

LE MARQUAGE LASER COMME NOUVELLE TECHNOLOGIE D'ETIQUETAGE BIO : LES PERCEPTIONS ET LE COMPORTEMENT DES CONSOMMATEURS

Olga UNTILOV, Jean PFIFFELMANN

| | |
|--|--|
| <p>Olga UNTILOV</p> <p>Affiliation(s) : Audencia Business School</p> <p>Adresse professionnelle : 4 rue Bisson 44100 Nantes</p> <p>Email professionnel : olga.untilov@audencia.com</p> | <p>Jean PFIFFELMANN</p> <p>Affiliation(s) : EM Strasbourg Business School, Strasbourg University, France – HuManiS (UR 7308)</p> <p>Adresse professionnelle : 61 Avenue de la Forêt-Noire, 67000 Strasbourg</p> <p>Email professionnel : jean.piffelman@em-strasbourg.eu</p> |
|--|--|

LE MARQUAGE LASER COMME NOUVELLE TECHNOLOGIE D'ÉTIQUETAGE BIO : LES PERCEPTIONS ET LE COMPORTEMENT DES CONSOMMATEURS

Résumé : Les autocollants et les emballages sont progressivement remplacés par un marquage laser pour distinguer les produits alimentaires biologiques des conventionnels. L'objectif de cette recherche est de comprendre les perceptions des consommateurs et leur effet sur l'attitude envers le produit, le bien-être espéré et l'intention d'achat. Des données qualitatives et quantitatives ($N = 328$) ont été analysées avec une approche multi-méthodes. Nos résultats montrent que les consommateurs qui perçoivent le marquage laser comme écologique et innovant ont une attitude plus positive envers le produit. Les consommateurs qui perçoivent cette technologie comme dangereuse, enregistrent des scores d'attitude envers le produit inférieurs.

Mots-clés : Technologie de marquage laser; Étiquetage biologique ; Fruits et légumes; Attitude envers le produit ; Bien-être espéré.

LASER MARKING AS NEW TECHNOLOGY IN ORGANIC LABELLING: CONSUMER PERCEPTIONS AND BEHAVIOR

Abstract: Producers and retailers replace plastic stickers and packaging with laser marking to distinguish organic from conventional food products. The goal of this research is to understand consumer perceptions and their effect on product attitude, expected well-being, and purchase intention. Qualitative written perceptions and quantitative data ($N = 328$) were analyzed through a multi-method approach. Our results show that consumers who perceive laser marking as eco-friendly and innovative have a more positive attitude toward the product. Consumers that perceive this technology as unsafe register lower product attitude scores.

Keywords: Laser marking technology; Organic labeling; Fruits and vegetables; Attitude toward the product; Expected well-being

Extended abstract

Nowadays, consumers place a significant accent on the global quality of the products and services they buy, special attention being paid to food products (Xu et al., 2020). High consumer expectations regarding the quality of food products and, more specifically, of the organic ones lead producers and retailers to develop more ingenious product improvement methods (Sumrin et al., 2021). One of the emerging practices is to reduce the packaging for organic fruits and vegetables that are specifically packaged to be distinguished from their non-organic equivalents in general supermarkets. For instance, retailers sell fresh fruits and vegetables labeled as "organic" on their skins using laser-marking technology instead of plastic packaging and stickers indicating the label.

From consumers' point of view, the functional values—health and safety attributes—are the essential motives to buy organic products (Lillywhite et al., 2013). Thus, the technologies applied to organic food products can be controversial because of the potential long-term health risks (Bouwmeester et al., 2009). If the health and safety attributes are violated by the eco-innovations, the purchase of such products and the perceived well-being may be negatively impacted despite the augmented social value (i.e., environmental benefits) of organic products (Ormel, 2002). Well-being represents a crucial variable in this research since individuals produce their own well-being by trying to optimize achievement of universal goals, within the set of resources and constraints they face (Ormel, 2002).

Using the Theory of Consumption Values (Sheth et al., 1991) and the Innovation Resistance Theory (Ram and Sheth, 1989), this study analyzes which values (i.e., functional, social or psychological) are more impacted by the technological processes, and what is the impact on consumers' purchase intention, as well as on consumers' expected well-being.

We used a bottom-up methodology to generate and explore the positive and negative consumer perceptions generated through an open question ("In your opinion, what are the advantages and disadvantages of laser marking technology for fresh fruits and vegetables to indicate their organic labeling?") about laser marking technology. To explore the quantitative variables generated by the qualitative analysis in combination with the measurement scales used in the questionnaire, the datasets were analyzed using PLS SEM.

In the qualitative analysis, the themes generated related to positive consumer perceptions about laser marking technology for fresh fruits and vegetables to indicate their organic labeling are "Eco-friendly" and "Innovative". Alternately, the themes related to negative consumers' perceptions are "Damaged", "Unsafe", "Unuseful", "Non-nutritive", and "Unappealing". The quantitative analysis shows that eco-friendly and innovative have a positive and significant effect on the attitude toward the product. However, unsafe exerts a negative and significant impact on the attitude toward the product. The findings also reveal that the total indirect effects between eco-friendly, innovative and unsafe are significant on both determined variables: purchase intention and expected well-being.

