



Hungarian University of Agriculture and Life Sciences

**SUSTAINABILITY LABELLING ON FOOD PRODUCTS: A
HUNGARIAN CONSUMER VIEWPOINT BASED ON PRIMARY
QUANTITATIVE RESEARCH**

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1. INTRODUCTION

The transition to sustainable food systems is increasingly driven by both global policy frameworks, notably the Paris Agreement and the UN Sustainable Development Goals (Willett et al., 2019; Eliasson et al., 2022; Teufer et al., 2023; United Nations, 2015). Such a transition is not only policy-driven but also consumer-led (Willett et al., 2019). Consumers are instrumental in promoting innovation and sustainability in markets (UN Trade and Development, 2020). As consumer interest in sustainable products is increasing, people's choices are more and more driven by their environmental concerns, and as a result, more people are looking for products that carry this value (Gomes et al., 2023; Squires, 2019). Many consumers not only express a preference for sustainability-labelled products but are also willing to pay a premium for them (Aprile & Punzo, 2022; Asche & Bronnmann, 2017; Carlucci et al., 2015; Proi et al., 2023; Xuan, 2021). Moreover, in the specific field of product sustainability, market expansion is extremely fast (Rossi & Rivetti, 2020). Growing consumer demand has also driven the global proliferation of eco-labels, with the Ecolabel Index (2023) reporting 456 ecolabels currently in use across 199 countries and 25 industrial sectors.

As global environmental concerns intensify and consumer demand for sustainable products grows (Xu et al., 2024; Nawaz et al., 2026; Zhang et al., 2025), food labelling emerges as an important instrument for shaping consumer choices and promoting pro-environmental behaviour (Anggia et al., 2025; Cook et al., 2023; Dorisse & Charry, 2025; Isabel et al., 2023; Bucca et al., 2026; Buse & Meyerding, 2025; Dreist et al., 2024; Tompa et al., 2025). Labels such as 'organic', 'sustainable', 'green', 'carbon-friendly', and even locally sourced are widely used to claim that products have certain environmental credentials or suggest that a product is environmentally friendly (Dihl et al., 2021; Duckworth et al., 2022; Feucht & Zander, 2018; Gorton et al., 2021; Kanay et al., 2021;

Panzone et al., 2016; Imran et al., 2025; Liu et al., 2025; Meyerding et al., 2019; Roa-goyes & Pickering, 2024; Yao et al., 2025). Consumers who prioritize health, environment, and ethical considerations increasingly rely on these sustainability labels to guide their choices (Cook et al., 2023; Grunert et al., 2014). However, the widespread use of sustainability labels has also been found to increase greenwashing practices (Nugraha et al., 2024). Greenwashing is a situation in which companies make claims without solid evidence or provide misleading information about their products or services to appear more environmentally friendly than they actually are (Alireza et al., 2025; Nugraha et al., 2024; Xu et al., 2025). Greenwashing has made it difficult for consumers to identify which products are genuinely sustainable in the market (Kahraman & Kazançoğlu, 2019; Nugraha et al., 2024). To address this new challenge, it is necessary to explore and understand the general determinants of consumer behavior, particularly the factors consumers typically use to make purchasing decisions (Nugraha et al., 2024). Multiple factors shape an individual's purchase decision, such as social density (Cai et al., 2021) and perceived status and identity (Xi et al., 2022).

Given these challenges, stronger regulation to curb misleading sustainability claims is needed. Additionally, it is important to understand consumer awareness or familiarity with existing sustainability labels on the market (Edirisooriya, 2025; Huang et al., 2024), as this awareness is crucial for assessing how well consumers can identify and interpret these labels, and for evaluating the effectiveness of sustainability claims. Additionally, exploring the level of trust in sustainability labels is essential, since consumer trust is a basic condition for building confidence in sustainability claims (Ernawati et al., 2025; Rahman et al., 2025). Furthermore, comprehensive market segmentation to identify which consumers are most susceptible to greenwashing is equally important. Some consumer segments are more prone to falling victim to misleading claims. Identifying these groups is an essential step towards developing more effective strategies to protect them.

To tackle these problems, the EU has introduced new legislative elements,

such as the Green Claims Directive, which aims to regulate environmental claims and their scientific support (European Parliament, 2024; Hedemann-Robinson, 2025; Maclellan & Catelle, 2025), as well as the European Farm to Fork Strategy on food (within the European Green Deal), which intends to improve transparency and trust in food products, empowering consumers and lowering environmental footprints through the entire food chain (Antonioli & Ciaian, 2023; The European Commission, 2020; Maclellan & Catelle, 2025; Manuel, 2025). However, the success of these policy initiatives largely hinges on consumers' understanding and beliefs about sustainability claims.

As a medium-sized EU member state with an open, trade-intensive economy (exports and imports of goods and services together accounted for approximately 185% of GDP in 2022 (The World Bank, 2024), Hungary is deeply integrated into EU and global markets and is therefore exposed to the full range of international sustainability labelling practices and greenwashing challenges, making it a suitable and representative case for analyzing consumer responses to sustainability claims. Hungarian consumers have been found to be willing to buy and pay a premium for products with sustainability labels (Naz et al., 2020; Fekete et al., 2025; Mekler et al., 2025). At the same time, several cases of greenwashing have been found, particularly in Hungary's food sector (Hungarian Competition Authority, 2002, 2008; Kundi & Ernszt, 2024), including the coffee and dairy industries (Hungarian Competition Authority, 2002, 2008; Kundi & Ernszt, 2024).

Against this backdrop, the current study investigates sustainability-related labelling in Hungary's food industry, which focuses on the consumer viewpoint. The research addresses six key objectives:

(1) to conduct a comprehensive systematic literature review on the prevalence and impacts of greenwashing in the food industry; (2) map the distribution of domestic products and sustainability labels in local and international retailers; (3) to evaluate Hungarian consumers' awareness, knowledge, and comprehension of sustainability labels in the food market. Additionally, it investigates the

differences between consumers' self-assessments and their actual knowledge of sustainability labels, and how such overestimation correlates with respondents' socio-demographic variables; (4) evaluates trust in sustainability labels and its effect on purchase decisions; and (5) performs an in-depth market segmentation analysis to identify vulnerable consumer groups in Hungary, particularly susceptible to greenwashing.

2. MATERIALS AND METHODS

2.1. Systematic literature review

To determine the prevalence and consequences of greenwashing in the food industry, this study began with a literature review. Researchers followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) principles to guarantee this study's transparency and rigor (Page et al., 2021), a well-established framework to meet both reporting and publication standards (Nugraha et al., 2024). According to the PRISMA guidelines, the review was conducted in a structured and reproducible manner, increasing the reliability and transparency of the results.

This review brings together current research on greenwashing from academics, industry, and regulatory authorities, identifying common trends such as deceptive sustainability claims and marketing methods, notably in the food sector. Real-world case studies demonstrate the impact of greenwashing on customers and brands.

A Systematic Literature Review (SLR) combines PRISMA guidelines with a systematic mapping study to identify trends, themes, and research gaps (Kalibatiene & Miliauskaitė, 2021; Page et al., 2021). Bibliometric analysis is also employed in this study to assess scientific production on greenwashing in the food industry, as it is the most accurate method for literature assessment (Kabil et al., 2021; Osareh, 1996).

Data was gathered from Scopus using the broad search keyword "greenwashing" to ensure comprehensive coverage of relevant studies. Only English-language publications between 2012 and February 2023 were included. The original search yielded 711 articles, which were filtered for duplicates, titles, and abstracts. Following a full-text review, 16 papers about greenwashing in the food business were selected.

Analysis and visualization were carried out using RStudio and VOSviewer, along with overlay network mapping, to identify research clusters and trends. Keywords were analyzed to identify dominating topics, and bibliometric cleaning guaranteed the accuracy of author and journal information. This approach provides a comprehensive overview of greenwashing research in the food industry, along with informed insights for academic and practical applications.

2.2. Investigation of the distribution of sustainability labels and domestic food products between local and international retailers in Hungary

The research was conducted in two distinct phases to capture both domestic product distribution and sustainability-related labelling: the first phase, from August to October 2020, focused on the availability and proportion of domestic food products, while the second phase, from August to October 2023, examined the prevalence and distribution of sustainability labels across the same retail units. Both phases applied an identical methodological framework, including the selection of retail chains, store locations, product categories, and on-site data collection procedures, ensuring consistency and comparability of the findings across the two periods.

2.2.1. List of trademarks and labels used in this study

15 sustainability labels and trademarks were identified and selected for this study following an extensive market investigation of both online and offline sources. Based on their visibility and frequency in the Hungarian food industry, these labels were selected.

2.2.2. Retail units and data collection

The study focused on the ten largest retail chains, which together account for almost 85% of all retail sales, to provide representative coverage of Hungary's food retail industry. These comprise three domestic chains (CBA, Coop, Reál) and seven international chains (Aldi, Lidl, Tesco, Spar, etc.). To ensure a fair distribution across Hungary's three main statistical regions, Central Hungary, the Great Plain, and Northern & Transdanubia, a total of 60 stores were sampled, with 6 locations chosen from each chain.

To represent typical consumer options, the most important shop format (such as hypermarkets for Tesco and Spar) was selected for each company. To ensure natural observation of product availability, this study conducted on-site visits without prior notice. To ensure transparency, researchers presented permission letters, outlined the study's goals, and informed store management during visits.

