

Understanding the Influences on Food Waste Segregation in the Malaysian Food Sector

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Abstract

Food waste is a major worldwide problem that has important implications for sustainability. The issue has received scholarly interest because of its environmental, social, and economic implications. Adopting segregation practices in the food sector has become widely accepted as a practical approach to reducing food wastage. Given the food sector's significant contribution to waste generation, it is critical to investigate the factors that influence the adoption of segregation practices in this sector. This study examines the influences by synthesising findings from prior studies between 2020 and 2024. Using a comprehensive literature review, the findings discuss critical factors impacting food waste segregation while highlighting existing gaps and limitations in the sector. These findings also provide future research with significant information and suggestions consistent with the Sustainable Development Goals (SDGs) that aim to promote effective and sustainable food waste management strategies. It also contributes significantly to the body of knowledge and practical ideas for developing sustainable practices in the food sector.

Keywords: Food Waste, Food Waste Segregation, Food Sector, Sustainability

INTRODUCTION

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Food waste has been a prominent issue in sustainability discussions due to its adverse environmental, economic, and social effects. The food sector, in particular, must tackle this critical issue. Recent research highlighted the need for food waste segregation as a long-term and feasible strategy for minimising the amount of waste that ends up in landfills since food waste is a major contributor to global waste. Despite its acknowledged potential, adopting such practices in the food sector remains limited, highlighting the need for further research into the reasons influencing this behaviour.

The Food and Agriculture Organisation of the United Nations (2019) define food waste as any food that has decreased in quantity or quality to the point that it is discarded by food service providers and consumers (Pérez-Marroquín et al., 2023). On the other hand, Ghani et al. (2013) define food waste as a combination of uneaten food and food preparation leftovers from residences, commercial businesses such as restaurants, institutional sources like school cafeterias, and industrial sources like factories. No matter how food waste is defined, the impact of this issue on the environment has been discussed

and proven across many studies. Excessive food waste generation increases greenhouse gas emissions unless effective waste management is implemented. Food loss and waste account for 8-10% of total world greenhouse gas (GHG) emissions, with an annual monetary value of USD 1 trillion (Mbow et al., 2019; Siming et al., 2022). It demonstrates that food waste has a detrimental influence on the environment and the economy.

Food waste is a global issue. According to the Food Waste Index Report 2024, it has highlighted that there are 1.3 billion tonnes of food waste produced every year, and it consists of three sectors: household, food service, and retail (United Nations Environment Programme, 2024). This indicates that food waste has been excessively produced at a global level. Surely, this huge amount of food waste is generated from various countries. China is among the countries that produce a significant amount of food waste globally. According to Nketiah et al. (2024), China generates up to 82.80 million tonnes of food waste annually. Europe and North America are also major contributors to global food waste, with significant amounts produced yearly. According to Rahman et al. (2024), the average quantity of food discarded by each individual (per capita) in Europe and North America ranges between 95 and 115 kilogrammes per year. These statistics show that numerous countries are responsible for the significant amount of food waste produced globally. Malaysia also is a major contributor to this global food waste. Examining this issue in Malaysia is essential, given its profound impacts on the environment, society, and economy (Dumitru et al., 2021). As Ismail et al. (2020) highlighted, excessive food waste poses a significant global challenge due to its numerous social, economic, and environmental repercussions.

In ASEAN countries, Malaysia contributes to a significant amount of waste about 12.8 million trash per year (Jain, 2017; Rangga et al., 2022). Therefore, this study aims to investigate the food waste issue in Malaysia. This is because Malaysia is one of the Asian countries facing issues in managing food waste (Teoh et al., 2022). According to a report from Solid Waste Management and Public Cleansing Corporation (SWCorp) in 2022, it has highlighted that Malaysia produced 134,588.04 kilogrammes of food waste in 2022, with food waste constituting the majority of the total solid waste generated. From the total of 134,588.04 kilogrammes of solid waste produced in 2022, food makes up 36% of solid waste, followed by plastic (23.9%), disposable nappies (11.3%), paper (8.8%), yard waste (3.6%), mixed waste (2.6%), metal (2.4%), glass (2%), drink cartons (1.3%), rubber skin (1.3%), wood (1.2%), others (1%), hazardous household waste (0.7%), and face masks (0.4%). This data indicates that food waste constitutes the largest portion of

