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Global Business & Finance Review (GBFR)

**Provided in Cooperation with:** People & Global Business Association (P&GBA), Seoul

*Suggested Citation:* Jeon, Yu Jung Jennifer (2023) : An analysis of key attributes of upcycled food using a best-worst scaling approach, Global Business & Finance Review (GBFR), ISSN 2384-1648, People & Global Business Association (P&GBA), Seoul, Vol. 28, Iss. 5, pp. 1-12, https://doi.org/10.17549/gbfr.2023.28.5.1

This Version is available at: https://hdl.handle.net/10419/305914

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GLOBAL BUSINESS & FINANCE REVIEW, Volume. 28 Issue. 5 (OCTOBER 2023), 1-12 pISSN 1088-6931 / eISSN 2384-1648 | Https://doi.org/10.17549/gbfr.2023.28.5.1 © 2023 People and Global Business Association

# **GLOBAL BUSINESS & FINANCE REVIEW**

www.gbfrjournal.org

# An Analysis of Key Attributes of Upcycled Food using a Best-Worst Scaling Approach

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#### ABSTRACT

**Purpose:** The purpose of this study is to identify priorities by evaluating the significance of attributes consumers consider when selecting upcycled food.

**Design/methodology/approach:** Based on a sample survey of 280 participants, a total of nine upcycled food attributes were derived and a total of 12 sets were proposed. By using a Best-Worst Scaling (BWS), the relative importance of a set of attributes was evaluated.

Findings: Among the nine upcycled food selection attributes derived based on previous studies, food safety was the most important attribute, followed by sensory appeal, nutritional value, origin and environmental information. In contrast, brand, cost-effectiveness, convenience and familiarity appeared to be attributes of relatively low significance in selecting upcycled food.

**Research limitations/implications:** The results of the study investigated the attributes affecting consumer purchase decisions in the emerging upcycled food market strengthened strategy establishment and improvement, and proposed ways to increase competitiveness.

**Originality/value:** This study has academic significance in that it identified upcycled food selection attributes based on the quantitative analysis methodology rather than common perception. It is differentiated from previous studies in that it derives preferences for purchasing determinants through BWS and presents how much more important certain attributes are than other attributes, so the size of relative importance can be quantitatively compared.

Keywords: Upcycled foods, Best-worst scales, Selection attributes

# I. Introduction

Although the concept of sustainability has been a topic of discussion in the fields of agriculture, rural regions, and food for some time, the emphasis has been mainly on the aspects of production and consumption (Yu, 2023). Nevertheless, food loss and waste is

Received: Sep. 6, 2023; Revised: Sep. 14, 2023; Accepted: Sep. 25, 2023

† Corresponding author: Yu Jung Jennifer Jeon E-mail: jeonyj@kdu.ac.kr critical in implementing a sustainable food system. In this light, the Food Recovery Hierarchy presented by the Environmental Protection Agency (EPA) argues that the best approach to minimizing food waste is to dispose of it at source and encourage reuse (EPA, 2021). As one of its Sustainable Development Goals by 2030 the United Nations includes a target of reducing waste by 50% at the consumption phase and reducing food loss at the pre-consumption stage including post-harvest processing, wholesale and production (United Nations, 2015). In this framework,

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the creation of upcycled foods has emerged as a promising sector which both academic and industrial bodies are actively working to advance (Sharma et al., 2021).

Upcycling combines the concepts of upgrading and recycling, signifying a recycling technique that introduces new value by repurposing by-products or waste. Hence, upcycled foods refer to food products that repurpose items that would typically be discarded, elevating them to greater utility while providing benefits for the environment and society (Spratt et al., 2020).

As an emerging food category, upcycled food confronts numerous challenges, one of which is gaining public acceptance (Moshtaghian et al., 2021). When it comes to the concept of consuming novel foods, particularly the notion of consuming by-products and foods created through novel methods, there may be a general aversion to the unknown and neophobia among consumers (Cox & Evans, 2008). Likewise, for firms in the food industry, financial concerns make the industry hesitant to invest in circular initiatives, as it is often more favorable to discard by-products than to find ways to repurpose them (Asioli & Grasso, 2021). The unpredictable nature of supply and demand of raw materials for products and the fact that the size of the upcycled food market is still quite limited in countries other than the North America and Europe are further challenges that need to be solved (Kim, 2023).

