



From baseline expectations to high-barrier signals: Mapping Indonesian generation Z's sustainable food consumption through item response theory and motive-based segmentation

Kristia Kristia^{a,c}, Sándor Kovács^{b,*}, Nádasi Levente Sándor^d

^a University of Debrecen, Faculty of Economics and Business, Doctoral School of Management and Business, Debrecen, 4032, Hungary

^b University of Debrecen, Faculty of Economics and Business, Coordination and Research Centre for Social Sciences, Debrecen, 4032, Hungary

^c Sanata Dharma University, Faculty of Economics, Management Study Program, Yogyakarta, 55281, Indonesia

^d University of Debrecen, Faculty of Economics and Business, Institute of Economics, Debrecen, 4032, Hungary

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ABSTRACT

This study aims to evaluate the strength of various indicators related to seven types of food consumption motives, sustainable food choices, and food waste management variables in distinguishing the motivation and latent behaviour of Generation Z Indonesia through Item Response Theory analysis. A total of 1160 survey valid responses collected with quota sampling adjusted to regional distribution and balanced gender proportion were analysed using Item Response Theory to evaluate indicators, K-means clustering for segmentation, and Structural Equation Modelling-Partial Least Square to test the significance of the relationship between consumption motives and sustainable consumption behaviour. Seasonal fruit intake ranks highest discrimination ability among sustainable food choices, and suboptimal food consumption leads among food waste management indicators. Through Item Response Theory, this study classified food motives and sustainable consumption indicators into five typologies, revealing varying psychological entry points from baseline expectations to high-barrier signals. Four main segments were identified with variations in food consumption motives: Frugal Indifferent Foodie, Health-Focused Independent Locavores, Holistic Demander and Eco-Friendly Enthusiast, and Epicureans Pragmatist Waste Conservator. This study contributes by combining IRT and segmentation to uncover hidden motivational divides and offers a fresh perspective for designing more targeted and realistic interventions for sustainable food behaviour among youth in emerging markets.

1. Introduction

Indonesia's food and nutritional landscape present an alarming paradox; firstly, some Indonesians still suffer from malnutrition problems, with approximately 21.6 % of toddlers experiencing stunting and 25 % of adolescents similarly affected due to weak economic capacity and limited access to nutritious food (BPS-Statistics Indonesia, 2023; Ministry of Health and UNICEF, 2024). Conversely, the country also grapples with problems on par with high-income countries, notably excessive food waste. This duality underscores the importance of strategies to address unsustainable food conditions from the policymaker level to the society (Bappenas, 2021; United Nations Environment Programme, 2024). In Indonesia's current demographic bonus state, Generation Z, as the largest generational cohort, plays a pivotal lead in

shaping a more responsible future trend through their consumption habit and preferences (2030 Agenda, UN SDG 12) (Kristia et al., 2023). Various forms of sustainable food choices that are feasible and applicable for young Indonesian consumers include the consumption of local and traditional foods that perceived to have minimal carbon footprint and could improve the welfare of local entrepreneurs (Fontefrancesco, 2023), consuming seasonal fruits and vegetables that are nutrient-dense (Kowalsky et al., 2022), consuming organic foods that have an eco-friendly production process (Bhutto et al., 2023) and selecting products with eco-friendly packaging. Sustainable food-related behaviour spans the entire process, from selecting and consuming food to managing its disposal. Consumers can participate to reduce food loss by buying imperfect or near-expiry products that are still safe to eat, and by adopting simple habits such as taking leftovers home and reprocessing

* Corresponding author.

E-mail address: kovacs.sandor@econ.unideb.hu (S. Kovács).

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them creatively (Elimelech et al., 2024). Although recent trends among Indonesian Generation Z indicate a growing preference for sustainable food choices and food waste management applications, competing consumption motives can still lead to diverse patterns of sustainable behaviour (Purwanto et al., 2023; Damanik et al., 2024). Some sustainable actions type may be adopted even by those with low motivation, while others demand a stronger motivation level, and consumer segments with dominant motives may also exhibit different levels of sustainable performance (Mastria et al., 2023).

Different and dominant food consumption motives form the basis for how individuals choose or avoid certain foods (Wei et al., 2022; Waehning and Filieri, 2022; Tufail et al., 2022). Polish Generation Z consumers with stronger health-related motives are more inclined to choose organic and environmentally responsible food options. Research on young consumers in Saudi Arabia and Turkey indicates that social norms and peer-based identity can shape sustainability-oriented food practices when such behaviours carry social or symbolic value (Canoglu and Ustuner, 2025; Elgammal et al., 2024). In the context of Generation Z in United States, where sustainable food consumption is more established, variation in ecological concern among this generation cohort has also been linked to differing levels of willingness to pay for sustainable food products, with those who report stronger environmental motivations showing greater purchasing commitment compared with those with lower concern (Su et al., 2019; Purnomo et al., 2024; Jung et al., 2025). Among Indonesian Generation Z, awareness of health and environmental sustainability has been rising, yet its translation into sustainable food consumption often depends on which motives are most dominant, as competing motives such as price consciousness and convenience can outweigh sustainability-oriented intentions (Purnomo et al., 2024; Agustina et al., 2024). These patterns suggest that people may differ in how strongly they prioritise certain motives, which in turn affects how sustainability values are reflected in everyday choices. To understand these differences more precisely, it is necessary to use a method that can capture variation in the strength and activation of each latent motive and behaviour. Many earlier studies have relied mainly on classical test theory, which treats all indicators as equally influential and therefore misses these subtler differences in latent motivational or behavioural intensity (Meguellati et al., 2024). Item Response Theory (IRT) offers an approach suited to capturing these differences because it estimates both the discriminative capacity of each indicator and the threshold on the latent continuum at which respondents become more likely to endorse a given motive or behaviour (Kim et al., 2021; Terluin et al., 2023; Gao et al., 2024). In this study, IRT is applied to seven types of food consumption motives (sensory appeal, convenience, health concern, price consciousness, ecological concern, social-welfare concern and social adherence) alongside measures of sustainable food choice and food waste management. This approach makes it possible to identify which motives and practices are more readily endorsed even by individuals with lower levels of latent motivation, and which require stronger internal commitment to sustainability before they are likely to emerge. By employing IRT to evaluate indicators that form seven type of food consumption motives variables, sustainable food choice behaviour and food waste management, this study aims to address methodological gaps, offer rigorous psychometric evaluation, and provide beneficial insights for promoting sustainable food consumption behaviour.

Even within a single generational cohort, young consumers are exposed to different constellations of information, ranging from health messages and financial pressures to appeals to buy local or attend to environmental sustainability, and, as they selectively internalise parts of these information packages, they develop distinct configurations of food-related motives that translate into different patterns of sustainable food choice and food-waste behaviour (Agustina et al., 2024; Vuong et al., 2025). Segmentation studies increasingly reveal that Generation Z's food choices are structured around varying combinations of consumption motives rather than uniform motive orientations (Jang et al., 2024; Kamenidou et al., 2023). A comparative look across countries

uncovers a recurring logic, which is young consumers tend to cluster along similar motivational lines. In the United States, Generation Z consumers fall into three segments (sustainable activists, believers, and moderates), which showing distinct motive orientations, from strong ecological and health awareness to more pragmatic attention to price and convenience (Su et al., 2019). A study in Germany identified five profiles among Generation Z, modern traditionalists, meat lovers, uninvolved, open-minded and moderates, each with its own mix of preferences for sustainability, product quality, price sensitivity and involvement in food shopping and eating habits (Ruppenthal and Rückert-John, 2025). Research in Hungary likewise reports clear differences: some young consumers emphasise hedonic and convenience aspects in their sustainable food choices, whereas others respond more strongly to product presentation (Fodor et al., 2024). Greece, research identified two types of Generation Z consumers: those who deliberately chose local and seasonal foods as part of more sustainable habits, and those whose everyday food decisions were shaped mainly by price motive and routine (Pleno et al., 2025). Collectively, those previous studies highlight that segmenting Generation Z according to the relative dominance of different food consumption motives provides a clearer picture of how diverse motivational configurations translate into varying levels of sustainable food choices and food-waste management behaviours. Extending this segmentation work to the Indonesian context is therefore crucial for understanding how motivational patterns shape sustainable food choices and food-waste management (Purwanto et al., 2023), and it also addresses a clear gap in the literature, as clustering studies that link food consumption motives with sustainable food behaviours among Indonesian Generation Z remain rare. The following are the main research questions answered in this study:

RQ1: How is the strength of each indicator forming the seven types of food consumption variables, sustainable food choice behaviour, and food waste management behaviour in distinguishing the level of motivation and latent behaviour of the Indonesian Z Generation identified with modern response theory in the form of item response theory?

RQ2: What are the characteristics of various segments of the Indonesian Z Generation clustered by the level of 24 food consumption motives indicators, and what forms of consumption motives drive that can affect sustainable food choices and food waste management behaviour of each cluster?

Although studies related to the relationship between food consumption motives and sustainable food consumption, as well as segmentation studies on Generation Z, have been carried out in previous studies, the research gap filled by this study includes:

- 1) This study employs item response theory to provide rigorous insights into evaluating discrimination and threshold indicators, which could not be generated by classical test theory in general.
- 2) This study focuses on studying the motivational aspect of Generation Z Indonesia, the largest generational cohort that has a significant influence in driving consumption patterns and achieving sustainability goals in the country.
- 3) This research provides detailed insight into how various motives for sustainable food consumption can drive sustainable food choices and management of food waste in different segments. Most previous studies have proved the effect of consumption motives and sustainable behaviour only on the general population or the aggregate, which may neglect the heterogeneity of behaviour within the population.

