

Waste Management and Recycling Practices in Selected Shopping Malls in Klang Valley, Malaysia

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ABSTRACT

The growth of municipal solid waste and the environmental effects of disposal have increased the need for better separation and recycling. Shopping malls are important commercial settings, as retail, food-service and public activities produce several waste streams and involve many stakeholders. However, recycling facilities do not always lead to correct separation or consistent participation. This study assessed current waste management practices and investigated issues affecting recycling practice in three purposively selected shopping malls in Klang Valley, Malaysia. A qualitative multiple-case approach was used. Data were collected from April to June 2026 through three semi-structured interviews, involving one management representative from each mall, and structured site observations. Interview data were analysed using thematic content analysis supported by ATLAS.ti. The malls had recycling bins, source-separation arrangements, appointed waste contractors and programmes for selected materials. However, implementation differed between the cases. Common issues included incorrect separation, contamination of recyclable materials, limited awareness among new tenants and staff, space or capacity constraints, and inconsistent stakeholder participation. Respondents also described differences in monitoring systems, food-waste handling and public recycling activities. The findings indicate that clearer labels, repeated training, routine monitoring, better collection planning and systematic performance records may support more consistent recycling practice. Future studies should include more malls, other stakeholder groups and quantitative waste records to provide a broader assessment of recycling performance in commercial buildings.

Keywords: shopping malls; waste management; recycling; waste segregation; Klang Valley

INTRODUCTION

In 2016, global municipal solid waste generation was estimated at 2.01 billion tonnes, equivalent to an average of 0.74 kg per person per day. Under a business-as-usual scenario, this amount was projected to increase to 3.40 billion tonnes by 2050 (Kaza et al., 2018). This continued increase may intensify environmental pressures, particularly greenhouse-gas emissions associated with waste treatment and disposal. Effective waste separation, recycling and organic-waste treatment are therefore important for reducing emissions from the waste sector (Samsuri et al., 2025). In Malaysia, the waste sector is the second-largest contributor to national greenhouse-gas emissions, accounting for about 9%, after the energy sector at approximately 80%. Solid-waste disposal sites contribute about 31% of waste-sector emissions, equivalent to approximately 3% of national emissions (Michel Devadoss et al., 2021). At the local level, Abd Khair and Ahmad (2017) found that effective solid-waste management in Subang Jaya depended strongly on management initiatives and programmes, although further improvements in waste-management practice were still required.

Shopping malls combine retail, food and beverage, service and public activities in a single commercial setting. These activities generate food waste, paper, cardboard, plastic and other general waste. Effective management therefore depends on separation at source, suitable collection facilities, contractor arrangements and participation by tenants, staff and visitors. Waste classification and recycling can reduce emissions associated with mixed

collection and disposal, although the results depend on separation quality and treatment arrangements (Wen et al., 2023).

Research on shopping-centre waste has discussed waste composition and circular business models, but evidence from the day-to-day management of Malaysian malls remains limited. Recycling performance is influenced not only by physical facilities but also by behaviour, monitoring and coordination among stakeholders (Sandina et al., 2023; Hamik et al., 2025). Pongpunpurt et al. (2024) highlighted the importance of collaboration among mall stores, office spaces and relevant stakeholders to improve plastic recycling and resource recovery. Assessing recycling practices in shopping malls is therefore important for understanding how activities are implemented and where waste recovery and management can be improved.

Although previous studies have examined waste composition, recycling behaviour and circular waste practices, limited empirical research has compared operational waste-management practices across Malaysian shopping malls using both management interviews and direct site observations. This study addresses this gap by providing exploratory, observation-supported evidence of how recycling practices are implemented across three shopping malls in Klang Valley. Its contribution lies in comparing the operational arrangements, stakeholder involvement and implementation issues across the selected cases. Against this background, the study has two objectives: (1) to assess current waste management practices in selected shopping malls in Klang Valley; and (2) to investigate issues affecting recycling practice. The following sections review the relevant literature, explain the research methodology, present and discuss the findings, and conclude with the main implications and future research needs.

LITERATURE REVIEW

Importance of Waste Management

Waste management is important because poor collection, treatment and disposal can affect environmental quality, public health and the use of natural resources. These effects include greenhouse-gas emissions, pollution and the loss of recoverable materials (Abubakar et al., 2022; Banerji et al., 2025).