solid waste produced. It shows that food waste has been excessively produced in Malaysia. Due to this excessive amount of food waste generated, many researchers have taken action to conduct a study on the issue of food waste. However, most studies they conducted primarily focused on household levels. Attiq et al. (2021), Chengqin et al. (2024), Fadhullah et al. (2022), Jamal et al. (2019), and Jereme et al. (2018) are examples of studies focusing on household food waste. The reasons behind this are due to the amount of food waste produced by the households, which was the highest among others. According to Food Waste Index Report in 2022, it has highlighted that households produce the most food waste (631 million tonnes), followed by food service (290 million tonnes) and retail (131 million tonnes) (UNEP, 2022). Even though food waste generated by households was recorded as the highest, the food sector in Malaysia also contributed to a significant amount of food waste as well in Malaysia (Sundaram et al., 2019; Mahdzir et al., 2022).

In Malaysia, the food sector establishment has increased. According to the Economic Census Report 2023, it highlights that food services had the most establishments (107,129) (Department of Statistics Malaysia, 2024). An increase in food sector establishment would increase the food waste produced by the food sector. Many scholars have supported that the rise of the food sector has resulted in increased food production, generating significant food waste (Abayomi et al., 2024; Otles et al., 2015; Todd & Faour-Klingbeil, 2024). This highlights the critical need to study the food sector in Malaysia, as it contributes significantly to food waste and household waste. Despite this concern, the study of food waste in the food sector remains insufficient (Dhir et al., 2020). Very few studies focus on food sector food waste despite its significant contribution to the amount of food waste. Studies from Kliaugaitė and Kruopienė (2017), Lang et al. (2020), Ng and Sia (2023), and Papargyropoulou et al. (2019) are examples of studies that focus on food sector food waste.

According to Kihila et al. (2021), adequate source waste segregation can help to reduce the waste volume while increasing collection and disposal efficiency. It highlights the importance of food waste segregation practices for enhancing disposal efficiency and reducing the waste volume going to landfills. For sustainability, the rising rate of food waste generation should be the key priority to be addressed. In response to prior research, the emphasis on food waste should be moved to food waste segregation within the food sector, as there are limited studies in Malaysia focusing on this area. Most of the research focuses on households rather than the food sector, which makes this study significant.

Previous research has highlighted limitations in implementing food waste segregation in Malaysia (Norkhadajah et al., 2014; Fadhullah et al., 2022; Chengqin et al., 2024). Therefore, understanding the factors influencing food waste segregation in the Malaysian food sector is vital. Hence, the article discusses factors influencing food waste segregation in Malaysia's food sector.

METHODOLOGY

This study utilised a systematic literature review to collect all the relevant information on food waste topics. A total of 30 journal articles between 2020 and 2024 were reviewed and assessed with a focus on extracting the key elements, influences, and trends. Scholarly databases such as ScienceDirect, Scopus, Emerald Insight, Web of Science, ProQuest, and Google Scholar were searched using keywords such as "food waste," "food waste segregation," "food sector," and "sustainability" to discover relevant journal articles. Articles were chosen based on relevance, academic rigour, and emphasis on food waste segregation in Malaysia. Studies on deeper waste management issues were only considered if they addressed food waste. Data from the selected journal articles were categorised to discover influences and problems connected with food waste segregation practices. Elements like government policy, corporate social responsibility, normative pressure, knowledge, and costs were highlighted. The data were synthesised to make conclusions, identify gaps in the literature, and offer practical recommendations for future research and practice.

RESULTS

As a result, the findings from 30 journal articles have been reviewed and summarised in the table. Five key elements have been identified from various journal articles on the influences of food waste segregation practices. The findings will be further discussed and synthesised in the next section to better understand the influences of food waste segregation in the Malaysian food sector. Table 1 summarises the key findings on the influences of food waste segregation in the Malaysian food sector based on the literature search for this study area.

