Shades of sustainability: who are the buyers and non-buyers of sustainable packaging?

Abstract

Plastic packaging has a destructive impact on the environment, and it is crucial to understand consumer response to plastic substitutes. The aim of this study is to examine the influence of sustainable lifestyles on the willingness to buy two types of packaging, sustainable and edible packaging, along with barriers to purchase. An online survey was conducted with 477 Australian consumers. Partial least squares structural equation modeling was used to test the hypotheses. Out of the three lifestyle segments identified through cluster analysis, two segments are willing to buy edible packaging. Perceived dispersed responsibility to protect the environment is a psycho-social factor influencing purchase intentions. Willingness to buy sustainable packaging is positively related to familiarity with the sustainable packaging format and willingness to buy is negatively related to functional barriers. Different lifestyle segments respond to edible packaging in different ways. This study makes an important contribution to the marketing literature given the scarcity of studies on sustainable lifestyle segmentation. The study has implications for business managers who wish to acquire competitive advantage through packaging and niche marketing.

KEYWORDS

sustainable packaging, edible packaging, lifestyle segmentation, purchase barriers.

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1. INTRODUCTION

Supermarket shelves are stocked with many products packaged in plastic. Although plastic packaging has a significant role to play in food packaging – keeping food fresh and safe to eat, making products easy to transport and consume - plastic packaging is easily disposable and is a pollutant. The cumulative amount produced, as of 2015, was around 5 billion tons of plastic, which is enough to wrap the Earth in a layer of cling-film (Zalasiewicz et al., 2016). According to recent estimates, only 9% of all plastics ever produced have been recycled, and most have ended up in landfills, the oceans or elsewhere in the environment (Geyer, Jambeck, & Law, 2017). The problem with plastic packaging has been well documented. Externalities are attributed to the greenhouse gas emissions (GHG), such as those resulting from the production phase (i.e., plastic consumes fossil feedstocks), damage to natural systems and potential health impacts arising from the use of synthetic substances and additives (Rochman et al, 2013).

Single-use food packaging, which is prevalent in plastic bottles, food wrappers and bags, is generally made of non-biodegradable, petroleum-based molecules (Oliveira et al., 2021), and is one of the main contributors to the negative externalities. It is reported that a third of all plastic food packages that are too small, or too complex to be recycled, often find their way into the ocean, for example, coffee cup lids, food wrappers, take-away boxes, drink pouches and sachets (MacArthur, 2017). Surveys show that most micro-plastics (which are fragments of plastic invisible to the naked eye, typically <5 mm), collected from rivers (Rowley, Cucknell, Smith, Clark, & Morritt, 2020) and the offshore marine environment, are polyethylene (PE) and polypropylene (PP), two resins commonly used in single-use plastic food packaging (Zettler, Mincer, & Amaral-Zettler, 2013). Plastic packaging kills marine fauna such as turtles through ingestion (Gregory, 2009), and this is a serious issue given that all, but one species of marine turtles, are classified as threatened (Nelms et al., 2015). Plastic contamination of the marine and coastal environment is so acute that plastic is now seen as a geological marker of the Anthropocene, which is defined as a new era in which many conditions on Earth are profoundly altered by the impact of humans (Crutzen & Stormer, 2000).

Internationally, efforts are being made to discourage single-use plastics, improve waste collection and recycling, and encourage sustainable packages. Some examples of sustainable packages are bio-based plastic and biodegradable plastic substitutes (Fadeeva & Van Berkel, 2021) and edible package made of natural and plant-based materials (Taufik,

Reinders, Molenveld, & Onwezen, 2020). Sustainable packaging is aligned with the United Nations Sustainable Development Goals, particularly Goal 12 (responsible consumption and production) and Goal 14 (life below water) (United Nations, n.d). However, the adoption of such packaging is still low due to consumers' lack of knowledge and concerns about price (Orzan, Cruceru, Bălăceanu, & Chivu, 2018). According to Steenis et al., (2017, p.286), "one of the key challenges for packaging managers, marketers and designers is to develop sustainable packaging designs that are acceptable to consumers." It is crucial to understand the response of consumers to sustainable packaging since consumers have market power and may reject emerging packaging technologies.

Research that evaluates the effect of sustainable packaging on consumers' decisions is relatively scarce and the drivers of purchasing have been overlooked (Boz, Korhonen, & Koelsch Sand, 2020; Testa, Iovino, & Iraldo, 2020). One driver of purchase behavior is lifestyle (Haan et al., 2018). Consumer lifestyles reflect values, attitudes and behaviors, and sustainable lifestyles are linked to the purchase of 'green' products and services (Belz & Peattie, 2012). Our study contributes to theory and practice in important ways. Firstly, the study draws on the framework of Lifestyles of Health and Sustainability (LOHAS) to develop clusters and profile consumers of sustainable packaging (Belz & Peattie, 2012; Choi & Feinberg, 2021). This framework has been largely neglected in the food packaging area, so this study adds value to the literature. Secondly, the study examines consumer response to edible packaging and responds to the call by Ketelsen et al., (2020) to focus on specific packaging solutions, as well as the call for marketing scholars to engage in responsible research, research that is useful to society and that contributes to achieving the Sustainable Development Goals (SDGs) (Bolton, 2021). By examining the factors inhibiting consumers' packaging choices, this study could provide industry-specific insights and help product managers develop more effective strategies.

This paper is structured as follows. Section 2 analyses the theoretical foundations of the study and outlines the hypotheses. The methodology used for the measurement of variables and the data collection process is outlined in Section 3, and the results are presented in Section 4. Finally, Section 5 discusses the findings, the limitations are outlined and avenues for future research are proposed.