Upcycled food is in the early stages of market formation, with conceptualization, product development, and certification beginning to take place. Yet, the global shift towards sustainable eating habits and an increasing consumer preference for eco-friendly products, combined with alignment to broader sustainability and ethical objectives, prove the growth potential of the upcycled food market. From a market economy perspective, upcycling offers considerable potential by reducing environmental and societal waste, adding economic value and, as a facet of the food technology sector, it stands poised to spearhead various technological innovations (Yu, 2023). Consequently, the expansion of the upcycled food sector is expected to develop given current considerations.

The growth of the upcycled food market hinges

primarily on public acceptance (Bhatt et al., 2018). Given that the reasons for selecting distinct foods may differ, it is essential to understand the attributes that sway consumers towards selecting upcycled food (Moshtaghian et al., 2023). As attributes not only serve as a selection criterion in the consumer's purchase decision-making process (Jun, Bang, & Choi, 2006), but also shape the consumer's attitude toward a product or service, identifying these attributes serve as foundational data for the development of upcycled foods.

Therefore, this study seeks to identify priorities by evaluating the significance of attributes consumers consider when selecting upcycled food. Given the importance of comparing these properties when making "trade-offs" within the same "tier," the study intends to gain insights using Best-Worst Scaling (BWS). BWS is a stated preference methodology that quantifies respondents' preferences based on decisions taken under hypothetical choice situations. The study has been designed to measure preferences by having respondents choose the most and least preferred (or important) items from a set of options, thereby quantifying the relative importance of different attributes or items. The study is viewed as an appropriate method aligned with the aims of this research, as it addresses the limitations inherent in various strategic methodologies.

#### II. Literature Review

#### A. Attributes of Upcycled Food

In upcycling, waste or used materials are repurposed or products are reused in innovative ways to create something valuable, sustainable, and high-quality, all while conserving resources (Sung, 2015). Using edible parts of discarded food in a manner like upcycling is not a novel concept, but the term "upcycled food" was only recently developed to formally describe this practice (Moshtaghian et al., 2021).

In the study of consumer acceptance of a novel food product category, Bhatt et al. (2018) provided a definition of upcycled food, stating that it encompasses

foods derived from surplus ingredients or those obtained during the manufacturing of other food items that might have otherwise been discarded. In contrast, Spratt et al. (2020) offered a manufacturer's perspective on upcycled food, explaining that it involves transforming ingredients and food items that would typically go to waste into higher-value products, vielding tangible benefits for both the environment and society. Adopting the most comprehensive perspective definition, the Upcycled Food Association defines upcycled food as that which "use[s] ingredients that otherwise would not have gone to human consumption, are procured and produced using verifiable supply chains, and have a positive impact on the environment" (Upcycled Foods Definition Task Force, 2020, p. 2). Although there might be differences depending on the position of manufacturing or consuming upcycled food, the shared aspect is the use of food that would have otherwise been discarded if it had not been upcycled.

The fact that success in the market ultimately hinges on consumer buying decisions means consumer acceptance is essential for the success of novel foods (MacFie, 2007). Consumers often select the optimal alternative based on the evaluation of various attributes inherent in a product or service in the purchasing decision-making process. As selection attributes provide insight into consumers' attitudes and consumption tendencies toward purchasing products or services, understanding them is a fundamental approach to analyzing consumer behavior for specific products or services (Fodness, 1994). Therefore, as the selection attributes of upcycled foods are the various characteristics that consumers consider in the selection process, analyzing the characteristics and figuring out their relative importance may be an opportunity to improve the areas in which upcycled food needs to be supplemented.

According to the study investigating the factors that motivate the Swedish population to choose upcycled foods, ethical concerns were the most important aspect, followed by natural content, sensory appeal, price, healthiness, familiarity and impression (Moshtaghian et al., 2023). Coderoni and Perito (2020) concluded that individuals who pay attention to nutritional value, product label, and origin, believe a product to be natural, and expect it to have environmental and health benefits are more likely to purchase upcycled food. Asioli and Grasso (2021) emphasized that nutritional and environmental information improved consumers' willingness to purchase. In addition, the selection attributes examined in the study of acceptability and purchase intention of upcycled foods or other novel foods include providing nutritional value and the brand (Aschemann-Witzel & Peschel, 2019), product design (Aschemann-Witzel & Peschel, 2019), product origin (Coderoni & Perito, 2020), price (McCarthy, Kapetanaki & Wang, 2020; Moshtaghian et al., 2023), convenience (McCarthy, Kapetanaki & Wang, 2020), sensory appeal (Hellwig et al., 2020; Moshtaghian et al., 2023), food safety (Schifferstein & Ophuis, 1998), familiarity (Moshtaghian et al., 2023) and so on. Table 1 summarizes the selection attributes