Each chosen product's name, brand, manufacturer, country of origin, packaging, and unit size were photographed and recorded as part of the data gathering process. EU registration numbers were also recorded for goods obtained from animals. Based on package labels or stamps, every item was categorized as either domestic or imported. 39,964 items of data were methodically collected between August 11 and October 28, 2020, and photographic records were retained for 5 years to ensure accountability and verification.

2.2.3. Product categories

The selection of product categories was intended to capture the most representative food items in the Hungarian retail market while reflecting local production capabilities and sustainability relevance. The process began with a roundtable consultation on July 27, 2020, involving the Hungarian Chamber of Agriculture, the Institute of Agricultural Economics, the Hungarian University of Agriculture and Life Sciences (with expertise in Codex Alimentarius

Hungaricus), and representative organizations of the Hungarian food retailing and processing sectors.

In these discussions, 16 product categories were delineated based on three primary criteria: (1) the presence of local production to guarantee self-sufficiency, (2) their ubiquity in retail establishments throughout Hungary, and (3) their prospective significance for sustainability labelling. Categories encompassed various meat products, dairy items, eggs, honey, fresh and seasonal fruits and vegetables, jams, pasta, and canned goods. These categories collectively accounted for over 67% of the total sales value in Hungary's retail food market in 2019 (HCSO, 2020).

In the 2023 data collection, certain categories were further delineated to better represent product diversity, increasing the total number of categories from 16 to 21. In 2020, the fruit and vegetable category was subdivided into fresh fruits and fresh vegetables, whereas dairy goods were categorized into several subcategories, including yoghurt, cottage cheese, and various cheeses. This method facilitated a thorough evaluation of sustainability labels across a diverse array of products typically accessible to Hungarian consumers.

2.2.4. On-site investigation method

Qualified professionals assessed pre-packaged products, recording the product name, brand, manufacturer, country of origin, packaging details, and, where applicable, EU registration numbers. Data were classified as domestic or imported based on packaging, stamps, or labelling.

2.3. Qualitative consumer study

2.3.1. Survey method and questionnaire design

A self-administered questionnaire was administered offline from November 2, 2023, to January 26, 2024, in 10 Hungarian towns, including Budapest, Mezőkövesd, Szolnok, Sárospatak, Várpalota, Kecskemét, Veszprém, Füzesabony, Győr, and Székesfehérvár. Locations were chosen to reflect diverse

geographies and social demographics, with high-traffic sites such as parks and train stations included to enhance sample representativeness.

The data was obtained via in-person interviews. Participants were apprised of the study's aims, data collection methods, and privacy protections in accordance with the EU GDPR. Participation was voluntary, anonymous, and devoid of any recorded identifying information.

The questionnaire comprised three sections: (1) an introduction to sustainable labelling; (2) perceptions and preferences about sustainability labels across various items; and (3) demographic information (age, gender, income, education, etc.). The questions comprised multiple-choice, true and false questions, and 5-point Likert-scale items to consistently gauge attitudes.

2.3.2. Socio-demographic characteristics

The research gathered 1,013 responses, which are largely representative of the Hungarian population in terms of gender, age, and area (Table 1) (HCSO, 2022). The gender distribution comprised 51.7% women and 48.3% men, closely aligning with national statistics. The age distribution reflected the population, with slight variations: 18–29 years (17.4%), 30–39 years (14.5%), 40–59 years (36.5%), and 60 years and older (31.6%). Regional representation was comparable, with Central Hungary being slightly over-represented at 32.8%.

Table 1. Socio-demographic of the sample in comparison to the Hungarian Central Statistical Office (KSH) population for representativeness (n=1,013)

Variable	Description	Sample (%)	Population based on the Census of 2022 (%) (Hungarian Central Statistical Office (HCSO), 2022)
Gender	Women	51.70	51.97
	Men	48.30	48.03
Age	18-29	17.40	16.22
	30-39	14.50	15.51
	40-59	36.50	35.86

	60 and above	31.60	32.40
Region	Central Hungary	32.80	31.42
	Central Transdanubia	10.70	11.00
	Western Transdanubia	11.60	10.23
	Southern Transdanubia	6.90	8.89
	Northern Hungary	11.40	11.33
	Northern Great Plain	14.00	14.63
	Southern Great Plain	12.60	12.50

2.4. Applied statistical methods

This research examines the influence of sustainability labelling and greenwashing on Hungarian consumers' purchasing decisions. The analysis employed several statistical methods: systematic literature review, descriptive statistics, cross-tabulation, nonparametric analysis, market segmentation (hierarchical and k-means clustering), and binary logistic regression. These methodologies offer extensive insight into consumer familiarity toward sustainability labelling, awareness, trust, and behavior, as well as the prevalence of sustainability labels in the marketplace.

2.4.1. Descriptive statistics

Descriptive statistics were used to summarize sociodemographic data and consumer opinions on sustainability labelling. Percentages and frequency distributions were used to measure awareness, experience, and interaction with certified products. To assess label familiarity, descriptive statistics were used to present consumers' level of familiarity with sustainability labelling. In terms of the knowledge level of sustainability labelling, respondents were divided into three categories: low, medium, and high knowledge. Trust in government-certified versus private certifications was also examined, with greater confidence in official labels recognized by the National Food Chain Safety Authority (Nébih).

2.4.2. Non-parametric analysis

Moreover, this study also analyzed the correlation between knowledge of sustainability-related labelling and various socio-demographic factors. A non-

parametric method, the Kruskal-Wallis test, was implemented to evaluate this relationship. This method is appropriate for comparing multiple independent groups when the dependent variable is ordinal. The level of knowledge regarding sustainability-related labelling, categorized into three levels (1 = low, 2 = medium, 3 = high), is the dependent variable in this instance. These categories were employed to illustrate the diverse levels of comprehension among participants regarding sustainability-related labelling practices.

2.4.3. Market segmentation

Market segmentation analysis was conducted to identify specific consumer groups in Hungary that may be perceived as more vulnerable to greenwashing practices. The first objective of the analysis was to identify natural groupings based on consumers' trust, knowledge, and intentions regarding sustainability labelling. This was done by conducting a two-step data analysis: the first step involved applying hierarchical clustering to group respondents, and dendrogram plots were used to visualize the cluster structure and determine the optimal number of clusters. This technique enabled an initial grouping of consumers by the attributes they shared.

The consumer clusters were then further refined and identified using k-means clustering. K-means clustering was instrumental in grouping consumers based on key variables such as trust in sustainability labels, vulnerability to greenwashing, and other explanatory factors, while accounting for their socio-demographic characteristics. The purpose of this method was to reveal different consumer classes and to help identify which subgroups were more vulnerable to deceptive sustainable claims. These findings are important for developing effective communication and intervention strategies to mitigate the influence of greenwashing on specific consumer segments.

2.4.4. Cross-tabulation

Cross-tabulation (cross-tab) analysis was used to investigate associations among categorical variables, such as demographic characteristics (e.g., gender,

age, household income) and consumer behaviors or attitudes toward sustainability labels. Cross-tab analysis was used to examine patterns and associations among categorical variables and to better understand how different parts of the population think about sustainability-related issues. Cross-tab analysis was also used to test whether socio-demographic variables among clusters showed significant differences. Additionally, this test is also used to investigate the significant differences in the distribution of local and international sustainability labels across product categories in Hungarian retail units

2.4.5. Binary logistic model

There are several reasons why consumers tend to overestimate their comprehension of sustainability-related labelling, including their level of understanding, behavioral variables, and sociodemographic factors. Binary (logit and probit) models could be used to assess whether consumers often overstate their comprehension of the sustainability label to address this issue. These models are appropriate for this kind of research because they pinpoint specific consumers who tend to overestimate their comprehension and provide insights into the precise factors that drive this behavior. This approach is consistent with several earlier investigations (Pedregal & Pe, 2010; Scarpato et al., 2016; Yang et al., 2022), which employ similar statistical approaches but address distinct subjects. For example, Yang et al. (2022), examined the relationship between sociodemographic traits and consumer behavior, focusing on how these factors influence consumers' inclination to scan QR codes for detailed product information before making a final purchase decision. Furthermore, Scarpato et al. (2016) also investigated how consumer behavior is influenced by purchasing habits and perceptions of food safety features in order to identify the key elements influencing consumers' attention to food safety. Because of their methodological congruence, the Logit and Probit models were employed in this work to examine the pertinent data, as demonstrated below:

$$Y_i = \alpha + \beta_x + \varepsilon \quad (1)$$

Y_i , the dependent variable is a binary response that indicates whether a responder overestimates their comprehension of sustainability labelling.

$$Y = \begin{cases} 0 & \text{if no} \\ 1 & \text{if yes} \end{cases}$$

In Equation (1), Y_i is unobservable, x are independent variables, and β is the regression coefficient associated with unknown parameters, and ε represents the error term in a normal distribution. Hence, Y_i can be determined with two possible outcomes: a respondent has an overestimation of the overestimation understanding of sustainability labels ($Y_i = 1$), and a consumer has no overestimation of their understanding ($Y_i = 0$).