2. Literature review

2.1. Perceived difficulty of endorsing food consumption motives and sustainable behaviour

Food consumption motives refer to the unobservable internal drives that underlie individuals' food choices (Panatsa and Malandrakis, 2024). The foundational theory of food consumption motives rooted in a pioneering study conducted to understand general everyday meal choices in the Western adult of high-income countries context, which include consideration of health aspects, mood, convenience, sensory appeal, natural content, price considerations, familiarity, weight control, and ethical concerns (Steptoe et al., 1995). Subsequent developments reflect shifts in food cultures, including the rise of digital food trends and influencer-driven recommendations, which introduce newer social and symbolic motives related to online visibility, trend adherence, and peer recognition (Filippelli et al., 2025). Prior research shows that various consumption motives are not equally salient for consumers to endorse; instead, they interact with a complex interplay of socioeconomic situations, demographic characteristics, personal preferences, and goals, leading to variations in consumption profiles between and within generational cohorts (Savelli et al., 2023).

Research on food-related decision-making shows that consumers endorse different motives with varying levels of ease, reflecting an underlying hierarchy of needs. Following Maslow's Hierarchy of Needs, people with financial limitations will prioritise functional aspects such as affordability, availability, and sustenance motivation since access to basic food security is their priority physiological need and tend not to be primarily motivated by higher-level needs such as self-actualisation to contribute to achieving sustainability (Verdeau and Monnery-Patris, 2024; van der Veer et al., 2024). Consistent with Herzberg Theory, affordability and availability act as hygiene factors in Generation Z's food consumption in several developing countries, such as China, Indonesia and Malaysia (Chen et al., 2024; Wijaya et al., 2022). Young consumers seldom experience these attributes as especially motivating, yet when prices are too high or products are hard to find, dissatisfaction quickly takes over and there is little room left for motivator factors such as maintaining health and contributing to sustainability (Canoglu and Ustuner, 2025; Acosta Aguinaga and Barcellos de Paula, 2025). Universal appreciation of the sensory qualities of cuisine proved to be a prominent motive in the context of consumers from countries with rich, diverse culinary traditions such as India (Imtiyaz et al., 2021), Serbia (Mitić and Vehapi, 2021), Nepal (Dahal et al., 2022), Iran (Hoseinean et al., 2024), and in higher income respondents in Kenya (Maina et al., 2024). Young students in Greece were also found to prioritise sensory appeal and familiarity as dominant non-moral motives over moral motives such as environmental concerns (Panatsa and Malandrakis, 2024). Viewed through the lens of Construal Level Theory, motives with low construal level and are anchored in the here and now, such as the lure of immediate sensory pleasure from tasty food, tend to feel concrete and vivid to consumers, which makes them easier to endorse (Grandison and Chadee, 2022). By contrast, motives that look to a more distant future, eating healthily to protect long-term wellbeing or choosing sustainable foods to reduce one's carbon footprint, remain relatively abstract and psychologically remote, so they are less likely to shape everyday food choices or perceived as more difficult behaviour to do (Jiang et al., 2023; Stahlmann et al., 2024). Existing studies have rarely examined, at the level of specific indicators, how strongly different motives and sustainable food-related behaviours discriminate between individuals with low versus high underlying propensities, particularly among Generation Z in emerging economies such as Indonesia.

2.2. Configurations of food consumption motives shaping sustainable food choices and food waste management

The preference for sustainable food can arise from multiple, and

sometimes competing, motivations rather than from altruistic environmental concern or a desire to create social impact alone (Kumar and Pandey, 2023). Besides altruistic concerns, consumers may choose sustainable options for egoistic or personal reasons, such as perceived health benefits, fit with their favourite tastes, convenience of purchase, or affordability (Wei et al., 2022; Mertens et al., 2022). From a Schwartz value perspective, self-focused motives (health, price, convenience), other-focused motives (concern for the environment and local communities) and motives linked to social conformity all are understood as different expressions of the same underlying value system, and prior work shows that differences in these value patterns are associated with variations in sustainable food choices (SFC) and their food waste behaviour (FWM) (Zhao and Huang, 2024; Marty et al., 2022; Pennanen et al., 2024). Recent work on informational entropy-based value formation conceptualises the mind as an information-processing system that must reduce informational overload by prioritising certain informational cues, such as price, taste, health or ecological signals, over others (Vuong et al., 2025). Over time, repeated exposure to particular cues makes some motives more chronically accessible than others, so that relatively stable value "signatures" emerge in food decisions (for example, more price-focused, health-focused or ecology-focused orientations) (Vuong et al., 2025).

Sensory appeal, defined by the taste, aroma, and texture of food, constitutes a fundamental aspect of the food preferences of many individuals within Generation Z (Teng et al., 2022; Moshtaghian et al., 2024; Guina et al., 2020). When sustainable products are perceived as at least as tasty and enjoyable as conventional alternatives, strong sensory motives can support SFC because the hedonic experience and sustainability attributes reinforce one another. However, when sustainability cues are associated with lower expected taste or unfamiliar textures, highly taste-driven consumers may avoid these options, even if they recognise their environmental benefits, thus weakening SFC (Senarathne and Thavarajah, 2025; Pasquariello et al., 2024). In the context of FWM, sensory appeal as a hedonic motive can pull behaviour in opposite directions. When food tastes good and the eating experience is satisfying, consumers are more likely to finish their meals, but high sensory standards can also lead them to reject suboptimal or near-expiry items that are still edible (Elimelech et al., 2024; Prescott and Spinelli, 2024; Varese et al., 2023).

According to Self-Determination Theory, sustainable food choices are more likely to be maintained when they satisfy intrinsic psychological values rather than being influenced solely by external pressures (Schulze and Janssen, 2024). Health, environmental, and social welfare motives are transsituational motives driven from enduring personal values relatively persist across different contexts (Arboleda et al., 2023). Recent shifts related to increasing environmental awareness and ethical considerations in food consumption are contemporary trends among young people (Halme et al., 2023). In Canada's Generation Z respondents found that the youth segment is divided into two segments, namely eco-centric individuals who consume sustainable food because of its impact on health and society, usually they are people who are more knowledgeable about environmental issues; the other segment is egocentric, which consumes sustainable food because they want to get health benefits for their bodies (Ruzgys and Pickering, 2024a). However, the health and environmental aspects are not a top priority, and they are still below the taste motivation, and price is the main barrier to realising a sustainable diet (Ruzgys and Pickering, 2024a; Chiciudean et al., 2024). In the literature on health-related motivation, eudaimonic health motives refer to pursuing health as a meaningful, value-based goal that can align with social or environmental concern, whereas more hedonic health motives emphasise feeling good in the short term and convenience and tend to be less strongly associated with sustained behaviour (Acosta Aguinaga and Barcellos de Paula, 2025; Polisetty et al., 2024; Lin et al., 2023).

Within the Value-Belief-Norm framework, altruistic and biospheric values, ecological worldviews, awareness of environmental

consequences and personal norms have repeatedly been linked to higher intentions for green consumption and lower tolerance for environmentally harmful or wasteful behaviour (Yang et al., 2024; Hoque et al., 2024). Ecological concern in food decisions is often accompanied by social-welfare concern, as shown in studies of locavorism where consumers choose local and traditional foods partly to support farmers, micro and small enterprises and to reduce the environmental impacts of long supply chains (Lema-Blanco et al., 2023; de Matos et al., 2024). In the context of Generation Z, some young consumers report prioritising local and seasonal products for these reasons, while others treat ecological and social-welfare considerations as secondary to taste and price (Fodor et al., 2024; Chen et al., 2024). Concepts such as Nature Quotient (NQ) describe the ecological ability variability as differences in the capacity to perceive and organise information about ecological interconnections, which helps explain why ecological motives become central for some individuals but remain relatively weak for others (Vuong and Nguyen, 2025).

In the context of Generation Z, some unique characteristics that encourage them to consume food are that they want to join social media trends and try the same food eaten by people closest to them or recommended by trusted food influencers (Kombanda et al., 2022; Qutteina et al., 2019; Kamenidou et al., 2019). The formation of this motivation variable is based on the subjective norm aspect of the Theory of Planned Behaviour, which states that peer influence, the behaviour of people closest to them, and the opinions of people who are idolised and considered influential can shape a person's behaviour (Chen, 2024a). Another theory that can underlie social adherence as a driver of food consumption is Social Cognitive Theory, which states that a person is moved to take action because of observing behaviour and learning the benefits obtained from consuming certain foods from people around him or influential figures (Jordi et al., 2025). In countries with a collectivist value, rooted in Hofstede's theory, environmental motives are more effective in driving people to practice sustainable consumption and good food waste management when these actions are supported and aligned with group expectations (Nguyen and Dekhili, 2024; Al Mamun et al., 2024). Research on horizontal and vertical individualism–collectivism and on Generation Z's espoused values shows that younger cohorts in several countries often combine benevolence and universalism with hedonism and self-direction, so that even in collectivist societies some consumers rely more on their own judgement and personal goals than on simply following others when responding to social and environmental food-related norms (Jung and Cho, 2023).

3. Methodology

3.1. Sampling method

To map the segmentation based on food consumption motives of Indonesian youth, this study used a research design in the form of a cross-sectional survey expected to capture respondents' consumption behaviour (Wang and Cheng, 2020). Quota sampling was employed for this study by targeting the number of respondents proportionally based on five major regions in Indonesia, while the selection of respondents was carried out by convenience method relying on the voluntariness of the respondents (Ilyasu and Etikan, 2021). The respondents' criteria for this study were young Indonesians aged 18 to 26 who were part of the Generation Z cohort. The minimum sample targeted in this research is 1067 valid responses calculated using the (Gomez and Jones, 2010) formula with a total Indonesian Generation Z population of 75.5 million (BPS - Statistics Indonesia, 2021), a confidence level of 95 % and a 3 % margin of error. After controlling the quality of survey responses and eliminating respondents who gave straight-line answers to all questions, one of the signals of non-seriousness in answering the survey (Jaeger and Cardello, 2022), the valid responses obtained were 1160. The distribution of the proportion of valid samples per region used in this study is 624 (53.7 %) respondents from Java, 265 (22.8 %) respondents from

Sumatra, 75 (6.5 %) respondents from Kalimantan region, 66 (5.7 %) respondents from Bali and Nusa Tenggara region, 131 (11.3 %) respondents from Sulawesi, Maluku, Papua region, which is adjusted to the actual percentage of the geographical distribution of Generation Z Indonesia. The quota proportion of female and male respondents in this study is balanced, with 580 respondents from each gender, to increase the representativeness of the data and approach the actual proportion of Generation Z Indonesia's gender distribution.

