition (Ministry of Economy Fiji 2018). Many small island developing states have a limited number of sanitary landfills. Furthermore, many island nations lack the technology and infrastructure to transform waste into energy (Ministry of Economy Fiji 2018). For example, none of the councils in Fiji have the facility to process high volumes of organic waste (Swapna and Singh 2018). Thus, it is imperative for councils to divert organic waste from landfills by increasing community awareness about waste separation and composting.

2.2. Waste collection services

Waste collection services are administered by the Department of Health at each municipal council, which then reports to the Ministry for Local Government, Housing and Environment (Pacific Region Infrastructure Facility 2018). Fiji has four electoral divisions – central, eastern, western and northern, and a mix of rural and town/city councils governs each division. Thirteen councils are dispersed across Viti-Levu and Vanua-Levu. In Viti-Levu, there are two city councils (i.e. Suva and Lautoka) and nine town councils (Ba, Nadi, Nausori, Nasinu, Navua, Lami, Rakiraki Sigatoka and Tavua). Two town councils are located on Vanua Levu (i.e. Labasa and Savusavu).

The local councils are responsible for solid waste collection, transportation and disposal. In some areas, waste collection services are outsourced to private companies (Pacific Region Infrastructure Facility 2018). Residents are required to pay town/city rates that cover services like garbage collection, roadside drain maintenance, kerbside grass and litter management, and street-light maintenance. Garbage collection fees vary across the country depending on the distance between towns/cities to disposal sites. For example, the fee ranges from FJ\$24 to \$85 per annum. Waste residuals are collected two to three times weekly in residential areas and daily for business enterprises. In some localities, recyclable items are collected weekly from commercial areas and fortnightly from residential area residents. Households are required to place their rubbish in appropriate bins or garbage bags for kerbside collection (Pacific Region Infrastructure Facility 2018). Waste collectors can refuse to collect household waste if it is placed in improper bags, such as plastic bags, cartons, baskets, sacks and open plastic buckets. Furthermore, councils deter improper practices by placing red stickers on improper bins or issuing a spot fine of FJD\$40 (Nadi Town Council 2020). Waste sorting and recycling are encouraged by the councils but not mandated by the law.

In metropolitan areas, several independent recycling companies collect scrap metal, paper, and plastic bottles from residences and businesses (Pacific Region Infrastructure Facility 2018). Residents can also hire private companies to collect bulky waste from their properties, such as garden waste, white goods and scrap metal. Additionally, some municipal councils provide green-waste shredding services at a cost (Nadi Town Council 2020). In the absence of recycling facilities, most of the recyclables, such as scrap metal, plastic bottles and paper are exported to countries like Australia, China, Indonesia, the Republic of Korea and New Zealand (Pacific Region Infrastructure Facility 2018). Regulations regarding the collection, treatment and disposal of electronic and electrical waste remain vague (Swapna and Singh 2018). Community recyclable drop-off centres are gradually introduced by councils (for example, by the Suva and

Lautoka city councils); however, the efficacy of these schemes is less documented and reported.

2.3. Waste management legislation and regulations

In urban areas, the Local Government Act governs the councils to collect and dispose of municipal solid waste. Rural local authorities, on the other hand, use the Public Health Act (Botton 2010). Both legislative acts specify where and how municipal solid waste will be collected and disposed of (Botton 2010). In April 2005, the Government introduced the Environment Management Act to ensure the sustainable use of natural resources and to initiate national-level discussions about environmental protection. By January 2008, the Government endorsed the Environment Management (Waste Disposal and Recycling) Regulations through the National Solid Waste Management Strategy and Action Plan 2008–2010 (Botton 2010). Additionally, the Litter Promulgation 2008 and Litter (Amendment) Decree 2010 regulate littering in public places through the enforcement of spot-fines by litter prevention officers (Sewak et al. 2021). The Fijian government enacted two new policies to reduce plastic pollution. First, single-use plastic bags were banned from 1 January 2020 and, second, polystyrene containers (typically used for food packaging) were banned from import, manufacture, and use from 1 August 2021 (Singh 2021). Increasingly, studies suggest that environmental regulations must be reinforced through advanced surveillance systems, environment restructuring, service provision and community awareness programs to deter illegal environmental activities (Allison et al. 2022; Fernando 2020; Sewak et al. 2021).

2.4. Community awareness programs

The local councils, the Department of Environment and the Education Ministry conduct environmental advocacy at schools and within communities. These awareness programs are designed to teach people about the benefits and techniques of waste segregation and recycling (Matagi, Yabar, and Mizunoya 2019). Some studies suggest that residents separate paper and green waste but often mix other forms of non-biodegradable waste with organic waste, thus creating recycling challenges (Farrelly, Schneider, and Stupples 2016; United Nations Economic and Social Commission for Asia and the Pacific 2020). The waste collection problem is further compounded by the misuse or non-use of waste receptacles, damaged or stolen communal rubbish containers and resistance to paying waste collection fees (Botton 2010).

Observers, such as the Japan International Cooperation Agency, have reported mixed public responses to waste minimisation and recycling projects that focus on home composting, market waste composting and recycling yard waste (Japan International Cooperation Agency 2012). Varying levels of success have been reported when considering public participation rates per area. The Japan International Cooperation Agency estimates that at least 20 per cent of household waste (approximately 0.107 kg/person/day) is recycled daily. However, only 1 per cent of the population within two piloted areas participated in council-run composting projects, implying the need to improve behaviour-change strategies. A better evidence base is needed about what works and what lessons can be drawn from different measures (Cox et al. 2010).

2.5. Using social marketing to design behavioural interventions

Studies from the social and psychological fields have established that many broad, structural elements enable or constrain people's ability to practice environmentally supportive behaviour (Hargreaves 2011; Kennedy et al. 2009; Lefebvre 2012; Parkinson, Schuster, and Russell-Bennett 2016; Pickering et al. 2020; Rundle-Thiele et al. 2019). Behaviour-change programs require a holistic view of the entire system (Delvaux and Van den Broeck 2023). Social marketing distinguishes itself from other behavioural strategies by adopting systems thinking to uncover the root causes of the social problem at the micro-, meso-, and macro-levels in society, and by designing solutions using input from all stakeholders (Wymer 2023). Social marketing is underpinned by theories and models from multiple disciplines such as psychology, behavioural economics, sociology, anthropology, political science and health sciences (Dietrich et al. 2022).

