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Surveying consumer preferences for eco-labeled fruits and vegetables in Euro-Mediterranean alternative food systems

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The growing environmental challenges in Mediterranean fruit and vegetables production, including water scarcity, soil degradation, and biodiversity loss, have led to increased interest in alternative food systems as a pathway to sustainable agriculture. However, a significant research gap remains in understanding consumer preferences for eco-labeled fruit and vegetables within these systems, particularly in comparison to conventional supply chains. Short food supply chains emphasize local engagement, transparency, and reduced environmental impact, whereas export-oriented supply chains prioritize large-scale production for global market but face concerns regarding their environmental implications. This study addresses this gap by analyzing the key drivers influencing willingness to pay for eco-labeled fruit and vegetables in short food supply chains and export-oriented supply chains, providing novel insights into consumer decision-making across different supply chain structures. Specifically, it investigates how consumers in these two supply chain systems differ in their attitudes toward eco-labels, focusing on interest in label information, environmental concerns, and trust in certifications. Using data from an online survey conducted in June 2023 in Italy, France, and Greece with a final sample of 1,163 respondents, this study follows a two-step approach. First, one-way analysis of variance is used to assess differences in consumers' attitudes toward eco-labels between supply chains. Second, partial least squares structural equation modeling is used to estimate relationships and identifies key drivers of willingness to pay for eco-labeled fruit and vegetables. The results show that trust in certifications emerges as the strongest predictor of willingness to pay in both supply chains, especially within short food supply chains. Interest in label information also plays a significant role in both contexts, while environmental concerns are more relevant for consumers in export-oriented supply chains. Younger consumers exhibit stronger preferences for eco-labeled fruit and vegetables, while education levels show no significant effect. The analysis highlights the distinct roles of supply chains in shaping consumer preferences. Short food supply chains foster trust through local engagement and transparency, reducing the need for formal certifications, whereas export-oriented supply chains rely more on certifications due to their more industrialized and impersonal nature. These findings contribute to the literature on sustainable food consumption by demonstrating how trust, information, and environmental awareness interact in different supply chain

contexts. The study provides practical insights for policymakers and stakeholders to refine certification strategies and improve consumer engagement, ultimately supporting the development of sustainable food systems.

KEYWORDS

sustainable food supply chains, consumer trust, willingness to pay, Mediterranean agriculture, ecolabel

1 Introduction

The increasing environmental challenges facing fruit and vegetable (FV) production in Mediterranean countries raise concerns about the long-term sustainability of traditional agricultural practices. Water scarcity due to excessive irrigation, soil degradation, pollution from chemical inputs, and biodiversity loss are major issues threatening the region's agricultural viability (Capone and Dernini, 2024). Furthermore, the effects of climate change, such as rising temperatures and prolonged droughts, further strain traditional agricultural practices and threaten the long-term sustainability of FV production in the region (Prada et al., 2024). Given these pressures, it is crucial to explore sustainable food supply chain models that can mitigate environmental impacts while meeting consumer demand. A key challenge, however, is understanding how different supply chain structures influence consumer trust in ecolabels and sustainability claims, particularly in the Mediterranean context where diverse supply chain models coexist.

In response to these challenges, Alternative Food Systems (AFSs) offer a promising framework for rethinking food production and distribution (Mancini et al., 2021). They encompass networks and practices that emphasize environmental responsibility, social equity, and local engagement throughout the supply chain, favoring eco-friendly farming and lower carbon footprints over conventional approaches (Michel-Villarreal et al., 2019). By promoting shorter supply chains and responsible production methods, AFSs can provide viable solutions that align environmental objectives with consumer and market needs.

Within this framework, Short Food Supply Chains (SFSCs) are recognized as a key component of AFSs (Barbosa, 2021; Hoang, 2021; Jia et al., 2024; Todorova, 2020). SFSCs create substantial social and economic value by reinforcing local economies, cultivating trust-based relationships, and improving producers' ability to capture value. They also promote community engagement, raise consumer awareness, and contribute to a more equitable distribution of income for farmers (Corvo et al., 2021). By minimizing the distance between producers and consumers, SFSCs reduce food miles, transportation needs, and associated greenhouse gas emissions (Bui et al., 2021; Jia et al., 2024; Raftowicz et al., 2024). Their emphasis on local sourcing and freshness also helps lower food waste (Hoang, 2021). Additionally, SFSCs promote environmental sustainability by conserving natural resources, reducing energy consumption, and supporting biodiversity, soil health, and water quality (Hoang, 2021; Jia et al., 2024; Todorova, 2020).

While existing research has extensively examined the environmental benefits of SFSCs (Raftowicz et al., 2024),

fewer studies have explored how they shape consumer trust in sustainability labels compared to other supply chain models. This study seeks to fill that gap by focusing on consumer perceptions of ecolabels within different supply chain contexts. In the Mediterranean region, FV products are distributed through diverse supply chain models, including Export-Oriented Supply Chains (EOSCs), which focus on large-scale production and distribution to cater to global market demands.

Despite the common comparison of conventional system and SFSC (Doernberg et al., 2022; Jarzebowski et al., 2020), this study compares SFSCs with EOSCs because the latter represents a competing alternative that also engages with sustainability certification schemes but at a larger scale.

Unlike conventional supply chains that primarily serve domestic mass markets with standardized products, EOSCs integrate ecolabels as a means to meet international consumer demand and regulatory requirements (Camanzi et al., 2019). This comparison is relevant because it allows an examination of how local versus global market orientations shape consumer trust in sustainability labels, providing insight into the effectiveness of ecolabels across different supply chain structures. Previous studies on consumer trust in ecolabels have largely focused on single supply chains rather than cross-chain comparisons. By directly comparing SFSCs and EOSCs, this study provides new insights into how the supply chain structure itself influences consumer perceptions of sustainability claims.