Our findings highlight that consumers have positive and negative perceptions of laser marking technology. Therefore, retailers could use our insights on consumer perceptions to communicate the positive effects of this technology and phase out the false-negative perceptions about this technology. For instance, they could raise consumers' awareness by highlighting the positive effect on the environment by removing packaging. They could also emphasize the positive impact of this label that offers more visibility, legibility, and tractability.

LASER MARKING AS NEW TECHNOLOGY IN ORGANIC LABELLING: CONSUMER PERCEPTIONS AND BEHAVIOR

Introduction

Nowadays, consumers place a significant accent on the global quality of the products and services they buy, special attention being paid to food products (Xu et al., 2020). High consumer expectations regarding the quality of food products and, more specifically, of the organic ones lead producers and retailers to develop more ingenious product improvement methods (Sumrin et al., 2021). In that respect, retailers are looking for innovative environmental, social, and economic responsibility practices (Welch et al., 2021). One of the emerging practices is to reduce the packaging for organic fruits and vegetables that are specifically packaged to be distinguished from their non-organic equivalents in general supermarkets. For instance, retailers sell fresh fruits and vegetables labeled as "organic" on their skins using laser-marking technology instead of plastic packaging and stickers indicating the label. This laser marking involves removing a thin layer of the skin of the fruit or vegetable using a light beam to affix the organic label. This practice is also referred to as "tattooed" labeling and represents a new eco-innovation¹.

Nonetheless, innovations related to food products often meet various forms of consumer resistance (Gonzalez-Arcos et al., 2021; Scheurenbrand et al., 2018). In recent years, a feeling of discomfort, anxiety, doubt, and even fear regarding food and its consumption drives numerous individuals (Bertrandias et al., 2021; Poulain, 2002). This feeling is constantly growing even though food security has reached an unprecedented level. Some researchers believe that the origin of this new form of fear is due to a perceived violation of the natural order of the alimentary process (Merdji, 2006; Sans et al., 2008). There is a significant gap between the sophistication of the industrial production processes and the mental representation consumers have about these food products. Thus, the food product may acquire a social symbolism that is very different from the initial meaning of the food. Consumers develop strong psychological barriers in the acceptance of such products (Kushwah et al., 2019). These barriers arise when the experience conflicts with the existing values and belief system of consumers (Ram and Sheth, 1989), thus creating a cognitive dissonance (Oshikawa, 1969). The objective of producers and retailers is then to phase out the cognitive dissonance.

From consumers' point of view, the functional values—health and safety attributes—are the essential motives to buy organic products (Lillywhite et al., 2013). Thus, the technologies applied to organic food products can be controversial because of the potential long-term health risks (Bouwmeester et al., 2009). If the health and safety attributes are violated by the eco-innovations, the purchase of such products and the perceived well-being may be negatively impacted despite the augmented social value (i.e., environmental benefits) of organic products (Ormel, 2002).

In a context where companies are innovating more and more to face the challenges of sustainable development, this research aims to shed some light on consumers' perceptions about these eco-innovations. Using the Theory of Consumption Values (Sheth et al., 1991) and the Innovation Resistance Theory (Ram and Sheth, 1989), this study analyzes which values (i.e., functional, social or psychological) are more impacted by the technological processes, and what is the impact on consumers' purchase intention, as well as on consumers' expected well-being. Answering these questions is crucial for future risk communication initiatives. A list of

¹ <https://www.jebosseengrandedistribution.fr/2021/02/04/le-tatouage-comestible-linitiative-pour-supprimer-le-plastique-des-rayons-fruits-et-legumes-bio/>

managerial implications will be provided in order to help producers and retailers to overcome the negative perceptions consumers may have about eco-innovations.

Literature review and research questions

This research aims at analyzing consumer perceptions about eco-innovations, and more precisely the perceptions consumers hold about laser marking of organic fruits and vegetables. Moreover, effect of these perceptions on product attitude, purchase intention and expected well-being will be measured. Thus, three major theories serve as a framework to build the core of the literature review: the Theory of Consumption Values (Sheth et al., 1991), the Innovation Resistance Theory (Ram and Sheth, 1989) and Social Production Function Theory (Ormel, 2002).

Consumers associate organic labels with better health and taste characteristics (Hughner et al., 2007; Lodorfos and Dennis, 2008). Moreover, health characteristics represent a primary consumption motive even if there is no proof that organic products are healthier than products without a label (Zanoli and Naspetti, 2002). Organic products are associated with fewer chemicals and non-GMO components (Xie et al., 2015) Thus, they are also perceived as safer (Hughner et al., 2007). According to the Theory of Consumption Values (Kushwah et al., 2019), these product-centric attributes correspond to the functional value. Other important motives that drive organic products purchase are related to social value (Ditlevsen et al., 2019). Social value in an organic food context is associated with consumers' self-image and utilitarian motives such as environmental protection (Sweeney and Soutar, 2001). Merle et al. (2016) term functional values as "benefits for oneself" while the environmental quality is designated as "benefits for others".

