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Sustainable Consumer Behavior and Food Marketing

Edited by
Oliver Meixner, Petra Riefler and Karin Schanes

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About the Editors

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Editorial

Sustainable Consumer Behavior and Food Marketing

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The global food system accounts for emissions amounting up to 18 Gt CO_2 equivalent per year, representing 34% of total GHG emissions [1] and the environmental impact of food consumption is one of the largest of all private consumption areas [2]. It is estimated, that about one-third of households' total environmental impact (including water and energy consumption, water and soil pollution, GHG emissions) is caused by food and drink consumption [3]. Therefore, the environmental impact can be considerably reduced if food consumption patterns change [4]. Enhancing more sustainable eating and drinking practices is a topic of increasing importance, across all stages along the food supply chain [5]. Accordingly, the scientific research on sustainability of food supply chains has grown steadily over the past decade, highlighting the important role of food consumption and production. This Special Issue is covering different aspects related to sustainable food consumption and production and presents 12 quantitative and qualitative contributions mainly focusing on the analysis of consumers' food consumption behavior and supplemented by related topics.

Inducing consumers to purchase eco-friendly food is essential to reduce greenhouse gas emissions. In order to change food consumption habits toward a more environmentally friendly eating pattern, the study of Penz and Hofmann [6] analyzed consumers' motivational and emotional aspects that influence their food purchase behavior. The qualitative, motivational part of the study found that ethical concerns and personal health cautiousness are the main drivers. Consumers reported that the positive emotion joy was caused by the variety and quality of fresh products and by producing and preparing one's own food. The main negative emotions were sadness, shame, and guilt. These emotions were influenced by the environmental externalities of the industries and consumer behavior patterns. Finally, the quantitative part showed significant influences of both negative and positive emotions on the intention and subsequent purchase of carbon-friendly food applying the Theory of Planned Behavior (TPB). A comparable study of Nekmahmud and Fekete-Farkas [7] aimed at predicting green purchasing decisions of young educated Bangladeshi consumers (n = 638). They, too, applied TPB by developing and testing an extended TPB model. The empirical findings indicate that, amongst others, consumers' environmental concern, green perceived benefits, and willingness to purchase green products have a strong positive influence on consumers' green purchase decisions. The study concludes that young and educated Bangladeshi consumers are interested in buying environmental products, have faith in and support green or environmental marketing. A further important aspect of green consumption tackles animal welfare which is acknowledged to be an essential element to realize sustainability within the food supply chain [8]. In accordance with the previous study, Yeh and Hartmann [9] tested an extension of the TPB to gain a better understanding of the determinants of consumer choices with regard to animal welfare including consumers' Willingness-To-Pay (WTP). They identified two consumer segments, a highly price sensitive one and one describing consumers for whom animal welfare, product variety, and price are of equal importance. The extended TPB model determines the importance of psychological TPB constructs in explaining respondents' consumer choice of processed meat considering different levels of animal welfare. Another

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study focusing on meat consumption by Del Bosque et al. [10] investigated consumer preferences for chicken meat (or more specific, for meat of dual-purpose breeds (DPBs), regionally produced feedstuff, and specific breeds). In general, consumers are interested in meat from DPBs (breeds that can be used for both laying eggs and producing meat). However, consumers showed that this attribute alone did not influence their purchase decision. Information about the origin of the product and the animal feedstuff were much more important. Therefore, Del Bosque et al. [10] assume that the geographical origin seems to be of crucial importance when marketing DPBs. Altogether, the findings of both meat studies [9,10] support previous findings that in order to make meat production more sustainable, alternative production systems are assumed to provide healthier, tastier, and more environmentally as well as animal friendly products [11].

It is widely acknowledged that not only animal welfare is of utmost importance, but also that meat production is the greatest contributor to climate change within agriculture [12]. Carbon savings from adoption of vegan diet have an average mitigation potential of 0.9 tCO2eq/cap [4]. In this respect, stockfree-organic agriculture is an emerging cultivation method (no animals in any part of the production process). The aim of the study of Jürkenbeck and Spiller [13] was to find out how consumers evaluate this relatively new cultivation technology. In general, animal welfare and environmental considerations were of specific interest to consumers. Jürkenbeck and Spiller [13] used a consumer segmentation approach to analyze the level of consumer acceptance of stockfree-organic agriculture and the related market potential amongst vegetarians and vegans. The latter seems to be considerable, almost all vegetarians and vegans supported stockfree-organic agriculture, whereas heavy meat consumers rather refused this cultivation method. Besides meat production and consumption, another important issue within the food supply chain was addressed by Plasek et al. [14]. They focused on large-scale production and consumption of palm oil, which leads to numerous negative externalities, such as deforestation, water and soil pollution, loss of biodiversity, social tension, to name a few [15]. In their research on palm oil, Plasek et al. [14] explored which health, environmental, or social consequences associated with palm oil influence consumers most in their decision not to consume palm oil. The results from a structural equation model analysis showed that the perceived effects of palm oil on health had the strongest influence on consumption intention, followed by environmental damage caused by palm oil production. The purchase intention is mainly influenced by the health effects associated with palm oil. Environmental and health risks perceived in general had a mediating effect only through information seeking.

Another important issue within the food supply chain is scarcity of water and fertile soil. Innovative food production systems, such as vertical farming, urban agriculture, and aquaponics, have been developed to address these issues. In particular, aquaponics seems to be an interesting sustainable food production system combining fish with plant production in a circulation system. The study of Eichhorn and Meixner [16] determined the factors influencing consumers' WTP for aquaponic products. Based on the results, aquaponic products are likely to be highly accepted by consumers. Regarding the WTP, the study highlights that consumers who were most willing to buy aquaponic products were those with higher environmental awareness. While, in general, consumers are still not very familiar with aquaponics, increased knowledge about these benefits could significantly increase WTP, in particular amongst consumers with high perceived environmental awareness. These results imply that practitioners should emphasize the environmental benefits of aquaponics in their communication policy. Beyond individual food consumption practices at home, which were addressed by the pre-mentioned studies, sustainable meal choices in the out-of-home catering market are essential to attaining green consumption patterns. The conclusions of the experimental choice study of Ohlhausen and Langen [17] reveal that respondents (n = 373 employees) had a clear preference for menu variety and spontaneous choice in company canteens. Both propensities impede the uptake of more sustainable behaviors in the catering sector, while other attributes in connection with ingredients were of less importance.

In addition to the crucial role of consumer behavior, Özkaya et al. [18] investigated how sustainable consumption is perceived by experts. Özkaya et al. [18] evaluated the sustainable consumption of food (SCF) concept and consumers' barriers to changing their consumption behavior towards higher sustainability. Twenty-five experts from various fields were interviewed, confirming the lack of awareness, unplanned shopping, and mistakes in post-consumption behavior are hindering the uptake of more sustainable consumption of food. In addition, absence of knowledge about the consequences of meat production, difficulties in changing lifestyles, and lack of motivation were identified barriers to SCF. Confirming the concept "sustainability" itself, it is of utmost importance to address the unsolved issue of measurement inaccuracy. This issue was addressed by Sosa et al. [19] in the field of tourism. They propose a selection of sustainability indicators that allow a better understanding of the connection between food and community-based tourism. The result is a list of 27 indicators, divided into socio-cultural, environmental, tourism, and economic dimensions. Another hypothetic dimension that might influence consumer behavior towards greener consumption patterns is trust. Rajković et al. [20] focused in their study on new forms of digital communication and investigated how companies could influence the crucial credence attribute "trust" in their social media communication. This is of particular interest as communication within and towards a virtual community via social media and the related trust-building mechanisms in an online environment are influencing purchase decisions (they applied structural equation modeling to investigate the connection between trust and willingness to purchase). Finally, the priority attribute within the food supply chain "price" was investigated by Huffaker et al. [21]. They focus on endogenously unstable markets (on the example of the global-domestic coffee supply chain in Papua New Guinea). Moving from consumer to market behavior and consequently to economic sustainability, the study completes the comprehensive look at the food supply chain of this Special Issue. Huffaker's et al. [21] main argument is that due to systematic frictions in unstable markets, conventional approaches fail to test for price-transmissions if markets do not tend to equilibrate. They further propose a new framework including, amongst others, nonlinear time series analysis, and they conclude that in the case of the investigated coffee supply chain price transmission from the global to the domestic market did not reach the producers (it did for domestic exporters and processors). Nevertheless, based on their analysis, market intervention was not appropriate to protect rural producers but rather non-market related tools (e.g., price supports).

Altogether, the contributions within this Special Issue deliver a comprehensive look at consumer behavior in the food sector, sustainability, and related marketing issues. To achieve the SDGs of the European Union towards higher sustainability, a large number of conceivable actions are connected to green consumer behavior. Therefore, we would like to thank all the authors for their contribution to this Special Issue supporting our understanding and delivering valuable insights into sustainable consumer behavior. We also want to thank the external reviewers for their feedback, comments, and suggestions, which helped to improve the significance of the contributions, and finally, we would like to express our particular thanks to the staff of MDPI for their valuable support.

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Article

Factors Influencing the Willingness to Pay for Aquaponic Products in a Developed Food Market: A Structural Equation Modeling Approach

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Abstract: Even in highly developed food markets, aquaponic products have not yet been successfully introduced. This is particularly surprising, as aquaponics is an excellent example of a sustainable circulation food production system. The purpose of this empirical study was to determine the factors that influence consumers' willingness to pay for aquaponic products. The direct and indirect relationships were tested via Structural Equation Modeling (SEM). Primary data of 315 respondents from Austria were collected. The findings revealed that the willingness to pay for aquaponic products was significantly and directly driven by the purchase intention. As a result, the successful implementation of aquaponics in the market requires the provision of information for consumers. We suggest emphasizing the value of aquaponics as a sustainable food production system, since indirect factors that influence the willingness to pay are (besides the assessment of aquaponics) environmental awareness and green consumption.

Keywords: aquaponics; Structural Equation Modeling; consumer behavior; purchase intention; willingness to pay; sustainability; food market

1. Introduction

Global food markets are confronted with increasingly scarce resources (fertile soil and water), a growing world population, and a multitude of environmental problems [1,2]. The United Nations (UN) assumes that more than 9.7 billion people will be living on the Earth in 2050 and the population will reach about 11 billion in 2100 [3]. In line with growing prosperity, agricultural production will have to increase by two-thirds by 2050 [4]. To address this problem, scarce resources, such as water and fertile soil, have to be used more efficiently, and a sustainable food production system is needed [5]. Innovative food production systems, such as vertical farming, urban agriculture, and aquaponics, could positively contribute in this respect. Aquaponics is considered to be a sustainable food production system [6–8] that combines fish farming ("aquaculture") and plant cultivation ("hydroponics") in an integrated circulation system that uses the resulting synergy effects [9,10]. The nutrients released by the fish are used by the plants, which, in turn, act as a natural filter (through bacteria) for the water used by the fish [11,12]. Aquaponic systems have a great potential to produce healthy food (fish, vegetables, and herbs) with efficient nutrient utilization and low water consumption. Due to its limited land requirements and sophisticated use of technology, aquaponics can contribute to food security—particularly in urban areas with short value chains [13–15]—but also in rural areas and developing countries [7,16]. Compared to conventional agricultural systems, aquaponics requires only about 10% of water depending on climate conditions [17], and pesticides cannot be used within the production system [18].

Over the past ten years, global aquaponic production has increased significantly, especially in North America and Australia, where numerous research reports were published and large aquaponic production plants were put into existence [19,20]. However, aquaponics is still in its early stages, and it is not yet a successful business model [10]. In addition, within the European market, the commercialization of aquaponic products is problematic because aquaponic products cannot be certified as organic food in the EU in accordance with the European Commission Regulation (EC) No. 889/2008, paragraph 4, and No. 710/2009, paragraph 11 [21]. In the Austrian food retail sector, the organic share is nine percent. Eggs, milk, and vegetables are most often bought organically [22]. Organic certification could be very beneficial here. Furthermore, Tokunaga et al. [23] have found that organic certification increases the willingness to pay (WTP) and predicts that it will increase the return on investment in aquaponics by about 5%.

The European aquaponics market is in an early stage of development; many new companies are being established in this field, but only a few reach the economically viable minimum production volume [19]. Furthermore, it is not possible to determine how high the break-even price for aquaponic products must be for the plants to be economically viable [24]. This is due to the large number of different systems working in different locations under different conditions [24].

Nevertheless, aquaponics producers need to know whether consumers are prepared to pay more for aquaponic products, as Miličić et al. [21] and Greenfeld et al. [10] have researched. In planning to be able to intervene more specifically in the willingness to pay for future consumers, it is, above all, important to know which factors influence this willingness to pay. For this reason, this paper aims to identify the factors that directly and indirectly influence the willingness to pay (WTP) for aquaponic products. Up until now, no published study seems to explicitly address the drivers of the WTP for aquaponic products. The central research question, therefore, is: which direct and indirect factors influence the willingness to pay for aquaponic products?

To answer the research question, the following hypotheses are tested:

H1: *Familiarity with aquaponics (FA) has a positive and significant impact on the willingness to pay (WTP).*

H2: *Familiarity with aquaponics (FA) has a positive and significant impact on the purchase intention (PI).*

H3: *Environmental awareness and green consumption (EAGC) have a positive and significant impact on the assessment of aquaponics (AA).*

H4: *Environmental awareness and green consumption (EAGC) have a positive and significant impact on intention to buy (PI).*

H5: *Environmental awareness and green consumption (EAGC) have a positive and significant impact on willingness to pay (WTP).*

H6: *The assessment of aquaponics (AA) has a positive and significant impact on the purchase intention (PI).*

H7: *The assessment of aquaponics (AA) has a positive and significant impact on the willingness to pay (WTP).*

H8: *The purchase intention in favor of aquaponic products (PI) has a positive and significant impact on the willingness to pay (WTP).*

We developed a Structural Equation Model (SEM) based on the literature (Chapter 2) and the hypotheses above. To test the SEM, survey data were collected in a highly developed food market (Austria). To analyze whether, for example, the WTP for aquaponic products is significantly and directly driven by the purchase intention and indirectly driven by the assessment of aquaponics or environmental awareness and green consumption, SEM is a commonly used approach. Successful implementation on the Austrian market requires, on the one hand, the provision of information for consumers. On the other hand, environmentally conscious consumers can be addressed as a target group. If these two aspects are taken into account, the influence of environmental awareness and

green consumption and the assessment of aquaponics can lead to a higher purchase intention and, consequently, to a higher willingness to pay, according to the SEM.

This paper is organized as follows: in the second chapter, we summarize prior research and develop the research framework. In the third chapter, we outline the research design with the sample procedure, measures, and reliability and validity tests. The results of the structural model are presented in the fourth chapter, followed by a discussion in the fifth chapter. Finally, we draw conclusions based on our analytical results in the sixth chapter.

2. Literature Review

There are several research projects that shed light on the scientific and technical aspects of aquaponics [11]. Yep and Zheng [9] provide a comprehensive literature review of the technical aspects of aquaponics. However, only a few studies deal with commercial questions [6,25], such as Blidariu and Grozea [26], who focus on the economic aspects of aquaponics, or Bosma et al. [27], who investigate the financial feasibility of aquaponics by means of a cost-benefit analysis. Social acceptance and the attitudes of potential consumers are particularly decisive for the success of aquaponic products in the market [28,29]. Furthermore, several studies show that consumer perceptions of aquaponics differ according to the definition and the values associated with it [21,28,30]. Regional and antibiotic- and pesticide-free production are strong purchasing arguments that reflect the consumer's positive engagement [21,30]. However, high technology use and intensive production, as well as little knowledge about the products, leads to negative consumer opinions, according to current research [21,28]. In addition, the formerly mentioned impossibility of organic certification is an important barrier [21]. In addition to differentiation—according to the values attributed to aquaponics—there are also differences, depending on the country in which the study is conducted [10,21,28,30,31]. A study by Tamin et al. [31] investigated the reaction of Malaysian customers to aquaponic products. The outcome was a positive buying interest. Zugravu et al. [30] examined consumer perception and the image of aquaponics in Romania. The framework concept of these studies assumes that the general perception of aquaponic products includes product opinion, price, and value. These variables are, in turn, influenced by demographic data, financial situations, and the influence of third parties on purchasing experience and information [30]. Furthermore, the study of Zugravu et al. [30] showed that domestic aquaponic products received more attention than foreign products and were preferably bought. Specht et al. [28] identified the general preferences of the inhabitants of Berlin (Germany) for the productive use of urban space, the acceptance of different forms of urban agriculture, and the perceptions of urban agricultural products. Specht et al. [28] showed that the greatest acceptance was achieved for an agricultural production system that combined commercial goals with environmental and social goals. This meant that systems with a predominantly profit-oriented and technologically intensive alignment were increasingly rejected [28], whereas aquaponic systems received poorer evaluations: only 28% of study respondents approved aquaponics as a production system for fish and vegetables, and only 27% would buy these products [28]. Miličić et al. [21] conducted a Europe-wide survey and found that consumer acceptance was generally positive and that consumers were also willing to pay more for products free of antibiotics, pesticides, and herbicides, and for products that came from local suppliers. Greenfeld et al. [10] showed that between 17% and 30% of Australian and Israeli consumers were willing to consume aquaponic products. However, according to their findings, the price premium would be rather low.

2.1. Familiarity with and Knowledge about Aquaponics (FA)

Aquaponic products face a major communication challenge because their food production system is unknown, they have a high degree of innovation and require generally high technological effort [24,32]. The low level of awareness among consumers is shown in the study by Miličić et al. [21], where 50% of the respondents stated that they had never heard of aquaponics, while only 30% had never heard of hydroponics. This data is comparable to Greenfeld et al. [10], where 56% of an Australian

sample claimed to be familiar with aquaponics, but only 17% of the Israeli sample were familiar with it. The finding leads to the assumption that knowledge about aquaponics might also be influenced by culture and previous consumption habits of fish. In principle, information and knowledge play important roles in the purchasing decisions of consumers. Behavioral literature generally speaks of a positive relationship between knowledge and behavior [33–35]. Moreover, Hoffmann and Akbar [36] predicated that it is only possible for consumers to weigh alternatives when they have sufficient knowledge. The influence of knowledge was also confirmed by Zugravu et al. [30], who found that existing knowledge is essentially linked to the intention to buy aquaponic products. Furthermore, Tamin et al. [31] claimed that a lack of information has a negative influence on the attitude towards aquaponics and reduces the willingness to buy.

2.2. Environmental Awareness and Green Consumption (EAGC)

"Environmental awareness" can be seen as a multidimensional attitude construct, with proximity to purchasing behavior [37]. According to Monhemius [37], the term can be understood as the knowledge and insight of the consumer about the ecological consequences of individual buying decisions and consumption behavior, whereas "green consumption" is a given when predominantly environmentally friendly and sustainable products are purchased and products that burden the environment and society are avoided [35,37,38]. Aquaponics is regarded as a sustainable and environmentally friendly system [7,8,12] and it is also perceived as such among consumers [21,28,31]. However, aquaponic systems require a high technology input and are energy-intensive, which, in turn, could be a deterrent for environmentally conscious consumers [28]. Despite that, Tamin et al. [31] classified aquaponic products as green products. According to Peattie [39], a product can be considered as a green product if it shows significant improvements (in production, consumption, and disposal) in favor of the environment compared to conventional products. Tamin et al. [31] also showed that consumers are aware of the importance of environmentally friendly products and believe that by purchasing environmentally friendly products, such as aquaponics, they are helping to protect the environment.

2.3. Attitude and Purchase Intention (PI)

Attitude is the general permanent assessment of people, objects, or topics [40]. The three-component theory plays an important role in attitude research. It states that attitudes are composed of affective, cognitive, and action-related components, and it focuses on the hypothesis that there is a connection between current attitudes and future behavior [41]. An attitude directly influences the behavior intention and, indirectly, the behavior. However, no direct conclusion should be drawn from a found attitude–purchasing intention relationship to an attitude–behavior relationship [40] because other factors, such as situational conditions, personality factors, or involvement, are also decisive for the actual buying behavior [42]. The connection between attitude and purchase intention was confirmed by the literature in several studies [31,43–45]. The study by Barber et al. [43] tested the influence of environmental knowledge and the attitude of wine consumers on their purchase intentions and showed a positive correlation between them. Furthermore, Hartmann and Apaolaza-Ibáñez [44] determined a connection between consumer attitudes and buying intentions with regard to green energy brands. A positive and significant relationship was also found by Kozup et al. [45] regarding attitude and the intention to buy organic products. Finally, Tamin et al. [31] applied the theory of planned behavior to determine consumer behavior regarding aquaponic products and confirmed a connection between the attitude dimension and the intention to buy for aquaponic products. The theory of Ajzen´s [46] planned behavior is the best-known theory for explaining attitude–behavior coherence [36].

2.4. Willingness to Pay (WTP)

In business, the maximum amount that an individual is willing to pay for a particular product is usually taken as a measure of the value of a good to the individual [47]. Here, the benefit of the product for the buyer plays a major role. The product will only be bought if the benefit for the consumer is

greater than the price to be paid. The study of Miličić et al. [21] surveyed the WTP for aquaponic products by means of comparative questions. It discovered that local, pesticide-, herbicide-, and antibiotic-free products are preferred. In particular, 75% of the respondents expressed that they would pay the same price for local products that were conventionally produced as for aquaponic products. More generally speaking, WTP seems to be influenced by a number of factors. Bower et al. [48] showed that WTP is significantly influenced, among other factors, by the intention of consumers to buy a certain product: if consumers are willing to buy a product, they are also willing to pay a price premium. Zhang et al. [49] examined factors influencing the consumer's purchase intention and willingness to pay a price premium for safe vegetables. Besides individual and family characteristics, factors such as attitude, price, safety perceptions, and purchase consciousness were tested. The findings showed that 67.6% of consumers were willing to buy safe vegetables and 65.8% were willing to pay a higher price. For aquaponic vegetables, this means that it may well be interesting to see whether consumers perceive them as safe vegetables and whether this leads to a price premium [49]. Another example of a conceptual model where the influence of search attributes (product information) on PI and of PI on WTP is assumed can be taken from Xu et al. [50].

On the basis of this model (Figure 1), the influencing factors on WTP are to be determined. This model is based on the findings from the literature presented above. We expect that knowledge of aquaponics influences WTP. However, it must be assumed that the level of awareness of aquaponics among Austrian consumers is very low and, for this reason, no or only little knowledge is available. Therefore, instead of the variable "knowledge," the variable "familiarity" was inserted into the model. Thus, we propose that: familiarity with aquaponics (FA) has a significant and positive impact on the willingness to pay (WTP) (H1) and on the purchase intention (PI) (H2). Furthermore, high environmental awareness leads to a better evaluation of green products, according to the literature [51–55]. Jaiswal and Kant [55] confirmed a positive and significant impact of environmental concern on the attitude towards green products and Chen and Peng [51] stated that a sense of responsibility for the environment encourages consumers to buy green products. Moreover, one of the crucial factors for a positive attitude towards organic products, which are also classified as green products, is environmental concern [52–54]. This leads to the assumption that consumers with environmentally friendly purchasing behavior assess aquaponic products more positively and that this also has an impact on purchase intention and WTP. In light of the above, we propose that: environmental awareness and green consumption (EAGC) have a positive and significant impact on the assessment of aquaponics (AA) (H3), on the intention to buy (PI) (H4), and on the willingness to pay (WTP) (H5). Based on the literature (Section 2.3), a positive correlation between attitude and purchase intention (PI) was assumed. Since we expected a low familiarity with aquaponics (FA), a comprehensive measurement of the attitude (and the dimensions of the attitude) was less appropriate. For this reason, the construct "attitude" was simplified to the construct "assessment of aquaponics" (AA). In the AA construct, new product ideas will be the focus, and, therefore, AA will be evaluated after a short product/system description. This leads to H6: the assessment of aquaponics (AA) has a positive and significant impact on purchase intention (PI). Finally, it is assumed that both AA and PI influence the WTP (H7, H8).

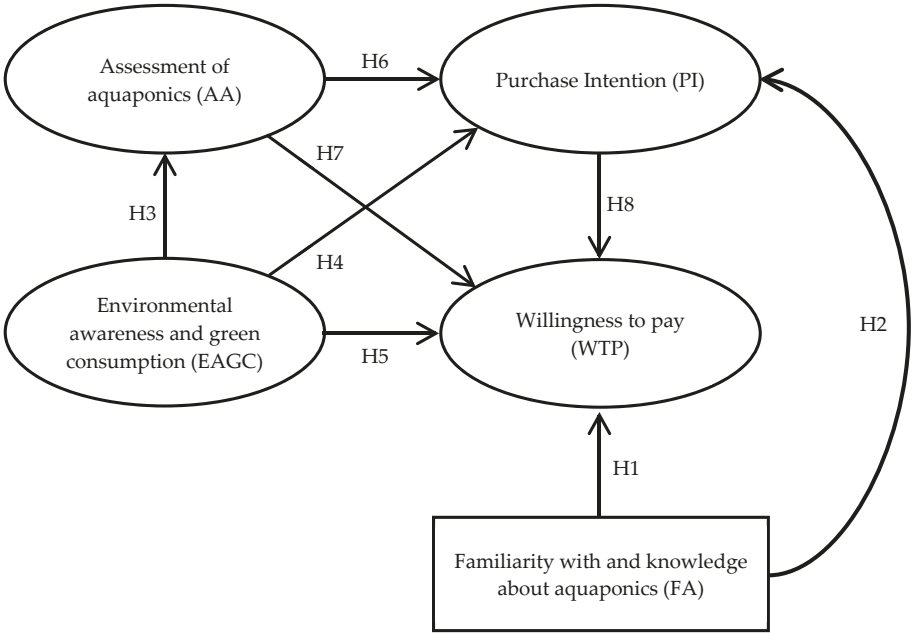

Figure 1. Proposed research framework.

3. Materials and Methods

The data were analyzed using IBM SPSS Statistics 24 in combination with IBM SPSS AMOS 24. Two pretests were conducted. The first pretest was conducted with 40 participants. Using the data from the first pretest, a comprehensive quality check of the measurement model was carried out. This quality test revealed weaknesses in the constructs of WTP, AA, and EAGC. For this reason, new measures were chosen for these constructs. Due to a large number of changes made in the first questionnaire, a further pretest with N = 38 was carried out. Based on the second pretest results, negligible changes were implemented, the final questionnaire was designed, and the general analysis was carried out.

3.1. Sample Size and Characteristics

The survey was conducted by means of a face-to-face interview with closed questions in a questionnaire. The implementation of the survey by personal interviews was chosen due to the fact that participants take more time to answer the questions, the instrument is more accurate, and the non-response rate is lower [56,57]. The interviews were conducted in Austria, in the large city of Vienna, in the smaller cities of Amstetten, Wels, and Salzburg, and in rural village areas around Berndorf bei Salzburg and Neuhofen an der Ybbs. The survey took place in February, 2019. Although we tried to reach specific quotas in terms of gender, age, income, etc., the sample was still a non-probabilistic convenience sample. A sample size of n = 349 was achieved. By eliminating outliers, removing the latent variable "product experience" from the model (only five respondents stated that they had product experience), and excluding incomplete questionnaires, the final dataset amounted to 315 cases. According to Hair et al. [58] and Kline [59], the sample size (N) should be greater than 10 to 15 times the number of the parameters/items (t) in the model. The number of parameters/items was t = 19, so a sample size of n = 285 was required. The sample size of n = 315 was, therefore, appropriate.

Table 1 shows the demographic information of the sample respondents (n = 315) in comparison with the overall Austrian population. As we can see from Table 1, the sample quota differs somewhat

from the overall Austrian population (slightly more females, fewer respondents below 20 and above 60, more rural places of residence, and a higher educated sample with, on average, a higher income). The transferability of the results is, therefore, limited.

Table 1. The demographic profile of respondents.

	Description	Frequencies	Valid %	Austria % [a]
Gender				
	Male	150	47.6	50.8
	Female	165	52.4	49.2
Age				
	≤20	21	7.3	20.8
	21–30	79	27.6	13.2
	31–45	72	25.2	20.2
	46–60	84	29.4	22.6
	61+	30	10.5	23.1
	Missing	29		
Place of residence				
	Rural	208	66.2	47.2
	Urban	106	33.8	52.8
	Missing	1		
Education				
	Compulsory school	21	6.7	18.0
	Apprenticeship/middle school	124	39.5	48.8
	High school diploma	93	29.6	15.6
	University	76	24.2	17.5
	Missing	1		
Income per month	Mean income per month		estimated 2183 to 2461	1887

[a] 2017, Source: http://www.statistik.at.

3.2. Measures

Measurement scales were used, whose validity had already been already confirmed in other studies. The scales used to determine EAGC (environmental awareness and green consumption) was a six-item and seven-point Likert-type scale, based on Miličić et al. [21]. The questions were [21]: I actively look for ways to buy from local farmers (e.g., buy at open air markets or directly from farmers); when I buy vegetables, I look for pesticide- and herbicide-free produce; I am careful when buying fish and would rather pay more for organically produced fish; when buying in a supermarket, I take the locally produced food, even if it is more expensive; when I buy food, I have to consider price as the most important factor for the decision; if the price of organic produce is twice the price of non-organic produce, I decide on non-organic produce. In the Appendix A in Table A1, the final questions regarding EAGC can be found (including frequencies, mean, and standard deviation). The scales used to determine AA (assessment of aquaponics) was a six-item and seven-point Likert-type scale, based on Miličić et al. [21] and Ratneshwar and Chaiken [60], respectively. Ratneshwar and Chaiken [60] developed the indicator variables to determine attitudes towards new products. The interviewees were first presented with a description of the new product idea, and then with questions about attitude. Two additional indicator variables were added to AA—one indicator about the sustainability of aquaponics and one about the protection of the oceans: aquaponic produce supports the conservation of the sea; aquaponics delivers answers for sustainable food production. The final, detailed questions on AA are also provided in Table A1 in the Appendix A. The indicator variables of PI originated from the work of Miličić et al. [21]. We asked five questions on a seven-point Likert-type scale. The questions were [21]: next time I buy vegetables, I will look for aquaponically grown vegetables; when deciding between conventionally farmed fish and aquaponically farmed fish, I would choose aquaponics fish; I would choose aquaponics fish even if they cost more; aquaponics is the answer to a more sustainable

food production; most of the scare about pesticides and herbicides is exaggerated; I like the idea, but I doubt I would actually eat the fish or vegetables grown in this way. Small adjustments have been made to these questions and the final questions can be found in Table A1 in the Appendix A. Moreover, a four-item, seven-point Likert-type WTP scale was adopted from Voon et al. [61]. Voon et al. [61] determined consumers' WTP for organic products, and we modified it into the variable "willingness to pay for aquaponic products." The questions were [61]: I'm willing to buy organic food even though choices are limited; I'm willing to buy organic food because the benefits outweigh the cost; buying organic food is the right thing to do, even if they cost more; I don't mind spending more time sourcing for organic food; I would still buy organic food even though conventional alternatives are on sale (Table A1 in the Appendix A). The FA variable was surveyed with a bi-nominal (yes-no) question (Table A2 in the Appendix A).

3.3. Testing the Hypotheses through SEM

SEM is suitable for determining the extent to which the theoretical framework is supported by empirical data. SEM was chosen for the analysis of the current study based on three reasons: (1) in structural equation analyses, it is possible to include variables that cannot be measured directly (latent variables). In marketing research especially, SEM is an important tool [62] that is often used for questions concerning the influence of important variables of consumer behavior [63]. In our study were the following latent variables: EAGC, AA, PI, and WTP. (2) Structural equation models are suitable for analyzing causal and complex relationships between individual constructs when compared with basic statistical methods. SEM allows multiple dependent and independent variables in the model. This makes SEM a preferred method for the quantitative testing of theoretical models [64]. (3) The focus of this study was not the amount of WTP expressed in a numerical, monetary value, but the factors influencing it. If the focus was on the WTP itself, auctions or experimental settings would be the chosen methods.

3.4. Reliability and Validity Analysis

For testing reliability and validity, an Exploratory Factor Analysis (EFA) was used first to check one-dimensionality and communalities. Secondly, a Confirmatory Factor Analysis (CFA) was conducted to confirm each indicator of the construct. In the end, an SEM was carried out to verify the conceptual framework and to test the hypotheses using AMOS with a maximum likelihood estimation.

Testing for one-dimensionality using EFA: the EFA was used to remove any indicators from the measurement that were not sufficiently correlated with a factor and to check the one-dimensionality of an indicator set [65]. The Kaiser–Meyer–Olkin (KMO) criterion, the Bartlett test, and the factor values were consulted for verification. The KMO values of the constructs ranged between 0.737 ("middling") and 0.891 ("meritorious") and were above the cut-off value of 0.6 [66]. The Bartlett test was rejected for all variables in this study and the sample matrix showed one-dimensionality for all constructs (Table 2).

Table 2. Exploratory Factor Analysis.

	Item	KMO Value	Composite Reliability	Cronbach's α	AVE	SMC
EAGC						
	Local	0.737 (middling)	0.744	0.738	0.421	0.434
	Purchase of fish					0.442
	Regional					0.431
	Pesticide-free					0.375
AA						
	Appropriate Price	0.891 (meritorious)	0.931	0.929	0.695	0.610
	Reasonable					0.772
	Positive					0.827
	Very good					0.793
	Protection of the ocean					0.536
	Sustainability					0.632
PI						
	Aquaponic vegetables	0.847 (meritorious)	0.927	0.927	0.717	0.631
	Good Idea					0.759
	Fish higher price					0.745
	Aqua fish					0.742
	Vegetables higher price					0.706
WTP						
	Variety	0.814 (meritorious)	0.912	0.902	0.724	0.703
	Good one					0.866
	Advantage					0.880
	Procurement					0.447

KMO = Kaiser–Meyer–Olkin criterion; AVE = Average Variance Extracted; SMC = Squared Multiple Correlations.

Construct and indicator reliability: for testing indicator and construct reliability, Cronbach's α, inter alia, was considered. The minimum cut-off level for Cronbach's α was 0.7 [67]. The values of Cronbach's α for the constructs in this study (EAGC, AA, PI, and WTP) varied from 0.738 to 0.927 and were above the required level.

Indicator reliability—Squared Multiple Correlations (SMC): Indicator reliability indicates whether the loadings are important. The root calculated from the SMC (charge squares) results in the factor charges. Composite reliability and AVE are calculated on the basis of factor charges [68]. Bagozzi and Baumgartner [69] suggested the cut-off value of 0.4 for SCM. Only the indicator variable "pesticide-free" (0.375) was slightly below this value and was considered less important.

Composite reliability: The composite reliability corresponds to the indicator reliability at the construction level. According to Bagozzi and Yi [70], the values should be greater than 0.6. All constructs reached a value above 0.6. AA reached a value of 0.931, PI of 0.927, EAGC of 0.744, and WTP of 0.912.

Average Variance Extracted (AVE): The AVE indicates, on average, what percentage of the dispersion of the latent construct over the indicators is explained [68]. Fornell and Larcker [71] suggested a minimum value of 0.5. The values ranged from 0.421 to 0.724. The threshold value of 0.5 could not be reached for the single EAGC variable. Due to the fact that the measure for EAGC was already confirmed in a study by Miličić et al. [21], the construct and the indicators were retained.

Validity of the model with CFA: A construct validity is given when a convergent, discriminant, and nomological validity is confirmed [72]. The measurement must not be falsified by other constructs or systematic errors [68].

Nomological validity: In nomological validity, the focus is on the relationships between the different constructs, as well as the relationships of the constructs to their measurement indicators [72]. The verification of nomological validity was carried out using the parameter estimates of the CFA. The hypotheses can be confirmed by the results in Table 3. All latent variables were positively correlated. Due to the overall positive and predominantly significant factor loads, a nomological validity of the construct could be assumed.

Table 3. Tested hypothesis, results from the Confirmatory Factor Analysis (CFA).

Construct	d	Construct	Estimate	S.E.	C.R.	*p*
EAGC	↔	AA	0.352	0.059	5.933	***
EAGC	↔	PI	0.548	0.051	10.747	***
EAGC	↔	WTP	0.603	0.047	12.933	***
AA	↔	PI	0.852	0.020	43.383	***
AA	↔	WTP	0.825	0.021	38.761	***
PI	↔	WTP	0.952	0.010	96.407	***

d = direction; S.E. = Standard Error; C.R. = C.R.-value; p = p-value (statistical significance); *** $p < 0.001$.

Convergence validity: Evidence for convergence validity can be derived from the average variance extracted [71]. With one exception, all AVE values were above 0.5 (Table 2). Only the EAGC construct had an AVE value of 0.421, which was too low.

Discriminant validity: The measurements of the constructs must differ significantly before discriminant validity is given. If one-dimensionality is achieved in the EFA, this is a good indicator of the existence of discriminant validity [68]. All constructs of this study exhibited one-dimensionality in themselves.

Furthermore, discriminant validity should be carried out on the basis of the CFA. The CFA that was already carried out to assess the reliability of the measurement models had the function of a so-called unrestricted model (Mu). This meant that the factor correlations in this model were freely estimated. This analysis revealed a chi-square value of χ2-Mu = 525.1. Afterwards, it was necessary to create restricted models (Mr). The covariance was fixed to 1 between two latent variables.