3.2. Research instrument

The research instruments used to measure food consumption motives and sustainable food consumption behaviour are questionnaires compiled and adapted from various works of literature, which include: sensory appeal (Teng et al., 2022; Moshtaghian et al., 2024; Guina et al., 2020), price conscious (Teng et al., 2022; Yue et al., 2020), convenience (Guina et al., 2020), health concern (Teng et al., 2022; Moshtaghian et al., 2024; Prakash et al., 2019), ecological concern (Teng et al., 2022; Aschemann-Witzel et al., 2022), social-welfare concern (Lema-Blanco et al., 2023; Kim and Huang, 2021), social-adherence (Guina et al., 2020), sustainable food choice (Gravelines et al., 2022), food waste management (Gravelines et al., 2022; Chang, 2023; Liu and McCarthy, 2023). These dimensions build on established work showing that food choices are shaped by both basic, functional considerations and more value-based or socially embedded motives (Panatsa and Malandrakis, 2024; Moshtaghian et al., 2024; Kronld and Lau, 1978; Verain et al., 2022; Simeone et al., 2025). Sensory appeal, price consciousness, and convenience represent more immediate, functional motives linked to taste enjoyment, cost management, and effort reduction in everyday eating (Stepoe et al., 1995; Kronld and Lau, 1978). Health, ecological, and social-welfare concerns, in contrast, reflect trans-situational motives rooted in more enduring personal values and ethical orientations that have been highlighted in research on sustainable and responsible consumption (Verain et al., 2022). Social adherence captures the influence of peers, reference groups, and social norms on food decisions and is conceptually aligned with the subjective norm component of the Theory of Planned Behaviour and with Social Cognitive Theory, which emphasise observational learning and perceived social expectations in shaping behaviour (Jordi et al., 2025; Chen, 2024b). Together, these seven motives type are particularly relevant for Generation Z, who demand basic expectations around taste, convenience, and price, while at the same time being exposed, through digital media and peer networks, to stronger messages about health, sustainability, and social identity (Teng et al., 2022; Guina et al., 2020).

Drawing on Hawkins and Mothersbaugh's consumer behaviour framework, which distinguishes acquisition and choice from disposition (Hawkins et al., 2020), this study operationalises sustainable food consumption behaviour through two complementary variables: sustainable food choice and food waste management, capturing the pre-consumption and post-consumption ways in which individuals interact with food. Sustainable food choice is measured through four types of behaviour: choosing local or traditional foods, preferring seasonal fruits and vegetables, purchasing organic products, and selecting products with natural or environmentally friendly packaging (Pasquariello et al., 2024; Gravelines et al., 2022). These indicators were selected because they reflect core themes in the sustainable diet literature, shorter supply chains and reduced food miles, support for local farmers and small producers, reduced chemical input, and lower packaging-related waste, and represent concrete choices that Generation Z of Indonesia consumers can enact in daily life (Veronica and Kusdibyo, 2021; Kristia et al., 2024).

Food waste management is assessed using four behavioural indicators: taking away leftovers when dining out, reprocessing or recycling edible leftovers at home, consuming suboptimal food, and near expired food (Purwanto et al., 2023; Gravelines et al., 2022; Chang, 2023; Liu and McCarthy, 2023). These behaviours correspond to key

strategies identified in the food waste literature: reducing plate waste, extending the use of edible food, and increasing acceptance of products that would otherwise be discarded along the retail or household chain (de Souza et al., 2025; Leung et al., 2025). They also vary in perceived difficulty, from relatively common and low-effort practices (such as taking leftovers home) to more demanding behaviours (accepting cosmetically imperfect or near-expiry products) (Zhang et al., 2023; Myhrer et al., 2024), which is consistent with the study's objective in capturing variation in endorsement thresholds across sustainable food-related behaviours.

The questionnaire consists of three primary parts, namely the first part, which contains the introduction to the survey topic, respondent age criteria, and questions related to respondents' willingness to be part of this study; the second part is demographic characteristics related questions; and the third part is questions related to food motives and sustainable food consumption behaviour. Before distributing the questionnaires to the target number of respondents, a pilot survey was conducted with fifty volunteers, and the research instruments used were tested for validity and reliability. After pilot testing the instruments used in this study, the authors obtained research ethics approval from the Indonesian research ethics committee, with the number E.6.m/115/KE-FPsi-UMM/IV/2024. The 32 indicators and questionnaire items can be seen in Appendix Table A.1.

3.3. Data analysis

Statistical software used to process data in this study are JAMOVI 2.3.28, RStudio 2024.04.2 version, and SMART PLS 4. In this study, several statistical analyses were carried out to ensure that the research instrument was psychometrically sound: Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Item Response Theory (IRT). In an exploratory analysis, the extraction method used is maximum likelihood with noblemen rotation, noting the multitude of fit indices available for this method (Goretzko et al., 2021). EFA analysis is carried out to identify the structure of the data; several unobserved variables will be seen from several sets of observed variables, especially by reviewing the factor loading value of each observed variable. If the value is above 0.4, it can be said that the questionnaire item can explain the intended unobserved variables (Sürücü et al., 2024). To ensure that the data does not undergo Common Method Bias (CMB), such as specific patterns appearing not because of actual opinions but because of method bias, Harman's One-Factor Test is conducted, and it is necessary to ensure that the first-factor value can explain more than 50 % of the total variance (Szakály et al., 2024; Harman, 1976).

Confirmatory factor analysis (CFA) was then conducted to check that the data had a good fit with the proposed model as well as the structure generated from EFA analysis by evaluating the CFI (>0.95), TLI (>0.95), SRMR (<0.08), and RMSEA (<0.08) indicators (Finch, 2020). Convergent validity is good if latent variables could explain more than fifty per cent of the variance of the manifest variables (Average Variance Extracted >0.50). The reliability of each latent variable is evaluated by ensuring that the hierarchical omega is more than 0.80, which indicates strong internal reliability. Each of the constructs used in this study was confirmed to be different and unique from each other when the Heterotrait-Monotrait Ratio value did not exceed 0.85 (Sarstedt et al., 2022).

The researcher conducted an Item Response Theory analysis to answer the first research question: understanding various latent variables in more depth and assessing the quality of manifest variable items in more detail. A manifest variable indicator is considered informative in differentiating individuals with various consumption motivation preferences or levels of sustainable consumption behaviour if its discrimination parameter is above 1.7 (Stănculescu, 2022). The threshold parameter of each manifest variable and Boundary Characteristic Curves (BCC) is reported to explain at what point respondents move from one response category to another (Shaw et al., 2021). To facilitate more

meaningful behavioural interpretation of the IRT results, the discrimination parameter (α) and difficulty thresholds (b_1 – b_4) were grouped in a post-hoc manner, using cut-off values defined with reference to the empirical distribution of item parameters. In this study dataset, α values of 5.0 and above lay in the upper tail of the discrimination distribution and were therefore treated as very strong. For the difficulty side, very negative first difficulty thresholds ($b_1 \leq -3.0$) were used to flag indicators where respondents could move out of the lowest response category with relatively little latent motivation. Within the low- b_1 items, those with discrimination parameter around 1.7–3.0 were treated differently from items with $\alpha \geq 3.2$, as the latter distinguish adjacent levels of the latent trait more sharply. First difficulty thresholds closer to the sample mean (b_1 roughly between -2.7 and -1.0), when combined with moderate-to-high discrimination ($\alpha = 3.0$ – 4.9), were used to identify items that were less likely to be endorsed by respondents with very low motivation. In addition, relatively high upper thresholds ($b_4 > 1.0$) marked indicators that tended to be strongly endorsed only by respondents located at the higher end of the latent continuum.

To answer the second research question, namely determining consumer segments based on variations in respondent responses related to the seven types of food consumption motives, this study uses the K-Means Clustering method as this method is well suited for large datasets (Tang et al., 2019). Various tests were employed to determine the optimal cluster number that can be used to perform K-Means clustering, including the Gap Statistic method, Hubert Index/D Index, Connectivity, Dunn Index, and Silhouette Index. Furthermore, K-means clustering was conducted based on 24 indicators from 7 types of food consumption motives with the Hartigan-Wong algorithm, which is known to produce stable clusters, have optimal partitions and achieve faster convergence than other algorithm methods (Kumar et al., 2024).

After grouping the respondents' answer patterns into clusters, the next step is to conduct structural equation modelling using SMART PLS 4 software, for each cluster to provides insight into the heterogeneity among groups and how different motivations in implementing sustainable behaviour drive each cluster. The prerequisites for testing path relationship significance are that each construct already has good convergent validity (AVE ≥ 0.50), passes the discriminant validity test (review HTMT <0.85) and is reliable (composite reliability ≥ 0.70) (Sarstedt et al., 2022). Exogenous variables are categorized to significantly affect endogenous variables if the p-value is below 0.05 and the t-statistics is more than 1.96 (Hair et al., 2021).

4. Results

4.1. Exploratory factor analysis and Confirmatory Factor Analysis

To identify the number of latent variables, uncover the underlying structure of all variables tested, and also see if there is a possibility of reducing variables without losing meaningful information, exploratory factor analysis was utilized in this study. The results of the overall diagnostic test or assumption test can indicate that the available data are suitable for factor analysis (KMO overall: 0.908; Bartlett's Test of Sphericity χ^2 : 20.864, $p < 0.001$). As shown in Table 1, the factor loadings of all manifest variables are more than 0.4, which indicates that all manifest variables explain their respective latent variables well.