Waste that cannot be recovered or treated is commonly sent to landfills or incinerated. Although landfilling is widely used, decomposing waste can release methane, while leachate may carry harmful substances into soil and water. Better separation, treatment and recovery are therefore needed to reduce reliance on disposal and its environmental effects (Grossule & Stegmann, 2020; Lokhandwala et al., 2024). Landfills are often selected because they appear simple and relatively inexpensive, but they provide limited recovery of useful materials, can retain waste for very long periods and may create serious air-pollution risks when fires occur. Landfilling may still be necessary for residual waste, but excessive dependence on it reduces opportunities to reuse and recycle materials (Davison, 2024). Sustainable systems should give greater attention to waste prevention, material recovery and suitable treatment technologies (Mostaghimi & Behnamian, 2023; Sharma et al., 2024).

Waste Management in Commercial Buildings

A waste management system normally includes storage, collection, transport, treatment, recovery and final disposal. In commercial buildings, the quality of separation at source affects later sorting and recycling. Systematic collection and clear operational responsibilities can reduce disruption and help maintain health and cleanliness (Hoorweg & Bhada-Tata, 2012; Das & Bharti, 2023). The type and volume of waste also vary with tenant mix, visitor traffic and food-service activity.

Shopping malls present a particular management challenge because public areas, retail units, offices and food outlets generate different materials at different times. Food and beverage tenants may produce wet and organic waste, while retailers commonly generate cardboard, paper, plastic packaging and mixed general waste. When these materials enter the same bin, later recovery becomes more difficult. Waste-room capacity, collection frequency and access for contractors must therefore be coordinated with tenant operating hours and peak visitor periods.

Previous studies have identified food waste and packaging as important commercial waste streams. Cicatiello et al. (2020) showed that decisions within retail operations influence food-waste management, while Sandina et al. (2023) demonstrated the value of identifying waste composition in a shopping-centre setting. These studies support the need to understand both the physical waste stream and the organisational practices that determine how it is handled.

Types of Waste Generated in Shopping Malls

Shopping malls commonly generate organic waste from food outlets, paper and cardboard from retail packaging, plastic containers and films, glass, metals, textiles, used cooking oil, electronic waste and mixed residual waste. The amount and composition vary with tenant type and operating activity. Food waste requires prompt collection because moisture and decomposition can create odour and contamination, while dry cardboard and paper need clean storage to retain their recycling value (Cicatiello et al., 2020; Sandina et al., 2023). Food-waste separation and recovery can also support circular-economy outcomes when treatment technologies are planned as part of an integrated system (Zhang et al., 2026).

Recycling, Behaviour and Circular Practices

Recycling supports material recovery and can reduce dependence on disposal when recyclable streams remain sufficiently clean. Circular-economy approaches extend this idea by keeping materials in use and converting selected waste into useful inputs (Lovrenčić Butković & Mihaljević, 2021). In shopping malls, possible activities include source separation, textile or electronic-waste collection, used cooking oil recovery, food-waste treatment and public recycling centres. However, the presence of bins alone does not show how much waste is recycled.

Behaviour is a recurring difficulty. Incorrect sorting, limited awareness and inconsistent compliance can contaminate recyclable materials. Malaysian research also shows that knowledge, convenience and supporting conditions influence recycling behaviour (Hamik et al., 2025). Regular communication, training and feedback may therefore be needed in addition to signs and facilities.

The participation of stakeholders is especially important for shopping malls, where management is not directly in charge of all decisions regarding waste disposal. Tenants, cleaners, waste contractors, staff and customers all influence the quality of waste separation. The required procedures can be communicated through training, while repeated monitoring is needed as staff change over time. Public communication should also be simple and easy to understand. Clear pictures, consistent colours, and proper bin placement can encourage proper separation and participation in recycling activities (Hamik et al., 2025; Pongpunpurt et al., 2024).

Recycling also encourages resource recovery and circular-economy practices. Paper, plastics, metals, textiles, used cooking oil and some electronic waste can be recovered when there are suitable collection and recycling channels available. Organic waste can also be treated by composting or other waste-to-resource processes. However, these initiatives require enough space, reliable contractors, regular maintenance and systematic records. Thus, the existence of a recycling programme does not necessarily indicate successful implementation when operational constraints remain (Pongpunpurt et al., 2024; Zhang et al., 2026).