Similarly, Innovation Resistance Theory (Ram and Sheth, 1989) suggests that there are two categories of barriers to innovation acceptance: functional barriers and psychological barriers. Functional barriers correspond to different risks related to the adoption of new products (especially the risk to be fooled), while psychological barriers arise due to conflict between existing consumer beliefs and new products (Sheth et al., 1991). A technological manipulation on organic products can create consumers confusion and thus distort the image they have about organic certification (Misra and Singh, 2016).

Taking into account these two theoretical frameworks and the fact that eco-innovations can lead to positive and negative perceptions, thus motivating and discouraging consumers from adopting them, our first research question is:

RQ1: What are the positive and negative consumer perceptions toward laser marking technology for fresh fruits and vegetables to indicate their organic labeling?

The second step is to analyze the impact of these perceptions on behavioral variables in line with the Theory of Reasoned Action (Fishbein and Ajzen, 1975). Thus, our second research question is formulated as follows:

RQ2: What are the perceptions influencing consumers' attitude toward the product?

Besides the classical dependent variables used in consumer-behavior research and in line with the Theory of Reasoned Action (Fishbein and Ajzen, 1975) – attitude and purchase intention – this study aims at analyzing the effect of eco-innovation perceptions on consumers' well-being. According to the Social Production Theory (Ormel, 2002), individuals produce their own well-being by trying to optimize achievement of universal goals, within the set of resources and constraints they face. Thereby, the purchase of laser marked organic products represents an act of behavioral confirmation that leads to well-being, while the perceived

healthfulness of the product is a constraint to achieve their universal goal. Hypotheses related to the second research question are formulated as follows:

- H1:** The intention to purchase laser-marked products is positively impacted by the attitude toward these products.
- H2:** The expected well-being related to the purchase of laser-marked products is positively impacted by the attitude toward these products.
- H3:** The relationships between consumer perceptions about laser-marked products and the expected well-being and purchase intention are mediated by the attitude toward these products.

Figure 1 Appendix A illustrates the conceptual model of this research.

Research methodology

Participants. We recruited participants ($N = 328$) in France through Bilendi services to participate in the online study in exchange for "Maximiles" points that they can accumulate and use to obtain gifts. The respondents ranged in age from 18 to 85 (53% women; $M_{\text{age}} = 45.78$ years; $SD_{\text{age}} = 15.57$). We tried to reproduce the distribution in the French population according to INSEE estimates as of January 1, 2021 (18-34 = 23.8%; 35-54 = 39.3%; 55+ = 36.9%). In our sample, 17.1% of participants have one or more tattoos on their body, 76.5% buy fruits and vegetables at least four times per month, and 34.1% are couples with children. In addition, 48.6% of fruits and vegetables our sample buys, are organic. Appendix B provides a more detailed sample description.

Study design. We first assessed participants' personality traits using measurement scales. We measured environmental concern with five items borrowed from Thøgersen et al. (2019) ($\alpha = .91$). Health concern was assessed with two items borrowed from Thøgersen et al. (2019) ($\alpha = .91$). We also measured food neophobia with four items of the food neophobia scale proposed by Pliner and Hobden (1992) ($\alpha = .81$). In a second time, we educated participants about the "tattooed" organic labeling with a description and an image (see Appendix C). Then, we asked an open-ended question: "In your opinion, what are the advantages and disadvantages of laser marking technology for fresh fruits and vegetables to indicate their organic labeling?". Finally, we measured the purchase intention using two items ($\alpha = .94$), well-being with the five-item scale from Diener et al., (1985) ($\alpha = .94$), and the attitude toward the product with the four-item scale from Holbrook and Batra (1987) ($\alpha = .88$). We measured all constructs with 7-point Likert scales or semantic differentials (see Appendix D).

Method of analysis. We used a bottom-up methodology to generate and explore the positive and negative consumer perceptions about laser marking technology for fresh fruits and vegetables to indicate their organic labeling. To analyze the qualitative texts generated through the open question, we used the contextual text coding (CTC) method, which is a mixed-methods approach to large-scale qualitative data analysis (Lichtenstein and Rucks-Ahidiana, 2021). According to the authors, the CTC method is useful for complex text analysis. Textual data are characterized by context-specific meanings and a lack of consistent terminology. Lichtenstein and Rucks-Ahidiana (2021) argued that the method provides an alternative to current approaches to analyzing large textual data sets. Computational text analysis and hand coding do not capture both the qualitative and quantitative analytical potential of large-scale textual data sets. The method is built on hand coding techniques and systematic sampling methods.

First, we developed and tested a codebook, namely we composed a list of substantive content codes with definitions based on prior knowledge of the literature and reading of

verbatim. Second, we tested the codes on data sources and revised, cut, and added new codes. During the process, we both added new inductive codes and revised the deductive codes. Indeed, when codes appear so broad that they apply very frequently, they might overstate the phenomenon of study (Lichtenstein and Rucks-Ahidiana, 2021). Therefore, we added subcodes to capture the range of ways that code applies to the data. Alternately, when codes were never used, we dropped or redefined these codes. Third, we conducted the coding of the corpus of data. The code was applied to indicate the presence or absence of a perception with a 1 for present and a 0 for absent, resulting in quantitative variables reflecting major positive and negative consumer perceptions. Finally, we tracked the trends along this process and when changes were made, we revised all prior coding before continuing further.