Based on the results of Harman's One Test Factor analysis, it was found that the percentage of variance in the first factor of this research data is 29.92 %, which is far below the 50 % threshold (Harman, 1976). This indicates that the data does not experience common method bias, such as excessively consistent answers, which may be caused by respondents' reluctance to fill out the questionnaire or the influence of mood.

4.2. Item response theory

To address RQ1, Item Response Theory (IRT) was employed to

Table 1
Summary of EFA, CFA, reliability, item response theory.

Latent variable	Manifest variable	EFA	CFA	Reliability indices			Item Response Theory				
		Factor Loading	Loading estimate	α	ω_2	AVE	α	b1	b2	b3	b4
Sensory appeal	SA.1	0.681	0.596	0.800	0.810	0.580	2.423	-3.724	-2.491	-0.932	0.624
	SA.2	0.774	0.666				3.431	-3.943	-2.651	-1.199	0.316
	SA.3	0.627	0.521				2.294	-4.404	-2.752	-1.122	0.467
	SA.4	0.720	0.900				2.324	-3.302	-1.762	-0.188	
Health concern	HEALTH.1	0.691	0.580	0.800	0.830	0.550	2.599	-2.547	-1.003	0.073	
	HEALTH.2	0.806	0.578				3.910	-2.132	-0.648	0.476	
	HEALTH.3	0.892	0.541				4.751	-1.980	-0.824	0.272	
	HEALTH.4	0.901	0.439				6.258	-3.571	-2.133	-0.817	0.253
Price conscious	PRICE.1	0.818	0.602	0.800	0.850	0.590	3.547	-3.613	-2.619	-0.956	0.251
	PRICE.2	0.751	0.797				2.929	-3.382	-2.183	-0.457	0.792
	PRICE.3	0.627	0.779				2.118	-3.844	-3.117	-1.260	0.213
Ecological concern	ECO.1	0.810	0.686	0.900	0.900	0.750	3.955	-3.520	-2.191	-0.507	0.732
	ECO.2	0.885	0.737				5.084	-2.784	-1.920	-0.505	0.691
	ECO.3	0.855	0.762				3.826	-2.714	-1.639	-0.278	0.804
Social-welfare concern	SWC.1	0.777	0.673	0.900	0.910	0.760	3.819	-2.289	-0.685	0.547	
	SWC.2	0.897	0.724				5.211	-3.507	-1.943	-0.590	0.576
	SWC.3	0.841	0.767				4.508	-2.704	-1.854	-0.578	0.557
Convenience	CONV.1	0.540	0.518	0.900	0.850	0.590	2.103	-3.134	-1.150	0.501	
	CONV.2	0.620	0.605				2.189	-3.858	-2.379	-0.691	0.642
	CONV.3	0.892	0.660				4.968	-3.287	-2.285	-0.806	0.432
	CONV.4	0.786	0.659				3.003	-3.331	-2.129	-0.680	0.587
Social-adherence	SOA.1	0.828	0.536	0.800	0.820	0.530	3.100	-1.867	-0.941	0.115	1.024
	SOA.2	0.617	0.597				2.240	-2.724	-1.743	-0.369	1.140
	SOA.3	0.786	0.657				2.863	-1.829	-0.875	0.133	1.118
Sustainable food choice	SFC.1	0.718	0.658	0.800	0.830	0.620	2.644	-4.041	-2.568	-1.003	0.595
	SFC.2	0.787	0.891				2.809	-3.527	-2.165	-0.719	0.759
	SFC.3	0.635	0.575				1.904	-4.383	-1.979	-0.102	1.507
	SFC.4	0.662	0.616				2.216	-3.577	-2.018	-0.291	1.194
Food waste management	FWM.1	0.688	0.618	0.900	0.910	0.720	2.178	-3.053	-1.989	-0.558	0.691
	FWM.2	0.648	0.698				2.066	-3.549	-2.093	-0.618	0.882
	FWM.3	0.846	0.729				3.706	-2.558	-1.201	-0.099	1.041
	FWM.4	0.796	0.729				2.688	-2.362	-1.110	-0.011	1.168

evaluate how well individual items across food consumption motives, sustainable food choices, and food waste management distinguish between varying levels of latent traits among Indonesian Generation Z. **Table 1** shows the results of IRT, especially the discrimination parameter (α) and threshold parameters (b1-b4) for each manifest variable. All manifest variables show a discrimination value (α) higher than 1.7, which reflects the sound quality of each item in differentiating respondents' answers (Stănculescu, 2022). The most distinctive indicators for each latent variable include the motivation to consume food with vitamin content (HEALTH.4) in health concern-related motives; the aspect of food aroma (SA.2) in sensory appeal; environmentally friendly preparation (ECO.2) aspect in ecological concern; contribution to local producers (SWC.2) in social welfare concern; ease of preparation

indicator (CONV.3) in convenience latent variable; affordability (PRICE.1) aspect in price-conscious variable; follow social media trend (SOA.1) aspect in social adherence variable; level of seasonal fruit and vegetable consumption (SFC.2) in sustainable food choice; and sub-optimal food consumption (FWM.3) in food waste management (see the elliptical shape in dark blue with an asterisk in Fig. 2-left side).

The sharp slope and narrow θ range of its BCC of HEALTH.4 (see Fig. 1) reflect a deep motivational divide: those high on this latent trait are internally driven toward wellness, while those low may still value health but lack volitional commitment. Among health-focused Indonesian Generation Z, the need to consume foods with sufficient vitamin content has emerged as a core intrinsic motivator and is endorsed even at very low latent health levels (as indicated by the lowest b1 and

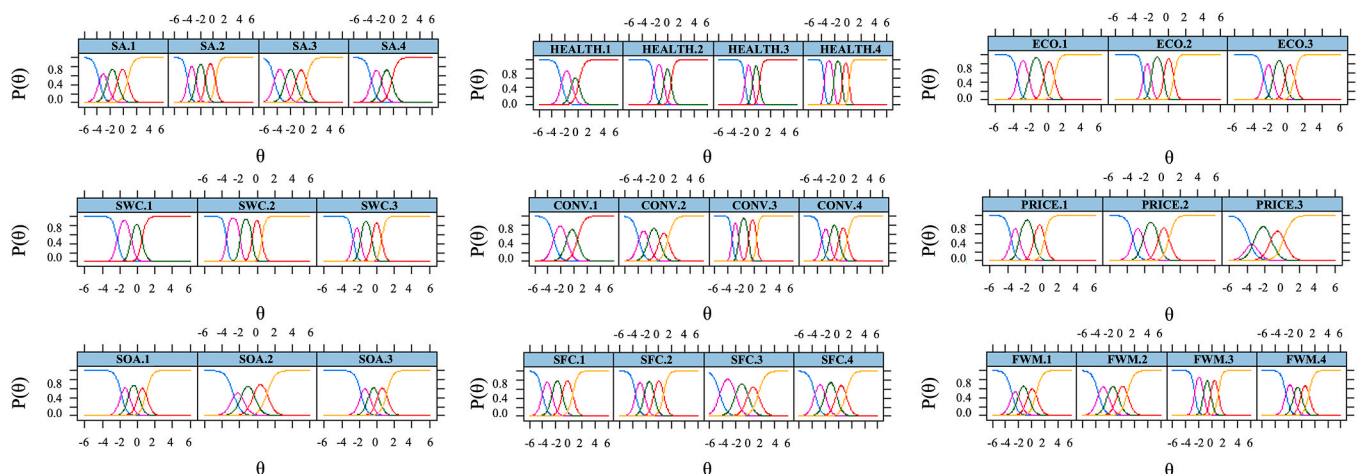


Fig. 1. Boundary characteristic curves (BCC) for all food consumption motives and sustainable food consumption behaviour indicators.

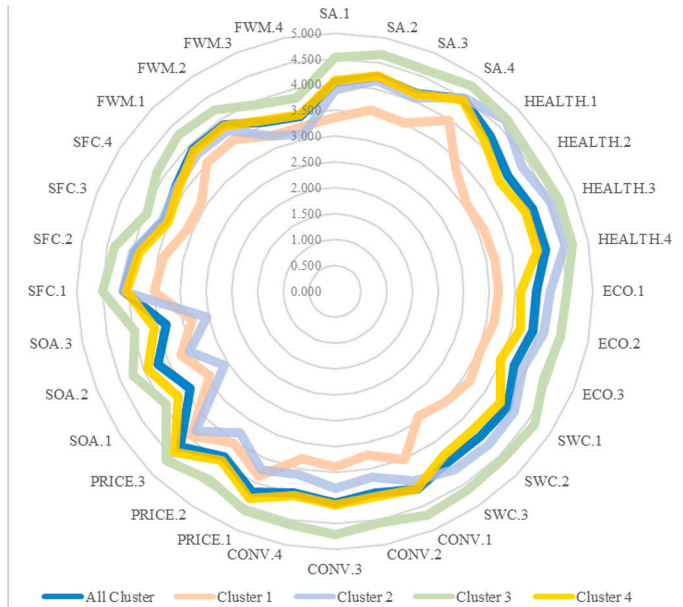
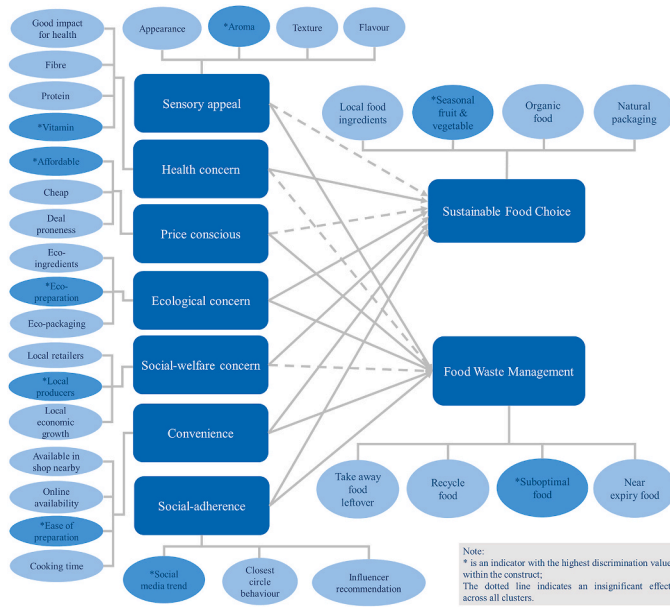


Fig. 2. Visualisation of the most distinct indicators and food consumption motives significance effect across all clusters (left) & average scores of 32 indicators across and within clusters (right).

highest b4 value within health concern motives). However, empirical data shows that the average score for HEALTH.4 (mean = 4.168) is not higher than HEALTH.1 (good impact for health, mean = 4.258), which has a higher response rating in terms of population (see right side of Fig. 2). Similarly, the motivation to obtain delicious food (SA.4) is the indicator with the highest mean (4.476) among all food consumption motives across all clusters, but this indicator is not the one with the strongest discriminant power within the sensory appeal construct. This interpretive gap between **population-level endorsement (mean scores)** and **latent-level sensitivity (IRT estimates)** calls for a more integrative lens in mapping motivational levers. Such divergence highlights that **high psychometric power does not always coincide with high population salience** and vice versa.