2. THEORETICAL FOUNDATION

2.1. Definition of sustainable packaging and edible forms of packaging

Sustainable packaging initiatives are aligned with the goal of sustainable development, i.e., development that meets the needs of the present, without compromising the needs of future generations (Brundtland, 1985). Sustainable packaging is defined as packaging that has a comparatively low environmental impact as measured by life cycle models (Glavič & Lukman, 2007).

One of the alternatives to conventional plastic is packaging that is bio-based (derived from biomass) and it is partially made from plant-based materials such as crops, wood or grasses and is either recyclable or compostable (Taufik, Reinders, Molenveld, & Onwezen, 2020). Edible packaging is a novel form of sustainable packaging, and it has gained interest among food scientists and the packaging industry (Parente Ribeiro Cerqueira, 2019). It consists of coatings and films that are edible, derived from proteins, lipids and polysaccharide molecules, found in plant-based materials such as cassava, potato starch and seaweed (Umaraw et al., 2020). The main purpose of edible coatings is to increase the natural barrier of perishable fruits and vegetables, but applications are expected to grow, such as packaging for ready-to-eat products (Aguirre-Joya et al., 2018). This packaging technology, made of bio-based materials, generally has lower greenhouse gas emissions (GHG) than fossil-based materials, and hence has the potential to contribute to a cleaner environment (Bos, Meesters, Conijn, Corré, & Patel, 2016). Therefore, edible packaging may help mitigate the problem of unsustainable plastic consumption.

2.2 Literature on LOHAS

Sustainable packaging is likely to appeal to distinct types of consumers, such as those who already possess an understanding of, and concern for, sustainability. To identify the sustainable consumers, researchers argue that lifestyles, rather than socio-demographics, are a more sophisticated means of profiling (Lubowiecki-Vikuk, Dąbrowska, & Machnik, 2021). Sustainable living is defined as "a distinct mode of living in which people carefully consider the world's nature systems and use (natural) resources without compromising the needs of future generations" (Haan et al., 2018, p. 265). Lifestyle theory posits that the personal habits and practices in which one typically engages can reflect, as well as inform, an individual's self-identity (Axsen et al., 2012). Studies show that consumers who are sustainability oriented are willing to pay a premium for an eco-friendly product (Axsen et al., 2012; Carley & Yahng, 2018) and shop at retailers who practice sustainable grocery packaging (Su, Duong, Dinh, Nguyen-Phuoc, & Johnson, 2021).

Despite the scholarly interest in profiling the sustainable consumer (Carrington et al., 2021), relatively little research has been conducted in the context of sustainable packaging. Recent work has identified consumer groups based on attitudes, such as those who are 'interested' or 'less interested' in bio-based packaging (Scherer et al, 2018), as well as the 'sustainability experts' and the 'sustainability benevolent' who are willing to pay a premium for products made of recycled ocean plastic (Magnier et al., 2019).

In recent years, studies have emerged about the lifestyles of health and sustainability (LOHAS) and a scale has been developed and validated to measure this construct (Choi & Feinberg, 2021). LOHAS is a comprehensive framework that captures the perceptual, attitudinal, and behavioral aspects of a sustainable lifestyle (Belz & Peattie, 2012). LOHAS consumers are defined as those who value holistic health, the natural environment, conservation, global social justice, personal growth, and sustainable living (Pesek et al., 2006). As a result, LOHAS consumers could be perceived as a multi-dimensional group (National Marketing Institute, 2008), and studies operationalize LOHAS by addressing different values. For example, one of the first studies to measure LOHAS comes from the Natural Marketing Institute (NMI) in USA (Derryberry, 2005), which proposes 10 LOHAS-related variables, covering domains such as physical health, protecting the environment (e.g. sustainable agriculture practice, renewable energy sources) and societal issues (women's issues, social consciousness). Szakály et al. (2017) measure LOHAS using 21 items to reflect environmental consciousness, health consciousness, ethical values, authentic values and individualism. Pícha and Navrátil (2019) use 16 items to reflect six dimensions of LOHAS: sustainable economy, healthy lifestyle, ecological lifestyles, preference for eco-friendly products, alternative healthcare, and personal development. Choi and Feiber (2021) use 28 items to reflect LOHAS consumers' concerns with physical fitness, mental health, emotional health, spiritual health, environmentalism, and social consciousness. In summary, the LOHAS construct captures the four pillars of sustainability, environmental, social, personal health and self-development.

The existing literature investigating LOHAS can be broken down into two main approaches. One group of studies associate LOHAS values with distinct types of sustainable consumption behaviours (Choi, 2021). The studies suggest that such behaviours are context-specific, and the salience of LOHAS values can vary across products or services. For example, Joo et al. (2008) find that LOHAS consumers' emphasis on health and the environment affects behavior in the context of hotel restaurants. Lee, Kim and Kim (2012)

report that the environmental dimension of LOHAS, including three sub-constructs, environmentalism, green consumerism and conserving resources, positively influences consumers' healthy food choices. Cowan and Kinley (2014) measure the LOHAS lifestyle using questions capturing environmental consciousness, environmental knowledge, and pro-environmental attitudes, and show that it influences green apparel purchase intentions. Park (2015) reports that LOHAS (including concerns with the environment and global impact) has a positive impact on trust in upcycled fashion goods. Häyrinen, Mattila, Berghäll, and Toppinen (2016) also focus on the environmental dimension of LOHAS and show that it shapes the perceptions of forest owners and the value they attach to the forest ecosystem. These studies demonstrate that some dimensions of LOHAS, particularly the environment- and health-related values/practices, have a significant influence on consumers' sustainable consumption behaviour. However, to what extent other LOHAS factors shape the sustainable behaviours seems to be neglected.

