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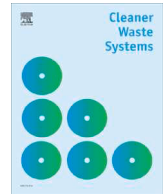
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Designing effective waste management practices in developing economies: The case of Suriname

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A B S T R A C T

Local authorities are responsible for the exponential increase of waste, estimated to be about 9 billion tonnes annually. However, developing economies face enormous waste management challenges compared to developed economies, suggesting the lack of effective waste management approaches in most developing economies, including the small island developing states (SIDS). This study explores waste management practices and behavior in Suriname in support of the government's ongoing efforts in developing a framework to integrate sustainable development goals into its national policies and strategies. The current research adopts a two-stage data collection method involving observation and semi-structured interviews. 15 key informants were purposively recruited and interviewed using the semi-structured interview method to understand the current perceptions and behavior towards waste production and management in Suriname. The results show that Suriname lacks a structured and formal waste management system like many other developing countries. Open dumping and uncontrolled incineration are the dominant waste treatment methods in the country. The semi-structured interviews show that many factors, such as the lack of government commitment, ineffective policies and regulations, lack of investment and infrastructure, and citizens' social-economic status, contribute to Suriname's current unsustainable waste management practices. Although the country faces many challenges, people, especially in villages, have positive attitudes towards the environment, enhancing their engagement in managing waste if the right schemes and facilities are installed. The study argued that the government should improve their participation and commitment to waste management, especially through installing, implementing and enforcing effective waste management policies and strategies. The study further demonstrates the need for collaborations between the government and other institutions, especially NGOs and private firms, to improve waste management investment and efforts. Using the ontology perspective, key findings are synthesized to highlight the practical and theoretical implications of the study. Limitations and future research are discussed.

1. Introduction

Over the years, human and business activities have had a considerable negative effect on the environment, including the terrestrial and marine ecosystems. For instance, overpopulation, deforestation, fishing, mining, and waste production play an important part in environmental changes, including climate change and biodiversity loss (Ceschi et al. 2021). Resources are consumed unsustainably, leading to an exponential increase in the volume of waste generated and sent to landfills daily. The current evidence suggests the need for humans and businesses to change their unsustainable behavior to reduce the negative consequences of their activities. The behavior change is necessary because many environmental issues, such as resource use and waste

generation, are anthropogenic and mostly associated with human consumption behavior (Hoornweg et al. 2013; Turaga et al. 2010). According to the current estimates, the global yearly waste production is about 9 billion tonnes, with the small island developing states (SIDS) responsible for 1.61 kg/capita/day (Caribbean SIDS), 0.82 kg/capita/day (Pacific SIDS), and 1.56 kg/capita/day (Atlantic, Indian Ocean, Mediterranean and South China SIDS) (Sewak et al. 2021).

Many policy efforts and practical schemes, such as waste hierarchy and deposit refund schemes, have been effectively introduced in developed economies to address the issue of waste production (Matsuda et al. 2018). However, developing economies, including Suriname, lack the capacity and infrastructure for waste management (Pereira and Fernandino, 2019; Milfont and Schultz, 2016). Ineffective waste

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management is a protracted problem in developing economies, including SIDS, exacerbated by tourism, population increase, urbanization, and changes in consumption behavior.

Like many other countries, waste management is the responsibility of the local government in Suriname, which was established in 1987 and sub-categorized into districts (distrikten) and subdistricts (ressorten). The country adopted the Barbados Programme of Action (BPOA) and the Mauritius Strategy (MSI) to achieve sustainable development, providing opportunities to address issues and challenges facing the implementation of the United Nations sustainable development goals (SDGs). As part of the efforts to develop a framework to integrate sustainable development goals into its national policies and strategies, Suriname considered waste management one of the key thematic areas, addressing sustainable consumption and production in the country.

Despite being a national priority, there is no formal and effective waste management system and structure in Suriname. According to the Ministry of Foreign Affairs (NIMOS 2013), Suriname generates more waste than its waste management capacity and becomes a serious problem affecting the infrastructure, environment, and people's health. For example, there was a fire outbreak in 2018 at Ornamibo, the biggest open dump site in Suriname, causing air and land pollutions with subsequent negative effects on people's health, especially children. As a result, Integrated Waste Management services are urgently required across Suriname, particularly Paramaribo, to reduce the consequences of increasing waste production. It is worth noting that many not-for-profit organizations, private companies, and governments are attempting to raise awareness about waste, especially plastic waste. This awareness has not been translated into practice, undermining the country's efforts in achieving its SDGs. With the current situation, there is no official data on waste generation, treatment, and disposal in Suriname for informed decisions on addressing the waste problem, suggesting that the country's waste management approach is developmental.

With a landmass of about 163,820 Sq. Km and projected population of 622,000 by 2030, there is an urgent need for the country to address the issues of waste production, especially regarding about 249 tonnes of household waste being produced daily across the country. As a result, this study explores waste management practices, including their effectiveness and impacts on people's behavior in Suriname. The main goal is to understand how the issues of waste can be addressed in Suriname, allowing local governments to translate national environmental management strategies into practice, including the achievement of SDGs. This study intends to facilitate effective and sustainable waste management practices in Suriname, creating a sustainable environment by changing people's mindsets and behavior from the current throwaway culture by answering the following research questions:

RQ1: What are the dominant waste management approaches in Suriname, including their effectiveness?

RQ2: What are the people's perceptions and behavior towards waste in Suriname?

RQ3: How can Suriname develop and implement effective waste management schemes consistent with the local attributes and culture?

Addressing these research questions are necessary for Suriname to develop effective waste management systems, resolving the complex and ill-structured waste management practices in the country. The findings of this study will allow policymakers, service providers, waste planners and environmental agencies to strengthen effective waste management practices by tailoring waste and environmental management initiatives to users' expectations and circumstances.

2. Waste management strategies and approaches

The rate at which waste is generated globally is astronomically increasing, mainly due to inefficient utilization and over-consumption of resources. The current astronomical rate of waste generation is exacerbated by population increase, urbanization and globalization, leading to the overproduction of goods, especially consumer products. While waste production is not a problem in its own right (Oke et al. 2021a), the way it is handled and managed, especially in developing economies, constitutes a major environmental, economic, and social disaster (Pereira and Fernandino, 2019). The responsibilities of waste management in most countries are championed by local councils/authorities, with waste management being considered a fundamental human right (Hoornweg et. al. 2013). The idea is to reduce the negative consequences of waste production. This right is elusive in developing and emerging economies compared to developed economies due to the unstructured and informal waste management approach in many developing and emerging economies.