Table 1:

Summary of the findings on the influences of food waste segregation in the Malaysian food sector

Variables	Authors	Findings
Government Policy	Ng & Sia, 2023	A positive relationship has been found between coercive pressure on food waste segregation mediated by corporate social responsibility.
	Wan et al., 2014; Chen & Lee, 2020	A positive relationship between perceived policy efficacy and intention to separate waste in Hong Kong was found.
Corporate Social Responsibility	Afsar & Umrani, 2020; Ng & Sia, 2023; Morea et al., 2023 Ng & Sia, 2023 Biggi et al., 2024	Most studies have confirmed that CSR has influenced pro-environmental behaviour. CSR directly influences food waste segregation intention. The effort to reduce food waste within the food sector is more likely to succeed when a company has a well-established CSR strategy.
Normative Pressure	Rui & Lu, 2021	Normative pressure is formed by customers' demands that place a higher value on environmental performance and use it to evaluate an organisation's legitimacy and reputation.
	Ng & Sia, 2023	Normative pressure has influenced the intention towards food waste segregation in organisations in Malaysia.
	Ke & Wareewanich, 2024; Ng & Sia, 2023	Normative pressure is the most dominant factor among the isomorphic pressures (coercive, normative and mimetic) to have influence on the intention of organisations towards the practice of food waste segregation.
	Ning et al., 2022	Normative pressure influences organisations in the manufacturing sector to embed environmental behaviour in daily operations to retain credibility and competitive advantage under external environmental protection concerns.
Knowledge	Chou et al., 2012; Martin-Rios et al., 2018; Lang et al., 2020	Numerous studies have found that their knowledge and attitudes influence restaurants' willingness to adopt a green approach.
	Ndiribe, 2023	Knowledge of the valuable potential of waste is crucial for waste reduction, which is the primary goal of the National Food Waste Reduction.
	Farooq et al., 2022	Awareness and knowledge can help companies or businesses enhance users' willingness to implement better waste management and sustainability decisions.
Cost	Mak et al., 2019; Hao et al., 2023 Zhang et al., 2023	Prior studies have found that businesses hesitate to invest in waste segregation if the associated costs are too high. When the cost of waste segregation increases and cooperation increases significantly, the motivation of households and businesses to cooperate will be reduced.

Rangga et al. (2022)	A study in Malaysia found that waste segregation could reduce landfill expenses while increasing recycling earnings.
Zhang et al., 2022	It has been discovered that the combination of rewards and costs influences segregation behaviour.

Source: Authors (2024)

FINDINGS AND ARGUMENTS

Segregating waste is separating waste based on how it is handled (Rakib et al., 2021). The most important waste management stage is handling and separating waste at the source (Fadhullah et al., 2022). This is because some waste is biodegradable and recyclable, and some are neither (Rakib et al., 2021). Previous studies revealed that waste management prioritises minimisation and segregation over other strategies (Masoumi et al., 2020; Safavian et al., 2015; Maleki & Sadeghi, 2022). It has been found that an appropriate source waste separation is important as it can reduce waste volume while increasing collection and disposal efficiency (Kihila et al., 2021). Despite the importance of waste segregation, past research discovered that food waste segregation at source programs has had limited implementation in Malaysia due to low awareness (Choon et al., 2017; Ng et al., 2020). Malaysia's Ministry of Housing and Local Government has revealed that only 24% of the 38,000 tonnes of waste created daily is separated and recycled, with the remaining 76% going to landfills (Ismail et al., 2020). A more serious issue is that landfills require vast amounts of land, and as they eventually fill up, the financial constraints associated with landfills increase, as will the building of additional landfills (Shukla et al., 2024). Therefore, the findings suggest that understanding the influences of food waste segregation in the Malaysian food sector is much needed. Based on the findings, five themes emerged as follows:

Government Policy

One of the elements is the government's policy. In the context of this study, government policy refers to a set of rules to encourage the practice of food waste segregation among organisations in the food sector. In other words, it refers to how an organisation perceives the government policy on its effectiveness based on the clarity, adequacy, and facilitation to influence them in practising food waste segregation. In the food sector, the government policy influence can be applied when government policy enforces the food sector in food segregation through government rules and standards in

encouraging sustainability practices. In Malaysia, the low awareness towards waste segregation could be tackled when the government standardises its environmental policy for the industry to comply with. Furthermore, the government can enhance organisational compliance by establishing policies that mandate the adoption of food waste segregation practices.

Much research implies that government policies significantly influence food waste segregation. According to Ng and Sia (2023), there is a positive correlation between coercive pressure on food waste segregation and corporate social responsibility. Coercive pressure on environmental issues reflects the policy of rules, laws, and standards. As defined by a scholar, laws, rules, and standards on pollution, energy efficiency, and quality define coercive pressure on environmental issues (Yue et al., 2023). Policies can also encourage the adoption of environmentally friendly things, which motivates businesses to adopt sustainable practices, and this strategy has been found to improve green governance and sustainability orientation (Erna & Mutaqin, 2023). Similarly, previous studies indicated a positive correlation between perceived policy efficacy and intention to separate waste in Hong Kong (Wan et al., 2014; Chen & Lee, 2020). These data suggest that government policy significantly influences food waste segregation behaviour. However, while some studies emphasise the importance of creating the intention to segregate waste, such intentions may not necessarily transfer into actual food waste segregation practices.