The second group of studies adopt a segmentation approach based on LOHAS values or practices. Market segmentation involves grouping consumers into homogenous segments that share similar characteristics (Belz & Peattie, 2012). By segmenting the market, marketers and policy makers can influence sustainable behaviors through well-timed interventions and promotional efforts (Thomas-Walters et al., 2021). In terms of LOHAS-focused segmentation research, Korhonen (2012) identifies three LOHAS segments in Finland called 'LOHAS heavy', 'LOHAS medium', and 'LOHAS light' and two other groups called 'Not interested' and 'Anti- LOHAS'. Pícha and Navrátil (2019) identify five types of LOHAS values, and they segment the market into 'interested in LOHAS', 'partial-interested in LOHAS' and 'not-interested-in LOHAS'. The National Marketing Institute segments the U.S. population into five groups, labelled 'naturalities', 'drifters', 'conventionals' and 'unconcerneds' (National Marketing Institute, 2008). While these studies are helpful in identifying broad segments of sustainable consumers, they overlook the heterogeneity of LOHAS consumers in terms of their interest in, and priority given to, particular LOHAS values; hence they cannot inform marketing strategy sufficiently regarding the framing of distinct appeals and messages that could be targeted at narrowly defined LOHAS segments. A few studies conduct more specific segmentations. For example, research on consumers in Hungary (Kiss, Kiss, Popovics & Szakaly, 2018; Szakály et al. 2017) identifies five segments: 'young trend followers', (high in all LOHAS values), 'ethical traditionalists' (high ethical value), 'young environmentally conscious people' (high environment consciousness), 'uninvolved elderly people' (support

local economy) and ‘disappointed pessimists’ (low on all LOHAS values). They also show the demographic characteristics of these segments. However, they have not investigated how these segments differ in terms of consumption behaviors and they do not adopt a highly context-specific approach.

In contrast to other scholars, the authors of the current study adopt a context-specific approach (sustainable packaging) and examine segments that may arise from three broad categories of LOHAS values - social, environmental and health. It is argued that the social dimension warrants more attention. Furthermore, the segments are distinguished not only by LOHAS values but also by consumer perceptions of sustainable packaging. This is important since perceptions of the benefits or drawbacks of sustainable packaging may vary according to the category of LOHAS values held by the consumer. To ensure we address the most relevant perceptions of sustainable package, we reviewed the literature and identified several factors: familiarity with sustainable packaging concept, barriers to the adoption of sustainable packaging and perceived dispersed responsibility. These factors are introduced in the hypotheses development section.

3. HYPOTHESES DEVELOPMENT

As summarized in the section 2.2, LOHAS consumers exhibit different types of values and practices: environmental consciousness, social consciousness, healthy lifestyle, and personal development. In this study, we focus on the first three types of LOHAS values and practices, while excluding personal development, given its low relevance to the adoption of sustainable packaging.

We argue that in the context of packaging, LOHAS consumers with a high environmental consciousness will be more likely to adopt sustainable packaging. According to Korhonen (2012), LOHAS consumers appreciate environmental value more than the functional, emotional, or instrumental value in product packaging. They pay much attention to the source of the packaging materials, and the recyclability and biodegradability of the package. The social consciousness dimension could also drive LOHAS consumers to have a higher preference for sustainable packaging. Socially conscious consumers are prone to supporting socially-responsible businesses (Choi & Feinberg, 2021) and they critically evaluate the production process of the products and make purchase decisions that meet their standards for social responsibility (Sung & Woo, 2019). They have a strong preference for

buying products from companies with social values that mirror those that they uphold (Pícha & Navrátil, 2019). For example, they buy Fair Trade products where farmers receive a higher than the average price for their products, developing countries realize a financial benefit, no child labor is exploited in the production process and no gender-based discrimination occurs in the payment of wages (Vuru & Fröhlich, 2012). Sustainable packaging, as part of a company's supply chain management practice, reflects a company's stance on social responsibility, and hence will attract those LOHAS consumers with higher social consciousness. LOHAS consumers who care about a healthy lifestyle could also be interested in sustainable packaging. Sustainable packaging aims to address food waste and loss by preserving food quality, as well as addressing food safety issues by preventing food-borne diseases and chemical contamination. In addition, by adopting sustainable packaging, a healthy lifestyle seeker could minimize the use of plastic packaging and avoid the negative impact of chemicals on human health (Azoulay, et al., 2019). We therefore hypothesize:

H1: Consumers with lifestyles of health and sustainability (LOHAS) are willing to buy products with sustainable and edible packaging.

Other than the sustainable lifestyle construct, the literature also suggests that familiarity influences the consumer's decision-making process. Familiarity is defined as "the number of product-related experiences that have been accumulated by the consumer" (Alba & Hutchinson, 1987, p. 411). Previous research stresses that familiarity is important in driving purchase decisions (Türkel, Uzunoğlu, Kaplan, & Vural, 2016) and it affects product evaluations (Perera & Chaminda, 2013). Studies show that consumers are not familiar with compostable, bio-based plastic packaging (Taufik et al., 2020) and it is logical to assume that some LOHAS consumers will not be familiar with edible packaging, since it has not been introduced into mainstream food channels. Therefore, we hypothesise:

H2: Familiarity with sustainable packaging is positively associated with a willingness to buy products with sustainable and edible packaging.