Nonetheless, many useful and relevant studies on waste management strategies provide recommendations on how waste management, especially recycling, can be enhanced (Das et al. 2019; Ikhlayel and Nguyen, 2017; Yuriev et al. 2020). While the discussion around sustainability has intensified due to the increasing awareness of the consequences of human and business activities, many available strategies and approaches, especially in managing waste, are only relevant to developed economies (Deus et al. 2020; Tassie Wegedie 2018). Contrary to developing economies, developed countries seek more integrated and sustainable waste management strategies due to their socio-political and economic status to invest in waste management infrastructure and policy (Margallo et al. 2019). This observation is consistent with Brunner and Fellner's (2007) views that it is counterintuitive for developing countries to apply similar waste management strategies as developed economies due to their lack of investment and socio-cultural issues affecting formal waste management plans.

Although these arguments are legitimate, the starting point in addressing ineffective waste management strategies in developing economies is to characterize waste according to its attributes and sources (Das et al. 2019). This understanding is crucial, particularly when considering the need for consistency in waste management strategies across contexts and for different materials (Oke et al. 2021a), providing an understanding of "what", "where", and "how" of waste management (Oke and Kruijsen, 2016). Waste management strategy in many countries is underpinned by the idea of waste management hierarchy (Polanec et al. 2013). However, this idea has not been successful in many developing countries where the norm is open dumping, unregulated landfill, and uncontrolled burning (Ikhlayel and Nguyen, 2017; Margallo et al. 2019), leading to environmental and public health issues (Ikhlayel and Nguyen, 2017). Unlike most developed countries, people in many developing countries have insufficient knowledge, education and awareness about the importance of effective waste management practices, such as prevention, reuse, and recycling (Friesen et al. 2018; Knickmeyer 2020). While it is easier to blame citizens for unsustainable waste management practices, the lack of political will and inadequate infrastructure contribute to improper waste management in developing economies (Das et al. 2019; Friesen et al. 2018).

Nevertheless, developing countries, such as Brazil and China, are moving towards achieving sustainability through national policies on waste management and circular economy initiatives. Despite the recent progress in managing waste, there are many obstacles that local authorities/councils face in enforcing and complying with waste management policies in developing economies (Azevedo et al. 2019; Pereira and Fernandino, 2019). For waste management strategies to be effective in developing economies, especially in Suriname, there must be wholesale reform and behavioral change toward waste and waste production.

2.1. Roles of waste management behavior in waste management strategies

Many scholars (such as Hu et al. 2021; Tassie Wegedie 2018; Wang et al. 2019) have attempted to draw parallels and connections

between waste management strategies, especially recycling, and people's behavior. The key argument of many waste management studies suggests the need for consumers to change their waste production and management behavior (Oke et al. 2021a; Yuriev et al. 2020), meaning that the current unsustainable behavior has damaging consequences on sustainability. As a result, waste management studies have identified many factors, such as attitudes (Hu et al. 2021), environmental values, and social norms (Vassanadumrongdee and Kittipongvises, 2018), information (Wang et al. 2019), and social-economic status (Tassie Wegedie 2018), influencing consumers' behavior. While these factors have been conceptualized and operationalized by authors when explaining waste management behaviors, results are often mixed and mostly inconclusive, leading to the disparities in how waste management initiatives are designed and implemented across different local authorities/councils (Oke et al. 2021b; Sewak et al. 2021). According to Oke et al. (2021a), shifting waste management responsibility to consumers will not address the current waste management issues without understanding people's consumption behavior and personal situation. While the lack of awareness has been attributed to ineffective waste management practices in developing economies (Hu et al. 2021; Iyamu et al. 2020), waste management authorities and planners must design initiatives that will be easy to understand and allow consumers to maintain consistency within and across contexts.

Nonetheless, increasing awareness about the consequences of human and business consumption through education, information, feedback and social marketing are argued to influence how consumers perceive and treat waste (Debrah et al. 2021; Sewak et al. 2021). This perception reflects consumers' personal and environmental values, waste management orientation, attitudes, and personal circumstances. In general, motivations for waste management behavior can be broadly classified into psychological factors, personal attributes, and situational/contextual factors (Concari et al. 2020; Liao et al. 2018). According to the psychological perspectives, attitudes, personal and social norms, values, perceived behavioral control, goal settings, intentions, and habits contribute to waste management behavior. These perspectives are mostly influenced by socio-psychology theories and models such as the theory of planned behavior (TPB) (Ajzen, 1991), the value-belief-norm (VBN) theory (Stern et al. 1999), and the norm activation model (NAM) (Schwartz, 1977).

While consumers' waste management behavior is related to socio-psychology factors (Concari et al. 2020; Hu et al. 2021), there should be waste management opportunities through different initiatives, such as reuse and recycling. Without the provision of structured and formal waste management initiatives by municipalities or waste management authorities, the explanation of how people handle their waste using psychological factors is incomplete and misleading. This view is supported by the disparities in waste management, including its influencing factors, between developed and developing economies (Sewak et al. 2021). This observation is consistent with many studies (Alshurideh et al. 2019; Yuriev et al. 2020; Steg and Vlek, 2009) that have demonstrated that factors other than psychological factors could better explain waste management behavior.

Taking together, designing a waste management programme is one thing; making it easy for people to utilize is another issue facing many local councils and municipalities (Oke and Kruijsen, 2016), especially in developing economies. Contrarily, a lack of waste management opportunities while expecting consumers to manage their waste sustainably is a challenge facing many municipalities and waste management planners in developing economies. While identifying and explaining factors influencing waste management behavior has been extensively explored in waste management literature, the difficulty in managing waste when there is no opportunity or facilities is generally under-researched.

2.2. Theoretical underpinning

Scholars have adopted many social-psychology and marketing theories, mostly based on their disciplines and funding bodies, to explore and explain factors influencing pro-environmental behaviors (Oke et al. 2021a). While there are many theories/models, such as the theory of planned behavior (TPB), value belief norms (VBN), norm-activation model (NAM), and the new environmental paradigm (NEP), TPB remains the dominant theory often used in pro-environmental studies. According to TPB, consumers' pro-environmental behavior is contingent on their behavioral intention, which is influenced by their attitudes towards the behavior, including their perceptions of others and the extent to which they have control over their behavior (Concari et al. 2020; Yuriev et al. 2020). Contrary to TPB, which emphasized behavioral intention as the determinant of pro-environmental behavior, NAM focuses on consumers' feelings of moral obligation, translated as personal norms. According to NAM, pro-environmental behavior is determined by consumers' personal norms, which are influenced by their awareness of consequences of performing (or not performing) the behavior and how they attribute responsibility for performing the behavior (Schwartz, 1977). With no guidance from Schwartz on how NAM should be empirically operationalized, authors have applied it either as a mediator or moderation model in their studies (De Groot and Steg, 2009). This inconsistency in its application has resulted in disparate conclusions on the contribution of personal norms to consumers' pro-environmental behavior. However, Stern et al. (1999) conceptualized VBN by integrating Dunlap et al.'s (2000) NEP scale and Schwartz's (1977) NAM to enhance the predictive capability of NAM. According to Stern et al. (1999), pro-environmental behavior is a function of values and norms. While values (altruistic, egoistic, traditional, and openness to change) contribute to the new ecological paradigm, personal norms are formed through ascription of responsibility and awareness of consequences (Schwartz, 1977). In other words, VBN is based on the premise that consumers develop a new paradigm based on how they value the environment, leading to the formation of beliefs underpinning their (personal) norms in performing (and supporting) pro-environmental initiatives.