Table 1. Literature on Attributes of Upcycled or Novel Food

Attribute	References
Origin	Coderoni & Perito (2020)
Brand	Aschemann-Witzel & Peschel (2016)
Nutritional Value	Asioli & Grasso (2021); Coderoni & Perito (2020); Saulais & Ruffieux, (2012)
Cost-Effectiveness	McCarthy, Kapetanaki, & Wang (2020); Moshtaghian et al. (2023)
Convenience	McCarthy, Kapetanaki, & Wang (2020)
Environmental information	Asioli, & Grasso (2021); Gracia & Magistris (2008); Moshtaghian et al. (2023)
Sensory appeal	Hellwig et al. (2020); Moshtaghian et al. (2023)
Familiarity	Moshtaghian et al. (2023)
Food safety	Schifferstein & Ophuis (1998)

referenced in previous studies on upcycled foods.

#### B. Best-Worst Scaling (BWS)

BWS was developed to extend the function of the discrete-choice experiment as an analytic method that measures the relative importance of individuals to multiple choice alternatives (Flynn et al., 2010). Initiated by Louviere (1987), it was designed to capture a deeper understanding of consumer preferences. Rather than solely focusing on the "most preferred" attribute like traditional questionnaires, he introduced the concept of evaluating the "least preferred" attribute. The fundamental idea was that respondents are more effectively able to identify extremes (i.e., the best and worst or most and least) in a set rather than giving precise ratings for all items in the set. This approach offers a way to gauge consumer preferences, building upon Thurstone's (1927) method of pairwise comparison, which compares two alternatives and chooses the one that is more important (Goodman et al., 2005). BWS is a method that has recently been used in various fields in that it has improved the defects of rating scales, ranking scales, and Analytic Hierarchy Process (AHP), which have been used mainly for preference and priority analysis.

AHP, a decision-making method that derives priorities by systematically evaluating mutually exclusive alternatives, is a multi-criteria analysis in which complex decision-making problems are stratified and importance is determined according to the hierarchy (Jung et al., 2022). Thus, it has been used in studies related to multi-criteria decision-making in which the target or standard to be derived is multiple or complex. It is performed based on the assumption that respondents give reasonable and consistent responses. If the consistency index, which indicates the degree of consistency of the response, falls short of the standard, the questionnaire is either excluded from the analysis or restored to consistency by re-surveying the respondents. It should be noted that the interviewer may induce an inconsistent response into a consistent response during the re-questioning

process. Furthermore, in the paired comparison approach used in AHP analysis, when there are many alternatives to choose from, the number of questions to be answered increases, making it more difficult to find consistent responses (Chang & Lee, 2015). As this is an analysis of experts, it is difficult to confirm the representativeness of the sample because judgment sampling is mainly used and so it is unreasonable to generalize the derived results. On the other hand, BWS is attracting attention as a priority decision method that compensates for the disadvantages of AHP as choice sets are composed at an appropriate level and generalization of the results is possible through quantitative analysis.

BWS is known as a method that addresses some of the disadvantages of traditional rating scales. Rating scales estimate relative ranks using ordinal scales, which may not capture the true intensity of preference or importance. Rating scales usually measure the value or importance of individual attributes independently, meaning they allow respondents to evaluate each attribute without considering how it may relate to or conflict with other attributes. In contrast, BWS considers these trade-offs and interrelationships between factors, providing a more realistic representation of decision-making processes.

In ranking scales which are used to estimate preferences among multiple alternatives, respondents are asked to assign a unique rank to each option from a set. As the number of options increases, it becomes difficult for respondents to differentiate and decide which is better, leading to possible inaccuracies in the data (Finn & Louviere, 1992). BWS helps to mitigate this issue, as respondents are asked to identify only the best and worst options from smaller subsets of the choices, rather than having to rank all options at once.