At the same time as EOSCs play a critical role in connecting Mediterranean producers to global markets, they also come with unique challenges and environmental implications. For instance, longer transportation in EOSC may increase carbon footprints (Ferguson Aikins and Ramanathan, 2020), raising concerns about their sustainability compared to SFSCs. However, EOSCs benefit from economies of scale, standardized quality control, and wider market reach, making them an essential part of the agri-food system [Food and Agriculture Organization of the United Nations (FAO), 2022]. Balancing the economic benefits of EOSCs with their environmental impacts is a growing concern, particularly in the context of sustainability initiatives.

From a consumer perspective, multiple factors influence FV purchasing decisions in general, including health considerations (Thøgersen et al., 2019), taste and freshness (Hemmerling et al., 2015), price sensitivity (Grunert et al., 2014), brand familiarity (Van Loo et al., 2020), and ethical or environmental concerns (Janssen and Hamm, 2012). Among these, ecolabels have gained prominence as a critical tool shaping consumer behavior, as they offer transparency regarding food production practices and environmental sustainability standards.

As consumer awareness and concern for sustainability rise, there is an increasing demand for environmentally friendly products and practices. In SFSCs, ecolabels enhance transparency, fostering trust in the sustainability and freshness of products, while addressing concerns related to food safety, environmental impact, and product authenticity (Raftowicz et al., 2024). In EOSCs, these labels provide access to globally certified products, further strengthening consumer confidence in product safety, quality, and sustainability (Oberlack et al., 2023).

Despite the growing significance of ecolabels, the extent to which consumer preferences for eco-labeled FV differ between SFSCs and EOSCs remains underexplored. Most studies on consumer trust in ecolabels have focused on conventional food systems or SFSCs in isolation, rather than comparing ecolabel effectiveness between supply chains with distinct market orientations. Understanding how consumer preferences for ecolabels shift between SFSCs and EOSCs is particularly relevant, as these supply chains reflect different degrees of consumer proximity, transparency, and certification requirements. While consumer decisions are shaped by multiple factors, this study specifically focuses on trust in ecolabels, interest in label information, and environmental concerns, as these three elements directly influence willingness to pay (WTP) for sustainability-certified products (Grunert et al., 2014; Janssen and Hamm, 2012; Recio-Román et al., 2020). This focus is justified given the increasing role of ecolabels in shaping consumer perceptions of food quality, authenticity, and environmental responsibility, particularly in differentiated supply chain models.

This gap is particularly important given that SFSCs often rely on relational trust and direct interactions, while EOSCs depend on third-party certification schemes and regulatory frameworks to assure sustainability. Furthermore, the provision of such labels and certifications also increases costs, and producing eco-friendly products often involves higher production costs and restrictions, which can reduce product affordability (Yenipazarli, 2015). These higher costs pose challenges for producers, manufacturers, and certification bodies, making it crucial for supply chain actors to understand consumer preferences and attitudes toward labels and certifications (Bernabéu et al., 2023; Sautereau et al., 2013). Addressing this gap is crucial for policymakers, certification bodies, and producers seeking to improve eco-labeling strategies across diverse supply chain models.

To bridge this gap, this study aims to examine consumer preferences for eco-labeled FV by comparing SFSCs and EOSCs. Specifically, it investigates how interest in label information, environmental concerns, and trust in certifications shape WTP for eco-labeled FV across these two supply chain systems. By analyzing consumer perceptions in three European Mediterranean countries—Italy, France, and Greece—this study provides insights into certification practices, offering practical implications for policymakers and market stakeholders.

By providing a comparative analysis, this study contributes to the literature by: (1) clarifying how trust in ecolabels varies between localized SFSCs and export-oriented EOSCs, (2) assessing the distinct roles of label information, environmental concerns, and certification trust in influencing WTP within these differing supply chain contexts, and (3) offering practical insights for policymakers

and market stakeholders to refine certification strategies and improve consumer engagement in different supply chain contexts. The findings will help design more effective eco-labeling policies that align with consumer expectations, ultimately supporting the transition to more sustainable food systems.

2. Materials and methods

2.1. Hypotheses statement

Considering the aim of this study, we focus on three important factors: Interest in information on the label, environmental concern, and positive attitudes towards and trust in the current certifications. The analysis examines how these factors influence consumers' purchasing preferences and their willingness to pay within AFSs.

Consumers' perceptions of quality and the effectiveness of sustainable practices significantly shape their food purchasing preferences (Herrmann et al., 2022; Sgroi et al., 2023). As consumer interest in product information grows, attention to details such as food origin, nutritional content, and sustainability claims increases (Janßen and Langen, 2017; Martini and Menozzi, 2021). In addition to seeking transparency about product attributes, many consumers are becoming increasingly aware of the environmental and social impact of their purchases (Galati et al., 2019). Research on consumer behavior suggests that heightened awareness of environmental issues not only influences purchasing decisions but also increases WTP for environmentally friendly and sustainably produced goods (Gomes et al., 2023).

Eco-labels serve as a crucial mechanism for addressing information asymmetries between producers and consumers, particularly in AFSs, where transparency and trust are key determinants of purchasing behavior. In SFSCs, ecolabels often emphasize local and environmentally sustainable practices, aligning with consumers who prioritize community engagement, food traceability, and eco-conscious production methods (Raftowicz et al., 2024). Conversely, in EOSCs, ecolabels function as standardized verification tools that help assure consumers of sustainable practices across large-scale international markets (Oberlack et al., 2023). Given these contextual differences, consumer attitudes toward eco-labels may vary across supply chain models, reflecting differences in perceived reliability, sustainability claims, and trust in certification systems.