Scholars have adopted these models, leading to mixed findings and different conclusions on enhancing pro-environmental behaviors, including waste management (Liao and Yang, 2021; Yuriev et al. 2020). Despite the dominance and relevance of these models in understanding why consumers engage in pro-environmental initiatives, the instability of behavioral intention and lack of consideration for contextual factors undermine their utility in convincingly explaining pro-environmental behavior. Besides, empirical studies have not explicitly explored how consumers develop attitudes, personal norms, values and how their interrelationships contribute to societal norms towards pro-environmental behavior (Oke et al. 2021a). Nonetheless, scholars (such as Setiawan et al. 2020; Liao and Yang, 2021) have combined these theories to bridge the gap in research findings and improve their studies' reliability.

Rather than integrating TPB, NAM, and VBN in developing a comprehensive model, these models serve as the theoretical lens to understand and explain why the Surinamese engage in waste management, including barriers affecting their behavior. The goal is not to test or confirm the predictive capability of these models but to apply their meanings to explain and support people's perspectives about their waste management behavior, taking into account the contextual factors contributing to their behavior.

3. Material and methods

3.1. Data collection

For this study, a two-stage data collection approach was adopted to gain holistic insights into waste management practices in Suriname.

The first stage involved observations of waste management practices in Wanica and Paramaribo districts due to their strategic importance to the Suriname economy and sustainability. For example, the Suriname landfill site is located in Ornamibo within the district of Wanica whereas Paramaribo is the largest city and capital of Suriname. Pictures were taken to document the patterns of waste management practices in Suriname, providing the opportunity to compare districts for a general insight of waste management practices in Suriname.

Considering the exploratory nature of this study, we adopted a qualitative research approach (Bazeley, 2013) in the second stage of the data collection to understand people's perspectives on waste management practices and recommend how the situation could be improved. This approach allows for an in-depth understanding (Creswell and Creswell, 2018) of the implementation and effectiveness of waste management practices in Suriname by exploring people's waste management experiences and perceptions. The interpretivism perspective is necessary to completement the observations (i.e., first stage) and due to the lack of research on waste management practices in Suriname, including waste management behavior.

Consistent with the qualitative approach, we adopted a convenient snowballing sampling method (Bazeley, 2013; Bryman, 2016), where key informants were recruited through personal contacts and recommendations. Due to the non-sensitivity of this study, the adopted snowballing sampling method allowed us to ask each participant to nominate other key informants who could provide valuable information about waste management practices in Suriname. Participants were recruited based on their knowledge of waste management in Suriname and relevance to the research questions (Braun and Clarke, 2006; Bryman, 2016). Having identified relevant participants, semi-structured face-to-face interviews were conducted to collect data in answering the research questions and achieving the goals of this study. Each interview session lasted for about 60 min and provided an opportunity for personal interactions with participants to gain a better understanding of different approaches, including motivations and challenges facing sustainable waste management practices in Suriname. The interview was discontinued when there was no new information from participants (Bryman, 2016) about waste management practices in Suriname. Due to the saturation point, the data reported in this paper were drawn from semi-structured face-to-face interviews with 15 key informants (Table A.1) from different walks of life, such as practitioners and consumers, in Suriname. All the interviews were conducted in Suriname and were audio-recorded for coherent analysis and discussion of participants' views.

3.2. Data analysis

The interviews were recorded, transcribed, and thematically analyzed to identify emerging themes and patterns (Bazeley, 2013; Braun

1. Data Familiarization
Each interview was transcribed, and read multiple times to generate ideas and identify key themes and patterns from participants' views

2. Codes Generation
The phase is for the preliminary coding of the dataset. It allows relevant and meaningful codes to be generated from interview transcripts in a flexible and systematic fashion.

3. Searching Themes
Codes were collated and organized into different themes, establishing relationships between codes to define themes.

4. Codes validation: Review and cross-check codes
At this point, themes were reviewed and cross-checked against the extracted codes (Stage 1) and the entire dataset (Stage 2). Decisions were made to reach a consensus about themes reflecting a convincing and compelling narrative on waste management issues in Surinam.

5. Naming and defining codes
This stage involves naming and refining of codes by gaining deeper insights into the dataset and developing a narrative of themes based on the participants' views.

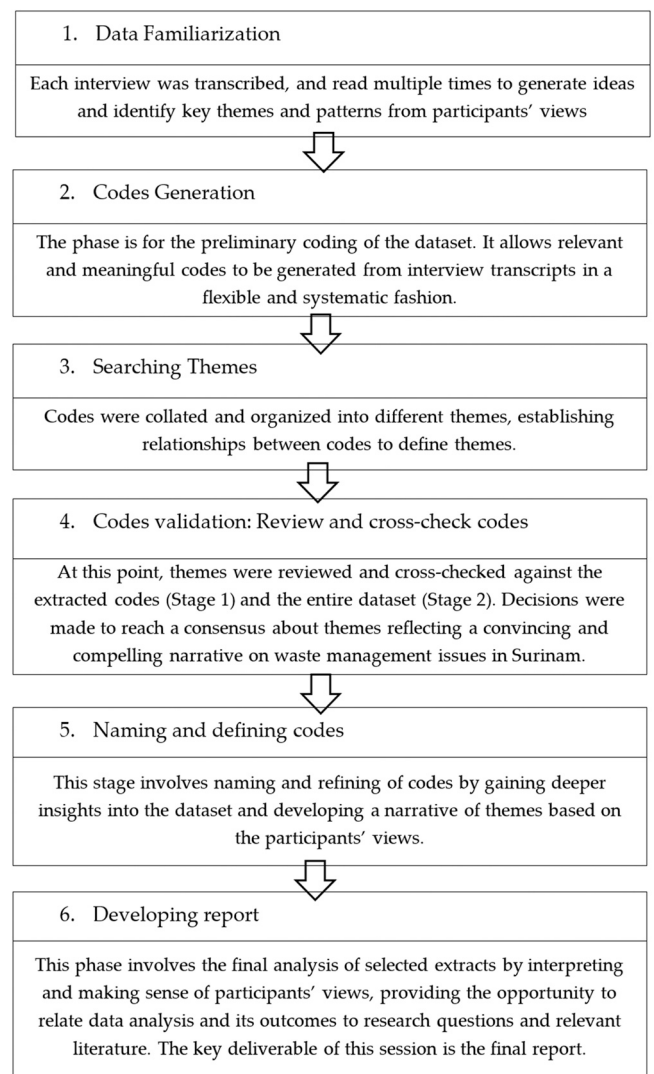| 6. Developing report |
| --- |
| This phase involves the final analysis of selected extracts by interpreting and making sense of participants' views, providing the opportunity to relate data analysis and its outcomes to research questions and relevant literature. The key deliverable of this session is the final report. |

Fig. A. 1. A step-by-step thematic analysis process (adapted from Braun and Clarke 2006).

and Clarke, 2006), reflecting people's accounts of waste management practices in Suriname. We adopted a step-by-step and iterative data analysis approach (Fig. A.1) as recommended by Braun and Clarke, providing a robust and systematic framework for data coding consistent with the research questions.