The Logit model, or logistic regression model, can delineate Equation (2), representing the Cumulative Distribution Function (CDF) of the logistic distribution (for example, $\Lambda(x'\beta)$), whereas the Probit model can express a conditional probability, as given in Equation (3), where $F(x'\beta)$ denotes the standard normal cumulative distribution function. Both exhibit projected probabilities constrained between 0 and 1.

$$F(x'\beta) = \Lambda(x'\beta) = \frac{e^{x'\beta}}{1 + e^{x'\beta}} = \frac{e^{x'\beta}}{1 + \exp(e^{x'\beta})} \quad (2)$$

The Probit model's probability can be articulated as Equation (3):

$$F(x'\beta) = \Phi(x'\beta) = \int_{-\infty}^{(x'\beta)} \Phi(z) dz \quad (3)$$

The model coefficients are determined using the maximum likelihood method. Moreover, Equation (4) presented the equation for optimizing the log-likelihood:

$$\log = yF(x'\beta) + 1(1 - y)[1 - F(x'\beta)] \quad (4)$$

This study can also compute marginal effects (ME) to obtain a probability interpretation of the independent variables. The marginal effects denote the proportional alteration in the likelihood of the dependent variable ($y = 1$) resulting from a one-unit change in the independent variable x . The ME for the Logit model is articulated in Equation (5):

$$\frac{\partial p}{\partial x_j} = \Lambda(x'\beta) [1 - \Lambda(x'\beta)] \beta_j = \frac{e^{x'\beta}}{(1 + e^{x'\beta})^2} \beta_j \quad (5)$$

Additionally, Equation (6) illustrates the marginal effects for the Probit model:

$$\frac{\partial p}{\partial x_j} = \Phi(x'\beta) \beta_j \quad (6)$$

If the estimated parameters of the independent variables and the marginal effects are significant for both the Logit and Probit models, the independent variable will be considered significant and will provide additional explanatory power.

3. RESULTS AND DISCUSSION

3.1. Experiment 1: Systematic literature review on the prevalence of greenwashing practices in the food sectors

This work indicates that although our study encompasses only the past decade, there was a notable surge in publications after 2017, while only one paper prior to 2016 examined greenwashing in the food industry. Furthermore, the food industry greenwashing literature has developed in the past decade across six primary research themes: certifications & labels, retailers, corporate social responsibility (CSR), consumers, food supply chain, and food safety. Our results show that several industries, particularly the food sector, are still understudied despite growing scholarly concern over greenwashing. This underscores the primary purpose of the study, which is to ascertain the extent of greenwashing within the food business. This study enhances comprehension of the key aspects within the food industry's greenwashing literature and advocates for viable interventions to reveal and tackle the most vulnerable regions to greenwashing.

In general, environmental concerns are the main focus of studies on greenwashing practices in the food business. Based on the 16 publications examined using the PRISMA method, this study offers a more thorough summary of greenwashing tactics found and documented in scholarly literature over the previous ten years.

Regarding greenwashing, certification, and labelling, the authors may reference the reports by Nguyen et al. (2019). Over 50% of research on greenwashing in the food sector focused on product labelling and certification. Instances of greenwashing in labelling occur when food companies provide misleading information to consumers, implying that their products are sustainable, although they likely are not. Over 50% of studies on greenwashing in the food industry focused on labelling and certification. Food manufacturers frequently engage in greenwashing through labelling, misleading the public into believing their products are environmentally sustainable when they are not

(Montero-Navarro et al., 2021). This was the case in Vietnam when the public interest in green products increased, and many stores and food businesses started selling organic products, but when the public requested proof of the organic status, they provided no evidence (Nguyen et al., 2019). Moreover, some corporations in North America changed the color of their food product labels to green to persuade consumers that their products were environmentally friendly, resulting in widespread deception (Guyader et al., 2017). The increasing prevalence of greenwashing demonstrates that the shortcomings of this practice render sustainable labelling an ineffective mechanism for enhancing and transforming food systems (Parker et al., 2021).

A further factor leading to greenwashing is the inadequate knowledge and comprehension of eco-friendly products by corporate owners (Chitaka, 2021). As an example of this, several South African restaurants replace plastic straws with what they misinterpret as more eco-friendly polylactic acid (PLA) straws (Chitaka, 2021). Nevertheless, when queried regarding PLA straws, restaurant owners were unaware that these straws did not satisfy the ASTM D 6691 standards for classification as biodegradable in aquatic environments, despite their support for mitigating plastic pollution in the ocean.

Greenwashing happened in certain German supermarkets and cheap retailers, which, despite asserting their commitment to selling and fostering the development of sustainable products, do not genuinely participate in such practices (Saber & Weber, 2019). German supermarkets and discounters have been characterized as reluctant to report on the negative environmental impacts of their activities, to be perceived as environmentally friendly (Saber & Weber, 2019). Moreover, large retailers such as TESCO, when they start putting their own eco-friendly labels on their products, in the eyes of consumers, such a practice can create a misconception as TESCO may be perceived as a fully sustainable retailer, while not all products it sells, distributes, and promotes are sustainable (Sirieix et al., 2013). Additionally, TESCO was accused of trying to incorporate an eco-label along with its other, non-environmentally friendly labels

on the same product, which some consumers considered to be one of the greenwashing examples (Sirieix et al., 2013).

Additionally, certain researchers have commenced investigating methods to combat greenwashing in the food industry (Brécard, 2017; DeFries et al., 2017; Liute & De Giacomo, 2022; Stecker, 2016). According to Brécard, 2017; DeFries et al., 2017; Liute & DeGiacomo, 2022; and Stecker, 2016, third-party certifications offered by NGOs are considered to have significant effectiveness when it comes to combating greenwashing in the food sector because they are comparatively stricter in the assessment process for verifying the eco-friendly labels. Recently, however, some NGOs like B Corp have eco-friendly labels, which have now been accused of greenwashing (Liute & De Giacomo, 2022). As claimed by some critics of B Corp, they have an eco-friendly label offered in one of the 5 areas of sustainability (Governance, Workers, Community, Environment, and Customers) in which a corporation need not focus on all of them as they can choose, and if the selected area constitutes a value of above 80, then that corporation is deemed to have an eco-friendly label (Liute & De Giacomo, 2022). This way, some companies focus on the ignored area of the environment and have less score (Liute & DeGiacomo, 2022), which is described as an eco-label that is not perfect (Brécard, 2017). Moreover, (vanTulder & Rodrigues, 2021) pointed out that one of the reasons for the increasing tendency of the ‘greenwashing’ phenomenon is the poor quality of the sustainability-related self-regulatory frameworks.

In addition, DeFries et al. (2017) proposed that voluntary certification could be a plausible approach for fulfilling sustainable development goals, as it is non-monetary and has other features that differ from greenwashing. Moreover, Toussaint et al. (2021) noted that consumers want traceability labels to avoid greenwashing. However, it is crucial to research traceability and voluntary labelling to determine whether these measures can counter the growing greenwashing practices in the food sector.

The rising prevalence of greenwashing in the food industry, coupled with insufficient oversight and regulation from eco-friendly certification providers (Stecker, 2016), endangers numerous firms that are not participating in greenwashing. This is attributable to eco-incident sensitivity, necessitating that consumers and investors approach their purchasing and investment decisions in the food sector with prudence (Gatti et al., 2021; Urbański & Ul Haque, 2020). This will impact sales, and the quest for investors in the food sector is apparent. Therefore, more help is needed, including further academic work on food sector greenwashing practices, to help consumers and businesses understand and avoid falling victim to the misleading information. Also, at this stage, further research in communication on the food sector greenwashing practices will help stakeholders construct evidence-based frameworks, including academic papers, to facilitate decisions based on solid evidence (Kasza et al., 2022). Furthermore, the lack of transparency among food producers, consumers, and investors needs to be addressed.

Due to increased identification of greenwashing in the food industry, the European Union has begun developing Green Claims guidance, which assists and protects consumers from potential deception (European Commission, 2023b). The EU's newly proposed law aims to enable consumers to make informed choices about purchase options by guaranteeing the truthfulness and reliability of environmental labels and claims (European Commission, 2023b). This initiative aims to systematically eliminate what has been characterized as one of the most critical obstacles to the adoption of sustainable practices (Avila et al., 2017). The regulatory framework established by the European Union has shifted the focus toward adopting sustainable practices in the food industry. D'Adamo (2023) encourages the food business to embrace policies that bolster consumer trust and adopt sustainability reporting measures. Reporting on sustainability practices mitigates the risk of greenwashing and educates the public regarding the food industry's sustainability efforts.

Furthermore, establishing a resilient community can mitigate greenwashing by: (1) Certification Communities offering credible certifications that authenticate companies' environmental assertions and misleading ads. Caferra et al. (2023) reported that certifications are a stabilizing factor in the chain reaction to eliminate greenwashing, as well as in the encouragement of virtuous supply chains, thereby fostering trust relationships with consumers; (2) Transparency Platforms help monitor and report the sustainability efforts of companies. These platforms can help companies substantiate their environmental claims by encouraging honesty. Transparency and information access are two important elements that assist consumers in making purchasing (Toussaint et al., 2021); (3) Consumer Education Groups enhance the understanding of the potentially misleading greenwashing, thereby enabling people to identify authentic sustainable practices and avoid deception. Trust from collaborating firms towards these groups can be established through transparency. Furthermore, investigations into the sustainable-related labelling ideas and standards from both top-down and bottom-up initiatives should be prioritized, since both approaches possess potential and may provide valuable insights (Lakerveld & Tulder, 2017). Looking into these sides can provide avenues for addressing the greenwashing issue. More authentic and open sustainable practices can be ensured by combining top-down regulation and bottom-up initiatives.

The SLR technique allows analysts to articulate many ideas that can underpin future research directions (Vaio et al., 2023). In light of the SLR findings from this research investigation, the authors propose the following propositions:

- Study 1: Assess consumers' understanding of and attitudes towards sustainable, eco-friendly, or green labelling.
- Study 2: Assess the impact of greenwashing on consumers and how it affects their purchasing decisions towards sustainable products.
- Study 3: Investigate the role of third-party organizations and commercial firms in developing and certifying sustainable labels.