Social marketing uses systematic yet iterative steps for program design and evaluation. The national social marketing criteria, developed by French and Blair-Stevens (2006) using principles from Andreasen's 2002 framework, comprise of eight benchmarks, as follows:

Social marketing benchmarks	Description
1. Behaviour	Interventions aim to change people's actual behaviour. Interventions have clear, specific, measurable and time-bound behavioural goals.
2. Customer orientation	Interventions focus on the audience. Interventions use a mix of data sources and research methods to understand the audience's lives, behaviour and the social issue. Data from different sources are used to gain understanding of key stakeholders.
3. Theory	Interventions are guided by appropriate behavioural theories. The theory, or theories, are identified after conducting the customer orientation research (Benchmark 2).
4. Insight	Actionable insights are generated from customer orientation work (Benchmark 2). Interventions are developed based on a deep understanding of what moves and motivates the target audience, including who and what influences the target behaviour.
5. Exchange	Interventions consider the benefits and costs of adopting and maintaining a new behaviour. Interventions offer incentives and rewards, based on customer orientation and insight (Benchmarks 2 and 4).
6. Competition	Interventions address direct and external factors that compete for the audience's time and attention. Interventions minimise the impact of competition by carefully designing the exchange elements (Benchmark 5).
7. Segmentation	Interventions are tailored to specific audience segments that have common characteristics. Segments are prioritised and selected based on clear criteria, such as size and readiness to change.
8. Methods mix	Interventions use all elements of the marketing mix (product, price, place and promotion) or primary intervention methods (inform, educate, support, design and control).

Source: French and Blair-Stevens (2006).

Interventions that utilise all benchmarks report better outcomes, as evidenced by studies focused on promoting healthy eating behaviour (Carins and Rundle-Thiele 2014), physical activity (Xia, Deshpande, and Bonates 2016), food waste reduction (Kim et al. 2020b) and recycling behaviour in schools (Haghighatjoo, Tahmasebi, and Noroozi 2020). Our study uses this benchmark criteria for data analysis to acquire in-depth, multi-level insights into the design and impact of Fijian waste management interventions.

3. Method

3.1. Data collection

Ethics clearance for this study was acquired in December 2019 (Reference # 2019/954). Data was collected through a mixed method approach involving archival research, structured questionnaires and informal telephone interviews with waste management officers. This approach was necessary to gain a holistic view of the existing evidence base. Scholarly work on household waste management practices in the Pacific region is currently scarce, and existing literature on waste is dispersed throughout reports, internet articles and news bulletins (Farrelly, Schneider, and Stupples 2016). Therefore, data from multiple sources improved accuracy and helped determine saturation points. Figure 1 illustrates the procedure for data collection and analysis.

A 10-year timeframe (2010–2019) was selected for this study to examine the evolution of behaviour-change strategies used by Fijian municipal councils. We used purposive sampling to specifically target urban-based municipal councils in Fiji. Municipal councils are governed by environmental legislative acts that are different from rural local authorities. Furthermore, it was crucial to compare the design and efficacy of waste management interventions across areas with similar socio-economic characteristics. Data collection started in January 2020 and ended in January 2021. Between January and March 2020, we contacted eleven municipal councils to obtain information about the key personnel responsible for waste management programs. Subsequently, a copy of the research information sheet, ethics letter and consent form was sent to the council administrators for approval. Seven councils responded positively, but only five councils signed the consent forms. Consequently, data was collected from five councils.

Firstly, the researchers liaised with the waste management officers and requested published materials related to behaviour-change programs, community outreach activities, capacity-building programs (e.g. training), and other initiatives designed to improve waste management. We sought resource materials such as newsletters, bulletins, factsheets, information booklets, program reports, press releases and journal publications. In addition, we informally interviewed one senior waste management officer at each council office by telephone. The interview focused on seven key points: (1) the officer's role, the years served in that role, and the major issues that the officer encountered in that role; (2) any changes observed by the officer in the way that people disposed their household waste in the past five years; (3) major challenges faced by the council to manage solid waste and the steps taken by the council to address these challenges; (4) the types of waste management interventions conducted by the council and the longevity of these interventions; (5) any external support, such as financial assistance or technical advice, received by the council to carry out the interventions; (6) the most effective way to encourage and facilitate behaviour change in the community; and (7) any improvements needed by council to increase behaviour change in the community. The interviews lasted 30 to 45 min. The interviews were not recorded, but we made notes during the process and transferred this data to a spreadsheet for further analysis.

Secondly, a copy of the self-administered structured questionnaire was emailed to the waste management team to further investigate the Council's services. The questionnaire