Table A.1
Participants' socio-demographics.

Participants ID	Gender	Age	Occupation
01	Male	40–50	Waste management practitioner (Owner of recycling company)
02	Female	25–35	Sustainable production and product development consultant
03	Female	25–35	Compostable packaging distributor
04	Male	35–45	Environmental consultant and facilities manager
05	Male	65–80	Sustainability expert and facilities manager
06	Female	25–35	Government official
07	Male	20–25	Entrepreneur
08	Female	20–25	Student
09	Male	22–32	Resident
010	Male	20–30	Student
011	Male	22–30	Civil servant
012	Female	20–30	Householder/Student
013	Male	20–30	Householder/Student
014	Female	20–30	Student
015	Male	20–30	Student

The transcripts were inductively analyzed, allowing for an in-depth understanding of peoples' waste management behavior, including the implementation and effectiveness of waste management practices in Suriname. The key findings were later organized into the terminologies and taxonomies of waste management, providing a systemic description of the complex and ill-structured waste management practices in Suriname. The ontology perspective (Cancino et al. 2018) allows for a parsimonious but comprehensive ontological framework of waste management (OFWM) for a better understanding of waste management issues in Suriname and how they can be addressed. Consistent with Cancino et al. (2018), the complexity of human behavior and the disparate factors influencing behavior suggest the need to apply the ontology perspective to systematically synthesize the research findings for waste management planners and policy-makers to implement and continuously evaluate appropriate waste management options for SDGs.

4. Findings

The study participants' socio-demographics (Table A.1) with age, gender, and occupation suggest that all participants are adults and have adequate understanding and awareness of waste management issues in Suriname.

4.1. Current waste management practices in Suriname

During this study, one of the investigators visited Suriname to observe and understand waste management practices in the country. It was observed that waste management in Suriname is ineffective and unstainable, with flytipping, littering, and open burning are generally adopted within the Surinamese communities, particularly Paramaribo district (Fig. A.2). However, waste is handled differently within and across districts, indicating that the experience of waste problems is not the same in cities and villages, including suburbs and slums. The observed disparity in waste handling across Suriname may contribute to waste management perceptions and behavior.

As shown in Fig. A.2 and Fig. A.3, the current waste management practices in Suriname are unstructured and not sustainable compared to high-income or developed countries. While residents are willing to prepare their waste for collection, many factors, such as weak legislation and lack of investment and infrastructure, contribute to the ineffective waste collection and treatment in Suriname. Despite the presence of a landfill site in Ornamibo, it was observed that the collection service is ineffective resulting in open burning and dumping in many cases. Limited collection facilities, informal collection services, high collection costs, manual and unhygienic recycling processes and lack of

Fig. A.3. Open dumping in Suriname.

awareness are other challenges facing Suriname, leading to dumping and uncontrolled burning of waste (particularly in Vuilstort Ornamibo).

4.2. Current waste handling approaches in Suriname

As shown in Fig. A.3, we observed that dumping and burning of waste, particularly in available open spaces and water bodies, are the major waste management approaches in Suriname. This observation is supported by our participants; for example,

"We now have people who are famous because they can be seen on camera dumping waste into the river" [Participant 1].

The situation in Suriname is similar to waste management approaches in many developing countries (Ikhlayel and Nguyen, 2017; Olukanni and Nwafor, 2019) and further explored using the participants' views.

While indiscriminate dumping and open burning are the dominant waste management approaches in Suriname and other developing countries, the lack of waste management schemes and the economic status of citizens are preventing people from effectively managing waste. For example, Olukanni and Nwafor (2019) reported that the

Fig. A.2. Waste collection in Paramaribo.

illegal dumping and burning of waste in Nigeria is mainly due to the country's lack of waste collection and separation systems. However, we observed that people in villages and cities across the two districts use special garbage bags and private waste collectors and finance their waste collection service. We further observed that many people, especially large families, lack the financial resources to pay for private waste collection services due to the high volume of waste they generate. The findings (Fig. A.2) of this study suggest that people with large families might struggle to buy the required bin (garbage) bags and pay for private waste collectors. For example,

"if you put your garbage in a different colour bag than yellow, that garbage collector will not take your waste. Those yellow garbage bags used to cost SRD 10 per bundle of 10; now, they are SRD 12,50. We were told that from buying those yellow bags, from those means, the garbage collection service is paid" [Participant 04].

"If you do not use the right colour garbage bag that the collection service will not take that garbage bag this resort to people burning their waste" [Participant 7].

While these findings might signal the lack of governmental support in managing waste in Suriname, many NGOs, such as Suresur, provide waste management opportunities to people in their jurisdictions. According to our participants, for example.

"The goal of Suresur is to find a sustainable possibility for waste, for example, placing bins for plastic bottles (recycling). This should motivate waste separation from residents in order to increase the efficiency of waste collection" [Participant 1].

"Suresur is the largest company that focuses on keeping awareness of waste management. You do have WWF, which is more focused on water, pollution and things like that. I am going to investigate, and I will send them for you" [Participant 02].

Due to the involvement of NGOs and other volunteers, some people are now separating their waste into different materials to extract value from the waste they generate. For example,

"We separate our waste as much as possible because we can compost the biological waste and reuse it for our plants (agriculture)" [Participant 4].

"There are different types of waste, and when I look at home waste, you have a lot of plastic bags and bottles. You also have food and their leftovers. I do separate these and throw it back into nature to become compost" [Participant 12].