- Study 4: Analyze consumer acceptance and willingness to pay for products bearing specific greenwashing labels, as well as the financial implications of such labelling.

3.2. Experiment 2: Retail study “The presence of sustainability labels and distribution of domestic food products across local and international retailers in Hungary”.

The impact of sustainability labels on consumer preferences in Hungarian retail is examined in this study. As consumers look for ethical products, sustainability certifications, such as organic, fair trade, and eco-friendly production labels, become increasingly important. The study examines their distribution and frequency across food categories, paying special attention to national and international labels and their role in building consumer confidence and encouraging sustainable practices.

According to this study, Magyar Termék is the most commonly used label (61.19%), followed by FSC (13.12%), EU Organic (7.82%), and others. The analysis considers only labelled products, omitting unlabeled items. Domestic products accounted for 61.19% of offerings, demonstrating the supremacy of local labels and their role in promoting environmentally sustainable consumerism. Hungarian consumers significantly prefer locally certified items to those with international labels, with 91% of sustainable labels on local products and only 9% on foreign products.

This study also breaks down label distribution across the product categories chosen in this study. Local labels are most common in honey (28%), yoghurt (14.33%), fresh milk (8.67%), cottage cheese, kefir, sour cream (7.58%), and ham from pork (6.67%), indicating a preference for local products. International brands are concentrated on processed or export-oriented commodities, such as cottage cheese/kefir (37.36%), dry pasta (17.13%), jams (12.59%), eggs (12.59%), and fresh vegetables (11.19%). Dual labelling is uncommon, occurring notably in dried pasta (88.42%).

Overall, local labels are highly associated with domestic agricultural products and consumer trust, but foreign certifications are more prevalent in processed commodities. This trend shows how local sustainability labelling can effectively encourage environmentally responsible activities and consumer confidence in Hungary's retail sector.

This work also examined the distribution of domestic products and found that 70.53% of items across 16 categories were locally produced, with domestic chains accounting for 79.26% and international chains for 66.79%. Perishable and high-value commodities such as honey, eggs, milk, and fresh meats were mostly produced domestically. This local preference is ascribed to consumer trust, familiarity, and awareness of local production processes, reinforcing the importance of domestic products in the development of a sustainable food system.

The findings have policy implications. Supporting local production through incentives, marketing, and awareness campaigns can improve both environmental and economic sustainability. Consumers engage as change agents, encouraging sustainable behaviors and improving local food systems, a concept known as food citizenship (Hatanaka, 2020). This work also emphasizes the importance of local sustainability labels and domestically sourced products in promoting sustainable consumption and resilient food systems in Hungary.

3.3. Experiment 3: Quantitative consumer study

3.3.1. Hungarian consumers' awareness or familiarity with sustainability-related labels

This study examined Hungarian consumers' knowledge of 15 commonly used food brands and sustainability labels. The results reveal significant diversity in consumer awareness and engagement. Magyar Termék comes among the top three, with 52.78% of respondents actively looking for products with this label, indicating a strong brand presence. The Environmentally Friendly Product (Környezetbarát Termék) label was recognised by 46.47%, but only 12.43%

actively sought it, whereas Bio Garancia received 36.82% recognition and 9.31% sought it.

Labels such as Biokontroll, Dolphin Safe, and EU Ecolabel, on the other hand, have low awareness and engagement (3.24-4.39%), indicating that consumers' exposure to these international certifications is infrequent. It is crucial to note that not all of the labels examined focus solely on sustainability; some, such as Magyar Termék and KME, emphasize local production or quality standards while also incorporating proven sustainability aspects, such as contributing to environmental and socio-economic sustainability by promoting local sourcing, reducing transport-related emissions, and supporting regional development (MAGYAR TERMÉK Nonprofit Kft., n.d.).

Local labels are often more well-known than foreign labels, with 15.55% of customers actively searching out local labels against 6.34% for international labels. Approximately 31% have likely purchased products with local labels, compared to 29.99% for foreign ones. These findings support previous research on ethnocentrism, trust, and perceptions of quality, freshness, and safety (Horváth et al., 2024; Szakaly et al., 2016; Mucha & Vinogradov, 2025).

3.3.2. Importance of sustainability-related labelling

Sustainability labels serve as informational and strategic messages to consumers, signaling environmental or ethical behavior. There are already roughly 200 sustainability-related labels on the market (European Commission, 2024; European Commission, 2025), including organic (Kaczorowska et al., 2019; Shaikh et al., 2024), the Rainforest Alliance logo (Annunziata et al., 2019; Jones et al., 2024), fair trade (Cook et al., 2023; Kaczorowska et al., 2019), various carbon index schemes (Cook et al., 2023; Holenweger et al., 2023), etc.

Hungarian consumers are increasingly valuing these labels. This study demonstrates that 47.7% of consumers prioritize sustainability when selecting food, and about 54.22% have purchased sustainably-related labelled food,

indicating a match between perceived importance and actual behavior. This implies that sustainability issues are embedded in purchasing decisions rather than being abstract preferences.

Consumers show higher engagement with locally produced and certified labels, reflecting trust, ethnocentrism, and the desire to support domestic production (Garai-Fodor et al., 2022; Kasza et al., 2024). Similar trends are observed internationally in EU countries (Poland, France, Germany, Finland, Sweden, Belgium) and beyond (U.S.A., U.K., Japan, Brazil, China, Taiwan), where sustainability increasingly guides food purchasing behavior (Cook et al., 2023; Efraim et al., 2017; Kaczorowska et al., 2019; Lee et al., 2018; Peschel et al., 2016; Potter, et al., 2021; Rokka & Uusitalo, 2008; Seo et al., 2019; Shaikh et al., 2024).

These findings underscore the role of sustainability labels as a bridge between consumers' ethical values and purchasing behavior, highlighting the importance of raising awareness and strengthening label credibility. Policymakers and producers can use this knowledge to create effective labelling methods, targeted marketing, and educational programs that encourage environmentally and socially responsible food consumption, thereby promoting the development of sustainable food systems in Hungary.

3.3.3. Overestimation of knowledge regarding sustainability-related labelling among Hungarian consumers

Although many Hungarian consumers value sustainability labels and buy labelled products, they have a limited understanding of these labels. This study measured both subjective knowledge (a self-rated 1-10 scale) and objective knowledge (four true-or-false questions about the environmental and social elements of food production). Overestimation occurred when perceived knowledge exceeded real knowledge.

The key findings show that most Hungarian consumers have low understanding: 42.51% have low knowledge, 37.47% have medium knowledge,

and 20.02% have high understanding. Higher education and income levels are associated with increased comprehension, indicating socioeconomic gaps in sustainability literacy (Aprile & Punzo, 2022; Obrad et al., 2021; Paola et al., 2020). These gaps raise the risk of greenwashing practices in the market.

The study found a moderate overconfidence bias, with mean perceived knowledge at 5.88 vs. real knowledge at 5.58, and approximately 45% of consumers overestimated their comprehension. Overconfidence can lead to misreading of labelling and increased susceptibility to misleading claims, especially in the context of rising greenwashing in the food industry (Montero-Navarro et al., 2021; Nugraha et al., 2024).

Moreover, Binary logistic regression in this study identified determinants of overestimation. Actual knowledge was negatively correlated with overestimation: each additional knowledge point reduced the risk of overestimation by 8.5%. Consumers who place a high value on sustainability certificates, on the other hand, are more inclined to exaggerate their competence, expressing enthusiasm without sufficient understanding. Age had a small but substantial effect, with older consumers being more prone to overconfidence. Sociodemographic characteristics had a substantial impact on patterns of knowledge and overestimation.

These findings are consistent with cognitive theories such as the Elaboration Likelihood Model (ELM), which states that people with limited knowledge rely on peripheral cues, making them more susceptible to misleading information, whereas informed consumers process labels critically (Dreist et al., 2025; Walters & Long, 2012; Lieke et al., 2024).

The findings emphasize the necessity for tailored interventions, including:

- Educational campaigns to enhance label literacy, particularly for lower-income and less-educated consumers.
- Simplified and standardized labelling to reduce cognitive load and misinterpretation.

- Clear regulatory frameworks to ensure credibility and transparency of sustainability certifications.

Addressing the gap between subjective and objective knowledge is critical for reducing consumer vulnerability to greenwashing, promoting informed purchasing, and encouraging the adoption of really sustainable food practices. These measurements have the potential to increase trust in the food chain and connect consumer perceptions with actual environmental and social implications.

3.3.4. Trust in sustainability claims and preference for local government labels

The study found that Hungarian consumers have more trust in local sustainability labels, particularly those authorized by government institutions, than in foreign labels or private/civil certificates. Local trademarks have a stronger appeal to customers since they reflect home environmental concerns and values, increasing relevance and familiarity. International labels, while recognized, are less trusted due to their global and less localized nature.

This study shows that 51.63% of respondents believe government-issued sustainability labels are more reliable than those provided by private enterprises or civil organizations, emphasizing the importance of official support in fostering consumer trust.

This study shows that over 64% of consumers are influenced by labels certified by the National Food Chain Safety Office (Nébih), demonstrating a high level of trust in government-regulated certifications. Trust in Nébih-certified labels shows consumers' demand for locally relevant certificates that adhere to national regulatory norms, hence increasing their perceived trustworthiness.