χ2-M$_r$ (EAGC and PI) = 689.7→ χ2-difference = 164.6
χ2-M$_r$ (AA and EAGC) = 751.9 → χ2-difference = 226.8
χ2-M$_r$ (AA and WTP) = 836.1 → χ2-difference = 311
χ2-M$_r$ (AA and PI) = 761.2 → χ2-difference = 236.1
χ2-M$_r$ (WTP and EAGC) = 672.4 → χ2-difference = 147.3
χ2-M$_r$ (PI and WTP) = 568.3 → χ2-difference = 43.2

The χ2-difference values should be above the critical value of 3.84. This is the case for all restricted models. Finally, the Fornell/Larcker criterion can be used. The AVE value should be greater than the squared correlation [71]. The AVE values were all greater than the squared correlations between the factors, with the exception of the link between WTP and PI. The AVE values of the constructs were 0.724 and 0.717, but the squared correlation was 0.906. Nonetheless, due to the given one-dimensionality of the constructs and the χ2-difference values, discriminant validity was assumed (but subject to reservations, which will be considered in the limitations).

4. Results of the Structural Model

After the evaluation of the measurement model, the structural model was examined using the goodness of fit statistics (χ2 = 632.079, df = 218, χ2/df = 2.899, RMSEA = 0.078, IFI = 0.924, TLI = 0.912, and CFI = 0.924). The model fit can be classified as acceptable. The χ2/df, root mean square error of approximation (RMSEA), comparative fit index (CFI), incremental fit index IFI, and Tucker–Lewis index (TLI) were within the required range and, thus, indicated an acceptable model quality: χ2/df $\leq$ 3, according to Homburg and Giering [65]; RMSEA $\leq$ 0.08, according to Browne and Cudeck [73]; CFI $\geq$ 0.9, according to Bentler [74]; IFI $\geq$ 0.9, according to Bollen [75]; and TLI $\geq$ 0.9, according to Homburg and Baumgartner [76]. The hypothesis system was tested by means of a path diagram using the standardized regression weight and p-values (Table 3). The purpose was to evaluate the effect of independent variables on dependent variables.

Moreover, R^2 gives information about the variance share of an endogenous latent variable, which is explained by the other latent variables [77,78]. In this model, there were three dependent variables:

namely, AA, PI, and WTP. EAGC explained 13% of the variance of AA. EAGC, FA and AA explained 83% of the PI and, furthermore, EAGC, FA, AA, and PI collectively explained 91.9% of the variance of WTP (Table 4).

Table 4. Explained variance of dependent variables (R^2).

Construct	Estimate
AA	0.130
PI	0.830
WTP	0.919

The present study was based on the hypothetical model that examined the direct or indirect effects of EAGC, AA, and FA on PI and WTP. The result of the path analysis is shown in Table 5. Most of the hypotheses (H2, H3, H4, H5, H6, and H8) were accepted at $p \leq 0.05$, except for H7 (i.e., AA → WTP) and H1 (i.e., FA → WTP) in the model of the present study. More specifically, the following conclusions can be drawn based on SEM and the tested hypotheses:

- It was assumed that if consumers had already heard of aquaponics, this would have a positive effect on WTP and PI. Based on the results (H1 $\beta = -0.022$; $p = 0.390$; H2 $\beta = -0.068$; $p = 0.029$), we found no relationship between FA and WTP and rejected H1. However, AA seemed to influence PI, supporting H2 on a 0.05 significance level (the negative sign of $\beta = -0.068$ was due to the measurement scale of the basic items with 1 = totally agree to 7 = totally disagree). If a respondent was familiar with aquaponics, PI was slightly higher, but this effect was very low (almost negligible), particularly when compared to other variables in the model.
- The results indicated that EAGC had a positive and direct effect on AA, the standardized regression weight amounted to $\beta = 0.361$, and the significance to $p < 0.001$ (***), supporting H3. Consequently, as expected in H4, AA had a positive and strong influence on PI ($\beta = 0.738$; $p < 0.001$). We did find a weak relationship between EAGC and WTP ($\beta = 0.136$; $p = 0.003$), supporting H5.
- As expected in H6, we further detected a strong and significant influence of AA on PI ($\beta = 0.738$; $p < 0.001$). However, we did not find a significant relationship between AA and WTP ($\beta = 0.076$; $p = 0.316$), and rejected H7. Finally, we found a strong and positive impact of PI on WTP ($\beta = 0.812$; $p < 0.001$), supporting H8.

Table 5. Tested hypotheses.

Hypothesis	Construct	d	Construct	Estimate* (β)	Estimate	*p*	Result
H1	WTP	←	FA	−0.022	−0.083	0.390	Rejected
H2	PI	←	FA	−0.068	−0.235	0.029	Supported
H3	AA	←	EAGC	0.361	0.372	***	Supported
H4	PI	←	EAGC	0.327	0.338	***	Supported
H5	WTP	←	EAGC	0.136	0.157	0.003	Supported
H6	PI	←	AA	0.738	0.739	***	Supported
H7	WTP	←	AA	0.069	0.076	0.315	Rejected
H8	WTP	←	PI	0.812	0.901	***	Supported

Standardized Regression weights (Estimate*, β), non-standardized Regression weights (Estimate) and *p*-values (*** $p < 0.001$).

5. Discussion

This study examined whether environmental awareness and green consumption, the assessment of aquaponics, purchase intention, and familiarity with aquaponics influences the willingness to pay for aquaponic products. We found a strong effect of EAGC on AA and a medium effect on the PI regarding aquaponic products. This result indicates that consumers consider aquaponics to be good for the environment. Environmentally conscious consumers rate aquaponics more positively and have

a higher PI. These findings are in accordance with the literature, confirming that aquaponics may be considered a sustainable food production system and aquaponic products may be considered green products [6–8,21,31]. Furthermore, the findings of this study support previous studies, showing that environmental awareness is one of the strongest antecedents of attitudes towards green products and green purchase willingness [51–55,79–81].

Furthermore, the AA construct displayed a direct and highly significant influence on PI. Honkanen et al. [82] stated that the attitude of a person to a subject or to the evaluation of a product is one of the most important explanations for a consumer's decision to use a particular product (including food) or service. Much of the literature has focused on the attitude–purchasing intention relationship and confirmed this connection in several studies [31,43,44]. Both the three-component theory and the theory of planned behavior are also based on this attitude–purchasing intention context [42,46]. Moreover, there are several studies confirming that PI is driven by the measure of attitude in the green consumer behavior literature [55,83–85]. However, both the literature and the empirical results of this study point to a direct, strong, and highly significant influence of AA on PI. However, a direct effect of AA on WTP was not proven.

Our research also found support for the relationship between PI and WTP. It appears, therefore, that consumers who have a high intention of purchasing aquaponic products are also willing to pay more for them. Considering that PI and WTP as constructs are by definition already very similar, the direction of the relationship between PI and WTP is controversially discussed in the literature. Bower et al. [48], as well as Xu et al. [50], indicate the direction of action from the PI to the WTP. Voon et al. [61] treated WTP as an antecedent of PI but did so without further explanation. Nevertheless, WTP is the latent variable, about which a final statement is to be made. The significant regression weight of 0.812 between PI and WTP and the R^2 of 0.919 underpinned the direction of action in the model.

Finally, we did not find support for the influence of FA on WTP (and only a very low influence of FA on PI). According to our data, there was no significant evidence that consumers who were familiar with aquaponics reacted differently concerning WTP. The effect size of FA on PI was, although significant, almost negligible. This might be due to the low number of respondents in our study who stated that they had already heard about aquaponics (12.4%). Therefore, this influencing factor seemed questionable in the actual model. However, we assumed that FA might influence WTP and PI as soon as aquaponic products are well established on the food market and more people become aware of them.

To sum up, and to answer the central research question, the most important direct influential factor on WTP is PI. EAGC and AA are significant indirect factors that influence WTP (the direct effect of EAGC on WTP is rather weak). Altogether, the three latent variables and the other effects account for 91.9% of the variance of WTP (Figure 2).

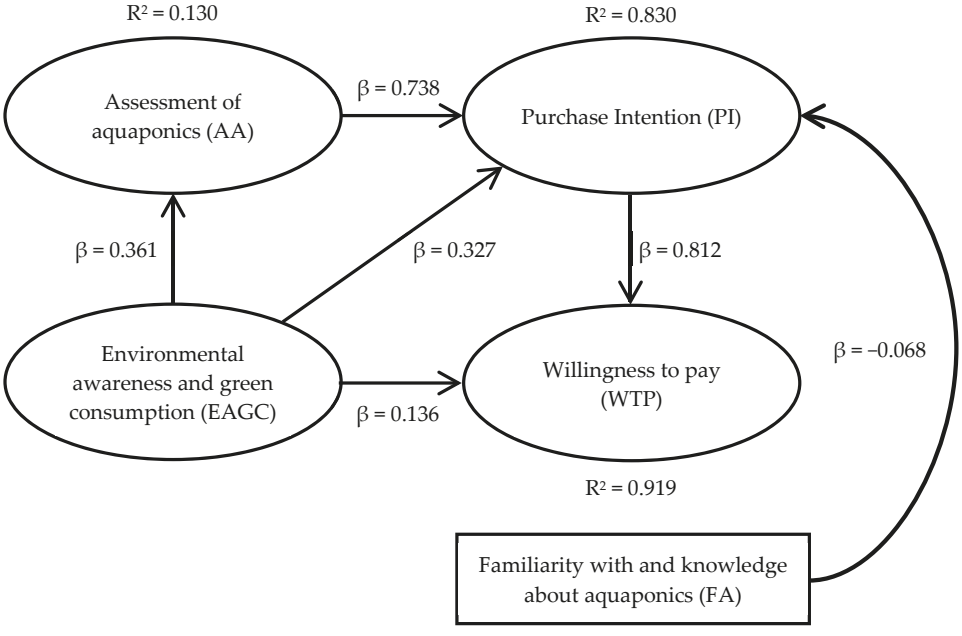

Figure 2. Tested structural model.

6. Conclusions

Confirming our results, aquaponic products that are placed on the market as a sustainable food alternative are likely to be highly accepted by environmentally aware consumers. However, aquaponics as a food production system is not self-explanatory (and up to now, knowledge and familiarity seem to be limited). In particular, the low familiarity with aquaponic systems among Austrian consumers can pose a major problem in marketing. For the Austrian aquaponics industry, we suggest taking on measures that increase the familiarity of aquaponics among Austrian consumers. This can be achieved, for example, via an information campaign involving the producers of aquaponics products. Due to the high complexity of aquaponic systems, we propose the preparation of the information in a consumer-friendly manner. It is thought that familiarity also plays an important role in an international context. Therefore, other countries should be aware of their consumers' familiarity with aquaponic products. As our results show, the assessment of aquaponics influences the purchase intention and, indirectly, the willingness to pay. For this reason, the attitude towards aquaponics plays a major role. In our SEM, the environmental awareness and green consumption of consumers was stated as a strong factor that influences the assessment of aquaponics. The consumers who were most willing to buy aquaponic products and also had a higher WTP were those with higher environmental awareness and green purchasing behavior. This result offers the Austrian (and, presumably, the international) aquaponics industry the opportunity to focus their marketing on environmentally aware consumers. To reach this target group, the environmental advantages of aquaponics should be highlighted in the communication policy. To highlight the sustainability of aquaponics, the absence of pesticides in vegetables, the production at the place of consumption (short transport distances through the possible urban production), and the efficient utilization of nutrients in aquaponic systems could be accentuated.

Considering all these advantages and arguments in the communication of aquaponics, a high acceptance among consumers is likely to be reached in highly developed food markets. In conclusion, a marketing strategy based on information transfer and environmental protection issues leads to a

positive assessment of aquaponics, and, as the structural model shows, this leads to higher monetary remuneration for producers of aquaponic fish and vegetables, too, as the purchase intention and willingness to pay also increases. Considering the current environmental and climate developments and our results, we think that there is potential for aquaponic products on the future market.

Limitations and future research: a few limitations are noted, suggesting some avenues for future research. (1) Even though we achieved a broad sample structure, the study does not reflect the general population in Austria due to the fact that the selection procedure presented nonprobability sampling. (2) The results only reflect the opinions of consumers in one specific, highly developed food market. Future studies might investigate different markets, countries, and cultures. (3) A further limitation is evident through the reduced complexity of the structural model. Variables such as knowledge, quality, safety perception, subjective norm, and perceived behavioral control were not explicitly considered in the model. In further research, the model could be extended by including these variables, especially to consider the theory of planned behavior to its full extent [46]. However, due to the expected low degree of the consumer's familiarity with aquaponic products, the reduced complexity of the model was appropriate. (4) The latent variable EAGC is only moderately represented by its set of indicators. This set of indicators could be adjusted in order to achieve better quality. (5) The constructs WTP and PI do not differ sufficiently according to the Fornell/Larcker criterion. In future research, attention should be paid to a sufficient differentiation of these constructs. (6) The willingness to pay in this study was not measured by a numerical value but by statements. In a further investigation, the WTP could also be measured numerically to determine the actual WTP. (7) Due to the low level of familiarity with aquaponics among consumers (12.4%), a relatively high level of hypothetical bias may occur. The more the consumer is familiar with the product, the lower the hypothetical bias is [86,87]. (8) Considering the questions of this study in a purely descriptive context, it is evident that there is a tendency towards the positive direction; this could be an indication of "yes saying." Nevertheless, the whole spectrum of answer possibilities was mostly used.

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Appendix A

Table A1. Constructs: Frequencies, mean, and standard deviation.

Construct			In Percent (1 = Totally Agree to 7 = Totally Disagree)							Mean	Std. dev.
			1	2	3	4	5	6	7		
EAGC [21]	V1.1	I actively search for possibilities to buy from local farmers (on farmers' markets, directly at farmers).	17.5	18.4	23.5	15.6	9.5	10.8	4.8	3.33	1.748
	V1.2	I am quite cautious when buying fish and prefer to pay more for organic fish.	34.9	25.1	14.3	10.2	8.9	4.8	1.9	2.55	1.626
	V1.3	I consider the product price to be the most important attribute.	10.8	17.1	15.6	19.0	19.7	13.0	4.8	3.78	1.708
	V1.4	I pay attention to pesticide-free production of vegetables (no use of pesticides).	30.5	22.9	14.3	13.3	6.7	7.9	4.4	2.84	1.805
	V1.5	If the price for organic produce is much higher (e.g., more than 50% plus) compared to conventional food, I decide to purchase the conventional food.	13.3	7.9	13.3	15.6	19.7	20.3	9.8	4.21	1.875
	V1.6	When buying food in super markets, I prefer to buy regional food even if it is more expensive.	27.9	35.6	21.3	6.0	6.0	1.3	1.9	2.38	1.348
AA [60]	V4.1	If aquaponic produce is offered in a shop at a reasonable price, I think I would buy it.	39.7	33.3	15.9	7.9	1.3	0.6	1.3	2.05	1.187
	V4.2	I consider aquaponic produce to make sense.	45.1	29.2	15.6	7.6	1.6	0.0	1.0	1.95	1.137
	V4.3	My overall evaluation of aqua ponic produce is positive.	36.8	33.7	16.8	8.9	1.6	1.0	1.3	2.13	1.222
	V4.4	I think aquaponic produce is very good.	31.4	28.6	21.9	14.3	1.6	1.0	1.3	2.34	1.268
	V4.5	Aquaponic produce supports the conservation of the sea.	46.0	21.6	16.2	11.4	1.0	1.9	1.9	2.13	1.391
	V4.6	Aquaponics delivers answers for sustainable food production.	43.5	26.3	16.2	9.2	2.2	1.3	1.3	2.09	1.297
PI [21]	V5.1	If I have to decide between aquaponic vegetables and con ventional vegetables, I will buy the aquaponic vegetables.	19.0	24.8	29.2	20.6	2.9	1.9	1.6	2.76	1.304
	V5.2	I would purchase aquaponic fish even though it is more expensive.	20.0	29.8	25.4	15.6	6.0	1.6	1.6	2.69	1.342
	V5.3	I like the idea behind it and think I would buy aquaponic produce.	35.2	32.4	20.0	7.0	2.9	1.6	1.0	2.18	1.246
	V5.4	If I have to decide between aqua ponic fish and conventional fish, I will buy the aquaponic fish.	27.6	28.6	20.6	17.1	3.5	1.3	1.3	2.49	1.329
	V5.5	I would purchase aquaponic vege tables even though it is more expensive.	17.1	27.3	31.4	13.3	6.7	2.2	1.9	2.79	1.352
WTP [61]	V6.1	I am willing to buy aquaponic produce even though the range of products is limited.	21.9	27.3	31.7	13.3	3.2	1.6	1.0	2.57	1.235
	V6.2	I am willing to buy aquaponic pro duce as benefits outbalance cost.	14.9	30.2	28.9	18.1	4.1	2.5	1.3	2.79	1.28
	V6.3	For me, purchasing aquaponic produce is the right thing even though it is more expensive.	13.3	28.6	29.2	17.8	7.0	2.5	1.6	2.9	1.325
	V6.4	I don't mind investing more time in purchasing aquaponic produce.	7.3	15.9	28.3	21.0	14.0	8.9	4.8	3.64	1.542

Table A2. Construct Familiarity: Frequencies.

Construct			In Percent	
			1 = yes	2 = no
FA [10,21]	V1.1	Have you ever heard of aquaponics?	12.4	87.6

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Consumers' Evaluation of Stockfree-Organic Agriculture—A Segmentation Approach

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Abstract: Recently, more and more research has been conducted on what sustainable nutrition could look like. Stockfree-organic agriculture is one possible approach but a relatively new and unstudied cultivation method. In addition to organic agriculture, it excludes any animal by-products during the whole cultivation process. Among the consumers of organic food are especially many vegetarians and vegans. To attract this target group, first farms in Europe have started to follow the stockfree-organic agriculture principles. As it is important to know the consumers' point of view on new developments in agriculture at an early stage of the diffusion process, this study deals with consumers' evaluation of stockfree-organic agriculture to draw conclusions about a possible market potential. This is especially important for stockfree-organic farmers, as well as for organic farmers who are considering converting their cultivation method, and for retailers who wonder whether it is worthwhile to offer these products. The data was collected in 2019 by means of an online survey. The sample consisted of 500 German respondents. Principal component and cluster analyses were used to identify consumer segments according to their attitudes towards the acceptance, advantages, and disadvantages of stockfree-organic agriculture. Additionally, the different segments were compared with each other according to various attitudes and eating behaviours. Overall, animal welfare considerations and environmental aspects were of particular importance to consumers. Animal usage was clearly rejected by one segment, which contained 24% of the sample. Nearly all vegetarians and all vegans supported stockfree-organic agriculture, whereas heavy meat consumers tended to refuse the support of stockfree-organic agriculture. The supporting group valuing high animal welfare and health concerns was much larger than the current status of this niche segment would suggest. This could be a major challenge for the agricultural sector in the long term, but could also include opportunities for greater sustainability.

Keywords: veganic; vegan-organic; vegan; stockless; sustainability; attitudes

1. Introduction

It is widely recognised that nutrition is responsible for a high share of environmental impact in agriculture [1]. In Europe, human nutrition accounts for 20% to 30% of the environmental impact on the global warming potential [2]. Therefore, it is important to find approaches to produce food which minimises the environmental impact of human nutrition. It is well known that meat production is the greatest contributor to climate change within agriculture [1,3]. Hallström et al. [4] found that greenhouse gas [GHG] reductions mainly depend on the amount and type of meat included in the diet as well as the foods used as meat substitutes. Willett et al. [3] recommend a reduction of 50–75% of meat consumption in Western countries for a sustainable diet. Eker et al. [5] state that "if the world's average diet became flexitarian by 2050, meaning that red meat consumption is limited to one serving per week and white meat to half a portion per day, the GHG emissions of the agriculture sector would

be reduced by around 50%". The Intergovernmental Panel on Climate Change (IPCC) states that a reduction in meat consumption and an increase in plant-based food is beneficial to human health and the climate [6].

In recent years, more and more people have adopted a flexitarian [7], vegetarian, or vegan diet [8]. A recent literature review shows that the GHG emissions caused by a vegan diet are lower than those of a vegetarian or omnivore diet [9]. Baroni et al. [10] have even shown that a vegan diet based on organic products has the lowest environmental impact based on life cycle assessments. The vegan diet excludes all animal products, such as meat, eggs, and dairy products. There are three main reasons why people follow a vegan diet. First, 90% of vegans mention ethically-related attitudes (animal rights); second, health-related attitudes (70%); and third, environment-related attitudes (47%) [11–13]. Other reasons given are the influence of peer groups and disgust [13,14]. Within the European Union, vegan foods can be identified by a voluntary vegan label on the product packaging [15]. The label refers to the list of ingredients but not to the cultivation method of the product. This means, for example, that carrots included in ready-to-eat carrot soup were treated with animal manure during cultivation but are labelled as vegan, because the ingredients of the carrot soup are vegan per se. Thus, the vegan label does not state if animal by-products (e.g., animal manure, blood, or bone meal) were used as fertilizer during cultivation. Another important point is that currently, some manufacturers label their products as 100% organic and 100% vegan. However, these labels only refer to the organic cultivation method and the vegan ingredients of the product. An exclusion of animal by-products during cultivation is not taken into account.

As stockfree-organic agriculture considers vegan and organic aspects, it is important to better understand consumers who prefer to purchase organic food [16–21]. The frequency of organic food consumption is associated with a higher level of education, healthier food intake, and vegetarianism [17]. Onyango et al. [22] found that the number of vegetarians/vegans among organic food consumers is higher than among non-organic consumers. Moreover, organic food supports consumers' ethical food purchase decisions [23]. The food safety of organically grown food was mentioned as a key motivation for buying organic food [24,25]. Salleh et al. [26] found that organic food purchase is influenced by the health-consciousness of consumers. Moreover, consumers from developed countries perceive organic agriculture to be better for animal welfare, climate protection, and the environment [27]. Generally, consumers are willing to pay a price premium for socially responsible produced products [24].

Stockfree-organic agriculture is an emerging cultivation method. It states that no animals are included in any part of the production process, and the farm uses no animal by-product as fertiliser for the soil such as manure, blood meal, bone meal, and fish emulsion [28]. This is important for vegans, since many vegans reject animal husbandry for ethical reasons, and some might even feel disgust with regard to animal manure being used as fertiliser. Stockfree-organic agriculture is the only cultivation method where food products do not come into contact with animal-based products. Therefore, it is an exclusive cultivation method which fully aligns with the contesting of animal use.

As a main source of fertility, plant-based compost or green manure from one's own property is recommended [29]. Companies whose products are certified with the stockfree-organic label operate according to the International Federation of Organic Agriculture Movements, the so-called "(IFOAM) Family of Standards". The IFOAM is an international association with the aim of introducing worldwide ecological, social, and economically sound systems based on the principles of organic agriculture [30].

In 2016, there were approximately 80 farms in Greece and Cyprus operating according to stockfree-organic agriculture [31]. Furthermore, for example, in the UK and Ireland 22 [32] and in Germany 21 farms [31] operate accordingly [33]. As the number of farms and thus the distribution in stationary retail is nearly non-existent, online sales play a certain role. In Germany, in September 2019, there were approximately five online shops with a limited choice of product variety, which means, in this context, up to 25 different products [34]. Due to the low distribution of stockfree-organic agriculture in Germany, it can be assumed that the awareness of stockfree-organic products among the population is low. The current research is therefore an attempt to estimate their market potential by

means of a survey on consumer perceptions of stockfree-organic products at a very early stage of the diffusion process.

2. Literature Review

A main discussion topic is whether stockfree-organic agriculture could contribute to a more sustainable agriculture. In order to discuss this aspect, literature on organic agriculture is taken into account first. In the literature, it is contested whether organic agriculture is sustainable compared to conventional agriculture. A land-based comparison of organic and conventional agriculture showed that organic farming makes a positive contribution in the areas of water protection, biodiversity, climate adaptation, and soil quality [35–39]. However, since organic farming requires more arable land, a yield-based comparison is more suitable for certain topics. It can be seen that the positive environmental contribution of organic farming is lower in a yield-based comparison than in a land-based comparison [25,27]. Meta-analyses show that organic farming has an average yield 19–25% lower than conventional farming [33]. To compensate for the yield gaps in organic farming, 23–33% more land is needed [40]. One way to feed the world with smaller yields and harvests would be to change global diets. A lower consumption of animal products plays a decisive role here. Muller et al. [40] show that 60% of the world's agriculture could be converted to organic farming without requiring much more land. The prerequisite for this is that food losses would need to be reduced by 50% and arable land for animal feed production by 50%. Of course, if feed production is to be reduced, animal production also has to be reduced by 1/3 [40]. To conclude, in general, it is not clear if organic agriculture is more sustainable than conventional agriculture as long as current dietary patterns are maintained.

The research on sustainability aspects of stockfree-organic agriculture is quite limited. Schmutz and Foresi [41] dealt with the common standards (e.g., plant-based compost, hay, or mulch for soil fertility from one's own farm or purchased from other organic farms) and challenges (e.g., in a greenhouse, only pollination by wild bees is allowed, the exclusion of coir) of stockfree-organic agriculture. Besides, Visak [42] concluded that stockfree-organic agriculture has advantages on sustainability (e.g., less water and energy required, higher biodiversity) compared to the western conventional farming practices. Additionally, stockfree-organic agriculture is animal-friendly. Colomb et al. [43] focused on the strengths and weaknesses of the sustainability of stockfree-organic agriculture and developed a sustainability model. Overall, their results show that the potential for developing more sustainable organic farming systems in stockfree-organic farms is high. The assessment of stockfree-organic agriculture as sustainable is even more difficult than for organic farming. The existing literature is very limited. Therefore, it is still unclear how to answer the question of whether stockfree-organic agriculture can be considered as more sustainable than organic farming. Further research is needed to give a clear answer regarding this aspect.

Consumer research about stockfree-organic agriculture is limited as well. One study by Jürkenbeck et al. [44] analysed the marketing potential of biocyclic-vegan (stockfree-organic) products. The results showed that most consumers and experts could define the meaning of biocyclic-vegan. Moreover, the purchase reasons for consumers were to support the new cultivation method, while experts mentioned ethical reasons. Kilian et al. [45] show that vegan consumers are willing to pay higher prices for stockfree-organic products than for organic products.

To conclude, organic agriculture has received intensive research attention, while stockfree-organic agriculture has so far been a fairly unstudied field in agricultural sciences. The existing literature about stockfree-organic agriculture to date is mainly concerned with the strengths and weaknesses as well as with the assessment of the sustainability of the production method. Therefore, it is important to expand the existing knowledge from the consumers' viewpoint to find out how consumers evaluate this cultivation method. In addition, it should be analysed whether the stockfree-organic cultivation method is accepted by consumers. This is important in order to be able to assess, for example, whether consumers would buy products from stockfree-organic agriculture if these were offered more widely at the points-of-sale. It is therefore helpful to evaluate the demand for stockfree-organic products.

The aim of the current study is to reveal the consumers' evaluation of stockfree-organic agriculture. Therefore, consumer segmentation was carried out to analyse the level of consumer acceptance of stockfree-organic agriculture. Additionally, the different segments are described and compared against each other to better understand the differences in their level of acceptance. Stockfree-organic agriculture is at a very early stage of the diffusion process. If widespread, it would lead to substantial changes in agriculture. In addition, it could have a major sustainability impact but would also pose massive challenges for agriculture. Overall, it is unclear whether there is any potential at all for this cultivation method. For this reason, this study can only be regarded as trend research.

3. Materials and Methods

3.1. Data Collection and Survey Design

In order to get information on how consumers view stockfree-organic agriculture, an online survey was carried out in June 2019. This survey method was chosen because it saves time, is cost efficient, guarantees anonymity, and minimises social desirability effects [46]. Furthermore, most people have access to the internet and therefore the possibility to participate. Additionally, a pre-test of the questionnaire was conducted including marketing experts, scientists, and consumers to ensure common understanding and reduce the misunderstanding of the questions. A professional online access panel provider was included for data collection. The URL of the online questionnaire was sent to their clients, who could choose to participate. To be able to use multivariate data analysis and to mimic the German population, the literature suggests sample sizes between 200 and 1,200 respondents [47]. As sampling method, quota sampling was used with quotas set for gender, age, education, and income according to the characteristics of the German population [48]. To ensure the good quality of the dataset, strict quality checks were performed. First, two quality check questions were distributed within the survey and had to be answered correctly, otherwise the respondents were directly excluded from the survey. Second, subjects who answered too fast (below 1/3 of the average response time (9)) or with stereotypical behaviour (e.g. straight-liners (15) within item batteries) were also removed from the dataset. Therefore, 500 of the originally collected data of 549 respondents remained in the sample for analysis.

First, the respondents answered sociodemographic questions and general questions about their dietary behaviours. The concept of stockfree-organic agriculture was explained to the respondents to ensure a common understanding, as the concept is not well known (Appendix A). Hereafter, respondents had to evaluate 16 statements about the advantages and disadvantages of a stockfree-organic agriculture on a five-point Likert scale ranging from –2 = "It is not important to me at all" to +2 = "It is very important to me". The statements were developed by the authors based on the existing literature about the characteristics of stockfree-organic agriculture. The number of the advantages and disadvantages mentioned was balanced to avoid over- and underrepresentation of one concept, to increase the reliability of the calculation. Furthermore, respondents had to evaluate statements about acceptance, ethical values, animal welfare concerns, and spiritual, social, and environmental attitudes on a five-point Likert scale ranging from –2 = "It is not important to me at all" to +2 = "It is very important to me". These items were selected on the basis of the existing literature [44], and corresponding statements for each attitude were developed by the authors.

3.2. Data Analysis

Descriptive calculations and multivariate data analyses were performed in SPSS 25. The quota setting of gender, age, education, and income worked in such a way that these parameters mimicked the German population. The German population was also well reflected in the information on the diets of the respondents. The data analysis consisted of two steps. First, a principal component analysis (PCA) with varimax rotation on the advantages and disadvantages of stockfree-organic agriculture was performed, in order to reduce the complexity of the data and to see if the concepts regarding the

advantages and disadvantages were consistent. Additionally, a confirmatory factor analysis of the three statements about the acceptance of stockfree-organic agriculture was undertaken. The Kaiser Meyer Olkin (KMO) criterion provides information about sampling adequacy. The internal consistency of the three factors was tested with Cronbach's alpha. In a second step, a cluster analysis was performed to obtain homogenous groups based on the factor values of the three factors. First, outliers were identified using the single linkage clustering, followed by Ward algorithms, including the elbow criteria and a dendrogram to identify the best solution for the number of classes. This resulted in a four-cluster solution. The cluster centroids were used as starting points for the third K-means clustering method. K-means was used to classify the group membership of the respondents. A discriminant analysis was performed to validate the accuracy of the classification.

To further compare the clusters, a second principal component analysis of the specific attitudes was conducted. The sociodemographic characteristics and the consumers' own dietary behaviour were compared between the clusters by calculating mean scores for the whole sample and for each cluster. Additionally, a one-way analysis of variance (ANOVA) with the respective post-hoc tests (Games Howell or Tukey) was carried out, as well as a cross tabulation with a chi-square test and a z-test.

4. Results

4.1. Sample Description

The resulting sample size consisted of 500 German citizens. Table 1 shows that the German population was represented by the quota parameters. 16.7% of the respondents knew about stockfree-organic agriculture; however, only 1% of the sample follow a vegan diet.

Table 1. Sample description.

		Sample (in %)	**German Population (in %) [48]**
Gender*	Male	50.2	49.3
	Female	49.6	50.7
	Divers	0.2	-
Age *	16–24	7.4	9.1
	25–39	20.2	22.1
	40–64	43.8	43.7
	65+	28.6	25.1
Education *	No graduation (yet)	1.8	3.9
	Certificate of Secondary Education	34.4	34.5
	General Certificate of Secondary Education	31.6	30.8
	General qualification for university entrance	15.0	13.8
	University degree	17.2	17.1
Income *	Below €1,300	25.2	26.3
	€1,300–€2,599	40.8	39.6
	€2,600–€4,999	27.0	27.1
	Above €5.000	7.0	6.5
Diet	Omnivore	80.6	-
	Flexitarian	13.4	11.6 [49] /13.0 [50]
	Pescatarian	1.2	3.0 [51]
	Ovo-Lacto-Vegetarian	3.4	3.7 [49] /5.1 [52]
	Lacto-Vegetarian	0.4	
	Vegan	1.0	1.0 [53] /0.9 [52]
Stockfree-organic agriculture	Known	16.7	-
	Unknown	83.3	-

Source: * Quotas based on Federal statistical office [48].

4.2. Results of the Principal Component and Cluster Analyses

The PCA on the advantages and disadvantages led to two factors (Table 2) and the KMO had a very good value, of 0.933 [54,55]. The first factor was named "Advantages and perception of stockfree-organic agriculture" and had a Cronbach's alpha value of 0.922. The second factor, "Disadvantages and challenges of stockfree-organic agriculture", had a value of 0.778. Both Cronbach's alpha values showed that the items were measured reliably within each factor [56]. A confirmatory factor analysis was conducted for the statements about the acceptance. It resulted in one factor named "Acceptance" and had a KMO of 0.737 and a Cronbach's alpha value of 0.892 (Table 2).

Table 2. Results of the four-cluster solution based on the principle component analysis of the acceptance, advantages, and disadvantages of stockfree-organic agriculture.

	Contesting the Use of Animals (1)	**Slight Supporter (2)**	**Slight Rejecter (3)**	**Not Interested (4)**	**Sample**
n (%)	108 (23.9)	227 (50.3)	60 (13.3)	56 (12.4)	N = 451 (100)
1. Acceptance (CA: 0.89)	**1.25^{a} (0.49)**	**0.13^{b} (0.48)**	**–0.83^{b} (0.74)**	**–1.01^{c} (0.83)**	**0.13 (0.96)**
Stockfree-organic agriculture should be supported. (0.92)	1.34^{a} (0.55)	0.23^{b} (0.63)	–0.78^{c} (0.85)	–0.93^{c} (0.97)	0.22 (1.04)
Stockfree-organic agriculture should receive more media attention. (0.92)	1.29^{a} (0.60)	0.07^{b} (0.73)	–1.05^{c} (0.89)	–1.05^{c} (0.84)	0.07 (1.11)
The idea behind stockfree-organic agriculture is … (0.88)	1.13^{a} (0.68)	0.09^{b} (0.61)	–0.67^{c} (1.00)	–1.04^{c} (0.97)	0.10 (1.02)
2. Advantages and perception of stockfree-organic agriculture (CA: 0.92)	**1.10^{a} (0.44)**	**0.29^{b} (0.39)**	**–0.21^{c} (0.58)**	**–1.13^{d} (0.64)**	**0.24 (0.81)**
People's knowledge of stockfree-organic agriculture should be increased in order to minimize prejudices. (0.82)	1.22^{a} (0.76)	0.20^{b} (0.80)	–0.82^{c} (0.87)	–1.29^{d} (0.73)	0.12 (1.13)
The stockfree-organic agriculture gets along without any animal components. (0.80)	0.94^{a} (0.79)	–0.02^{b} (0.79)	–0.78^{c} (0.99)	–1.23^{d} (0.73)	–0.04 (1.07)
A stockfree-organic diet is fairer. (0.79)	0.69^{a} (0.83)	–0.10^{b} (0.66)	–0.83^{c} (0.81)	–1.36^{d} (0.70)	–0.16 (0.97)
Stockfree-organic agriculture protects the groundwater. (0.76)	1.33^{a} (0.67)	0.64^{b} (0.74)	0.37^{b} (0.86)	–0.88^{c} (0.92)	0.58 (0.99)
The working conditions for farmers in stockfree-organic agriculture are good, as they do not come into contact with pesticides. (0.76)	1.30^{a} (0.65)	0,55^{b} (0.75)	0.15^{c} (0.90)	–0.98^{d} (0.90)	0.49 (1.02)
A stockfree-organic diet reduces the ecological footprint. (0.75)	1.03^{a} (0.86)	0.11^{b} (0.71)	–0.13^{b} (1.05)	–1.18^{c} (0.77)	0.14 (1.03)
Stockfree-organic foods contain no harmful substances such as antibiotics and sex hormones. (0.75)	1.37^{a} (0.68)	0.60^{b} (0.85)	0.38^{b} (1.11)	–1.11^{c} (0.89)	0.55 (1.11)
All foods (including vegetables, cereals, and fruit) are produced without animal suffering in stockfree-organic agriculture. (0.75)	1.25^{a} (0.75)	0.46^{b} (0.82)	0.13^{b} (1.20)	–1.05^{c} (0.92)	0.42 (1.10)
Since no fodder plants are needed in stockfree-organic agriculture, more land is available for human nutrition. (0.74)	0.81^{a} (0.74)	0.14^{b} (0.61)	–0.32^{c} (0.77)	–1.13^{d} (0.79)	0.08 (0.90)

Table 2. *Cont.*

	Contesting the Use of Animals (1)	Slight Supporter (2)	Slight Rejecter (3)	Not Interested (4)	Sample
2. Disadvantages and challenges of stockfree-organic agriculture (CA: 0.78)	**0.25^{a} (0.52)**	**0.35^{a} (0.44)**	**1.18^{b} (0.44)**	**–1.04^{c} (0.63)**	**0.26 (0.75)**
In stockfree-organic agriculture, the cultural landscape, e.g. the Alps, might get lost due to the loss of grazing animals. (0.78)	0.05^{a} (0.96)	0.27^{a} (0.70)	1.23^{b} (0.79)	–0.95^{c} (0.90)	0.20 (0.98)
Farm animal breeds may disappear if many people follow a stockfree-organic diet. (0.76)	–0.03^{a} (0.99)	0.31^{b} (0.76)	1.08^{c} (0.83)	–0.78^{d} (0.99)	0.20 (0.98)
Stockfree-organic foods do not offer all the necessary products for traditional dishes. (0.73)	0.12^{a} (0.99)	0.24^{a} (0.78)	1.27^{b} (0.81)	–1.23^{c} (0.92)	0.18 (1.08)
The stockfree-organic diet makes the supply of minerals and vitamins (e.g. B12) more complicated. (0.66)	0.52^{a} (0.97)	0.45^{a} (0.82)	1.02^{b} (0.95)	–1.13^{c} (0.88)	0.35 (1.06)
Stockfree-organic food is more expensive. (0.56)	0.60^{a} (0.87)	0.49^{a} (0.88)	1.18^{b} (1.08)	–1.12^{c} (1.00)	0.41 (1.11)

Notes: Question on advantages and disadvantages: "Again, we would like to know your opinion about stockfree-organic agriculture. Please state how important the following statements are to you." Question on acceptance: "How important are the following statements to you?" CA = Cronbach's Alpha for the factors; numbers in brackets behind the items indicate loadings on the factor above; factors: advantages and disadvantages—60.05% of total variance explained; Bartlett's test of sphericity: p = 0.000; KMO = 0.933; factor: acceptance—82.25% of total variance explained; Bartlett's test of sphericity: p = 0.000; KMO = 0.737; values for each cluster in the row of the factors are mean index values; n = number of respondents; means (standard deviation); different letters a, b, c, and d indicate a significant ($p < 0.05$) difference between groups according to Games–Howell; scale from −2 = "It is not important to me at all" to +2 = "It is very important to me"; due to the rounding of the decimal places of the cluster sizes, it is possible that the result is not exactly 100 percent.