Two approaches can be used to analyze the data in BWS: (a) the counting approach, and (b) the modeling approach. The counting approach involves counting the number of times each item is chosen as the "best" or "most preferred" and the "worst" or "least preferred." The modeling approach involves using statistical models such as the multinomial logit model or the conditional logit model. Flynn, Louviere, Peters, and Coast (2008) emphasized that there is no difference in the results of the two approaches, and in fact, Choi's (2017) study verified that the results derived from the two approaches are consistent.

BWS can be divided into three cases based on the nature of the items being evaluated and the questions being asked: Case 1, the object case, involves individual evaluations of the best and the worst item or object in each choice set; Case 2, the profile case, is where attributes and levels are listed and respondents select the best and worst levels; and Case 3, the multi-profile case, where the respondents are prompted to select the best and worst profiles from choice sets of multiple profiles (Louviere, Flynn, & Marley, 2015).

As the aim of this study is to measure the relative importance of upcycled food attributes in purchasing decisions, the BWS Case 1 is employed. Case 1 is a method that analyzes priorities based on the relative importance of several attributes or alternatives. It is designed so that respondents select "most important" and "least important" items or "best" and "worst" items from choice sets consisting of three or more items. Choice sets are presented in several sets as the items are changed based on the ranking method. Respondents select the "best" and "worst" items from each choice set, and through these, the relative importance is measured to determine the priority between the items.

#### III. Methods

#### A. Study Design

The attributes of upcycled food measured in this study were derived based on previous literature on value-added surplus products, waste-to-value foods, and novel foods along with upcycled foods. A total of nine items were chosen as the attributes including nutritional value, cost effectiveness, environmental information, sensory appeal, familiarity, safety, convenience, origin, and brand. Nutritional value includes factors such as calories, protein content, vitamins, minerals, and other nutrients in the food. Cost-effectiveness refers to the price of the food product and whether it offers good value in terms of its quality. Environmental information considers whether the product has certifications related to sustainability, eco-friendliness, or the use of upcycled materials. It also includes information about the environmental impact of the product's production and packaging. Sensory appeal pertains to taste, texture, and flavor, while familiarity refers to well-known ingredients or menus. Safety encompasses the reliability of the food product in terms of food safety, including the absence of contaminants and the appropriate use of food additives. Convenience evaluates how easy it is for consumers to purchase, consume, and store the product. Origin indicates information about the source of ingredients, and brand recognition indicates a highly recognized and trusted brand.

Questionnaires of the BWS comprise choice sets so that respondents select the most important and the least important attributes by comparing each attribute in a conflicting relationship in the mind of the respondent. In general, two-level orthogonal main-effect design and balanced incomplete block design (BIBD) are used to construct choice sets in BWS. Although the two methods have different strengths and weaknesses, the BIBD prevents the problem of inhibiting the response, as the number of attributes in the choice set is fixed. Differing numbers of items in a choice set not only adds to the confusion of the respondents but also increases possibility of an incorrect response, as the total number of questions to be answered increases as the questions are repeated. Employing BIBD addresses this limitation because each item is presented an equal number of times, consistently in every position, and with identical frequency as are all the other items (Linder et al., 2022). Thus, attributes were randomized using BIBD.

As a result of BIBD execution using the R program, six out of a total of nine upcycled food attributes were configured as selection alternatives in one set, and a total of 12 sets were proposed. Respondents were designed to select one "most important" and one "least important" attribute from a set of six items.

#### B. Data Collection and Analysis

Before conducting the main survey, the questionnaire was pilot tested with two experts from the industry and 50 students in Foodservice Management from a university in Seoul, Korea to detect and correct any misunderstanding of items to supplement the questionnaire.

The survey was conducted on residents of Seoul and its suburbs from March 13 to 20, 2023. A total of 307 questionnaires were distributed through convenience sampling, a non-probability sampling method. Of the collected questionnaires, only 280 (91.2%) were used for the final analysis, excluding those containing missing values or marked the same in both "most important" and "least important" items in one set.

The collected data were analyzed using the statistical program SPSS 18.0 and the open-source program R. In deriving upcycled food attributes, BWS, which compares and confirms different items in a conflicting relationship at the same level, was used, and the responses were analyzed through a counting approach. The counting approach calculates scores based on the frequency of items selected as the "most important" and "least important" items among all the questions asked of the respondent.