Issues in Implementing Recycling Practices in Shopping Malls

Recycling facilities do not automatically produce high participation or correctly separated materials. In Malaysia, recycling participation and separation at source remain uneven even though policies and facilities have increased (Shina et al., 2026). In shopping malls, visitors make quick disposal decisions, tenants handle different waste streams and staff turnover can weaken earlier training. These conditions may lead to incorrect sorting, contaminated recyclables and inconsistent participation. Similar studies link recycling difficulties to awareness, convenience, coordination and the quality of supporting systems (Hamik et al., 2025; Oluwadipe et al., 2025).

Implementation also depends on storage space, collection frequency, contractor arrangements, markets for recovered materials and clear responsibility among stakeholders. Reverse-logistics barriers may interrupt the movement of recovered materials, while resource and institutional constraints can limit circular practices (Mwanza & Mbohwa, 2019; Giri et al., 2024). Shopping-centre research further shows that circular waste

programmes involve both operational opportunities and practical challenges (Pongpunpurt et al., 2024). These issues support examining recycling as a management process rather than only counting the number of bins provided.

Monitoring and Research Gap

Digital records and smart-waste systems may help managers monitor collection schedules, waste tonnage and recycling trends (Lakhout, 2025; Sivasamy et al., 2025). Yet operational descriptions are often reported without measured recycling, contamination or landfill-diversion rates. The present study contributes a small case-based account of reported practices and visible facilities, while explicitly distinguishing these observations from verified environmental performance.

A useful monitoring system should distinguish total waste generated, material sent for recycling, residual waste sent for disposal, and rejected or contaminated recyclables. Monthly totals alone may not explain why performance changes. Records should therefore be interpreted alongside changes in occupancy, visitor activity, tenant mix and collection arrangements. The absence of comparable records was a key limitation in the present study and influenced the cautious interpretation adopted in this paper.

METHODOLOGY

Research Design and Case Selection

The study used an exploratory qualitative multiple-case design. Three shopping malls in Klang Valley were selected purposively because they had visible recycling practices and management representatives who could provide operational information. To protect organisational and participant confidentiality, the malls are identified as Case Study 1, Case Study 2 and Case Study 3. This selection criterion was useful for examining existing practice but introduced positive-case selection bias: malls without recycling arrangements were excluded. The findings therefore cannot be used to estimate the prevalence or effectiveness of waste management across all shopping malls.

A multiple-case design allowed common practices and differences to be examined across three operational settings. The unit of analysis was the waste management and recycling practice of each selected mall. The study focused on management arrangements, facilities visible during site visits and the views of the three representatives. It did not calculate the environmental footprint of each mall or evaluate compliance with every legal requirement.

Table 1: Profile of the Case Studies

Case Study	Location	Year opened	Recycling hub	Waste room	Recycling bins
Case Study 1	Kuala Lumpur	2020	Ground Floor	Ground Floor	Every floor
Case Study 2	Kuala Lumpur	2023	Basement 2	Basement 3	Every floor
Case Study 3	Petaling Jaya, Selangor	December 2025	Basement 3	Basement 3	Every floor

Table 2: Respondent and Data Collection Details,,,

Code	Position	Experience	Duration	Observation access
R1	Facility Supervisor	15 years	~1 hour	Public areas, waste room and recycling hub

R2	Sustainability Operations	3 years	~1 hour	Public areas and recycling hub; waste room not accessible
R3	Property Executive	2 years	~2 hours	Public areas, waste room and recycling hub

Data Collection

One management representative from each mall participated in a semi-structured interview. The representatives worked in facility management, sustainability operations or property/building management. Questions covered current waste operations, recycling initiatives, stakeholder involvement, implementation issues and future improvements. A structured observation checklist was used during the site visits to record visible bins, labels, recycling areas, cleanliness, signs, educational material and other accessible indicators.

The interviews were conducted during scheduled visits and lasted approximately one to two hours. The same broad topic areas were used for all three respondents so that answers could be compared, while follow-up questions were used to clarify case-specific practices. The observation checklist covered facilities and infrastructure, operation and management, awareness and promotion, and general condition. Items that could not be accessed or verified during a visit were recorded as not available rather than assumed to be absent.