LOHAS consumers are likely to encounter some barriers to the adoption of sustainable packaging. Consumers' concerns about the functional value, quality and performance could be barriers for accepting sustainable packaging (Tan, Johnstone, & Yang, 2016). Since edible packaging is still in the development phase, consumers may doubt

whether it serves its core function, which is to protect the product, and hence be unwilling to make trade-offs (such as accepting a lower level of technical performance in exchange for improved eco-performance) (Peattie, 2001). Uncertainties also exist about whether sustainable packaging can really benefit the environment (Jeya Jeevahan et al., 2020). For instance, the production of some types of edible packaging may have negative externalities, such as land use and threats to biodiversity (Patel, 2019), as well as pollution arising from the production process (Guillard et al., 2018). It is reported that market demand for sustainable packaging is hampered by 'green-washing' suspicions, and public acceptance for sustainable packaging will depend on overcoming fears about safety and health impacts (Falcone & Imbert, 2018).

In addition, individuals do not have equal access to the market or may lack the information needed to make informed choices, and powerful actors, such as retailers, producers and brands influence food consumers and their participation in the marketplace. For example, terms such as 'bio-plastics' and 'biodegradable' are reported to be ambiguous and often confuse consumers (Van den Oever, Molenveld, van der Zee, & Bos, 2017), implying that marketing communications strategies fail to deliver a clear message to consumers. Other marketing factors, such as high prices (Martinho, Pires, Portela, & Fonseca, 2015; Orzan, Cruceru, Bălăceanu, & Chivu, 2018) and lack of availability (Coelho, Corona, Klooster, & Worrell, 2020), serve as constraints for individuals and limit their ability to bring about change through their personal consumption choices. In summary, these barriers create obstacle for LOHAS consumers interested in buying sustainable packaging. As a result, the following hypothesis is advanced:

H3: Perception of barriers (safety, healthiness, naturalness etc.) is negatively associated with a willingness to buy products with edible packaging.

2.5 Responsibility for solving plastic pollution

Inquiring about perceptions of responsibility may give additional insight into LOHAS consumers and their reasons for buying sustainable packaging, and it may reveal new avenues for tackling plastic pollution. In this study, perceptions of responsibility are analysed, i.e., whether it is up to the individual (self-focus), others (focus on third parties) or everyone (dispersed or collective responsibility) to solve the plastic pollution problem.

On one hand, the classic norm activation framework (Schwartz, 1996) highlights the 'ascription of responsibility' concept. This construct represents the extent to which people believe that they are personally responsible for causing a problem and hence have a moral obligation to take remedial action (Schwartz, 1996). For example, if consumers believe that responsibility for plastic pollution is up to third parties such as the business sector, but not themselves, they may be less inclined to avoid plastic packaging and buy more sustainable forms of packaging.

On the other hand, if consumers believe that it is mainly up to the individual to deal with plastic pollution, then this perception may reflect a simplistic view of plastic pollution or a lack of understanding of the role of packaging in the supply chain. The purchasing environment, or surrounding context, may inadvertently increase the chances that people will use unsustainable packaging formats. For example, convenience foods tend to be wrapped in plastic and single-use plastic packaging is prevalent in the take-away sector, and this fulfils a health and safety role, particularly in the light of Covid-19, so individual effort to reduce waste may be unwittingly undermined by the actions of other supply chain members.

As a result, a perception of dispersed responsibility - where the challenge of addressing plastic pollution is perceived to involve action from consumers, the government, the business sector and international communities - is likely to influence the acceptance of sustainable packaging. In fact, scholars recognise that plastic pollution is a complex, global problem and sustainable consumption is not simply within the capacity of individuals to bring about alone; structural changes in society, or the surrounding context, are needed to increase the chances that people will engage in more sustainable packaging choices (Kemper & Ballantine, 2017; Little, Lee, & Nair, 2019). According to Lau et al., (2020, p. 6) , "substantial commitments to improving the global plastic system are required from businesses, governments, and the international community to solve the ecological, social, and economic problems of plastic pollution and achieve near-zero input of plastics into the environment". In alignment with the joint effort perspective, the following hypothesis is formulated:

H4: Perceived dispersed responsibility, where obligation to protect the environment from plastic pollution is shared by the self and others, is positively associated with a willingness to buy products with sustainable and edible packaging.

A summary of the hypotheses is provided in Figure 1.

INSERT FIGURE 1 HERE

3. METHODOLOGY

3.1 Data collection and sample

Ethical approval for the study was obtained from the authors' universities. Data was collected by means of a web-based survey. Previous studies have highlighted various sources of common method variance, including the consistency motif (meaning that respondents to try to maintain consistency in their responses to similar questions or to organize information in consistent ways), and the social desirability bias (desire to give culturally/socially acceptable answers) (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). In order to avoid such biases, careful attention was paid to survey design, such as item wording, response style, anchor labels, scale types and length of survey (MacKenzie & Podsakoff, 2012). Purposive sampling was used, targeting 'green' consumers as well as more mainstream consumers in Australia, with varied educational and income backgrounds. Survey participants were recruited in collaboration with the Qualtrics data service, using their respondent panel pool. Consumers who were likely to be 'green' were recruited by targeting a regional university and online groups dedicated to plastic avoidance, organic and local food consumption. A total of 477 usable responses were obtained.

3.2 Measurements

In order to measure our constructs of interest, we adapted the scales used in the literature.

For the dependent variable, we used two measures. The first one is the willingness to buy sustainable packaging, a 2-item measure was adapted from Prakash et al., (2019).