 $BW_i$ , A disaggregated BW for each item, is derived from the equation  $BW_i = B_i - W_i$ , where  $B_i$  indicates the frequency of responding to item *i* as the most important attribute,  $W_i$  signifies the frequency of responding to items *i* as the least important attribute of upcycled food. In other words,  $BW_i$  represents the difference between the response frequencies for the most and least important attributes. The formula for  $std.BW_i$  which used to determine the priority among attributes is  $\frac{BW_i}{N_r}$ . Here, *N* represents the number of respondents, and *r* is the number of times that item *i* is included in the choice set.  $Sqrt.BW_i$  means the square root of the ratio of the number of times selected as most important and the least important for each attribute and can be expressed as  $\sqrt{\frac{B_i}{W_i}}$ . Lastly, *std.sqrt.BW<sub>i</sub>* represents the relative

importance between items, and the value is obtained through  $\frac{std.BW_i}{\max. std.BW_i}$ . Here max.  $std.BW_i$  is the maximum value of  $sqrt.BW_i$ . If the value of  $std.sqrt.BW_i$  is 0.5 and  $std.sqrt.BW_j$  is 0.21, item *i* is about four times as significant as item *j*.

Based on these equations, this study analyzed the dataset to derive the selection attributes and priorities of upcycled food.

#### IV. Results

#### A. Descriptive Statistics

As depicted in Table 2, among the respondents, 170 (60.7%) were female and 170 (39.3%) were male. Only 82 (29.3%) had experience with upcycled food, while the majority had no experience (198; 70.7%). The 30s accounted for the largest proportion, but the distribution was generally uniform from the 20s to the 50s. Most respondents had received higher education with university (184; 65.7%), graduate school (29; 10.4%) and college (27; 9.6%).

## B. Analysis Result of Best-Worst Scaling

Table 3 is the result obtained through the counting approach. *B* is the frequency of items answered as most important, and *W* is the frequency of attributes answered as least important. *BW* is the difference between the frequency of the most and least important attribute, and the score of  $std \cdot BW$  is used as an index to indicate priority among the attributes. If sqrt.BW=1, it indicates that the number of times respondents selected the attribute as most important and the least important is equal. Therefore, when sqrt.BW is greater than 1, it denotes that the number of times respondents chose the most important attribute is greater than the number of times they chose the least important. Conversely, if sqrt.BWis less than 1, it indicates that the number of attributes selected as the least important is greater than the number of attributes selected as the most important. For  $std.sqrt.BW_i$ , the priority item has a value of 1, and the remaining items have a value less than 1. This is used as an index to compare the relative importance of items.

As a result of calculating the relative importance of each attribute using the sqrt.BW value, when choosing upcycled food, respondents consider food safety (3.5368) as the most important, followed by sensory appeal (2.5166), nutritional value (1.3364), origin (1.2973) and environmental information (1.1410). On the other hand, brand (0.8640), cost-effectiveness (0.5866), convenience (0.4340) and familiarity (0.3914) were analyzed as relatively less important factors. In addition, as shown in values of std.sqrt.BW, food safety and sensory appeal, the first and second priority items, are critical attributes of upcycling food, as they show a large difference in relative importance values compared to the rest.

Table 2.	Demographic	Characteristics	of R	lespondents	(N=280)
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Characteristic	N (%)	Characteristic	N (%)	
Gender	ender Upcycled food experience			
Male	110(39.3)	No experience	198(70.7)	
Female	170(60.7)	With experience	82(29.3)	
Age		Education level		
20-29	63(22.5)	High school	40(14.3)	
30-39	92(32.9)	College	27(9.6)	
40-49	56(20.0)	University	184(65.7)	
50-59	58(20.7)	Graduate school	29(10.4)	
Above 60	11(3.9)			
Occupation				
Professionals	59(21.1)	Housewives	13(4.6)	
Self-employed	43(15.4)	Retired / unemployed	7(2.5)	
Office workers	Office workers 87(31.1)		20(7.1)	
Service providers	51(18.2)			

Table	3.	Aggregated	best-worst	scores
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Attribute	В	W	BW	std.BW	sqrt.BW	std.sqrt.BW
Food Safety	688	55	633	0.28259	3.5368	1.0000
Sensory appeal	836	132	704	0.31429	2.5166	0.7115
Nutritional Value	434	243	191	0.08527	1.3364	0.3779
Origin	345	205	140	0.06250	1.2973	0.3668
Environmental Information	263	202	61	0.02723	1.1410	0.3226
Brand	365	489	-124	-0.05536	0.8640	0.2443
Cost- Effectiveness	149	433	-284	-0.12679	0.5866	0.1659
Convenience	136	722	-586	-0.26161	0.4340	0.1227
Familiarity	133	868	-735	-0.32812	0.3914	0.1107