The use of one representative per case provided focused operational accounts but limited the range of viewpoints. The study did not establish data saturation and does not claim that three interviews represented tenants, contractors, visitors or the wider shopping-mall sector. Interview accounts were compared with observations where access allowed. Respondent and mall identities were anonymised, and the interviews were conducted with the participants' agreement. Participants were informed about the purpose of the research, participation was voluntary, and informed consent was obtained before the interviews.

Data Analysis

Interview transcripts were analysed using thematic content analysis supported by ATLAS.ti (Soratto et al., 2020). Relevant statements were coded, the initial codes were developed deductively from the research objectives and interview questions, while additional codes were added inductively when recurring issues emerged from the interview data. Coding decisions were reviewed against the original transcripts to ensure that the themes reflected the respondents' accounts. Similar codes were grouped, and five themes were developed: current practices; waste reduction and recycling initiatives; stakeholder involvement; implementation issues; and improvement strategies. Themes were compared across R1, R2 and R3, while observation findings were reviewed separately to check which reported facilities or activities were visible during the visits. The ATLAS.ti network views in the findings section show how the codes and themes were organised; their occurrence labels are software references rather than statistical measures.

RESULTS AND DISCUSSION

Current Waste Management Practices

All three representatives reported that their malls used formal waste collection arrangements and licensed or appointed contractors. Waste was separated into categories such as food waste, paper, plastic, cardboard and general waste. Policies, standard operating procedures and contractor requirements were used to guide collection and disposal. The three cases also reported recycling bins or hubs and some form of performance record.

The first thematic category produced four related themes: waste management operations; waste management policy and compliance; waste segregation and recycling practices; and waste-generation management. The codes included outsourced management, collection, disposal, licensed contractors, government guidance, internal policy, tenant compliance, food-waste management and identification of waste types. Figure 1 presents the ATLAS.ti network used to organise these findings.