To explore the quantitative variables generated by the qualitative analysis in combination with the measurement scales used in the questionnaire, the datasets were analyzed using PLS SEM. PLS SEM with SmartPLS 3 was used to estimate the measurement and structural models (Hair et al., 2019). Partial-Least-Squares (PLS) technique was selected for analyzing the various paths and hypotheses since PLS is a nonparametric-multivariate-approach. It neither presumes normality of data nor does it need large sample-sizes unlike other causal-modelling methods (Arnett et al., 2003). The strength of PLS lies in the vigor of the PLS technique in overcoming shortcomings like skewness and multi-collinearity among the factors. Additionally, it is also particularly promising when complex models with many constructs are involved (Hair et al., 2017).

Measurement proprieties. All indicator loadings on their corresponding constructs are higher than .7 (Appendix E), and CR and AVE of all the constructs are higher than .7 and .5 respectively. Also, the SRMR value (.048) of the composite factor model is under .08, which shows goodness of fit between observed and expected correlations (Henseler et al., 2014). Discriminant validity is established since all HTMT criteria are below .85 (Appendix F). Therefore, the measurement model possesses clear evidence of reliability, convergent validity, and discriminant validity.

Results

In the qualitative analysis, the themes generated related to positive consumers' perceptions about laser marking technology for fresh fruits and vegetables to indicate their organic labeling are "Eco-friendly" and "Innovative". Alternately, the themes related to negative consumers' perceptions are "Damaged", "Unsafe", "Unuseful", "Non-nutritive", and "Unappealing". Appendix G presents the codebook with the final classification of the codes, their description, and the percentage of occurrence of the codes among participants.

In regards to our second research question and the quantitative analysis, the hypotheses were tested using 10,000 bootstrap samples. The results show that eco-friendly ($t = 6.128$, $\gamma = .284$, $p < .001$, CI [.190; .371]) and innovative ($t = 2.272$, $\gamma = .120$, $p < .05$, CI [.016; .221]) have a positive and significant effect on the attitude toward the product. However, unsafe ($t = 3.405$, $\gamma = -.167$, $p < .001$, CI [-.265; -.072]) exerts a negative and significant impact on the attitude toward the product. Damaged ($p = .258$), unuseful ($p = .834$), non-nutritive ($p = .443$), and unappealing ($p = .204$) do not exert effects on the attitude toward the product. The attitude toward the product exerts, in turn, a positive influence on consumers' expected well-being ($t = 31.870$, $\gamma = .761$, $p < .001$, CI [.712; .806]) and purchase intention ($t = 22.655$, $\gamma = .741$, $p < .001$, CI [.674; .802]), in line with H1 and H2.

The findings also reveal that the total indirect effects between eco-friendly ($t = 5.807$, $\gamma = .216$, $p < .001$, CI [.142; .287]), innovative ($t = 2.253$, $\gamma = .091$, $p < .05$, CI [.012; .170]), and unsafe ($t = 3.340$, $\gamma = -.127$, $p < .001$, CI [-.205; -.054]) on well-being are significant. Besides,

the indirect effects between eco-friendly ($t = 5.621, \gamma = .210, p < .001, CI [.137; .282]$), innovative ($t = 2.220, \gamma = .089, p < .001, CI [.011; .168]$), and unsafe ($t = 3.335, \gamma = -.124, p < .001, CI [-.199; -.053]$) on purchase intention are significant. The product of the coefficients using the bootstrapping sampling method (Nitzl et al., 2016) demonstrates the significant mediating of the attitude toward the product for both dependant variables. H3 is accepted.

Finally, the control variables related to consumers' personality traits have a significant influence in the model. More specifically, while environmental concern ($t = 2.399, \gamma = .138, p < .05, CI [.034; .260]$) and health concern ($t = 3.894, \gamma = .231, p < .001, CI [.111; .346]$) positively impact the attitude toward the product, food neophobia exerts a negative influence on the attitude toward the product ($t = 2.660, \gamma = -.162, p < .01, CI [-.274; -.064]$). Having a tattoo, however, does not influence the attitude toward the product ($p = .429$).

Conclusion

Theoretical contributions. This research shows that positive and negative perceptions emerge in the case of laser marking for organic product. These findings align with the Theory of Consumption Values (Sheth et al., 1991) and Innovation Resistance Theory (Ram and Sheth, 1989), which state that motives and barriers shape the consumption and purchase of organic products. While the positive perceptions, "eco-friendly" and "innovative", represent aspects related to the social value or "benefits for others" of organic consumption, the negative perception, "unsafe", is related to both, functional and psychological values (Kushwah et al., 2019). This research provides a framework with the association between motives, barriers, and the dependent variables such as product attitude, purchase intention, and consumers' expected well-being. In the existing literature, well-being is frequently related to self-image, and individuals with the highest perceived well-being scores are those who adopt the most environmentally friendly behaviors (Jacob et al., 2009). This research shows that functional values – the perceived risk of consumption – also impact expected well-being, and the attitude toward the product mediates this relationship.