Age has a substantial impact on trust: older consumers choose Nébih labels the most (71.59% for 60+ years), followed by those aged 40-59 (64.50%), 18-29 (62.21%), and 30-39 (55.47%). These findings suggest that consumers over the age of 40 place greater value on government-endorsed sustainability certifications, whereas younger consumers have lower levels of trust. Other

demographic indicators, such as gender, settlement type, income, and education, do not affect label trust.

These findings indicate that local, government-certified sustainability labels are more familiar, credible, and persuasive among Hungarian consumers, emphasizing the relevance of national certification schemes in fostering trust and sustainable purchasing patterns.

3.3.5. Market segmentation and vulnerability to greenwashing

This study investigated Hungarian consumers' susceptibility to greenwashing by analyzing their knowledge, trust, and purchasing intentions for sustainability labels. Using hierarchical and K-means clustering, four consumer categories were discovered. Selective Adopters (51%) are well-informed, have moderate trust, and purchase intention, making them less vulnerable and great targets for educational marketing. The Primary Greenwashing Target (22%) has low understanding but high trust and moderate purchasing intent, making them vulnerable to deceptive claims. The Moderate Greenwashing Target (17%) has low knowledge and trust, but moderate by intention, indicating some susceptibility, whereas Green Label Skeptics (10%) are wary, with low trust, knowledge, and purchase intention, and reject green marketing. Over 39% of Hungarian customers are possibly susceptible to greenwashing.

Demographic factors influence these tendencies. Women are the primary targets of greenwashing, and selective Green Label Skeptics are more likely to be men than Adopters. Higher education and income levels are associated with Selective Adopters, whereas lower education and income levels are concentrated in vulnerable sectors. Older consumers often have greater trust in labelling, which affects their receptiveness. Prior purchasing behavior is consistent with these trends: Selective Adopters are the most likely to purchase sustainability-labeled products, while vulnerable segments do as well, but with less awareness, increasing their exposure to deceptive claims.

These results demonstrate that consumer vulnerability to greenwashing is influenced by knowledge, trust, purchasing intention, and socio-demographic characteristics. Policy and marketing interventions should focus on improving literacy among the vulnerable groups, providing clear, evidence-based information, and tailoring communication to different consumer segments. By addressing knowledge gaps and promoting transparency, policymakers and businesses can reduce susceptibility to greenwashing, encourage responsible consumption, and strengthen trust in genuine sustainability labels.

4. CONCLUSIONS, RECOMMENDATIONS, AND FUTURE DIRECTIONS

4.1. Conclusion, recommendations, and implications

The systematic literature review and empirical analysis emphasize the increased prevalence of greenwashing in the food industry, notably due to deceptive labelling, insufficient transparency, and inconsistent customer understanding. Key causes include confusing eco-labels and gaps in consumer information, emphasizing the importance of clear, harmonized rules, particularly at the EU level, as well as coordination among authorities, NGOs, and business partners. Addressing greenwashing necessitates ongoing monitoring of customer awareness, preferences, and the effectiveness of third-party certification.

The study's findings show that local sustainability labels dominate the Hungarian retail sector. The Magyar Termék label was found on 61.19% of products, followed by FSC (13.12%) and EU Organic (7.82%). Domestic products accounted for 70.53% of offerings, with local stores outpacing foreign chains (79.26% vs. 66.79%). These findings show that Hungarians trust locally certified products, emphasizing the importance of domestic food systems and local labels in driving demand and encouraging sustainable practices.

Consumer behavior analyses reveal that sustainability labelling is becoming more relevant in purchasing decisions. About 47.70% of Hungarian consumers consider sustainability a critical criterion, and 54.22% have purchased labelled items. However, the study shows a moderate overconfidence bias: consumers slightly overestimate their grasp of sustainability-related labelling, thereby increasing vulnerability to deceptive claims. Knowledge functions as a safeguard; well-informed consumers are less likely to exaggerate, but interest without comprehension can increase vulnerability. Age has minimal impact, with older consumers slightly more likely to overestimate, likely due to reliance on life experience rather than factual information.

Hungarian consumers place more trust in government-backed sustainability labels, such as those certified by Nébih, which are perceived as credible and regionally relevant. Cluster analysis revealed four separate consumer segments based on sustainability awareness, trust, and purchasing intentions: Selective Adopters (51%), Primary Greenwashing Targets (22%), Moderate Greenwashing Targets (17%), and Green Label Sceptics (10%). The first category is well-informed and critically examines claims, whereas the primary and moderate targets, which account for 39.13% of customers, are vulnerable to greenwashing due to a lack of understanding and trust, despite having previously purchased labelled items. Green Label Skeptics maintain low levels of trust, understanding, and involvement, indicating cautious consumer behavior.

Policy and business implications are clear. Interventions should be tailored to specific segments, with targeted educational programs for vulnerable groups, standardized labelling regulations, and transparent, evidence-based communication. Government-backed sustainability labels can enhance consumer trust and reduce the impact of misleading claims. For marketers and policymakers, these findings highlight the importance of integrating behavioral, cognitive, and socio-demographic insights to design effective strategies that encourage informed and responsible consumption, mitigate greenwashing, and strengthen trust in genuine sustainability initiatives.

4.2. Limitations and future directions

Despite its contributions, this study has limitations. It does not directly measure consumers' exposure to deceptive sustainability claims or behavioral responses, limiting the ability to empirically link overconfidence to susceptibility to greenwashing. Future research could employ experimental or longitudinal designs, or analyze real-world purchasing data, to examine how knowledge overestimation affects vulnerability to misleading claims. Additionally, the study did not assess the economic or environmental impacts of greenwashing. Future work should quantify the effects of greenwashing on business performance and sustainability outcomes to provide a comprehensive understanding of its consequences.

5. NEW SCIENTIFIC RESULTS

- I. In Hungarian retail, sustainability-related labels in the analyzed product categories are predominantly local, accounting for approximately 91% of label presence, with international labels constituting the remaining 9%.
- II. A significant part (43%) of Hungarian consumers has only a limited understanding of sustainability-related labelling, and about 46% tend to overestimate their understanding of sustainability labels. Age was found to play a significant role (logistic regression, $p < 0.05$) in the level of overestimation related to sustainability-related labelling, which could be used for targeted awareness raising against greenwashing.
- III. Actual knowledge of sustainability-related labelling is a significant negative predictor of knowledge overestimation among Hungarian consumers (logistic regression, $p < 0.05$), indicating that consumers with lower objective knowledge systematically overestimate their understanding, while those with higher knowledge demonstrate more accurate self-assessment.
- IV. Hungarian consumers express greater confidence in and a preference for sustainable food labels issued by the government. About 51% of consumers consider these "official" labels to be more reliable, 51% perceive them as

compliant with stricter regulations, and 65% report trusting specific sustainability-related labelling from a government-issued sustainability label (Nébih).

- V. A substantial share (39%) of Hungarian consumers was classified as “greenwashing targets (combination of primary and moderate greenwashing target)”, characterized by low knowledge, low-to-moderate trust in sustainability claims, and moderate purchase intention toward sustainability-related labelled products, representing a consumer segment that is particularly susceptible to misleading environmental claims. Gender, education, and income were found to influence consumers’ vulnerability to greenwashing practices (cross-tab, $p < 0.05$).

6. LIST OF PUBLICATIONS IN THE FIELD OF STUDY

6.1. Publications in Journals

First Author Publications

- Nugraha, W. S., Szakos, D., Süth, M., & Kasza, G. (2024).** Greenwashing in the food industry: A systematic review exploring the current situation and possible countermeasures. In *Cleaner and Responsible Consumption*, 15. <https://doi.org/10.1016/j.clrc.2024.100227> – IF 5.3, D1
- Nugraha, W. S., Kasza, G., Süth, M., & Szakos, D.** Consumer understanding and its impact on tackling misleading environmental claims in the Hungarian food sector – Discover Food – Under Review (2026)
- Nugraha, W. S., Nguyen, M-T., Ma'ruf, M, I., Chun, B-X., Szakos, D., Kasza, G.** The impact of climate variability on horticulture production: Is it different in Indonesia? – Heliyon –Under Review (2024)
- Nugraha, W.S., Yudhistira, B., Ardiyanto, A., Alfian, B., Karim, I., Szakos, D., & Kasza, G.** Exploring Non-Muslim Consumer Acceptance and Market Strategies for Halal Meat Products: A Critical Review – Discover Food – Under Review (2026)
- Nugraha, W.S., Rachmawati, A, N., Rizkaprilisa, W., Assegaf, S., Szakos, D., Hardiyanti, M., Nafula, M., Süth, M., & Kasza, G.** A comprehensive review of food donation systems: assessing quality and safety standards and exploring possible countermeasures – Food Policy – Under Review (2026)
- Nugraha, W. S., Kasza, G., Süth, M., & Szakos, D.** Positioning food sustainability labels in Hungary: Exploring familiarity, trust, knowledge, and intention – International Journal of Consumer Studies – Under Review (2026)

Corresponding Author Publications

- Yang, S-H., Yeh, C-H., **Nugraha, W. S., Kasza, G.** Consumer Preference for Animal Welfare, Traceability, and Farm Brand in Fresh Egg Products: Evidence from Taiwan. In *Cleaner and Responsible Consumption*. <https://doi.org/10.1016/j.clrc.2026.100438> – IF 5.3, D1