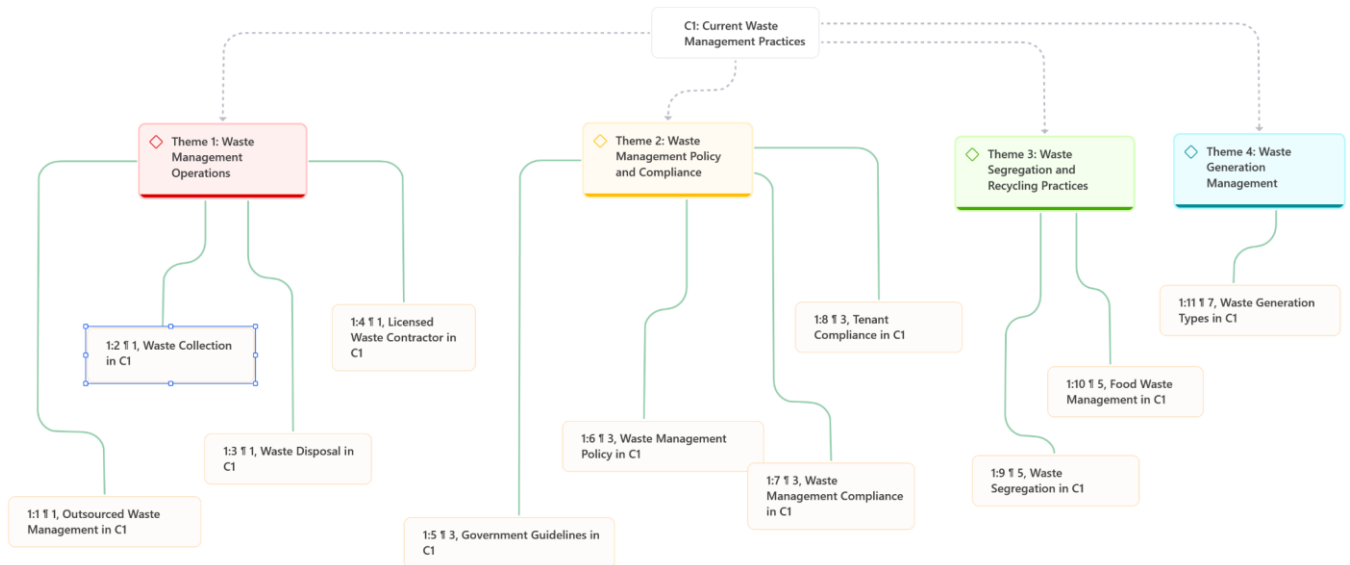


Figure 1: ATLAS.ti Network for Current Waste Management Practices

The operational emphasis differed. R1 described daily collection, tenant briefings and closer monitoring of separation. R2 described recycling spaces, food-waste treatment and a digital tracking platform. R3 described source separation, contractor collection and daily or weekly tonnage records. These are reported practices; the study did not obtain the underlying records needed to verify volumes, recycling rates or environmental outcomes.

Table 3: Summary of Reported Practices

Practice	R1	R2	R3
Recycling bins or hub	Yes	Yes	Yes
Source separation	Reported	Reported	Reported
Food-waste activity	Conversion to fish feed reported	Food digester/composting reported	Separate handling reported
Textile or special collection	Textile collection	Textile, toy and e-waste space	Used cooking oil and selected recyclables
Performance monitoring	Monthly contractor records	Digital tracking reported	Daily/weekly tonnage and ESG records reported

Recycling Initiatives and Stakeholder Participation

The malls applied the 3R concept through different combinations of infrastructure, programmes and communication. R1 reported recycling bins on each level, a buy-back activity and textile collection. R2 reported a dedicated recycling space and food-waste processing. R3 reported source separation, reduced paper use and awareness activities. The range of initiatives suggests that mall management can support recycling in several ways, but the data do not justify ranking one system as more effective than another.

Four themes were developed for waste reduction and recycling initiatives: recycling facilities and infrastructure; innovative recycling practices; monitoring and performance evaluation; and awareness and stakeholder engagement. The underlying codes covered facilities, programmes, textile collection, food-waste recycling, used cooking oil, 3R activities, performance monitoring and awareness campaigns. Figure 2 shows the relationship between these themes and codes.