The second measurement scale for a second dependent variable, willingness to buy edible packaging with a premium. Edible packaging is a novel technology and represents an innovative solution for avoiding waste. It could be made of diverse materials and take on different forms (Janjarasskul & Krochta, 2010). To remove any ambiguities about the nature of the packaging, we described the key features of edible packaging. The measure was designed to force respondents to reveal their purchase intentions through a discrete choice experiment and help overcome the limitations of the self-reported survey approach (Carrington, Zwick & Neville, 2016). This type of measure responds to the call for research that simulates the choice dynamics of consumers and how they manage tensions between conflicting objectives, such as environmental and non-environmental benefits (Testa, Iovino,

& Iraldo, 2020). Four purchase scenarios were included in the survey. The items were adapted from Aldred Cheek and Wansink (2017) and captured attributes such as plastic packaging, edible packaging, price and organic/non--organic ingredients. We choose a price premium since the success of edible packaging hinges on inducing consumers to pay a price premium to cover the costs of production (Galgano, 2015). Furthermore, the price premium for 'green' products is typically used to explain the 'green gap' (Gleim & Lawson, 2014). Organic food is considered a luxury item and is typically high priced (McFadden & Huffman, 2017) and its perceived health benefits influence purchase (Hansen, Sørensen & Eriksen, 2018). The respondents were asked to select their most preferred option, reflecting the trade-offs that consumers are required to make in the marketplace.

With regard to the independent variables, to measure the sustainable lifestyle construct, we included 21 items related to sustainable practices, from multiple studies, such as purchase (e.g., I buy fair trade food products; I buy certified organic good) (Geiger et al., 2018), usage (e.g., I cook my own meals with fresh ingredients) (Bartolotta & Hardy, 2018; Schnurr et al., 2018) and disposal (e.g., I recycle as much as I can) (Geiger et al., 2018; Schnurr et al., 2018; Bartolotta & Hardy, 2018). Several items were specifically related to plastic usage (e.g., I buy snacks and drinks in single-use packaging (e.g., take away, fast food); I regularly use single-use plastic bags; I regularly use plastic water bottles) (Schnurr et al., 2018; Bartolotta & Hardy, 2018). These items reflect a consumer's value and practice related to his/her environmental consciousness, social consciousness, and health consciousness, which are the three important dimensions of LOHAS.

The perceived dispersed responsibility was measured with a total of four items adapted from Herbes et al. (2018) and Paço and Gouveia Rodrigues (2016). A sample item is "protecting the environment from plastic pollution is the responsibility of our government".

To measure familiarity with sustainable packaging and edible packaging, a total of five items were adapted from Herbes e al. (2018). The measure covered the main attributes of sustainable packaging, such as the reuse, recycle and recover concepts. Sample items are "I am familiar with recyclable packaging" and "I am familiar with edible packaging".

To measure purchase barriers of edible packaging, 13 items were adapted from Aldred Cheek and Wansink (2017) and Herbes et al. (2018). We asked participants to evaluate to what extent the aspects of edible packaging are potential barriers for them to purchase. Sample items include "the product with edible packaging may not be as safe as

standard products" (Herbes et al., 2018) and "the ingredients may not be as nutritious as other foods" (Aldred Cheek & Wansink, 2017).

For most items, the response format was a 5-point scale such as frequency scales ranging from never (1) to always (5); familiarity scales ranging from not at all (1) to extremely familiar (5), and 5-point Likert-type scales ranging from strongly disagree (1) strongly agree (5). In addition, several control variables were included in the analysis. Gender and education were measured using categorical variables and employment was measured using a dummy variable, covering full-time, part-time, self-employment and other.

4. RESULTS

4.1 Developing and Validating Sustainable Lifestyle Scale

Since the LOHAS scale was extracted from several studies to reveal a multiple-dimension construct, we used half of the sample (223) for exploratory factor analysis (EFA) and the other half (224) for confirmatory factor analysis (CFA) to establish the validity our main construct, i.e., LOHAS lifestyles. This approach is one that is suitable when establishing a new construct (Anderson & Gerbing, 1988).

Exploratory factor analysis (EFA) was conducted using first half of the sample on the 21 LOHAS (lifestyle) items. After eliminating the items with low loading (less than 0.50) and cross-loading (an item loading on two factors with a difference smaller than 0.20), 13 items loaded onto four corresponding factors (loading factors higher than .50). In Table 1, the first factor captures ecological practice, in which respondents are engaged with environment-friendly behaviors such as recycling and reducing waste and consumption (the total item variance was 17.02 %). The second factor captures sustainable diet practices, for example cooking and eating healthily (the total item variance was 14.43 %). The third factor captures socially conscious practice, in which respondents purchase products to benefit the local or broader community (the total item variance was 13.76 %). The fourth factor captures the single-use plastic minimizing practice (the total item variance was 12.71 %).

INSERT TABLE 1 HERE

In relation to the validity of the measures, the Composite Reliability (CR) was higher than 0.6 (Fornell & Larcker, 1981), suggesting adequate convergent validity of the construct. We also examined the internal validity of the measurement model through average variance extracted (AVE). All AVE values were within the acceptable threshold (values above .7 are

considered good, while a value of .5 is acceptable) (Fornell & Larcker 1981). Therefore, the convergent validity of the constructs was established.

Discriminant validity is established using two approaches. First, we performed the confirmatory factor analysis using the second half of the sample in IBM SPSS AMOS 25, a structural equation modeling (SEM) software. The model showed good fit (Chi-square=54.189, Probability level = .219; CFI=.988; TLI=.979; NFI=.917; IFI = 0.988, RMSEA=.026), supporting the conclusion that the four latent factors are strong reflections of the associated observed variables, confirming the EFA loadings. Second, it is important that the measures are not a reflection of some other variables, which is indicated by low correlations between the measure of interest and the measures of other constructs (Cheung & Lee 2010). The AVE for each factor was larger than the square of the correlation estimates of the factor with all other constructs (squared variance (SV)) (Table 2). We thus conclude that the four sub-constructs show sufficient discriminant validity (Fornell & Larcker 1981).