Managerial implications. Our findings highlight that consumers have positive and negative perceptions of laser marking technology. Therefore, retailers could use our insights on consumer perceptions to communicate the positive effects of this technology and phase out the false-negative perceptions about this technology. For instance, they could raise consumers' awareness by highlighting the positive effect on the environment by removing packaging. They could also emphasize the positive impact of this label that offers more visibility, legibility, and tractability. Alternately, the other levers of cognitive dissonance reduction are the fact that this technology does not affect the taste, perishability period, and, most importantly, the safety of the products. To do so, retailers can use, salespeople or advertising at the point of sale, namely all advertising communication materials used to draw consumers' attention at the moment of purchase, such as merchandise displays or in-store advertising.

Limitations and avenues for future research. This research has several limitations. First, in the qualitative analysis, only the dominant themes were considered in case of overlapping themes. Researchers can consider all the themes or undertake other methods to avoid this in the future. Second, we asked participants about the advantages and disadvantages of laser marking technology for fresh fruits and vegetables to indicate their organic quality. However, we mentioned the term "tattooed" in the laser marking technology description before asking them the open-ended question. The term "tattoo" may potentially mislead participants regarding the functioning of this technology. Third, fruits or vegetables do not have the same skin sensitivity, and we did not measure the perceived shelf life. Therefore, another experiment could compare fruits and vegetables with non-sensitive skins vs. sensitive skins.

References

- Arnett DB, Laverie DA and Meiers A (2003) Developing parsimonious retailer equity indexes using partial least squares analysis: a method and applications. *Journal of Retailing* 79(3): 161–170. DOI: 10.1016/S0022-4359(03)00036-8.
- Bertrandias L, Cazes-Valette G and Gurviez P (2021) How Concern for Animal Welfare Impact Meat Consumption? *Decisions Marketing* 103(3): 229–250.
- Bouwmeester H, Dekkers S, Noordam MY, et al. (2009) Review of health safety aspects of nanotechnologies in food production. *Regulatory Toxicology and Pharmacology* 53(1): 52–62. DOI: 10.1016/j.yrtph.2008.10.008.
- Diener E, Emmons RA, Larsen RJ, et al. (1985) The Satisfaction With Life Scale. *Journal of Personality Assessment* 49(1). Taylor & Francis Ltd: 71. DOI: 10.1207/s15327752jpa4901_13.
- Ditlevsen K, Sandøe P and Lassen J (2019) Healthy food is nutritious, but organic food is healthy because it is pure: The negotiation of healthy food choices by Danish consumers of organic food. *Food Quality and Preference* 71. Elsevier: 46–53.
- Fishbein M and Ajzen I (1975) *Belief, attitude, intention, and behaviour* Addison-Wesley. Reading, MA 1: 975.
- Gonzalez-Arcos C, Joubert AM, Scaraboto D, et al. (2021) “How Do I Carry All This Now?” Understanding Consumer Resistance to Sustainability Interventions. *Journal of Marketing* 85(3): 44–61. DOI: 10.1177/0022242921992052.
- Hair JF, Sarstedt M, Ringle CM, et al. (2017) *Advanced Issues in Partial Least Squares Structural Equation Modeling*. saGe publications.
- Hair JF, Risher JJ, Sarstedt M, et al. (2019) When to use and how to report the results of PLS-SEM. *European Business Review* 31(1). Emerald Publishing Limited: 2–24. DOI: 10.1108/EBR-11-2018-0203.
- Henseler J, Dijkstra TK, Sarstedt M, et al. (2014) Common Beliefs and Reality About PLS: Comments on Rönkkö and Evermann (2013). *Organizational Research Methods* 17(2). SAGE Publications Inc: 182–209. DOI: 10.1177/1094428114526928.
- Holbrook M and Batra R (1987) Assessing the Role of Emotions as Mediators of Consumer Responses to Advertising. *Journal of Consumer Research* 14: 404–20. DOI: 10.1086/209123.
- Hughner RS, McDonagh P, Prothero A, et al. (2007) Who are organic food consumers? A compilation and review of why people purchase organic food. *Journal of consumer behaviour* 6(2–3): 94–110.
- Jacob J, Jovic E and Brinkerhoff MB (2009) Personal and Planetary Well-being: Mindfulness Meditation, Pro-environmental Behavior and Personal Quality of Life in a Survey from the Social Justice and Ecological Sustainability Movement. *Social Indicators Research* 93(2): 275–294. DOI: 10.1007/s11205-008-9308-6.
- Kushwah S, Dhir A, Sagar M, et al. (2019) Determinants of organic food consumption. A systematic literature review on motives and barriers. *Appetite* 143. Elsevier Ltd. DOI: 10.1016/j.appet.2019.104402.

Lichtenstein M and Rucks-Ahidiana Z (2021) Contextual Text Coding: A Mixed-methods Approach for Large-scale Textual Data. *Sociological Methods & Research*. SAGE Publications Inc: 0049124120986191. DOI: 10.1177/0049124120986191.