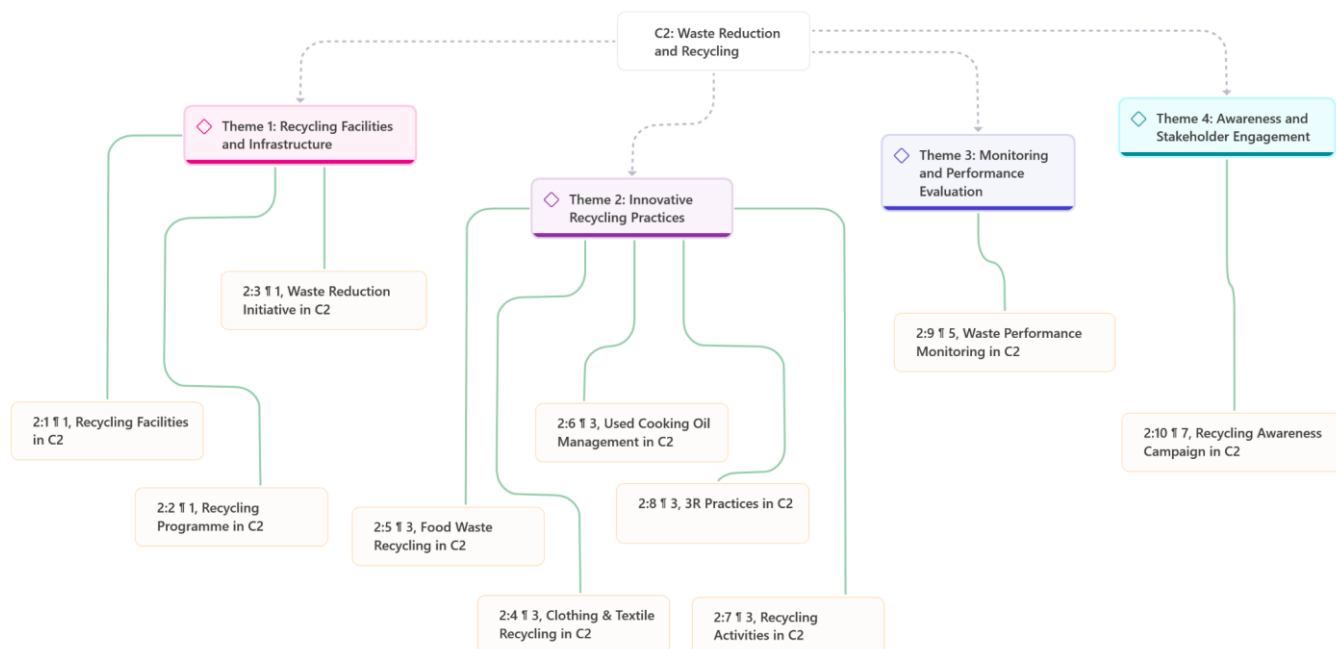


Figure 2: ATLAS.ti Network for Waste Reduction and Recycling Initiatives

Tenants and staff were involved through briefings, training or operational rules. Customers were encouraged through recycling facilities, signs and campaigns. However, respondents also reported that new tenants and employees sometimes lacked knowledge of the required procedures. This supports the literature that awareness must be repeated and linked with convenient facilities, monitoring and feedback rather than treated as a one-off campaign (Oluwadipe et al., 2025).

The stakeholder category was organised into three themes: awareness and training; participation; and collaboration. Respondents described tenant induction or briefing, staff training, customer access to recycling points and cooperation with external stakeholders. The findings suggest that responsibility is distributed across several parties, but the level of involvement differs by case. The ATLAS.ti network is presented in Figure 3.

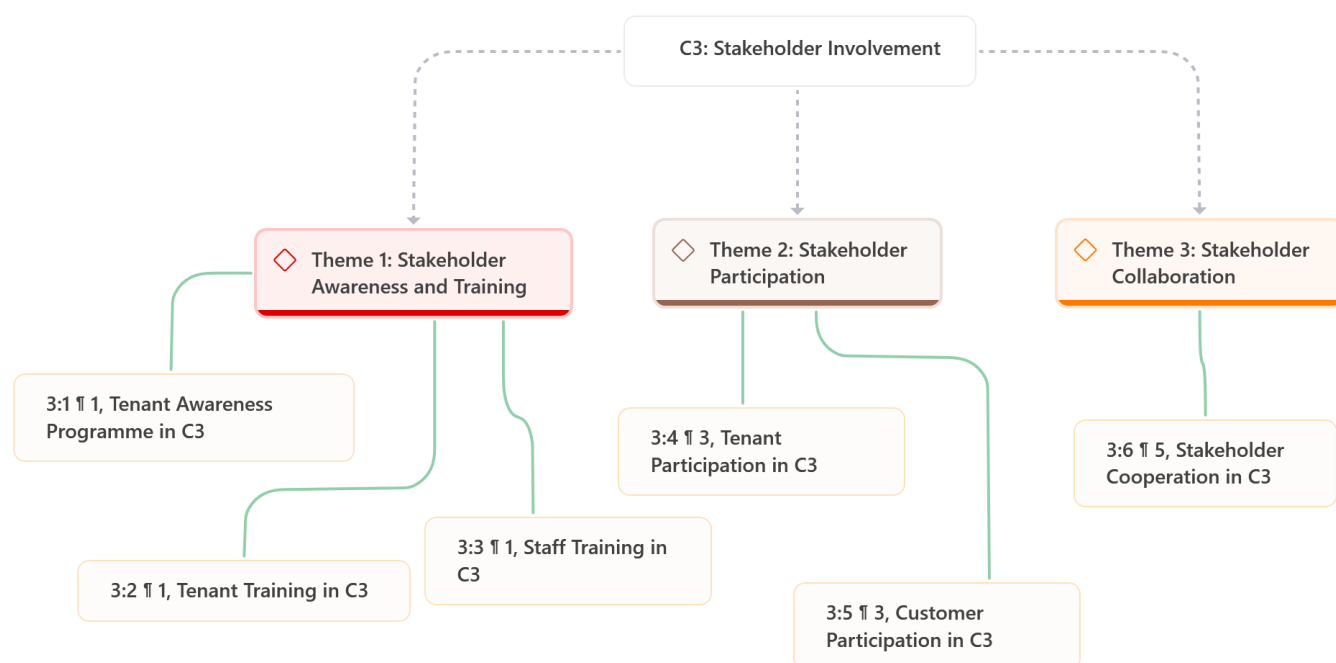


Figure 3: ATLAS.ti Network for Stakeholder Involvement

Issues Affecting Recycling Practice

Incorrect separation was the most common issue. Food waste or general waste was sometimes mixed with recyclables, reducing their suitability for recovery. Respondents linked this problem to limited awareness, new staff, tenant non-compliance and inconsistent practice. Operational issues included odour in a waste room, limited bin-centre capacity, overflow during peak periods, collection scheduling and disposal cost.