The factor values of both PCAs were used for the subsequent cluster analysis as cluster-building variables. After case exclusion due to missing values (42) and the elimination of outliers (7), the remaining sample for the PCA consisted of 451 respondents. As described above, the cluster analysis was based on the three factors and resulted in four consumer segments. The first group consisted of 23.9%, the second of 50.3%, the third of 13.3%, and the fourth of 12.4% of the total sample. According to the discriminant analysis, 96.7% of cases were classified correctly. In Table 2, the results of the factor and cluster analysis including mean values of the corresponding statements are included. The mean values of the statements were used for the analysis because they were more suitable for the interpretation. The values allow a direct recognition of the differences.

Table 2 illustrates that two clusters (cluster 1 and 2, 74.2% of the total sample) rated the advantages of a stockfree-organic agriculture as important. The two clusters (1 and 2) differed, e.g., in the importance rating of the disadvantages.

Cluster 1 (named "contesting the use of animals") evaluated the advantages of a stockfree-organic agriculture as the highest. Some disadvantages were not important to them while others were. Cluster 2 ("slight supporter") rated the advantages as important but not as high as the "contesting the use of animals (1)" cluster. Besides, the disadvantages were important to the "slight supporter (2)" cluster.

The other two clusters (clusters 3 and 4, 25.7% of the total sample) rated the acceptance and the advantages as not important. On the one hand, the "slight rejecter (3)" cluster considered the disadvantages as important while, on the other hand, the "not interested (4)" cluster regarded the disadvantages as highly unimportant. The "slight rejecter (3)" cluster evaluated the advantages in a more differentiated way. Some were rated as important and others as unimportant. The disadvantages were consistently regarded as important. The "not interested (4)" cluster regarded the advantages of stockfree-organic agriculture as very unimportant and therefore did not recognise them as advantages. Furthermore, they also considered the disadvantages to be unimportant. Moreover, it was analysed whether the clusters had different attitudes (Table 3) to support stockfree-organic agriculture.

Table 3. Results of the four-cluster solution based on the principle component analysis of consumers' attitudes evaluation.

	Contesting the Use of Animals (1)	Slight Supporter (2)	Slight Rejecter (3)	Not Interested (4)	Sample
n (%)	108 (23.9)	227 (50.3)	60 (13.3)	56 (12.4)	N = 451 (100)
Animal welfare attitude, CA: 0.88	**1.64^{a} (0.52)**	**1.30^{b} (0.69)**	**1.31^{b} (0.64)**	**0.56^{c} (1.16)**	**1.29 (0.78)**
In the production of animal food, animals should be treated with dignity. (0.82)	1.70^{a} (0.54)	1.37^{b} (0.73)	1.39^{b} (0.74)	0.68^{c} (1.28)	1.36 (0.84)
In the production of animal food, we should make sure that the animals had a good life. (0.79)	1.65^{a} (0.57)	1.34^{b} (0.73)	1.37^{b} (0.76)	0.51^{c} (1.30)	1.32 (0.86)
The right to physical integrity of animals should be respected in the production of animal-based foods (e.g. no castration, no removal of tails (piglets)). (0.73)	1.55^{a} (0.65)	1.20^{b} (0.85)	1.18^{b} (0.79)	0.50^{c} (1.30)	1.19 (0.92)
Rejection of animal use, CA: 0.70	**0.41^{a} (0.67)**	**–0.04^{b} (0.71)**	**–0.69^{c} (0.68)**	**–0.78^{c} (0.78)**	**–0.11 (0.82)**
The production of animal-based food should be avoided, as the use and keeping of animals is morally unacceptable. (0.78)	0.29^{a} (1.04)	–0.19^{b} (0.99)	–1.05^{c} (0.95)	–1.00^{c} (1.10)	–0.29 (1.11)
In the production of non-animalbased foods (e.g., cereals, fruit, vegetables), care should be taken to ensure that these are produced without animal by-products (e.g. animal meal, animal blood, slurry). (0.70)	1.07^{a} (0.86)	0.55^{b} (1.05)	–0.10^{c} (1.20)	–0.36^{c} (1.24)	0.48 (1.15)
In the production of non-animal based food (e.g., cereals, fruit, vegetables), animals should be completely excluded. (0.68)	0.94^{a} (0.92)	0.25^{b} (1.01)	–0.17^{bc} (1.15)	–0.39^{c} (1.26)	0.28 (1.13)
The keeping of dogs and cats is morally unacceptable. (0.58)	–0.65^{a} (1.21)	–0.78^{a} (1.10)	–1.40^{b} (0.89)	–1.36^{b} (0.80)	–0.91 (1.10)
Environmental attitudes, CA: 0.84	**1.38^{a} (0.51)**	**1.05^{b} (0.59)**	**1.00^{c} (0.65)**	**0.46^{b} (0.97)**	**1.05 (0.69)**
Food should be packaged in an environmentally friendly way. (0.77)	1.64^{a} (0.57)	1.35^{b} (0.75)	1.27^{b} (0.76)	0.69^{c} (1.16)	1.33 (0.82)
Food was produced in a way that did not affect the balance of nature. (0.75)	1.00^{a} (1.02)	0.77^{a} (0.91)	0.70^{a} (0.87)	0.20^{b} (1.06)	0.75 (0.97)
Food has been produced in an environmentally friendly way. (0.74)	1.26^{a} (0.80)	0.87^{b} (0.79)	0.82^{b} (0.89)	0.23^{c} (1.17)	0.88 (0.91)
If possible, food packaging should be avoided. (0.72)	1.44^{a} (0.73)	1.07^{b} (0.85)	0.93^{b} (1.02)	0.41^{c} (1.19)	1.06 (0.94)
When soil resources are used, it is important to return resources to the soil. (0.71)	1.58^{a} (0.53)	1.19^{b} (0.71)	1.34^{b} (0.71)	0.73^{c} (1.15)	1.24 (0.78)
Attitudes towards social justice with regard to farmers, CA: 0.56	**0.35^{a} (0.51)**	**0.09^{b} (0.44)**	**–0.01^{b} (0.48)**	**–0.05^{b} (0.56)**	**0.12 (0.50)**
*The farmer gets enough money for his products. (–0.76)	–0.76 (0.97)	–0.63 (0.98)	–0.72 (1.09)	–0.50 (1.21)	–0.65 (1.03)
*The working pressure in agriculture is high. (0.75)	1.28^{a} (0.72)	0.90^{bc} (0.89)	1.00^{abc} (1.03)	0.64^{c} (1.07)	0.97 (0.91)
*The health of farmers is at risk. (0.64)	0.54^{a} (0.83)	0.01^{b} (0.85)	–0.32^{b} (1.02)	–0.29^{b} (1.06)	0.05 (0.94)

Table 3. *Cont.*

	Contesting the Use of Animals (1)	Slight Supporter (2)	Slight Rejecter (3)	Not Interested (4)	Sample
Spiritual attitudes, CA: 0.60	**0.62^{a} (0.78)**	**0.15^{b} (0.68)**	**–0.03^{b} (0.72)**	**–0.57^{c} (0.79)**	**0.15 (0.80)**
I take the time to meditate, pray or something like that to find my inner peace/balance. (0.80)	–0.15^{a} (1.29)	–0.67^{b} (1.21)	–0.97^{bc} (1.12)	–1.34^{d} (1.08)	–0.67 (1.25)
When I am in nature, I feel a strong connection. (0.75)	1.22^{a} (0.84)	0.76^{b} (0.94)	0.90^{bc} (0.86)	0.07^{d} (1.23)	0.79 (1.01)
I try to make a significant contribution to society by reducing animal suffering. (0.44)	0.80^{a} (0.94)	0.37^{b} (0.82)	–0.02^{bc} (1.07)	–0.43^{c} (1.01)	0.32 (0.98)

Notes: Question: "How important are the following statements to you?", CA= Cronbach's alpha for the factors; numbers in brackets behind the items indicate loadings on the factor above; 64.15% of total variance explained; Bartlett's test of sphericity: p = 0.000; KMO = 0.864; values for each cluster in the row of the factors are mean index values; means (standard deviation); different letters a, b, c, and d indicate a significant ($p < 0.05$) difference between groups according to the post-hoc test (Games–Howell or Tukey); scale from −2 = "It is not important to me at all" to +2 = "It is very important to me"; * question: "To what extent do you agree with the following statements?"; scale from −2 = "I do not agree at all" to +2 = "I totally agree".

The evaluation of the different attitudes leads to the conclusion that the "contesting the use of animals (1)" cluster attached the greatest importance to all different attitudes. The "not interested (4)" cluster's answers assigned the lowest importance or highest unimportance to each attitude.

The "contesting the use of animals (1)" cluster considered it to be very important to ensure animal welfare and, as a result, that animals should be treated well during the production of animal-based food products. Respondents tended to reject the use of animals. The environmental attitude was very important to them as well. Food packaging played a particularly decisive role here and should be environmentally friendly or completely omitted. Spirituality was in some way important to respondents. The least importance was attached to the attitudes towards social justice with regard to farmers.

The "slight supporter (2)" cluster attached the greatest importance to animal welfare attitudes as well, i.e. respondents wanted animals to be treated well. The rejection of animal use was neither important nor unimportant to them. The environmental attitudes received the second-most importance to them. The attitudes towards social justice with regard to farmers and spiritual attitudes were judged to be neither important nor unimportant.

The "slight rejecter (3)" cluster rated animal welfare attitudes as important but considered the rejection of animal use as unimportant. Environmental motivation was as important to them as it was to the "slight supporter (2)" cluster. The attitudes towards social justice with regard to farmers and spiritual attitudes were assessed as neither important nor unimportant.

The "not interested (4)" cluster considered animal welfare attitudes as somewhat important to them but did not reject the use of animals. Environmental attitudes were assigned nearly the same importance as animal welfare attitudes. The attitudes towards social justice with regard to farmers were neither important nor unimportant, while spiritual attitudes were unimportant to them.

Overall, it can be seen that all clusters attached the greatest importance to animal welfare and environmental attitudes. In addition, the participants of the four clusters differed in their healthy eating behaviour and their food consumption in the past seven days (Table 4).

Table 4. ANOVA analysis of healthy eating and dietary variables of the four clusters.

	Contesting the Use of Animals (1)	Slight Supporter (2)	Slight Rejecter (3)	Not Interested (4)	Sample
n (%)	108 (23.9)	227 (50.3)	60 (13.3)	56 (12.4)	N = 451 (100)
I avoid fried food.	0.47^{a} (1.11)	0.24^{a} (1.15)	0.15^{a} (1.18)	-0.36^{b} (1.20)	0.21 (1.17)
I often eat legumes (e.g., beans, chickpeas, lentils).	0.21^{a} (1.04)	-0.06^{ab} (0.99)	-0.18^{ab} (0.95)	-0.38^{b} (1.05)	−0.05 (1.02)
I often eat nuts and seeds (e.g., sunflower seeds, walnuts, hazelnuts).	0.42^{a} (1.23)	-0.09^{ab} (1.11)	0.10^{ab} (1.15)	-0.25^{b} (1.28)	0.04 (1.19)
I do not consume much salt.	0.29^{a} (1.13)	0.30^{a} (1.06)	-0.05^{ab} (1.20)	-0.20^{b} (1.00)	0.18 (1.10)
I prefer whole grain products.	0.46^{a} (1.16)	0.28^{a} (0.97)	-0.03^{ab} (1.23)	-0.39^{b} (1.07)	0.20 (1.10)
*How often have you eaten organic products in the past 7 days?	3.06^{a} (1.14)	2.38^{b} (1.09)	2.02^{bc} (0.91)	1.55^{c} (0.78)	2.39 (1.14)
*How often have you eaten vegan meals (no animal products) in the past 7 days?	2.41^{a} (1.20)	1.93^{b} (0.94)	1.48^{c} (0.75)	1.34^{c} (0.67)	1.91 (1.02)
*How often have you eaten vegetarian meals (no meat and fish but other animal ingredients) in the past 7 days?	3.20^{a} (1.30)	2.57^{b} (1.15)	2.50^{b} (1.20)	1.70^{c} (1.03)	2.60 (1.25)
*How many times have you eaten meat in the past 7 days?	2.61^{a} (1.20)	3.07^{b} (0.91)	3.27^{bc} (0.86)	3.50^{c} (1.04)	3.04 (1.04)

Notes: n = number of respondents; means (standard deviation); different letters a, b, and c indicate a significant ($p < 0.05$) difference between groups according to post-hoc testes (Games–Howell or Tukey); scale from −2 = "Not applicable at all" to +2 = "Totally applicable ", and * scale from 1 = "never" to 5 = "very often".

The "contesting the use of animals (1)" cluster followed the healthiest diet compared to the other clusters, e.g., they often ate legumes, nuts and seeds, whole grain products, and avoided fried food. When answering the questions about food consumption in the past seven days, it was noticeable that the "contesting the use of animals (1)" cluster most often ate organic products, vegan, and vegetarian meals. In addition, they consumed the least amount of meat. The "not interested (4)" cluster, on the other hand, followed the unhealthiest diet, as they rarely consumed foods such as whole grain products or legumes. In addition, they most frequently consumed meat and rarely vegan or vegetarian meals. The other two clusters (slight supporter (2) and slight rejecter (3)) were located between the two extreme clusters.

Moreover, the clusters were compared according to their diets (Table 5). The "contesting the use of animals (1)" cluster consisted of all vegans and lacto-vegetarians of the sample and the majority of flexitarians and ovo-lacto-vegetarians. The "slight supporter (2)" cluster included many omnivore and flexitarians and some ovo-lacto-vegetarians. The "slight rejecter (3)" and "not interested (4)" clusters did not differ in terms of their diets. Both clusters contained the highest proportion of omnivores and were even above the sample distribution (Table 5).

The group comparison based on sociodemographic characteristics (age, gender, income, education) led to minimal differences, while knowing about stockfree-organic agriculture did not lead to a higher acceptance (Appendix B).

Table 5. Mean comparison of consumers' diets between the four clusters using cross tabulation.

	Contesting the use of animals (1)	Slight supporter (2)	Slight Rejecter (3)	Not interested (4)	Sample
n (%)	108 (23.9)	227 (50.3)	60 (13.3)	56 (12.4)	N = 451 (100)
Omnivore	58.3^{a}	84.1^{b}	95.0^{c}	92.9^{bc}	80.5
Flexitarian	24.1^{a}	13.2^{b}	5.00^{b}	5.4^{b}	13.7
Pescatarian	0.9^{a}	1.3^{a}	0.0^{a}	1.8^{a}	1.1
Ovo-Lacto-Vegetarian	10.2^{a}	1.3^{b}	0.0^{b}	0.0^{b}	3.1
Lacto-Vegetarian	1.9^{a}	0.0^{b}	0.0^{ab}	0.0^{ab}	0.4
Vegan	4.6^{a}	0.0^{b}	0.0^{ab}	0.0^{ab}	1.1

Notes: Question: "Which diet do you follow?"; data in percent; differences between clusters were tested using Chi-square test and cross tabulation z-test ($p = 0.05$); different letters a, b, and c indicate a significant ($p < 0.05$) difference between groups.

5. Discussion

Currently, there are many discussions on how to further develop agricultural systems. Stockfree-organic agriculture is one of many emerging agricultural production systems. Therefore, the aim of this study was to find out consumers' attitudes towards stockfree-organic agriculture. This is important to better understand the potential of a relatively new cultivation method.

To our knowledge, the present study is the first consumer segmentation based on the acceptance and perceived advantages and disadvantages of stockfree-organic agriculture. Subsequently, different ethical, environmental, social, and spiritual attitudes as well as food consumption patterns were examined for the description of the cluster differences. Therefore, this study provides a deeper understanding of the individual target groups that accept and rate the advantages and disadvantages of stockfree-organic agriculture differently, and differ with regard to their attitudes towards animal welfare, their rejection of animal use, the importance they attribute to environmental, social, and spiritual aspects, and their dietary behaviour.

About a quarter of the German population judged stockfree-organic agriculture positively. The majority of consumers of all clusters rated several attitudes (animal welfare considerations and environmental aspects) to support stockfree-organic agriculture as important. The result that several attitudes played a role in the evaluation of stockfree-organic agriculture is in line with other studies that have already shown that common motivations to reduce meat consumption are based on animal welfare considerations, and environmental aspects [11,57].

The consumer segmentation resulted in a four-cluster solution. The first segment, "contesting the use of animals (1)", attributed the highest importance to the acceptance and the advantages of stockfree-organic agriculture, while the disadvantages were of no great importance to them. This segment was the second-largest and accounted for approximately 24% of the German population. It expressed concern about the consumption of animal-based food products and thereby showed a positive attitude towards stockfree-organic agriculture. However, this segment was somewhat uncertain with regard to assessing potential disadvantages. The high support of stockfree-organic agriculture in this cluster is reflected by the high number of vegetarians/vegans and consumers who rejected animal usage for food products. Comparatively, many more consumers in this cluster rejected the animal usage than actually followed a vegetarian or vegan diet. It can be assumed that they struggle with an inner conflict between their inner values and their actual behaviour (attitude-behaviour gap), which is known as 'meat paradox' in the literature [58,59]. Hölker et al. [52] also identified a segment which includes consumers who reject animal usage, and only a small proportion of them implemented this rejection in their diets. This segment also dedicated the highest importance to different attitudes. In particular, animal welfare and environmental attitudes need to be mentioned here. The consumers of this segment considered it very important not to use animals, and especially not to use animal by-products in the production of non-animal-based foods. Kilian

et al. [45] showed that vegans accept manure based on animal faeces more frequently than, for example, fertilization with horn meal. The lower acceptance of animal by-products can be seen as a logical conclusion of the rejection of livestock farming and clearly shows that this segment does not want animals to be used and be part of the food production chain. Consumers are willing to pay a price premium for stockfree-organic produces [45]. A study by Hölker et al. [60] shows that a part of the population completely rejects animal usage, which is in line with our results. Moreover, the highest share of vegetarians and all vegans of the sample are accumulated in this segment. In addition, the highest proportion of consumers following a flexitarian diet is represented here. Therefore, one explanation for the fact that these groups placed high importance on the acceptance and advantages, while low importance was placed on the disadvantages of stockfree-organic agriculture, could be that they are aware of the disadvantages and want to reduce them. Therefore, they might have already adjusted their diet accordingly. Pelletier et al. [61] have found that young adults who place a higher emphasis on alternative food production practices have a healthier diet. This result is also reflected in our results, as this cluster followed the healthiest diet (Table 4) [62–64] compared to the other clusters and showed the highest acceptance level. Lund et al. [65] and Hölker et al. [52] have also shown that there is a link between one's attitude to animal welfare considerations and dietary habits. Respondents who attached great importance to animal welfare aspects tended to follow a flexitarian, vegetarian, or vegan diet [52,65].

The second segment, "slight supporter (2)", was the largest in the study and contained an average consumer group (the mean values of this segment were close to the mean values of the overall sample). As they had the same mean values for both environmental attitudes and animal welfare considerations as the entire sample, it is evident that these two topics are of general importance to the population, which is also shown in other studies [1,52,66,67]. The "slight supporters (2)" had some animal welfare concerns, as the "slight rejecter (3)" segment. In contrast to the "slight rejecters (3)", however, they did not recognise any major disadvantages of stockfree-organic agriculture. When compared with the "contesting the use of animals (1)" segment, they did not realise the advantages of stockfree-organic agriculture. In more detail, "slight supporters (2)" differed from the "contesting the use of animals (1)" segment in terms of a lower importance of the advantages of a stockfree-organic agriculture. When evaluating the disadvantages, both clusters (1 and 2) differed only in one score (loss of farm animal breeds), the "slight supporters (2)" considering it more important than the "contesting the use of animals (1)" cluster. The "slight supporter (2)" cluster might have recognised the consequences of the exclusion of farm animals. From this it can be presumed that they recognised the advantages of stockfree-organic agriculture but may not have wanted to lose the traditional image of agriculture, which includes the idyllic scenery with farm animals on a meadow and the recreational value of the agricultural landscape [68]. The weaker evaluation of the advantages is also reflected in the diet of the "slight supporter (2)" cluster. There were no vegans and fewer ovo-lacto-vegetarians and flexitarians than in the "contesting the use of animals (1)" cluster, and thus they gave lower importance to the advantages. Hölker et al. [52] showed that the abolitionism argumentation (i.e., that humans are not allowed to use animals for their own purposes at all) leads to a reduction in the consumption of animal-based foods. "Slight supporters (2)" judged it as somewhat important not to use animal by-products in the production of non-animal-based foods. In this cluster, flexitarians were represented to the same extent as in the average sample. It is possible that this cluster was dissatisfied with the circumstances of the current livestock production and therefore reduced its meat consumption [12,69]. Overall, the eating behaviour in this cluster seems to be quite average (most values were very close to the average sample). In comparison to the "contesting the use of animals (1)" cluster, they consumed meat more frequently and vegetarian and vegan dishes less frequently. They ate a little less healthily than the "contesting the use of animals (1)" cluster, e.g., they ate fewer legumes, nuts, and seeds.

The third segment was the second smallest and was called "slight rejecter (3)". They did not really see the advantages and recognised possible disadvantages of stockfree-organic agriculture. Moreover, they differed from the "not interested (4)" cluster in that they considered the advantages as slightly unimportant, while the "not interested (4)" cluster did not see any advantages. In contrast, the

"slight rejecters (3)" regarded the disadvantages of a stockfree-organic agriculture as highly important. They considered environmental attitudes and animal welfare concerns as important. Consumer awareness of environmental and animal welfare aspects in food consumption has increased in recent years [70]. Other consumer segmentations also show clusters that pay attention to environmental and animal welfare aspects [52,70]. This cluster did not reject the use of animals for food products. In the production of non-animal-based foods, they did not value the exclusion of animal by-products. It is possible that vegan products (the word vegan) was met with rejection/reactance, a known defence reaction [71]. The majority of consumers in this cluster ate meat products regularly; however, 5.0% of the segment were flexitarians. The "slight rejecters (3)" did not differ from the "not interested (4)" cluster in the frequency of their meat consumption, but they ate vegetarian meals more frequently, and their meals were slightly healthier. Their current meat consumption, which was above that of the average sample, may have been due to their routine eating habits and cooking of well-known dishes. To change diet is difficult and long-lasting process for consumers [72,73].

The last segment was the smallest and was called "not interested (4)". It was characterised by the fact that its members judged the acceptance, advantages, and disadvantages of stockfree-organic agriculture as unimportant. The "not interested (4)" cluster considered the exclusion of animal by-products in the food production of non-animal-based foods to be extremely unimportant. This attitude may stem from the fact that these respondents consumed meat very frequently and were not interested in vegetarian/vegan dishes. 92.9% of the respondents in this cluster followed an omnivore diet, only 5.4% a flexitarian diet, and 1.8% a pescatarian diet, meaning that all respondents consumed animal products. Such a segment, consisting only of meat eating consumers, could also be identified in previous consumer segmentation [52]. The high consumption of meat can still originate from traditional German dishes, since German cuisine is originally very meaty [74]. A vegetarian/vegan diet has no rooted tradition in Germany, and therefore the participants may respond with reactance [71]. Other studies also show that meat lovers exist in the population [75,76]. Verain et al. [77] have carried out a consumer segmentation which examined the willingness to reduce meat consumption. They found that there was one segment which consistently rejected reducing meat consumption and consumed meat very frequently (six times a week) [77]. In addition, the "not interested (4)" cluster ate the unhealthiest food compared to the other three segments. Past research found out that high meat consumption is associated with an unhealthier food intake [78]. Another reason might be that consumers are more interested in the short-term enjoyment of tasty food than in the long-term consequences of an unhealthy diet. Another study found out that there are consumers who believe that taste and a healthy product correlate negatively [79]. For them, taste is more important than a healthy diet [79]. A further reason might be that they do not want to restrict their food choices to specific products, or that they are simply not interested in agricultural and nutritional topics.

6. Conclusions and Limitations

Surprisingly, stockfree-organic agriculture was known by 17% of respondents, although it is in an early phase of the diffusion process and not widespread. Because of that, this study can be classified as explorative. The majority of respondents were confronted with this topic for the first time in their lives during the survey. Because of that, the concept of stockfree-organic agriculture had to be explained to respondents (Appendix A). The study therefore measures spontaneous perceptions and evaluations rather than stable attitudes. Stockfree-organic agriculture, if widespread, would have the potential to profoundly change agriculture, including organic farming, and to render it more sustainable. Therefore, this trend study is important.

Overall, it can be seen that stockfree-organic agriculture is supported by considerably more citizens (23.9%) than only vegans (1.1%). It can be concluded that potentially up to 24% of society evaluates vegan food products from stockfree-organic agriculture very positively. Vegans reject the use of animals because of their attitudes, and therefore stockfree-organic agriculture is a logical continuation of their dietary style. However, these days, it is not possible to follow a diet without animal by-products

used in food production, but foods without animal by-products are important for consumers who follow a vegan lifestyle. Therefore, it is important to communicate that stockfree-organic products exclude all use of animals. Since many consumers who purchase and eat a lot of organic food often opt for organic food for ethical reasons, it is important to make them aware of the advantages of stockfree-organic agriculture, which excludes all animal usage. If consumers were aware of this, it would probably lead to increased demand, from which farmers of stockfree-organic products would benefit. Since 24% of the population rate products of stockfree-organic agriculture positively, it can be cautiously concluded that consumers might also be willing to consume them. Assuming that the products are readily available and recognisable at the points-of-sale, it can be assumed that they will be in demand by consumers. Farmers who already operate an organic farm could consider whether it would be more economical to switch to stockfree-organic agriculture.

The results and assessments of the respondents should be interpreted with caution and might be biased by the given information. Furthermore, the estimate of consumed food in the past seven days was a self-estimation in this study and therefore might deviate from true values. Additionally, the sample is based on German consumers, and the results might therefore deviate for other countries due to social and cultural aspects. Since stockfree-organic agriculture is not yet widespread in Germany, it is not possible to exclusively eat such products. For this reason, we could only measure attitudes and intentions, not actual buying behaviour. It would be interesting to conduct a further study on the evaluation of the acceptance, advantages, and disadvantages if this were a more established cultivation method.

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Appendix A

Original German Text of the Stockfree-Organic Agriculture Explanation

In Deutschland entwickelt sich gerade eine neue Anbaumethode. Diese erweitert die ökologische Landwirtschaft um Prinzipien aus der veganen Ernährungsweise. Dabei werden Lebensmittel nach ökologischen Standards angebaut und kommen nur mit veganen Produkten in Berührung. Sie wird bio-vegane Landwirtschaft genannt. Julia und Johannes ernähren sich biovegan, d.h. sie essen keine Lebensmittel, die vom Tier stammen und zusätzlich bevorzugen sie Lebensmittel, die während der Produktion nicht mit tierischen Produkten in Berührung kamen. Sie essen kein Fleisch, Fisch, Eier, Milchprodukte und Honig. Des Weiteren wurden die Lebensmittel nach ökologischen Standards angebaut. Beim Abendessen trinken sie gerne mal ein Glas Wein. Sie rauchen nicht und gehen einmal wöchentlich zum Sport. Julia ist nicht schwanger. Es werden keine tierischen Produkte verwendet, z.B. Gülle, Hornspäne oder Blutmehl zur Düngung der Felder. Die bio-vegane Landwirtschaft strebt eine vollständige Entkopplung von tierischen Produkten aus der Nutztierhaltung an. Außerdem werden alle Bedingungen, die in der ökologischen Landwirtschaft gelten, eingehalten wie z.B. der Verzicht von synthetischen Dünge- und Pflanzenschutzmitteln.

Translation to English of the Original German Text of the Stockfree-Organic Agriculture Explanation

A new cultivation method is currently developing in Germany. This extends the organic agriculture based on principles from the vegan diet. Food is cultivated according to organic standards and only comes into contact with vegan products. This is called stockfree-organic agriculture. Julia and Johannes

eat stockfree-organic, i.e., they do not eat food that comes from animals and, additionally, they prefer food that did not come into contact with animal products during production. They do not eat meat, fish, eggs, dairy products, and honey. Furthermore, the food was produced according to ecological standards. At dinner they like to have a glass of wine. They do not smoke and practice sports once a week. Julia is not pregnant. No animal products are used, e.g. manure, horn meal, or blood meal to fertilise the fields. Stockfree-organic agriculture aims at a complete decoupling of animal products from livestock farming. In addition, all conditions that apply to organic farming, such as the renunciation of synthetic fertilisers and pesticides, are applied.

Appendix B

Table A1. Cluster differences according to sociodemographic variables and knowledge about stockfree-organic agriculture.

		Contesting the Use of Animals (1)	Slight Supporter (2)	Slight Rejecter (3)	Not Interested (4)	Sample
	n (%)	108 (23.9)	227 (50.3)	60 (13.3)	56 (12.4)	N = 451 (100)
Gender	Male	38.0^{a}	52.0^{b}	53.3^{ab}	60.7^{b}	49.9
	Female	62.0^{a}	47.6^{b}	46.7^{ab}	39.3^{b}	49.9
	Divers	-	0.4	-	-	0.2
Age		43.8^{a}	52.6^{b}	53.5^{b}	49.5^{ab}	50.3
Education	No graduation (yet)	1.9^{a}	1.8^{a}	1.7^{a}	3.6^{a}	2.0
	Certificate of Secondary Education	25.0^{a}	37.4^{a}	36.7^{a}	42.9^{a}	35.0
	General Certificate of Secondary Education	26.9^{a}	31.3^{a}	31.7^{a}	33.9^{a}	30.6
	General qualification for university entrance	26.9^{a}	11.5^{b}	6.7^{b}	10.7^{b}	14.4
	University degree	19.4^{ab}	18.1^{ab}	23.2^{a}	8.9^{b}	18.0
Income	Below €1,300	27.8^{a}	27.3^{a}	18.3^{a}	19.6^{a}	25.3
	€1,300 - €2,599	47.2^{a}	37.9^{a}	40.0^{a}	39.3^{a}	40.6
	€2,600 - €4,999	19.4^{a}	27.3^{ab}	30.0^{ab}	35.7^{b}	26.8
	Above €5,000	5.6^{a}	7.5^{a}	11.7^{a}	5.4^{a}	7.3
*Knowledge of stockfree-organic agriculture	Yes	0.31^{a} (0.47)	0.05^{b} (0.23)	0.13^{c} (0.34)	0.07^{b} (0.25)	0.16 (0.37)

Note: Data in percent; * question: Do you know about stockfree-organic agriculture? yes (1)/no (0); mean (standard deviation); differences between clusters were tested using ANOVA or Chi-square test and cross tabulation z-test ($p = 0.05$); letters a and b indicate a significant ($p < 0.05$) difference between groups.

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Why Not Green Marketing? Determinates of Consumers' Intention to Green Purchase Decision in a New Developing Nation

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Abstract: Consumers are paying close attention to green products to reduce the environmental impact on health issues. As the scope of this research, this current study focuses on determining consumers' purchase decisions regarding green products using a survey conducted in a fast-growing developing country. This research was descriptive and considered a conceptual framework for extending the Theory of Planned Behavior (TPB), which was selected as the primary theoretical model. The significant contributions and main objectives of this study are as follows—to explore the present scenario of green marketing in Bangladesh with previous studies, and to fill a research gap regarding green purchase decisions by applying the TPB model with adding additional constructs, such as environmental concerns, green perceived quality, and future green estimates. A range of qualitative and quantitative techniques were adopted to collect data from the target groups, where a sample of young educated Bangladeshi consumers (n = 638) was used to consider the measurement and structural models by applying a partial least squares-structural equation modelling (PLS-SEM) method. The empirical findings show that consumers' environmental concern (EC), green perceived benefits (GPB), green awareness of price (GAP), green willingness to purchase (GWP), and future estimation of green marketing (GFE) have a strong positive influence on consumer' green purchase decision (GPD). Still, the green perceived quality (GPQ) has a negative influence on green purchase decisions (GPD). To inform consumers about green or eco-friendly products, this study provides valuable suggestions to companies, marketers, and policymakers for designing green marketing tools such as green advertising, green branding, and eco-labels. Based on these findings, it gives some managerial insights for the promotion of green products and green marketing.

Keywords: environmental marketing; green product; green consumer; green purchase decision; consumer behaviour; theory of planned behaviour; sustainable consumption; Bangladesh

1. Introduction

It is well-known that ever-increasing business activities and production are globally polluting the natural environment (e.g., damage to people, wildlife, and crops). In this world, human needs are unlimited, but resources are limited. Thus, it is inevitable that marketers need to utilize limited resources efficiently and effectively so that individual and organizational goals can be achieved without spoiling many resources. Green marketing recommends using eco-friendly products, e.g., refillable, ozone friendly, healthy food, phosphate-free and recyclable products. Moreover, green marketing can be applied in environmentally friendly ways to satisfy the customers' needs, wants, and demands by protecting the environment and society [1,2].

In the twenty-first century, some environmental issues, such as global warming, the effects of greenhouse gases, pollution, and global climate change are directly connected to the agricultural and manufacturing industries, which have a devastating impact on human actions. These emerging environmental issues can only be solved if consumers are responsible for reducing the hazardous effects on the environment by using a larger quantity of green products. Therefore, many companies have begun to apply green production and marketing strategies to meet customer preferences to achieve long-term business profits [3–5]. Green marketing has become one of the key developments in modern business, which is more applied in developed countries than lower and middle-income countries [6,7]. Due to the growing importance of environmental sustainability, green marketing is becoming more popular [3,8,9]. United Nations set out 17 sustainable development goals (SDGs), including "poverty, hunger, health, education, gender equality, water, sanitation, energy, environment, climate change, and social justice". Green marketing strongly supports the second goal among the SDGs, which indicates "achieving food security & improving nutrition and promoting sustainable agriculture". Bangladesh was a relatively late adopter of the Green Revolution for political reasons [10]. Bangladesh's government is trying to achieve the SDGs before 2030. Therefore, environmental marketing is one part of achieving SDGs, such as ensuring sustainable food production, attaining food security, and improving nutrition. In the least developed countries (LDCs) and new developing countries such as Bangladesh, green evaluation is an emerging issue as it ensures better products or food quality, especially for health and the environment.

Nevertheless, in the last decade, the GDP growth rate in Bangladesh increased from 5.05 in 2009 to 7.86 in 2019. Therefore, the quality of life, income, and expenditure are growing, and the lifestyle is changing day by day. So, people are conscious of the environment and are becoming interested in buying environmentally friendly or green products.

Bangladesh is trying to embrace the green production and organic food farming culture while targeting specific class segments if not in the mass-market [11,12]. It is blessed with a lot of potentials to produce all varieties of organic foods due to the favorable agricultural climate regions. The number of green product producers is not very large in Bangladesh, but the trend is increasing in both sectors. The Bangladesh Organic Products Manufacturers Association (BOPMA) is playing an essential role in strengthening the growth of organic trade nationally and internationally. Bangladeshi organic producers produce foods, including vegetables, fruits, dairy, dried vegetables, fruit juices, fishes, etc. In addition, many industries in Bangladesh, especially the textile industry, leather industry, agriculture industry, food manufacturing industry, plastics industry, cosmetics industry, etc., are producing green products to meet the needs of specific customer groups. Companies are adding green products to their product lines progressively. During the past few decades, environmental awareness of consumers has increased, and they demand so-called "green" or "environment-friendly" products or services [13].

Younger consumers show more interest in buying green products, but older consumers are the main buyers [14]. Family eating habits are changing dramatically as new parents tend to buy more organic food and products for their children [15]. Regular consumers of organic food in Bangladesh are upper class and educated people who follow green consumption practices [16]. Therefore, the production of green products and green consumption habits is increasing day by day, especially in city areas. To realize the antecedents of consumers' green-purchase intentions [17], it is essential for marketers, academicians, and researchers because it supports appropriate developing strategies for green products. Previously, several marketing scholars addressed consumer purchase intention on green products in the developed countries, e.g., Europe, USA, Australia, Canada [18–30]. Still, there is an absence of empirical research in fast-growing developing countries such as Bangladesh. Yet, Bangladesh is in the early stages of research on environmental issues, green products, and green purchasing decisions compared to other developing countries [18–30]. Few studies (Hossain and Khan, 2018; Adrita, 2020) have examined the marketing mix in developing Bangladesh linked to consumer attitudes towards green marketing. There has been no study on green purchasing decisions applying the Theory of Planned Behavior (TPB) in Bangladesh [30,31].