Lodorfos GN and Dennis J (2008) Consumers' intent: in the organic food market. *Journal of Food Products Marketing* 14(2): 17–38.

Merdji, M (2006) L'imaginaire du dégoût : une approche anthropologique de l'univers émotionnel de l'alimentation. In M Kalika et P Romelaer (éd.) *Recherches en Management et Organisation*. Paris: Economica, 179–194.

Merle A, Herault-Fournier C and Werle CO (2016) The effects of indication of local geographical origin on food perceptions. *Recherche et Applications en Marketing (English Edition)* 31(1): 26–42.

Misra R and Singh D (2016) An analysis of factors affecting growth of organic food: Perception of consumers in Delhi-NCR (India). *British Food Journal* 118(9). Emerald Group Publishing Limited: 2308–2325. DOI: 10.1108/BFJ-02-2016-0080.

Nitzl C, Roldan JL and Cepeda G (2016) Mediation analysis in partial least squares path modeling: Helping researchers discuss more sophisticated models. *Industrial Management & Data Systems* 116(9). Emerald Group Publishing Limited: 1849–1864. DOI: 10.1108/IMDS-07-2015-0302.

Ormel J (2002) Social production function (SPF) theory as an heuristic for understanding developmental trajectories and outcomes. In: Caspi A and Pulkkinen L (eds) *Paths to Successful Development: Personality in the Life Course*. Cambridge: Cambridge University Press, pp. 353–379. DOI: 10.1017/CBO9780511489761.015.

Oshikawa S (1969) Can Cognitive Dissonance Theory Explain Consumer Behavior? *Journal of Marketing* 33(4). SAGE Publications Inc: 44–49. DOI: 10.1177/002224296903300408.

Pliner P and Hobden K (1992) Development of a scale to measure the trait of food neophobia in humans. *Appetite* 19(2). Elsevier: 105–120.

Poulain JP (2002) The contemporary diet in France: “de-structuration” or from commensalism to “vagabond feeding”. *Appetite* 39(1): 43–55. DOI: 10.1006/appe.2001.0461.

Ram S and Sheth JN (1989) Consumer Resistance to Innovations: The Marketing Problem and its solutions. *Journal of Consumer Marketing* 6(2): 5–14. DOI: 10.1108/EUM000000002542.

Sans P, De Fontguyon G and Giraud G (2008) Value-based labels for fresh beef: an overview of French consumer behaviour in a BSE crises context. *International Journal of Consumer Studies* 32(5): 407–413. DOI: 10.1111/j.1470-6431.2008.00708.x.

Scheurenbrand K, Parsons E, Cappellini B, et al. (2018) Cycling into Headwinds: Analyzing Practices That Inhibit Sustainability. *Journal of Public Policy & Marketing* 37(2). SAGE Publications Inc: 227–244. DOI: 10.1177/0743915618810440.

Sheth JN, Newman BI and Gross BL (1991) Why we buy what we buy: A theory of consumption values. *Journal of Business Research* 22(2): 159–170. DOI: 10.1016/0148-2963(91)90050-8.

Sumrin S, Gupta S, Asaad Y, et al. (2021) Eco-innovation for environment and waste prevention. *Journal of Business Research* 122: 627–639. DOI: 10.1016/j.jbusres.2020.08.001.

Sweeney JC and Soutar GN (2001) Consumer perceived value: The development of a multiple item scale. *Journal of retailing* 77(2). Elsevier: 203–220.

Thøgersen J, Pedersen S and Aschemann-Witzel J (2019) The impact of organic certification and country of origin on consumer food choice in developed and emerging economies. *Food Quality and Preference* 72: 10–30. DOI: 10.1016/j.foodqual.2018.09.003.

Welch D, Swaffield J and Evans D (2021) Who's responsible for food waste? Consumers, retailers and the food waste discourse coalition in the United Kingdom. *Journal of Consumer Culture* 21(2). SAGE Publications: 236–256. DOI: 10.1177/1469540518773801.

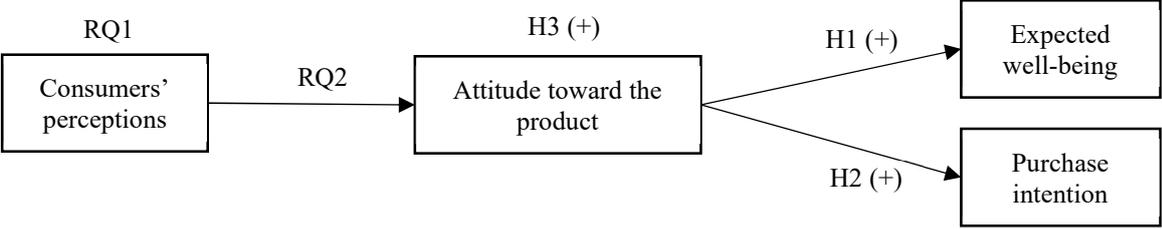
Xie B, Wang L, Yang H, et al. (2015) Consumer perceptions and attitudes of organic food products in Eastern China. *British Food Journal* 117(3): 1105–1121.