The issue-related codes were grouped into behavioural issues, waste contamination, operational issues, and enforcement and compliance. Behavioural concerns included lack of awareness and tenant non-compliance. Operational concerns included odour, overflow and disposal costs. Enforcement was mentioned as a response to repeated non-compliance, but respondent accounts indicated that rules alone did not remove the need for training and monitoring. Figure 4 summarises this thematic structure.

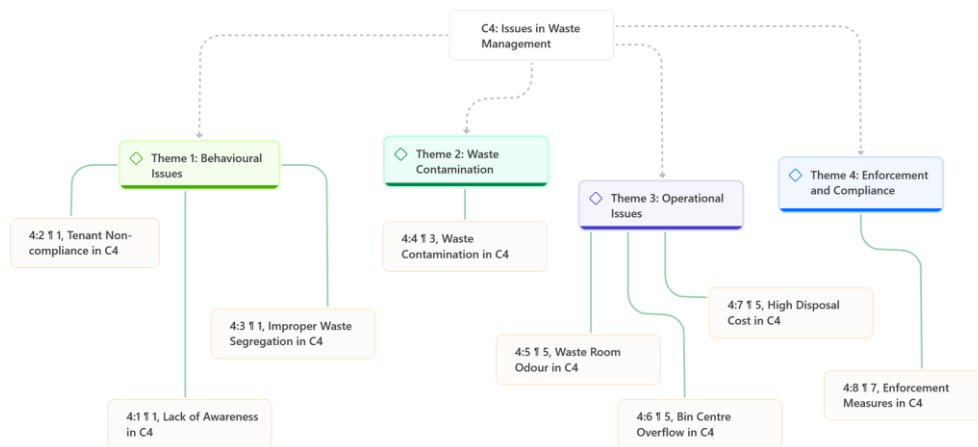


Figure 4: ATLAS.ti Network for Issues in Waste Management

Table 4: Main Issues Identified Across Cases

Issue	Evidence from the cases	Likely implication
Incorrect waste separation	Reported by R1 and R3; occasional mixing also reported by R2	Lower quality of recyclable streams
Contamination	Food waste mixed with recyclables	More sorting and possible rejection of materials
Awareness and compliance	New tenants or staff may not understand procedures	Inconsistent separation behaviour
Operational constraints	Odour, limited space, overflow and collection scheduling	Disruption and higher handling requirements
Limited performance evidence	Records were reported but not reviewed in this study	Environmental performance cannot be verified

A central finding across the three cases is the gap between providing recycling infrastructure and achieving consistent recycling practice. Although all three malls had recycling bins, collection arrangements and selected recycling programmes, incorrect separation, contamination and awareness problems remained. This suggests that infrastructure alone is insufficient. Its effectiveness depends on repeated training, stakeholder cooperation, monitoring and sufficient operational capacity. The findings therefore shift attention from the presence of recycling facilities to how consistently those facilities are used and managed.

Observation Findings

Waste segregation bins, visible labels, recycling facilities and public-area bin placement were observed in all three malls. Recycling areas were accessible in the areas visited. At Case Study 1, the waste room and monitoring-related records were visible during the visit. At Case Study 2, the waste room was not accessible, so

cleanliness, collection practice and tenant separation in service areas could not be assessed. At Case Study 3, separation facilities and a waste room were observed, but an active monitoring system or campaign was not visible during the visit.

Table 5: Selected Observation Results

Observation item	Case Study 1	Case Study 2	Case Study 3
Segregation bins and labels	Observed	Observed	Observed
Recycling area/hub	Observed	Observed	Observed
Waste-room condition	Observed	Not accessible	Observed
Monitoring system visible	Some evidence	Not observed	Not observed
Active campaign during visit	Not evident	Not evident	Not evident

Cross-Case Comparison

The comparison shows a common basic structure across the three cases. Each mall had designated recycling facilities, arrangements for waste collection and a management representative who could explain the process. The cases also shared similar behavioural concerns, particularly incorrect separation and the need to remind tenants or staff about procedures. These similarities suggest that infrastructure and written procedures are necessary starting points, but daily implementation depends on the people who use and supervise the system.