4.3. People's pro-environmental behavior

The visit to Suriname for data collection provided the opportunity to observe people's pro-environmental behavior, particularly waste management. Compared to the city, where litter and open dumping of waste was in every nook and cranny, it is surprising that there was no litter in villages, especially Hollandse Kamp, including the surrounding areas. Based on this observation, participants were asked about their views concerning the disparity in people's behavior across the country; it is evident that people in the villages have different environmental attitudes, orientations and values to people in the cities. People in the villages possess a more altruistic value consistent with their relationship with nature, influencing their waste prevention and reuse behavior. According to the participants, for example,

"I think one of the biggest problems with people's irresponsible behavior is due to their broken connection with nature. People especially in the city inferior and see the forest and nature as a faraway place" [Participant 03].

"We also clean the village regularly by walking around with the youths of the village with garbage bags and collecting any waste/litter lying around. I have been to other indigenous and maroon villages, and I have seen how they handle their waste, and their villages looks fine. So apart from our village, other villages are well on the way to knowing how to deal with their waste" [Participant 4].

"It is just a bad habit of the Surinamese which is difficult to break because their motto is "Where I have eaten there I should leave my waste" as well as "If I don't litter the people that clean the streets will not have a job" [Participant 15].

These comments resonate with research findings that people with altruistic traits and values are open to change and feel connected to nature, affecting their behavior towards the environment (Stern et al. 1999; Xu et al. 2021). This is consistent with TPB theory which argues that people's behavioural intention is often influenced by their attitude, perspective and the extent to which they have control over their behaviour (Concari et al. 2020; Yuriev et al. 2020). Although the observed waste management situation in cities can be attributed to the lack of education and awareness about the environment and waste issues, awareness has been increasing across Suriname in recent years. For example,

"I have been working on this subject for 10 years, and it is only now that I am seeing an increase of awareness in Surinam" [Participant 1].

"I would say that it is a lack of knowledge, imagine that knowledge and awareness is applied and it does not change, you might say that it is the culture but think for now I think it is due to awareness and lack of knowledge" [Participant 2].

These comments align with the NAM theory, which emphasises that people's awareness of their environment is significantly influenced by their norms and an understanding of the consequences of their actions. Thus, behaviour is attributed to responsibility and performance (Schwartz, 1977).

4.4. Effects of education and awareness on waste management behavior

The lack of knowledge and awareness of environmental issues contribute to waste management behavior in Suriname; however, peoples' perceptions and interpretations of education are relative, and how it influences waste management behavior is different from one person to another. While many people perceive education as formal training and academic qualifications, others perceive education as a form of waste management information and awareness to inform citizens about waste issues in Suriname. Nonetheless, the findings of this study show that formal education contributes to awareness of the consequences of environmental and waste generation issues, shaping attitudes towards waste. Although formal education increases environmental attitudes, knowledge and awareness, these have no observable positive impact on waste management behavior.

"I think it is more of a social thing; education might be a subject to lift it to higher heights in the sense of the higher educated, you are how much more you can know about dirt but the basic thing is that piece of education. How were you raised? What did you get from home? You know how you get to the point of good and bad from home, when it comes to education. For example, as a director you cannot make this, you should know that is just the expectation but someone who is low educated can just know hey your yard must be clean. In the country (village) where my grandmother is, I see every day that they sweep in front of the yard, they know that they have to rake, dishes must be washed, no dirty in a hole this must be put in a bag. I do not think education plays a role I think" [Participant 9].

Considering that people in cities are mostly educated, and professionals, the disparity in waste management behavior between cities and villages suggests that the level of education or qualifications does not influence waste management behavior. This observation could mean the existence of the attitude-behaviour gap, undermining the contribution of attitudes in explaining pro-environmental behavior. Nonetheless, the findings show that the lack of awareness, especially about the consequences of waste production and management, including the lack of adequate information about sustainability, negatively impacts waste management behavior. For instance,

"I think there is a lack of education; people are not aware of the potential that waste has. It is then the job of the people that have this knowledge to make people more aware" [Participant 02].

"I think it all comes back to education and awareness, especially at schools. It should be the subject they get graded for and helps raise them to be responsible with their waste" [Participant 9].

While there is increasing awareness and education on sustainability issues, including waste production, in developed economies (Zamri et al. 2020), particularly through collaboration with organizations, this study shows the level of education and awareness about the importance of waste management in Suriname is limited. While there are suggestions that the current education system in Suriname should be reviewed and extended to the older generation, others observed that some concerned citizens have started creating awareness about environmental and waste management issues. According to our participants, for example,

"There is a gentleman who does campaigns on how important it is to handle your waste responsibly. He goes to schools in villages and educates children who then impact their parents by doing it together. In the end, the villages want to be clean, which indicates that you are simply missing education or someone who is actually informing you of what exactly needs to be done" [Participant 3].

"Except for the educational system to be upgraded in order to reach the older generation, this subject should be portrayed everywhere. For instance, on the radio, on tv, billboards because I feel like the more they would see or hear it the better or more they might be more motivated to adapt a responsible environmental behavior" [Participant 8].

This view is consistent with Knickmeyer (2020), who observed that developing countries mostly lack knowledge, education and awareness of the importance of waste management and its consequences on the environment. However, different factors such as knowledge about environmental issues and strategies affect individuals' intent to display responsible environmental behavior (Miafodzyeva et al. 2013; Yuriev et al. 2020). For waste management efforts to be effective in Suriname, there is a need for collaborations between key stakeholders, including non-governmental organizations and private businesses, to educate people about sustainability issues.

Local councils (municipalities) should facilitate this collaboration to increase waste management knowledge through environmental and waste management education. It could be formal or informal based on the target audiences' information/communication needs and requirements. Consistent with Schwartz's (1977) NAM, creating awareness about the consequences of waste production and unsustainable waste management could allow people to ascribe waste management responsibility to themselves rather than the government. Although awareness of consequences and ascription of responsibility might influence personal norms (Setiawan et al. 2020; Liao and Yang, 2021), situational attributes, such as the installation of waste management schemes, should support waste management norms and behavior (Concari et al. 2020; Oke et al. 2021a) in Suriname. Irrespective of people's level of formal education and waste management awareness, people have fundamental rights to access appropriate waste management facilities and schemes in Suriname for education and awareness to effectively facilitate waste management behavior.

4.5. Contribution of socio-economic status to waste management behavior

Considering the disparity in waste management behavior between cities and villages, we compared the northern and southern parts of the largest city (Paramaribo) to establish whether the socio-economic status of the area influences people's waste management practices and behavior. The comparison is necessary to understand the influence of perceived social norms on people's waste management and recycling behavior. The northern part of Paramaribo, which affluent and elite people mostly occupy, is the cleanest part of the city, and the participants noticed this pattern. For example,

"I would then look at okay money is one of them, most people who live there have a better job you do not like many children there, in the south you have more parents with 8/9 children, and you have a job so you cannot really pay attention to everything or you cannot pay a garbage man SRD 300 each month, but in the north, it just happens" [Participant 10].