Xu L, Yang X and Wu L (2020) Consumers' Willingness to Pay for Imported Milk: Based on Shanghai, China. *International Journal of Environmental Research and Public Health* 17(1). 1. Multidisciplinary Digital Publishing Institute: 244. DOI: 10.3390/ijerph17010244.

Zanoli R and Naspetti S (2002) Consumer motivations in the purchase of organic food: a means-end approach. *British food journal* 104(8): 643–653.

Appendix A: Conceptual model

Figure 1: The conceptual model



Appendix B: Participant's characteristics

| Characteristic | Category | N | % |
|--|----------------------------|----------|----------|
| Age | 18-34 | 78 | 23.8% |
| | 35-54 | 129 | 39.3% |
| | 55 or more | 121 | 36.9% |
| Gender | Women | 174 | 53% |
| | Men | 154 | 47% |
| Tattooed | Yes | 56 | 17.1% |
| | No | 272 | 83.9% |
| Monthly purchase frequency of fruits and vegetables | No purchase | 2 | .6% |
| | Once a month | 14 | 4.3% |
| | Twice per month | 26 | 7.9% |
| | Three times per month | 35 | 10.7% |
| | Four times a month or more | 251 | 76.5% |
| Education level (highest diploma obtained) | No diploma | 9 | 2.7% |
| | Middle school | 11 | 3.4% |
| | Youth Training | 40 | 12.2% |
| | High school | 74 | 22.6% |
| | Higher National Diploma | 54 | 16.5% |
| | Bachelor | 34 | 10.4% |
| | Master's Degree | 71 | 21.6% |
| PhD | 35 | 10.7% | |
| Household composition | Single-person household | 106 | 32.3% |
| | Single-parent family | 22 | 6.7% |
| | Couple without children | 88 | 26.8% |
| | Couple with children | 112 | 34.1% |
| Proportion of organic fruits and vegetables purchased | | 328 | 48.6% |

Appendix C: Education (in French)

Pour continuer ce questionnaire, nous vous présentons une solution d'étiquetage imprimée directement sur les peaux des fruits et légumes issus de l'agriculture biologique. Comme le montre la photographie ci-dessous, il s'agit d'une inscription laser tatouée sur la couche externe de la peau des fruits et légumes bio.

Ce "tatouage" se substitue aux étiquettes autocollantes apposées directement sur certains fruits ou légumes ou à leur emballage pour informer les consommateurs de leur labellisation "bio".



Appendix D: Measurement items and variable sources (in French)

| Construct | Measurement items | Sources |
|------------------------------------|---|---------------------------|
| Environmental concern | <p>Vos habitudes d'achat sont fortement influencées par vos préoccupations pour l'environnement. (EC1)</p> <p>Vous prenez en compte l'impact environnemental potentiel de vos actions lorsque vous prenez la plupart de vos décisions d'achat. (EC2)</p> <p>Vous êtes prêt(e) à être restreint(e) dans vos choix afin de prendre des mesures plus respectueuses de l'environnement. (EC3)</p> <p>Il est important pour vous que les produits que vous utilisez soient respectueux de l'environnement. (EC4)</p> <p>Vous êtes une personne écologiquement responsable. (EC5)</p> | Thøgersen et al. (2019) |
| Health concern | <p>Lors de mes achats, j'essaie de prévenir les problèmes de santé avant de ressentir les symptômes. (HC1)</p> <p>Lors de mes achats, je suis préoccupé(e) par les risques sanitaires et essaie de prendre des mesures pour les éviter. (HC2)</p> | Thøgersen et al. (2019) |
| Food neophobia | <p>Je ne suis pas intéressé(e) par des produits alimentaires différents de ceux que je connais déjà. (FN1)</p> <p>Je n'aime pas les produits alimentaires des autres pays. (FN2)</p> <p>Je mange presque toujours les mêmes choses. (FN3)</p> <p>Je n'essaie pas un produit alimentaire si je ne sais pas ce qu'il contient. (FN4)</p> | Pliner and Hobden, 1992 |
| Purchase intention | <p>Je serais susceptible d'acheter des fruits et légumes bio marqués au laser s'ils étaient disponibles à l'achat. (PI1)</p> <p>J'aurais l'intention d'acheter des fruits et légumes bio marqués au laser s'ils étaient disponibles à l'achat. (PI2)</p> | — |
| Well-being | <p>La pratique de marquage au laser de la labellisation rendrait mon bien-être plus idéal. (WB1)</p> <p>La pratique de marquage au laser de la labellisation améliorerait mon bien-être. (WB2)</p> <p>La pratique de marquage au laser de la labellisation contribuerait à mon bien-être alimentaire. (WB3)</p> <p>La pratique de marquage au laser de la labellisation me donnerait satisfaction. (WB4)</p> <p>La pratique de marquage au laser de la labellisation serait un élément positif pour mon bien-être. (WB5)</p> | Diener et al. (1985) |
| Attitude toward the product | <p>Je n'aime pas ces produits / J'aime ces produits. (AP1)</p> <p>Je réagis défavorablement vis-à-vis de ces produits / Je réagis favorablement vis-à-vis de ces produits. (AP2)</p> <p>J'ai un sentiment négatif à l'égard de ces produits / J'ai un sentiment positif à l'égard de ces produits. (AP3)</p> <p>Ces produits sont mauvais / Ces produits sont bons. (AP4)</p> | Holbrook and Batra (1987) |