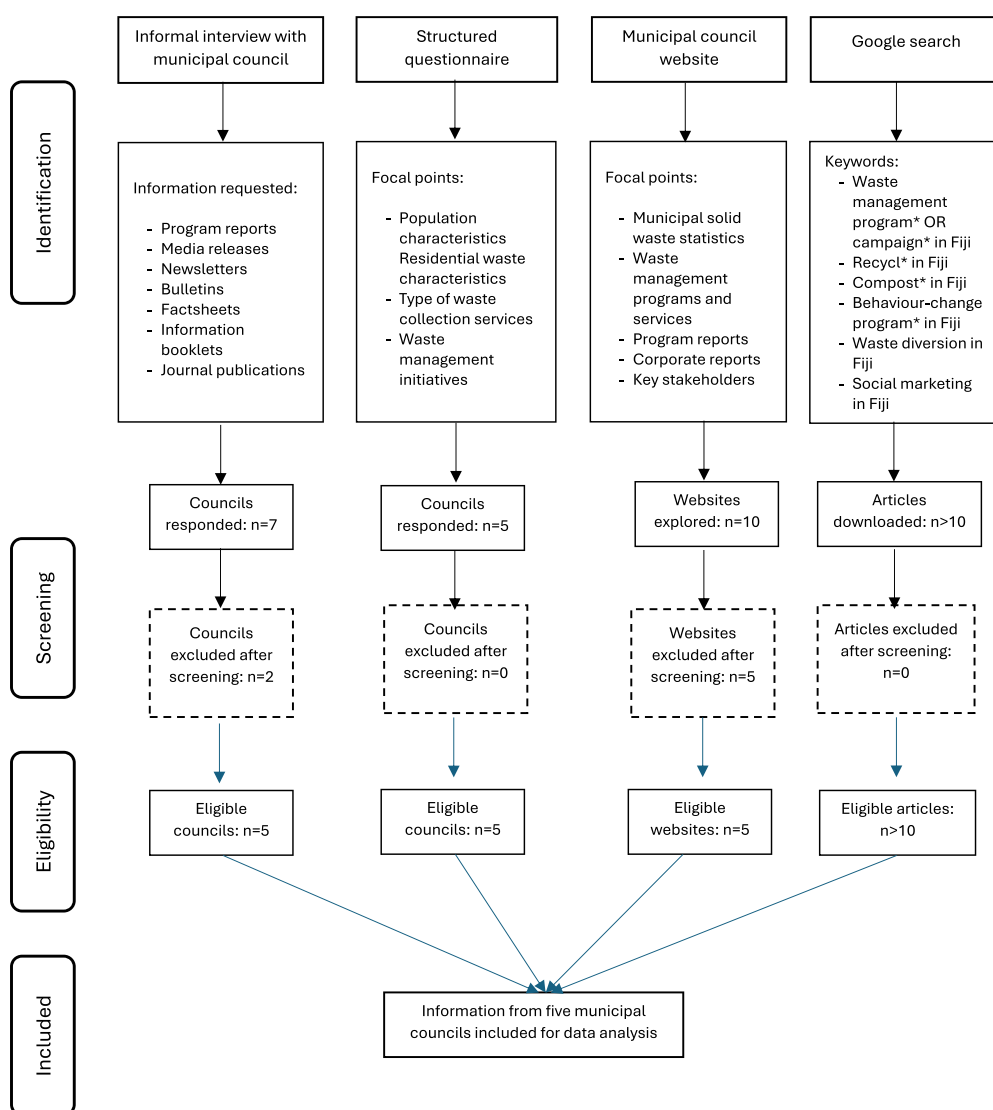


Figure 1. Flowchart showing source of data and analysis

was divided into four sections: (1) Population characteristics for the municipality, such as the total households and the total number of ratepayers; (2) Residential waste characteristics, such as the amount of municipal solid waste generated in the area, estimated household waste per capita, percentage of organics, percentage of recyclables, percentage of residue, total municipal solid waste and the ratio of residential waste to non-residential waste; (3) Type of waste collection services provided by the council, such as the number of landfills in the area, collection of dry recyclables, collection of organic waste, frequency of waste collection, fee for garbage collection, landfill tipping fee for households and annual waste management expenditure for the council; and (4) Council's waste management initiatives. The fourth section inquired about the type of waste management initiatives conducted by the council, details of the initiative, the project's timeframe and the

sponsors. We liaised with the waste management officers in cases where insufficient data was provided, or further clarification was needed.

Thirdly, we screened council websites for information related to waste management programs and services. We searched for corporate reports, statistics about municipal solid waste, services offered by the council, customer feedback forms, information about stakeholders and social media tools used by the council. Lastly, we conducted a grey literature search on Google to obtain additional information on local waste management programs. A specific time-parameter (i.e. 2010–2019) was used to identify articles related to solid waste management programs in Fiji. The keywords used for the search are highlighted in [Figure 1](#).

3.2. Data screening

Data collated from this research was screened by two researchers. We applied a threefold eligibility criterion to screen the data: (1) published between 2000 and 2019; (2) monitoring and evaluation reports are available; and (3) social marketing elements are reported. During the screening process, two councils were excluded due to a lack of monitoring and evaluation reports. The remaining five councils provided sufficient data, including Suva, Lautoka, Nadi, Nausori and Sigatoka. The same five councils responded favourably to the structured questionnaire and were included for further processing. Not all councils had a website. Our initial search yielded ten positive results; however, after the screening process, only five councils were selected for this study. Lastly, the results from Google search were screened using the above-mentioned threefold eligibility criteria, and only the eligible articles were selected for analysis. More than ten electronic articles met the eligibility criterion and were downloaded and used for analysis.

3.3. Data analysis framework

This study utilises the national social marketing benchmark criteria by French and Blair-Stevens (2006) to examine how waste management interventions are designed, implemented and evaluated. We created a matrix to record any social marketing benchmarks reported in the waste management interventions. The first author created the pilot matrix and then validated it with one of the co-authors. We finalised the results once consensus was reached among two coders.

4. Findings

4.1. Waste management programs

Municipal councils launched various community-based initiatives after the government enacted the National Solid Waste Management Strategy and Action Plan 2008–2010. [Table 1](#) provides an overview of the programs from 2008 to 2019.

4.1.1. Home composting program

Councils advocate waste separation and backyard composting so households can generate green manure at home. The home composting program was initiated in Nadi in 2009,

Table 1. Timeline of Fijian council's community-based solid waste management programs.

Location / Timeline	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Lautoka	3Rs program.		Clean schools program. Market organics program. Home composting program. Clean schools program.					Eco-bags program.				
Nadi	3Rs program.	Home composting program. Market organics program.			Eco-bags program.							
Nausori								Clean schools program. Home composting program. Market organics program. Home composting program.	3Rs program.			
Sigatoka				Clean schools program. 3Rs program. Market organics program.	Eco-bags program.							
Suva					Market organics program. Home composting program.		Clean schools program.	3Rs program.	Eco-bags program.			

followed by Lautoka and Suva in 2010 and 2012, respectively, and later in Nausori and Sigatoka. Councils use various techniques to raise awareness about composting and recycling. The most popular approach is door-stepping (also known as house-to-house visits), whereby project officers distribute pamphlets, chat with people about waste separation and recycling, and drop-off newsletters and pamphlets in mailboxes (Nadi Town Council 2020). Councils sell compost bins at a rate of FJD\$30 to the public. In some areas, technical officers from the council facilitate the set-up of composting equipment at the buyer's home and monitor the usage.

4.1.2. Market organic waste composting program

Councils provide large wheelie bins for market vendors to deposit organic waste, which is transferred to a composting facility daily. This system is usually managed by a driver and two workers (Kumar 2013). In Lautoka, the Japan International Cooperation Agency financed the construction of a composting shed and donated a mini-shredder to help process yard waste (Lautoka City Council 2020). The Nausori town council provides separate bins for waste disposal in the market area (Nausori Town Council 2020). Nausori has a green-house compost farm at Manoca Depot (Nausori Town Council 2020). It takes four to five months for the compost to mature fully. In Nadi and Lautoka, the manure is sieved, weighed and packed in 10 kg bags to be sold at FJ\$3 each (Kumar 2013). The production cost is FJ\$2.64 per 10 kg. In Sigatoka, green waste from the market is transferred to Nasau Youth Training school for producing soil conditioner, which the council then sells at FJ\$1 per kg (Sigatoka Town Council 2020). Users can purchase this manure for flower and vegetable gardening. The council also uses the product for internal use, such as planting vegetables and flowers in council-managed spaces such as parks. The Lautoka city council is aiming to produce 'bokashi', which is a fermented compost accelerator (Kumar 2013).