Corporate Social Responsibility (CSR)

The second element is Corporate Social Responsibility (CSR). CSR also has an important influence on food waste segregation in the food sector. In this study, CSR refers to an organisation's belief in their responsibility and commitment to carry out sustainability practices including food waste segregation. It encourages the food sector to take responsibility for social and environment by practices food waste segregation in their organisations. Organisations that embedded CSR in their operation will tend to practices food waste segregation to reduce the impact of excessive amount of food waste produced as supported by numerous studies.

Most research has found that CSR influences pro-environmental behaviour (Afsar & Umrani, 2020; Ng & Sia, 2023; Morea et al., 2023). For example, Ng and Sia (2023) argued that CSR directly impacts food waste segregation intentions. This idea is further

supported by research by (Biggi et al., 2024), which found that efforts to minimise food waste in the food sector are more likely to succeed when they have a well-established CSR strategy. According to Rajesh (2019), companies with strong CSR policies are likelier to use effective waste segregation practices in their overall environmental strategy. These data demonstrate how CSR substantially impacts sector conduct regarding reducing food waste. However, food waste reduction measures do not always imply segregating behaviour. Furthermore, even when there is an intention to segregate food waste, this does not always imply that actual segregation behaviour will be applied.

Normative Pressure

Furthermore, the findings suggest that normative pressure also influences food waste segregation behaviour. Normative pressure is one of the isomorphic pressures (coercive pressure, normative pressure, and mimetic pressure) from institutional theory (Ng & Sia, 2023). It involved all pressures arising from consumer demand, professional groups and associations. These pressures would lead to an organisation's pursuit of adherence to look legitimate in their conduct (Reis et al., 2020). According to Ng and Sia (2023), when consumers demand environmentally friendly products, organisations in food sectors tend to be involved in food waste segregation. This is because organisations would feel pressure to engage in food waste segregation in order to meet the customer demand and remain competitive in the industry in Malaysia. Hence, the influence of this normative pressure on food waste segregation among the food sector in Malaysia has been found in numerous studies.

Normative pressure has been found to have influence on food waste segregation among the food sector. It happens when normative pressure is formed by customers' demands that place a higher value on environmental performance and use it to evaluate an organisation's legitimacy and reputation (Rui & Lu, 2021). Additionally, it also has been found by Ng and Sia (2023) that normative pressure has influenced the intention towards food waste segregation in organisations in Malaysia. It also has been supported by another study that normative pressure influences organisations in the manufacturing sector to embed environmental behaviour in daily operations to retain credibility and competitive advantage under external environmental protection concerns (Ning et al., 2022). This is applicable to food waste segregation behaviour, where the main concern of food waste segregation is to protect the environment and preserve sustainability. Furthermore, many studies suggest that normative pressure is the most dominant factor

among the isomorphic pressures (coercive, normative and mimetic) to have influence on the intention of organisations towards the practice of food waste segregation (Ke & Wareewanich, 2024; Ng & Sia, 2023). This is aligned with this study to evaluate food waste segregation practices among the food industry in Malaysia. It shows that most of the findings have successfully highlighted the influence of normative pressure on organisations towards green practices. It has also been proven that normative pressure exerts the strongest influence, compared to other forms of isomorphic pressure in institutional theory, on the intention to engage in food waste segregation within organisations. However, the findings remain ambiguous, as some studies focus on the intention rather than the actual behaviour of food waste segregation within organisations.

Knowledge

The next element that emerged from the investigation is knowledge. Knowledge is defined as the ability to understand diverse issues and terminology related to the environment (Tong et al., 2020; Atiq et al., 2021). In this study, it refers to the ability of the organisations in the food sector to understand the importance of food waste segregation practices in reducing food waste in their organisation. In the food sector, the influence of knowledge is applied when organisations understand the environmental and social significance of food waste segregation, which in turn motivates them to adopt such practices. It includes understanding the alarming amount of food waste generated daily, the environmental and social impacts of such waste, and how food waste segregation can help mitigate these issues. In Malaysia, knowledge would influence food waste segregation because it gives awareness about the significance of food waste segregation (Bashir et al., 2020). It is because awareness frequently leads to better waste management procedures, such as the segregation of food waste at the source (Edullantes et al., 2024; Pan et al., 2025). Therefore, knowledge would influence the organisations to practice food waste segregation as suggested by numerous studies.