- Fernando, I., Nisa', F., Yudhistira, B., **Nugraha, W. S.**, Sutopo, C. C. Y., Giovanni, A., Rahmawaty, A., Muhammad, F. N., Mario, M. B., & Kasza, G. (**2025**). A comprehensive review on the utilization of housefly larvae (*Musca domestica*) as dietary meals in aquaculture. In *Discover Sustainability*, 6(1). <https://doi.org/10.1007/s43621-025-01826-1> – **IF 3.0, Q1**
- Fernando, I., Yudhistira, B., Premachandran, K., Singh, S., Muhammad, F. N., Oboturova, N. P., Nagdalian, A. A., Mario, M. B., Aini, L. Q., & **Nugraha, W. S.** (**2025**). Edible ants (Hymenoptera: Formicidae) as human foods: a comprehensive review. In *Cogent Food and Agriculture*, 11(1). <https://doi.org/10.1080/23311932.2025.2568196> – **IF 2.3, Q2**
- Siddiqui, S. A., Karim, I., Shahiya, C., Shityakov, S., **Nugraha, W. S.**, & Kasza, G. (**2024**). A critical review of consumer responsibility in promoting sustainable cocoa production. In *Current Research in Food Science*, 9. <https://doi.org/10.1016/j.crfs.2024.100818> – **IF 7.0, D1**
- Siddiqui, S. A., Khan, S., Mehdizadeh, M., Nirmal, N. P., Khanashyam, A. C., Fernando, I., Jatmiko, Y. D., Afiyanti, M., Bansal, S., Adli, D. N., Nagdalian, A. A., Blinov, A. V., Lodygin, A. D., **Nugraha, W. S.**, Kasza, G., & Walker, T. R. (**2023**). Consumer Studies Focus on Prebiotics, Probiotics, and Synbiotics in Food Packaging: a Review. *Current Food Science and Technology Reports*, 1(1), 13–29. <https://doi.org/10.1007/s43555-023-00003-7>

Co-authored Publications

- Kunszabó, A., Kasza, G., Szakos, D., Oláh, J., Lakner, Z., Popp, J., **Nugraha, W. S.**, Dorkó, A., & Süth, M. (**2025**). Household food waste - consumer intentions and capacities for further reduction considering different food waste categories. *Sustainable Chemistry and Pharmacy*, 48. <https://doi.org/10.1016/j.scp.2025.102209> – **IF 5.8, Q1**
- Kasza, G., Izsó, T., Kunszabó, A., Szakos, D., Lénárt, I., Bozánne Békefi, E., Vongxay, K., Popp, J., Oláh, J., Lakner, Z., **Nugraha, W. S.**, Bognár, L., & Süth, M. (**2024**). Consumer knowledge, attitudes, and behaviour regarding food safety – A perspective from Laos. *Heliyon*, 10(9). <https://doi.org/10.1016/j.heliyon.2024.e29725> – **IF 3.6, Q1**
- Kasza, G., Oláh, J., Popp, J., Lakner, Z., Fekete, L., Pósa, E., **Nugraha, W. S.**, & Szakos, D. (**2024**). Food miles on the shelves: the share of local food

- products in the Hungarian retail sector. *Agricultural and Food Economics*, 12(1). <https://doi.org/10.1186/s40100-024-00297-8> – **IF 4.5, Q1**
- Kasza, G., Izsó, T., Szakos, D., **Nugraha, W. S.**, Tamimi, M. H., & Süth, M. (**2023**). Insects as food - Changes in consumers' acceptance of entomophagy in Hungary between 2016 and 2021. *Appetite*, 188. <https://doi.org/10.1016/j.appet.2023.106770> – **IF 3.8, Q1**
- Nazaruddin, L. O., **Nugraha, W. S.**, Nurhasan, H. M., Lencsés, E., Fekete-Farkas, M., & Gyenge, B. (**2023**). The role of halal requirements, health-environmental factors, and domestic interest in food miles of apple fruit. *Open Agriculture*, 8(1). <https://doi.org/10.1515/opag-2022-0228> – **IF 1.6, Q2**
- Siddiqui, S. A., Asif, Z., Murid, M., Fernando, I., Adli, D. N., Blinov, A. V., Golik, A. B., **Nugraha, W. S.**, Ibrahim, S. A., & Jafari, S. M. (**2022**). Consumer Social and Psychological Factors Influencing the Use of Genetically Modified Foods—A Review. In *Sustainability*, 14 (23). <https://doi.org/10.3390/su142315884> – **IF 3.3, Q1**
- Kunszabo, A., Süth, M., Szakos, D., **Nugraha, W. S.**, Kasza. Bio-waste Sorting Behaviour of Residents: A Systematic Review – Cleaner Waste Systems – Under Review (2025)
- Hardiyanti, M., Kasza, G., Kurniati, I., **Nugraha, W. S.**, & Szakos, D. Evaluating Nutrient Composition in Surplus Food Redistribution Programs: Evidence from Yogyakarta, Indonesia – Food Science & Nutrition – Under Review (2026)
- Kasza, G., Lámfalussy, T., Szakos, D., **Nugraha, W. S.**, & Ózsvári, L. New insights into fish consumption analysis: A combined animal protein-transition approach – Discover Food – Under Review (2026)

Oral Presentations

- Nugraha, W. S.**, Kasza, G., Süth, M., & Szakos, D. Food sustainability label in Hungary: understanding awareness, trust, and consumer intentions. *FOODBALT 2026 - 19th Baltic Conference on Food Science and Technology*. Jelgava, Latvia. (2026)
- Szakos, D., Süth, M., A. Kunszabó, A., Oláh, J., Popp, J., Lakner, Z., Dorkó, A., Izsó, T., **Nugraha, W.S.**, & Kasza, G. 11th International Conference on Sustainable Solid Waste Management (RHODES 2024). Rhodes Island, Greece. (2024)

- Nugraha, W. S., Szakos, D., Süth, M., & Kasza, G.** The Influence of Consumer Awareness on Mitigating Greenwashing Practices in Hungary. NUTRICON 2025 - 12th Annual, International and Scientific Macedonian Food Quality and Safety, Health and Nutrition Congress. Ohrid, North Macedonia. (2025)
- Nugraha, W. S., Szakos, D., Süth, M., & Kasza, G.** The role of consumer awareness in reducing greenwashing practices in Hungarian food market. 4th International Conference on Responsible Consumption and Production (EURECA-PRO). Chania, Greece. (2025)
- Nugraha, W. S., Szakos, D., Süth, M., & Kasza, G.** The effect of consumer knowledge on limiting greenwashing in Hungary. 40. Óvári Tudományos Napok Mosonmagyaróvár. Győr, Hungary. (2025)
- Szakos, D., **Nugraha, W. S.,** Miklós, S., Kasza, G. Insects as food – is it an alternative? Consumer survey results from 2023. 40. Óvári Tudományos Napok Mosonmagyaróvár. Győr, Hungary. (2025)
- Császár-Biró, A., Kasza, G., Izsó, T., Kunszabó, A., Haykir, O., **Nugraha, W. S., & Szakos, D.** From Field to Framework: Segmenting Food Safety Attitudes in Vientiane. 5th FOODCONF, Science, Technology & Innovation. Budapest, Hungary. (2025)
- Dinaj, R., Szakos, D., **Nugraha, W. S.,** Süth, M., & Kasza, G. Agroforestry and Nutrition: A Systematic Review Exploring Interconnections Between Agroforestry and Food Systems. 5th FOODCONF, Science, Technology & Innovation. Budapest, Hungary. (2025)
- Dorkó, A., Kasza, G., **Nugraha, W.S.,** Oláh, J., Popp, J., Lakner, Z., Süth, M., & Szakos, D. Consumer Perception of Cultured Meat in Hungary: Attitudes, Risks, and Sustainability Aspects. 5th FOODCONF, Science, Technology & Innovation. Budapest, Hungary. (2025)
- Hardiyanti, M., Kasza, G., Kurniati, I., Nugraha, W. S., & Szakos, D. Assessing the Nutritional Adequacy of Food-Rurplus Redistribution Menus in Yogyakarta, Indonesia. 11th International Congress of Food Technologists, Biotechnologists and Nutritionists. Zagreb, Croatia. (2025)
- Szakos, D., Dorkó, A., **Nugraha, W. S.,** Oláh, J., Popp, J., Lakner, Z., Miklós, S., & Gyula, K. Evaluation of Cultured Meat Based on Consumer Risk Perception and Sustainable Consumption Aspects. GreenFoodTech 2025. Saint-Malo, France. (2025)

Poster Presentations

Rendora, K.A., **Nugraha, W. S.**, Szakos, D., & Kasza, G. From Minimalist to Holistic: Segmenting Consumers by Sustainability Engagement in Food Choices. 39th EFFoST International Conference 2025. Porto, Portugal. (2025)

7. REFERENCES

- Alireza, S., Anaraki, M., & Basili, R. (2025). Large language models for sustainability reporting: A systematic review and research agenda. *Sustainable Futures*, 10(December 2024), 101494. <https://doi.org/10.1016/j.sfr.2025.101494>
- Anggia, F., Kristian, B., Dorthy, H., & Sinaga, E. (2025). Consumer Responses to Sustainable Product Labeling (Eco-label) in Purchasing Decisions. *West Science Business and Management*, 3(03), 677–687.
- Antonioli, F., & Ciaian, P. (2023). Trends in sustainability claims and labels for newly introduced food products across selected European countries. *Agribusiness*, (November 2022), 371–390. <https://doi.org/10.1002/agr.21894>
- Aprile, M. C., & Punzo, G. (2022). How environmental sustainability labels affect food choices: Assessing consumer preferences in southern Italy. *Journal of Cleaner Production*, 332. <https://doi.org/10.1016/j.jclepro.2021.130046>
- Asche, F., & Bronnmann, J. (2017). Price premiums for ecolabelled seafood: MSC certification in Germany. *Australian Journal of Agricultural and Resource Economics*, 61(4), 576–589. <https://doi.org/10.1111/1467-8489.12217>
- Avila, L. V., Leal, W., Brandli, L., Macgregor, C. J., Martins, R., Molthan-hill, P., Pinar, G., & Moreira, R. M. (2017). Barriers to innovation and sustainability at universities around the world. *Journal of Cleaner Production*, 164, 1268–1278. <https://doi.org/10.1016/j.jclepro.2017.07.025>
- Brécard, D. (2017). Consumer misperception of eco-labels, green market structure and welfare. *Journal of Regulatory Economics*, 51(3), 340–364. <https://doi.org/10.1007/s11149-017-9328-8>