4.1.3. Clean school program

All five councils support the clean school program. This program commenced in July 2010 to promote sustainable waste management at schools. The program has three components: (1) awareness raising, (2) separation of organic waste for school composting and (3) separation of recyclables for collection (Nadi Town Council 2020). Volunteers from the Japan International Cooperation Agency teach students about waste management techniques (Nausori Town Council 2020). These volunteers organise school competitions and design promotional materials (e.g. select project logos, slogans and characters) (Nadi Town Council 2020). The Nadi town council initially piloted the Clean School program with eleven schools and later extended it to thirty schools (Nadi town council 2020). In 2019, 37 schools from Lautoka submitted their action plans and participated in the annual competition (Lautoka City Council 2020). Similarly, schools in the Nadroga and Navosa areas in Sigatoka participated in the program by collecting plastic bottles in schools, which were then transferred to collection points managed by Coco Cola Fiji Limited (Sigatoka Town Council 2020).

4.1.4. Promotion of eco-bags

The Eco-bags program commenced in Nadi in 2012, followed by Suva in 2016. It is part of the 3Rs project developed with the Japan International Cooperation Agency, Suva

Women's Prison, Banaban Women's Association and the Public Rental Board women's group (Suva City Council 2020). Councils in Nadi, Lautoka and Suva work with the Japan International Cooperation Agency volunteers to train women market vendors to sew bags from off-cut pieces of cloth from garment factories and tailoring shops (Suva City Council 2020). The eco-bags are engraved with a 'Fiji-made' sticker and sold at the Council office and farmer's markets for prices ranging from FJ\$6 to FJ\$15 (Nadi Town Council 2020; Suva City Council 2020).

4.1.5 3Rs program

The 3Rs is a shortened name for the 'waste minimisation and recycling promotion project in Fiji', implemented from October 2008 till March 2012 in Lautoka and Nadi. The program was upgraded to J-PRISM I, as projected by the Japan International Cooperation Agency and South Pacific Regional Environmental Programme (project partners), and implemented from 2011 to 2015 (Nadi Town Council 2020). During the first stage of J-PRISM I, three municipalities received garbage compactor vehicles (i.e. Suva, Nausori and Lami), and technical training was provided to project officers (Pacific Region Infrastructure Facility 2018).

The J-PRISM II program was implemented in December 2016 (Nadi Town Council 2020). Under this program, recyclable items were collected fortnightly from residents and weekly from businesses in metropolitan areas. Recycling companies accepted eligible collectables, including plastic bottles, soft and hard plastic, metals (such as tin cans), paper and cardboard, glass and textile materials (Kumar 2013). During the first one or two months of the project, garbage trucks played special music and made announcements via loudspeakers when collecting rubbish from the residential area. This system was designed to alert households about collection services. The collection crew monitored the discharge practices of households and business enterprises and refused to collect dirty recyclables. The recyclables collected from the residential and business areas were delivered to the recycler's depot for sorting and packaging (Kumar 2013).

4.2. Social marketing analysis

This section assesses all five programs using social marketing benchmarks to examine program design and associated gaps. Table 2 provides an overview of the analysis.

4.2.1. Behavioural objectives and theoretical underpinning

Behavioural objectives are present in all five programs, but not all programs reported measurable goals. Only two projects reported specific goals. For example, the 3Rs project aimed to increase the rates of material recovery from a baseline of 3 to 8 per cent in 2010 to 10 per cent by 2015 and 15 per cent by 2020 (Japan International Cooperation Agency 2012). Secondly, the home composting project targeted residents living in urban areas and aimed to approach 30 per cent of the total households in each municipality within ten years (i.e. 2010–2017) (Kumar 2013). This translated to around 3,000 households and 200 businesses. The market composting project targeted vendors who operated at council-run markets to promote waste segregation and composting. However, there were no measurable targets set under this project. Similarly, the eco-bags project did not mention specific targets apart from training women to

Table 2. Program analysis using social marketing benchmarks.

Design											
Intervention name	Behavioural objective(s)	Theory	Target audience	Design				Participatory design			
				Segmentation	Formative research	Competition	Upstream stakeholders	Midstream stakeholders	Downstream stakeholders		
Home-composting program	✓		✓	-	✓	✓	✓	✓	-		
Market organic waste program	✓		✓	-	-	-	✓	✓	-		
Clean schools program	✓		✓	-	-	-	✓	✓	-		
Eco-bags program	✓		✓	✓	-	-	✓	✓	-		
3Rs program	✓		✓	✓	✓	-	✓	✓	-		
Implementation				-	✓	✓	✓	✓			
				Promotion							
Exchange	Place	Products / services	Price	Print media	Door-stepping	Press release	Mass media	Social media	Digital media		
✓	✓	✓	✓	✓	✓	✓	✓	-	✓		
✓	✓	✓	-	-	✓	✓	-	-	-		
-	✓	-	-	-	✓	✓	-	-	-		
-	✓	✓	✓	-	✓	✓	✓	-	✓		
✓	✓	✓	-	✓	✓	✓	✓	-	✓		

(Continued)

Table 2. Continued.

Intervention name	Behavioural objective(s)	Design						
		Monitoring and evaluation	Theory	Target audience	Segmentation	Formative research	Competition	Participatory design
Monitoring	Evaluation	Behavioural outcomes						
✓	✓	Lautoka: 380 households participated in the pilot program. Approximately 107 g/person/day of kitchen waste recycled.						
✓	✓	Lautoka: An average of 800 kg/day of organic waste is sent to the composting yard. Matured compost is sold for \$5 per 10 kg bag. The total amount of sales is not reported.						
✓	-	Lautoka: 37 schools participated in the program in 2019. Nadi: 30 schools participated in the program in 2019.						
✓	-	Not reported						
✓	✓	Lautoka: Recycling rate increased from 5.9 per cent to 12.8 per cent from 2008 to 2011. Nadi: Recycling rate increased from 2.8 per cent to 22.3 per cent from 2008 to 2011.						

create and sell eco-friendly shopping bags. Finally, the goal of the Clean School project was to train students to recycle correctly and to compost at school premises. No specific, measurable goals were noted for the clean school project. None of the programs utilised behavioural theories or frameworks.

4.2.2. Target audience and segmentation

Two interventions analysed in this study targeted households (that is, the 3Rs program and home composting program), while the remaining three were community-oriented (i.e. market composting program, clean schools' program and eco-bags program). The 3Rs program also targeted businesses. Limited evidence suggests that advanced segmentation (such as cluster analysis) was used to select the target audience. Researchers and practitioners use segmentation analysis to identify groups with common characteristics (Kitunen et al. 2023). Only urban classification is noted across programs; however, no further demographical, behavioural or psychological segmentation is present. The eco-bags program is the only project that targets explicitly female market vendors.

4.2.3. Formative research and competitor analysis

Baseline surveys were conducted in Lautoka and Nadi by local authorities and experts from the Japan International Cooperation Agency to study waste flow. These included a waste amount and composition survey (2008–2009), a final disposal amount survey (November–December 2008), public opinion survey (December 2008 - February 2009) and recycling activities survey (December 2008 - February 2009) (Kumar 2013). The researchers noted problems regarding waste storage and discharge. For example, many people use plastic bags instead of placing waste in lidded containers for kerbside collection. This form of discharge increases the risk of scavenging by stray animals. The waste collection time was not fixed; therefore, improper discharge was noted. There was also a widespread belief that waste management was the responsibility of municipal councils (Kumar 2013).