This study focuses on well-educated young people in Bangladesh because the views and attitudes of young people had primarily been ignored since the beginning of the environmental movement [32]. According to UNFPA, 30 percent (47.6 million) of the total population in Bangladesh are young (10–24 years) [33]. Moreover, the World Bank collection of development indicators stated that about 1.2167% of Bangladesh's population is comprised of graduates [34]. It is crucial to understand the attitude of young, educated people towards environmental behavior and green purchasing decisions due to the fact they are the future customers, representatives of society, and have a more pressing concern for social and natural problems [35]. Hence, the current research tries to investigate the young, educated consumers' purchase decisions of a green product in a newly developing country, Bangladesh. In addition, it examines the emerging factors affecting consumers' purchase decisions on environmentally friendly products and compares the relationship with the proposed variables.

The main notable contributions of this current study are to explore green marketing with previous studies and fill a research gap regarding green purchase decisions through applying the Theory of Planned Behavior (TPB) with adding additional constructs, such as environmental concerns, green perceived quality, and future green estimates as a theoretical framework. The present study is the first empirical survey that explains to consumers a comprehensive view of their green purchasing decisions about green products in Bangladesh focusing on the young and educated generation. This segment of the population will formulate the future strategy on a national and business level as well, so their knowledge, belief, attitude, and purchasing behavior toward green products are the key to sustainable development. Our empirical research was started by exploring the factors affecting consumer behavior toward greening production and consumption and determining their effect size using the Likert scale. Our research serves to fulfill this information gap by constructing a model including the explored factors influencing young consumer behavior and test the significance of that using partial least square-based structural equation modeling (PLS-SEM).

However, this research answers the following questions: what are the main factors of green marketing that are affecting the young consumers' purchase decision of a green product in a newly developing country? What is the current market situation of green products in Bangladesh? What are the relationships among the variables of the proposed model for a green purchase decision?

Hence, understanding the youth's attitude and behavioral intention towards green purchases would support marketers and producers to be more concerned about consumer's needs or demands, thus providing a better, safer, and healthier product. Nevertheless, both policymakers and business leaders need to know and deeper understand the factors affecting the sensitivity and behavior of the young generation.

The key practical implication of this research is to implement environmental marketing strategy, marketing mix, and marketing tools based on the green purchase decision of young consumers. Moreover, the company, marketer, and policymaker can redesign the marketing tools such as green branding, green advertising, and eco-labels based on the knowledge of the young consumers and the results of our research. The results of our research presented in this paper are expected to give more new insights to the strategy managers and marketing managers to frame new marketing strategies and tools to improve profitability in the green market, formulating strategies for maximizing sustainable value creation and increasing the number of environmentally aware young consumers, the young and educated consumers can be used as influencers or brand ambassadors of new green products and the behavior toward them. The results can also provide ideas for policymakers to frame better legal directives to promote green technology initiatives and educational programs, helping to change the minds and behavior of the young generation as business leaders and consumers towards the protection of the environment.

This current study, firstly, focuses on a literature review, differentiating the present research from past studies. Secondly, the methodology and data analysis techniques discussed consist of a descriptive analysis of green marketing and hypothesis testing with a model fit. Finally, a summary of the results,

the conclusion, the recommendations, future research of environmental marketing, and green products are discussed.

2. Literature Review and Hypothesis Development

2.1. Why Green Marketing?

Green marketing is a combination of ecological marketing and environmental marketing. It started its journey in the late 1980s and early 1990s. The American Marketing Association (AMA) in 1975 stated that "marketing of products that are assumed to be environmentally safe and friendly is called green marketing". In general, there is no universal definition of green marketing (also similarly termed as environmental marketing, eco-marketing, social marketing, organic marketing, and sustainability marketing), but ecological awareness is a common component of the definitions [2,36] where business organizations are committed to promoting, designing, distributing, and pricing products that do not negatively impact the environment [37]. In the recent past, many authors defined green marketing [3,9,38–44]. "Green marketing also ties closely with issues of industrial ecology and environmental sustainability, such as extended producer liability, life-cycle analysis, material use, resource flows and eco-efficiency" [39] (p. 285). The key goal of green marketing is to present the importance of protecting the environment to consumers while consuming the product [45]. In addition, green marketing generates environmental advantages through consumer awareness [46].

Preliminary studied by renowned marketing scholars identified the benefits of green marketing, e.g., offers some eco-advantages, brings competitive advantages of positive environmental impact, raises awareness on environmental social issues, ensures the sustainable long-term growth with profitable, ensures energy use, efficiency or recyclability and promotes corporate social responsibility (CSR) [3,45,47–49]. Green marketing also supports countries to achieve sustainable development (SDGs) goals and indicators, especially for LDCs countries. Most of the people in Bangladesh suffer from malnutrition due to a lack of quality food. Green marketing can provide some solutions to this malnutrition by providing green foods.

2.2. Green Consumer

The green consumer is a vital emerging force behind green marketing and strategy [4,50]. Green consumers consume the products willingly, or actively seek out those are not harmful to the environment and satisfy consumers' needs [5,38]. A green customer always avoids products that can harm a living organism, involves immoral experiments in animal or human affairs, and consumes a lot of renewable energy. Likewise, green consumerism is linked with green consumption, which involves consuming in an environmentally friendly and sustainable way. In developed countries, consumers are changing their behavior and start to adopt green use to diminish the negative effect of consumption practices on the environment [2]. Thus, green consumption could help to improve environmental sustainability [51].

2.3. Green Product and Green Food

The green product is made in a way that has no side effects on nature. Many marketing scholars have attempted to define green products. The terms green products and environmental products refer to products which are used naturally, and which are made from non-toxic, recycled materials, or with less packaging/eco-packaging [52–57]. Moreover, Peattie defined a product as 'green' "when its environmental and societal performance, in production, use, and disposal, is significantly improved and improving in comparison to conventional or competitive product offerings" [58] (p. 181). Green products are regularly considered healthier and safer than other regular products [59–61], and they reduce the utilization of natural assets and the negative impact on the product's life-cycle [62,63]. Repair, recondition, re-manufacture, reuse, recycle, and reduce are developing processes of green products [39,64].

Meanwhile, Teng et al. argued that several green foods are not organic foods, and green foods consist of two categories, including the use of a specific range of chemicals and organic foods [65]. Thus, the first category lays a good foundation for developing the second group. "Green food encompasses natural food items which are free from artificial chemicals such as fertilizers, herbicides, pesticides, antibiotics, and genetically modified organisms" [66] (p. 158). Green food is generally considered as superior to food products [56], and is better for health and the environment than general products.

2.4. Environmental Concern

According to Bickart and Ruth, "environmental concern can be defining consumers' appearance of problems about the importance of the environment for the benefits in the welfare of the nation [67]". Customers who are worried about environmental issues are positive about green products and highly motivated to buy eco-friendly products to maintain a good healthy lifestyle [68–70]. Earlier scholars found in their study that environmental concern affects the consumer's purchasing decision process, especially for green products [17,23,61,71,72]. At present, young, educated consumers are anxious about the environment. They are highly emotional or sensitive to the level of investment needed to protect the situation, with a strong affection for their country.

Nevertheless, Xu et al. claimed that environmental consciousness could not have any significant direct impact on purchase intention. Still, it can have an indirect effect on the purpose of purchase through perceived behavioral control [28]. Likewise, people's mental states regarding purchasing green products affect their green investment [23]. Similarly, prior researchers observed that environmental concerns had a significant correlation with ecological purchase behavior and environmental–social benefits (attitudes) that have a positive impact on their green purchasing behavior [73,74]. Therefore, we assume the following hypothesis:

Hypothesis 1 (H1). *Environmental concern has a significant positive influence on the green purchase decision in young, educated consumers.*

2.5. Green Perceived Benefit

Perceived benefits are beliefs about the positive results related to behaviors in response to perceived risk and include six characteristics: monetary economy, convenience, value, quality, expression, and entertainment [75]. Previous research highlighted that the perceived benefits correlate with sustainable building design. In particular, the benefits of economic and environmental aspects appear to be the most influential [76]. Consumers' perceived benefits of green products will lead to a positive attitude towards purchase intent and higher satisfaction, but without adding benefits will have a negative relationship with greenwashing [2]. Perceived benefits mean that customers would like to obtain accurate and useful quality products by reducing uncertainty. Consumers always think that if they get several perceived benefits from a green product, then they will be influenced to purchase those products. Similarly, green foods have perceived benefits such as being good for health, good for the environment, pleasant to taste and preventing diseases [77,78]. Thus, the following hypothesis is proposed:

Hypothesis 2 (H2). *Green perceived benefit has a positive influence on the green purchasing decision in young, educated consumers.*

2.6. Green Perceived Quality

According to Zeithaml, perceived quality describes consumer judgment about the overall superiority of a product compared to an alternative [79]. It is a significant factor that influences consumers in making buying decisions [79–82], and measures customer satisfaction [83,84]. In addition, the green perceived quality was referred to as 'the consumers' decision about the overall environmental

excellence of the brand' [85]. Most of the customers believed that green products have reliable quality, standards of quality, and value for money [86]. Perceived quality has a positive effect on behavior intention [82]. This empirical study specifies that the consumer green perceived quality (GPQ) has a positive influence on consumers' green purchase decision and puts forward the following hypothesis:

Hypothesis 3 (H3). *Green perceived quality has positively influence on the green purchase decision in young, educated consumers.*

2.7. Green Awareness of Price

Many researchers highlighted that price is the most vital factor that influences consumers' purchase decisions while purchasing any product or service. The pricing of green products is a crucial issue for the company. Companies' management faces the pricing issue of their products with an appropriate choice of reasons related to procurement and marketing. Selling price, corporate social responsibility (CSR), and carbon emissions index are the key price competition between green and non-green producers [5].

Green pricing means "Pricing for green products that offset consumers' sensitivity to price against their interest in paying more for the environmental performance of the products" [87]. Previous studies acknowledged that price is a strategic barrier deterring consumers from purchasing green products [88–90]. The price-conscious consumer does not agree to pay a premium price for green products; thus, it has a negative correlation between price awareness and attitudes toward purchasing green products or green foods [91]. Nevertheless, Essoussi and Linton argued that consumers are interested in paying premium prices for green products [92]. Indeed, the combination of perceived benefits and product types is affecting the interest of paying extra. In general, organic food price is higher than conventional food [5], whereby organic foods are 16–50% more costly than traditional foods [91]. Even though the positive attitude towards organic foods is increasing in developing countries, the high price and lack of rules and regulations play a vital role in pursuing it further [93]. According to the previous literature review, we hypothesize the following:

Hypothesis 4 (H4). *Young, educated consumers' green awareness of the price of green products has positively impact on green purchase decisions.*

2.8. Green Willingness to Purchase

Green willingness to purchase depends on consumers' positive and negative perceived value. Consumers with a positive perceived value of organic products are highly interested in buying a natural product [91]. When consumers feel negative value, they are less interested in purchasing a natural product. The price of green products is higher than traditional products. Earlier research indicated that consumers are willing to pay for products by judgments variety criteria including being eco-friendly [57], food quality and safety [94], and health [95]. Positive attitudes for green products concern the interest in paying extra for green products or services [96]. Green willingness to purchase is an essential variable for measuring customers' current and future purchase decisions on green or environmentally friendly products. It also helps to estimate consumer green demand. Thus, we predict the following hypothesis:

Hypothesis 5 (H5). *Young, educated consumers' green willingness to purchase influences on the green purchase decisions.*

2.9. Green Future Estimation

Future estimation depends on consumers' present demand for products or services. If consumers have a positive response in the current market, it will increase in the future. If green products are environmentally friendly and suitable for their health, consumers want to get all green foods or

products. Green marketing is viral in a more developed and high-income country. So, green marketing will be effective for a lower and middle-income country. Consumers of underdeveloped and developing countries are also interested in purchasing green products, and the popularity of green marketing is increasing among the young generation day by day. Consumers who already have good experience in eco-friendly products with satisfactory levels are eager to repeat purchases of green products. Thus, it predicts the following hypothesis:

Hypothesis 6 (H6). *Green future estimation of a product has a significant positive influence on green purchase decisions in young, educated consumers.*

2.10. Green Purchase Decision

Previous research linked consumers' green food consumption and behavioral attitudes such as health awareness, the trust of organic food demand, environmental consciousness, and the appeal of natural food attributes [28,97,98]. The Theory of Planned Behavior (TPB) was established by Ajzen, who recommended: "a person who has a positive attitude towards a particular behavior has a greater intention to involve in this behavior [99]". The green purchase decisions are described as purchasing green products, supporting green companies, approving sustainable consumption practices [100,101], and spending extra for green products [92]. Two aspects mainly affect green consumers' purchasing decisions. One is intrinsic to the consumer, e.g., environmental responsibilities, self-interest, gaining knowledge and willingness to resource conservation, and reducing the environmental impact. In addition, another extrinsic factor relates to the social image of consumers and product attributes (e.g., products' pricing, quality performance, safety, and promotion). Prior researchers explored some factors of green purchase intentions [23,29,56,72,102], such as attitude [103], purchase intention, problems, responsibility, human-oriented, affectionate, cognitive responses and collectivism, which are focused on promoting green purchase behavior. In developing countries, perceived deterioration is a reliable prediction for consumer green purchase decisions [98].

According to the theory of consumption value, green products have a significant social value that can reach green purchasing behavior. Paying extra to buy green products is currently hindering green purchase decisions. Moreover, earlier research professed that organic food is natural, nutritious, good for health, and eco-friendly. The positive attitude of the consumer towards organic food is an additional aspect to demonstrate positive purchase intentions and behavior [56,104].

Similarly, green purchase intentions, green products, organic food, and green purchase behaviors in previous research have not been studied in the context of Bangladesh. The consumers of Bangladesh reacted very positively towards green marketing [77]. Young, educated consumers are mostly like to purchase green products in developing countries [105]. Even the young generation of Bangladesh can take play a suitable role in affecting climate change and protecting the environment by adapting green purchase decisions. The people of Bangladesh are exceedingly sensitive to purchase products—for example, consumers' loyalty about green products, quality of products, environmental safety, and global warming, luxury alarm about the high price, and environmental awareness. Table 1 illustrates the previous ten years' research variables of consumers' behavior towards organic foods and green products.

Table 1. Previous ten years' research on essential variables of green marketing or green foods/products (2009–2020).

Authors (Year)	Context (Country) and Major Paper Titles	Variables
Xu et al. [28]	(China) purpose of purchasing authentic green furniture	environmental consciousness, subjective norm, perceived behavior control, physical health concern, purchase intention, experience, and attitude
Feil et al. [102]	(Brazil) consumer behavior toward organic food	socio-economic and demography, motivation, perception, attitude
Tong et al. [29]	(China) environmental knowledge in making green food choices	respondent characteristic, purchase intention, willingness to pay
Cheung and To [23]	(China) consumers' green purchasing behavior	attitude green products information, environmental consciousness, green (product quality and purchase behavior)
Qi and Ploeger [56]	(China) consumers' intentions towards purchasing green food	attitude perceived behavioral control, face consciousness, confidence, purchase intention
Bashir et al. [72]	(Pakistan) consumer behaviors in the green hotel	personal norms, behavioral intention, environmental consciousness, green consumer behavior
Sobhanifard [106]	(Iran) the consumption of organic foods	perceived naturalness, trust, sanitarians, and marketing
Nguyen et al. [107]	(Vietnam) green emerging market	attitudes, knowledge, norms, rational, moral, self-identity and perceived barriers, emotional and self-identity
Wang [108]	(Taiwan) purchase behavior towards green brands	green perceived value, quality, risk, information costs, and purchase intentions
Bong Ko and Jin [22]	(the USA and China) purchase intention toward green apparel products	environmental knowledge, subjective norm
Anisimova [21]	(Australia) multiple factors influencing consumer behavior towards organic foods	trust, healthism, hedonism, experiences, and purchase intentions
Ghosh et al. [90]	(India: Kolkata) modelling and promoting organic food	price, healthy, availability, eco-friendliness, certification, and brand
Lee [20]	(USA) determinant factors of organic foods	health and environmental, price consciousness, children's age, number of children, and convenience of purchase
Joshi and Rahman [35]	(India) young consumer's green purchase behavior	social influence, environmental knowledge, recycling, ecolabelling, environmental messages, and green purchase

Table 1. *Cont.*

Authors (Year)	Context (Country) and Major Paper Titles	Variables
Bossle et al. [109]	(Brazil) adoption of eco-innovations and go green	internal variables (environmental capability, managerial concern, and human resources) and external variables (regulatory and normative pressures, cooperation and government support)
Misra and Singh [110]	(India) factors affecting the growth of organic food	impeding factors, safety and health, trust and certification, information and availability, and lifestyle
Uddin and Khan [111]	(India) exploring green purchasing behavior	environmental attitude, involvement, consciousness, perceived effectiveness, and green purchase behavior
Teng and Wang [97]	(Taiwan) factors driving organic food consumption	subjective norm, revealed information, perceived knowledge, trust, attitude, and purchase intention
Cheung et al. [112]	(Hong Kong) factors affecting the organic food	environmental concern, organic food knowledge, health consciousness
Khare [113]	(India) green buying behavior	previous environmental attitudes, personal and social-environmental norms, self-identity, and buying behavior
Kumar and Ghodeswar [114]	(India) consumers' green product purchase	environmental protection and responsibility, experience, environment friendliness, social appeal, and green product purchase decisions
Dewald et al. [89]	(USA) attitudes towards "green" restaurants	willing to pay
Anisimova and Sultan [19]	(Sweden) brand communications in organic foods	organic knowledge, consumer trust, and brand communications
Lim et al. [91]	(Malaysia) perceived value and willingness to purchase organic food	perceived value and desire to purchase
Wang [115]	(Taiwan) factors on green purchasing intentions	external control and collectivism, subjective norms, environmental visibility, and green purchasing intentions
Henryks et al. [88]	(Australia) Organic food purchase	availability, habit, visual and olfactory cues, false assumptions, price, and visibility and access to organic food

Table 1. *Cont.*

Authors (Year)	Context (Country) and Major Paper Titles	Variables
Tang et al. [116]	(China) purchase intent towards green products	environmental concern, consumer attitude, belief, value perception, government policy, and consumer purchase intention
Chen and Lobo [117]	(China) determinants of organic products purchase intentions	product, regulatory, lifestyles, beliefs and attitude, ethnocentrism, post-purchase evaluation, purchase intention
Chen and Chang [83]	(Taiwan) green electronic products	green satisfaction, perceived quality, risk, and trust
Chen and Chang [118]	(Taiwan) green purchase intentions	green trust, perceived value, risk, and purchase intentions
Suh, Eves, and Lumbers [119]	(South Korea) understanding of organic food	trust, attitudes, and experience with organic food
Akehurst et al. [18]	(Portugal) reexamining green purchase behavior	ecologically conscious, behavior, socio-demographic measures, psychographic measures, green purchase intention, green purchase behavior
Quah and Tan [120]	(Malaysia) purchasing decisions of organic food products	socio-demographical and attitudinal factors, food-safety, availability, price, and health-supplement expenditures

2.11. Theory of Planned Behavior (TPB) and Research Model

The concept of the Theory of Planned Behavior (TPB) was developed by Icek Ajzen to expand the predictive power of the Theory of Reasoned Action (TRA) [121,122]. TPB has been demonstrated to give an excellent scheme for conceptualizing, estimating, and identifying determinants that influence behavioral intention and to provide a systematic strategy to information campaign establishment [123]. There are three variables in TPB theory, including (1) attitude, (2) subjective norms, and (3) perceived behavioral control, which are cooperative, leading to the development of a person's behavioral intention [99]. TPB effectively implemented a wide range of customer intentions and behaviors [17,82,124]. Scholars have applied TPB in anticipating food and product choice. For instance, researchers used TPB to predict consumers' intention to purchase green food or organic food [24,56,101,124–126] and green products [24,28,29]. Attitude is the total evaluation of the consumer involvement response in green marketing strategy for Bangladesh. Therefore, to better understand the clarification of young educated consumer's intentions to buy green products, this study attempts to extend TPB by adding other separate variables (environmental concern, green perceived benefits, green perceived quality, awareness of price, green willingness to purchase, and green future estimate) to get proper outcomes in the context of a developing country, Bangladesh. TPB provided an alternative model that gave the customer a deeper understanding of the intention of purchasing green products. Thus, the conceptual model proposes that attitudinal factors (environment concern, which connected to the attitude of TPB), green perceived benefits, green perceived quality, awareness of price, and green willingness to purchase can predict the intention behaviors of the purchase of green products. However, in this current study, we do not consider the subjective norms in the context of Bangladesh because the usefulness of subjective norms in clarifying consumer food preferences is still disputed by researchers; several studies, therefore, did not consider the subjective norms of investigation [56,127]. Nevertheless, we studied the previous ten years' (2009–2019) research variables of environmental marketing or green marketing and green products (see Table 1); therefore, we propose a conceptual research framework for lower and middle-income countries, especially for Bangladesh. Figure 1 exhibits the conceptual model which can help to measure the current young, educated consumer's purchasing decision on green products and future evaluation of green or environmental marketing concepts.

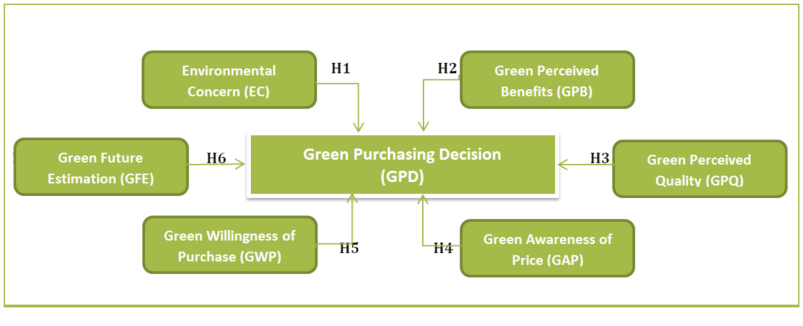

Figure 1. Proposed conceptual model of the green purchase decision.

3. Methodology

This study tried to investigate the young, educated consumers' purchase decisions on green products and the current condition of green marketing in Bangladesh. The analysis was multi-layered, and both quantitative and qualitative data were adopted to understand the overall consumers' situation, and personal experiences were used to better understand the primary data and assessment of the research outcome. Figure 2 exhibits the flow chart of the research methodology.

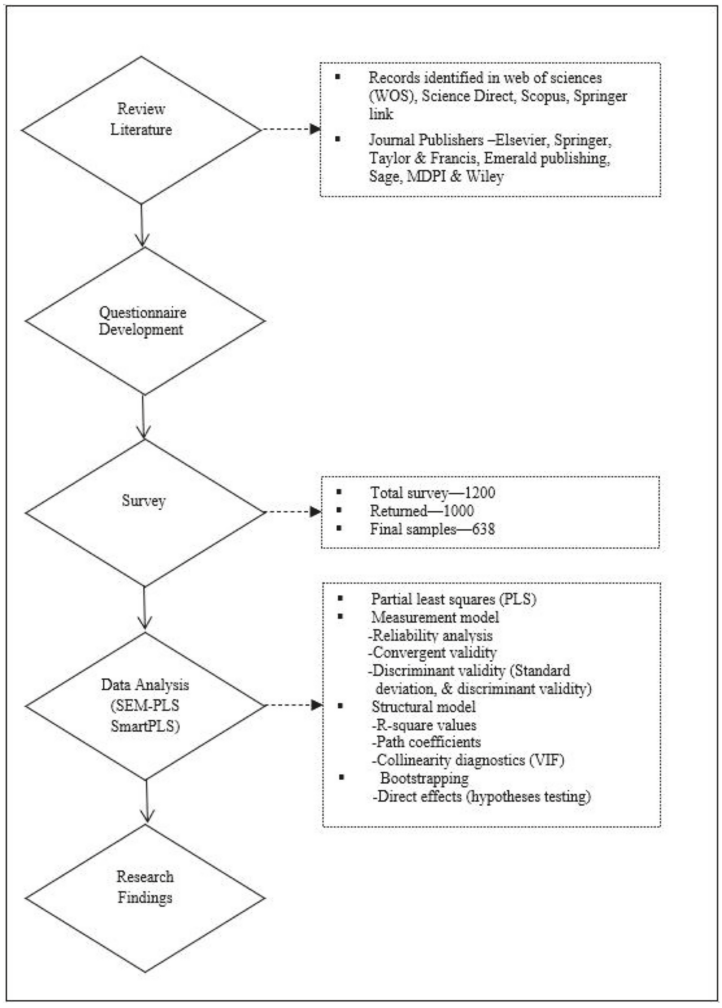

Figure 2. The flow chart of research methodology (source: authors' illustration).

3.1. Participants and Procedure

To accomplish this study, a mixture of primary and secondary data was used. Convenience sampling was adopted, and a total of 1200 self-administrated questionnaires were distributed directly to young educated consumers. Respondents were current students and those employed in various organizations in Bangladesh, such as universities, banks, hospitals, hotels, and manufacturing firms. Young, educated customers were chosen because they are the key to bringing about the desired change in green product purchases.

Here, we targeted those young consumers who had previous experience purchasing green products or eco-friendly products, e.g., natural soap, recycled toilet paper, reusable shopping polybag/plastic or bottles, rechargeable batteries, LED lights, solar panels, energy efficiency products, or energy-saving TVs, refrigerators, laundry, and daily organic vegetables or food at least once a month at grocery stores and local market. There was no mass consumer group; that is why we asked the questions in general. This research was a pilot project for a newly developing country Bangladesh.

After the responses had been screened, a whole of 1000 respondents returned the filled out questionnaires as samples for analysis among the 1200. We asked the respondents about the survey. Did they have previous experience in purchasing green products? If yes, then they could access further questions. We considered only those young respondents who had experience in buying green products. Two hundred (200) respondents filled out the questionnaires and did not have experience in purchasing green products.

Due to respondent's lack of ability, unconsciousness, and disproportionate missing values, 162 questionnaires were excluded. Therefore, finally, 638 samples were obtained for this research. This sample size is considered to apply for analysis, as indicated by earlier studies [128]. Moreover, Kline and Hair et al. mentioned that the size of the sample should be, as a minimum, ten times the indicators [129,130]. Here, 21 indicators were considered; thus, a minimum sample size of 210 was required. So, finally, 638 samples were obtained for data analysis, where the response rate was 74%. Descriptive analysis was carried out to obtain figures about the socio-demographic profile of respondents, and Table 2 exhibits that 62.4% (n = 398) were male and 37.6% (n = 240) were female. In Bangladesh, men usually used to go shopping more than women. Society does not prefer women to go shopping, but this social system is changing with women's empowerment and development. To illustrate the reality of this study, the behavior of male customers purchasing green products is much higher than the number of females

Table 2. The socio-demographic profile of respondents.

Variables	Frequency	Percent
Gender		
Male	398	62.4
Female	240	37.6
Age		
15–20 years	102	16.0
20–25 years	170	26.6
25–30 years	204	32.0
30–35 years	162	25.4
Level of Education		
Higher secondary	78	12.2
Undergraduate	50	7.8
Graduate	152	23.8
Master/Postgradute	304	47.6
PhD/Others	54	8.5
Average Monthly Income		
0–120 USD	200	31.3
120–240 USD	98	15.4
240–260 USD	116	18.2
>480 USD	224	35.1
Total (Respondents)	638	100

Sixteen percent of the respondents were less than 20 years of age (n = 102), 26.0 percent were 20–25 years old (n = 170), 32.0 percent were 25–30 years old (n = 204), and 26 percent were 30–35 years old (n = 162). Here, all respondents were well educated, with 47.6 (n = 304) percent of respondents having a Masters degree, 23.8 percent being graduates, 12.2 (=78) percent having higher secondary education, and the rest of them being undergraduates and others/Ph.D. Young people with an educational degree (graduates) in Bangladesh are more likely to buy green products because they are more aware of the environment and green products.

The random sampling technique was applied to select respondents from Bangladesh over two months, from November to December 2019.

3.2. Questionnaire Development and Instrument

The questionnaire was conducted in Bangla and then transcribed verbatim and translated into English. The questionnaire was considered in three subdivisions. The first identified respondents' specific demographic criteria (age, gender, education, and income) to obtain a real understanding of the research results. The second section included three questions for evaluating the previous consumer awareness of green marketing and experience of purchasing green products with mention of green products; we selected those young respondents who had experience purchasing green or environmentally friendly products. The final section covered 25 measurement questions. The questionnaire formulated the questions on six constructs of independent variables, which are environmental concern (EC), green perceived benefits (GPB), green perceived quality (GPQ), green awareness of price (GAP), and green willingness to purchase (GWP), green future estimation (GFE) and one dependent variable is green purchase decision (GPD) through a literature survey and focus group discussion (see Tables 2 and A1 in the Appendix A for the questionnaire constructs). Before administering the study, a pilot test was performed among 30 respondents through an online survey, using the social media platform Facebook to pre-test the content and readability. A few changes were made to the final questionnaire to make it more understandable from the respondent's point of view, considering the recommendations of the pilot study.

After constructing the reliability and validity test, we excluded four items (GPB3, GPQ2, GAP1, and GPW1) in which the value of the external loading was lower than 0.7. Consequently, 21 measurement items were taken for the final analysis. To ensure the reliability, the constructs for independent variables of environmental concern [100,131–133], green perceived benefit and green perceived quality [77], green awareness of price [134] and dependable variable green purchase decision, were adapted from [113,135–137] previous similar studies to fit into the framework of the research. The other two variables, green willingness to purchase and green future evaluation, were adapted from the focused group discussion (FGD), and a 5-point Likert scale was applied for designing measurement-related questions for both independent variables and dependent variable (1 = strongly disagree to 5 = strongly agree). However, two issues used a dichotomous item. There are only two response options in a dichotomous question: yes or no, and so on [138].

3.3. Statistical Technique

The partial least square-structural equation modelling (PLS-SEM) model was used for data analysis, and it is a variance-based path modelling method for analyzing the structural equation modeling, hypothesis testing, and measurement model by using Smart-PLS 3.2.0 version [139]. Moreover, IBM SPSS 20.0 (version 20.0, IBM Corp., Armonk, NY, USA) versions used for data input and frequency distribution for the demography profile. A recent development in the PLS-SEM is called the fully-fledged SEM method [140,141]. This covariance-based method, compared to multivariate data analysis SEM, is more flexible usually when working with distributed data, and the proposed method reaches higher statistical power with the smaller sample size [142]. Research statistics do not always use multivariate normal distribution because it is less complex to sample measurement than different methods such as AMOS and LISREL [143]. Despite this, "SEM overcomes the barriers of bivariate analyses through the simultaneous analysis of all the complex relationships between the constructs [144] (p. 147)".

Moreover, "SEM is most applicable when there are multiple constructs in the research, each representing the use of some measurable variables and allowing estimating all relationships simultaneously" [128] (p. 641). A bootstrapping of 300 sub-samples applied for analysis assumptions. Moreover, statistical experts noted that there are enormous advantages of PLS-SEM as a nonparametric; such as the fact that normally distributed data are not required, the small sample size is applicable, and type II errors can reduce with efficiently managing formative measurements [142,143,145,146]. Moreover, PLS-SEM supports analyzing a structural model including multiple items and direct and

indirect paths, defining the predictor variant. Regarding the objectives of this study, PLS-SEM is most suitable for explaining how underlying key drivers predict purchase intention [147].

3.4. Partial Least Squares

"The PLS was performed, which uses quantitative and structural models, namely the two stages of analysis because this approach has been supported to be effective for theoretical model structures with high complexity but low theoretical data" [148] (p. 270).

The main important reasons for applying PLS-SEM applications are to use low sample sizes, non-normal data, and structural indicators, and examine more complex model structures or variations, for example, heterogeneity [130].

3.5. Measurement Model

In the measurement model, the latent constructs' inconsistency and validity, e.g., internal consistency reliability, discriminant validity, and measurement of the convergent construction validity, were observed in this stage.

3.6. Reliability Analysis

The study calculated the reliability, which was measured via Cronbach's coefficient alpha and t composite reliability for testing the internal consistency of the constructs. There was no problem with the reliability of all constructs that exceeded the Cronbach's alpha values of 0.700 [149,150]. Cronbach's alpha is widely applied in the social sciences and business areas, providing a conservative result, and as a result, researchers have recommended composite reliability as an alternative measure [108]. Table 3 illustrates that the calculated values of the Cronbach alpha values for all constructs exceeded the threshold value of 0.700, except for GPQ 0.605, which means that data are good and reliable. Composite reliability is between 0.791 and 0.918, all of which exceed the boundary of 0.70 [130], indicating strong reliability between processes. Cronbach's alpha value of the GPQ construct is 0.650, which is lower than 0.70, but composite reliability is 0.791. A satisfactory, reliable value would be between 0.60 and 0.95 [151,152]. Thus, the survey instrument is consistent with measuring all construction and random errors regularly.

3.7. Convergent Validity

Convergent validity was measured by composite reliability, standardized factor loadings, and average variance extracted (AVE). In this study, the standardized loadings of all measurement items were revealed by a bootstrapping analysis of 300 subsamples. In Table 3, the convergent validity was accomplished with factor item loadings exceeding 0.60, composite reliability exceeding 0.70, and AVE above 0.50 [130]. All were significant ($p < 0.001$) with strong confirmation of convergent validity and the items of measurement loaded well upon their constructs. Fornell and Larcker mentioned that the minimum cut-off value of 0.50 is for a reliable construct [153]. Before that, four items were removed for failing to meet these loading standard criteria, which is lower than 0.50, these being: an item of green perceived benefit (GPB3: "green product prevent diseases and increase immunity" with loading 0.652), green perceived quality (GPQ2: "green products have consistent quality concerning the environmental concern" with loading 0.565), green awareness of price (GAP1: "the green product is expensive" with loading 0.063) and green purchase willingness (GPW2: "I am willing to purchase green products if these provide better quality products than traditional or regular products with loading 0.618"). According to Fornell and Larcker, the convergent validity used to be additionally reached when the AVE values of each item in the model was determined to be greater than 0.50 [153].

Table 3. The measurement model (reliability, validity, and variance inflation factor (VIF)) analysis.

Determinants	Items	Loading	Cranach's Alpha	rho_A	Composite Reliability [a]	(AVE) [b]	VIF (Variance Inflation Factor)	Adapted from Authors
Environmental Concern								
I am a strong believer in the preservation of nature and wildlife	EC1	0.905	0.880	0.885	0.918	0.736	3.033	Mishal et al., Sharma and Bansal, Schlegelmilch et al., Wimmer [100,131–133]
I am pleased to purchase green products	EC2	0.811					1.879	
I consider the potential environmental impact of my purchase when making many of my decisions	EC3	0.822					1.987	
I would describe myself as an environmentally responsible person	EC4	0.892					2.760	
Green Perceived Benefits								
I think green products are good for health.	GPB1	0.873	0.730	0.736	0.881	0.787	1.493	Islam and Zabin [77]
Green products have well to test and flavor	GPB2	0.901					1.493	
Green Perceived Quality								
Green products have an acceptable standard of quality.	GPQ1	0.708	0.605	0.611	0.791	0.559	1.122	Islam and Zabin [77]
The green products appear to be durable	GPQ2	0.718					1.294	
The green products appear to be reliable	GPQ3	0.813					1.364	
Green Awareness of Price								
I would choose environmentally friendly goods and services, campaigns or companies if the price were the same	GAP1	0.924	0.811	0.815	0.913	0.841	1.868	Suki [134] and focus group discussion
If the price of green products is less expensive, I'm willing to change my lifestyle by purchasing Green products	GAP2	0.910					1.868	

Table 3. *Cont.*

Determinants	Items	Loading	Cranach's Alpha	rho_A	Composite Reliability [a]	(AVE) [b]	VIF (Variance Inflation Factor)	Adapted from Authors
Green Willingness to Purchase								
I am interested to purchase a green product if these will be available in Bangladesh	GWP1	0.891	0.738	0.738	0.884	0.792	1.518	Focus group discussion
I'm willing to pay more for environmentally friendly products	GWP2	0.889					1.518	
Green Future Estimation								
I think that green marketing will be an excellent idea for our country	GFE1	0.712	0.776	0.792	0.855	0.596	1.500	Focus group discussion
I think that green product will be popular in our country	GFE2	0.786					1.690	
I think that green marketing will be more effective and give a better product than regular marketing	GFE3	0.780					1.648	
I think a consumer will accept the green products in the future	GFE4	0.806					1.548	
Green Purchasing Decision								
I prefer to buy environmentally friendly products than non-green products	GPD1	0.912	0.869	0.879	0.911	0.721	3.260	Khare, Ha and Janda, Coleman et al., Mostafa [113,135–137]
I would like to increase the purchase/use of green products for me	GPD2	0.836					2.047	
I buy green products even if they are more expensive than the non-green ones.	GPD3	0.763					1.635	
I would recommend the green products to my friends and/or others	GPD4	0.878					2.891	

Note: a—Composite reliability = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square of the summation of the error variances)}.
[b]—AVE = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of the error variances)}.

3.8. Discriminant Validity

Campbell and Fiske [154] introduced the concept of discriminant validity, which was indicated as the degree to which latent variables are distinct from each other [152,155]. Discriminant validity is recognized when the square root of the average variance extracted (AVE) for each construct is greater than the correlations of all other constructs [153,156,157]. Table 4 illustrates that discriminant validity has been accomplished considering on-diagonal values (AVE) which are higher than the off-diagonal values (correlations of all other constructs). Green willingness to purchase green products was found to be the strongest correlation with the purchase decision (r = 0.802, $p < 0.05$), and conforms to awareness of price (r = 0.774, $p < 0.05$), environmental consciousness and green benefit (r = 0.838, $p < 0.05$), green future estimation (r = 0.737, $p < 0.05$), and finally green perceived quality (r = 0.641, $p < 0.05$).