- Bucca, M., Chinnici, G., Reitano, M., Selvaggi, R., & Zarb, C. (2026). How quality labels shape consumer behavior : a study on orange preferences. *Journal of Agriculture and Food Research*, 25(October 2025), 0–7. <https://doi.org/10.1016/j.jafr.2025.102554>
- Buse, S., & Meyerding, S. G. H. (2025). Impact of packaging color on choice and health perception : Insights from chickpeas and ravioli in Germany. *Journal of Agriculture and Food Research*, 19(January), 101690. <https://doi.org/10.1016/j.jafr.2025.101690>
- Cafferla, R., Tsironis, G., Morone, A., P. Tsagarakis, K., Morone, P., & D’Adamo, I. (2023). Environmental Technology & Innovation Is the circular economy proposed as sustainability in firm mission statements ? A semantic analysis. *Environmental Technology & Innovation*, 32, 103304. <https://doi.org/10.1016/j.eti.2023.103304>
- Cai, D., Zhu, L., Zhang, W., Ding, H., Wang, A., Lu, Y., & Jin, J. (2021). The impact of social crowding on consumers’ online mobile shopping: Evidence from behavior and erps. *Psychology Research and Behavior Management*, 14, 319–331. <https://doi.org/10.2147/PRBM.S292360>
- Carlucci, D., Nocella, G., De Devitiis, B., Viscecchia, R., Bimbo, F., & Nardone, G. (2015). Consumer purchasing behaviour towards fish and seafood products. Patterns and insights from a sample of international studies. *Appetite*, 84, 212–227. <https://doi.org/10.1016/j.appet.2014.10.008>
- Chitaka, T. Y. (2021). Environmentalism or greenwashing? Responses of South African value chain actors to plastic straw marine pollution. *South African Journal of Science*, 117(7–8). <https://doi.org/10.17159/SAJS.2021/9042>
- Cook, B., Costa Leite, J., Rayner, M., Stoffel, S., van Rijn, E., & Wollgast, J. (2023). Consumer Interaction with Sustainability Labelling on Food Products: A Narrative Literature Review. *Nutrients*, 15(17). <https://doi.org/10.3390/nu15173837>

- D'Adamo, I. (2023). The analytic hierarchy process as an innovative way to enable stakeholder engagement for sustainability reporting in the food industry. *Environment, Development and Sustainability*, 25(12), 15025–15042. <https://doi.org/10.1007/s10668-022-02700-0>
- DeFries, R. S., Fanzo, J., Mondal, P., Remans, R., & Wood, S. A. (2017a). Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. *Environmental Research Letters*, 12(3). <https://doi.org/10.1088/1748-9326/aa625e>
- DeFries, R. S., Fanzo, J., Mondal, P., Remans, R., & Wood, S. A. (2017b). Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. *Environmental Research Letters*, 12(3). <https://doi.org/10.1088/1748-9326/aa625e>
- Dorisse, A., & Charry, K. (2025). When multi-labelling backfires : The influence of sustainability FOP labels valence and orientation. *Appetite*, 213(April).
- Dreist, D., Weinfurter, T., Spiller, A., & Lemken, D. (2024). EU climate labeling policy : Analyzing consumer ' s comprehension of CO 2 footprint labels. *Journal of Agriculture and Food Research*, 17(February), 101248. <https://doi.org/10.1016/j.jafr.2024.101248>
- Edirisooriya, M. (2025). Sustainability on the Tag: An Integrative Review of Consumer Interpretation and Design Influence on Eco-Labels in Fashion. *Glocality*, 8(1). <https://doi.org/10.5334/glo.117>
- Ernawati Ernawati, Lutfi Kausar Rahman, Erna Susanti, Anatia Agusti, & Annisa Desty Puspatriani. (2025). The Role of Consumer Trust in Sustainability in Increasing Interest in Purchasing Environmentally Friendly Products. *Brilliant International Journal Of Management And Tourism*, 5(2), 344–351. <https://doi.org/10.55606/bijmt.v5i2.5194>

- European Commission. (2023). *Green Claims*. Retrieved January 15, 2026, from https://environment.ec.europa.eu/topics/circular-economy-topics/green-claims_en
- European Parliament. (2024). “*Green claims” directive: Protecting consumers from greenwashing*. Retrieved June 12, 2025, from [https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI\(2023\)753958](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2023)753958)
- Gatti, L., Pizzetti, M., & Seele, P. (2021). Green lies and their effect on intention to invest. *Journal of Business Research*, 127(January 2020), 228–240. <https://doi.org/10.1016/j.jbusres.2021.01.028>
- Gomes, S., Lopes, J. M., & Nogueira, S. (2023). Willingness to pay more for green products: A critical challenge for Gen Z. *Journal of Cleaner Production*, 390. <https://doi.org/10.1016/j.jclepro.2023.136092>
- Grunert, K. G., Hieke, S., & Wills, J. (2014). Sustainability labels on food products : Consumer motivation , understanding and use. *Food Policy*, 44, 177–189. <https://doi.org/10.1016/j.foodpol.2013.12.001>
- Guyader, H., Ottosson, M., & Witell, L. (2017). You can’t buy what you can’t see: Retailer practices to increase the green premium. *Journal of Retailing and Consumer Services*, 34, 319–325. <https://doi.org/10.1016/j.jretconser.2016.07.008>
- Hatanaka, M. (2020). Beyond consuming ethically? Food citizens, governance, and sustainability. *Journal of Rural Studies*, 77(December 2019), 55–62. <https://doi.org/10.1016/j.jrurstud.2020.04.006>
- Hedemann-Robinson, M. (2025). Environmental Claims and the EU’s Legal Response for Combating Greenwashing. *European Energy and Environmental Law Review*, 34(3), 64–78. <https://doi.org/https://doi.org/10.54648/eelr2025006>
- Horváth, H., Komlosi, L. I., & Dobo, R. (2024). Product trademarks-generation Z at the crossroads of economics and law: An exploratory analysis through a

- multi-industry approach. *Russian Law Journal*, 1(12), 1173–1182. <https://doi.org/https://www.russianlawjournal.org/index.php/journal/article/view/3905/2493>
- Huang, L., Solangi, Y. A., Magazzino, C., & Solangi, S. A. (2024). Evaluating the efficiency of green innovation and marketing strategies for long-term sustainability in the context of Environmental labeling. *Journal of Cleaner Production*, 450. <https://doi.org/10.1016/j.jclepro.2024.141870>
- Hungarian Central Statistical Office. (2023). *Number of retail shops by type of shop*. Retrieved March 5, 2026, from <https://www.ksh.hu/internal-trade>
- Hungarian Competition Authority. (2002). *Vj-4_2002_25 - GVH*. Retrieved March 5, 2026, from <https://www.gvh.hu/>
- Hungarian Competition Authority. (2008). *Vj-105_2008_12 - GVH*. Retrieved March 5, 2026, from <https://www.gvh.hu/>
- Isabel, W., Lemken, D., Spiller, A., & Schulze, M. (2023). Welcome to the (label) jungle? Analyzing how consumers deal with intra-sustainability label trade-offs on food. *Food Quality and Preference*, 104(October 2022), 104746. <https://doi.org/10.1016/j.foodqual.2022.104746>
- Kahraman, A., & Kazançoğlu, İ. (2019). Understanding consumers' purchase intentions toward natural-claimed products: A qualitative research in personal care products. *Business Strategy and the Environment*, 28(6), 1218–1233. <https://doi.org/10.1002/bse.2312>
- Kasza, G. (2025). Positioning of the high-quality food trademark in Hungary through consumer segmentation. *Journal of Agriculture and Food Research*, 24(August). <https://doi.org/10.1016/j.jafr.2025.102466>
- Kasza, G., Csenki, E., Szakos, D., & Izsó, T. (2022). The evolution of food safety risk communication: Models and trends in the past and the future. *Food Control*, 138(April). <https://doi.org/10.1016/j.foodcont.2022.109025>
- Kundi, V., & Ernszt, I. (2024). The Phenomenon of Greenwashing : An Analysis of the Hungarian Regulation. *Journal of Sustainability Research*, 6(4), 1–20.