Furthermore, households that could not pay for green waste collection services tended to dispose of or burn near the roadside illegally (Kumar 2013). Some businesses also divert their recyclables by selling them to private recycling companies (Kumar 2013). The researchers noted that the lack of recycling facilities affected the local processing of recyclable materials. Another limitation was that there were no by-laws to promote the 3Rs. The audit also revealed that environmental education conducted by the Lautoka city council was very limited in budget and human resources (Kumar 2013). There is no evidence that formative research and competitor analysis were conducted for the eco-bags program. Similarly, there is no evidence that formative research was conducted for the market-composting project and the Clean Schools program.

4.2.4. Participatory approach

Council offices designed environmental awareness campaigns in collaboration with Government ministries (e.g. Ministry of Environment, Ministry of Education and Ministry of Local Government), regional agencies (e.g. South Pacific Regional Environment Programme and Secretariat of the Pacific Community) and international agencies (e.g. Japan International Cooperation Agency, United Nations Environment Programme, United Nations Development Programme, European Union, Asia Development Bank).

The Japan International Cooperation Agency is the leading agency that provides training and technical and financial support for waste management initiatives in Fiji and other Pacific Island countries. Fiji requested technical cooperation from Japan in 2005 to minimise waste and promote recycling (Nadi Town Council 2020). A Japanese Overseas Cooperation Volunteer is based at each council and provides support in waste management and environmental education (Nadi Town Council 2020). The Sigatoka Town Council works with Mission Pacific, a Coca-Cola Pacific Limited subsidiary, to recover plastic bottles and aluminium cans (Sigatoka Town Council 2020). Similarly, the Suva City Council collaborates with agencies like Waste Recyclers, Coca-Cola Amatil Fiji Limited, the European Union, the United States Embassy and the Japan International Cooperation Agency to set up recycling receptors in the parks (Suva City Council 2020). The Clean Schools program was designed with the Ministry of Education and the Japan International Cooperation Agency. Notably, across all five programs, there is no documented evidence indicating that representatives of the target audience (i.e. end-users) were actively engaged in the program design phase, suggesting a lack of participatory input that may impact the relevance and effectiveness of these initiatives.

4.2.5. Exchange

Under the 3R program, the project officers distributed a nylon bag that contained the 3R logo and a recycling leaflet that contained instructions about waste sorting and the timetable for recyclable collection to selected households and businesses (Kumar 2013). Nylon bags were distributed only once at the beginning of the program. Participants were requested to discharge recyclable materials at the kerbside at designated times and days (Kumar 2013). Under the market waste composting program, the Nadi and Lautoka councils provided separate bins to market vendors to discharge their green waste. These included 120-litre wheelie bins with council stickers or recycled drums (Kumar 2013). Customers who purchased composting bin(s) received an instructional manual that contained guidelines for home composting. Consumers could also request assistance in setting up the bin at home.

4.2.6. Marketing mix

Products and services: The council provides various services to ratepayers, such as kerbside waste collection, roadside grass and litter maintenance, streetlamp maintenance and cleaning of stormwater drains. This information is outlined in Table 3. Mixed waste is collected two to three times per week for residents and daily for businesses. Recyclable materials are collected fortnightly for residents and weekly for businesses. White goods are collected once per month.

Price: Two out five programs highlighted the price element. For instance, the home composting program indicated the financial cost for acquiring a compost bin as FJ\$30. The composting bins were sold at the Council office, which creates more costs for the customers in terms of time and energy required to obtain the item. The government provides a subsidy of FJ\$25 per bin from the original retail price of FJ\$55. At the time of purchase, consumers must register their details (for example, name, home address and phone number) to activate after-sales technical support and delivery. Leaflets containing instructions on how to use composters are attached to the item. The Department of Environment and local councils also provide compost-bin training upon request. The

Table 3. Waste collection services provided by five municipal councils in Fiji.

Name of municipal council	Total population (2017)	Total ratepayers (2019)	Amount of municipal solid waste generated (tonnes) (2017)	Estimated household waste (kg/capita)	Type of waste collection services:				Waste collection service fee for households (FJD) per annum
					Collect mixed waste	Collect dry recyclables separately	Collect organic waste	Frequency of waste collection	
Suva City Council	93, 870	11,409	11,108	0.599 / day	Yes	Only from the collection points where bins are placed	Only from Suva Market	3 days per week for mixed waste 1 per month for green waste Quarterly for white goods	\$27.50
Nadi Town Council	75, 048	3,159	5,772	0.374 / day	Yes	Yes	No, the council promotes home composting	2 days per week for household waste and 5 days per week for commercial waste. Fortnightly for household recyclable waste and weekly for commercial	\$24
Lautoka City Council	71,573	8,169	8,234	0.432 / day	Yes	Yes	Yes	recyclable waste. 2 days per week for household waste and 5 days per week for commercial waste. Fortnightly for household recyclable waste and weekly for commercial	\$39.24
Nausori Town Council	57,882	4,374	4,320	0.249 / day	Yes	No	No	recyclable waste. Twice per week for mixed waste. Once per month for garden waste. Quarterly for white goods.	\$85
Sigatoka Town Council	10, 509	248	2,246	0.639 / day	Yes	No	Yes	No schedule published.	\$54.50

eco-bags program did not indicate any fiscal and non-fiscal costs associated with creating the eco-bags; however, the cost of the eco-bags for the customers ranged from 6 to 15 Fijian dollars.

Place: Most of the services are delivered directly to the users. The program targets urban dwellers to encourage organic waste separation and the creation of home compost. First-time bin users are encouraged to seek technical assistance from the Council office. Council officers and community leaders (e.g. village heads) monitor the use of compost bins through house-to-house inspections (Lautoka City Council 2020; Sigatoka Town Council 2020). The first round of monitoring is conducted within a month of distribution to check whether bins have been correctly installed (Kumar 2013). The second monitoring occurs after three months to check the composting process – for example, how often the bins were used per week, how much waste was placed in the bin, how full the bin is, the types of waste placed in the bin and the condition of the compost (colour, odour, moisture, insects and temperature) (Kumar 2013). The final monitoring round is conducted after six months to check composting status and final product use.