4.3. K-means clustering and path analysis

To address RQ2, K-means clustering was conducted based on 24 indicators representing food consumption motives. The number of segments was determined using several validation techniques, including Gap Statistics, Hubert’s D Index, and internal validation measures (Connectivity, Dunn Index, and Silhouette Index). As shown in Fig. 3 (left side), Gap Statistics suggested 4 and 7 as potential optimal points, while the D Index indicated a sharp knee at 2 clusters. Despite the

discrepancy in the optimal number of clusters given by various indicators, ranging from 2, 4, 6, to 7, this study uses 4 clusters to divide the existing segments. The division of 4 clusters is a good moderate solution since the connectivity value in the division of 4 clusters is classified as having a moderate value (632.0921), a reasonably high Dunn Index value indicating adequate cluster separation (0.0839), and a Silhouette Index of 0.1184 which is lower than the division of 2 clusters but still acceptable. In research related to segmentation based on food consumption motives indicators, the division into 4 clusters provides a more detailed grouping than dividing respondents into 2 or 3 clusters (see Fig. 3, right side), maintaining interpretability while avoiding over-clustering, which makes segments too granular (Shi et al., 2021).

Segment 1, labelled as *Frugal Indifferent Foodies that comprises 18 % of the total sample*, is characterized by the consistently lowest endorsement scores across all food consumption motives compared to other clusters. As shown in the average comparison (Fig. 2 right side), this segment exhibits particularly low sensitivity to ecological, health, and social welfare while showing a slightly higher price consciousness level compared with the second segment. Demographically, Segment 1 is evenly distributed between males and females (48.8 % and 51.18 %, respectively), with a majority residing in provincial capitals (38.39 %) or big cities (37.44 %) and mostly reporting moderate (41.23 %) and strong (23.22 %) financial situations.

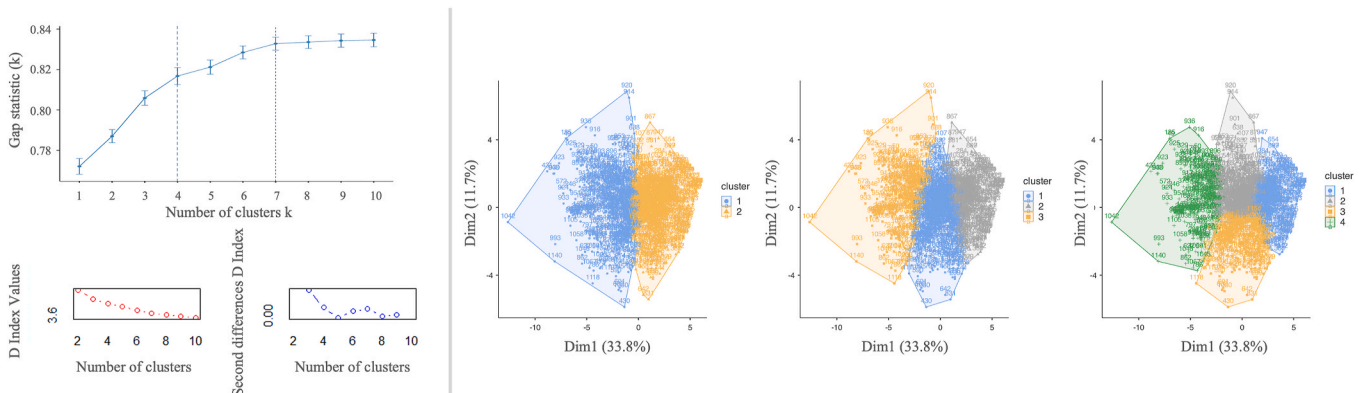


Fig. 3. Optimal number of clusters based on Gap Statistics (top left) D Index (bottom left); Scatter plot comparison on 2 Clusters, 3 Clusters, 4 Clusters (right).

Segment 2, termed *Health-Focused Independent Locavores* (high average scores for health concerns and social welfare concerns, but low social adherence), represents 21.12 % of the total sample (n = 245). The gender distribution in segment 2 is relatively balanced, with slightly more male respondents (51.84 % male and 48.16 % female), with most respondents living in provincial capitals (44.08 %) and large cities (34.69 %). The financial situation of this segment skews toward stronger economic capacity, with 46.53 % reporting moderate financial conditions and 28.16 % strong. Regarding regional distribution, respondents from Java (52.65 %) and Sumatra (31.84 %) dominate this cluster.

Segment 3, labelled *Holistic Demanders and Eco-Friendly Enthusiasts*, is the largest cluster, accounting for 29.22 % of the sample (n = 339). This segment shows high holistic motivation towards all aspects of food consumption and sustainable behaviour. This third segment has a near-even gender distribution (52.8 % male and 47.2 % female), with most individuals living in provincial capitals (45.72 %) and big cities (38.35 %). Financially, this group exhibits a more polarised profile: while 31.56 % report moderate financial conditions, 32.45 % indicate strong financial status. Java (56.34 %) remains the primary residence region, followed by Sumatra (22.71 %).

Segment 4, designated as *Epicurean Pragmatist Waste-Conservers*, comprises 31.47 % of the sample (n = 365). This fourth cluster prioritise taste and deals while remaining pragmatic in managing food leftover to minimize waste. Female respondents slightly outnumber males (53.15 % versus 46.85 %). Geographically, this cluster is most concentrated in provincial capitals (49.86 %) and Java-based respondents dominate (54.25 %). The financial situation shows a moderate to strong distribution, with 36.44 % categorized as moderate and 25.75 % as strong.

Across all clusters, all latent variables tested had Cronbach's Alpha (α) and hierarchical Omega (ω_2) values equal or greater than 0.8 (see reliability indices on Fig. 1), indicating all latent variables in this study have excellent internal reliability. For the discriminant validity, HTMT values of each construct in all clusters as well as in each cluster do not exceed the threshold value of 0.90, indicating that all latent variables are genuinely different from other constructs in this research model. Regarding the path relationships, as shown in Table 2 analysis across all clusters reveals that several food consumption motives significantly drive sustainable food choices and food waste management behaviour. Specifically, SFC is significantly influenced by social-welfare concern, health concern, social adherence, ecological concern, and convenience. Meanwhile, FWM is significantly driven by price consciousness, convenience, social adherence, ecological concern, and negatively by sensory appeal.

Table 2
Path coefficient relationship across and within clusters.

Path Relationship	All Clusters		Segment 1		Segment 2		Segment 3		Segment 4	
	(O)	T statistics	(O)	T statistics	(O)	T statistics	(O)	T statistics	(O)	T statistics
CONV → FWM	0.208	5.715***	0.191	3.072**	0.279	4.166***	0.033	0.466	0.193	2.894**
CONV → SFC	0.105	3.293**	0.090	0.968	0.089	1.176	0.074	0.972	0.107	1.400
ECO → FWM	0.087	2.509*	-0.010	0.141	-0.014	0.178	0.036	0.508	0.161	3.039**
ECO → SFC	0.124	4.203***	0.175	2.241*	-0.056	0.715	0.165	2.128*	0.077	1.371
HEALTH → FWM	0.015	0.434	-0.011	0.080	0.061	0.800	0.067	1.038	-0.071	0.977
HEALTH → SFC	0.164	4.691***	0.033	0.327	0.133	2.017*	0.123	1.961*	0.093	1.274
PRICE → FWM	0.223	7.171***	0.402	6.754***	0.148	1.724	0.204	3.590***	0.159	2.269*
PRICE → SFC	0.028	1.020	0.119	1.636	0.060	0.632	-0.017	0.309	0.021	0.204
SA → FWM	-0.116	3.510***	-0.169	2.014*	0.113	0.958	-0.152	1.046	-0.103	1.602
SA → SFC	0.039	1.310	0.082	1.018	0.035	0.385	-0.126	0.978	-0.057	0.920
SOA → FWM	0.191	6.204***	0.154	2.161*	0.030	0.348	0.231	4.069***	0.197	3.096**
SOA → SFC	0.148	5.450***	-0.033	0.253	0.147	1.730	0.266	4.546***	0.153	2.460*
SWC → FWM	0.031	0.756	-0.055	0.679	0.073	1.009	0.075	1.245	0.068	1.078
SWC → SFC	0.197	5.449***	0.261	3.539***	0.223	3.232**	0.033	0.510	0.149	1.980*

*p < 0.05; **p < 0.01; ***p < 0.001.