"I view it differently. I feel like the people from these elite neighbourhoods see themselves as a different class, so they won't easily pollute or be reckless with their waste in that neighbourhood, while people from middle to low-class neighbourhoods have no discards for their waste. But there are people in these lower-class neighbourhoods that are highly educated but still don't have an ERB" [Participant 14].

Although local councils are mostly responsible for municipal solid waste management (Hoornweg et al. 2013), this study observed that waste collection and street sweeping are arranged privately by residents in the North. Participants believed that people in the North have the financial resources for private collection and cleaning services compared to other residential locations. Based on this observation, participants were asked about the effects of socio-economic status on their behavior. The understanding is important to establish the extent to which the perceived social (class) norms contribute to the waste problems in Suriname. Consistent with TPB, this study shows the effects of people's perceptions regarding waste management behavior of others, including their expectations about waste management on waste management behavior, especially recycling. Residential areas and locations influence these perceptions and consequently affect waste management behavior in those locations. For example,

"If you go to North and you see that the environment is clean, you will automatically try to uphold the standard of keeping it clean. Even if you were used to littering in your own surrounding, you would not do it if you are there because you see a difference. But if you are in an environment where you can see waste all around you will automatically indulge in this behavior if you don't have that level of self-awareness of not littering you will think it is okay to do so" [Participant 8].

"I also have this idea that maybe it is about status like their social standard. It is expected of them to keep their surroundings clean because they exhibit this luxurious lifestyle. This triggers them to have a special amount which they use for their waste management " [Participant 10].

"Because people that live in a certain neighborhood (slums) have a different attitude and characteristics, so for example even if they have these bins, they would still likely not use these bins correctly by still mixing waste." [Participant 15].

4.6. Barriers to effective waste management practices

4.6.1. Lack of government participation

Despite the efforts of NGOs in providing a sustainable solution to the issues of waste in Suriname, there should be more commitment and support from the local councils (municipalities). However, the lack of government support and commitment to addressing waste management issues in Suriname is perceived as the major barrier to waste management behavior. For example, government could install effective and consistent collection systems across the country instead of individuals arranging for private waste collection, resulting in flytipping due to the residents' socio-economic status (see 4.5). According to the participants, the local councils across Suriname are not adequately performing their statutory obligations to address unsustainable waste management practices. For instance,

"The government chooses temporary actions instead of sustainable ones because profit cannot be made from the environment. They see it as a less important aspect" [Participant 1].

"So as a country, we have to work towards strict rules better control and enforcement" [Participant 9].

For Suriname to achieve sustainable development, especially through effective waste management practices, the country must depend on good governance and the rule of law, with effective enforcement and compliance. This perception is consistent with Hoornweg et al. (2013), who argued that sustainable development must depend on good governance underpinned by the rule of law and facilitated by effective enforcement and compliance. The enforcement is particularly necessary for Suriname to ensure compliance to waste strategies, policies and regulations if and when introduced. According to Participant

Stakeholder		Process		Outcome
Government	±	Attitudes		Awareness
Central		Collaboration		Knowledge
Local		Commitment		Behavior
Institution		Structure		Implementation
Not-for-profit		*Governance*		Monitoring
Private Institution		*Schemes*		
Public (Citizens)		Infrastructure		
Urban		*Policies*		
Rural		*Regulation*		
		Facilities		
		Investment		
		Participation		

[to/in/toward/about/for/of waste management]

Fig. 4. Ontology of Waste Management (OWM).

3, for example, *"Making strategies is really a problem here, with the half-finished plans by the government. Plans can be made, but they are not put into practice"*. The effectiveness of the waste strategies and policies could be achieved through the collaboration between the international network for environmental compliance and national officials in charge of enforcement and compliance in Suriname.

On the other hand, the local government should install effective waste management schemes with the right facilities, preventing people from sending valuable resources to landfills or unhygienic burning. For example, the incineration facility at Nickerie should be upgraded with combined heat and power (CHP) and appropriately utilized in providing integrated waste management solutions to the citizens.

4.6.2. Collaborations in addressing waste management issues

With many NGOs and other institutions introducing initiatives to reduce the negative consequences of waste generation in Suriname, the participants believe that the government, especially the municipalities, should be committed and support their efforts through collaborations. The synergy between the government, private companies, NGOs, and other stakeholders could potentially address issues facing waste management practices in Suriname. According to our participants, for example,

"The government should work together with organizations from the private sector because these often perform better. You do have those big companies, for example, The National Oil company does their part 100 %, Torarica (hotel group), they have had the Greenkey award, an international award to the first South American country that has talked about their very responsive in dealing with waste, to use as little plastic as possible, they actually want to have a zero-waste concept, so they do their part, but the government itself does not do much" [Participant 3].

"So, we helped Suresur to raise awareness on those plastic bottle bins, and we see that they are being used, and we are happy about that. We prefer one person who uses it over zero. In addition, we had the clean-country action where people cleaned their surroundings. We also had beach cleaning in Albina and Weg Naar Zee. We twice organized a car-free day to make people aware of the fact that you can also go to the supermarket by bicycle instead of by car or on foot" [Participant 9].

Consistent with previous studies (such as Friesen et al. 2018; Troschinetz and Mihelcic, 2009), this study shows that the government's lack of support and commitment is a major barrier to effective waste management practices in Suriname. According to the participants, for example,

"There are no fixed waste management practices; I must say we are working on it, for example, that household waste will now be processed in gasification. It is still unclear whether it will serve as an energy plant" [Participant 1].

"There are no waste management practices; however, they were working on the standards of waste management. Whether they have continued is unknown" [Participant 2].

"There is not really a model consigned yet, where we point to a very expert or advanced handling of our waste" [Participant 9].

"I don't know if there are waste management practices, but if there is, it is ineffective" [Participant 13].

Like many other developing economies, the current situation in Suriname lends to illegal open dumping and uncontrolled burning of resources that could have been better utilized for economic development. This view does not mean that there are no waste management policies and legislation in Suriname; however, these are fundamentally ineffective, possibly due to the lack of implementation, enforcement and monitoring. For example,

"There is a law that prohibits people from littering and open dumping. However, these rules/laws are not followed or applied by citizens because the consequences are minimal" [Participant 1].

This situation reinforces the need for appropriate waste management governance in Suriname as previously alluded (sub-Section 4.6.1). There are many suggestions from the participants to address the issue of waste management in Suriname. These suggestions include introducing financial instruments and ensuring collaborations with other institutions in the country, particularly NGOs and private companies. Although imposing taxes may not be attractive to many citizens due to people's social-economic status, participants believed that market-based interventions by introducing/imposing taxes could address indiscriminate waste dumping and burning in the country. According to the participants, for example,

"The government should work together with organizations from the private sector because these often perform better" [Participant 3].