Promotion: Door-stepping is a common approach used by Councils to educate households and business establishments about sustainable waste management. For the 3Rs project, program officers and youth volunteers distributed leaflets through house-to-house visits and discussed waste segregation and its benefits. The leaflets contained information about recyclable materials and the collection schedule. Community meetings are another platform for sharing information (through presentations), briefing community leaders and requesting cooperation (Kumar 2013). The timetable for community meetings is distributed through circulars. The Nadi Town Council publishes two monthly newsletters to inform stakeholders about the project's achievements (Nadi Town Council 2020). The 3Rs project officers claim that the door-stepping approach and community meetings effectively promote recycling and composting (Kumar 2013). Mass media channels used for the 3Rs project included radio advertisements, newspaper articles and advertisements (for example, in Fiji Sun and City Star) and television (for example, Fiji One News and documentaries produced by the Department of Education) (Kumar 2013). For the home composting project, posters were pasted at several municipal facilities and bins were displayed at a booth near the cashier's desk. Project officers conducted demonstrations at community meetings, council-run events (such as the Sugar Festival and Open Day) and schools (Kumar 2013). Bins were advertised in newspapers and radio. Door-stepping by program officers and 3R volunteers is used to promote compost bins. The project officer raised awareness among market vendors regarding segregating compostable waste (Kumar 2013). Both promotion and monitoring occurred directly at the farmers' market. Posters about waste separation were pasted around the market. Similarly, 3R project officers conducted awareness sessions with students during school visits (Kumar 2013). Competitions were also organised where all participating schools were rewarded with certificates of participation and other awards by the Minister of Environment during a special award ceremony (Kumar 2013).

4.2.7. Monitoring and evaluation

Monitoring ensures that the intervention activities are implemented as planned (Xia, Deshpande, and Bonates 2016). Some councils use performance indicators to monitor

program outcomes. For example, the 3R program uses two measures – the final waste disposal amount and the recovery rate – to determine program efficacy. Additionally, waste collection workers in Lautoka monitor the quality of discharged recyclables and record the number of households participating in the program (Kumar 2013). Contaminated items are rejected by the waste collectors, who provide necessary guidance to non-compliant households (Kumar 2013). Recyclable items are transferred to the recycling company for sorting by category, weighted and baled, and exported overseas for recycling (Kumar 2013). The results of monitoring activities in Lautoka and Nadi revealed an average discharge rate of recyclables of 6.2 g/day for households and 217 g/day for business establishments (Kumar 2013).

The 3R officers and some representatives from the Ministry of Education monitor the Clean School project through school visits (Kumar 2013). Teachers supervise 3R activities on school premises. Program officers monitor the number of participants but not the volume of waste collected at schools. For the home composting program, a database is kept for customers who purchase compost bins. This enables the council to monitor sales and intensify promotional activities when sales are low. Project officers routinely visit homes to monitor the use of compost bins and to offer any technical advice.

Evaluation helps to determine whether an intervention achieved its desired goals and objectives (Xia, Deshpande, and Bonates 2016). In Lautoka, 380 households practised home composting under the pilot program (Kumar 2013). The amount of recycled kitchen waste was estimated to be 107 g/person/day (Kumar 2013). Under the market waste composting project, the amount of organic waste collected and deposited at the composting yard is monitored and recorded. An average of 800 kg of organic waste is transported daily to the composting yard in Lautoka, which undergoes solar evaporation (Kumar 2013). The organics are left on open ground and tilted over every two days. It takes three weeks for a pile of organics to dry up completely. The compost matures within six months, after which it is sieved and packed in 10 kg bags and sold for FJ\$5 per bag. The project team monitors the sales. Not all councils report the number of eco-bags produced and sold under the project.

Under the 3R project, program officers noted an increase in the recycling rate from 2008 to 2011. In Lautoka the recycling rate increased from 5.9 per cent to 12.8 per cent, and in Nadi the recycling rate dramatically increased from 2.8 per cent to 22.3 per cent. The disposal rates decreased by 10.4 per cent in Lautoka and 25.8 per cent in Nadi (Farrelly, Schneider, and Stupples 2016; Kumar 2013). Waste statistics are inconsistently reported across councils, making it difficult to determine the impact of waste management initiatives from 2011 to date.

5. Discussion

5.1. Intervention types and their impact

Effective waste management systems require the participation of various stakeholders in sorting and recycling schemes (Temmerman and Veeckman 2024). This review focuses on three important community-level stakeholders: households, schools and farmer's markets. Collectively, these stakeholders have the potential to divert almost two thirds of municipal solid waste by sorting and recycling at source (Kaza et al. 2018). Five

municipal councils in Fiji applied the following behavioural strategies to engage these stakeholders:

- Schools: Clean Schools Program (informational approach)
- Households: Home Composting Program (provision of subsidised or free products) and 3Rs Program (social marketing program)
- Market vendors: Market Organic Waste Composting Program (structural modifications) and eco-bags program (skills enhancement)

The informational approach is used to enhance individuals' knowledge and attitudes toward adopting a new behaviour (Xia, Deshpande, and Bonates 2016). The Clean Schools program adopted this strategy to teach students about sustainable waste management. Program officers organised national-level competitions to assess which schools engaged in sustainable activities. However, it is unclear how these short-term activities affect students' habitual pro-environmental behaviour. Future research should investigate whether school-based environmental programs lead to long-term success in behaviour change among students. Some studies suggest that active learning strategies are needed at schools to develop environmental attitudes in students (Rousell and Cutter-Mackenzie-Knowles 2020; Taylor and Macpherson 1993). These could be in the form of non-formal, interactive modes of learning that take place within the broader community (Crossley and Sprague 2014; Rousell and Cutter-Mackenzie-Knowles 2020). For example, outdoor environmental education that enables students to visit terrestrial parks, rainforests and conservation sites (Raman 2017). Other scholars suggest that learning can occur through museums, television, newspapers, internet, films and novels, community events, homes, neighbourhood and own backyards (Rousell and Cutter-Mackenzie-Knowles 2020).

Similarly, ongoing adjustments to solid waste management systems are necessary to meet local needs (Weekes et al. 2021). Previous studies suggest that changes in the physical environment can promote behaviour change (Bernstad 2014; Roberts et al. 2018). However, any changes in the built environment should be preceded by consultations with the people that are using those facilities (Rundle-Thiele, Dietrich, and Carins 2021). This claim is substantiated by the findings of our study. For example, council officers placed large wheelie bins at different locations within the farmer's market and advised farmers and market vendors to dispose their organic waste in the bin. This program was successful in some locations. For instance, the Lautoka town council recorded an average of 800 kg/day of organic waste that was collected from farmer's markets and sent to the composting yard. However, more evaluative studies are needed to assess the program's impact on farmers' attitudes and behaviour at other sites.