5. Discussion

5.1. Typology of indicators of motives and sustainable food consumption based on item response analysis

To complement the psychometric findings and guide applied interpretation, this study develops five functional typology that classifies consumption motives and sustainable consumption behaviour based on item response theory analysis results (see Table 3).

Indicators that showed the highest discrimination parameter ($\alpha \geq 5.0$) within each construct and a complete set of thresholds (b_1 – b_4), visible as three clear peaks on the BCC, were grouped as **Core Discriminators** since they most sharply separate respondents with different levels of the latent trait. Vitamin intake motives (HEALTH.4), environmentally friendly food preparation (ECO.2), and motivation to buy food from local producers (SWC.2) are sharp differentiators among Indonesian Generation Z consumers, separating those with heightened personal concern from those with minimal engagement. Sustainable food marketing must be carefully tailored: reinforcing value-based identity in highly motivated segments while designing attractive entry points for those still developing ecological, social, or health-related awareness. For example, in motivating consumers with low social welfare concerns to buy from local producers, the benefits that need to be emphasised are direct and practical benefits that can be felt, such as superior freshness and lower prices. In contrast, for highly motivated consumers, messages must directly trigger community support and social solidarity, aligning with Self-Determination Theory, which states that highly motivated individuals are driven by motivations based on authentic values and communication styles that support value autonomy (Khan et al., 2023). The excessive use of external incentives on highly motivated groups is feared to cause a decline in intrinsic engagement or the occurrence of a motivational crowding-out effect (Bruers, 2023).

Latent Gateways, represent a dynamic category of motivational indicators characterized by a combination of low b_1 thresholds ($b_1 \leq -3.0$), indicating early endorsement even by individuals with low latent motivation and high discrimination parameters ($\alpha \geq 3.2$), which reflect strong differentiation across motivational levels. The indicators in this group function as “gateways” in the sense that they are relatively easy to adopt, but once adopted more strongly, they mark a step up along the latent continuum and can be used as early leverage points in interventions, especially to promote more sustainable consumption to lower-level motive groups. Sensory triggers such as aromas (SA.2) can stimulate consumers with varying consumption motives through peripheral route processing before rational motives kick in (Morquecho-Campos et al., 2022). Environmentally friendly attributes and natural ingredients (ECO.1), when framed in relatable terms, e.g., easy to prepare (CONV.3), affordable (PRICE.1), can further lower the

Table 3
Typology of food consumption motives and sustainable food consumption indicators based on Item Response Theory (IRT) parameters.

Typology	IRT Parameter Range		Characteristics	Indicators
	α Range	b value Range		
Core Discriminators	≥ 5.0	Complete value of b_1, b_2, b_3, b_4 with 3 peaks of ^a BCC	Indicators that exhibit strong discrimination and highlight a clear latent motivational divide among respondents.	HEALTH.4; ECO.2; SWC.2
Latent Gateways	≥ 3.2	$b_1 \leq -3.0$	Early engagement and moderate to high discrimination.	SA.2; ECO.1; PRICE.1; CONV.3
Baseline Expectations and Behaviour	1.7–3.0	$b_1 \leq -2.5$	Basic expectations indicators that are easily agreed upon, but offer limited capacity for segmenting consumers.	SA.1; SA.3; SA.4; HEALTH.1; CONV.1; CONV.2; PRICE.2; PRICE.3; SOA.2; SFC.1; SFC.2; SFC.4; FWM.1; FWM.2
Late Activation Motives	3.0–4.9	$b_1 -2.7$ to -1.0	Most likely bottom-rated and considered unimportant indicators among the least motivated group.	HEALTH.2; HEALTH.3; SWC.1; SWC.3; SOA.1; ECO.3; CONV.4
High Barrier Signals	1.7–4.0	$b_4 > 1.0$	Indicators that require strong intrinsic motivation to endorse, typically representing barrier-signals.	SOA.3; SFC.3; FWM.3; FWM.4

Note.

^a BCC refers to the Boundary Characteristic Curve.

perceived effort required to engage with sustainable options (Elmor et al., 2024).

Baseline Expectations and Behaviour comprise indicators with very low first thresholds ($b_1 \leq -2.5$) and comparatively lower discrimination ($\alpha = 1.7\text{--}3.0$) than Latent Gateways. **Baseline Expectations and Behaviour** refers to the band of indicators located at the lower end of the motivational continuum that respondents treat as minimum conditions rather than aspirational goals, so they tend to be endorsed early even by those with low latent motivation and contribute less to separating individuals along the latent continuum. Several consumption motives fall into this category, indicating that Generation Z consumers have broad and multidimensional basic needs when interacting with food choices. In their daily consumption, Indonesian young consumer expect sensory satisfaction (appearance-SA.1, texture-SA.3, taste-SA.4), require health assurance (positive health impacts-HEALTH.1), availability (both physical-CONV.1 and online-CONV.2), economic value (low prices-PRICE.2, tendency to seek discounts-PRICE.3), and social validation (following the behaviour of their immediate circle-SOA.2). At the same time, multiple sustainable behaviours, e.g. local ingredients (SFC.1), seasonal food (SFC.2), managing leftovers (FWM.1), recycling edible food (FWM.2), fall under Baseline Expectations and Behaviour category suggests that those sustainability practices have been normalized among Generation Z Indonesians. Taken together, this typology is interpreted as analogous to Herzberg's hygiene factors: for respondents with lower motivation, these features function as basic requirements; the absence of these indicators tends to create dissatisfaction, while their endorsement still adds some differentiation but less sharply than higher-discrimination parameter indicators in signalling stronger motivational commitment (Chan and Baum, 2007).

Late-Activation Motives are indicators whose first thresholds lie closer to the sample mean on the latent scale ($b_1 = -2.7$ to -1.0), which implies that respondents with very low latent motivation are likely to remain in the lowest response category and that endorsement is relatively difficult at the lower end of the continuum. Their discrimination values fall in the moderate-to-high range of discrimination parameter ($\alpha = 3.0\text{--}4.9$), indicating that once endorsement begins to increase, these items provide a relatively clear gradation across levels of the latent trait. Consumption motives in this typology include fibre intake (HEALTH.2), protein consumption (HEALTH.3), patronage of local retailers (SWC.1), concern for local economic growth (SWC.3), following social environmentally friendly packaging (ECO.3), social media food trends (SOA.1), quick cooking time (CONV.4). Previous studies in the Indonesian consumer context suggest that, even though many households recognise the importance of adequate protein intake, actual consumption of both animal and plant-based protein remains low because of economic barriers and the relatively higher cost of protein-rich foods (Khoiriyah and Forgenie, 2025). At the same time, the widespread

reliance on low-cost staples such as instant noodles, further contributes to the under-consumption of protein and fibre in everyday diets (Agustina et al., 2024). From a motivational standpoint, social-welfare-oriented concerns such as supporting local retailers and contributing to local economic growth operate as other-regarding, psychologically distant goals that tend to shape behaviour only when pro-social motives and trust in local producers are sufficiently developed, so respondents with low social welfare motivation in our sample find it difficult to regard these community-level benefits as important drivers of their everyday food choices (Meng et al., 2025; Li et al., 2025). Likewise, environmentally oriented motives such as preferring natural, environmentally friendly packaging relate to abstract, long-term disposal outcomes rather than immediate eating benefits, so for consumers with low ecological concern these attributes remain psychologically distant and rarely become salient enough to function as primary drivers of everyday food choices (van Birgelen et al., 2009).

High Barrier Signals characterized by elevated upper-threshold values ($b_4 > 1.0$) and moderate discrimination parameters ($\alpha = 1.7\text{--}4.0$). Only respondents with very high latent motivation tend to endorse these indicators, which sit at the more demanding end of the action spectrum. The label "High Barrier Signals" captures the stacked motivational, social, and occasional economic hurdles implied by these upper thresholds, such that endorsement typically requires a willingness to incur extra costs, deviate from prevailing norms, or publicly align one's identity with these positions. This high barrier signals group includes consumption motives items such as follow influencer recommendations (SOA.3); reflect behaviours that are not easily adopted without social identification or alignment with peer norms. On the sustainability behaviour front, preference for organic food (SFC.3), and acceptance of suboptimal food consumption (FWM.3) also fall into this category. In terms of Construal Level Theory, High Barrier Signals indicators sit on the more abstract, future-oriented side of the spectrum such as buying organic or accepting cosmetically imperfect food is tied to diffuse environmental or ethical outcomes rather than to immediate sensory reward (Jiang et al., 2023; Stahlmann et al., 2024). When food is viewed through that distant lens, only consumers who already think about eating in high-level, long-term terms tend to move from merely agreeing in principle to actually acting on these motives.

5.2. Segment characteristics and the role of food consumption motives in sustainable food choices and food waste behaviour

Building upon K-Means cluster and path analysis findings, further segmentation analysis identified four distinct consumer segments which discussed on 5.2.1–5.2.4 subsections (summary of the characteristics of each segment is shown in Fig. 4).