INSERT TABLE 2 HERE

4.2 Factors influencing willingness to buy sustainable packaging and exploratory factor analysis

EFA was performed by including all other items related to factors influencing willingness to buy sustainable packaging. Seven items fall onto functional barriers (e.g., respondents' concern about hygiene and safety, healthiness, naturalness, convenience, delivering environmental outcomes), while three fall onto marketing-related barriers (e.g., no label, lack of knowledge, newness, availability and price). Three items fall onto familiarity with traditional sustainable packaging, such as the reuse, recycle and recover concept (the 3R's) and two fall onto Familiarity with new packaging, such as edible and zero waste packaging. Four items fall onto perceived dispersed responsibility. Table 3 also reports the Cronbach's alpha and Composite reliability of the scales, which are all at least 0.65, suggesting satisfactory convergent validity.

INSERT TABLE 3 HERE

To further establish the discriminant validity across all the constructs, including the LOHAS scales and other influencing variables, we examined the cross loading reported in SmartPLS. All the cross loadings are less than the loading on the main construct. We also referred to the Fornell and Larcker and the Heterotrait-monotrait Ratio of Correlations (HTMT ratio) reported in SmartPLS, since Voorhees, Brady, Calantone and Ramirez (2016)

demonstrate that the AVE-SV (shared variance) comparison (Fornell and Larcker 1981) and HTMT ratio (Henseler, Ringle and Sarstedt, 2015) with 0.85 cut-off provide the best assessment of discriminant validity and should be the standard for publication in marketing. As shown in the Table 2a, the AVE for each factor was larger than the square of the correlation estimates of the factor with all other constructs. In Table 2b, the HTMT is all less than 0.85. Hence the discriminant validity is established.

4.3 Hypothesis Testing

We employed partial least squares structural equation modeling (PLS-SEM) in SmartPLS to test the hypotheses. PLS-SEM is said to be more appropriate when the model is complex (all variables can be tested simultaneously) (Ong & Puteh, 2017). It also allows the inclusion of a single item construct and offers flexibility in terms of data analysis (Hair et al., 2011).

Two sets of PLS-SEM analysis were run, taking willingness to buy sustainable packaging and willingness to buy edible packaging as dependant variables respectively, the results of which are shown in Table 4 in Model 1 and Model 2. Since the functional barriers and marketing barriers are only relevant to edible packaging, they are included only in Model 2, but not Model 1. In Model 1, willingness to buy sustainable packaging is positively related to ecological practice ($\beta = .242$; $p < .001$), single-use plastic minimizing practice ($\beta = .097$; $p < .05$), and socially conscious practice ($\beta = .116$; $p < .01$). In Model 2, willingness to buy the edible package with a premium is positively related to socially conscious practice ($\beta = .115$; $p < .05$). Both sets of results support the hypothesis (H1) that LOHAS values manifested by ecology practice, socially responsible practice, and single-use plastic minimizing practice are associated with a higher willingness to buy sustainable or edible packaging. However, LOHAS value focusing on sustainable diet practice seems not to be associated with the willingness to buy sustainable and edible packaging.

INSERT TABLE 4 HERE

In addition, familiarity with the 3R's (traditional sustainable packaging attributes) is positively related to willingness to buy sustainable packaging in Model 1, while familiarity with edible and zero-waste package is positively related to willingness to buy edible packaging in Model 2, lending some support to the hypothesis 2, which predict a positive relationship between familiarity with sustainable packaging and willingness to buy sustainable packaging and edible packaging.

Perceived functional barriers are negatively related to willingness to buy edible packaging (model 2: $\beta = -.119$; $p < .01$), though perceived marketing barriers do not show significant result. Such results partially support the hypothesis 3.

Perceived dispersed responsibility to protect environment is positively significant in both Model 1 ($\beta = .124$; $p < .01$) and Model 2 ($\beta = .129$; $p < .01$), supporting the hypothesis 4.

4.5 Cluster analysis

Based on our findings of four types of sustainable lifestyles, we further conducted cluster analysis for our sample. Using Ward's method in STATA, a cluster analysis is performed on each case's factor means on the four factors for the sample. The stopping rule, based on Calinski–Harabasz pseudo-F index, is used to decide the number of clusters. Large values of the Calinski–Harabasz pseudo-F index indicates distinct clustering (Calinski & Harabasz, 1974). The 3-cluster solution shown in Table 5 emerges as the best solution as it shows the greatest pseudo-F value (164.15).

INSERT TABLE 5 HERE

An analysis of variance (ANOVA) was then performed to compare the mean of the factors for the three clusters. The results show that there were significant differences ($p < 0.05$) between the responses of the groups formed in the cluster analysis. The Tukey test was also applied to compare all possible pairs of means across every two groups, where significant differences at $p < 0.05$ have been found for all the clustering variables across three groups, as shown in Table 7. We hence can confirm the three distinct clusters. The first cluster, non-sustainability practitioners, includes 127 respondents and is featured by significantly lower scores on all the sustainable lifestyle components as compared to the other two clusters. The second and the third clusters are both sustainable lifestyle segments, but they prioritize different aspects of LOHAS practices. The second cluster, sustainable diet and socially conscious practitioners, includes 80 respondents and is featured by significantly higher scores in sustainable diet practice and socially conscious practice as compared to the other two clusters. The third cluster, ecological and plastic minimizing practitioners with 271 respondents, is featured by significantly higher scores in ecological practice and single-use plastic minimizing practice than the other two clusters (see Table 6).