"An example, if taxes were paid for waste collection, investments could be made into the university of Surinam so that research could be done on how to better deal with waste" [Participant 12].

The interventions, if properly implemented, could create jobs, facilitate waste collection services, strengthen waste management capabilities, attract investments, enhance infrastructural development and allow the country to implement sustainable waste management strategies.

4.7. Synthesis of findings: constructing the ontological framework of waste management

Following the coding process, the participants' views were synthesized in developing the ontological framework (Fig. A.4) with illustrative sentences, each representing the domain of waste management. The idea is to make the complexity of waste management visible and comprehensible (Cancino et al. 2018). The ontological framework (Figure A.4) is a three-level hierarchy model, consisting of three illustrative components derived from the participants' views of waste management in Suriname. The illustrative components (i.e., total combinations = 6 *10 *5 = 300) and glossary of terms in the ontology are presented in Appendix A.

The first level is logically deconstructed three dimensions of waste management, each represented by a column. These dimensions are: (a) Stakeholder, (b) Process, and (c) Outcome. The second level categorized the elements within each dimension into taxonomies. The third level represents the sub-categories of some elements.

The three primary stakeholders in the ontological framework of waste management are the Government, Institution, and Public (citizens), and arranged in order of priority and contributions to effective waste management. The government, an important stakeholder, is subcategorized into central and local governments to understand the importance of each level of government. Also, institution is subcategorized into non-for-profit and private organizations, representing the classifications of organizations that are involved in waste management efforts. Citizens, on the other hand, are subcategorized into urban and rural based on the location and influenced by their social-economic status. Thus,

Stakeholder ⊆ [Government (Central and Local), Industry, Public].

The taxonomy of Process derived from the findings of this study consists of Attitude, Collaboration, Commitment, Structure, Infrastructure, Investment and Participation. The framework explicitly includes Participation to highlight the importance of stakeholders in the effectiveness of waste management systems. Process decisions and actions from waste management governance and schemes are subsumed under Structure whereas those related to Policies, Regulations, and Facilities are subcategorized under Infrastructure. Thus,

Process ⊆ [Attitudes, Collaboration, Commitment, Structure (Governance and Schemes), Infrastructure (Policies, Regulations, and Facilities), Investment and Participation].

The taxonomy of Outcome derived from participants' views includes Awareness, Knowledge, Behavior, Implementation, and Monitoring of waste management systems. These taxonomies are sequential and cyclical stages in OWM, indicating the need for reinforcement of awareness and knowledge of waste management to enhance and sustain people's behavior. While awareness and knowledge are important to waste management behavior, waste management systems should be implemented and monitored for efficiency such that the new acquired behavior does not return to the status quo. Thus,

Outcome ⊆ [Awareness, Knowledge, Behavior, Implementation, and Monitoring].

The three dimensions are arranged and should be read from left to right with adjacent symbols, words, and phrases so that the concatenation of elements across the columns is presented in a natural English sentence that represent a specific component of waste management framework. Each component is a potential candidate for further studies and an area for waste management improvement. Presented below are three Illustrative components of meaningful use of OWM from 84 (3*7*4) level-1 components and the subcategories of the taxonomies (shown as subscripts):

Government $_{central}$ attitudes toward waste management awareness.

Institution $_{private}$ investment for waste management knowledge.

Citizen $_{rural}$ commitment to waste management behavior.

These three and 300 others encapsulated in this ontology are logically the potential components of OWM, that could be further explored in waste management behavior research and practice. Although some of these components and subcategories may not obvious and relevant in some contexts due to the differences in contextual attributes, the ontology framework provides a comprehensive model to systematically analyze and understand the complexity of waste management behavior.

5. Discussion and conclusion

This study explores waste management practices in Suriname to understand people's perceptions and how the current practices can be improved. This understanding is necessary to highlight issues facing waste management practices and how the government can implement a more sustainable waste management approach. According to the

findings, Suriname has no formal and structured waste management practices to address the increasing waste generation across the country. The findings show that the dominant waste management approaches in Suriname are unhygienic open incineration and waste dumping at open dumpsites (especially Ornamibo). The lack of formal waste management research and practices contributes to waste behavior in Suriname; however, the proposed OWM (Figure A.4) and its glossary (Appendix A) provide a structured and systemic framework for further studies and the implementation of waste management practices. This study shows that Suriname like many developing countries struggle with waste management practices compared to high-income or developed countries. It further shows a lack of positive attitudes and commitment towards waste from both the government and citizens, especially in cities. For example, the absence of governmental plans and formal waste management services in Suriname affects people's waste behavior resulting in littering and dumping.

While unsustainable approaches are dominant in managing waste in Suriname, these practices are influenced by a combination of different factors, including awareness of waste issues, lack of government commitment, and inadequate infrastructure to address waste problems (see Figure A.4). The study further shows that the government often introduce temporary measures instead of critically assessing the problem to draft a sustainable waste management strategy. Consistent with many studies (Debrah et al. 2021; Friesen et al. 2018; Salmenperä et al. 2021), this study demonstrates that the lack of government support and commitment is the major contributor to the ineffective and unsustainable waste practices in Suriname. For Suriname and other developing countries to derive value from waste and achieve a circular economy, the government should be directly involved through legislation, policies, and infrastructure, attracting investment opportunities in waste management. For example, Troschinetz and Mihelcic (2009) observed that municipal waste management in 19 developing countries was largely influenced by government policies and efforts.

Although the lack of government commitment and concern contributes to ineffective waste management practices, the challenges and issues of waste in Suriname are multifaceted and underpinned by many factors. Consistent with many theories, such as TPB, NAM, and VBN in pro-environmental research, people's personal and psychological traits influence their waste management behavior. This study supports many studies (such as Debrah et al. 2021; Choi and Johnson, 2019; Liao et al. 2018) on changing people's waste management attitudes, values, norms (personal and social), and beliefs towards the environment. This change is particularly necessary in waste management to engrain sustainable waste management practices into people's day-to-day behavior.

However, the findings show that the issue of waste in Suriname is a social dilemma considering the disparity in waste management practices across the country. From the findings, there are differences between cities and villages in the way waste is managed, suggesting that people in the village are more altruistic and improve their environment than people in cities. The findings show that people in villages have a close relationship with the environment and possess more environmental values than people living in the cities, which can be attributed to culture and value-orientation rather than the effects of awareness or information. This observation is supported by previous studies (see Miafodzyeva et al. 2013) that reported increasing recycling rates in less populated areas compared to the low recycling rates in densely populated urban cities.