It is therefore hypothesized that:

- H1. Consumers in SFSCs and EOSCs differ in their attitudes toward eco-labeled fruit and vegetables, particularly in terms of interest in label information, environmental concerns, and trust in certifications.

Furthermore, research suggests that stronger environmental awareness and concern are associated with a greater willingness to adopt behaviors that contribute to ecosystem preservation, such as choosing products with reduced pesticide and fertilizer use or supporting environmentally friendly production methods (Isaak and Lentz, 2020; Wyss et al., 2022). Given that eco-labels often serve

as a signal for such practices, we expect that higher environmental concern will be positively linked to WTP for certified FV.

Additionally, the credibility of labels, standards, and certifications depends on both the accuracy of the information provided and the level of consumer trust in these mechanisms (Rupprecht et al., 2020). Consumers with a strong belief in the reliability of certifications are more likely to incorporate eco-labeled products into their purchasing decisions (Peiró Signes et al., 2023). Since SFSCs are often associated with direct producer-consumer interactions, transparency, and trust in local sustainability efforts, trust in certifications and interest in label information are expected to be particularly influential in shaping WTP within this supply chain model.

It is therefore hypothesized that:

- H2. Consumer WTP for eco-labeled fruit and vegetables in SFSCs is positively influenced by trust in certifications and interest in label information.

Consumers' preferences and WTP for eco-labeled products are also shaped by the perceived trustworthiness of the certifying organization and the overall credibility of the information provided (Dangelico et al., 2021). Unlike SFSCs, where proximity to producers may enhance trust, EOSCs operate across broader markets where consumers rely more on standardized certifications and independent verification of environmental claims. Thus, in EOSCs, environmental concerns and interest in label information may play a stronger role in influencing WTP compared to SFSCs, where direct relationships and local engagement provide additional assurance.

It is therefore hypothesized that:

- H3. Consumer WTP for eco-labeled fruit and vegetables in EOSCs is positively influenced by environmental concerns and interest in label information.

Beyond these three important factors, demographic profiles such as age, income, education level and geographic location can influence consumer behavior and preferences for environmentally friendly products. People in different age groups have distinct needs and priorities, leading to different preferences and WTP (Gomes et al., 2023). The level of education can be decisive for consumer attitudes and concerns and is said to have a positive effect on consumer awareness (Vicente et al., 2021). Geographical location significantly affects consumer's preferences due to different cultural norms and values. To this end, in this paper we include age, education level, and country as control variables to assess their impact on consumers' willingness to pay (WTP) for fruits and vegetables (FV).

2.2 Survey design

The study targeted consumers who are the primary decision-makers for purchasing FV in their households. The survey began with two sets of screening questions. The first collected socio-demographic information, including gender, age, and education

level. To ensure relevant participation, the second set served as filters to identify eligible participants who: (1) shop for food at least once a week, and (2) pay attention to certifications or standard information on labels when purchasing FV.

The questionnaire was structured into key sections to capture essential variables related to consumer behaviour. These sections included interest in label information, focusing on details such as nutritional content, geographical origin, shelf life, and the presence of environmental certifications (Peiró Signes et al., 2023). Environmental concerns were also examined, particularly awareness and perceptions of sustainability-related issues such as deforestation, depletion of natural resources, non-recyclable packaging, high carbon emissions, and excessive water consumption (Isaak and Lentz, 2020). Another key aspect was trust in certifications, assessing consumers' satisfaction with current certifications, trust in existing certification schemes, and attitudes toward environmental certifications (Nygaard, 2023). Examples of measurement items by construct include:

- **Interest in label information** (Peiró Signes et al., 2023): sample items include: "When shopping, I usually check the nutritional content (e.g., vitamins)," "I pay attention to the geographical origin of the product," "I check whether the product is certified organic," and "I look for eco-friendly or ethical/social certification labels". Responses were recorded using a 7-point Likert scale (1 = Strongly Disagree to 7 = Strongly Agree).
- **Environmental concern in production** (Isaak and Lentz, 2020): items included: "It is important to me that fruit and vegetables are produced without causing deforestation or biodiversity loss," "I prefer fruit and vegetables produced using recyclable packaging," "I value production methods with low carbon emissions and reduced energy or pesticide use," and "I care that water is used sparingly in the production of fruit and vegetables."
- **Trust in certifications** (Nygaard, 2023): statements included: "I am satisfied with the information provided by existing certifications," "I trust the claims made by current certification standards," and "How do you feel about environmental certifications?" (measured on a scale from 1 = Very Negative to 7 = Very Positive).

To measure WTP, consumers were asked whether or not they were willing to pay more for eco-labelled FV. If the answer was "yes", a further question was asked to determine the additional willingness to pay as a percentage. These values are spread across seven levels, representing the increase in consumers' WTP, from 5% to over 30% (up to 5%, 10%, 15%, 20%, 25%, 30% and over 30%) (Huang, 2024; Vapa-Tankosić et al., 2020). These responses were used as input for the WTP variable in the model. Table 3 provides further details on the structure of the questionnaire.

The questionnaire included multiple-choice questions, Likert scale items, and open-ended questions. A seven-point Likert scale ranging from "1—Strongly Disagree" to "7—Strongly Agree" was employed, as it correlates more strongly with observed significance levels compared to five-point scales and is perceived by respondents as a more accurate option (Lozano et al., 2008). Additionally, the survey incorporated

explanations of sustainability concepts and environmental standards to ensure respondents had a clear understanding of the key issues.

The questionnaire was initially developed in English and later translated into the official languages of the target countries. The translation process involved native language experts from each country, ensuring linguistic and contextual accuracy. Each translation was thoroughly reviewed by at least two additional experts before finalization. The translated versions have been available since June 2023 for data collection.