Numerous studies have found that restaurants' willingness to adopt a green approach is influenced by their knowledge and attitudes (Chou et al., 2012; Martin-Rios et al., 2018; Lang et al., 2020). As supported by Ndiribe (2023), knowledge of the valuable potential of waste is crucial for waste reduction, which is the primary goal of the National Food Waste Reduction. Also, a study found that awareness and knowledge can help companies or businesses enhance their users' willingness to implement better waste management and sustainability decisions (Farooq et al., 2022). It means that knowledge

is significant for a company to encourage their employees or customers towards effective waste management, such as food waste segregation, since it is the most significant step in waste management (Fadhullah et al., 2022). These findings demonstrate the importance of knowledge in driving food waste segregation practices in the food sector. Hence, these findings are significant and impactful in understanding the factors influencing food waste segregation.

Cost

Another emerging element from the investigation is cost. In general, cost is a key term in both business and economics. In this study context, cost represents the price paid or resources lost in the practice of food waste segregation. It refers to how much cost an organisation in the food sector perceives it takes to practice food waste segregation in their organisation. In the food sector, the influence of cost is applied in organisations, as they are more likely to practise food waste segregation when they perceive the cost required to practise food waste segregation as low for them. This includes things like the cost of segregation bins, employee training, and waste management systems. Regular monitoring and compliance checks to ensure compliance with segregation procedures also require cost, which may involve additional manpower or technological advancement (Woon et al., 2021). On the other hand, when organisations perceive cost savings in segregating food waste, they tend to adopt it in their organisation. For example, a study in Malaysia found that waste segregation could reduce landfill expenses while increasing recycling earnings (Rangga et al., 2022). Hence, cost savings would influence organisations in Malaysia to adopt food waste segregation in their company if they perceived it as beneficial to their organisations. In this study, costs have been found to be associated with food waste segregation practices in many studies.

Numerous studies have discussed cost and food waste segregation issues. For instance, previous research has revealed that firms are hesitant to invest in waste segregation if the associated costs are prohibitively high (Mak et al., 2019; Hao et al., 2023). Similarly, as waste segregation costs rise and cooperation increases dramatically, households and industries' motivation to cooperate decreases (Zhang et al., 2023). Furthermore, a study found that combining rewards and costs influences segregation behaviour (Zhang et al., 2022). It demonstrates that when the costs outweigh the benefits, the willingness to apply food waste segregation decreases, which is consistent with economic theory. As a result, the findings show that cost may influence the adoption of

food waste segregation policies, as industries are more inclined to practise food waste segregation when the related expenses are not viewed as a burden. The higher the cost of implementing food waste segregation, the less likely they will support it.

CONCEPTUAL FRAMEWORK

The findings propose five key elements influencing food waste segregation in the Malaysian food sector based on the data performed by previous studies, as discussed above. A conceptual framework has been proposed to elaborate more on the relationship between the five elements and food waste segregation in the Malaysian food sector. According to Antonenko (2014), a conceptual framework serves as a tool for organising investigation, establishing a theory-based and data-driven justification for the topic's significance and the technique's rigour. This study requires a well-structured research framework to demonstrate the associations between the numerous factors impacting food waste segregation in the Malaysian food sector. Therefore, as shown below, a proposed conceptual framework shows the relationship between five key elements: government policy, corporate social responsibility, normative pressure, knowledge, and cost of food waste segregation in the Malaysian food sector.