- Lakerveld, A. Van, & Tulder, R. Van. (2017). Review of Social Economy Managing the transition to sustainable supply chain management practices : Evidence from Dutch leader firms in Sub-Saharan Africa Managing the transition to sustainable supply chain firms in Sub-Saharan Africa. *Review of Social Economy*, 6764(July), 1–25. <https://doi.org/10.1080/00346764.2017.1286033>
- Liute, A., & De Giacomo, M. R. (2022). The environmental performance of UK-based B Corp companies: An analysis based on the triple bottom line approach. *Business Strategy and the Environment*, 31(3), 810–827. <https://doi.org/10.1002/bse.2919>
- MacLennan, J., & Catelle, W. De. (2025). The Revision of EU Greenwashing Laws : A New Framework of Analysis. *Business and Human Rights Journal*, 1–7. <https://doi.org/10.1017/bhj.2025.14>
- MAGYAR TERMÉK Nonprofit Kft. (n.d.). *HUNGARIAN PRODUCT Nonprofit Ltd.* Retrieved March 5, 2026, from <https://amagyartermek.hu/>
- Manuel, S. (2025). The Fight Against Greenwashing in the European Union: Directive (EU) 2024/825 of the European Parliament and the Council, of February 28, 2024, and the Portuguese Case*. *Cuadernos de Derecho Transnacional*, 17(1), 353–365. <https://doi.org/10.20318/cdt.2025.9333>
- Mekler, A., Gonta, M., Madar, N., & Cserjés-Kopándi, I. (2025). *Voice of the consumer: Hungarian consumer preferences analysis 2025.*
- Montero-Navarro, A., González-Torres, T., Rodríguez-Sánchez, J.-L., & Gallego-Losada, R. (2021). A bibliometric analysis of greenwashing research: a closer look at agriculture, food industry and food retail. *British Food Journal*, 123(13), 547–560. <https://doi.org/10.1108/BFJ-06-2021-0708>
- Nawaz, A., Irshad, S., Luo, X., Walayat, N., & Widyanti, P. (2026). Advances in green food processing technologies : Enhancing efficiency , safety , and sustainability. *Food Control*, 181(May 2025), 111715. <https://doi.org/10.1016/j.foodcont.2025.111715>

- Naz, F., Oláh, J., Vasile, D., & Magda, R. (2020). Green purchase behavior of university students in Hungary: An empirical study. *Sustainability*, 12(23), 1–21. <https://doi.org/10.3390/su122310077>
- Nguyen, T. T. H., Yang, Z., Nguyen, N., Johnson, L. W., & Cao, T. K. (2019). Greenwash and green purchase intention: The mediating role of green skepticism. *Sustainability (Switzerland)*, 11(9), 1–16. <https://doi.org/10.3390/su11092653>
- Nugraha, W. S., Szakos, D., Süth, M., & Gyula, K. (2024). Greenwashing in the food industry : A systematic review exploring the current situation and possible countermeasures. *Cleaner and Responsible Consumption*, 15(July). <https://doi.org/10.1016/j.clrc.2024.100227>
- Parker, C., Carey, R., Haines, F., & Johnson, H. (2021). Can Labelling Create Transformative Food System Change for Human and Planetary Health? A Case Study of Meat. *Kerman University of Medical Sciences*, 10(12), 923–933. <https://doi.org/10.34172/ijhpm.2020.239>
- Pedregal, D. J., & Pe, J. J. (2010). *Determinants of commercial revenues at airports : Lessons learned from Spanish regional airports q. 31*, 788–796. <https://doi.org/10.1016/j.tourman.2009.08.005>
- Proi, M., Dudinskaya, E. C., Naspetti, S., Ozturk, E., & Zanolì, R. (2023). The Role of Eco-Labels in Making Environmentally Friendly Choices: An Eye-Tracking Study on Aquaculture Products with Italian Consumers. *Sustainability (Switzerland)*, 15(5). <https://doi.org/10.3390/su15054659>
- Rossi, C., & Rivetti, F. (2020). Assessing young consumers' responses to sustainable labels: Insights from a factorial experiment in Italy. *Sustainability (Switzerland)*, 12(23), 1–23. <https://doi.org/10.3390/su122310115>
- Saber, M., & Weber, A. (2019). Sustainable grocery retailing: Myth or reality?—A content analysis. *Business and Society Review*, 124(4), 479–496. <https://doi.org/10.1111/basr.12187>

- Saleem ur Rahman, Bang Nguyen-Viet, Waheed Akbar Bhatti, & Jari Salo. (2025). Greenwashing vs green branding: the role of non-deception and brand nature experiences in green brand trust formation. *Asia-Pacific Journal of Business Administration*, 1–23. <https://doi.org/https://doi.org/10.1108/APJBA-06-2024-0336>
- Scarpato, D., Rotondo, G., Simeone, M., Gómez, A., & Gutiérrez, P. (2016). *How can food companies attract the consumer concerned about food safety ? A logit model analysis in Spain*.
- Sirieix, L., Delanchy, M., Remaud, H., Zepeda, L., & Gurviez, P. (2013). Consumers' perceptions of individual and combined sustainable food labels: A UK pilot investigation. *International Journal of Consumer Studies*, 37(2), 143–151. <https://doi.org/10.1111/j.1470-6431.2012.01109.x>
- Squires, S. A. (2019). Do generations differ when it comes to green values and products? *Electronic Green Journal*, 1(42). <https://doi.org/10.5070/g314239436>
- Stecker, M. J. (2016). Awash in a Sea of Confusion: Benefit Corporations, Social Enterprise, and the Fear of “Greenwashing.” *Journal of Economic Issues*, 50(2), 373–381. <https://doi.org/10.1080/00213624.2016.1176481>
- Szakaly, Z., Soos, M., Szabo, S., & Szent, V. (2016). Role of labels referring to quality and country of origin in food consumers' decisions. *Acta Alimentaria*, 45(3), 323–330. <https://doi.org/10.1556/AAlim.2015.0012>
- Teufer, B., Waiguny, M. K. J., & Grabner-kr, S. (2023). Consumer perceptions of sustainability labels for alternative food networks. *Baltic Journal of Management*, 18(4), 493–508. <https://doi.org/10.1108/BJM-10-2022-0380>
- The European Commission. (2020). *Farm to Fork Strategy*.
- The World Bank. (2024). *Trade (% of GDP) - Hungary*. Retrieved June 12, 2025, from <https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=HU>

- Toussaint, M., Cabanelas, P., & González-Alvarado, T. E. (2021). What about the consumer choice? The influence of social sustainability on consumer's purchasing behavior in the Food Value Chain. *European Research on Management and Business Economics*, 27(1). <https://doi.org/10.1016/j.iedeen.2020.100134>
- UN Trade and Development. (2020). *World Consumer Rights Day: Do consumers play a role as influencers of sustainable consumption?*. Retrieved June 12, 2025, from <https://unctad.org/news/world-consumer-rights-day-do-consumers-play-role-influencers-sustainable-consumption>
- United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. Retrieved June 12, 2025, from <https://sdgs.un.org/2030agenda>
- Urbański, M., & Ul Haque, A. (2020). Are you environmentally conscious enough to differentiate between greenwashed and sustainable items? A global consumers perspective. *Sustainability (Switzerland)*, 12(5), 1–25. <https://doi.org/10.3390/su12051786>
- Vaio, A. D., Latif, B., Gunarathne, N., Gupta, M., & D'Adamo, I. (2023). Digitalization and artificial knowledge for accountability in SCM: a systematic literature review. *Journal of Enterprise Information Management*, 37(02), 606–672. <https://doi.org/10.1108/JEIM-08-2022-0275>
- van Tulder, R., & Rodrigues, S. B. (2021). The UN 's Sustainable Development Goals : Can multinational enterprises lead the Decade of Action ? *Journal of International Business Policy*, 4(1), 1–21. <https://doi.org/10.1057/s42214-020-00095-1>
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., ... Murray, C. J. L. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems.

- In *The Lancet* (Vol. 393, Number 10170, pp. 447–492). Lancet Publishing Group. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)
- Xi, X., Yang, J., Jiao, K., Wang, S., & Lu, T. (2022). “We buy what we wanna be”: Understanding the effect of brand identity driven by consumer perceived value in the luxury sector. *Frontiers in Psychology, 13*(September), 1–15. <https://doi.org/10.3389/fpsyg.2022.1002275>
- Xu, M., Kei, Y., Geng, R., Liu, Z., & Potter, A. (2025). Greenwashing and market value of firms : An empirical study. *International Journal of Production Economics, 284*(April 2024), 109606. <https://doi.org/10.1016/j.ijpe.2025.109606>
- Xu, Y., Zhang, Z., Ren, Y., Yuan, R., Wang, Y., Li, R., Zhao, S., & Qiu, L. (2024). Can carbon labels shift consumers towards sustainable food ? Evidence from Chinese consumers. *Sustainable Futures, 8*(3), 100363. <https://doi.org/10.1016/j.sftr.2024.100363>
- Xuan, B. B. (2021). Consumer preference for eco-labelled aquaculture products in Vietnam. *Aquaculture, 532*(October 2020), 736111. <https://doi.org/10.1016/j.aquaculture.2020.736111>
- Yang, S. H., Phan, H. T. T., Hsieh, C. M., & Li, T. N. (2022). What Intentions and Interesting Information Can Make Consumers Scan QR Code While Buying Eggs? *Foods, 11*(9), 1–16. <https://doi.org/10.3390/foods11091259>
- Yao, Y., He, X., & Liu, Z. (2025). The impact of nature relatedness on carbon labeling type selection and willingness to pay a carbon premium. *Sustainable Futures, 10*(June). <https://doi.org/https://doi.org/10.1016/j.sftr.2025.100790>
- Zhang, X., Giusti, A., Li, S., Deng, W., Sun, Z., Li, Y., Peng, H., Hu, J., Armani, A., & Wen, J. (2025). Beyond mislabelling : Chinese fish balls authentication by metabarcoding allows unveiling hidden mammal and avian species. *Food Control, 176*(February), 111338. <https://doi.org/10.1016/j.foodcont.2025.111338>