2.3 Data collection

The survey was carried out using an online platform (www.qualtrics.com) in June 2023. The participants were chosen in cooperation with the market research agency Toluna (2023) as part of a transnational panel in Italy, France and Greece. These three countries are known for their Mediterranean diet, which is characterized by a high consumption of FV (EUROSTAT, 2022). The survey began with a pre-test or soft launch, in which approximately 100 questionnaires were completed. After addressing minor errors identified during this phase, we proceeded with the final survey. Participants indicated that it took them an average of 15 to 20 min to complete.

The survey targeted 382 consumers in Italy, 412 in France and 369 in Greece (see Table 1). The sample size was determined using Cochran's sampling formula (Cochran, 1977), with a 95% confidence level. We then used a quota strategy to ensure a representative distribution of respondents based on key demographic factors (gender, age, and education), including demographic characteristics (Futri et al., 2022). Quotas were set based on specific consumer groups to ensure a balanced sample that captures meaningful insights into diverse purchasing behaviours. The responses were monitored during data collection to enhance information reliability, through data quality checks, including screening for speeders, and inconsistent responses. After thorough data cleaning and validation, some participants were excluded due to the filter and control questions described in the previous section (2.2 Survey design) or due to incomplete responses. Consequently, our final sample consisted of 1,163 respondents from all three countries.

The demographic characteristics of the final SFSC and EOSC participants are shown in Table 1. Participants were assigned to either SFSC or EOSC based on their self-reported purchasing behaviour, specifically their dominant shopping channels for fruits and vegetables. Respondents who primarily sourced their products through local markets or a combination of online platforms with local and/or national products were assigned to the SFSC quota. Those who chose grocery stores, supermarkets, or primarily relied on imported and/or national products were assigned to the EOSC quota. This classification allowed for a meaningful comparison of consumer preferences across different supply chain models. In SFSCs, the sample was evenly distributed across the three countries, reflecting the local nature of these supply chains. In contrast, EOSCs had a higher representation from France, which aligns with its larger export-oriented FV market. The gender distribution was nearly equal in both supply chains, and the majority of

TABLE 1 Demographic information of the sample.

Characteristic	SFSC		EOSC		Representative of national statistics
	N	%	N	%	%
Gender					
Male	339	49.1	232	49.0	IT 49%, FR 48%, GR 49%
Female	351	50.9	241	51.0	IT 51%, FR 52%, GR 51%
Age (in years)					
18–24	94	13.6	80	16.9	IT: 10%, FR: 14%, GR: 11%
25–54	334	48.4	244	51.6	IT: 48%, FR: 45%, GR: 47%
55–64	167	24.2	92	19.5	IT: 16%, FR: 15%, GR: 16%
Over 65	95	13.8	57	12.1	IT: 26%, FR: 25%, GR: 27%
Education					
Primary school	15	2.2	12	2.5	IT: 37%, FR: 18%, GR: 22%
Secondary or college	387	56.1	263	55.6	IT: 43%, FR: 42%, GR: 44%
Higher education	288	41.7	198	41.9	IT: 20%, FR: 41%, GR: 35%
Country					
Italy	245	35.5	137	29.0	
France	220	31.9	192	40.6	
Greece	225	32.6	144	30.4	
Total	690		473		

respondents were between the ages of 25 and 54. A large percentage of respondents had at least a secondary education degree and more than 40 percent had a high level of education. In the SFSCs, the sample is almost evenly distributed across the three countries, while in the EOSC, France has more respondents than Italy and Greece. As already mentioned, age, education level and country were considered as control variables.¹

2.4 Research methodology

This study utilized a two-step approach to examine consumer preferences and WTP for eco-labelled FV. The methodology involved the following steps:

Step 1: ANOVA for differences between supply chains:

To determine whether an integrated model or two separate models are more suitable for SFSCs and EOSCs, one-way analysis of variance (ANOVA) tests were conducted. These tests assessed differences in three variables: interest in the information on the

¹ The supplementary material for this article can be found online at <https://amsacta.unibo.it/id/eprint/7696/>.

label, environmental concern, and positive attitudes and trust in certifications. Two approaches were employed: the first analyzed each variable individually, while the second combined all variables into a composite score for analysis.

Step 2: PLS-SEM to estimate relationships:

In order to evaluate factors affecting consumer preferences and their WTP for eco-labelled FV, Partial Least Square Structural Equation Modelling (PLS-SEM) and SmartPLS software (version 4.0.9.5) were used. This method is widely used in studies investigating preferences and attitudes as it is flexible in terms of sample size, data distribution requirements and compatible with different data scales (Ringle et al., 2023; Shela et al., 2023; Si et al., 2023).

Assessing the reliability and validity of the measurement model is a fundamental step before evaluating the structural model. Reflective scales are used to assess the measurement model based on the relationship between indicators and latent constructs (Shela et al., 2023). To this end, the internal reliability of the model, which is assessed using indicator or factor loadings, was examined. According to Hair et al. (2021), the threshold for the elimination of factor loadings is between 0.4 (lowest acceptable value) and 0.7 (indicating a strong relationship). However, any elimination within this range should be approached with caution to improve internal consistency reliability or convergent validity (Hair et al., 2021). The measure of average variance extracted (AVE) was used for the validity of the constructs, and Cronbach's alpha and composite reliability (CR) were used to examine the reliability of internal consistency (Hair et al., 2021). Based on the relevant literature discriminant validity was determined by heterotrait–monotrait ratio (HTMT), which is recognized as the better criterion (Hair et al., 2021).

The structural model was evaluated using the coefficient of determination (R^2) and predictive relevance (Q^2) (Suphasomboon and Vassanadumrongdee, 2022), standardized root mean square residual (SRMR) (Henseler et al., 2016) and normed fit index (NFI) (Hair et al., 2021). The effects of the studied variables, interest in information, environmental concerns, and positive attitude towards and trust in current certifications on consumers' WTP for certified FV were assessed.