INSERT TABLE 6 HERE

We then compared the three clusters' perception regarding sustainable and edible packaging, including their purchase intention, familiarity of sustainable packaging concept, functional and marketing barriers and dispersed responsibility, using ANOVA. Specifically, we looked at the Tamhane' T2, which is a less sensitive method to violation of the assumption of equal variance in ANOVA (Lee & Lee, 2018). Tamhane's T2 method gives a test statistic using the t-distribution by applying the concept of 'multiplicative inequality' introduced by Sidak (Lee & Lee, 2018). Sidak's multiplicative inequality theorem implies that the probability of occurrence of intersection of each event is more than or equal to the probability of occurrence of each event. In Table 7, the last three columns show the difference across every two groups and the significant level of such differences.

INSERT TABLE 7 HERE

We examined willingness to buy sustainable packaging in general and willingness to buy edible packaging with a price premium. For all the three groups, sustainable packaging was appealing to more consumers than edible packaging, as shown in Figure 2. From the Panel A in Table 7, the two sustainable lifestyle segments show significantly higher willingness to buy sustainable packaging and edible packaging, while the two sustainable groups do not show significant difference.

INSERT FIGURE 2 HERE

Table 7 Panels B, C, D and E compare the factors that drive or hinder the three groups from buying sustainable and edible packaging. For the functional barriers, the ecological and plastic minimizing practitioners perceive significantly lower functional barriers related to hygiene and freshness, healthiness, convenience, and naturalness, than the other two groups. The three groups do not show significant difference about their perception of the sustainable packaging's environment benefits. Sustainable diet and socially conscious practitioners show stronger suspect of the ability of sustainable packaging to solve plastic waste problem, as compared to ecological and plastic minimizing practitioners. In summary the ecological and plastic minimizing practitioners see the lowest level of functional barriers from sustainable packaging.

The three groups generally perceive more marketing barriers than functional barriers of purchasing edible packaging. The biggest marketing barriers indicated by three groups are availability, i.e., products with edible packaging are not as easy to find as standard products,

followed by the high price of such products. However, the three groups' perception of marketing barriers do not show significant difference.

In terms of the familiarity with packaging attributes, the two sustainable lifestyle practitioner groups generally indicate higher familiarity with sustainable packaging attributes than the non-sustainable consumers. When comparing the two sustainable lifestyle practitioner groups, they show similar familiarity level about most of the packaging attributes, except that the sustainable diet and socially conscious practitioners indicate significant higher level of familiarity with edible packaging and zero waste packaging than ecological and plastic minimizing practitioners.

Lastly, the two sustainable lifestyle segments attribute a significant higher level of perceived dispersed responsibility to consumers, the government and business to protect the environment than the non-sustainable practitioners.

5. DISCUSSION

5.1 Theoretical and managerial implications

The first objective of this study is to examine which lifestyles of health and sustainability (LOHAS) are associated with the willingness to buy sustainable packaging. The results of the PLS-SEM reveals that consumers with LOHAS tend to have higher willingness to buy sustainable package; such an association is observed for the consumers adopting the ecological practice, socially conscious practice and plastic minimizing practice, but not for those practicing a sustainable diet. A significant positive influence on the willingness to buy edible packaging with a price premium is only observed for the consumers adopting socially conscious practices, but not for consumers with other types of LOHAS practices. These findings support prior research showing positive attitudes towards the purchase of organic food sold in sustainable packaging (Santos et al., 2021).

The second aim of this study is to identify consumer segments based on lifestyles of health and sustainability (LOHAS). A three-segment solution emerges from cluster analysis. The first segment, the non-sustainable practitioners, are not engaged with sustainable living and attributes a low level of responsibility to themselves and others for solving plastic pollution. This type of consumer is not part of the LOHAS segment (Belz & Peattie, 2012), confirming prior research on segments who resist sustainability living, such as the 'grasshoppers' (Jayaratne, Mort, & D'souza, 2017), the 'brown' consumers (Lavelle, Rau, &

Fahy, 2015) and the 'non-greens' (Verain et al., 2012). The second segment (the sustainable diet and socially conscious practitioners), which is the smallest in size, is committed to sustainable, food-related practices (such as cooking one's own meals, eating healthily) as well as socially responsible actions (buying fair-trade, organic and regional items). The presence of this segment is not surprising given that sustainable product attributes are most often communicated to consumers using product labels, such as organic or fair-trade (Bangsa & Schlegelmilch, 2020). The third segment, the largest, is motivated to pursue an ecological lifestyle, which focuses on reducing consumption (using left-overs for the next meal, reducing rubbish, recycling) and avoiding single-use packaging. The typology proposed here contributes to the literature on market segmentation that emphasises psychographics and behavioral bases (Barr et al., 2011; Verain et al., 2012), and is aligned with the view that the 'green' market is not a homogenous one and consumers will have different motives for 'going green' (Lavelle et al., 2015, p. 376).

Furthermore, the literature has identified barriers to the purchase of sustainable packaging, but the existing literature lacks an understanding of the main barriers encountered by different consumer segments. Our results show that all three lifestyle clusters generally perceive higher marketing barriers than functional barriers when purchasing edible packaging. The biggest marketing barriers indicated by three groups is availability, i.e., products with edible packaging are not as easy to find as standard products, followed by the high price of such products. This finding is aligned with previous literature that considers availability and high prices to be some of the numerous barriers to sustainable consumption (Kushwah et al., 2019). It is anticipated the higher price, due to the high cost of raw materials and limited production (Galgano, 2015) could limit the marketability of edible packaging (Patel, 2019). However, in the PLS-SME analysis, perceived marketing barriers do not show a significant effect on consumers' willingness to buy edible packaging. Such results may imply that consumers' low interest in edible packaging is not primarily due to the marketing barriers. Simply promoting sustainable packaging at competitive prices and offering it in convenient locations would not be sufficient to drive the consumers to adopt sustainable packaging.