Table 4. Discriminant validity.

Variables	1	2	3	4	5	6	7	VIF
1. Green Awareness of Price	0.917							2.408
2. Environmental concern	0.661	0.858						3.252
3. Green Future Estimation	0.635	0.626	0.772					2.416
4. Green Perceived Quality	0.588	0.589	0.603	0.748				2.085
5. Green Perceived Benefits	0.690	0.773	0.590	0.640	0.887			3.127
6. Green Willingness to Purchase	0.656	0.726	0.721	0.639	0.646	0.890		3.052
7. Green purchasing decision	0.774	0.838	0.737	0.641	0.838	0.802	0.849	

Notes: correlation is significant at the 0.05 level (2-tailed).

The variance inflation factor (VIF) values of this analysis ranged from 2.085 (green perceived quality) to 3.252 (environmental consciousness), which are below the reference value of 5 [142], indicating that the structural mode result does not have a negative effect and no multicollinearity among the items or predictor constructs. Therefore, each factor was statistically discrete from the other and explained evidence of satisfactory discriminant validity.

3.9. Structural Model

Generally, the structural model is used to test the research hypothesis, and this is the second step in the PLS analysis. Moreover, PLS uses a method for measuring predictive capability, which is known as the blindfolding method. Based on the blindfolding procedure, an analytical relevance was determined in the model (Stone–Geiger test, Q2) with the interdisciplinary variable cross-validation data redundancy result is 0.589, which is larger than 0 [143]. Moreover, "The R2 value of the endogenous variable was 0.871, which exceeds the recommended minimum value level of 10%" [158]. Notably, 87.1% of the variance in young educated consumers' green purchasing decisions is described by the independent variables that reflect reliable clarifying power for the model. Rasoolimanesh et al. reported that R-2 values that exceed 20% were considered as high for consumer behavior studies [159]. In this research, a bootstrapping resampling technique was applied via the 95% bias-corrected and bootstrap confidence intervals (BCa) with 500 sub-samples to measure the effect of six exogenous determinates (GPQ, GPB, GAP, GFE, GPW) on the endogenous variable GPD (green product purchasing decision) which was applied to define standard errors estimates, and to investigate the value of path coefficients through *t*-tests [160].

Hair et al. clarified that "the coefficient of the path will be significant if the value is not zero without the confidence interval" [142] (p. 156). Table 5 and Figure 3 demonstrate the outcomes of the path coefficients and t values were indicators, as defined in, whereby environment concern (EC) seems to have a positive relationship with a green purchasing decision, which is useful in prospect (bootstrap *t*-value = 5.710, $p < 0.05$). Therefore, Hypothesis H1 is supported. Similarly, the standardized beta coefficients reveal that green perceived benefits (GPB) are found to significantly influence young, educated consumers' purchasing decisions regarding green products (bootstrap *t*-value = 8.686, $p < 0.05$). So, it is supposed that H2 is supported. The path estimates noted that green awareness of

price (GAP) has a significant and positive relationship with the green purchasing decision (bootstrap t-value = 5.710, $p < 0.05$); as a result, H3 is supported. Nevertheless, young, educated consumer green perceived quality (GPQ) has an insignificant influence on purchase decisions on the green product (CPD) in Bangladesh (t-value = 1.511 $p > 0.05$). So, this acts as evidence to prove that green perceived quality p-value is 0.131, which exceeds the value of 0.05. Thus, H4 is not accepted, signifying the negative correlation between GPQ and GPD. Furthermore, as projected, green willingness to purchase (GWP) has a positive influence and significantly affects young, educated consumers' purchase decision on the green products (CPD) in Bangladesh and revealed a positive result (t-value = 4.717; $p < 0.05$); thus, H5 is accepted. In a similar vein, consumer future estimation of green marketing (GFE) positively influences purchasing decisions on green products in Bangladesh and revealed a significant outcome (t-value = 4.077; $p < 0.05$); thus, H6 is retained.

Table 5. Statistical results of the structural model and coefficient of determination (R2).

	Hypothesized Paths	Mean (M)	Standard Deviation (SD)	Bootstrap t Value	p Values (2-Tailed)	Results
H1	Environmental concern → Green purchase decision	0.243	0.043	5.710	0.000	H1 supported
H2	Green perceived benefit → Green purchase decision	0.328	0.038	8.686	0.000	H2 supported
H3	Green perceived quality → Green purchase decision	−0.040	0.028	1.511	0.131	H3 not supported
H4	Green awareness of price → Green purchase decision	0.170	0.026	6.556	0.000	H4 supported
H5	Green purchase willingness → Green purchase decision	0.219	0.047	4.717	0.000	H5 supported
H6	Green future evaluation → Green purchase decision	0.151	0.036	4.077	0.000	H6 supported
	Endogenous latent construct		Coefficient of determination (R^2)		Adjusted R	
	Green Purchase decision (GPD)		0.871		0.869	

Note: for two-tailed tests: statistically significant at $p < 0.05$ (for t-value > 1.960).

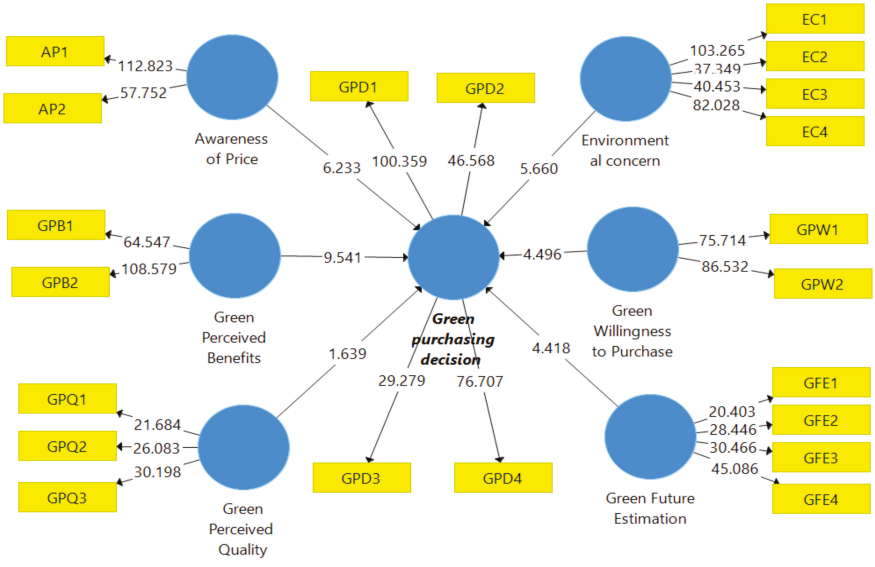

Figure 3. Structural model results, path coefficients (t-values, with the level of significance) and R-square values.

4. Discussions

This study investigates which factors influence young, educated consumers' purchase decisions on green products in a developing nation, and what are the associations among the hypotheses of the proposed model. The empirical result of PLS-SEM indicates that environmental concern (EC) has a strong influence on young, educated consumers' green purchasing decisions in Bangladesh, and therefore, Hypothesis (H1) is supported. These findings support those obtained in the previous foreign survey in developed countries [2,17,20,23,24,28,29,71,72,74]. They also prove that environmental concern (EC) has a positive impact on ecological purchasing decisions on green foods [72,112]. The results imply that young consumers who describe them as environmentally responsible and are concerned about wasting the resources of the earth had a positive attitude toward the purchase of green products.

Next, the second hypothesis explored whether green perceived benefits strongly significantly influenced young consumers' purchasing decisions regarding a green product. Thus, H2 is supported, implying that the significant relationship between GPB and GPD has been observable. The result is reliable, in that a positive impact on perceived benefits supports previous research [28,161–163]. However, perceived behavioral controls, such as perceived benefits, could not have an apparent, direct effect on customers' purchasing intention. Still, it is the driving factor that affects consumer purchase attitudes in China [164]. The young generation believes that green products are organic and chemical-free, and green products are suitable for health and prevent diseases and increase immunity. Consumers' green behavior is the cause of repurchasing green or organic products.

This result is obtained by mentioning the standardized beta coefficient of the SEM—young consumer green perceived quality (GPQ) has a significant negative influence on purchase decision on the green product (GPD). Nevertheless, high-quality green products were reported to moderate the relationships between the attitude towards eco-social benefits and green purchase behavior [23]. Thus, H3 is not supported and this indicates a significant negative correlation between GPA and GDP in Bangladesh. This outcome demonstrates that companies do not provide a standard of quality products, and it has inconsistent quality for the environmental concern in Bangladesh. Young consumers in Bangladesh are not satisfied with green product quality because of unethical practices. On the contrary, companies offer an environmental friendly and standard quality of products or services in developed countries. Nevertheless, the perceived quality of green products has been positively associated with purchasing intentions towards the green brand [108], green trust, and green satisfaction [83]. Previous studies hypothesized that there is a negative association between perceived risk and perceived quality [81,82,108,165,166].

Price is an essential factor for developing countries. The PLS-SEM approach revealed that well- educated young consumers' awareness of price on environmental friendly products emerges as the four vital variables, which affect the consumer green purchasing decision and make visible a positive relationship, thus supporting the postulated H4. This result is reliable with past research in developed countries [89,90,167,168] that showed that consumers exposed their willingness to pay a higher premium for eco-labeled green products. The outcomes describe that most of the young consumers are interested in buying green products and agree to change their lifestyle if the price of the product is the same or lower than the regular product. Therefore, they are willing to purchase green products at actual prices.

Furthermore, Hypothesis H5 is supported, implying that consumers' green willingness to purchase (GWP) has a strong positive relationship with purchasing decisions for green products. The reason for this considerable connection is that young, educated consumers in Bangladesh are fascinated with buying eco-friendly products or services if green products are available and provide better quality products than regular products. Moreover, in developing countries, consumers who have awareness about the Earth and environment are highly interested in paying extra for eco-friendly products. In addition, behavioral controls such as willingness to pay have the most significant impact on customer purchasing decisions [28]. The young scholar Lim et al. stated that consumers who have realized a

good value in organic foods are highly motivated to buy organic foods [91]. Finally, the quantitative method found the acceptability of H6, where it has been noted that young, educated consumers' future estimation (GFE) of green marketing has a positive influence on purchasing decisions regarding the green product.

5. Conclusions and Recommendations

Human beings are highly concerned about environmental and health issues. People want to buy environmental friendly products and organic foods. After completing the research, knowing these research outcomes, we can say that Bangladeshi peoples are no exception—the young and educated are interested in buying environmental products, and they support green or environmental marketing. The current research aimed to explore the young, educated consumers' purchase decisions of a green product and the present scenario of green marketing in Bangladesh. Moreover, we investigated the emerging factors which are affecting young consumers' purchase decisions regarding eco-friendly products. This research tried to prove the application of the TPB model, along with including additional variables (environmental concerns, green perceived quality, and future green estimates) for predicting the young, educated consumers' green purchasing decisions in the Bangladesh context. The theoretical framework and PLS-SEM have revealed that EC, GPB, GAP, GWB, and GFE have shown a direct positive significant influence in green purchase decisions. Here, only one predictor, named green perceived quality, showed a direct negative and insignificant impact on consumer purchasing decisions on green products. The results confirm that the proposed extended TPB is a helpful model for understanding the consumers' green purchase decisions.

Bangladeshi consumers suppose that green products are very beneficial for health and the environment, and green products do not have any harmfulness and side effects for health. Although the consumers argued, the prices of green products are higher than conventional products. The outcomes indicate that if the green product is less expensive, then a consumer will strongly agree to buy green products and change their lifestyle. Bangladeshi consumers believed that green marketing would be an excellent idea, and it will be accessible in Bangladesh. Moreover, green marketing is part of the sustainable development goals (SDGs). According to the survey results, 100% of consumers have faith in green marketing, which will be more effective than regular marketing, and 60% of people strongly prefer green products. An average of 40% prefers green products than non-green products. Indeed, purchase intentions do not always correspond to actual purchase. Consumers do not always do what they say. In addition, the research has contributed to filling a research gap of green purchase decisions through applying the TPB in Bangladesh by adding constructs; environmental concerns, green perceived quality, and green future estimates, instead of subjective norms in the original TPB model.

Several significant managerial implications could be used by marketers to make an appropriate marketing strategy for green products. In Bangladesh, most consumers are not concerned about green marketing, but they are aware of eco-friendly products. When they know that green products are also an eco-friendly product, their interest in buying green products increases a lot. Based on these results, the marketer needs to move forward to develop the market for green products. Further, marketers are encouraged to provide consumers with appropriate information on how they can consume nature's eco-friendly products. So, the company and marketer should launch suitable campaigns to promote green marketing. The company and marketer can inform consumers about green products by using green marketing tools such as green branding, green advertising, and ecolabels. Additionally, it is time to apply the effectiveness of green advertising while emphasizing the environmental benefits of the green product, promoting a sustainable lifestyle, improving the green image of the brand, and reducing the characteristic imperfections of green products [169,170]. Most consumers respond positively to green ads (e.g., print and television ads) [171,172] that predict customer purchase intention. Dangelico and Vocalelli remarked that producers and supply need to provide complete, accurate, and easy-to-understand information about a lifelong environment [3]. Ecolabels are also an essential

marketing promotional tool [173] that can improve the sales and brand quality of a product, encourage manufacturers to comprise the environmental impact of their products, and create consumers who are more aware of environmental issues [174].

A study found that 70% of consumers are affected by eco-friendly messages from advertising and product labeling on purchasing decisions [175]. Additionally, eco-branding also aids in the development of the green market and the challenge of transforming the production [3,170,176]. Therefore, marketers should highlight the clear and correct information regarding green products or services with ecolabels that supports encouraging consumers' adoption of green products and increase the knowledge of green products or services.

Farmers and suppliers of our country can produce green food without using the pesticide formalin and mixed chemical food. Different types of shops such as supermarkets can start the trend of selling green products. A company could show its high involvement and support through effective environment-related campaigns, for example, energy conservation for a better sustainable environment to expand consumer awareness of green products. Direct persuasion through the different communication media or tools such as publicity can be used by the government, health, or environment associations to promote eco-friendly products that are free from danger to the environment. Continuous information about eco-friendly products can undoubtedly give positive encouragement to purchase green products to the consumers' minds that encourage changing from conventional food products. There is no doubt that the key to sustainable and green consumption is the consumer itself and conscious consumer behavior. However, the contribution of all economic actors is also essential—sustainable consumption is unimaginable without education or governmental regulations and political measures, especially in such a fast-growing developing country like Bangladesh. The government can create pressure also on the company and marketer to produce green products that will be eco-friendly. In Bangladesh, there is a huge responsibility from the sides of both policy decision-makers and producers in handling the continuously increasing consumption and production and effectively steering them towards sustainability. Currently, consumers are aware of food security and environmental protection. Therefore, improving public consciousness and positive word of mouth and green consumerism will increase green purchasing behavior and green purchasing decisions. This empirical quantitative study would help marketers and producers to understand the consumer's present perception, needs, or demands for safer, better, and healthier production of products. Thus, at the same time, it ensures achieving relevant SDGs and targets, providing reduced pollution, and conserving the environment, which is a dangerous element in all production. To accomplish these targets, farmers, manufacturers, retailers, and government agencies must work together to ensure green production to catch the consumers' attention.

6. Limitations and Further Research

There are certain limitations to this study that should be noted. Firstly, the data collection of the research was only engrossed in the newly developing country in Bangladesh. The result may differ between a developed country and a newly developing country. Secondly, the sample size was smaller, according to the population. So, the researcher should take more sample sizes to justify the research. Thirdly, this research did not select for specific green products. Therefore, buying green products is not the same experience. Thus, certain types of green products should be further classified as research targets to create the right strategy for market segmentation.

Given that consumers have a profound understanding of the worsening environmental issues, thus it might also reflect on consideration to examine the demographic moderating variables, e.g., income, gender, age, or other custom features. We recommend extending the study to other consumer categories, such as Generation X, in the future. In addition, we recommend considering testing the moderating effects of consumer characteristics such as peer influence, self-identifying as a green consumer, self-image, recycling, and cultural facts for future research. Additionally, we suggest a study from developing and developed countries in some parts of the world by using cross-cultural

analysis that can reflect the implications of consumer green purchase decisions, green marketing and sustainability of green markets.

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Abbreviations

EC	Environmental Concern
GPB	Green Perceived Benefits
GAP	Green Awareness of Price
GWP	Green Willingness to Purchase
GFE	Green Future Estimation
GPQ	Green Perceived Quality
GPD	Green Purchasing Decision
TPB	Theory of Planned Behavior
PLS-SEM	Partial Least Squares-Structural Equation Modelling

Appendix A

Table A1. Measuring items for all variables.

Determinants	Items
Environmental Concern	I am a strong believer in the preservation of nature and wildlife
	I am pleased to purchase green products
	I consider the potential environmental impact of my purchase when making many of my decisions
	I would describe myself as an environmentally responsible person
Green Perceived Benefits	I think green products are good for health.
	Green products have well to test and flavor
Green Perceived Quality	Green products have an acceptable standard of quality.
	The green products appear to be durable
	The green products appear to be reliable
Green Awareness of Price	I would choose environmentally friendly goods and services, campaigns or companies if the price were the same
	If the price of green products is less expensive, I'm willing to change my lifestyle by purchasing Green products
Green Willingness to Purchase	I am interested in purchasing a green product if these will be available in Bangladesh
	I'm willing to pay more for environmentally friendly products

Table A1. *Cont.*

Determinants	Items
Green Future Estimation	I think that green marketing will be an excellent idea for our country
	I think that green product will be popular in our country
	I think that green marketing will be more effective and give a better product than regular marketing
	I think a consumer will accept the green products in the future
Green Purchasing Decision	I prefer to buy environmentally friendly products than non-green products
	I would like to increase the purchase/use of green products for me
	I buy green products even if they are more expensive than the non-green ones.
	I would recommend the green products to my friends and others

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Spontaneous Variety-Seeking Meal Choice in Business Canteens Impedes Sustainable Production

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Abstract: Sustainable meal choices in the out-of-home catering market are essential to attaining the Sustainable Development Goals. This study investigated consumers' acceptance of different features that help service providers to work more sustainably. For this purpose, data of a choice experiment and a supporting online questionnaire were analyzed using latent class analysis (LCA) and the data of n = 373 employees. Examined attributes in the choice experiment were menu variety, menu type, ordering system, ingredients and price. LCA led to four consumer segments: variety seekers (27.6%), spontaneous decisionmakers—vegetarian (25.7%), spontaneous decisionmakers—meat (24.1%) and vegetarians/vegans (22.6%). Results showed that consumers in all four segments expected to have the choice between different menus in company canteens. Moreover, they preferred spontaneous choice to preordering. Both preferences hamper sustainable production and consumption in the catering sector.

Keywords: out-of-home catering; sustainable nutrition; variety seeking; spontaneous choice; company canteens

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1. Introduction

The out-of-home catering market is the second biggest food branch in Germany, with 12.4 billion guests per year in 2019. On average, each guest uses these services more than 140 times a year [1,2]. The out-of-home catering market consists of four major segments: hotel and restaurant catering, fast-food catering, event catering and company catering. In 2019, German employees spent 7.4 billion euros on their meals at work. The sector of company catering reported growth rates of about 2 to 3% per year [1–3]. Improving the sustainability of the dishes offered and ensuring that healthy and more sustainable options are also chosen by guests are both relevant means to reach the Sustainable Development Goal 12 by 2030. In this regard, company canteens need to know the factors determining consumers' meal choice at business lunches in order to promote their most sustainable dishes to orient the out-of-home catering market towards increased sustainability. Research illustrates that, in general, consumers' eating habits and meal choices can be influenced by different means, such as System 1 nudges (e.g., default options), System 2 nudges (e.g., information or label) or participation activities [4–12]. In particular, consumers' eating habits and meal choice are shown to be affected by search attributes (e.g., price, nutritional composition, variety) [9,13,14], experience attributes (e.g., taste, habit) [9,15], credence characteristics (e.g., organic or regional produce) [13,16,17], sociodemographics (e.g., age, gender) [14,18], and time (e.g., convenience, accessibility) [9,15,19] and can be differentiated into product-based and process-based choices [20]. Considering that kitchen chefs already have the goal of influencing guests' eating behavior towards a more sustainable and healthy direction [21], our study contributes to this research field by focusing on the consumers choice. Four meal choice determinants are investigated as particular choices made in out-of-home consumption occasions, especially in a business context, and that impact

overall sustainability. These are: (1) menu variety, (2) ordering system, (3) menu type and (4) ingredients.

Determinant (1) refers to the variety of dishes offered every day in business canteens and restaurants. This can be considered a sustainability issue since the amount of food waste resulting from preparation and overproduction is often positively correlated with the range of dishes offered at one time [22–24], which also leads to avoidable costs from the supply side. It is also up to the consumer to decide whether a narrow selection of dishes is sufficient or whether a wider selection should be available. This desire for variety is also known as variety-seeking behavior [25–28]. Consumers tend to deviate from previously used products or choices, even if they are satisfied with them, due to the curiosity of the new experience [29–31]. Variety seeking behavior is often seen in settings where the risk of making a bad choice is low, such as within the out-of-home catering sector.

Determinant (2) refers to the use of an ordering system. This also contributes to the predictability of demand. Preorders instead of spontaneous choice help kitchen staff to better plan product purchases and food preparation and thus reduce the amount of food produced that goes unconsumed [23,32,33]. Moreover, previous literature indicates that consumers tend to select healthier dishes while preordering instead of choosing spontaneously in the canteen [34–36].

Determinant (3) refers to the menu type and (4) to the ingredients used. Organic or regional produce and vegan and vegetarian options, in contrast to conventional and meat production, are factors that reduce CO_2 emissions and the amount of pesticides used in agricultural production [16,17,37–39]. These can also be considered relevant for social and ethical reasons [40,41].

Furthermore, it is important to know whether only experienced and regular canteen users, or potential guests as well, are favoring these determinants that are responsible for the current unsustainable situation in the out-of-home catering sector [16,42–44]. If potential guests do not accept the offer on the grounds that it is unsustainable, marketing strategies to attract more customers, as well as a change to the product offer, could also be helpful to improve sustainability in the out-of-home catering sector. Therefore, differences between both groups could be used to apply adaptations on the producer side (e.g., cooking processes, ingredients, recipes, management of natural and monetary resources) or on the consumer side (e.g., information- or behavior-based strategies) [10,45,46]. Based on the current situation in out-of-home catering, which is mainly driven by regular canteen users, a segmentation process for the different underlying meal choice preferences via latent class analysis could supply more detailed recommendations to business canteen providers to improve sustainability. Therefore, this study proceeds as follows: after the presentation of the study design, the empirical context and methods are applied. The survey results are then presented and discussed, focusing on both consumer and producer behavior that impacts the sustainability performance of business catering, and conclusions are drawn.

2. Materials and Methods

An online choice experiment in combination with an online questionnaire allowed us to assess the relevance of five meal attributes and their determining factors inside business canteens. The choice experiment was generated with a complete factorial design (full profile design) as there was a sufficiently high number of potential respondents. Results were evaluated with a choice-based conjoint analysis, as well as logistic regression (logit), willingness to pay (WTP) and latent class analyses using Sawtooth Software, and Stata software was employed to conduct logistic regression analyses on latent class membership [47–49]. In the choice experiment, a total of eight random tasks per respondent were administered to the participants. Each choice set contained four choice alternatives and an additional opt-out option (see Appendix A, Figure A1). Each alternative consisted of five attributes and three attribute levels each. The attributes tested included menu variety, i.e., the number of different dishes offered each day (one dish offered, two dishes offered, two dishes offered plus salad buffet); the menu type, i.e., whether the offered dishes were vegan,

vegetarian or not (one vegetarian dish daily, one vegan dish daily, one meat dish daily); the preferred ordering system (preorder until the end of the previous week, preorder by 9 a.m. on the day of eating, spontaneous choice possible) and desired ingredients (organic, local, seasonal). Price (4.50, 5.50, 6.50€) was included for analyzing WTP (linear model) and because of its particular relevance in consumption decisions. The questionnaire covered the areas of general food choice preferences (based on an adaptation of the Food Choice Questionnaire [50,51]), including product- as well as process-based questionnaire items (for an overview, see Appendix A, Table A1).

3. Results

3.1. Sample Characteristics

In total, 373 respondents working in the Ministry for Environment, Agriculture, Conservation and Consumer Protection of the State of North Rhine-Westphalia and the State Agency for Nature, Environment and Consumer Protection of the State of North Rhine-Westphalia participated in autumn 2017. Of these, 201 were regular canteen users and 172 were identified as potential guests as they only visited the business canteen a maximum of once a week. With regard to the sample characteristics (see Appendix A, Table A2), slightly more female participants took part in the survey than male (female canteen users A: 53.2%; female potential guests B: 57.0%). The largest share of the survey was accounted for by the age group of 45 years or older (A: 52.2%; B: 50.0%). Regarding household size, single-person households (A: 24.9%; B: 18.0%) and two-person households (A: 33.3%; B: 41.3%) dominated the sample. The household income was fairly evenly distributed between canteen users and potential guests, except for the lowest income category, with a peak between 3600–5000€ in the group of canteen users (A: 32.3%).

3.2. Latent Class Approach for Analyzing the Regular Canteen Users

Due to the high opt-out rates of the potential guests (see Appendix A, Table A3), the latent class analysis was only conducted with the 201 employees who used their canteens several times a week. The canteen users had lower opt-out rates that were explainable by a better ability to imagine the choice tasks displayed in the choice experiment.

Regarding the latent class segmentation, Table 1 illustrates that the four-group solution has the best goodness of fit values and is therefore used in the following calculations. The consistent Akaike information criterion (CAIC) in particular, where smaller values are preferred over larger ones, decreases down to the four-group solution and then starts increasing to the five-group solution again. The consistent Akaike information criterion is the most used criterion for determining group segmentation [48,52,53]. The Bayesian information criterion (BIC), where smaller values are preferred [54], decreases until the four-group solution and then decreases only slightly from the four to the five-group solution.

Table 1. Goodness of fit criteria of the latent class analysis.

Number of Latent Classes	Log Likelihood	AIC	CAIC	BIC	Chi-Square
2	−1767.81	3577.63	3711.67	3690.67	1640.32
3	−1702.94	3469.88	3674.13	3642.13	1770.07
4	−1650.18	3386.35	3660.81	3617.81	1875.60
5	−1608.12	3324.25	3668.92	3614.92	1959.70

The first 27.6% of all canteen users (see Table 2) preferred to have a large variety of dishes offered each day in their business canteen and showed the highest relevance for this attribute level compared to the other groups. Group 1 could therefore be called "variety seekers". The second most important issue for this group was to have the possibility of choosing spontaneously but preordering on the day of eating would be an acceptable option as well. While meat dishes were favored, vegetarian dishes were also acceptable, but vegan dishes were perceived as unattractive. Group 1 revealed the highest interest in organic ingredients compared to the other groups.

Table 2. Partworth utilities of the different canteen user segments (latent class analysis).

		Class 1	Class 2	Class 3	Class 4
		Variety Seekers	**Spontaneous Decisionmakers (Vegetarian)**	**Spontaneous Decisionmakers (Meat)**	**Vegetarians/Vegans**
Class Size		**27.6%**	**25.7%**	**24.1%**	**22.6%**
Attribute	**Attribute Levels**				
Menu Variety	One dish offered	−91.92 ***	−67.20 ***	−51.73 ***	−37.89 ***
	Two dishes offered	12.01 *	6.20	10.87	9.95
	Two dishes offered plus salad buffet	**79.91** ***	60.99 ***	40.85 ***	27.94 ***
Menu Type	One vegetarian dish daily	16.80 **	**38.11** ***	−3.21	**65.16** ***
	One vegan dish daily	−52.58 ***	−23.84 ***	−46.94 ***	**38.78** ***
	One meat dish daily	35.79 ***	−14.27 *	**50.16** ***	−103.94 ***
Ordering system	Preorder (previous week)	−65.85 ***	−121.18 ***	−88.62 ***	−55.58 ***
	Spontaneous choice	52.57 ***	**156.70** ***	**107.85** ***	60.38 ***
	Preorder (by 9 a.m.)	13.28 *	−35.51 **	−19.23	−4.79
Ingredients	Organic	**27.89** ***	15.37 **	−9.96	15.68 *
	Local	−9.34	−1.33	8.18	11.60
	Seasonal	−18.56 **	−14.04 *	1.78	−27.27 ***
Price		−37.46 ***	−1.28	−47.86 ***	**−53.08** ***
None		−129.36 ***	83.62 ***	149.05 ***	−99.37 ***
Attribute Importance (%)					
Menu Variety		**34.37**	25.64	18.52	13.17
Menu type		17.67	12.39	19.42	**33.82**
Ordering system		23.68	**55.58**	**39.29**	23.19
Ingredients		9.29	5.88	3.63	8.59
Price		14.99	0.51	19.14	21.23

Note: Attribute levels and attribute importances determining labelling of the classes are marked in bold. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

The second group of the latent class analysis consisted of 25.7% of all canteen users. Respondents categorized into this group were considered "spontaneous decisionmakers (vegetarian)" due to the highest partworth utilities for "spontaneous choice" and the highest average importances for the attribute "ordering system". As expected, they strongly rejected the two preordering options. Regarding the other attributes, they preferred a high variety of meals offered, as well as vegetarian and organic dishes. Spending more money was not necessarily a problem for this group; their partworth utilities were close to zero, and their lowest average importance was for price.

Group 3 were considered "spontaneous decisionmakers (meat)", with 24.1% of all canteen users. As the second most important attribute, they clearly preferred "one meat dish daily" and did not choose vegan or vegetarian dishes. The only attribute that was more important to this group was an ordering system with spontaneous choice. Regarding other choice attributes, they liked to have a larger variety of meals offered as well as affordable prices, and wanted to have local instead of organic ingredients. Overall, they had the most difficulty selecting between our choice options and used the opt-out option several times more than the other groups.

The group "vegetarian/vegan" consumers made up 22.6% of the canteen users. Their most important attribute was the menu type, with the vegetarian option clearly on top, followed by vegan dishes. "One meat dish daily" was strongly rejected by this group. An ordering system with a spontaneous choice attribute level was the second most important, followed by cheap and affordable prices. This group had the lowest partworth utilities and highest average importances for price and thus wanted to spend less than the other three groups. Variety in offered dishes was preferred, as well as organic ingredients.

A logistic regression on latent class membership was conducted to compare the results of the different latent class segments of our choice experiment with their stated intentions in the questionnaire (see Table 3). With a factor analysis (eigenvalues > 1) and a varimax rotation (Kaiser–Meyer–Olkin (KMO) criterion: 0.802), six relevant factors were condensed and checked for reliability using Cronbach's alpha indicator, where values should not drop below 0.6 [55]. The values for Cronbach's alpha varied between the six factors, ranging from 0.721 to 0.883 (for an overview of the included items see, Appendix A, Table A1). These factors, as well as sociodemographic information, were included in a logistic regression on latent class membership. Therefore, four separate logistic regressions were executed, each of these with one of the four latent classes as a dependent variable.

The difference between the two latent classes 2 and 3, which strongly prefer to spontaneously choose their meals, can be explained by the factor of social and environmental compatibility (included items: origin of ingredients, social and environmental standards, naturalness). Here, the "spontaneous decisionmakers (vegetarian)" clearly prefer to choose their dishes according to social and environmental compatibility ($\beta = 0.580$ **, standard error (SE) = 0.220) and therefore tend to make their meal choices based on process-oriented factors. "Spontaneous decisionmakers (meat)" are less likely to be in the age category of $\leq$44 ($\beta = -1.413$ *, SE = 0.640) and do not care much about social and environmental compatibility ($\beta = -0.643$ ***, SE = 0.193) but tend to choose product-oriented factors. Hence, they prefer to eat appealing dishes (included items: consistency, smell, appearance) at business lunch ($\beta = 0.547$ *, SE = 0.215). On the contrary, canteen users categorized into the vegetarian and vegan latent class are more likely to be $\leq$44 years-old ($\beta = 1.559$ *, SE = 0.773) and do not care much about product-oriented factors, e.g., appealing impressions ($\beta = -0.568$ *, SE = 0.232). However, in accordance with their selections in the choice experiment, they do consider the process-oriented factors of social and environmental compatibility ($\beta = 0.422$ *, SE = 0.215).

Overall, there were only a few significant differences between the sociodemographic factors. Group membership was not determined by gender, household size or household income in our study. Compared to previous heterogeneous nutrition studies, this was not a surprising result [56–59]. Age was the only sociodemographic factor that was able to distinguish between two of our latent classes.

Table 3. Logistic regression on latent class membership of canteen users.

	Variety Seekers		Spontaneous Decisionmakers (Vegetarian)		Spontaneous Decisionmakers (Meat)		Vegetarians/Vegans	
	β (Std. Error)	*p*	β (Std. Error)	*p*	β (Std. Error)	*p*	β (Std. Error)	*p*
FAC1 Social and environmental compatibility	−0.134 (0.173)		0.580 (0.220)	**	−0.643 (0.193)	***	0.422 (0.215)	*
FAC2 Health	0.094 (0.180)		−0.271 (0.196)		0.085 (0.191)		0.127 (0.210)	
FAC3 Influence on mood	−0.148 (0.182)		0.193 (0.192)		−0.250 (0.198)		0.229 (0.203)	
FAC4 Familiarness with the meal	0.139 (0.190)		0.128 (0.199)		0.057 (0.200)		−0.352 (0.211)	
FAC5 Appealing impression	0.061 (0.191)		−0.158 (0.207)		0.547 (0.215)	*	−0.568 (0.232)	*
FAC6 Financial aspects	−0.339 (0.203)		−0.100 (0.219)		0.222 (0.218)		0.297 (0.226)	
Gender (female)	−0.196 (0.350)		0.473 (0.371)		−0.394 (0.373)		0.050 (0.389)	
Age ≤ 44	0.720 (0.619)		−0.925 (0.642)		−1.413 (0.640)	*	1.559 (0.773)	*
Age ≥ 45	−0.037 (0.605)		0.267 (0.593)		−0.708 (0.585)		0.706 (0.774)	
Household Size ≤ 2	−0.517 (0.664)		1.409 (1.127)		0.042 (0.701)		−0.614 (0.712)	
Household Size ≥ 3	0.196 (0.671)		1.681 (1.134)		−0.413 (0.729)		−1.434 (0.778)	
Household Income ≤ 3600€	1.015 (1.171)		1.172 (1.172)		−0.416 (0.867)		−0.811 (0.822)	
Household Income > 3600€	1.021 (1.160)		0.946 (1.160)		−0.443 (0.855)		−0.778 (0.806)	
Constant	−1.945 (1.259)		−3.728 (1.528)	*	0.296 (0.973)		−0.884 (1.000)	
Observations Pseudo R2	201 0.0600		201 0.1261		201 0.1299		201 0.1359	

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

3.3. Meal Choice Determinants Impacting Overall Sustainability in Business Canteens

To assess the relevance of the different meal attributes for those already eating the food offered in the canteen but also for those not currently eating there, the full data set was divided into A) canteen users (employees who use their canteen at least twice a week up to every day), and B) potential guests (employees who do not or only rarely visit their canteen, up to a maximum of one visit per week).

The analysis of the average importances (see Figure 1) clearly reveals that the ordering system (spontaneous choice, preordering) is the most important attribute for both groups (canteen users A: 38.35%; potential guests B: 45.16%). This is followed by the second most desired attribute, menu variety, i.e., the number of dishes offered per day (A: 27.91%; B: 22.82%). The third most important attribute is price (A: 15.52%; B: 17.06%), followed by the menu type (vegan, vegetarian, meat) (A: 10.95%; B: 10.44%) and last, the ingredients (organic, local, seasonal) (A: 7.27%; B: 4.52%). Figure 1 illustrates that, based on average importances, no major differences in the ranking of desired attributes between canteen users and potential guests can be reported (which is also confirmed by logit analyses regarding the individual attribute levels—see Appendix A, Table A3).

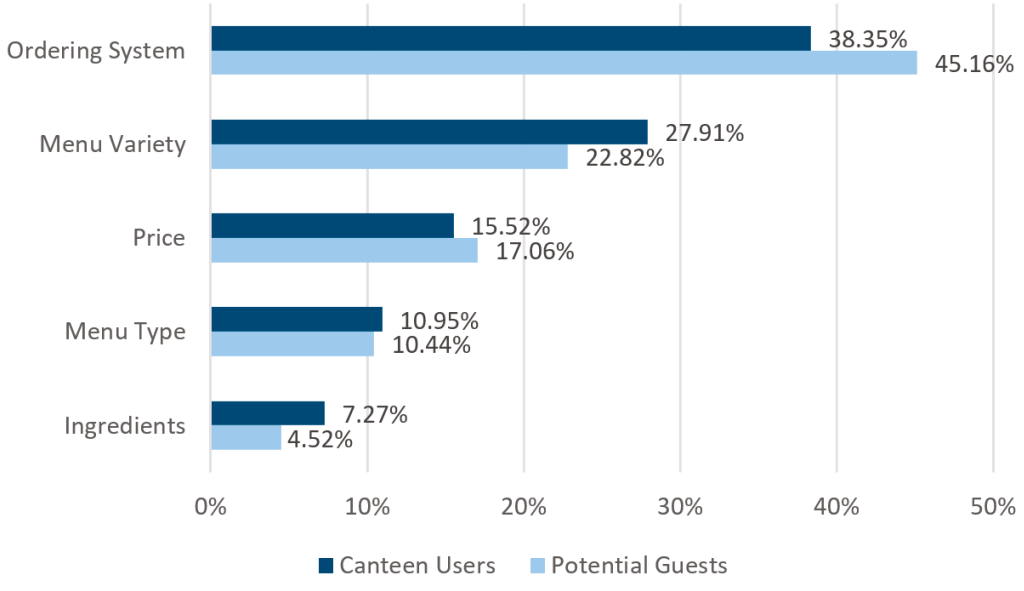

Figure 1. Average importance of attributes for meal choice in canteens.