3 Results

The results of the one-way ANOVA tests, presented in Table 2, highlight significant differences between SFSCs and EOSCs regarding interest in label information, environmental concern, and trust in certifications, both individually and as a composite score (Hypothesis 1).

TABLE 2 Results of ANOVA tests comparing variables by supply chain type (SFSC vs. EOSC).

Variable	<i>F</i>	<i>P</i> -value
Interest in the information	40.588	0.000
Environmental concern	6.751	0.009
Positive attitude and trust in certifications	13.194	0.000

As shown, significant differences were found between SFSCs and EOSCs for all three variables (Figures 1, 2). Specifically, interest in the information on the label exhibited the largest difference, with an *F*-value of 40.588 ($p < 0.001$), indicating a strong distinction in how consumers perceive and value information in the two supply chain contexts. Similarly, positive attitudes and trust in certifications showed a notable difference, with an *F*-value of 13.194 ($p < 0.001$). Finally, environmental concern also differed significantly between the two supply chains, though to a lesser extent, with an *F*-value of 6.751 ($p = 0.009$). These results confirm that consumer attitudes and concerns vary meaningfully depending on the supply chain type. Given the observed differences, two separate models were estimated for SFSCs and EOSCs to more accurately capture the unique dynamics within each supply chain context.

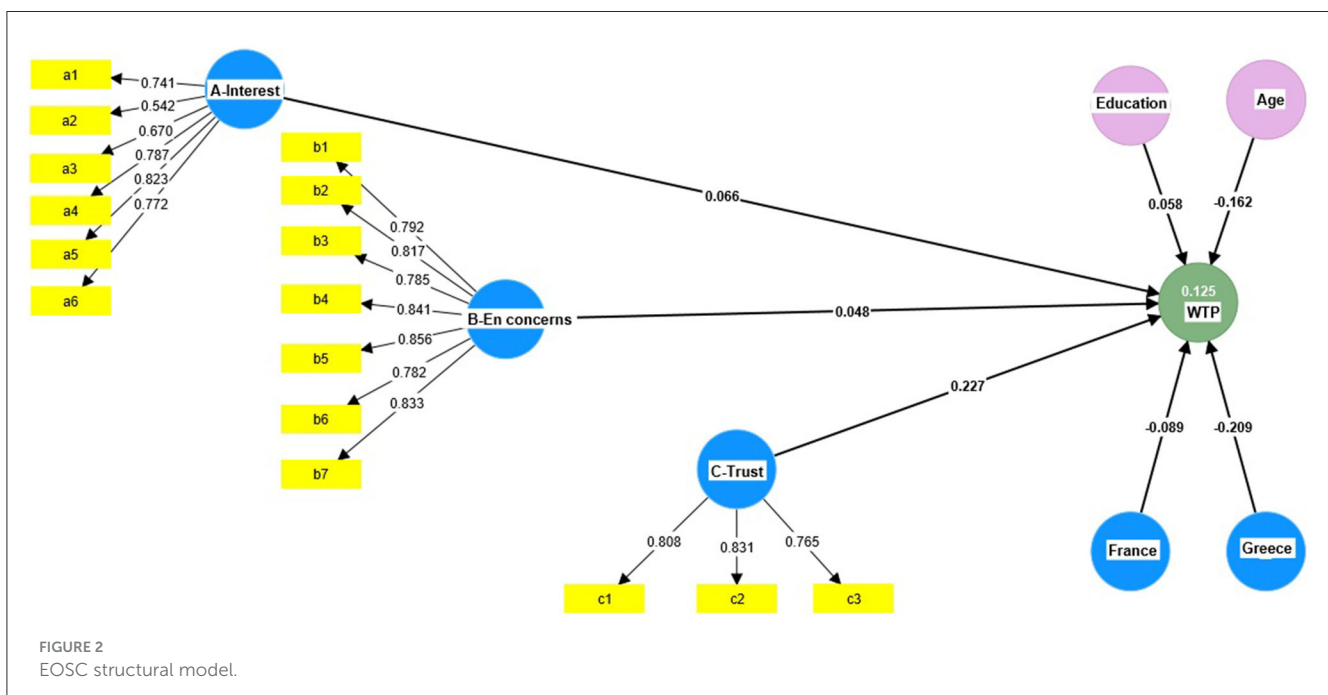
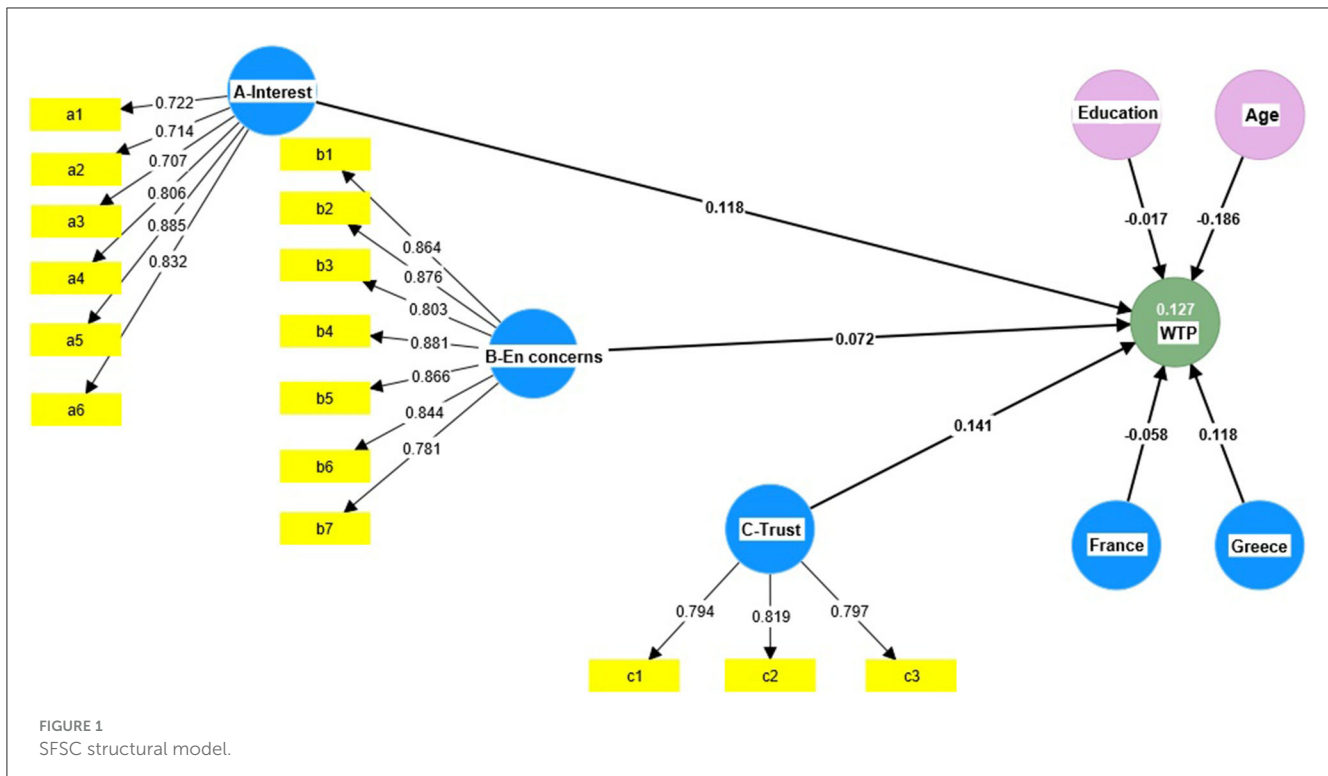
The results of the measurement models for both SFSCs and EOSCs are summarized in Table 3, including the observed and latent variables, factor loadings (λ), Cronbach's alpha (CA), composite reliability (CR), and average variance extracted (AVE).