Training activities help build local capacity and increase knowledge regarding best practices (Remling and Veitayaki 2016). The eco-bags program was designed to teach female market vendors to create eco-bags from scrap textiles and generate revenue from the sales. Unfortunately, the program's behavioural outcomes were not reported at the time of this study. The home composting program, on the other hand, provided subsidised composting bins and technical support. This program was declared successful by one municipality. Lautoka town council recorded high participation rate and an increase in the sale of composting bins, but the other four municipalities did not

document or report behavioural outcomes. A similar trend is noted by a recent study that synthesised waste management literature, recommending that more evaluative studies are needed to assess the impact of behavioural approaches on the uptake of sustainable waste management activities (Raghu and Rodrigues 2020).

The 3Rs program is well-crafted using multiple social marketing elements. The program reported a significant increase in recycling rate within three years (2008–2011). Program officers attributed the program's success to streamlined waste collection services and performance indicators used by the team. Two other municipalities implemented the 3Rs program in 2015 and 2016, respectively. However, the efficacy of the program at these sites could not be determined due to discrepancies in reporting. Non-conventional behavioural interventions are proving effective in some countries. For example, community composting hubs and neighbourhood share-waste schemes offer viable alternatives to backyard composting, effectively addressing space limitations and hygiene concerns. Neighbourhood schemes have proven popular in Australia and New Zealand, allowing households with limited backyard space to deposit organic waste at a recipient's place or communal hub. End-users can manage such schemes with little or no involvement from local authorities. Community-based recycling schemes, like waste banks, are also worth exploring in the Pacific islands to enable households to exchange recyclable materials for cash (Hondo, Arthur, and Gamaralalage 2020).

5.2. Integrating social marketing in waste management programs

Despite its utility in generating user-oriented solutions, findings from this review suggest that social marketing remains underutilised in waste management. The systematic approach of social marketing, which takes an outside-in approach, can help overcome agency-oriented biases during program planning and implementation. Practitioners need to understand the lived realities and challenges of individuals or communities and develop solutions that are streamlined to their needs (Remling and Veitayaki 2016). Our findings concur with the works of Fuldauer et al. (2019), who state that more local engagement is needed in designing waste prevention and material reuse strategies within island settings. It is possible to increase material recovery from waste by creating pathways and services that make it easy for people to recycle and compost. The challenge for practitioners is identifying strategies conducive to different settings and populations.

The type of communication channel used for environmental advocacy and the frequency of interaction require considerable attention. Local authorities commonly use door-stepping to communicate about 3Rs and backyard composting. Though helpful in interacting directly with end users, this method is inappropriate for people who work away from home. Results from a household survey indicate that residents prefer to receive information through flyers, mass media (e.g. radio and television) and social media (United Nations Economic and Social Commission for Asia and the Pacific 2020). Users favour social media communication, often underutilised within the waste management sector. None of the programs examined in our study used social media for information and promotional activities. Instead, print media (such as flyers, council gazettes and advertisements in newspapers), mass media (advertisements on television and radio) and press releases are standard (Singh 2021). The advantage of social

media is that it allows for the timely dissemination of information and two-way interaction with end users and stakeholders. Top-down information flows often prove ineffective due to their passive mode and insensitivity towards social and cultural landscapes (Bertana 2020; Walshe et al. 2018). Recent research indicates the importance of communicating about the pathways of recycling and what happens to waste after collection (such as the production of biogas, soil conditioner, bokashi and incineration) (Landells et al. 2022). This type of communication increases the transparency of the council's operations and builds community trust. It extends consumer responsibility beyond kerbside recycling to being part of a wider circular economy (Landells et al. 2022).

In addition, insights from behavioural and social sciences are underutilised in environmental and conservation programs (Williamson et al. 2018). This is evident in our analysis. Although strategies such as economic incentives and structural modifications are used, none of the programs explicitly integrated theoretical frameworks into program design and evaluation. The purpose of behaviour change models and heuristics is to conceptualise human behaviour, explain and predict phenomena, and understand how behaviour can be changed (Michie et al. 2017; Williamson et al. 2018). For example, rational choice models (such as the theory of reasoned action and the theory of planned behaviour) suggest that individuals make decisions that maximise the expected net value at the lowest cost. For rational thinkers, positive behavioural intentions are linked to attitude, beliefs, subjective norms and perceived behavioural control. Advances in behavioural sciences have brought forward numerous holistic frameworks that extend the focus beyond individual-level variables towards social, cultural, situational and infrastructural dimensions. For example, the capability-opportunity-motivation-behaviour (COM-B) model, conceived by Michie, Van Stralen, and West (2011), integrates intra-psychological (such as motivation and capability) with external factors (such as physical and social opportunity). Similarly, the socio-ecological model by Bronfenbrenner analyses human behaviour through a multi-lens perspective involving microsystems (how the individual interacts with their immediate surroundings), mesosystems (how the individual interacts with the community, including work, school, church and neighbourhood), exo-systems (individual's interaction with community contexts and social networks), macrosystems (the influences of society, religion and cultural values on the individual) and chronosystem (the influence of time on individuals) (Kilanowski 2017).

Increasingly, research is pointing towards a fusion of behaviour change techniques to create a higher impact (Hondo, Arthur, and Gamaralalage 2020; Landells et al. 2022; Michie et al. 2017; Williamson et al. 2018). Traditional methods have commonly included education, economic incentives (such as rewards, subsidies and payments), fiscal measures (such as taxes) and legislation (such as fines) (Michie, Van Stralen, and West 2011; Williamson et al. 2018). Contemporary behaviour-change tools include choice architecture, nudges and boosters, social incentives (such as norms and commitments) and emotional appeals (Williamson et al. 2018). The selection of theoretical models and tools depends on the user's understanding and familiarity with the frameworks, ease of use, behaviour-specific context and the population under study. Capacity building and refresher workshops in theory use will help practitioners acquire the necessary knowledge to translate theory into practice. An inadequate understanding usually leads to suboptimal theory usage (Kumar 2013), as evidenced in our findings.

5.3. Using participatory approaches to develop interventions

Participatory program design fosters inclusivity and equity by involving local stakeholders and community members to collectively design waste management solutions (He et al. 2024). Our analysis identified two categories of stakeholders that collaborated with Fijian municipal councils in the development of waste management programs. The first category encompassed upstream stakeholders, including advisors from the Ministry of Education, the Department of Environment and the Ministry of Local Government and Urban Development and Housing. Such high-level collaboration enhances the program's profile by expanding its visibility, scope and overall impact. Second, the councils collaborated with several midstream stakeholders, including the Japan International Cooperation Agency, the United Nations Development Programme, South Pacific Waste Recyclers, Rotomould Company, Secretariat of the Pacific Regional Environment Programme and Mission Pacific. This sort of partnership helps to strengthen waste management programs by leveraging the expertise, resources and technical support provided by these organisations.