3.4. Willingness to Pay for Meal Choice in Business Canteens

Taking the willingness to pay measures as another visualization of relevance and welfare (see Appendix A, Table A4), the estimated extra cost of 2.65 to 2.70€ for spontaneous choice instead of preordering paints a clear picture. Preordering in the previous week is discarded with WTP values of −2.25€ for canteen users and −2.65€ for potential guests. The WTP for the attribute level "two dishes offered plus salad buffet" (on average, employees are willing to spend around 1.65€ (canteen users) and 1.27€ (potential guests) more for this option) further reveals the significance of unrestricted choice variety. Thus, if a canteen only wants to offer one dish per day, guests' willingness to pay for the remaining dish might be lower compared to a situation in which more dishes can be chosen. However, this result is only certain for the case in which consumers are not informed about the advantages of the reduced choice for them, the canteen and sustainability issues in general. The third most valued attribute is the menu type of a daily vegetarian option. Employees are willing to spend around 0.70€ more to have this vegetarian option. Employees were willing to pay around 0.29€ (potential guests) and up to 0.42€ (canteen users) more for the option of organic food as opposed to other meal ingredients such as local or seasonal food.

4. Discussion

Regarding the goal of assessing the extent to which consumers would accept different means of improving company canteen meal sustainability, four aspects were tested in an online choice experiment. Two of these aspects were directly related to meals (labeling of local, organic and seasonal produce as well as vegan, vegetarian or meat dishes) while the other two aspects were related to the service (preordering systems vs. spontaneous choice, and the number of different dishes offered per day and thus the variety of meals available).

Our findings, especially the desire for a wide variety of meals offered each day, spontaneous choice and meat components at business lunch, could impede progress towards the goal of sustainable out-of-home catering. Vegetarian and vegan dishes are better options regarding CO_2 emissions as well as their overall sustainability impact [16,37,39]. As previous research shows, the desired variety of meals, as well as the preference for

spontaneous choice, increase the amount of kitchen food waste and plate leftovers [22–24]. A preordering system, combined with reduced meal variety per day, would allow kitchen staff to better plan required meal quantities [23,32].

The finding that consumers prefer to choose their meal out of a varied selection can be explained using the concept of variety-seeking behavior. This concept assumes that consumers tend to change their commonly used products, even if they are satisfied with them, because the new experience is a benefit on its own [25–28].

Better planning reduces food waste and thus saves (natural and monetary) resources. In the best case, the saved monetary resources could be used to improve meal quality and not only business revenues. This assumption sounds plausible, but this line of thought did not occur to the study participants or was not shared. Results showed that participants did not include the criterion of an overall benefit for sustainability (by choosing in advance and from a smaller selection) into their personal utility function. In this regard, it is important to bear in mind that study participants were not informed about the overall goal of the survey. Hence, they were not told that less variety-seeking and more preordering could save resources. A lack of environmental knowledge could certainly have hindered participants in their choice of sustainably in the experiment since mostly vegan or vegetarian diets, and organic or regional produce are commonly known to be environmentally friendly [21]. However, as the participants worked in state authorities dealing with resource topics, this explanation lacks plausibility. An even more reasonable explanation is provided by present bias or hyperbolic discounting [60,61]. Present bias or hyperbolic discounting describes the finding that consumers prefer benefits they gain today from a current behavior to possible greater future benefits of a different current behavior that appears less attractive today. Restricting one's own pleasure by preordering or choosing the only dish available for the sake of sustainability benefits for all creatures, climate and the planet in an uncertain future does not appeal to everyone. In addition to the present bias, it may simply be a perceived lower sense of responsibility for sustainable behavior when dining out of the home compared to at home. This includes a lack of perceived influence regarding the choice of ingredients and the food offered in out-of-home catering.

The current literature revealed that consumers tended to make healthier choices while preordering their meals for lunch breaks instead of spontaneously choosing them at the counter [34–36]. Although spontaneous choice prevailed in our choice experiment, the option of preordering (until 9 a.m.) was perceived as a tolerable possibility by variety seekers as well as potential guests. In many cases, canteen users simply could not imagine using a preordering system as they have not yet had any experience with these systems. Consequently, they had little preference for preordering systems (which could be explained by the status quo bias). Therefore, when introducing such systems, it is important that the application used to purchase dishes, as well as the exchange of payment, such as food vouchers, for previously purchased dishes, is made as easy as possible. In other words, the offer must be adapted as far as possible to the customer, not the customer to the offer.

It could be assumed that a price discount offered for each meal preordered (until 9 a.m.) would attract guests' attention. A possible trade-off between indicated consumer demands and sustainable consumption could be the possibility of preordering (until 9 a.m.) one "most sustainable" vegetarian dish daily, which would be offered at an attractive price to lure consumers with both economic and sustainability incentives. Regarding ingredients, the canteen staff could alternate between organic and local ingredients to address the preferences of canteen users as well as potential guests. Another trade-off variant could be achieved by preordering (until 9 a.m.) the main component of the meal (e.g., meat and processed food) and spontaneously choosing side dishes, for example, a buffet containing salads and vegetables with better health and sustainability impacts. These variants should be tested in future studies to reveal which of the two ordering systems, here preordering for the main component and spontaneous choice for the side dishes, would satisfy the urge of consumers for variety seeking and their need for spontaneous choice.

5. Conclusions

Even though respondents worked in two state authorities of agriculture and could thus be assumed as more knowledgeable than an average German canteen user, the study results revealed a distinct preference for food choice attributes that hindered sustainable production in out-of-home catering. The most obvious conclusions to be drawn from our data were that, no matter how often respondents ate a business lunch or how business canteen users were segmented, they showed a clear preference for menu variety and spontaneous choice. Less important were other dish characteristics related to the ingredients, although vegetarian as well as meat options available each day and organic ingredients were preferred by the majority of respondents. Social and environmental compatibility as a process-oriented factor was only prioritized by respondents who already preferred vegetarian or vegan meal offers.

Previous literature revealed that canteen users tended to reject obvious changes in the meal offers, especially when respondents were older [62]. A remaining possibility for strengthening sustainable meal choices is to nudge consumers and help them subconsciously opt for the healthier and more sustainable choices [9,12,63–65]. While System 1 nudges address fast, automatic and emotional thinking, System 2 nudges focus on slow, exhausting and logical thinking [5,10]. If company canteens decide to allow spontaneous choice with its fast, automatic and emotional characteristics, it is advisable to use System 1 nudges (e.g., default options at the counter or in the menu) to nudge guests towards more sustainable meal choices. If company canteens decide to offer preordering and want to enhance its attractiveness, it is advisable they employ System 2 nudges (e.g., information for preordering at the counter or displaying labels while preordering) to further boost sustainable meal choices [10,64–66].

As illustrated above, the clear preference for spontaneous choice and menu variety, as well as the need for meat at business lunch displayed by our choice experiment, hamper sustainable production and consumption in the catering sector.

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Appendix A

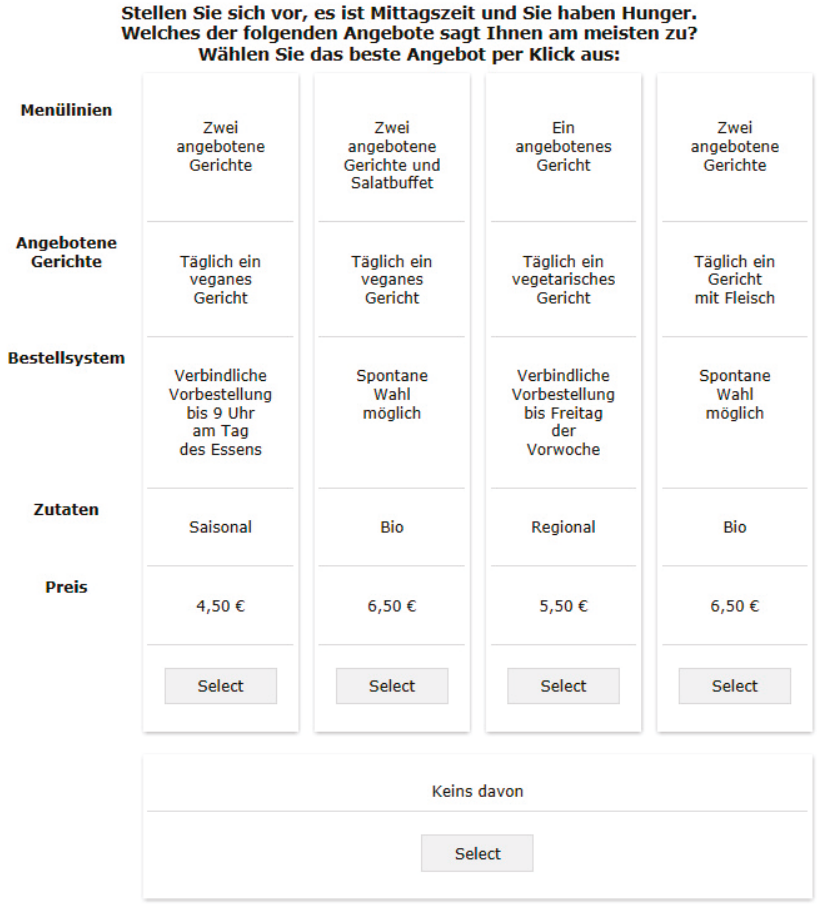

Figure A1. Example choice set of the choice experiment. Note: The choice experiment was executed in the German language. Translation: Imagine it is lunchtime and you are hungry. Which of the following offers appeal to you the most? Select the best offer by clicking. Menu variety/Menu Type/Ordering system/Ingredients/Price. Option 1: Two dishes offered/one vegan dish daily/preorder by 9 a.m./seasonal/4.50€. Option 2: Two dishes offered plus salad buffet/one vegan dish daily/spontaneous choice/organic/6.50€. Option 3: One dish offered/one vegetarian dish daily/preorder the previous week/local/5.50€. Option 4: Two dishes offered/one meat dish daily/spontaneous choice/organic/6.50€. Opt-out option: None.

Table A1. Factor analysis of the questionnaire items.

Questionnaire Items	Mean	Std. Err.	Factor Loading
Social and environmental compatibility (Cronbach's alpha: 0.883)			
Whether regional ingredients are used.	3.73	0.073	0.7226
Whether social standards (e.g., Fairtrade) are met.	3.37	0.080	0.7210
Whether the origin of the ingredients is clearly marked.	3.36	0.087	0.7022
How natural the ingredients are.	3.95	0.070	0.6847
Whether seasonal ingredients are used.	3.78	0.071	0.6737
Whether environmental standards (e.g., MSC—Marine Stewardship Council) are met.	3.49	0.082	0.6653
Whether organic ingredients are used.	3.44	0.087	0.6618
Whether artificial ingredients are contained.	3.73	0.081	0.5607
Whether additives are contained.	3.58	0.084	0.5509
Health (Cronbach's alpha: 0.882)			
A low calorie content.	2.99	0.084	0.7580
Whether the food will help me keep my weight under control.	3.20	0.091	0.7303
A low fat content.	3.28	0.079	0.7242
Whether the food keeps me healthy.	3.88	0.073	0.7092
A high fibre content.	3.20	0.079	0.6873
A high vitamin content.	3.63	0.072	0.6263
A high protein content.	2.81	0.084	0.5791
Whether the food is good for skin/hair/nails/teeth.	2.39	0.082	0.5722
Influence on mood (Cronbach's alpha: 0.865)			
Whether eating helps me cope with stress.	2.49	0.088	0.8430
Whether a meal will help me relax.	2.80	0.086	0.8380
Whether a meal cheers me up.	2.86	0.090	0.7881
Whether a meal makes me feel good.	3.70	0.079	0.6130
Whether a meal will help me cope with my life.	2.20	0.087	0.6024
Familiarness with the meals (Cronbach's alpha: 0.722)			
Whether I habitually eat a certain offer.	2.19	0.071	0.7070
Whether I'm familiar with a meal.	2.34	0.075	0.6471
Whether the food can be eaten quickly.	2.03	0.064	0.6281
Whether a meal is one of my favourite dishes.	2.93	0.088	0.5548
Appealing impression (Cronbach's alpha: 0.765)			
The mouthfeel (consistency) of the dishes.	4.00	0.064	0.5806
The smell of the dishes.	3.99	0.058	0.5745
The appearance of the dishes.	3.96	0.057	0.5706
Financial aspects (Cronbach's alpha: 0.721)			
That my meal isn't expensive.	2.95	0.076	0.7122
That my choice is cheap.	2.09	0.072	0.5782

Note: The following items had no factor loading over 0.5 and were excluded: whether the dish is vegetarian; whether the dish is vegan; how nutritious the food is; whether the food contains ingredients I can't handle; the taste of the dishes; a good price-performance ratio of my selection; whether I can just eat the food (e.g., no spaghetti with sauce); whether I get the food fast at the food counter. Items were based on [50,51].

Table A2. Sample characteristics.

Sociodemographic Attributes		A: Canteen Users		B: Potential Guests	
		Frequency	Share (%)	Frequency	Share (%)
Gender	Female	107	53.2	98	57.0
	Male	94	46.8	73	42.4
	N/A	-	-	1	0.6
Age	≤44	75	37.3	67	38.9
	≥45	105	52.2	86	50.0
	N/A	21	10.5	19	11.1
Household Size	1	50	24.9	31	18.0
	2	67	33.3	71	41.3
	3	24	11.9	30	17.4
	4	33	16.4	29	16.9
	>4	11	5.5	6	3.5
	N/A	16	8.0	5	2.9
Household Income	<1300€	5	2.5	10	5.8
	1300–2600€	43	21.4	44	25.6
	2600–3600€	38	18.9	30	17.4
	3600–5000€	65	32.3	43	25.0
	>5000€	41	20.4	37	21.5
	N/A	9	4.5	8	4.7
N		201		172	

Table A3. Logit models for canteen users and potential guests.

Attribute	Attribute Levels	A: Canteen Users			B: Potential Guests		
		β	Std. Err.	t Ratio	β	Std. Err.	t Ratio
Menu Variety	One dish offered	−0.878	0.059	−14.982 ***	−0.665	0.060	−11.112 ***
	Two dishes offered	0.129	0.049	2.661 **	0.072	0.052	1.376
	Two dishes offered plus salad buffet	0.749	0.047	15.885 ***	0.594	0.050	11.844 ***
Menu Type	One vegetarian dish daily	0.322	0.046	6.935 ***	0.329	0.051	6.470 ***
	One vegan dish daily	−0.316	0.050	−6.316 ***	−0.234	0.054	−4.317 ***
	One meat dish daily	−0.006	0.048	−0.126	−0.096	0.052	−1.826
Ordering System	Pre-order (previous week)	−1.016	0.064	−15.810 ***	−1.239	0.079	−15.717 ***
	Spontaneous choice	1.220	0.048	25.407 ***	1.240	0.054	22.852 ***
	Pre-order by 9 a.m.	−0.204	0.053	−3.821 ***	−0.002	0.059	−0.026
Ingredients	Organic	0.188	0.047	3.986 ***	0.135	0.051	2.653 **
	Local	0.047	0.048	0.978	−0.008	0.053	−0.161
	Seasonal	−0.235	0.050	−4.689 ***	−0.127	0.054	−2.356 *
Price		−0.452	0.043	−10.525 ***	−0.468	0.046	−10.173 ***
None		0.449	0.071	6.331 ***	0.725	0.073	9.865 ***
Goodness of Fit							
Akaike Info Criterion (AIC)		3932.87			3468.02		
Consistent Akaike Info Criterion (CAIC)		3996.69			3530.28		
Bayesian Information Criterion (BIC)		3986.69			3520.28		
Chi-Square		1263.09			981.16		
N		201			172		

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table A4. Willingness to pay (WTP) measures for canteen users and potential guests.

Attribute	Attribute Levels	Canteen Users WTP	Potential Guests WTP
Menu Variety	One dish offered	−1.94€	−1.42€
	Two dishes offered	0.29€	0.15€
	Two dishes offered plus salad buffet	1.65€	1.27€
Menu Type	One vegetarian dish daily	0.71€	0.70€
	One vegan dish daily	−0.70€	−0.50€
	One meat dish daily	−0.01€	−0.20€
Ordering System	Pre-order (previous week)	−2.25€	−2.65€
	Spontaneous choice	2.70€	2.65€
	Pre-order by 9 a.m.	−0.45€	0.00€
Ingredients	Organic	0.42€	0.29€
	Local	0.10€	−0.02€
	Seasonal	−0.52€	−0.27€
None		0.99€	1.55€
N		201	172

Note: WTP was calculated with the attribute price as a linear function (output of the logit analysis).

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Gaining Trust in the Digital Age: The Potential of Social Media for Increasing the Competitiveness of Small and Medium Enterprises

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Abstract: Trust in information originating from a company is becoming essential, as consumer preferences are increasingly versatile and oriented towards credence attributes. Social media, which emerged as a dominant means of online communication, might help increase consumers' trust in companies. The paper empirically investigates a conceptual trust-building mechanism that could occur on companies' social media pages. A survey was conducted among social media users in Belgrade (Serbia). The collected data were analyzed using covariance-based structural equation modeling. It confirmed that in an interactive environment of companies' social media pages, trust can be built towards two objects. The first one is trust among consumers, and the second one is trust towards a company. The results also confirm a connection between trust and an intention to purchase, both being also related to a consumer's willingness to obtain information. Therefore, the result can serve as a basis for creating more effective marketing campaigns where a company is the source of information regarding credence (added-value) attributes of its products.

Keywords: consumer behavior; purchase intention; trust; social media; small and medium enterprises

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1. Introduction

The expansion of social media with its possibilities to share consumers' opinions about products online has shifted the locus of power on markets towards the consumers [1,2]. Due to the empowerment of the demand side, requirements for information, such as origin, production processes and product flows within supply chains, are being brought to light [3,4]. On the other side, aspirations to build trust in their products have become easier to achieve for companies—mainly due to the rapid development of digital technologies, where transparency has become an important trust-building factor [5,6]. Lastly, there are obvious advantages of such processes for the consumers, as the information asymmetry problem can be lessened for an inexperienced consumer within such environments [7].

Interpersonal interactions provided by social media pages are identified as a fertile ground for the effects of electronic word-of-mouth (eWOM) marketing [8]. eWOM is disseminated in an online space where potential, actual or former customers can share their opinions about products [9]. By sharing their impressions or reviews, active members voluntarily generate additional value for other consumers [1]. Consumer-generated information has a bigger effect on an average consumer compared to other sources [10,11]. Members of the online networks can convince others with their knowledge and experience, helping the trust in a product and willingness to buy a product [12,13]. Grewal et al. [14] explained that the reason for such occurrence is the non-existence of incentives for WOM carriers. The explained processes also allow consumers to form opinions about the products they are not familiar with [15,16]. Moreover, online networking actions of individuals help

to share values, which further helps in building trust among them [17]. Finally, eWOM also has a direct effect on the purchase intentions of consumers who are less familiar with a product [18,19].

However, we also perceive the importance of trust in a company in an online environment from two different perspectives. The first one is a more tangible one: It is about a positive relation between the trust in a company and purchase intentions at the consumer level [20,21]. The second one is more complex; it emphasizes the role of trust when different types of information are provided by a company. We assume that the information of interest in an online environment is about a company's product(s). The products are presented with their attributes, which can be categorized as search, experience or credence attributes [22,23].

Credence attributes are increasingly becoming the point of interest among consumers, especially considering food products [24]. Companies can use such characteristics of their products as a tool to differentiate their products within the market and build competitiveness [25,26]. Furthermore, credence attributes represent a way of building consumer loyalty toward a brand: with higher assurance in credence attributes, consumer loyalty increases [27]. Such effects go hand in hand with a higher willingness of consumers to pay (WTP) for products having such attributes, ensuring price premiums for producers. Examples for such behavior can also be found among food industries [28,29]. However, the previously explained influence of eWOM in an online environment depends on the type of attributes in question. As credence attributes are the ones that cannot be checked by a regular consumer, consumers are not eligible to share their opinions about them. Moreover, consumers do not normally write online reviews about credence characteristics [30].

Today, we see a constant rise in the popularity of credence characteristics and the unsuitability of eWOM to mediate that kind of information. In our approach, we therefore mainly focus on the possibility of eWOM to increase consumers' trust in a company. Positive feedback from consumers regarding experience attributes, for example, will help to build trust in a company [19]. Once the company becomes more trustworthy, consumers' acceptance of information originating from it will be increased. The significance of this process lies in the fact that a company is an eligible source of information regarding credence characteristics of products.

The positive influence of credence attributes on consumers' purchase intentions and their WTP has already been well researched, and in the vast majority of those research works, the existence of the credence attribute in the product was non-questionable (e.g., presented as certified by a third party). However, real-world conditions gradually deter from such a setting, as companies' increasingly use social media to present a myriad of credence characteristics that surpass the range of available certificates. Thus, in conditions where homogeneous information provided with a certificate is not available, consumers' purchase intentions and WTP are largely influenced by the trust levels towards a company—an information provider. Based on those facts, we emphasize a research gap and the importance of understanding the trust-building mechanism that occurs on social media. To bridge that gap, we add to a scarce literature basis which encompasses the usage of well-grounded psychological theories in analyzing online environments and the economic behavior of an individual. Specifically, trust antecedents and trust posteriors of a consumer who interacts in an online space explain the underlying trust-building mechanism as well as its subsequent influence on purchase decisions.

We also analyze the subsequent trust influence regarding its path through the consumers' intention to obtain information in an online space. Very few papers have considered this path, and to the best of our knowledge, none of them have specified the origin of the information provided in an online space in the mentioned construct. We went a step further and regarded the origin of information in this part of the model. In our model, therefore, we were able to formulate the intention to obtain information from a company as a separate construct. We believe that this significantly increased the practical value of

the research, as it is in line with the previously described growing role of a company as an online information provider.

We aim to answer three research questions: First, what are the main determinants of trust-building mechanisms on social media? Second, what is the influence of eWOM on the purchase intention of consumers? Lastly, how does the potential increase in the consumers' trust in a company influence their intentions to obtain company-originated information and purchase intentions?

The data were collected in Serbia, an EU candidate country where small and medium enterprises (SMEs) are facing strong competition from the EU. SMEs are of crucial importance, taking 56% of the domestic GDP and employing 66% of the workforce in the domestic economy. A total of 99% of companies there are classified as SMEs [31]. Accordingly, legislative actions propose different ways of keeping SMEs profitable, especially in the sector of food production, such as within a production of added-value products [32]. In this paper, we present a compatible approach that advances the understanding of the positive effects of social media usage on SME businesses [33].

The main contribution of this research is twofold. Firstly, it provides an in-depth understanding of trust determinants induced by social media and applicable in current market conditions by SMEs. To the best of our knowledge, this is the first study that points out the perspective of trust increase within digital solutions in this geographical region. Furthermore, we contribute to the existing discussion of the impact of social media on consumers' purchase decisions, by providing the perspective of transition economies where social media, due to a slower infrastructure development, still has a potential to grow. Thus, the results obtained in this research could be of great value to SME actors in other developing economies around the world.

This paper is structured as follows: In Section 2, we present the theoretical background of our approach. In the following Section 3, we specify the model within formulated hypotheses. Information about the used materials and methods is provided in Section 4. The empirical results are presented in Section 5, followed by a discussion that includes limitations in Section 6. Finally, our conclusions and practical implications are presented in Section 7.

2. Theoretical Backgrounds

As there is no single theory that can be used as the base for answering our research questions, we used a composite approach based on the definition of trust (as a multidimensional construct) [34] and two established theories: trust transfer theory [35] and theory of reasoned action [36].

For an exchange relationship, trust can be defined as one side's belief that the other side will do what was agreed before [37]. Schurr and Ozanne [38] defined trust as a confidence in competences and a readiness of another side to devote itself to the business cause and fulfill its obligations. In broader terms, Mayer et al. [39] defined trust as a readiness to be exposed to actions of another party where the mentioned readiness should be independent of the ability to check that other side.

The trust constructs used in the model were formulated considering Gefen and Straub's [34] explanation of the complex nature of perceived trust. According to it, trust occurs through three factors: ability, integrity and benevolence. These factors are important for trust and related to each other. The authors state, however, that values of these factors can significantly vary at different points in time. Thus, although it is not necessary to have similar value intensities, the presence of all three factors at the recording time is necessary in order to consider them as trust factors. In keeping with the mentioned theoretical basis, trust, for online environments, is a belief formed on the perceived characteristics of another side: ability, integrity and benevolence [40]. These factors are considered within the scales and the questions used to collect data in this research (for more detailed insights about the used scales and questions, please refer to Table A1 in the Appendix A).

Trust transfer theory represents the second part of the theoretical foundations we based our research on. Trust transfer is recognized as one of the significant mechanisms of trust formation [41]. It is a process that occurs when "the unknown target [is] being perceived as related to the source of the transferred trust" [35] (p. 6).

Shi and Chow [42], based on findings by Campbell [43], pointed out that the necessary relatedness is based on similarity, closeness and common fate. Thus, they find an applicability of the trust transfer approach in an online environment, where companies appear as a part of an online group on a social media page. As part of a (online) group, the company shares similar values with potential and existing customers, inducing the trust transfer process.

eWOM in a social media environment accommodates a trust transfer process, in the direction from other members (experienced consumers) towards a company [44]. In other words, consumers' trust in a company is increased as the company is perceived as part of the same group with more trustful subjects. In the eyes of potential customers, more trustful subjects are other customers who have already tried a product [45].

Thus, the result of the trust transfer process will be observed not only as trust in a particular product or some experience attributes provided by other consumers, but as trust in the information supplied by the company as well. Although a company's claims and consumer reviews can be different by nature (i.e., credence and experience attributes), the sense of a group activity within the dedicated social media page should help build consumers' trust in a company.

The third theoretical part we use is defined as theory of reasoned action (TRA). Due to its primary purpose of understanding a willing behavior of an individual, this theory is recognized as a suitable framework for a research aimed towards relationships between consumers' attitudes, intentions and behaviors [46].

TRA is also considered a sufficient basis for researching the mentioned relationships in the consumers' trust context, as there is no dedicated theory explaining consumer behavior connected to it. [46]. In the literature, TRA has already been used for investigating consequences of trust and the relationship between trust and trust outcomes [46–48]. The same approach will be used here within an "antecedents–trust–outcomes" model form proposed by Lu et al. [44]. This approach lies in the fact that, according to TRA, the expectation about the behavior outcomes (salient beliefs) affects the intention to initiate a particular behavior [49]. Pavlou and Gefen [47] mentioned that trust and perceived risk can be observed as salient beliefs. Therefore, relating to the applicability of TRA, trust can be regarded as the prior cause of people's behavior.

According to TRA, a behavioral intention is the best predictor of an actual behavior [49]. By including behavioral intentions into the analysis, it is possible to extrapolate findings to real-world behavior. Thus, in our research context, purchase intention, as the most important endogenous variable, represents the best predictor of an actual purchase intention at the consumer level. The statement is also valid for two other endogenous variables in the model: intention to obtain information from a company and intention to obtain information from other virtual community (VC) members (a term we use to include anyone other than the company).

3. Model Specification

The models that account for the effect of word-of-mouth (WOM) on consumers' behavior can be divided into three groups. The simplest group consists of the first WOM model formulations called The Organic Interconsumer Influence Model [50]. In this case, WOM happens between consumers without any direct encouragement, effect or quantification by companies. The next group, the Linear Marketer Influence Model, starts with research that points out the importance of influential individuals among consumers [50]. This is characterized by active engagement by companies to influence such individuals, which consider the effect they have on other consumers [51]. The third and the newest group of research is The Network Coproduction Model, and it includes Web 2.0 development which

has provided an opportunity for consumers to quickly interact and share opinions [50]. It also accounts for the participation of companies, as they quickly recognized the importance of that space and got involved [52]. Social media pages founded by companies represent a way for them to participate in an online environment in a more controlled manner [53]. However, the basic specifics of this model are still valid: compared to previous times, new tactics and metrics are applied by companies in order to aim and influence the consumer or opinion leaders. Further, it accounts for the existence of a multidirectional exchange of messages in that environment.

The model we use as the base for our research was formulated by Lu et al. [44]. This model is within the frames defined by the Network Coproduction Model and belongs to the group of models which account for the influence of consumers' trust. Trust is an antecedent of the intention to obtain information (eWOM adoption) and also an antecedent of the value of co-creation in an online environment [54]. As trust is defined as a belief, it can be incorporated in the model form determined by theory of reasoned action (or theory of planned behavior) and used as an antecedent of consumers' purchase intention [55].

We employed a modified version of the model [44], as a way to econometrically prove (by covariance-based structural equation modeling) the research hypotheses using the collected data. The used model uses trust as the central construct and involves 10 constructs in total.

The model also includes the effect of trust antecedents on trust, following the model form "antecedents–trust–outcomes". Following this framework, the antecedent part in our model consists of familiarity, perceived similarity, structural assurances, trust propensity and electronic word-of-mouth (eWOM) (Figure 1). The eWOM part was added considering the importance of positive comments on consumers' attitudes [19]. Regarding trust outcomes, the model includes the intention to obtain information from a company and from other VC members and consumers' purchase intention. The separation of the intention to obtain information from a company and from other VC members represents the second modification of the model. With this modification, we will be able to measure the effect of trust in a company on the intention to obtain information from a company. The importance of such a modification is drawn from the necessary informant role of a company when certifications are not available and credence attributes of products are in question. We also introduced an endogenous covariance between two new factors. In this manner, the model is able to capture the covariance, whose existence is safe to assume because of the shared origin of these factors.

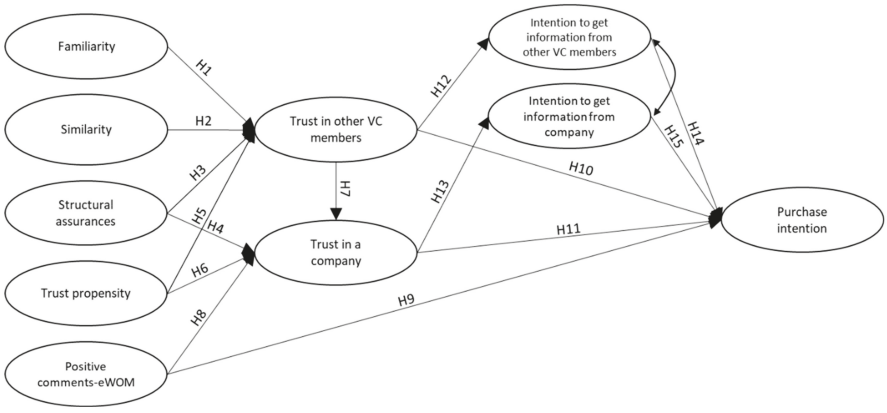

Figure 1. Structural model with hypotheses.

On the side of the trust antecedents, the model considers familiarity as the result of the interactions of individuals (excluding the company or the website administrator).

Due to this familiarity, an individual can form expectations towards others [56]. These expectations are the source of trust or distrust and therefore antecedents of trust [57]. As Lu et al. [44] emphasized, previous interactions significantly contribute to trust development. Accumulated knowledge gained through interpersonal experience will positively influence trust. In order to verify this claim, H1 was formed.

Hypothesis 1 (H1). *Perceived familiarity will positively affect consumers' trust in other VC members.*

Grouping people and creating communities have a positive influence on trust. Similarities in groups improve the acceptance of the exchanged information [40,58]. Likewise, social media users are prone to communicate with other users similar to them, where shared preferences and similarities are taken into account during the decision process to trust or not [57]. Accordingly, we formulated H2.

Hypothesis 2 (H2). *Perceived similarity will positively affect consumers' trust in other VC members.*

Structural assurances are beliefs based on conditions and guarantees in a particular situation, which makes success likely [41]. Lu et al. [44] hypothesized that if the website maintains the online rules, it will result in greater confidence, firstly in other VC members, but also in the administrator, the company or the website. Therefore, H3 and H4 will be checked.

Hypothesis 3 (H3). *Perceived structural assurances will positively affect trust among other VC members;*

Hypothesis 4 (H4). *Perceived structural assurances will positively affect consumers' trust in a company.*

Reflecting on previous findings [39], it can be supposed that in a social commerce environment, trust propensity is positively related to trust. Trust propensity is the tendency of an individual to believe or not believe in other individuals; it has increased significance in a situation when the trustor is more unfamiliar with the trustee [59]. This relation will be checked through hypotheses H5 and H6.

Hypothesis 5 (H5). *Trust propensity will positively affect trust among other VC members;*

Hypothesis 6 (H6). *Trust propensity will positively affect consumers' trust in a company.*

Lu et al. [44] formulated trust as a latent component regarding trust dimensionality outlined by Mayer et al. [39] that includes three dimensions of trust: ability, integrity and benevolence. The mentioned trust dimensions are consistent in both trust constructs in the model: trust in VC members and trust in a company. The positive relation between these two constructs is defined as a trust transfer [35]. To prove the mentioned relation, H7 was formed.

Hypothesis 7 (H7). *Consumers' trust in other VC members will positively affect consumers' trust in a company.*

Trust in a company is influenced by the previous behavior of the company and experiences of other members which, in the social media environment, have an opportunity to punish or reward the company through the power of eWOM [44]. The existence of eWOM in the online environment provides fulfillment of a need for expressing satisfaction or dissatisfaction about the product or services [60,61]. Within negative or positive eWOM, there is an influence on consumers' trust in a company, globally or, in particular, in the spheres of the company's credibility and benevolence [19,62,63]. Thus, as a modification of the model, a latent variable representing positive eWOM was introduced and hypothesis H8 was formed.

Hypothesis 8 (H8). *Positive eWOM will positively affect consumers' trust in a company.*

Moreover, eWOM can have a direct influence on the purchase intention [64,65]. Confirmatory to it, previous findings indicate that the purchase intention of a consumer greatly depends on the comments of previous consumers [66]. Purchase intention will be an additional effect of the positive eWOM defined within H9.

Hypothesis 9 (H9). *Positive eWOM will positively affect purchase intention.*

Lu et al. [44] differentiated between two trust constructs; both are predecessors of purchase intention in their model. The first one is the consumers' trust in other members of the VC. According to the authors of the model, if there is trust between VC members, the likeliness of purchase is higher. The other construct, consumers' trust in a company, is also positively related to the purchase intention [19,44].

Hypothesis 10 (H10). *Trust in other VC members will positively affect purchase intention;*

Hypothesis 11 (H11). *Trust in the company will positively affect purchase intention.*

Lu et al. [44] also acknowledged trust as a predecessor to consumers' intention to obtain information. However, we split that construct into two new constructs: intention to obtain information from other VC members and intention to obtain information from a company. Therefore, conditions were set for estimating the trust influence on the process of information acceptance in conditions where two distinct sources are present: a company and other VC members. This modification was intended to indicate possible ways for achieving higher acceptance of information coming specifically from a company, through the confirmation of two hypotheses:

Hypothesis 12 (H12). *Trust in other VC members will positively affect the intention to obtain information from other VC members;*

Hypothesis 13 (H13). *Trust in a company will positively affect the intention to obtain information from the company.*

The model [44] uses suggestions given by Pavlou and Fygenson [67], according to which a consumer visits an online site in search of information. The information there is searched in a cognitive phase of the consumer's need and relates positively to their purchase intention. In other words, social media provides information about the products when a potential buyer knows what they are looking for, and the information found there should positively influence the final purchase intention. According to the introduced modification with separate sources of information, we formed two hypotheses:

Hypothesis 14 (H14). *The intention to obtain information from other VC members will positively affect the purchase intention;*

Hypothesis 15 (H15). *The intention to obtain information from a company will positively affect the purchase intention.*

The scales used in the research have been used before (Table A1 in the Appendix A) [19,44]. A scale for constructing familiarity is Lu et al.'s [44] modification of the scale previously introduced by Gefen [68] for familiarity within a web store. The scale for similarity partially originates from Crosby et al.'s [69] research, where similarity was measured under three aspects: appearance, lifestyle and status similarity. Lu et al. [44] modified that scale by keeping only the lifestyle component due to the inapplicability of appearance and status similarity in an online environment. The same authors adapted the structural assurance scale from Gefen et al. [20]

and the purchase intention scale from Pavlou and Gefen [47]. Trust propensity, intention to obtain information and some parts of the trust constructs were measured with scales adapted from Ridings et al. [70]. Further, measuring trust within its dimensions was conducted with questions originating from Bhattacherjee [71]. Items for measuring the purchase intention were originally used by Pavlou and Gefen [47].

We adapted the scale for intention to obtain information proposed by Lu et al. [44] with respect to the information source in the social media online environment: other consumers and a company. Hence, using slightly modified versions of the questions, we formed two new factors. Moreover, we adopted the scale from Pavlou and Dimoka [62] to measure the perception of positive comments (eWOM), as they have a positive effect on consumers' trust in a company and purchase intentions [19].