All factor loadings exceed the recommended threshold of 0.50 (Hair et al., 2021), indicating adequate indicator reliability. The AVE values for each construct meet the minimum threshold of 0.50, confirming convergent validity for both SFSC and EOSC models. Internal consistency is also confirmed as CA and CR values fall within the acceptable range of 0.60 to 0.95 (Hair et al., 2021). These findings demonstrate that both supply chain measurement models are reliable and valid, providing a strong foundation for further analysis.

Discriminant validity was confirmed using the heterotrait–monotrait (HTMT) ratio, which remained below the recommended threshold of 0.90 for all constructs (Hair et al., 2021). These findings confirm that all constructs are distinct and valid in both models.

Following the determination of the appropriate measurement models, the structural models were subsequently estimated. The metrics R^2 and Q^2 were used to determine the explanatory power of the models. For both models, R^2 was given as 0.13 and Q^2 as 0.09 and 0.08 in SFSC and EOSC, respectively. As the Q^2 values of the WTP were greater than zero, the model's predictive relevance is confirmed (Suphasomboon and Vassanadumrongdee, 2022). The SRMR values of 0.06 for both models fall below the recommended threshold of 0.08, indicating a good fit between the models and the observed data (Henseler et al., 2016). Additionally, the NFI values of 0.81 for the SFSC model and 0.86 for the EOSC model, while below the conventional cutoff of 0.90, suggest an acceptable level of model fit (Hair et al., 2021).

The results of the PLS-SEM analysis of the final structural model including the control variables and hypotheses tests are presented in Tables 4, 5. The SEM model for SFSCs indicates that consumer WTP for eco-labeled FV is significantly influenced by trust in certifications, as evidenced by the positive and statistically significant coefficient ($\beta = 0.227$, $p = 0.01$). Additionally, interest in label information has a positive effect ($\beta = 0.066$), though it is marginally significant ($p = 0.06$). These findings support the hypothesis that trust in certifications and interest in label information positively influence consumers' WTP for eco-labelled FV in SFSCs (Hypothesis 2).



For EOSCs, the results demonstrate that both environmental concerns regarding FV production and interest in label information positively impact consumers' WTP. Specifically, environmental concern in production has a positive and statistically significant effect ($\beta = 0.072$, $p = 0.05$), while interest in label information shows a stronger influence ($\beta = 0.118$, $p = 0.02$). These findings align with the hypothesis that WTP for eco-labelled FV in EOSCs is driven by consumer environmental concerns and their interest in label information (Hypothesis 3). Additionally, positive attitude

and trust in certifications also has a significant positive influence ($\beta = 0.141$, $p = 0.01$), suggesting that given the more distant nature of EOSCs compared to SFSCs, trust in certification systems influences consumer WTP. This highlights the importance of credible and transparent certification schemes in reinforcing consumer confidence in eco-labelled FV in export-oriented markets.

Among the control variables, age has a negative influence on consumer preferences for certified FV in both supply chains ($\beta = -0.162$, $p = 0.01$ for SFSC and $\beta = -0.186$, $p = 0.01$ for

TABLE 3 Results of factor loadings, reliability and validity of final constructs for SFSC and EOSC.