Nevertheless, the engagement of downstream stakeholders, specifically end-users, was overlooked during the program design phase, potentially limiting the program's relevance and effectiveness. In our review, none of the programs discussed the participation of students, households or market vendors in the co-design process. The exclusion of downstream stakeholders during the program design phase is a recurring issue identified in the literature (Dietrich et al. 2016; Matenga-Ikihele et al. 2021; Rundle-Thiele, Dietrich, and Carins 2021). This is concerning, as the success of an intervention hinges on the input, acceptance, engagement and adaptive behaviour of the end-users (Prasad et al. 2025). In the context of waste management, understanding the challenges faced by the community in waste management is essential for informing effective policy and programmatic interventions. Such insights are important to design tailored interventions and educational campaigns to promote sustainable waste management at the household level.

Within the social marketing field, scholars are using pragmatic participatory design methods to develop user-centred programs. The co-create-build-engage (CBE) framework is a good example because it applies all eight social marketing principles to design behaviour-change programs (Rundle-Thiele, Dietrich, and Carins 2021). The first step involves co-creating (C) programs with end-users by incorporating four social marketing principles – stakeholder orientation, segmentation, competition and theory. The first step generates relevant insights (fifth social marketing principle) that contributes to the build process. The second step is to build (B) programs by applying the marketing mix (sixth principle), that eventually results in exchange package (seventh principle). The last step is to engage (E) end-users in the program, which produces desirable behavioural outcomes (eight principle) (Rundle-Thiele, Dietrich, and Carins 2021). The CBE process facilitates the collaboration between program managers and stakeholders to formulate evidence-based solutions (Hondo, Arthur, and Gamaralalage 2020). Furthermore, this approach blends traditional knowledge with non-traditional (external) knowledge that helps address local challenges (Remling and Veitayaki 2016).

5.4. Research contributions

This systematic review contributes to the current literature in three different ways. Firstly, to the best of the authors' knowledge, this is one of the first reviews to

systematically examine local waste management interventions in small island developing states from a behavioural standpoint (Michie et al. 2017; Williamson et al. 2018). Using the lens of social marketing, this article reviewed five types of waste management programs in Fiji to investigate how programs were designed and delivered and how this affected behavioural outcomes. This study found that theory application in waste management programs is relatively low. None of the programs integrated a theoretical framework into program design and evaluation. This represents a future opportunity for practitioners since systematically designed programs enable comparisons between pre- and post-intervention results, setting the baseline for evidence-based learning and practice.

Secondly, this study investigated the social marketing elements that are underrepresented in waste management interventions. Our findings revealed several gaps in program design – for example, the lack of segmentation, formative research, competition, price and promotion. This finding is of particular importance, as it delineates the principal challenges associated with the application of social marketing. This study found that school environment programs revolve around short-term awareness-raising activities during calendar events, and recycling behaviour is not strictly monitored and documented. Furthermore, environmental education is delivered through traditional teaching approaches that promote rote learning. Interactive teaching mechanisms are yet to be fully explored in schools. In addition, the communication strategy used for environmental advocacy needs to be carefully selected to align with end-users' preferences. This study found that local authorities used door-stepping to raise awareness about waste sorting and composting. There is mounting evidence from consumer surveys about the preference for social media over traditional methods. Environment educators can harness the power of social media to communicate with the community and to enable feedback for service improvement.

Finally, and most importantly, this study found that end-user engagement remains limited in waste management interventions. Our findings revealed that downstream stakeholders (end-users) were not actively involved during the planning and design process. This indicates a future opportunity to learn about end-users' needs and challenges and to create relevant and practical solutions. Local authorities can build community trust by integrating the voice of the customer in future waste management planning. This means that programs are designed in collaboration with the target audience (for example, students, households and market vendors), piloted, monitored and modified to optimise outcomes.

5.5. Managerial implications

Insights generated from this review can be translated into actionable items for policy-makers and program managers. These include:

- (a) Behavioural interventions should have specific objectives that can be measured at multiple time intervals to determine project impact and outcomes. These objectives and outcomes require proper documentation.
- (b) Behavioural theories are recommended to guide the design and monitoring of interventions. This helps to make baseline comparisons, measure program efficacy and to promote evidence-based learning and practice.

- (c) Advanced segmentation analysis will help to locate the most appropriate target audience and to customise interventions tailored to their needs.
- (d) Formative research should be conducted at regular intervals to determine real-time challenges associated with household-level composting and recycling.
- (e) Programs should be designed with end-users to optimise efficiency. Downstream stakeholders are equally important as upstream- and side-stream stakeholders.
- (f) Promotional tools should include digital media and social media platforms to reach a wider audience and to enable two-way interactions.
- (g) A national waste-statistics database would be useful in the long term to monitor trends of recycling and waste production. Reporting of waste statistics should be standardised across all municipalities.
- (h) Vending recycling machines and community composting hubs should be explored as alternative solutions to enhance recycling behaviour.

5.6. Limitations of the study and implications for future research

This study contains several limitations. First, this research has limited focus on the activities undertaken by non-governmental organisations that promote sustainable waste management. A systematic review of non-governmental organisations' environmental programs would help identify the behavioural techniques used at the grassroots level. Non-governmental organisations are important in environmental advocacy, activism, capacity building, policy planning and conservation activities. Second, this research focuses only on programs conducted in metropolitan areas; not all councils (such as rural authorities) are covered. Future research can be scaled up to other areas not captured in this study. This would generate insights from geographically and culturally diverse settings and increase our understanding of the impact of customised waste management programs on resource recovery efforts. Third, this research only explores waste prevention and management activities without discussing waste processing mechanisms such as waste-to-energy, biogas creation, incineration, aerobic or anaerobic digestion and other methods. It would be useful to explore this topic further – for example, by investigating civic perspectives and interest in waste processing techniques that could be conducted at the community level (through the creation of cooperatives or social enterprises) or through increased private-sector investment in recycling and composting.

6. Conclusion

When waste sorting and recycling are not mandated by law, local authorities and environmental agencies rely on voluntary mechanisms to influence civic attitudes and behaviour. This means that behavioural interventions need to be skilfully engineered to appeal to the target audience and to facilitate and sustain positive behaviour. Many local councils have untapped potential to recover resources from municipal solid waste. Effective waste management systems require the application of behavioural sciences, such as social marketing, to revamp efforts towards improving the quality of human health, reducing environmental footprint, addressing many of the climate change issues, and promoting economic growth and employment opportunities (United Nations Environment 2019). This paper provides in-depth insights into the

strengths and shortcomings of existing waste management initiatives in small island developing states, such as Fiji, and recommends evidence-based measures that can be cost-effective and sustainable in the future.

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No potential conflict of interest was reported by the author(s).

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