4. Materials and Methods

4.1. The Survey

The survey was conducted in Belgrade, Serbia, during May and June 2019. Students of the University of Belgrade, in teams of 2 or 3, conducted a face-to-face survey in public places. Subjects were asked to fill out a questionnaire on the spot. Questions used in this paper were part of a larger questions set of 72 questions. All questions (Table A1 in the Appendix A) were recorded with a 7-point Likert scale.

In order to make the sample as representative as possible, only persons who actively follow a company on social media were included in the survey. Only those who answered that question in the affirmative were questioned further. Due to the criteria, the age structure in our sample (Table A2 in the Appendix A) expectedly deviated from the age structure of the total population in the country (or in the city of Belgrade, as these two are not significantly different). It should be noted that the age structure of social media users is not an adequate criterion for sample representativeness, as the younger people among them are more often online fans or followers [72]. For our target population, represented by the mentioned subset of social media users, there are no official data, so the sample bias cannot be precisely estimated. The high share of people in their 20s was, however, expected when looking at age structures in similar papers [19,44].

During the process of translation and adaptation, the imperative was to maintain the original questions' meaning. Due to semantic language differences, some questions could not be translated from English to Serbian without losing some of their original meaning. In situations such as these, those questions were not translated and included in the questionnaire, making the dataset and the measuring model more parsimonious. The semantics of the questions were proofed in a two-way approach. Firstly, brainstorming sessions about the questions' meaning between Serbian-speaking co-authors were held. The second step included survey pre-test sessions in small groups of students at the University of Belgrade. In groups of 5, bachelor students answered and commented on their perception of the meaning of each question. Expressing an opinion regarding the questions' semantics was strongly encouraged. In the end, the results from both steps were used as guidelines for writing the final versions of the questions.

Due to the logistical and organizational conditions, conducting the survey was possible in the capital city of Serbia only. With a limited number of surveyors available, including other cities and regions in the sample would have forced the change of the survey type from a face-to-face type to an online type. This idea was rejected because it was assumed that such an approach would cause a low and selective participation [73]. A low participation would likely arise due to the length of the survey [74]. Further, the questions, based on scales aimed for factor analysis, certainly would not have helped the response rates in the online survey either [75]. Considering all these points, our sample is representative of the limited population, as the primary aim was to prove the online trust-building mechanism and its influence on purchase intentions within the defined model.

In total, 1111 persons were included in the questionnaire. Data cleaning was conducted by deleting listwise using several criteria. Firstly, empty recordings and recordings consist-

ing of all the same entries were removed. Secondly, recordings which had more than 10% (more than 3) of missing answers were also excluded. Thirdly, recordings with repeated patterns or noticeably illogical answers were subject to deletion too. Therefore, the final sample size significantly shrunk to 737 recordings. It is possible that 72 questions (in the complete questions set) were, for some respondents, too many to answer in public space conditions. Many unfinished questionnaires are confirmatory to this. Moreover, due to the explained conditions, surveyors were unable to check the quality of answers on the spot.

4.2. Structural Equation Modeling

In order to analyze data, we used a structural equation modeling approach (SEM). SEM is a category of a multivariate analysis that allows inclusion of unobservable variables in the model. With the SEM, we used several indicators to define each of the unobservable variables (a construct) in the model (Table 1). In this manner, we fulfilled theoretical assumptions about the multifaceted nature of the constructs. Further, including more indicators of the same constructs will lower the measurement error [76]. The theoretical background was used to formulate the constructs, which are mathematically presented as a linear combination of several observable variables (questions).

Table 1. Constructs of the model.

Composite Variables	Abbreviation	Indicator Variables	Explanation of the Construct
Familiarity	MFTY	x1, x2	Individuals' impression of familiarity with other members of the virtual community (VC)
Similarity	MSTY	x3, x4, x5	Individuals' impression of similarity with other members of the VC
Structural assurances	STASS	x6, x7	Individuals' feeling of assurance regarding privacy while communicating in the VC
Trust propensity	TPROP	x8, x9, x10	Individuals' self-assessment about proneness to trust other persons
Positive comments through eWOM	COMM	x31, x32	Individuals' impression of positive consumer feedback in the comments in the VC
Trust in other VC members	TM	-	-
-Integrity and benevolence		x11, x12, x13	Individuals' impression of integrity and benevolence of other VC members
-Ability		x14, x15	Individuals' impression about of ability of other VC members
Trust in a company	TC	-	-
-Integrity		x16, x17	Individuals' impression of integrity of a company
-Benevolence		x18, x19	Individuals' impression of benevolence of a company
-Ability		x20, x21	Individuals' impression of ability of a company
Intention to obtain information from other VC members	IGIM	x22, x23, x24	Individuals' self-assessment of an intention to go to the social media page in order to find information originating from other VC members
Intention to obtain information from a company	IGIC	x25, x26, x27	Individuals' self-assessment of an intention to go to the social media page in order to find information originating from a company
Purchase intentions	PINT	x28, x29, x30	Individuals' self-assessment of an intention to actually purchase products of the company he/she follows online

The composite value of the construct was calculated as a sum of the products of weights and corresponding data observations for the indicator variables. The weight of one indicator is relative to other indicators with whom it shares the same dimension, representing one construct. As there is more than one observation in the sample, a matrix form of the mathematical expression represents the measuring model in SEM.

In the structural part of SEM, we defined a structural model within the research hypotheses. The hypotheses represent the defined relationships among the constructs. Within the SEM, 10 main constructs were simultaneously included as independent or dependent variables in a number of equations, due to the interrelationship between them (Figure 1).

The SEM we used is covariance-based, as this is a justified choice when research is of a more confirmatory nature [77]. A relationship between two constructs, among many others in SEM, where $y = \beta x + \varepsilon$ (presented in the structural model as X → Y), can be explained as

$$\mathrm{Cov}(x,y) = E[xy] = E[x(SSx + \varepsilon)] = E[SSxx + x\varepsilon] = SSE[xx] + E[x\varepsilon] = SSCov(x,x) + \mathrm{Cov}(x,\varepsilon) \quad (1)$$

$$\text{With } \mathrm{Cov}(x,\varepsilon) = 0; \quad (2)$$

$$\mathrm{Cov}(x,y) = SSCov(x,x) = SSVar(x);\ SS = (\mathrm{Cov}(x,y))/(\mathrm{Var}(x)) \quad (3)$$

5. Results

A table with factor loadings was calculated using R software (Table 2). According to the theorized model, 10 factors were set, and Promax rotation was used. We treated all of the constructs as unidimensional, as all of them were loaded on proper factors from the beginning. Furthermore, discrete validity and other measurements had significantly better values than in the case of treating the model as a second order model because of the trust constructs. Eigenvalues for all 10 extracted factors were above 1. The final results of the factor analysis are presented in Table 2.

The result of Bartlett's test was highly significant at a $p < 0.001$ level, confirming the dataset's suitability for factor analysis. Further, sampling adequacy was confirmed with a Kaiser–Meyer–Olkin (KMO) index value of 0.94 [78,79]. This result is noticeably above Kaiser's [79] threshold of 0.5, and it describes the dataset's adequacy for factor analysis as "superb" [80]. After the factor analysis, most of the loadings were above the recommended level of 0.7 [76]. Regarding the lower loadings (0.48 to 0.54), they appeared at trust indicators which are also a part of a sub-factor in the main factor (Table 2). Besides that fact, these indicators were still far from the minimum threshold of 0.3 to 0.4 [76].

It was estimated that the 10 extracted factors explain about 68% of the variance (Table 2). On the other hand, the percentage of the explained variance in the analysis using one factor is 38%. This result passes Harman's single factor test—there is no common method bias in the dataset [81].

The internal consistency reliability of the constructs is confirmed with Cronbach's alpha values presented in Table 3 [82,83]. To conduct a convergent validity check, composite reliability (CR) and average variance extracted (AVE) scores were estimated. CR and AVE were estimated within a formula given by Fornell and Larcker [84]. All constructs fulfill the conditions of > 0.7 and > 0.5, for CR and AVE.

Table 2. Factor loadings (for abbreviations, please refer to Table 1).

	TC	TM	MSTY	IGIM	TPROP	IGIC	PINT	MFTY	STASS	COMM
x1	0.06	−0.01	−0.04	0.01	−0.01	0.01	0.02	**0.91**	0.08	−0.01
x2	0	−0.04	0.09	0	0.03	0.03	0.05	**0.78**	0.04	0
x3	0.08	−0.02	**0.71**	0.05	−0.02	0.02	−0.03	0	−0.03	0.09
x4	0	0.07	**0.93**	0.01	0	−0.08	0.03	0.01	−0.1	−0.05
x5	−0.03	0.02	**0.85**	−0.01	0	0.03	−0.01	0.02	0	−0.03
x6	−0.01	−0.01	−0.13	0	−0.02	0.05	−0.01	0.01	**0.92**	0.04
x7	0.05	0.05	0.02	0.03	0.02	−0.09	−0.05	0.14	**0.73**	−0.04
x8	0.05	−0.08	0.02	0.07	**0.81**	−0.01	−0.02	−0.12	0.08	0.04
x9	0.01	0.02	−0.02	−0.03	**0.87**	0	0	0.09	−0.09	0
x10	−0.06	0.04	−0.02	−0.03	**0.83**	0.02	0.02	0.03	0	−0.03
x11	0	**0.52**	0.22	−0.03	0.01	0.03	−0.05	0.06	0.09	0.01
x12	0.03	**0.59**	0.16	0	0.04	0.06	−0.05	0	−0.01	−0.01
x13	0.02	**0.72**	−0.06	0.1	−0.01	0.01	0	0.02	0.05	−0.01
x14	−0.03	**1**	−0.09	−0.04	−0.02	0	0.01	−0.07	0	0
x15	0.06	**0.77**	0	−0.05	0	−0.04	0.08	−0.01	−0.05	0.05
x16	**0.78**	−0.01	0.09	−0.02	0	−0.05	0.08	0.01	−0.02	−0.05
x17	**0.85**	0.07	−0.09	0.01	0.02	−0.1	0.11	0.03	−0.05	**−0.03**
x18	**0.99**	0.02	−0.14	−0.01	−0.02	0.03	−0.07	0.13	−0.12	0.01
x19	**0.78**	−0.02	0.02	0.01	0.01	0.09	−0.16	0.02	−0.03	0.08
x20	**0.51**	−0.09	0.14	−0.04	−0.01	0.05	0.06	−0.05	0.19	0.01
x21	**0.48**	0.05	0.06	−0.01	−0.01	0.03	0.09	−0.21	0.24	−0.02
x22	0.01	0	0.04	**0.84**	0.01	−0.05	0.03	0.03	−0.03	−0.02
x23	−0.01	0.01	−0.01	**0.91**	0	−0.02	0.01	−0.06	0.05	−0.02
x24	−0.03	−0.03	−0.01	**0.72**	−0.02	0.08	0.02	0.04	0.01	0.07
x25	0.08	0.09	−0.03	0.17	−0.01	**0.71**	−0.07	−0.03	−0.06	−0.08
x26	0.02	−0.11	0.03	−0.03	0	**0.92**	−0.03	0.02	0.03	0.01
x27	−0.07	0.08	−0.05	−0.11	0.02	**0.75**	0.07	0.06	0	0.05
x28	−0.02	−0.06	0.05	−0.03	0	0.32	**0.54**	−0.02	0.03	−0.01
x29	0.02	0.06	−0.04	0.09	0.02	−0.05	**0.78**	0.05	−0.07	0
x30	0.02	0.01	0.01	−0.01	−0.01	−0.02	**0.81**	0.02	0.01	0.02
X31	0	0.05	−0.02	−0.01	0	−0.01	0.01	−0.02	0.02	**0.9**
X32	0.01	0.16	0	0.03	0	−0.02	0.02	0.01	−0.01	**0.71**
Eigenvalues	3.57	3.05	2.27	2.17	2.12	2.13	1.81	1.67	1.51	1.47
Proportion of variance explained	0.11	0.1	0.07	0.07	0.07	0.07	0.06	0.05	0.05	0.05
Cumulative proportion of variance explained	0.11	0.21	0.28	0.35	0.41	0.48	0.53	0.59	0.63	0.68

Table 3. Assessment of the measurement model for the constructs.

Constructs	Cronbach's Alpha	CR	AVE	Std. Loadings
MFTY	-	0.84	0.72	x1 (0.91) x2 (0.78)
MSTY	0.87	0.87	0.70	x3 (0.71) x4 (0.93) x5 (0.85)
STASS	-	0.81	0.69	x6 (0.92) x7 (0.73)
TPROP	0.87	0.88	0.70	x8 (0.81) x9 (0.87) x10 (0.83)
TM	0.88	0.85	0.55	x11 (0.52) x12 (0.59) x13 (0.72) x14 (1.00) x15 (0.77)
TC	0.90	0.88	0.57	x16 (0.78) x17 (0.85) x18 (0.99) x19 (0.78) x20 (0.51) x21 (0.48)
IGIM	0.87	0.87	0.68	x22 (0.84) x23 (0.91) x24 (0.72)
IGIC	0.83	0.84	0.64	x25 (0.71) x26 (0.92) x27 (0.75)
PINT	0.83	0.76	0.52	x28 (0.54) x29 (0.78) x30 (0.81)
COMM	-	0.79	0.66	x31 (0.9) x32 (0.71)

Discriminant validity was estimated using the Fornell–Larcker criterion and heterotrait–monotrait (HTMT) ratio (Tables 4 and 5). The Fornell–Larcker criterion for discriminant validity has been fulfilled. Additionally, the HTMT ratio was used. The HTMT ratio is described as a new emerging discriminant validity criterion because it arguably represents the best compromise between high sensitivity and low arbitrary violation (i.e., false positive) rates [85]. Voorhees et al. [86] showed its usefulness in covariance-based structural equation modeling (CB-SEM) as well. Thus, in line with their recommendations given for determining discriminant validity in marketing, the HTMT ratio was also used: all values are below the threshold of 0.85, also confirming the discriminant validity [85,86].

Table 4. Correlation matrix and square roots of average variances extracted (AVEs) (Fornell–Larecker criterion).

	TC	TM	MSTY	IGIM	TPROP	IGIC	PINT	MFTY	STASS	COMM
TC	**0.75**									
TM	0.62	**0.74**								
MSTY	0.68	0.72	**0.83**							
IGIM	0.45	0.51	0.55	**0.83**						
TPROP	0.38	0.44	0.42	0.26	**0.84**					
IGIC	0.54	0.50	0.50	0.49	0.33	**0.80**				
PINT	0.56	0.55	0.55	0.49	0.34	0.65	**0.72**			
MFTY	0.30	0.48	0.45	0.34	0.48	0.34	0.35	**0.85**		
STASS	0.67	0.52	0.63	0.39	0.33	0.44	0.47	0.21	**0.83**	
COMM	0.50	0.68	0.55	0.48	0.35	0.42	0.51	0.31	0.41	**0.81**

Table 5. Heterotrait–monotrait (HTMT) ratio.

	TC	TM	MSTY	IGIM	TPROP	IGIC	PINT	MFTY	STASS	COMM
TC										
TM	0.67									
MSTY	0.69	0.77								
IGIM	0.46	0.54	0.58							
TPROP	0.38	0.45	0.42	0.27						
IGIC	0.56	0.54	0.50	0.51	0.35					
PINT	0.61	0.61	0.59	0.56	0.37	0.72				
MFTY	0.40	0.54	0.54	0.40	0.51	0.43	0.47			
STASS	0.70	0.57	0.60	0.41	0.35	0.43	0.48	0.37		
COMM	0.55	0.76	0.60	0.52	0.37	0.45	0.57	0.39	0.45	

We tested our research model within the formulated hypotheses. Significant relationships between trust in other VC members (TM) and, on the antecedent side, familiarity (MFTY) (SS = 0.107, $p < 0.01$), similarity (MSTY) (SS = 0.649, $p < 0.001$), structural assurances (STASS) (SS = 0.116, $p < 0.01$) and trust propensity (TPROP) (SS = 0.093, $p < 0.01$) support hypotheses H1, H2, H3 and H5. The path between TM and trust in a company (TC) was also significant, supporting the H7 hypothesis about the existence of a trust transfer process (SS = 0.361, $p < 0.001$). Similarly, significant paths between STASS and TC (SS = 0.433, $p < 0.001$) and between positive comments through eWOM (COMM) and TC (SS = 0.091, $p < 0.05$) support hypotheses H4 and H8.

Hypotheses that describe direct effects of TM and TC, H10, H11, H12 and H13, are supported too. In the case of TM, this is proven by significant paths towards intention to obtain information from other VC members (IGIM) (SS = 0.550, $p < 0.001$) and purchase intentions (PINT) (SS = 0.125, $p < 0.05$). For TC, significant paths to intention to obtain information from a company (IGIC) (SS = 0.552, $p < 0.001$) and PINT (SS = 0.156, $p < 0.01$) support the related hypotheses (H13, H11).

The influence of the rest of the factors that positively affect the purchase intention was defined with hypotheses H9, H14 and H15, and they are supported by significant

paths of COMM to PINT (SS = 0.180, $p < 0.001$), IGIM to PINT (SS = 0.135, $p < 0.01$) and IGIC to PINT (SS = 0.409, $p < 0.001$). The only path which appeared insignificant in the model was the path TPROP–TC (SS = 0.039, $p = 0.257$) described by hypothesis H7. This insignificant path was omitted and the model was estimated again (Figure 2). Values of absolute, incremental and parsimonious fit measures are shown in Table 6.

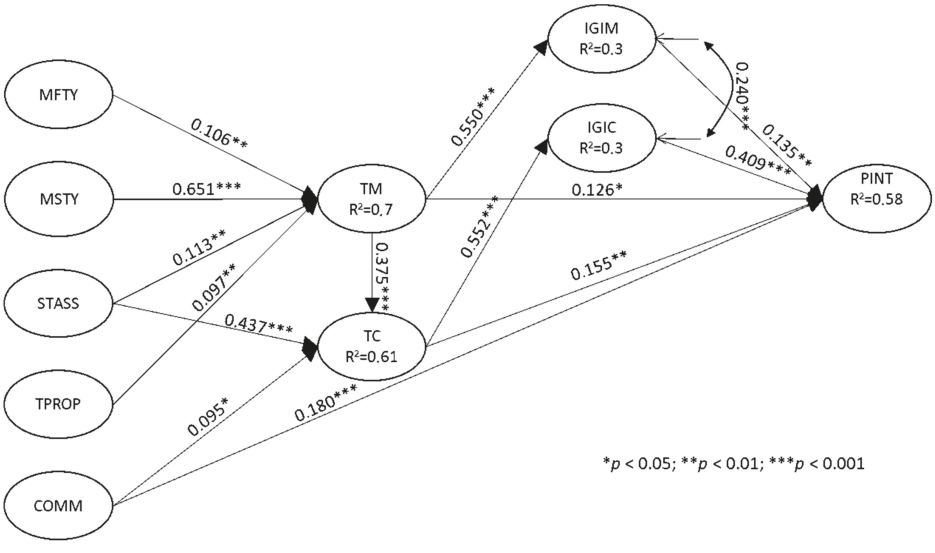

Figure 2. Standardized model solution.

Table 6. Model fit indices and their thresholds of acceptance.

Name of the Category	Name of the Index	Index Name	Level of Acceptance	Values
Absolute fit	Chisq	Discrepancy Chi-Square	$p > 0.05$	0.0000
	RMSEA	Root Mean Square of Error Approximation	<0.08	0.057
Incremental fit	CFI	Comparative Fit Index	>0.9	0.931
	TLI	Tucker–Lewis Index	>0.9	0.922
Parsimonious fit	Chisq/df	Chi-Square/Degree of freedom	<5.0	3.36

All fit indices fulfill the defined thresholds, except the *p*-value, which is below the conservative condition of the value ≥0.05. Nevertheless, the model fit can be described as good, due to the unsuitability of using that criterion as the basis for acceptance or rejection of the model, especially for larger samples [87].

Beside the direct effects defined with the hypotheses, we used the advantages of structural equation modeling to investigate indirect effects too. We took the TM as the starting point of the indirect path to include and identify the mediation role of the already confirmed trust transfer process path (TM–TC) on PINT. The next indirect path we considered was the path starting with the COMM construct. In this manner, we aimed to confirm complimentary effects to the trust transfer process: besides the direct influence of positive comments on the purchase intention, they also help the trust in a company and can therefore have a mediated positive influence on purchase intentions too.

As a precondition for testing indirect effects, we used the second and third criteria from the well-known set of four given by Baron and Kenny [88]. The reason for that was due to previous results of the methodical checks using simulated data, which showed

that the reduced set of criteria was regularly better performing than the full set [89,90]. According to the reduced set of criteria, there were cues for further investigating indirect effects between TM and PINT (Figure 3) and between COMM and PINT, too.

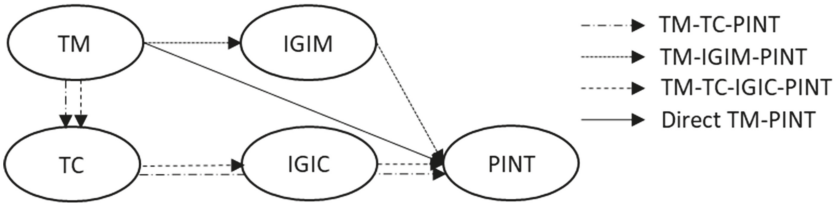

Figure 3. Graphical representation of the examined indirect paths.

In the analysis of the mediated effects, 10,000 bootstrapped samples were drawn. The confidence intervals were bootstrapped as their asymmetry was thought out [91]. However, the bias-corrected bootstrap procedure recommended by MacKinnon et al. [91] was avoided, due to its proneness towards type I errors [92], and also according to the recommendations from [93]. Indirect effects were identified only in the case of examining paths between TM and PINT (for a detailed result of the indirect analysis of paths between COMM and PINT, please refer to Table A3 in the Appendix A).

When tested using bootstrapped standard errors and bootstrapped confidence intervals, all indirect paths from TM to PINT were proven to be significant. The calculated confidence intervals for indirect paths TM–TC–PINT, TM–IGIM–PINT and TM–TC–IGIC–PINT are, respectively, 95% CI [0.007, 0.109], 95% CI [0.009, 0.140] and 95% CI [0.040, 0.129]. At the same time, the direct effect of TM on PINT was non-significant, 95% CI [−0.032, 0.284]. Therefore, every indirect path from TM to PINT can be described as a full mediation.

6. Discussion

The hypothesized positive relationship between two trust constructs and most of the corresponding trust antecedents is confirmed. To begin with, trust in other VC members on social media is being carried out with perceived familiarity. Hence, previous findings by Lu et al. [44] and Gefen and Straub [34] are confirmed. Similarities between members have also been proven to be in a positive relationship with trust towards VC members.

As far as structural assurances are concerned, a positive relationship is shown in both succeeding constructs—trust in other VC members and trust in a company. However, although in line with findings by Pavlou and Gefen [47], this result is different from results by Lu et al. [44]. Their research showed only a positive relationship between structural assurances and consumers' trust in other VC members on social media, but not in a company as well. Lu et al. [44] explained that the lack of the relationship between structural assurances and the trust in a company might be caused by including only a sense of security from impersonal structures in the questions. Since we used the same scale in the research, the different result could not be caused by an inclusion of additional personal security senses. However, qualitative analysis of the online activities of the companies mentioned in the survey has shown that a majority of the individuals in our sample assessed the information shared by companies via popular social media services. Compared to Lu et al.'s [44] research, this is substantially different because their respondents were members of a dedicated online selling website. In our research setting, the everyday familiarity with social media, and the well-known structural assurances about it, could positively influence trust towards the company which uses it as a communication medium.

Personal attitudes (trust propensity) have a significant influence on people's trust in other VC members, but not on their trust in a company. Therefore, previous studies [44,70] are only partially proven in this case. The additional exogenous construct introduced by us, positive eWOM, positively influences trust in a company and confirms previous findings [62,94].

Between the two trust constructs, there is a positive relationship, reflecting the existence of the hypothesized trust transfer [35]. An individual's intention to obtain information showed to be in a positive relationship with the corresponding trust constructs. Findings by Ridings et al. [70] are confirmed, and it is shown that, corresponding with the differentiation of the trust constructs, the construct of intention to obtain information can be divided by information sources. It was possible to analyze the social media webpage environment as a heterogeneous information provider—a virtual space where different subjects with diverse consumer trust levels exist, just as they exist in reality. Lastly, purchase intention is positively affected by positive eWOM, trust in VC members, trust in a company and intention to obtain information from other VC members as well as from a company.

The mediated effects of trust in other VC members on purchase intentions have proven the importance of the trust transfer process. The path which represents it (TM–TC) is the first and the mutual part in two out of three statistically significant indirect effect paths towards purchase intentions (Table 7). The first of the two (TM–TC–PINT) proves the role of the trust transfer in increasing consumers' trust in the company, which further positively affects the purchase intention. The second path (TM–TC–IGIC–PINT) also confirms its influence on trust in the company. This further helps consumers in perceiving a company as an information provider, which increases their purchase intention. The third significant path, which originates from the trust put in other VC members, includes the informative role of the other VC members and its influence on the purchase intention.

Table 7. Analysis of indirect effects of trust in other VC members (TM) on purchase intentions (PINT).

Indirect Effects of TM on PINT (Standardized)	*p* Values	S.E.	Confidence Intervals		
			−2.5%	SS Estimate	2.5%
Total	0.000	0.069	0.206	0.343	0.479
Total indirect	0.000	0.046	0.127	0.217	0.306
Specific indirect					
TM–TC–PINT	0.026	0.026	0.007	0.058	0.109
TM–IGIM–PINT	0.026	0.033	0.009	0.074	0.140
TM–TC–IGIC–PINT	0.000	0.023	0.040	0.085	0.129
Direct TM–PINT	0.118	0.081	−0.032	0.126	0.284

On the other hand, the lack of a mediated effect between positive comments and purchase intention is somehow contradictory to the theoretical background, as it was supposed that the consumers' positive feedback was the carrier of the trust transfer. Further, according to the results of the main structural model, positive comments influence trust towards a company at a less significant level compared to their effect on purchase intention (Figure 2). We believe that the explanation might be found in the effects not covered by the data collection: the consumers' sense of transparency and value co-creation [95]. Regarding the transparency, there are already developed approaches for dealing, online, with inevitable negative consumer feedback, in ways that do not harm consumers' trust [96]. Therefore, it is possible that the decisional role, at the consumer level, has the overall impression of the company's transparency, regarding both good and bad sides of their products. We can expect that this is connected to the value co-creation which was already proven to be present and influential on consumers' trust in similar online environments [97]. As the respondents were not asked for how long they were following a particular web page, it is very possible that they were already more or less an active part of the value co-creation (at least only as followers). In such a case, they appreciate the mutual aim of making products better [98], even when that includes negative comments. Joining a brand community, according to social identity theory, is a fulfillment of identification with a group [99,100]. As it was already explained, according to eWOM theory, other consumers are a more trustable source compared to a company, so the inclusion of it as part of the community group enables the trust transfer process. To recap, trust in a company is not

built by positive judgments of the more trustworthy subjects, but by regarding the company as a part of a trustworthy group, involved in value creation.

Limitations

To fulfill the sample size requirements, it was not possible to focus on one dedicated social media platform, company or product. Therefore, a less specific analysis has been made possible within the trade-off. Due to the different platforms, economic subjects and products in question, it is possible that some discrepancies may arise and slightly influence the estimates.

The representativeness of the sample is restricted to young persons who are social media users (online followers) and reside in the capital of Serbia, Belgrade. As we explained in the methodical part, we intentionally restricted the range of the sample representativeness in order to collect a sufficient number of valid answers that can confirm the defined hypotheses.

7. Conclusions

The conducted research mostly confirmed the supposed trust-building mechanism in an online environment and its hypothesized relation to the purchase decision. Regarding the determinants of trust between other VC members, the influence of familiarity, similarity and structural assurances was confirmed. When it comes to trust in a company, the same was confirmed for structural assurances and positive comments. Furthermore, the positive relation between trust between other VC members and trust in a company, defined as a trust transfer process, was also confirmed to be a part of the trust-building mechanism.

The direct effect of eWOM on consumers' purchase intentions was also confirmed. When accounting for the effects of the potentially increased trust in a company, it was confirmed that it significantly affects purchase intentions. This also occurs indirectly, through the intention to obtain information.

Overall, the usability of the results goes hand in hand with a depicted situation where an added value of products is present and a company is the only source of information. Thus, these results should be considered as the basis for formulating modern online marketing strategies for SMEs. By utilizing the online environment, trust antecedents can be nurtured in modern conditions where consumer preferences progressively change to credence attributes. This is especially applicable in the area of food products, where added-value is predominantly obtained through credence attributes which often outgrow the range of the existing certification schemes.

In offering an environment where experienced consumers can freely share their opinions, practical implications for SMEs develop in three ways. Firstly, positive comments will have a positive direct influence on purchase intentions. In accordance with the results, consumers will consider other consumers as a relevant source of information and their purchase decisions will be under the direct influence of the received information.

Secondly, positive comments and other trust determinants have an underlying dimension that allows for the building of trust in a company, which represents a useful tool for SMEs for increasing competitiveness in the market. With increased consumer trust, SMEs are more effective in transferring information about credence attributes to customers. Successively, the higher acceptability of the information at the consumer level ensures obtaining planned price premiums for distinct credence attributes of a product.

Thirdly, within the provided transparency, the trust transfer process goes beyond building trust in a company based on only positive comments. Although comments directly influence trust in a company, and especially purchase intentions, their role is not crucial. The analysis of mediated effects showed that the effect of comments on purchase intentions is not carried through the trust in a company. This sheds light on another dimension in the trust-building process, which diminishes the mentioned mediated effect. This dimension includes consumers' perception of a company as a valuable member of the online community, with the same aims as the other VC members. Accordingly, trust

can be built on the basis of value co-creation, where the company would be a part of the trustworthy online community. If they are well managed, it is likely that negative comments will not have a decisive effect on the level of trust in a company. Practically, companies should treat negative comments as information about a problem that should be jointly solved. Such an approach provides the opportunity to ignite the value co-creation process, which increases consumers' trust in the company and, further, purchase intentions. Moreover, companies should move away from directly addressing negative comments with opposing claims, which is likely counter-effective, as consumers' trust in other consumers is higher than in a company.

Therefore, future marketing strategies should strongly consider creating transparent, dynamic and open online communities, followed by a company's active engagement there. We believe that such an approach would be highly compatible and beneficial for the effectiveness of already present legislative actions that favor production of credence-based products. With suitable marketing campaigns, it would be possible to create increased trust towards a company in the form of purchase intentions at the consumer level, ensuring necessary price premiums for SMEs.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the authors.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Questions used in the questionnaire.

Constructs	Mean	Std. Deviation
Familiarity		
I become familiar with the identities of some members through reading posts, posting, or replying to messages in the social commerce community.	4.73	1.60
I become familiar with the interests and behavioral characteristics of some members, such as their writing styles, through reading, posting, or replying to messages in the social commerce community.	4.75	1.49
Similarity		
I feel that other VC members have similar interests to mine	5.15	1.30
I feel that other VC members have similar values to mine.	5.11	1.27
I feel that other VC members have similar experience to mine.	5.10	1.30

Table A1. *Cont.*

Constructs	Mean	Std. Deviation
Structural assurances		
I feel safe communicating with other members because the VC platform provides Internet safety alerts.	5.14	1.37
I feel safe communicating with other members because I the accessed social commerce community through a well-known medium.	5.15	1.34
Trust propensity		
I generally have faith in humanity.	5.19	1.43
I feel that people are generally reliable.	4.79	1.55
I generally trust other people unless they give me reason not to.	4.99	1.52
Trust in other VC members' integrity and benevolence		
The other VC members would not knowingly do anything to disrupt the conversation.	4.95	1.32
The other VC members are concerned about what is important to others.	5.16	1.25
The other VC members will do everything within their capacity to help others.	5.03	1.23
Trust in other VC members' ability		
The other VC members have specialized capabilities that can add to the conversation in this community.	5.17	1.14
The other VC members are well qualified in the topics we discuss.	5.17	1.22
Trust in the company's integrity		
Promises made by the company/manufacturer/brand are likely to be reliable.	5.12	5.15
The company/manufacturer/brand is sincere and reliable.	1.26	1.23
Trust in the company's benevolence		
The company/manufacturer/brand is interested in my well-being.	5.20	5.33
I expect that the company's/manufacturer's/brand's intentions are benevolent.	1.27	1.25
Trust in the company's ability		
The company/manufacturer/brand is competent and effective.	5.35	1.18
The company/manufacturer/brand knows about the product.	5.44	1.22
Intention to get information from the other VC members		
I intend to come to the VC to get related information from the consumers, when I want to purchase some products.	5.28	1.36
I intend to come to the VC to get provided information by the consumers when I need to know the characteristics of some products.	5.31	1.28
I will consider coming to the VC to get related information when I need to know other people's experiences with the products.	5.24	1.24
Intention to get information from the company		
I intend to come to the VC to get related information from the company or the producer when I want to purchase some products.	5.20	1.25
I intend to come to the VC to get company-provided information when I need to know the characteristics of some products.	5.22	1.23
I will consider coming to the VC to get related information when I need to know information which the company provides.	5.23	1.24

Table A1. *Cont.*

Constructs	Mean	Std. Deviation
Purchase intention		
Given the chance, I would consider purchasing products presented in the VC in the future.	5.27	1.16
It is likely that I will actually purchase products presented in the VC in the near future.	5.17	1.25
Given the opportunity, I intend to purchase products presented in the VC.	5.27	1.18
Positive comments (eWOM)		
The comments about the product or service are positive.	5.26	1.19
Overall, the comments on the company/manufacturer/brand social media page are positive.	5.28	1.21

Table A2. Sample demographics (N = 737).

Measure	Item	Count	%
Gender	Male	302	41.0%
	Female	413	56.0%
	No answer	22	3.0%
Age	14 and below	1	0.1%
	15–19	15	2.0%
	20–24	472	64.0%
	25–29	113	15.3%
	30–34	38	5.2%
	25–39	22	3.0%
	40–44	24	3.3%
	55–59	7	0.9%
	60–64	1	0.1%
	65 and over	5	0.7%
	No answer	9	1.2%
Education	Unfinished primary school	3	0.4%
	Primary school	3	0.4%
	High school	325	44.1%
	University degree	390	52.9%
	No answer	16	2.2%

Table A3. Analysis of indirect effects of positive comments through eWOM (COMM) on PINT.

Indirect Effects of COMM on PINT (Standardized)	*p* Values	S.E.	Confidence Intervals		
			−2.5%	SS Estimate	2.5%
Total	0.001	0.064	0.092	0.216	0.341
Total indirect	0.114	0.023	−0.009	0.036	0.081
Specific indirect					
COMM–TC–PINT	0.191	0.011	−0.007	0.015	0.037
COMM–TC–IGIC–PINT	0.123	0.014	−0.006	0.021	0.049
Direct COMM–PINT	0.003	0.062	0.060	0.180	0.301

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Who Wants Chicken? Uncovering Consumer Preferences for Produce of Alternative Chicken Product Methods

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Abstract: As ethical and environmental concerns regarding current poultry production systems arise, consumers look for alternatives. This study assesses consumers' preferences for chicken meat of dual-purpose breeds (DPBs), regionally produced feedstuff, and specific breeds, along with attitudes and social norms that explain these preferences. We conducted an online survey (n = 934) including a discrete choice experiment and elements of the theory of planned behavior. Results show that after price, product and feedstuff origin are preferred by consumers, followed by breeding form and specific breed. Utilities for each attribute and level were calculated and consumer segments were created using latent class analysis. Three different consumer groups were identified: (1) price-sensitive consumers, (2) price-sensitive and origin-oriented consumers, and (3) origin-oriented consumers. We conclude that although consumers are interested in meat from DPBs, this attribute alone is not enough to influence the purchase decision, and geographical origin seems to be of crucial importance. However, by highlighting important attributes (i.e., animal welfare, regional/local production), DPB products could be introduced to the market. The consumption of these alternative products has economic implications, such as not relying on imports and promoting local production/consumption, along with social implications as refraining from killing day-old chicks.

Keywords: Bresse Gauloise; choice experiment; dual-purpose breeds; faba beans; Kollbecksmoor; theory of planned behavior; Vorwerkhuhn; White Rock

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1. Introduction

Massive animal production methods started gaining popularity after World War II as these systems included specialized indoor environments and automation instead of manual labor. These methods increased the production of poultry meat worldwide, surpassing beef production [1]. In more recent years poultry production, and therefore consumption, has also increased worldwide. In the last 10 years, meat consumption in Germany has slightly decreased from approximately 61.6 kg per person to 59.5 kg [2]. However, poultry consumption in Germany has increased in from 17 kg (2006) to 20.9 kg (2017) per capita [3]. This increase in consumption has resulted in a production increase from 801,000 tons in 2000 to 1,537,000 tons in 2017 [3].

This fast increase in production and consumption has led to breeding of specialized chicken breeds to achieve a higher performance [4]. However, within these production schemes other animal welfare-related issues arose, such as the killing of day-old male chicks of the laying breeds. The killing of these male chicks is commonly practiced in the commercial production of eggs, in organic and conventional farming, since the males are not profitable [5]. In Germany, around 45 million male chicks are killed every year due to their non-profitability [6]. Consumers' complaints and requests to stop the killing of day-old chicks have led to the German government's decision to prohibit this practice starting January 2022 [7]. Consumers' increasing concern in this issue has led to the development of various alternatives to this practice. Among the different alternatives are: (1) in-ovo gender determination, i.e., looking into the egg to see the gender, (2) breeding of the brother, i.e.,

continue with specialized breeds but rear the male chicks of the laying breeds, and (3) the use of dual-purpose breeds [6]. This study focuses on the latter.