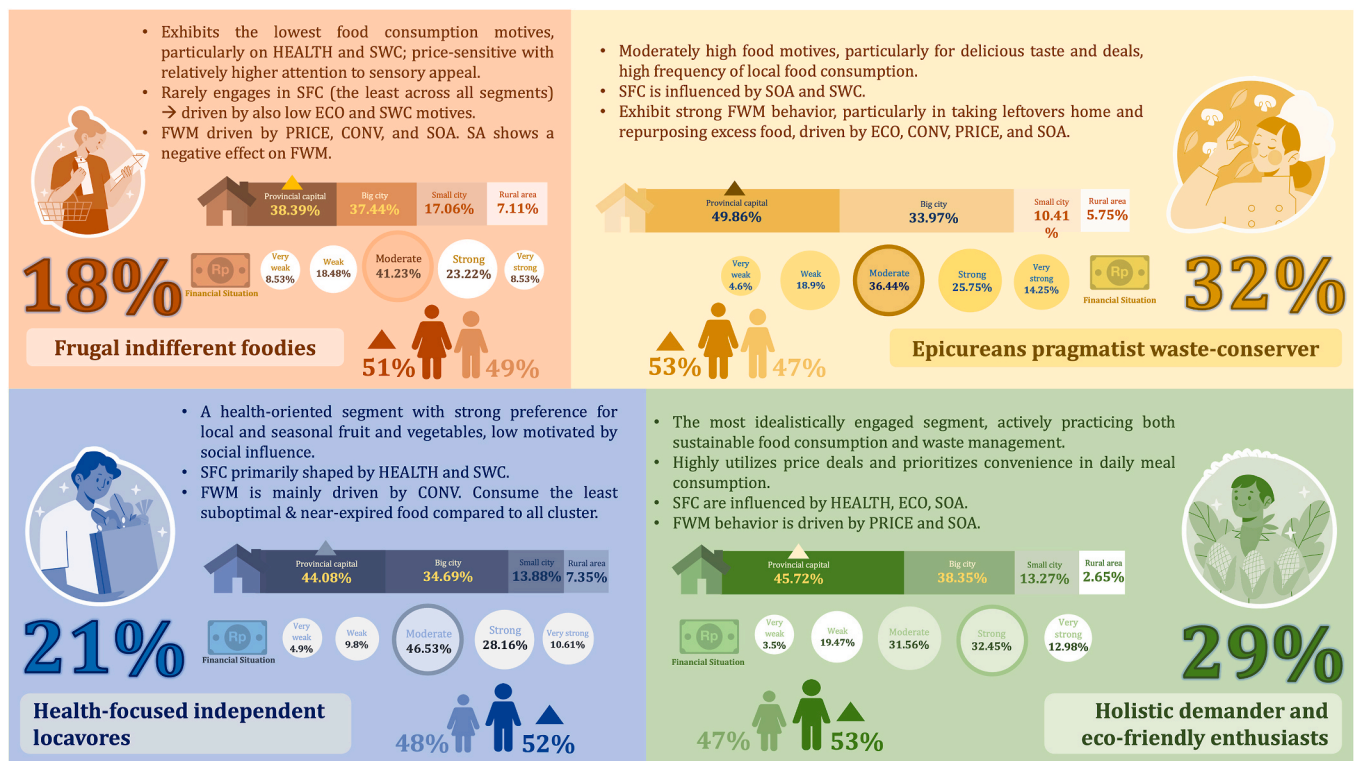


Fig. 4. Summary of the characteristics and consumption motives of the four identified segments.

5.2.1. Segment 1: Frugal Indifferent Foodies

Consumers in the first segment represent frugal orientation through their firm emphasis on affordability and discount-seeking behaviour. Although they appreciate good taste, their sensory-driven motivation remains moderate, far less intense than other segments. Motivations related to environmental stewardship or social welfare, which are classified as higher-level motivations in Maslow's framework (Verdeau and Monnery-Patris, 2024; van der Veer et al., 2024) and elaborated in Self-Determination Theory (Khan et al., 2023) as intrinsic, value-driven aspirations, are not salient among this group, resulting in limited sustainable food consumption behaviours. This first segment displays an indifferent stance towards sustainability-related motives, as reflected in their low concern for ecological and social-welfare-driven food choices. From an informational entropy-based perspective, their value system appears to have been shaped in contexts where price signals, discount cues and basic taste expectations are constantly salient, so the mind gives these bits of information far more weight than more abstract ecological or social messages (Vuong et al., 2025). Sustainable behaviours that do appear, such as taking home leftovers and reprocessing food, are driven primarily by merely financial considerations, the convenience of avoiding future food purchases, and conformity to the behaviour of close social circles, rather than intrinsic pro-environmental values. This pattern is consistent with a relatively low Nature Quotient, in the sense that information about ecological interconnections hardly enters their everyday reasoning, while price and discount cues dominate so that food waste is seen more as wasted money than as damage to nature (Vuong and Nguyen, 2025). Once the Frugal Indifferent Foodies feel that taste, freshness or appearance has dropped below their personal standard, their inclination to manage food waste tends to fall away, which is consistent with the significant negative link observed between sensory appeal motives and food waste management in this group. For this segment, persuasive efforts need to start from indicators in the Baseline Expectations and Latent Gateways bands, because these motives are already relatively easy for low-motivation consumers to endorse. Messages that frame sustainable options in terms of

affordability, simple convenience cues and low-effort sensory triggers are more realistic than appeals to high-level ecological or social ideals.

5.2.2. Segment 2: Health-Focused Independent Locavores

Segment 2 is Indonesian Generation Z consumers prioritising health and social welfare considerations over external social influences when making food choices. In this segment, price is less decisive than in Segment 1, and a larger share of respondents report being in a moderate to very strong financial position (Information regarding demographic characteristics can be seen in Fig. 4). With a bit more room in their budgets, they may afford choose to pay extra for foods they perceive as beneficial, which is consistent with earlier findings that health-motivated youth are typically less price-sensitive (Kim and Kim, 2022). This Health-Focused Independent Locavores profile fits with eudaimonic consumption motive, in which people mainly pursue goals they experience as meaningful for themselves rather than simply complying with social pressure (Polisetty et al., 2024). Interestingly, while their health and social welfare concerns foster sustainable food choices, ecological concern was not a significant motivator. This pattern runs against the common assumption that health-aware consumers are always eco-conscious and echoes studies showing that concrete benefits such as personal health and support for the local economy often carry more weight for Generation Z than diffuse environmental claims (Peral-Peral et al., 2022). In line with an informational entropy-based view of value formation, that treats motives as the outcome of selective information processing, this segment can be read as the product of environments where concrete messages about personal health and supporting local producers are far more visible in daily life than system-level climate or biodiversity narratives (Vuong et al., 2025). Those are the themes that are most likely to stick and gradually harden into stable food-related motives. When it comes to food waste management, they are more willing to act sustainably if the actions are convenient, fit easily into their daily routines and do not demand much extra effort. Their reluctance to accept suboptimal or near-expiry products suggests a tendency to equate cosmetic flaws with possible

risks to health and food safety (Elimelech et al., 2024; Bandi, 2023). For Health-Focused Independent Locavores, persuasion can lean on Late-Activation Motives and Core Discriminator, especially motives related to personal health and local social welfare, which already matter for them. Positioning more demanding sustainable actions, such as buying from local producers, as a direct extension of these existing concerns is likely to work better than generic environmental messaging.

5.2.3. Segment 3: Holistic Demanders and Eco-Friendly Enthusiasts

Segment 3 consumers embody a highly engaged and multifaceted motivational profile, displaying strong scores across all seven food consumption motives. Respondents in this segment also tend to endorse the Core Discriminator items, choosing vitamin-rich foods, favouring environmentally friendly preparation and deliberately buying from local producers placing them toward the upper end of the underlying continuum for health, ecological and social-welfare concern identified by the IRT model. Most members of this cluster live in capital or large cities and describe their financial situation as strong, and this socio-economic profile fits post-materialist value shift arguments: once basic economic security feels less fragile, young people have more room to care about health, environmental quality and support for local producers (Inglehart, 2018). Living in big cities saturated with student discounts and applications-based food promotions also helps to explain why price and convenience still score highly for them; in mental-budgeting terms, taking advantage of deals and easy ordering adds a sense of spending wisely, which sits comfortably alongside, rather than undermining, their more sustainable and value-driven food orientations (Kristia et al., 2023; Elgeka and Ma, 2020). Compared with the Health-Focused Independent Locavores, the sustainable food choices of Holistic Demanders and Eco-Friendly Enthusiasts seem to grow from a mix of personal health motives, ecological concern and a tendency to follow what friends and influencers do; in their case, social norms and peer cues appear to reinforce rather than dilute their sustainable orientations (Agustina et al., 2024). Indonesia's relatively collectivist value orientation, as described in Hofstede's cultural dimensions (Harahap et al., 2024), offers a plausible cultural backdrop for the significant effect of social adherence in this segment's sustainable food choices and food-waste practices, since everyday conduct is often evaluated in terms of harmony with important others. The prominent role of social adherence in both SFC and FWM in this segment highlights the applicability of Social Cognitive Theory and subjective norm impact from the Theory of Planned Behaviour, where observational learning and perceived social expectations facilitate behaviour change (Chen, 2024b; Confetto et al., 2023). In line with previous research in the context of Generation Z Indonesia, the behaviour of Segment 3 consumers in managing food waste is driven by their motivation to save money, adhere their behaviours to those closest to them, and follow trends on social media (Kristia et al., 2023). Holistic Demanders and Eco-Friendly Enthusiasts are well placed to respond to a combination of Baseline Expectations and High Barrier Signals. Interventions can assume that taste and convenience must still be met, but can also explicitly activate costlier, identity-laden behaviours, such as buying organic, accepting suboptimal products or following sustainability-oriented influencers, because this segment already operates at the upper end of the motivational continuum.