	Scales and items	SFSC				EOSC			
		λ	CA	CR	AVE	λ	CA	CR	AVE
A	Interest in information on the label		0.82	0.87	0.53		0.87	0.90	0.61
a ₁	Nutritional content information	0.74				0.72			
a ₂	Geographical origin information	0.54				0.71			
a ₃	Shelf-life information	0.67				0.71			
a ₄	Presence of organic certification	0.79				0.81			
a ₅	Presence of eco-friendly certification	0.82				0.88			
a ₆	Presence of ethical/social aspects information	0.77				0.83			
B	Environmental concern in production		0.92	0.93	0.66		0.93	0.95	0.72
b ₁	No deforestation or plant diversity loss	0.79				0.86			
b ₂	Natural resources protecting	0.82				0.88			
b ₃	Recyclable packaging	0.78				0.80			
b ₄	Reduced use of energy	0.84				0.88			
b ₅	Low carbon emissions	0.86				0.87			
b ₆	Reduced use of pesticides/fertilizers	0.78				0.84			
b ₇	Using water sparingly	0.83				0.78			
C	Positive attitude and trust in certifications		0.73	0.84	0.64		0.74	0.85	0.65
c ₁	Satisfaction with existing certification	0.81				0.79			
c ₂	Trust in existing certification	0.83				0.82			
c ₃	Feelings about environmental certification	0.76				0.80			

λ , Factor Loading; CA, Cronbach's Alpha; CR, Composite Reliability; AVE, Average Variance Extracted.

EOSC). There is a positive relationship between education level and consumer WTP in the SFSC ($\beta = 0.058$, $p = 0.06$), but there is no significant relationship for the EOSC ($\beta = -0.017$, $p = 0.36$). To distinguish the influence of country on consumer preferences, Italy is considered the reference category. As shown in Table 5, results indicate that while there is no statistically significant difference between Italy and France, consumers in Greece exhibit significantly lower WTP for eco-labelled products in the SFSC model ($\beta = -0.209$, $p = 0.01$). However, in the EOSC model, country-level differences were not statistically significant.

4 Discussion

The results confirm the importance of trust in certifications, interest in label information, and environmental concern as key drivers of consumer WTP for eco-labelled FV. Positive attitude and trust in certifications stand out as the most significant factors, reinforcing the value of transparent and credible certification schemes. Specifically, trust in existing certification systems and satisfaction with these systems are particularly influential. Their effects differ between SFSCs and EOSCs (Hypothesis 1).

In SFSCs (Hypothesis 2), where consumers often interact directly with producers, trust in certifications is inherently built through transparency and personal relationships, reducing reliance on formal certifications. Conversely, in EOSCs (Hypothesis

3), characterized by industrialized and impersonal production processes, trust and satisfaction with certifications play a critical role in bridging the gap between consumers and producers. Specifically, certifications or standards related to food safety, as well as social and environmental aspects of production. This finding aligns with the principles of SFSCs, where closer consumer-producer relationships and enhanced transparency foster greater trust. These results are consistent with Rupprecht et al. (2020) and Dangelico et al. (2021), who highlight the important role of trust in certification systems in shaping consumer purchasing decisions.

Interest in label information and environmental concerns are also significant variables influencing consumer preferences. Among label attributes, the presence of eco-friendly certifications and organic certifications were the most impactful. However, in SFSCs, the inherent trust in local producers and their transparent practices may reduce the need for detailed label information or explicit environmental assurances. This finding builds on Janßen and Langen (2017) and Martini and Menozzi (2021), who emphasize the growing consumer interest in food origin and label details, while showing that trust in the supply chain can substitute for such informational needs in more localized contexts.

Conversely, in EOSCs, where production is more industrialized and impersonal, consumers rely more on labels and certifications to evaluate sustainability attributes, corroborating findings from Martini and Menozzi (2021). The positive impact of environmental concern on WTP for eco-labelled FV supports previous research

TABLE 4 Results of Heterotrait-Monotrait Ratio for SFSC and EOSC.

Heterotrait-Monotrait ratio	SFSC							
	A	B	C	D	E	F	G	H
(A) Interest in information on the label								
(B) Environmental concern in production	0.576							
(C) Positive attitude and trust in certifications	0.678	0.496						
(D) Age	0.113	0.121	0.060					
(E) Education	0.069	0.033	0.080	0.049				
(F) France	0.043	0.032	0.110	0.029	0.134			
(G) Greece	0.080	0.123	0.108	0.079	0.233	0.476		
(H) Willingness to pay	0.234	0.147	0.335	0.171	0.055	0.023	0.058	
Heterotrait-Monotrait ratio	EOSC							
	A	B	C	D	E	F	G	H
(A) Interest in information on the label								
(B) Environmental concern in production	0.496							
(C) Positive attitude and trust in certifications	0.700	0.538						
(D) Age	0.075	0.043	0.119					
(E) Education	0.047	0.018	0.013	0.145				
(F) France	0.080	0.097	0.032	0.082	0.060			
(G) Greece	0.064	0.158	0.044	0.179	0.200	0.547		
(H) Willingness to pay	0.250	0.198	0.288	0.212	0.019	0.089	0.113	

(Galati et al., 2019; Wyss et al., 2022), which links heightened environmental awareness to increased consumer engagement with sustainable products. Key sub-items driving this concern include low carbon emissions and the use of water sparingly. However, the context-dependent variation in this effect underscores the distinct dynamics of SFSCs and EOSCs. In SFSCs, the direct producer-consumer connection appears to decrease the influence of environmental concerns, suggesting that consumers view these systems as inherently sustainable.

A cross-country comparison further reveals key insights. While no significant difference in WTP was observed between Italy and France, consumers in Greece exhibited a significantly lower WTP for eco-labelled FV ($\beta = -0.209$, $p = 0.01$). This suggests that cultural, economic, or institutional differences may shape consumer attitudes and the perceived value of eco-labels. For instance, higher trust in national certification schemes in Italy and France may reinforce consumers' WTP, while Greek consumers might be more skeptical or price-sensitive due to economic conditions or lower exposure to reliable certification mechanisms. These country-specific variations underline the importance of tailoring policy and communication strategies to local contexts to enhance consumer acceptance of eco-labelled products.