Instead, our PLS-SEM analysis indicates that perceived functional barriers are negatively related to the willingness to buy edible packaging. The results show that not only the non-sustainable segment, but also the sustainable diet and socially conscious practitioner segment perceive significantly more functional barriers than the ecological and plastic

minimizing practitioners. The former two groups seem to be more concerned about hygiene and safety, along with freshness, and are not convinced about the environmental benefits of edible packaging. This finding is aligned with previous studies highlighting the importance of safety in driving public acceptance for sustainable packaging (Falcone & Imbert, 2018). Scholars note that the costs to performing pro-environmental behavior can be high, for example, sacrificing product performance in exchange for sustainable features, and such costs contribute to 'attitudes-behavior gap' (Steg & Vlek, 2009). If consumers are faced with trade-offs between options that are sustainable and options that satisfy self-oriented consumption goals (e.g., health and safety), they may choose a less sustainable option (Luchs et al., 2015). Therefore, product managers should minimize functional risk, particularly for the diet-conscious segment. To achieve acceptance in the marketplace, we recommend investment in research and development (R&D) to improve the functional performance, and in marketing communications to reassure the sustainable diet segment that edible packaging will perform its core function and meet strict food safety regulations. In addition, ecological and plastic minimizing practitioner segment has particularly higher doubt about the ability of edible packaging to address the plastic pollution problem. Therefore, the packaging sector needs to provide evidence, such as data from life cycle analysis, to ensure that the environmental benefits of new packaging formats are made clear to consumers.

Our PLS-SEM analysis supports hypothesis 2 that familiarity with 3R attributes is positively associated with a willingness to buy sustainable packaging and familiarity with novel edible packaging is positively associated with a willingness to buy edible packaging. This finding is aligned with prior work highlighting the importance of familiarity in shaping consumer attitudes and behavior (Türkel et al., 2016). Our post-cluster analysis, on one hand, shows that the sustainable lifestyle practitioners generally indicate higher familiarity with sustainable packaging attributes than the non-sustainable consumer. This could explain the higher willingness to buy sustainable packaging and edible packaging of sustainable lifestyle practitioners. On the other hand, our results show that consumers in the three clusters are less familiar with the novel edible packaging concept, though they have a relatively high understanding for the traditional 3R packaging concept. Such results could partially explain the much lower level of willingness to buy edible package than general sustainable package. We hence recommend that product managers enhance familiarity and target marketing communications about novel packaging (e.g. through point-of-purchase displays, leaflets, free samples and taste tests) at the ecological and plastic minimizing practitioners.

The results of the PLS-SEM show that perceived dispersed responsibility is positively associated with willingness to buy sustainable and edible packaging. This finding supports prior research that reveals that personal accountability alone is not enough to activate purchase intentions for green products (Munerah et al., 2021). Cavaliere et al. (2020) report that consumers who attribute importance to third parties' collective commitment in tackling plastic pollution are more concerned about the adverse effects of plastic over-use, and more active in avoiding single-use plastic. The cluster analysis suggests that two sustainable lifestyle segments place high importance on the responsibility of all stakeholders in contrast to the non-sustainable practitioners, which could be another reason that the LOHAS consumers demonstrate high willingness to buy sustainable marketing. Interestingly, all three segments place significantly highest importance on consumers' responsibility, followed by business and government responsibilities, and lastly the environment organizations' responsibility. Thus, the packaging industry and other stakeholders may need to stress and demonstrate their responsibility in marketing campaigns. Adapting marketing communications to different consumer segments may stimulate the purchase of plastic substitutes and reduce waste. For the two sustainable lifestyle two segments, stressing the responsibility of the third parties in bringing novel packaging technologies to the marketplace is appropriate in targeted communications campaigns. For the non-sustainable segment who perceive low responsibilities from all the parties, information-based campaigns highlighting the complex nature of plastic pollution and need for collective action on plastic packaging is recommended.

5.2 Limitations and avenues for future research

The study has its limitations. An online survey was used to measure purchase intentions, and although the choice dynamics of consumers were examined, a survey does not capture the actual behavior of consumers in the marketplace. Consumers' judgments of edible packaging may depend on the situation. For example, edible packaging may be more acceptable to consumers in an out-of-home consumption context and in situations where it is difficult to make ethical packaging choices. Prior studies have shown that consumer acceptance depends on how well the packaging material is integrated with its principal food product, e.g., an edible film that holds a liquid and is eaten in conjunction with the liquid is more acceptable to consumers than a separate edible cup (Cheek & Wansink, 2017). Future studies could assess different types of edible packaging and the impact of situational factors on its marketability.

Our study considered a few factors that drive and inhibit purchase intentions, whereas future studies could consider the combined influence of a range of factors that influence consumer behavior, such as perceived self-efficacy and the level of trust in eco-labels.

6. CONCLUSION

Plastic packaging has negative externalities and there is an urgent need to limit its use and promote substitutes. This study extends our understanding of sustainable consumer behavior by testing a conceptual model that explores the influence of the lifestyle tendency, familiarity, perception of barriers and perceived responsibility on the willingness to buy sustainable packaging. An important theoretical contribution of this study is the profiling of three lifestyles segments who vary in their response to sustainable packaging and their perceptions of barriers. No study has been conducted in Australia to test consumers' response to edible packaging, and by focusing on a specific packaging category. This study has important managerial implications. Companies need to overcome the barriers to the purchase of edible packaging and address the shortcomings of company strategy.

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