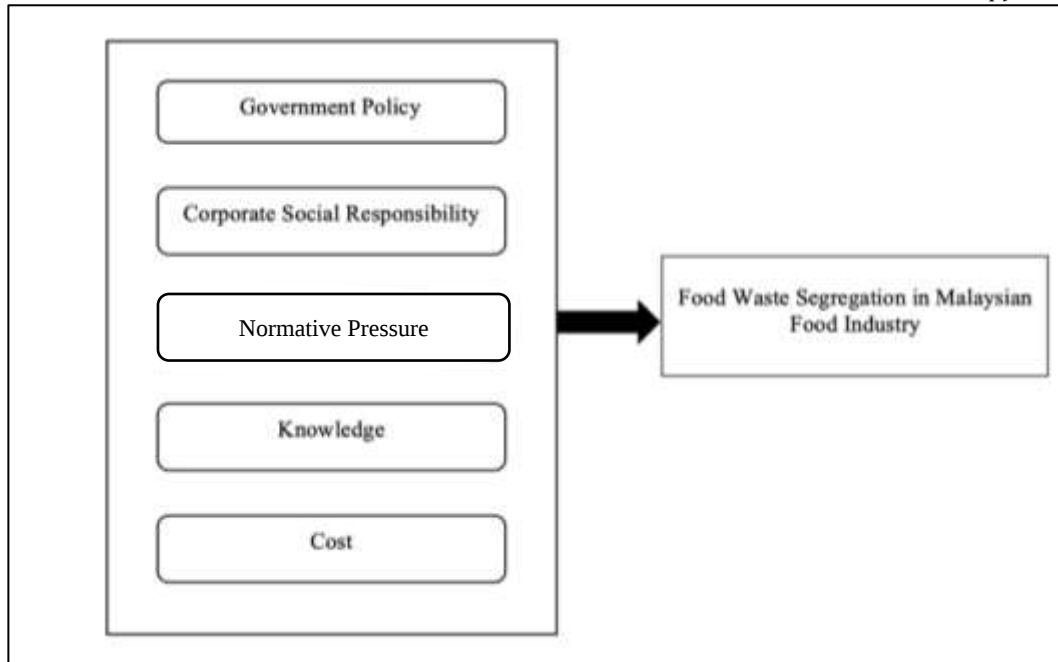


Figure 1: Proposed conceptual framework

CONCLUSIONS AND RECOMMENDATIONS

The analysis found five themes influencing food waste segregation: government policy, corporate social responsibility, normative pressure, knowledge, and cost. Based on the data, these influences are linked to food waste segregation. It shows that when these factors are combined, the likelihood of the food sector segregating their food waste is much higher. However, different themes show different strengths based on the evidence from the findings. The evidence suggests that government policy and CSR stand out as structural and strategic levers with the potential to influence the widespread adoption of food waste segregation among the food sectors. These themes call for immediate attention from Malaysian governments and policymakers in strategising sustainability efforts towards reducing food wastage in the food sector. On the other hand, normative pressure, knowledge and cost also have strong evidence in the relationship with food waste segregation. Most of the evidence has strengthened cost as an influence towards the food waste segregation behaviour. However, some studies also show sufficient knowledge will lead to the willingness to practice food waste segregation, while

normative pressure, government policy, and CSR appear to foster food waste segregation intention (Chen & Lee, 2020; Qu et al., 2023; Ng & Sia, 2023).

In this study, several limitations have been highlighted. Firstly, the studies have consistently revealed a persistent gap between willingness and intention and behaviour towards food waste segregation practices for factors such as government policy, corporate social responsibility (CSR), normative pressure, and knowledge. This limitation is consistent with a study from Ng and Sia (2023) which highlighted the need for deeper investigation into whether government policy and CSR influence the actual behaviour of food waste segregation practice or not. This highlights a gap in current knowledge, as the extent to which these factors influence real-world practices remains unclear. Therefore, future research should focus on examining how these factors can effectively translate intention into actual food waste segregation practices within the food sector.

Secondly, since most of the studies were conducted abroad, researchers concentrating on Malaysia's points of view should look into whether such factors affect food waste separation in Malaysia, particularly in the Malaysian food sector. Future studies should focus on food waste segregation practices within Malaysia's food sector. Thirdly, most literature revealed that most studies focused on household views rather than the food sector's, implying that the study of food waste segregation within the food sector remains underexplored and is significant. The evidence shows that only studies Ng and Sia (2023), Biggi et al. (2024), and Lang et al. (2020) conducted on the food sector. Future study is suggested to conduct more study on the food sector since it produced a significant amount of food waste as well (Todd & Faour-Klingbeil, 2024). Therefore, investigating what leads the Malaysian food sector to separate its food waste is critical, as the contributions substantially impact sustainability, aligning with the SDG goals.

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Author Contributions

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Conflict of Interest

There is no conflict of interest associated to this publication.

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