# V. Conclusion and Discussions

#### A. Conclusions

This study set out to analyze the relative importance of selection attributes considered in upcycled food purchase using the BWS. The results of the empirical analysis of this study are as follows. Among the nine upcycled food selection attributes derived based on previous studies, food safety (3.5368) was the most important attribute, followed by sensory appeal (2.5166), nutritional value (1.3364), origin (1.2973), and environmental information (1.1410). In contrast, brand (0.8640), cost-effectiveness (0.5866), convenience (0.4340), and familiarity (0.3914) appeared to be attributes of relatively low significance in selecting upcycled food.

The result revealed that food safety is the most influential purchase determinant of upcycled food, which supports prior studies (Schifferstein & Ophuis, 1998). This finding indicates that the safety and reliability of upcycled ingredients or process of manufacture are key considerations for consumers when making purchase decisions on upcycled food. Consumers may react sensitively to upcycling food since it is a newly "developed" option with the perception of "recycling food waste." In this context, Coderoni et al. (2020) argued that it is necessary to pay attention to two psychological aspects when analyzing the consumer acceptance of newly developed products, pointing out food neophobia and food technology neophobia. When accepting a novel food, consumers are likely to feel resistance, as they have not secured certainty about the food. The same goes for new technologies in food. Although when a new food technology emerges to meet growing consumer demand, it is not easy for consumers to embrace innovative methods. In other words, consumers' aversion to novel foods such as upcycled foods is attributed to high anxiety about upcycled ingredients. It appears food development using upcycling is considered by consumers only with reluctance. Thus, among the upcycled food selection attributes, food safety was derived as the most prominent determinant.

Therefore, it will be of utmost importance to establish a supply chain that can be verified and monitored through public or third-party organizations, and only when food safety standards can be met will consumers accept upcycled food.

Sensory appeal was selected as the second important attribute that motivates upcycled food choices, which reflects the results of Moshtaghian et al. (2023) and Hellwig et al. (2020).

This implies that despite the distinctiveness of upcycling, when it comes to food, taste, smell and other sensory inputs play an important role. Upon reviewing studies that examined the sensory characteristics of upcycled foods, it was observed these foods had sensory qualities that were not seen as favorable compared with those of conventional alternatives (Hellwig et al., 2020; Stelick et al., 2021). As the notion of upcycled food grows and businesses broaden their target market, there is a pressing need to develop products with upcycled ingredients that deliver the taste and flavor of traditional food.

Nutritional value was the third vital attribute of upcycled food choice. A primary measure of a food's nutritional value is its macronutrient and energy content, specifically its high protein and fiber levels and low-fat content (Julia & Hercberg, 2017). In fact, many upcycled foods are nutritionally superior to other options. For example, an energy bar was developed using beer by-products, which have roughly 30% fewer calories than wheat flour and offer double the protein and 21 times the fiber (Kim, 2023). Moreover, snacks crafted from soybean curd, a by-product of tofu production, provide the protein equivalent of one egg and fiber comparable to two bananas. This suggests that numerous products derived from upcycling can offer greater nutritional value than their traditional counterparts (Kang, 2023). Therefore, it is essential for businesses to strive to align the nutritional attributes of upcycled food with consumer preferences, facilitated by proactive engagement with their markets. For instance, offering health management features such as dietary tracking through applications might be an effective approach in heightening consumer awareness about the health benefits of upcycled foods.

The fourth attribute motivating the selection of upcycled food was the origin. The origin of a product often has a substantial impact on shaping consumer choices, creating competitive distinctions for products during the purchase decision process, primarily driven by the intrinsic attributes of the products (Gudero, 2009). In the case of purchasing green food, consumers are more concerned about the reliability of the source of production (Polimeni et al., 2018). Consequently, in eco-friendly consumption patterns, consumers are typically more inclined to pay a premium when informed of a product's local origins (Perito et al., 2019). Given that upcycled products may involve uncertainty about the ingredients, providing details about the origin helps to alleviate these concerns. Thus, it is vital to enhance consumer decision-making by effectively managing origin information and ensuring transparency.