Differences appeared in the emphasis given to particular activities. Case Study 1 placed greater attention on routine collection, tenant briefing, textile collection and selected food-waste recovery. Case Study 2 described a dedicated recycling space, digital performance tracking and food-waste treatment, although access restrictions limited direct observation of service areas. Case Study 3 described source segregation, contractor records and operational concerns such as storage capacity and overflow. These differences may reflect variations in building layout, tenant mix, management priorities and available resources. They should not be interpreted as a league table because the evidence was not collected using a quantitative performance scale.

Interview and observation evidence did not always provide the same level of detail. A representative could describe a monitoring system or programme that was not visible during a short visit, while a visible recycling facility did not confirm how frequently it was used. The two data sources were therefore treated as complementary. Interview evidence helped explain procedures and responsibilities, whereas observation provided a limited check of physical conditions at the time of the visit. Where access was restricted, the paper reports the item as not observed rather than absent.

The comparison also highlights the difference between activity and performance. Recycling bins, campaigns, contractor reports and waste-treatment equipment are activities or management inputs. Recycling rate, contamination rate, cost per unit of waste and landfill diversion are performance outcomes. The present study mainly documented the first group. Future evaluations should connect each activity to measurable outcomes so that management can determine which interventions provide consistent improvement.

Table 6: Cross-Case Comparison of Practices and Issues

Comparison area	Case Study 1	Case Study 2	Case Study 3
Operational approach	Daily collection and closer separation monitoring	Dedicated recycling space and food-waste treatment	Source segregation and contractor collection

Special initiatives	Textile collection, buy-back activity and food-waste recovery	Textile, toy and e-waste collection; digital tracking	Used cooking oil collection and reduced paper use
Stakeholder approach	Tenant briefings and monitoring	Facilities, signs and awareness activities	Awareness activities and operational rules
Main reported issues	Incorrect separation and contamination	Restricted service-area access and occasional mixing	Incorrect separation, limited capacity and overflow
Monitoring evidence	Monthly contractor records reported	Digital tracking reported	Daily or weekly tonnage records reported

Study Limitations

This study has several limitations. It involved three purposively selected malls and one management respondent from each case. The malls were chosen because recycling practices were already present, which favoured relatively active cases. The sample did not include tenants, customers, cleaning staff, waste contractors or regulatory officers. Data saturation was not established, and the findings should not be generalised to all malls in Klang Valley or Malaysia.

The observation periods were short and access differed between cases. Some service areas and records were not available for inspection. The study also did not analyse verified waste tonnage, recycling rates, contamination rates, costs or landfill-diversion data. ATLAS.ti supported data organisation, but coding was completed by one researcher and no independent inter-coder comparison was conducted. These limitations mean that the study offers an exploratory account of practices and issues rather than a definitive evaluation of environmental performance.

CONCLUSION

The three selected shopping malls had established waste separation, contractor arrangements and recycling facilities, but they differed in their programmes and operational controls. Incorrect separation, contamination, awareness gaps and operational constraints remained common concerns. The study suggests that clearer infrastructure, repeated training, stronger monitoring and better coordination could support more consistent recycling practice.

The contribution of this study is exploratory. It documents practices and problems reported by management representatives and observed during short site visits. It does not demonstrate the environmental effectiveness of the malls because actual waste-generation, recycling, contamination and landfill-diversion data were not analysed. Future studies should include more malls, additional stakeholders and quantitative performance records. Comparative sampling should also include malls with limited or no recycling provision to reduce positive-case selection bias.

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Conflict of Interest

The authors declare no conflict of interest related to this study.

Data Availability

The interview and observation records contain operational information and are not included in the article. Availability is subject to participant confidentiality and author confirmation.

Declaration Of Generative Ai Use

Generative AI tools were used to assist with language editing and manuscript organisation. The authors reviewed and revised the output and remain responsible for the accuracy, interpretation, citations and final content of the manuscript.

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