The lack of education and awareness of environmental issues have been blamed (see Debrah et al. 2021; Iyamu et al. 2020) for ineffective and unsustainable waste management practices in developing economies. To effectively address the issue of waste management practices in developing economies, particularly Suriname, there is a need to increase people's awareness about the consequences of waste generation and the current unsustainable waste management behavior. For example, increasing awareness and knowledge about the social and economic effects of dumping and burning waste can activate people's

personal norms, positively influencing their waste management behavior. The approach may influence people's value orientation and belief system, changing their attitudes toward waste generation and its treatment. However, the findings of this study show that perceptions and interpretations of education are different and mostly influenced by residential areas or locations.

Besides the perceived effects of education and information, participants attribute the disparity in waste management behavior to individuals' economic status.

While there is a consensus about the effects of the socio-economic status of residential areas, there is less agreement about the contribution of formal education to waste management behavior. They agreed that formal education could affect people's views about waste issues, but waste management information and awareness are important in changing people's behavior. For example,

*"In the sense of the higher educated you are much aware, and you know more about waste, but the basic thing is that piece of education about waste management" [*Participant 9].

"I would say that education really plays a role because someone that is highly educated and aware about the situation will think about waste in a different way. But someone who hasn't had that level of education and who is not aware of the consequents would not be triggered to be more ERB" [Participant 12].

While people in cities are generally educated, this does not translate to positive waste management behavior, suggesting that awareness instead of formal education or qualifications contribute to waste management behavior. For waste management programmes, to be attractive and effective, consumers (users) should be actively involved in the design process. Involving consumers as part of the waste management solutions using co-design approaches and principles allows initiatives/schemes consistent with the local situations and consumers' needs/expectations to address waste management challenges (Oke and Kruijsen, 2016). Putting consumers at the centre of waste management solutions is particularly important for developing economies to organically develop their waste management practices rather than copying systems that are not aligned with their context from developed economies.

Partnerships between government and other institutions, especially NGOs and private firms, are important areas worth considering by developing economies, particularly Suriname, to improve waste management efforts. According to Olukanni and Nwafor (2019), the participation of the private sector is required due to the failure of the public sector to achieve effective service delivery, especially waste management, in developing economies. This partnership, if effectively implemented, could address issues such as funding, investment, infrastructure, awareness, environmental programmes, and waste management policy implementation and monitoring. As a result, waste management issues in developing economies are institutional problems rather than people's value-orientation and behavior. Eliminating these institutional issues and other situational factors affecting people's waste management behavior could enhance sustainable waste management practices in developing economies. For example, open/illegal dumping and burning of waste, which are norms in many developing economies, including Suriname, could be perceived as anti-social if waste management infrastructure is installed, changing people's perceptions and behavior towards waste.

Based on the findings of this study, the government should improve their participation and commitment to waste management, especially through installing, implementing and enforcing effective waste management policies and strategies. The leadership and support from the government will complement NGOs and private institutions' efforts in developing and improving waste management practices in Suriname.

Consequently, it could attract direct and indirect investments, enhancing the prosperity to separate and extract valuable materials from the waste stream.

5.1. Limitations and future research directions

This study has several limitations and implications for future research. Due to the qualitative nature of this study, it is impossible to generalize its findings to all villages and cities in Suriname and other developing economies. Although the generalization of findings is the main weakness of all qualitative research, the approach provides a more exploratory and robust understanding of waste management practices in Suriname. Future studies could build on the findings of this study using Figure A.4 and Appendix A and adopt a quantitative approach to generalize the results across Suriname. An in-depth analysis of the country's environmental policies, particularly waste management strategies, could complement the quantitative study, enabling further insights into how policies and strategies translate to practice. It would be important to characterize waste streams and investigate how Suriname could extract resources from waste to achieve a circular economy.

Considering that open/illegal dumping and open burning of waste are prevalent in Suriname, this study suggests the need for the government to show commitment and support for effective waste management practices. The commitment could attract investment and collaboration opportunities between the key stakeholders, leading to providing infrastructure and secondary materials markets. Future research could explore how stakeholders, including the local governments, community, not-for-profit organizations, and private sector in Suriname could collaborate for effective waste management practices in the country. The research could explore how waste management systems could be co-designed using user-centred approach. Involving stakeholders, especially service users, in design and implementation of waste management practices in Suriname ensures that the introduced waste management schemes address practical waste issues and achieve users' expectations despite the disparities in waste management behavior in Suriname. Understanding the disparities in waste management behavior across different regions could assist waste planners and policymakers design effective waste management strategies and attractive schemes consistent with the local attributes and factors. The findings of this study could assist Suriname and other developing economies to introduce an effective and sustainable waste management system by developing and implementing effective strategies to facilitate waste management practices.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A: ontology of waste management glossary

Illustrative combinations (total = 6 *10 *5 = 300)

Glossary	Description
Stakeholder	An entity with a stake in and either affect or affected by waste and waste management.
Government	The public agency legally and financially responsible for waste management. These include governance, regulations, policies, law, strategies, and finance.
Central	A country's national government.
Local	A sub-set of national government, including the district, state, municipality, city, and village government.
Institution	Establishments undertaking different operations to meet the societal or market needs and expectations.
Not-for-profit	Institutions that are not profit-oriented.
Private	Privately owned profit-oriented institutions.
Public (Citizens)	All the people, including citizens and non-citizens, residing in the country.
Urban	Well-developed and densely populated towns and cities.
Rural	Under-developed and less populated towns and cities.
Process	A set of logically and structurally related waste management activities performed to reduce waste issues
Attitude	Enduring and general evaluation of waste and waste management practices based on a set of beliefs, emotions, and past behaviors toward waste and waste management practices.
Participation	Engagement in waste management schemes influenced by attitudes and other contextual factors.
Collaboration	Relationships between stakeholders to address waste issues
Commitment	Roles/actions of stakeholders in managing waste
Structure	The formal arrangement or organization of waste management systems
Governance	The authority and accountability framework to define and control the outcomes and benefits from waste management practices.
Schemes	Waste management initiatives and programmes introduced by the government to address the problem of waste generation.
Infrastructure	Physical and non-physical frameworks supporting and guiding waste management practices.
Policies	Guidelines for waste management based on systematic principles for integrated and effective waste management systems/schemes.
Regulation	Legal and market-based rule, authority, or mechanism established by the government to control waste management practices.
Facilities	Equipment and tools for waste management activities.
Investment	Financial and non-financial resources devoted to waste management
Outcome	Results and consequences of waste management efforts.
Awareness	Understanding and consciousness of waste problems.
Knowledge	Skills gained through information and experience.
Behavior	A set of observable and measurable actions, activities, or processes mostly initiated in response to internal or external cues.
Management	The process of realizing effective waste management and its contributions in addressing issues and challenges facing the implementation of SDGs
Practices	Waste management actions based on policies and strategies.
Monitoring	Continuous assessment and feedback on outcomes of waste management practices, policies, and strategies.

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