Environmental information has been identified as another important attribute of upcycled food. This is consistent with the findings of Verain et al. (2021) and Padel and Foster (2005) who declared that when looking at motives for choosing sustainable foods, environmental issues emerge as influential determinants. Because upcycled food is a differentiated product in terms of the environment and circular economy, environmental sustainability is inevitably more important than other attributes. Several studies have shown that when consumers become aware of the environmental benefits of upcycled food, their readiness to spend more on such products rises (Asioli & Grasso, 2021; Coderoni & Perito, 2021). As a result, it is essential to find ways to increase consumers' acceptance of upcycled foods by emphasizing the positive environmental impact. Objective reviews must be regularly conducted to determine whether upcycled food production is more environmentally friendly than conventional food production. Although the principle of upcycled food production is environmentally friendly, it is necessary to confirm whether it is truly environmentally friendly when considering the input of other materials required in the recycling process. In addition, empirical research is required to determine how much upcycled food reduces the carbon footprint. Although the value of reducing the carbon footprint should not be underestimated, if the effect of reducing the carbon footprint is not as great as expected, there is a need to enrich objective standards that can be used as a basis for judgment (Yu, 2023).

In contrast, brand, cost-effectiveness, convenience, and familiarity were found to be relatively less important attributes when choosing upcycled food. The reason brand is not deemed a significant determinant is due to the limited number of brands in Korea that manufacture upcycled food products. The study found that the cost-effectiveness of upcycled food was not a major aspect in consumer decision-making. Often, the price is determined by each individual based on the functional benefits of the product (Harvanto & Budiman, 2016), but it is not solely determined by its functional attributes; it also takes into account its emotional appeal, encompassing both of these aspects in its valuation (Rai et al, 2019). Given that upcycled food offers increased added value, it is conceivable that consumers might be willing to pay a premium for it, even if it is priced higher. Likewise, convenience was not considered to be a crucial aspect in selecting upcycled food, likely because consumers already perceive upcycled food as highly accessible. Currently, most upcycled foods can be easily ordered online, eliminating the need for a store visit, and can be consumed directly or with minimal preparation. In particular, individuals who label themselves as green consumers are open to altering their buying habits in an eco-friendlier direction, and occasionally accepting inconveniences or higher costs associated with eco-friendly products (Law & Cheung, 2007; Mazhenov et al., 2016). Furthermore, some brands use customer data on preferences, interests, and health condition to suggest products or offer subscription services. This suggests that further convenience is not a priority when opting for upcycled food. In terms of familiarity, as upcycled food is inherently a novel product, its familiarity does not appear to significantly motivate purchase decisions related to it. Rather than trying to win over the public by promoting familiarity, it would be more appropriate to focus on the safety of ingredients and the product process.

#### **B.** Implications

This study attempted to confirm the relative importance through BWS by deriving the purchase decision attributes as the consumption subject of upcycled food is expanded. The implications derived from the results of this study are as follows.

First, this study has academic significance in that it identified upcycled food selection attributes based on the quantitative analysis methodology rather than common perception. The study is differentiated from previous studies in that it derives preferences for a total of nine purchasing determinants through BWS and presents how much more important certain attributes are than other attributes so that the size of relative importance can be quantitatively compared.

Second, its practical importance lies in proposing methods to enhance strategy formulation and refinement, thereby increasing competitiveness by examining the factors influencing consumer purchasing decisions in the emerging upcycled food market. This result is anticipated to hold practical value in two main ways. First, it guides product development, enhancement, and marketing strategies by predicting consumer behavior. Second, it informs the creation and refinement of food policies or systems that consider consumer perspectives.

#### C. Limitations and Future Research

Some of the limitations deserve consideration when interpreting the results and in terms of future studies. This study employed BWS Case 1, emphasizing both the best and worst attributes of upcycled food. Examining BWS Case 2 (which evaluates attribute levels) and BWS Case 3 (which scrutinizes the best and worst profiles) in future studies might provide a deeper understanding for the upcycled food industry.

Finally, obtaining a representative sample was challenging due to the nascent stage of upcycled food in the market, making it less accessible than traditional products. The result is a limitation in the sample's representativeness. In future studies, as the sample size grows and if studies are conducted comparing different product groups, we anticipate a more profound comprehension of the relationship between consumer perceptions and preferences regarding upcycled food.

#### Acknowledgements

This work was supported by the 2022 Far East University Research Grant (FEU2022S08).

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