The findings also highlight younger consumers exhibit stronger preferences for eco-labelled FV, aligning with previous studies such as Gomes et al. (2023), which suggest that younger demographics are more environmentally conscious and willing to engage with sustainable products. Interestingly, education levels, often considered a determinant of eco-conscious behavior, were

not significant in this study, indicating that trust and perceived credibility may outweigh educational influences in shaping WTP for eco-labelled products. This differs from Vicente et al. (2021), who suggest a positive relationship between education and environmental awareness, emphasizing the unique interplay of trust and supply chain characteristics in this context.

AFSs, particularly SFSCs, offer a compelling framework for addressing environmental and social challenges in the food sector. By emphasizing local engagement, reduced environmental impact, and transparency, SFSCs align with consumer priorities for sustainability. These systems demonstrate their potential to build stronger consumer trust, which is crucial for enhancing the acceptance and success of eco-labelled products. Unlike EOSCs, which often prioritize price and availability, SFSCs provide a model for integrating sustainability into food systems through direct connections and community-oriented practices.

This distinction underscores the value of AFSs in promoting sustainable consumption patterns. SFSCs not only address environmental concerns but also provide consumers with a tangible sense of involvement and trust in the production process. The local dimension of SFSCs ensures a closer alignment between consumer expectations and production practices, reinforcing their role as a cornerstone of sustainable food systems. Conversely, the industrialized nature of EOSCs often limits opportunities for consumer engagement and trust-building, thereby reducing the effectiveness of eco-labels in these systems.

While this study provides valuable insights, some limitations should be noted. First, the data is drawn exclusively from three

TABLE 5 Results of structural equation models.

Variables	SFSC			EOSC		
	β	SD	p-value	β	SD	p-value
Age	−0.162	0.034	0.01	−0.186	0.042	0.01
Education level	0.058	0.036	0.06	−0.017	0.047	0.36
Country: France	−0.089	0.089	0.16	−0.058	0.111	0.30
Greece	−0.209	0.090	0.01	0.118	0.122	0.17
Interest in information on the label	0.066	0.044	0.06	0.118	0.052	0.01
Environmental concern in production	0.048	0.038	0.11	0.072	0.043	0.05
Positive attitude and trust in certifications	0.227	0.037	0.01	0.141	0.046	0.01
R ²		0.13			0.13	
Q ²		0.09			0.08	
SRMR		0.06			0.06	
NFI		0.81			0.86	

β , Coefficient; SD, Standard deviation. Coefficient of determination (R²) and predictive relevance (Q²), standardized root mean square residual (SRMR) and normed fit index (NFI).

Mediterranean countries—Italy, France, and Greece—limiting generalizability to other regions with different cultural, economic, or environmental contexts. Second, the survey relies on self-reported preferences, which may not fully capture actual consumer behaviour in purchasing decisions. Additionally, although the study centers on three main variables—trust in certifications, interest in label information, and environmental concerns—other factors influencing consumer preferences were not considered. Future studies could extend this research by examining a broader geographical scope, employing experimental methods, or analyzing additional relevant variables.

5 Conclusion

This study highlights the critical role of consumer preferences for certifications and labels in informing their decisions about environmentally friendly production practices within SFSCs and EOSCs. Key findings emphasize the importance of interest in label information, environmental concerns, and trust in certifications as the primary drivers of consumer behaviour. Notably, attributes such as eco-friendly certification and organic certifications information on labels significantly influence decision-making, while trust and satisfaction with certifications vary in their impact between SFSCs and EOSCs. In SFSCs, trust is often rooted in direct interactions with producers, whereas in EOSCs, certifications serve as vital assurances of transparency and sustainability. The results suggest that targeted communication strategies and

improved certification systems could enhance consumer trust and satisfaction, ultimately supporting the adoption of sustainable practices in both supply chain models.

Based on the findings, several practical implications emerge for policymakers and industry stakeholders. In SFSCs, where trust is often built through direct interactions, policymakers should support the development of simplified, locally tailored certification schemes that minimize bureaucratic burdens while maintaining credibility. Certification bodies can collaborate with local producers to align eco-labels with consumers' expectations for transparency and sustainability. In EOSCs, where personal trust is less prevalent, industry actors should prioritize credible third-party certifications and ensure that label information is clear, accessible, and comprehensive. Additionally, national authorities and NGOs—particularly in countries like Greece—should invest in consumer education initiatives to enhance awareness and confidence in certification systems. Across both supply chains, targeted marketing strategies emphasizing the environmental and social benefits of eco-labels can further engage younger and environmentally conscious consumers, supporting the broader transition toward sustainable food systems. Finally, cross-country differences in WTP suggest that both public and private actors must avoid “one-size-fits-all” labeling strategies. Instead, certification frameworks and marketing efforts should be adapted to reflect country-specific trust dynamics, economic contexts, and consumer values to maximize the impact of eco-labelling in promoting sustainable food systems.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repository and accession number(s) can be found below: <https://doi.org/10.6092/unibo/amsacta/7696> WP1 T1.3 Consumer Preferences Eco-labels in Short Supply Chains.

Ethics statement

Ethical review and approval were obtained by the Bioethics Committee of the University of Bologna (Protocol no. 0122660 dated 08/05/2023). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. SA: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing

– review & editing. LM: Conceptualization, Formal analysis, Methodology, Supervision, Writing – review & editing. CR: Formal analysis, Methodology, Writing – review & editing. LC: Conceptualization, Data curation, Investigation, Project administration, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor CC declared a past collaboration with the authors SA, LM, and LC.

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