Appendix E: Measurement properties (N = 328)

| Constructs | Items | Means (SD) | Standardized loading | Reliability and validity |
|--|--------------|-------------------|-----------------------------|---------------------------------|
| Environmental concern | EC1 | 4.79 (1.45) | .888 | CR = .934 AVE = .740 |
| | EC2 | 4.89 (1.51) | .836 | |
| | EC3 | 5.18 (1.31) | .894 | |
| | EC4 | 5.02 (1.24) | .854 | |
| | EC5 | 5.56 (1.40) | .826 | |
| Health concern | HC1 | 5.14 (1.43) | .957 | CR = .956 AVE = .916 |
| | HC2 | 5.24 (1.42) | .958 | |
| Food neophobia | FN1 | 2.79 (1.63) | .725 | CR = .871 AVE = .629 |
| | FN2 | 3.19 (1.69) | .829 | |
| | FN3 | 3.25 (1.43) | .877 | |
| | FN4 | 3.06 (1.73) | .730 | |
| Purchase intention (R²=63.9%) | PI1 | 4.44 (1.65) | .972 | CR = .971 AVE = .944 |
| | PI2 | 4.62 (1.67) | .971 | |
| Well-being (R²=56.6%) | WB1 | 3.72 (1.62) | .928 | CR = .956 AVE = .812 |
| | WB2 | 3.80 (1.60) | .937 | |
| | WB3 | 4.23 (1.66) | .923 | |
| | WB4 | 3.86 (1.66) | .933 | |
| | WB5 | 4.39 (1.78) | .773 | |
| Attitude toward the product (R²=24.9%) | AP1 | 4.35 (1.92) | .871 | CR = .919 AVE = .741 |
| | AP2 | 4.34 (1.88) | .892 | |
| | AP3 | 4.55 (1.77) | .859 | |
| | AP4 | 4.55 (1.50) | .818 | |

Appendix F: Discriminant validity results (HTMT < .85)

| Constructs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|
| 1. Environmental concern | | | | | | | | | | | | | | |
| 2. Health concern | .445 | | | | | | | | | | | | | |
| 3. Food neophobia | .057 | .153 | | | | | | | | | | | | |
| 4. Having a tattoo | .286 | .195 | .043 | | | | | | | | | | | |
| 5. Eco-friendly | .109 | .187 | .071 | .071 | | | | | | | | | | |
| 6. Innovative | .057 | .033 | .078 | .069 | .064 | | | | | | | | | |
| 7. Damaged | .137 | .127 | .114 | .038 | .071 | .200 | | | | | | | | |
| 8. Unsafe | .143 | .157 | .068 | .057 | .077 | .112 | .072 | | | | | | | |
| 9. Unuseful | .058 | .032 | .133 | .056 | .002 | .049 | .052 | .046 | | | | | | |
| 10. Non-nutritive | .019 | .015 | .108 | .073 | .017 | .065 | .217 | .093 | .046 | | | | | |
| 11. Unappealing | .068 | .037 | .041 | .025 | .118 | .005 | .023 | .037 | .059 | .119 | | | | |
| 12. Attitude toward the product | .253 | .313 | .152 | .059 | .357 | .125 | .029 | .100 | .030 | .034 | .125 | | | |
| 13. Well-being | .307 | .325 | .151 | .046 | .278 | .175 | .012 | .109 | .041 | .044 | .166 | .812 | | |
| 14. Purchase intention | .325 | .308 | .075 | .100 | .368 | .139 | .048 | .084 | .069 | .024 | .111 | .809 | .843 | |

Appendix G: Codebook

| Code/Variable | Description | % |
|----------------------|--|----------|
| Eco-friendly | Consumers believe that the laser-marked organic label has a positive impact on the environment because it uses less plastic, paper, glue, and packing. | 43.0% |
| Innovative | Consumers believe that that the laser-marked organic label is a positive innovative method to label the products in the sense that it offers more visibility, legibility, and traceability. | 25.9% |
| Damaged | Consumers believe that that the laser-marked organic label damages the product in the sense that the conservation period is shorter. | 23.8% |
| Unsafe | Consumers believe that that the laser-marked organic label negatively affects food safety because it uses chemicals or toxic elements. | 19.2% |
| Unuseful | Consumers believe that that the laser-marked organic label is not useful, because it is not so environmentally friendly, because it needs energy, but also the price is high and the legibility remains low. | 13.4% |
| Non-nutritive | Consumers believe that that the laser-marked organic label lowers the taste and nutritional value of the product. | 7.6% |
| Unappealing | Consumers believe that that the laser-marked organic label is not visually pleasant and not appetizing. | 6.1% |