5.2.4. Segment 4: Epicurean Pragmatist Waste-Conservers

Consumers in Segment 4 exhibit pragmatic epicureanism reflected in their main priority of taste satisfaction and practical factors such as affordability, promotion deals, food availability, and ease of preparation. Their motivational pattern is best described as pragmatic with a stronger focus on immediate personal benefits than on abstract environmental ideals, and this configuration closely resembles findings from studies of Greek Generation Z consumers (Kalyva et al., 2024). The epicurean pattern is particularly visible in Segment 4, whose large size suggests that taste-driven eating may approximate the everyday norm

for many Indonesian Generation Z consumers raised with rich and diverse local cuisines (Ulita et al., 2024). However, sensory appeal does not consistently lead to sustainable choices, likely because sustainable foods vary in how well they match these taste preferences, so sustainability remains more weakly internalised than the now entrenched value placed on taste (Vuong et al., 2025). In terms of performing sustainable behaviour, Segment 4 shows selective commitment, such as prioritising eating local food and consuming seasonal food while consuming less organic food. The food consumption motive that significantly drives Segment 4 to consume sustainable food is social adherence and their concern for the social welfare concerns of the food producers they consume rather than their concern for ecological welfare. Segment 4 translates their motivation to have a good impact on nature by performing food waste management, especially with their behaviour of bringing home their food leftovers and reprocessing the excess food so that it is not wasted. This is due to the pragmatist characteristics of Segment 4, who highly prioritised the affordability and convenience aspects of their food choices so that although they have a sense of concern for the environment, they choose to express it in a more low-budget way by doing food waste management. Seen through Schwartz's value framework, this segment looks more anchored in hedonism and security than in self-transcendence: enjoying food, keeping spending under control and following familiar routines matter more than abstract ecological ideals (Bryla, 2021). Like Segment 1 and Segment 2, convenience is also proven to significantly drive Segment 4 consumers to perform food waste management behaviour. In addition to ecological value drives, which are intrinsic values, Segment 4 consumers' motivation to adhere to social norms and the behaviour of their closest friends is proven to drive this segment to perform food waste management significantly. The aspect of food waste management that needs to be further improved from Segment 4 is related to their acceptance of less aesthetically pleasing food close to expiry, as the average of both behaviours is scored low by this segment. For Epicurean Pragmatist Waste-Conservers, persuasive strategies are best anchored in Baseline Expectations and Behaviour, tying sustainable outcomes to good taste, value for money and ease of preparation. Rather than pushing premium green products, it is more effective to frame low-budget practices such as consuming affordable local-seasonal food, bringing leftovers home or reprocessing excess food as natural extensions of their everyday pragmatism.

6. Conclusion and practical implications

To effectively promote SFC and FWM among Indonesian Generation Z, strategies should leverage *baseline expectations* such as flavour, affordability, ease of access, and basic health assurance while progressively normalising *high-barrier* sustainable behaviours like organic food and suboptimal food consumption. Practical interventions should enhance convenience, highlight sensory quality, and utilise *latent gateways* (e.g., appetising food aroma, affordability, ease of preparation) to lower perceived entry barriers. *Late activation motives*, including social media influence and local community solidarity, should be mobilised to create social proof and desirability, while communication strategies must weave together personal health, environmental responsibility, and social welfare into a compelling, multi-benefit narrative that feels achievable and rewarding rather than burdensome. The following targeted strategies are proposed for each segment:

Strategies targeting *Frugal Indifferent Foodies* should leverage *Latent Gateways and Late Activation Motives* such as emphasise affordability, ease of preparation, and aroma sensory triggers rather than value-laden promotion. Interventions could include promoting discounted suboptimal foods through sensory reassurance ("Taste Maintained" labels), nudging leftover-friendly behaviours via doggy bag designs or restaurant staff training (Cheng et al., 2023; Ergul et al., 2023), and creating peer-influenced campaigns using relatable figures through social media (Giaccherini et al., 2021; Ong et al., 2023).

Interventions targeting *Health-Focused Independent Locavores* should leverage *Late Activation Motives and Core Discriminator* such as emphasizing the nutritional superiority (vitamin, fibre, protein content) and community impact (empowering local producers and retailers) of sustainable local foods, while gradually introducing *latent gateways* related to the ease of preparing foods and the quality of processed or imperfect foods (Pai et al., 2025; Kovács et al., 2022). Segment 2 represents a promising foundation for promoting sustainable food consumption through the appeal of personal health and local solidarity narratives rather than ecological altruism alone.

For *Holistic Demanders and Eco-Friendly Enthusiasts*, any intervention has to start from what they already take for granted, food that tastes and looks good, is easy to obtain offline or via delivery apps, feels fairly priced, and fits with their usual habits of buying local or seasonal products and managing leftovers; these features correspond to their *Baseline Expectations and Behaviour*. On top of this, communication can deliberately tap into *High Barrier Signals* by framing organic products, suboptimal or near-expiry items and food-rescue actions as smart, identity-relevant ways to act on their concern for health, the environment and local producers, rather than as sacrifices. Influencers play a crucial role here; authenticity, credibility, and emotional engagement are key factors for effectively transmitting sustainability messages through peer and media channels. Influencers play a crucial role here; authenticity, credibility, and emotional engagement are key factors for effectively transmitting sustainability messages through peer and media channels (Ruzgys and Pickering, 2024b).

Given the significant influence of the motivation to socially adhere and contribute to social welfare on *Epicurean Pragmatist Waste-Conservers consumers* to undertake sustainable food consumption, a viral campaign strategy that focuses on community impact is expected to increase sustainable food consumption in this segment. Campaigns and exposure regarding messages to sustainable food consumption are expected to be a catalyst for young people at the contemplation stage or early adopters of sustainable consumption but have not yet fully and consistently carried out this behaviour (Ruzgys and Pickering, 2024b). Support from retailers to promote food waste reduction is by providing bundling discount promos for near-expired items and appetising ready-to-eat meals made from suboptimal vegetable or fruit ingredients, making it easier for young consumers to consume these types of items and providing financial benefits (Chang et al., 2024).

7. Limitations & recommendation

Although this study has taken steps to ensure the sample's representativeness by using a relatively large sample size and ensuring gender representativeness among respondents, limitations related to the underrepresentation of respondents from rural areas remain, resulting in limitations in the generalisability of findings for this category. In addition, the findings of this study regarding the insignificance of several consumption motives on SFC or FWM provide opportunities for further research to examine various factors that may link these motives to more sustainable practices. Recommendations for future research include qualitative research incorporating in-depth interviews or focus group discussions to understand the context and reasons for the gap between various motivations and behaviours. There is also a need to test moderating and mediating variables that can strengthen or link various food consumption motives with sustainable food choice and food waste management, such as trust in local certification schemes or cultural tightness-looseness orientations. Future studies could also apply the present IRT-based and segmentation approach to other age groups, so that motivational gaps across the life course can be mapped and used to inform interventions that educate citizens towards more sustainable food consumption, citizens who are responsible for their own health and for the health of the planet.

CRedit authorship contribution statement

Kristia Kristia: Conceptualization, Data curation, Formal analysis, Software, Writing – original draft. **Sándor Kovács:** Methodology, Visualization, Writing – review & editing. **Nádasi Levente Sándor:** Funding acquisition, Supervision, Writing – review & editing.

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.

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Appendix Table A.1. Research Instruments

Variable	Indicator	Questionnaire Item
Sensory appeal	<i>When choosing food for daily consumption it is important to me that</i>	
	Appearance (SA.1)	... has an appetising appearance
	Aroma (SA.2)	... has a pleasant aroma
	Texture (SA.3)	... has a pleasant texture when consumed
	Flavour (SA.4)	... has a good flavour
Health concern	<i>When choosing food for daily consumption, I want to ensure that the food</i>	
	Good impact for health (HEALTH.1)	... has a good impact on my health.
	Fibre (HEALTH.2)	... is high in fibre.
	Protein (HEALTH.3)	... is high in protein.
	Vitamin (HEALTH.4)	... is high in vitamin and nutrition.
Price conscious	<i>When choosing food for daily consumption,</i>	
	Affordability (PRICE.1)	... price affordability is my main consideration.
	Cheap (PRICE.2)	... I will choose food options that are cheap.
	Deal proneness (PRICE.3)	... as much as possible I take advantage of discount promos or price cuts.
Ecological concern	<i>When choosing food for daily consumption it is important to me that the food</i>	
	Environmentally friendly ingredients (ECO.1)	... made from environmentally friendly raw materials
	Environmentally friendly preparation (ECO.2)	... produced in an environmentally friendly way
	Environmentally friendly packaging (ECO.3)	... use environmentally friendly packaging

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(continued)

Variable	Indicator	Questionnaire Item
Social-welfare concern	<i>When choosing food for daily consumption it is important to me that</i>	
	Local retailers (SWC.1)	... my food purchases contribute to the welfare of local micro and small retailers.
	Local producers (SWC.2)	... my food purchases contribute to the welfare of local producers (farmers, ranchers or other local producers).
Convenience	Local economic growth (SWC.3)	... my food purchases contribute to the overall growth of the local economy.
	<i>When choosing food for daily consumption it is important to me that</i>	
	Available in shop nearby (CONV.1)	... the food can be easily bought in shops, stalls, restaurants around where I am.
	Online availability (CONV.2)	... I can order the food online.
Social-adherence	Ease of preparation (CONV.3)	... the food is simple in preparation.
	Cooking time (CONV.4)	... the cooking process is quick.
	Follow the social media trend (SOA.1)	I eat certain foods because the food is a social media trend and viral.
Sustainable food choice	Follow closest circle behaviour (SOA.2)	I eat certain foods because the food is also consumed by my friends and family.
	Follow influencer recommendation (SOA.3)	I eat certain foods because trusted influencers recommend them.
	<i>How often do you buy food as follows</i>	
Food waste management	Local food ingredients (SFC.1)	Local groceries (from traditional markets, stalls, grocery stores or farmers).
	Seasonal local vegetables and fruits (SFC.2)	Seasonal local vegetables and fruits (orange, mango, rambutan, durian, mangosteen, etc.).
	Organic food (SFC.3)	Organic food.
	Natural/environmentally friendly packaging (SFC.4)	Food with natural and environmentally friendly packaging.
Food waste management	<i>How often do you engage in this behaviour</i>	
	Take away food leftover (FWM.1)	If I am eating out and cannot finish my meal, I pack the leftovers for later consumption.
	Recycle food (FWM.2)	I process any excess food in a way that it can be consumed again.
	Suboptimal food consumption (FWM.3)	When buying food or groceries, I do not mind choosing products that are not perfect, as long as they are still edible.
	Near expiry food consumption (FWM.4)	I am willing to eat food that has almost reached its expiry date, as long as it is still in good condition and suitable for consumption.

Data availability

Data will be made available on request.

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