1.1. Dual-Purpose Breeds: Consumer Perspectives on an Alternative to Killing Day-Old Male Chicks

Dual-purpose breeds (DPBs) are chicken breeds that can be used for both laying eggs and producing meat; i.e., female chickens (hens) lay eggs and male chickens (cockerels) are fattened to produce meat [8]. DPBs are not able to compete with specialized fattening (meat-type) and laying breeds—DPB hens lay fewer eggs and DPB males produce less meat than specialized breeds, even if reared for a longer period of time. The main challenge is that these lower laying and fattening performances mean an increase in costs related to production, particularly with feed and housing, which should lead to higher product prices [9]. At the same time, DPBs could produce better meat quality with regard to sensory profile, while also meeting consumer expectations on animal welfare. As consumers are searching for higher animal welfare standards, they might be willing to pay a higher price [4,10,11]. Hence, the DPB may be a very valuable transitory product line for sustainable food systems.

The importance of dual-purpose breeds does not rely solely on the ethical aspects of avoiding the culling of day-old chicks. The current specialized methods have created a loss of genetic variability of poultry; hence, by fostering DPBs, especially traditional breeds, breeders are contributing to the conservation of poultry genetic resources [12,13]. In Germany, traditional breeds such as Vorwerkhuhn (VH), a traditional breed from Germany, and Bresse Gauloise (BG), a traditional breed from France, have been used as DPB chickens by small-scale farmers. Additionally, commercial laying lines like White Rock (WR) could be bred with a dual-purpose traditional breed, in order to produce a DPB with a higher laying performance, such as Kollbecksmoor (KM) [14].

The impression that alternative poultry production systems provide healthier, tastier, and more environmentally friendly and more animal friendly products has led to consumers valuing these alternative systems and increasing their demand when compared to conventionally produced meat [15–17]. This shows that consumers are increasingly more interested in having more information about the products they purchase and consume. Additionally, Apostolidis and McLeay [18] show that some consumers who are not price driven are willing to pay more for sustainable-related attributes in meat products and consume less meat. Nonetheless, it is still unknown whether these consumers would be willing to pay a higher price for DPBs when other product attributes are compromised (e.g., product origin, feed origin) or whether consumers prefer the place of origin (of either production or feedstuff) versus attributes related to animal welfare, particularly DPBs. Additionally, the preference for a specific chicken breed has not been previously tested.

1.2. Faba Beans: An Alternative to Soy Imports for Protein Feedstuff

A further problem in the current poultry industry is that poultry farming requires a high amount of protein-rich feedstuff. When looking at the overall poultry farming system, feedstuff production accounts for a higher environmental impact than rearing the animals [19]. Soybeans are extensively used as a protein source in poultry diet formulations [20]. The problem with soybeans is that the European Union's (EU) yield is not enough to cover the needs of its own poultry industry and there is a need to import soybean products from other countries [21,22]. These large imports cause problems in EU agriculture, mainly instability due to price volatility of soybeans on the global market [23] and EU consumers' concerns with genetic modified soy crops and deforestation of the Americas [22,24].

An alternative to soybean products is other protein crops like beans and peas, which are traditional European crops and suit the natural production surroundings well. Local agricultural industries could benefit from these crops by having a greater independency in their production and they could also benefit from these crops' environmental benefits like nitrogen fixation [23]. Faba beans (*Vicia faba* L.) are one of the oldest and most widely

cultivated legumes [25]. They contain approximately 30% protein, which is complemented by a rich amino acid composition [25,26], making faba beans a good poultry feed protein source [26]. The use of faba beans in poultry diet has been challenged by anti-nutritional factors in the beans [20,27]. However, recent research has shown that there is no adverse effect in the chickens' health or in the carcass quality parameters when animals are fed with a faba bean-based diet compared to a soy-based diet [28]. Additionally, a recent study showed that meat quality parameters and sensory properties of chicken meat (of the abovementioned breeds) do not suffer a negative effect from a faba bean-based diet [29].

1.3. Study Aim and Research Questions

Food choice is a complex process that is influenced by different factors, e.g., situation, available information, previous experiences, personal preferences, lifestyle, and knowledge about the products [30,31]. Additionally, other aspects like attitudes regarding animal welfare issues and agricultural systems, and access to product information also determine purchase criteria of agricultural products [32,33]. Nowadays, consumers are confronted with abundant sustainability-related choices, such as fair trade products, organic products, animal products produced under animal-friendly conditions, and regional products. This abundancy of sustainable products can confuse consumers since an overload of information is delivered to them in different ways and for different, specific topics [34]. Often labeling is used to communicate specific characteristics of products, particularly credence attributes (attributes that cannot be evaluated by a consumer—e.g., animal-friendly); it is important to communicate particularly relevant information on the packaging so consumers use this information for decision making [35]. In this regard, one can distinguish different labeling strategies ranging from a binary to multilevel label—each containing a different level of abstract information [36]. Especially when it comes to the aspect of extrinsic food quality, it is the question of which information to communicate best, in order to reach the consumer successfully.

It is not known which altered product characteristics of alternative systems have the highest potential or which may be of interest to consumers. Thus, the objective of this study is to better understand which of the studied attributes (i.e., breed type, breeding form, product origin, feedstuff origin) are preferred by consumers. Additionally, this study aims to understand consumers' basic attitudes, beliefs, and motivations towards DPBs. Therefore, the following research questions were investigated:

RQ1: What is consumers' preference for dual-purpose breeds, regionally and German produced feed, and specific breeds over other attributes when buying chicken meat?
RQ2: How can these preferences be explained?

Our study aims to contribute to the missing literature regarding a socially accepted poultry production system, which takes into account the killing of day-old chicks, the use of dual-purpose breeds, the use of traditional breeds, and feeding chickens regional faba beans rather than soy imports.

The following section presents the concept of a discrete choice experiment (DCE) along with the different attributes and levels used in this study, as well as the theory of planned behavior (TPB) and the elements of it that were used to collect data. Section 3 then presents the main results of the study, including results from the latent class analysis used to create consumer segments based on their utilities for each attribute. Additionally, we further describe each class using the different elements of the TPB and sociodemographic information. In Section 4, we then discuss our findings with existing literature and present the major limitation for this study. Finally, in Section 5, we present our main conclusions and ideas for future research in this topic.

2. Materials and Methods

2.1. Conceptual Framework

The present study combines two methodological approaches. First, a DCE was conducted to detect participants' preferences regarding the different attributes they value the

most when purchasing chicken meat. Then, in order to better describe the motivations behind these preferences, elements of the TPB were used and adapted since this method can trace attitudes, norms, and perceived behavioral control about a specific behavior [37]; in this case, a choice of purchase.

2.1.1. Discrete Choice Experiment

Thus far, chicken meat from DPBs is rarely found in the market, therefore there is little to no purchase data available. In order to simulate this market data, a DCE was implemented. In these experiments, respondents make choices from two or more alternatives with different varying attributes, allowing the elicitation of preferences and values for specific products that do not exist yet [38]. This also allows calculating consumers' willingness to pay (WTP) based on individuals' decision making [39].

The Lancastrian consumer theory assumes that different products have multiple characteristics which raise the utility of each product, and that each product will possess several characteristics which are shared by other products [40]. Thus, stating that consumers derive utility not from a product itself but from the combination of product attributes and levels. To measure these preferences or utilities, DCEs are applied. A DCE is a technique used to research consumer preferences by simulating a purchase situation in supermarkets, where different products are offered, and the consumer may choose any or none. These DCEs have been applied in a wide range of contexts, such as evaluating the impact of country-of-origin labeling and traceability in consumers' preferences [39] or evaluating preferences for animal-friendly foods [41]. These studies indicate that DCEs can be successfully implemented for calculating such preferences. In addition to the elicited preferences, data can be used to classify consumers based on latent or unobserved characteristics into segments via latent class analysis (LCA) [42].

For this study, we used five different attributes with four levels each. The attributes and levels selected for this study were those of interest to the authors and are mainly related to the animal from which the product comes from rather than to extrinsic characteristics (e.g., weight, color, fat). The attributes and levels used are the following:

1. *Breeding form*: The levels of this attribute were chosen to test consumers' preference for (1) dual-purpose breeds, (2) breeding of the brother—rearing brothers of laying hens despite their low fattening performance, (3) organic products, which consumers usually associate with higher animal welfare standards and show a higher WTP for these [43–46], and (4) no information, which resembles the current market situation where basic information regarding the husbandry system (barn raised, free range, organic) is provided.
2. *Breed*: The levels chosen for this attribute were four dual-purpose breeds currently used in Germany; (1) Bresse Gauloise (BG), a French native DPB commonly used due to its good laying and fattening performance, (2) Vorwerkhuhn (VH), a German native DPB used mainly to preserve the genotype [14], (3) White Rock (WR), a commercial laying line with potential to be used as a DPB, and (4) Kollbecksmoor (KM), a crossbreed of VH and WR used due to its good laying and fattening performance. The name of each breed was presented along with a picture of the corresponding breed in order to increase consumers' exposure to each breed's appearance.
3. *Price*: The levels of this attribute were based on current market prices in Germany for breast fillets; the lowest level corresponds to the lowest market price, while the highest level to the highest market price. The levels in between are 9.64 EUR apart from the previous and following levels.
4. *Product origin*: The levels in this attribute were chosen to test consumers' preference for a regional product over (1) national (German) product, (2) product from the EU, since it is where Germany imports mostly from [3], and (3) product from outside the EU.
5. *Feed origin*: The levels in this attribute were chosen to test consumers' preference for regional faba beans over (1) German faba beans, (2) Brazilian soy, since it is the

most common protein feedstuff [47,48] and the country where most imports to the EU come from [48], and (3) no information, which resembles the current market situation where no information regarding the feedstuff is provided.

The levels of the attribute "breeding form" are not mutually exclusive, i.e., they can be found combined with one another in the market (e.g., DPB or brother of laying hen reared organically). For this study, it was decided to test the preference for each of these levels individually. The objective was to better calculate the utilities of the specific wording "organic", "breeding of the brother", and "dual-purpose breed" and not a combination of these.

In order to make this experiment more realistic, we decided to prohibit eight combinations of attributes that could not possibly be found in the market. The lowest price level did not appear with organic or DPB levels since the cost production of these products does not allow such a price. Similarly, the lowest price level did not appear with BG since the current market price of this breed is comparable to organic (highest price). Non-EU product origin did not appear with regional nor German faba beans; moreover, it also did not appear with the highest price level. Finally, regional product origin and regional faba beans as feedstuff do not appear with the lowest price label since literature suggests that consumers are willing to pay more for regional products [49,50]. Table 1 provides an overview of the different attributes, levels, and prohibitions included in the design.

Table 1. Attributes, levels, and prohibitions included in the design of the choice sets.

Attributes	Levels	Prohibitions
Breeding form	Organic	5.98 EUR/kg
	Breeding of the brother	
	Dual-purpose breed	5.98 EUR/kg
	No information	
Breed	Bresse Gauloise	5.98 EUR/kg
	Vorwerkhuhn	
	White Rock	
	Kollbecksmoor	
Price	5.98 EUR/kg	Regional product
	15.62 EUR/kg	
	25.26 EUR/kg	
	34.90 EUR/kg	Non-EU product origin
Product origin	Regional	
	Germany	
	EU	
	Non-EU	Regional faba beans, German faba beans
Feed origin	Regional faba beans	5.98 EUR/kg
	German faba beans	
	Brazilian soy	
	No information	

Source: authors' own.

The description of the CE reads as follows—participants were asked to imagine they want to buy chicken breast fillets. Next, they were presented with ten different choice sets. Each choice set had three options from which to choose plus a non-purchase option. The non-purchase option could be chosen if none of the other options met participants' preferences or WTP for their preference. Figure 1 shows an exemplary choice set. In this study, since the products are not in the market, each option was labeled as "Option 1", "Option 2", "Option 3", or "Option 4".

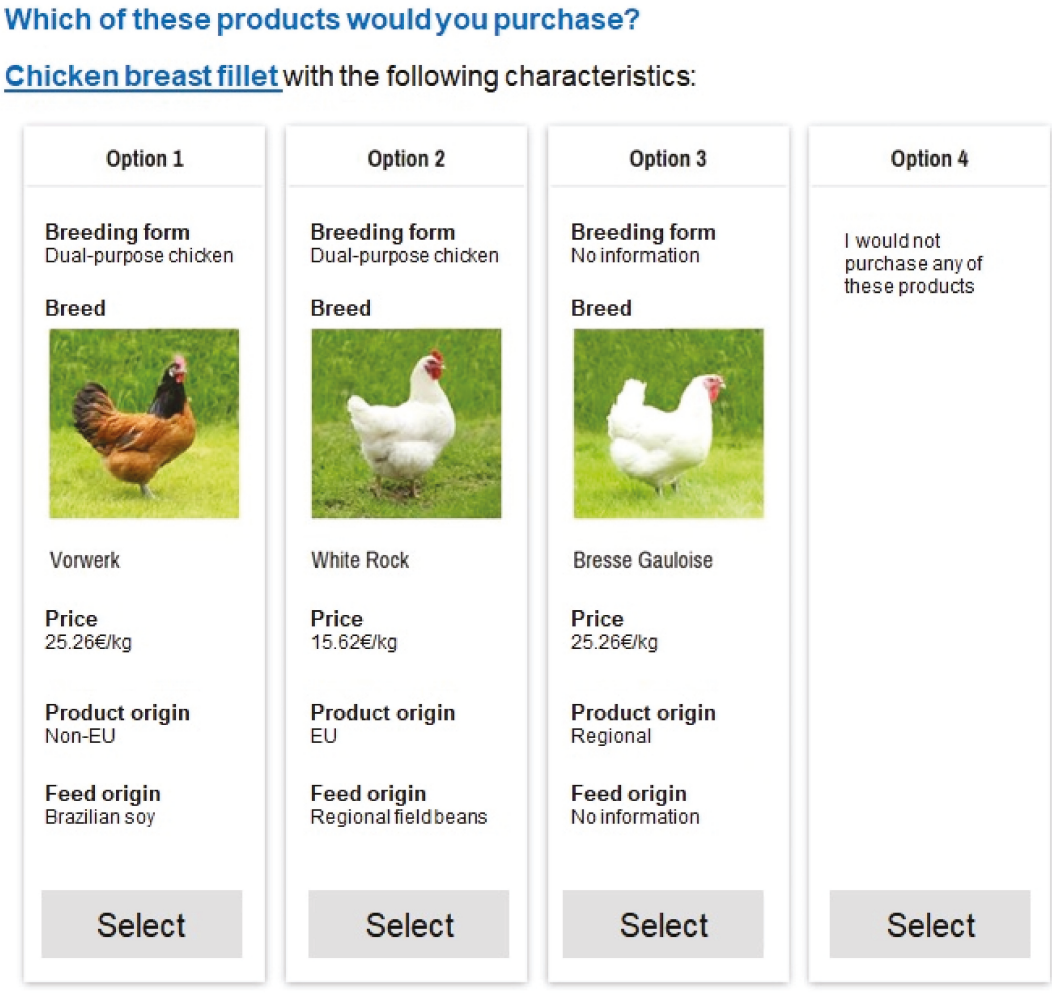

Figure 1. Example of a choice set (translated from German).

This experiment was prepared with Sawtooth Software (Version 9.5.3) as a balanced, fully randomized choice design.

2.1.2. Theory of Planned Behavior

Since food choice is a complex process, purchase behavior is not only affected by sociodemographic characteristics, or the product's price or attributes, but also by psychological characteristics of buyers, such as attitudes and beliefs [51]. Therefore, to measure these psychological characteristics, we employed elements of the TPB.

Based on the TPB, consumers' intention to behave in a certain way (e.g., purchase a product) is determined by their attitudes, social norms, and perceived behavioral control. These predicting intentions refer to the following: (1) "attitudes" (A) refers to the favorable or unfavorable attitude towards the behavior in question, (2) "subjective norms" (SN) refers to the social pressure consumers perceive to perform or not this behavior, (3) "perceived behavioral control" (PBC) refers to the perception consumers have of it being easy or hard to perform the behavior [37]. This theory has been widely used in different scenarios, such

as predicting consumers' willingness to buy meat from a mobile slaughter unit [52], and to predict consumers' intention to purchase organic food [53]. Such studies show that the TPB can be successfully applied to predict food consumption behavior. Therefore, in this study, it is assumed that consumers who have a positive attitude towards buying DPB chicken meat, are influenced by their family, friends, and society approving DPBs, and believe they are able to buy DPB chicken meat should have a stronger intention to buy the product.

Although the TPB has been widely used and has received empirical support, other research, e.g., [54,55] has used the value belief norm (VBN) theory which links factors to predict pro-environmental behavior [56]. Nonetheless, the aim of this study is not solely guided by an environmentally friendly preference, but by several dimensions of sustainability (e.g., purchase of local products, animal welfare, and diversity of genotype—biodiversity). Therefore, for the purpose of this study, the elements of the TPB were extended with moral elements of the VBN theory to consider other attributes that would help better understand consumers' purchase intention of DPB products. Other studies, e.g., [52,57–59] have also combined both theories to better explain specific behaviors. Hoeksma et al. [52] tested the VBN theory versus the TPB and the extended TPB (combination of TPB with VBN) to predict consumers' willingness to buy meat that was not available in the market yet; they found that the combination of both theories explained a higher percentage of variance in the models than the theories by themselves. From the VBN theory, personal norms (PN) were included since these reflect people's sense of obligation to act in a certain way. Since the topic of DPB is related to animal welfare concerns, personal norms on animal welfare (PNAW) were added. Additionally, since the topic of regional/German faba beans as feedstuff is also a research point, personal norms to address consumption of regional products (PNR) were included.

Items related to the attitude towards DPB, SN, PBC, PNAW, and PNR were measured using a 7-point Likert-scale, from 1 "totally agree" to 7 "totally disagree". Statements were adapted from [53,60–62]. Table A1 (Appendix A) shows the statements used to evaluate each predictor of the extended TPB. All statements were randomized to prevent systematic order effects.

2.2. Survey Design

A sample of 1100 participants was recruited via a professional online panel (Respondi AG) in July and August 2018 in Germany. The sample was selected by a quota sampling procedure with gender, age, education, and income, to achieve representativeness of the German population. Additionally, participants were asked in which state of Germany they currently lived in. In this study, all participants gave written informed consent to take part in the study before the survey started. This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the University of Goettingen.

First, participants were screened to select only those who consume chicken meat. Additional questions related to participants' consuming and buying patterns were asked: consuming frequency of chicken meat and eggs, and buying frequency of chicken meat, eggs, regional products, organic products, and animal products with animal welfare labels. Next, to ensure all participants had the same basic knowledge about the topic and could make an informed decision, all participants were shown a text with information about the current poultry farming system, dual-purpose breeds, and the current poultry feed situation (see Table A2, Appendix A). Participants were then asked if they were aware of these specific issues: killing of one-day-old male chicks and soy import for animal feedstuff. The DCE was next; here, participants were presented with 10 choice sets consisting of 3 products plus the option "I would not purchase any of these products", as shown in Figure 1. Finally, elements of the extended TPB were used to measure the relationship between respondents' attitudes and purchase behavior.

2.3. Data Analysis

A total of 977 participants completed the survey. After data cleaning (participants who needed less than half of the average response time or more than twice the average response time were removed) the total sample was reduced to 934 participants. All descriptive statistics were calculated using IBM SPSS, Version 26.

The analyses of the DCE were calculated using Sawtooth Software Lighthouse Studio (Version 9.5.3). First, the hierarchical Bayes multinomial logit model was used to estimate attribute preferences and part-worth utilities, utility values for each level of every attribute of a product of each level, for each respondent [42].

Next, in order to narrow down the statement batteries of the extended TPB to the core of each concept, a confirmatory factor analysis (CFA) set on five factors was performed. The requested five factors account for each of the extended TPB predictors (see Table A1, Appendix A). The principle components analysis method was used for the extraction of the factors with an orthogonal (varimax) rotation. To optimize each factor, variables with loadings <0.4 were suppressed [63] from the final item list of each factor in order to better display principal elements for each factor. The quality was tested using the Kaiser–Meyer–Olkin (KMO) test and the Bartlett's test for sphericity. To measure the internal reliability of each factor, Cronbach's alpha (Cα) was calculated. These analyses were calculated using IBM SPSS (Version 26).

Since consumer heterogeneity was found in responses of the extended TPB as well as utilities for some attributes of the DCE, we decided to further segment consumers into groups based on their responses in the DCE. Therefore, a latent class analysis was performed to determine different segments of consumers. In an LCA, each participant gets a utility for each attribute in the choice experiment; however, this utility is determined by the latent, or unobservable, class membership [42]. This analysis was calculated using Sawtooth Software Lighthouse Studio (Version 9.5.3).

Finally, each factor was used to further characterize each consumer segment along with sociodemographic data and purchase frequencies of chicken meat, organic products, regional products, and products with an animal welfare label. To analyze the differences of the describing variables between groups, an ANOVA with post-hoc tests Tukey for variance homogeneity and Games–Howell for variance heterogeneity was calculated using IBM SPSS (Version 26).

3. Results

The sociodemographic characteristics of the sample are described in Table 2. Gender, age, and income fairly represent the German population, while education is slightly under- or overrepresented in certain categories. Nearly half (53%) of the participants lived in northern Germany (Berlin, Brandenburg, Bremen, Hamburg, Lower Saxony, Mecklenburg-West Pomerania, North Rhine-Westphalia, Saxony-Anhalt, and Schleswig-Holstein), while 46% lived in the southern states (Baden-Württemberg, Bavaria, Hesse, Rhineland-Palatinate, Saarland, Saxony, and Thuringia).

Most participants (56%) consume chicken meat at least once a week, while 50% of participants purchase chicken meat with the same frequency. Chicken meat is mostly purchased in supermarkets (46.4%) and discounters (36.7%), while only 2% is directly from the farmer.

After participants read the provided information regarding the current poultry farming situation, they were asked if they were aware of the killing of one-day chicks, to which 85.4% responded "yes", 12.4% "no", and 2.1% "I do not know". Respondents were also asked if they were aware of the imports of protein feed for animals, 26.1% responded "yes", 66.4% "no", and 7.5% "I do not know".

Table 2. Sociodemographic characteristics of the sample (n = 934) and the German population.

	Sample (%)	Population (%)		Sample (%)	Population (%)
Gender			Education		
Female	50.9	50.7	No education	0.5	4.0
Male	49.1	49.3	Lower secondary education	34.3	31.4
Age			High school diploma	30.8	29.4
18–24 years old	8.8	9.1	Technical college	15.3	13.7
25–39 years old	20.8	22.6	University degree	19.1	17.1
40–64 years old	43.5	43.1	Income (net/month)		
65 or more years old	27.0	25.2	Less than 1300 EUR	25.1	26.3
			1300–2599 EUR	39.3	39.6
			2600–4999 EUR	28.1	27.1
			5000 EUR or more	7.6	6.5

Source: authors' own data for sample, German population based on data from the Federal statistical office [64].

3.1. Discrete Choice Experiment

3.1.1. Hierarchical Bayes

Aside from the part-worth utilities, the average importance of the hierarchical Bayes estimates for each attribute was calculated. These averages showed a general overview of how each attribute influenced the overall utility of a product. The presented average importance of attributes and utilities of levels are only valid for this specific combination of attributes.

Results indicated that after price (38.63%), the attributes "feed origin" and "product origin" had the highest importance, with 21.11% and 20.19%, respectively. The breeding form only accounted for 13.47% of the preference, while the breed had the lowest preference (6.58%).

3.1.2. Latent Class Analysis

In an LCA, it is important to decide the number of groups, or classes, needed for further analysis or interpretation. The optimal number of classes is usually determined by the Akaike information criterion (AIC), consistent AIC (CAIC), and Bayesian information criterion (BIC) [65]. By looking at the higher decrease in AIC, CAIC, and BIC in three groups and by interpreting the group sizes and characteristics of the different class solutions, we selected three classes. Table 3 shows the model fit criteria.

Table 3. Criteria for number of groups in latent class analysis.

Groups	Log-Likelihood	AIC	CAIC	BIC	Chi-Square
2	−9242.67	18,551.35	18,820.04	18,787.04	7410.62
3	*−8749.21*	*17,598.42*	*18,005.52*	*17,955.52*	*8397.55*
4	−8440.82	17,015.64	17,561.16	17,494.16	9014.33
5	−8268.78	16,705.56	17,389.50	17,305.50	9358.40

AIC: Akaike information criterion; CAIC: consistent AIC; BIC: Bayesian information criterion. *Italics:* Selected number of groups and its criteria. Source: authors' own calculations.

The attribute importance reveals which attributes are more important to consumer classes (from hereon also referred to as segments) while the part-worth utilities show the preference of each level for each particular attribute. Higher values represent a higher importance or preference of each attribute or level. Table 4 shows the attribute importance and part-worth utilities for each attribute and level in detail.

Table 4. Attribute importance and part-worth utilities for each class.

	Class 1	Class 2	Class 3
Size (%)	22.8	20.0	57.2
Attribute importance (%)			
Breeding form ***	5.10	5.09	17.09
Breed ***	2.57	2.44	4.16
Price ***	70.27	62.13	18.76
Product origin ***	11.30	20.52	27.63
Feed origin ***	10.73	9.76	32.33
Part-worth utilities			
Breeding form			
Dual-purpose breed	9.44	−5.80	31.16
Breeding of the brother	10.06	10.95	26.38
Organic	−4.38	9.52	−3.30
No information	−15.13	−14.68	−54.28
Breed			
Vorwerkhuhn	−6.40	−7.50	0.17
White Rock	6.36	2.60	8.12
Bresse Gauloise	3.78	4.77	4.44
Kollbecksmoor	−3.73	0.11	−12.73
Price			
5.98 EUR/kg	171.41	181.68	−0.21
15.62 EUR/kg	68.11	28.45	43.67
25.26 EUR/kg	−58.60	−80.85	6.99
34.90 EUR/kg	−180.92	−129.29	−50.45
Product origin			
Regional	16.29	36.37	55.93
Germany	17.67	30.83	49.48
European Union	3.93	−1.68	−23.19
Non-EU	−37.90	−65.52	−82.22
Feed origin			
Regional field beans	21.71	12.94	72.00
German field beans	21.39	19.22	71.58
Brazilian soy	−32.40	−2.19	−89.43
No information	−10.70	−29.97	−54.15
None	−143.76	120.14	−104.11

*** $p \leq 0.001$. Source: authors' own calculations.

The first class accounted for 22.8% (n = 213) of the sample. This group of participants gave the highest importance to price (70.27%), particularly to the lowest level (5.98 EUR/kg), followed by product (11.30%) and feed origin (10.73%), particularly regional and German origin. Breeding form and breed accounted for less than 6% of attribute importance each. Breeding of the brother and DPB had the highest utilities in this attribute. Bresse Gauloise was the breed with the highest utilities from the attribute breeds. The second group consisted of 20% (n = 184) of participants and also gave the highest importance to price (62.13%), particularly the lowest level. However, this group allocated around 30% of importance to origin (product and feed, 20.52% and 9.76%, respectively), particularly regional and German. Breeding form and breed only accounted for less than 8% importance for this group. Breeding of the brother and organic showed the highest utilities for this class when referring to breeding type. The third, and largest, class consisted of 57.2% (n = 537) participants. Contrary to the other groups, this group allocated a higher importance to feed (32.33%) and product origin (27.63%), specifically regional and German. Price showed an importance of 18.76%, and contrary to the other groups, the highest utilities were on the second and third levels (15.62 EUR/kg and 25.26 EUR/kg). For this group, breeding form was more important (17.09%); here, DPB and breeding of the brother

showed the highest utilities. Similar to the other groups, the attribute importance of the attribute "breed" accounts for less than 5%.

3.2. Extended Theory of Planned Behavior

The five factors obtained by the CFA accounted for 77.27% of explained variance and the KMO value was 0.906, which is generally seen as a very good value [63,66]. The internal reliability of each factor was tested with Cα, and the values obtained ranged from 0.689 to 0.909.

Table 5 shows each obtained factor in detail along with individual loadings, means, and standard deviations for each item. Factor 1 (Cα: 0.882) resulted in six items related to the participants' attitude towards DPB. The highest loadings were those of items related to the general idea of purchasing the products; however, when talking about the confidence of the purchase the loading decreased. Factor 2 (Cα: 0.870) resulted in six items related to personal norms on animal welfare. While most items were directly related to animal welfare, elements of PBC and PNR were also found. Factor 3 (Cα: 0.909) consisted of four items related to social norms that influence participants' attitude towards purchasing DPB. All items showed similar loadings. Factor 4 (Cα: 0.855) resulted in four statements related to personal moral norms on regional products influencing consumers' purchase. The loadings obtained were similar for three items, while the statement related to guilt from purchasing products from different regions or countries obtained a lower loading. Finally, Factor 5 (Cα: 0.689) resulted in three items related to participants' perceived behavioral control, specifically to participants' knowledge or ability to purchase these products.

Table 5. Factors obtained of extended theory of planned behavior statements (n = 934).

Wording	Factor Loading	Mean | SD
Factor 1: "Attitude towards DPB" (Cα: 0.882)		
It is a good idea to buy products from DPB (eggs and meat).	0.911	2.02 | 1.21
The purchase of products from DPB (meat and eggs) is good.	0.887	2.11 | 1.19
The purchase of products from DPB (eggs and meat) is interesting for me.	0.870	2.29 | 1.34
It is important for me to buy products from DPB (eggs and meat).	0.680	2.80 | 1.39
I am confident that I will buy chicken meat and eggs from DPB.	0.615	2.77 | 1.47
I see myself in a position to buy chicken meat and eggs from DPB in the future.	0.428	2.99 | 1.61
Factor 2: "Personal norms on animal welfare" (Cα: 0.870)		
I feel morally obliged to consider animal welfare in my daily behavior.	0.811	2.65 | 1.50
I feel guilty buying meat and eggs where the day-old chicks were killed.	0.807	3.59 | 2.00
People should do everything to improve animal welfare.	0.719	2.00 | 1.25
I feel a moral obligation to buy DPB products (meat and eggs) regardless of what others do.	0.682	3.09 | 1.69
I am ready to invest more time and money in purchasing chicken meat and eggs from DPB.	0.522	3.22 | 1.75
I feel guilty if I buy chicken meat and eggs from other countries or regions.	0.509	4.03 | 1.91
Factor 3: "Subjective norms" (Cα: 0.909)		
People who are important to me want me to buy products from DPB (eggs and meat).	0.892	4.24 | 1.70
People who are important to me think that I should buy products from DPB (eggs and meat).	0.884	4.08 | 1.67
People whose opinions I value would prefer that I buy chicken and eggs from DPB.	0.873	3.81 | 1.72
The positive opinion of my friends influences me to buy products from DPB (meat and eggs).	0.763	4.25 | 1.74

Table 5. *Cont.*

Wording	Factor Loading	Mean | SD
Factor 4: "Personal norms on regional products" (Cα: 0.855)		
People should do everything possible to increase the consumption of regional products.	0.810	2.22 | 1.29
I feel obliged to consider regional consumption in my daily behavior.	0.803	2.69 | 1.60
I feel a moral obligation to buy products from this region, regardless of what others do.	0.788	2.93 | 1.76
I feel guilty if I buy chicken meat and eggs from other countries or regions.	0.521	4.03 | 1.91
Factor 5 "Perceived behavioral control" (Cα: 0.689)		
I know where I can buy chicken meat and eggs from DPB.	0.840	5.11 | 1.95
Products from DPB (meat and eggs) are available in the shops where I usually go shopping.	0.840	4.39 | 1.74
I see myself in a position to buy chicken meat and eggs from DPB in the future.	0.522	2.99 | 1.61

Cα: Cronbach's alpha, DPB: dual-purpose breed. Explained variance: 77.27%; KMO: 0.906; Bartlett's test: Chi-square: 13,498.96, sig.: 0.000. Likert-scale: 1 "I fully agree" to 7 "I fully disagree". Source: authors' own calculations.

3.3. Characterization of Classes

To further describe each obtained class, sociodemographic data, purchase frequencies (organic products, regional products, and products labeled with animal welfare, purchase place) and the extended theory of planned behavior were used. Table 6 shows the results of consumer segmentation with respect to the abovementioned (significant) describing variables.

Segment 1: Price-conscious consumers (23%). Consumers in this group were mostly men (60%) with a monthly net income of up to 2599 EUR (67%). Participants in this group mostly purchase their chicken meat at discounter stores. The attribute they valued most was price, and within the price the lowest level (5.98 EUR/kg) obtained the highest utilities. In this group, product and feed origin had a similar importance (11%), especially the regional and German levels. Breeding form and animal breed were not highly important (5% and 2%, respectively); however, the levels of breeding of the brother and dual-purpose breed were preferred in this group. This group also shows a more positive attitude towards DPBs (attitude towards the behavior—ATB), which can also be observed in the utilities of DPB, and a higher PBC versus Segment 2.

Segment 2: Price-sensitive and origin-oriented consumers (20%). This group consisted of a similar percentage of male and female participants. Most consumers (55%) were between 40 and 64 years old and most (73%) had a monthly net income of up to 2599 EUR. Participants in this group purchase chicken meat mostly in supermarkets and discounters. The most important attribute for this consumer segment was also price (62%), specifically the lowest level. However, contrary to Segment 1, this group places more importance (almost twice as much, i.e., 20%) on the product origin, particularly in regional origin. The importance of the breeding form and animal breed for this group were also very small (5% and 2%, respectively); however, the breeding of the brother and organic were preferred, rather than dual-purpose breed (as opposed to Segment 1). The lower preference for DPB can also be observed in the attitude towards DPB (ATB), where Segment 1 reported a more positive attitude towards dual-purpose breeds. Results also showed that subjective norms had a significantly lower impact in this group than in Segments 1 and 3.

Segment 3: Origin-oriented consumers (57%). Women make up the majority (56%) of this group, and 39.5% of participants reported a monthly net income of at least 2600 EUR. Similar to Group 2, participants in this group purchase chicken meat mostly in supermarkets and discounters. Nonetheless, 21.9% members of this segment purchase chicken meat from either a butcher, directly from the farmer, in organic shops, or at the farmer's market, while only 7.4% in Group 1 and 5.4% in Group 2 do so. Contrary to the other two segments, this group valued feed and product origin (regional and German) more than other attributes such as price. This

was also reflected in the group's reported purchase frequency of regional products and on their personal norms regarding regional products. For consumers in this group, price and breeding type obtained almost the same importance. Participants were willing to pay more for their products (15.62 EUR/kg and 25.26 EUR/kg), which can be related to 40% of participants earning at least 2600 EUR (net) per month. As opposed to Segments 1 and 2, the utilities of consumers in this group were higher for dual-purpose breeds. This was also observed in the describing variables where the attitude towards dual-purpose breeds (ATB) and personal norms on animal welfare (PNAW) were more positive in Segment 3 when compared to the other groups. Similarly, Group 3 reported purchasing products with an "animal welfare" label with a higher frequency than the other two groups. A similar difference was observed in the PBC, where Class 3 felt a higher control to purchase DPB products when compared to the other two classes.

Table 6. Description of each class based on significant describing variables.

	Class 1	**Class 2**	**Class 3**
Size (%)	22.8	20.0	57.2
Describing variables: Sociodemographic (%)			
Gender ***			
Female	40.4	48.4	55.9
Male	59.6	51.6	44.1
Age *			
18–24 years old	8.5	6.0	9.9
25–39 years old	27.2	10.3	21.8
40–64 years old	38.0	55.4	41.5
65 or more years old	26.3	28.3	26.8
Net income per month **			
Less than 1300 EUR	30.5	27.7	22.0
1300–2599 EUR	36.2	45.1	38.5
2600–4999 EUR	23.9	23.9	31.1
5000 EUR or more	9.4	3.3	8.4
Describing variables: Purchase frequencies [1] ($\mu \mid \sigma$)			
Organic products ***	$3.46^{a} \mid 1.00$	$3.61^{a} \mid 0.97$	$2.85^{b} \mid 1.05$
Regional products ***	$2.41^{a} \mid 0.76$	$2.38^{a} \mid 0.89$	$2.00^{b} \mid 0.78$
Products with "animal welfare" label ***	$3.06^{a} \mid 0.91$	$3.23^{a} \mid 0.94$	$2.66^{b} \mid 0.93$
Describing variables: Place of purchase (%)			
Discounter	57.3	42.4	26.6
Supermarket	35.2	47.8	50.3
Butcher	2.3	2.2	8.6
Directly from the farmer	0.9	0.5	3.2
Organic shop	1.9	0	4.3
Farmer's market	2.3	2.7	5.8
Other	0	4.3	1.3
Describing variables: Factors [2] ($\mu \mid \sigma$)			
ATB ***	$2.57^{a} \mid 0.93$	$3.01^{b} \mid 1.22$	$2.28^{c} \mid 1.04$
PNAW ***	$3.70^{a} \mid 1.26$	$3.72^{a} \mid 1.32$	$2.63^{b} \mid 1.15$
SN ***	$4.13^{a} \mid 1.49$	$4.60^{b} \mid 1.46$	$3.90^{a} \mid 1.50$
PNR ***	$3.56^{a} \mid 1.41$	$3.47^{a} \mid 1.48$	$2.55^{b} \mid 1.18$
PBC ***	$4.29^{a} \mid 1.23$	$4.70^{b} \mid 1.32$	$3.92^{c} \mid 1.42$

[1] Scale: 1 "Very often" to 5 "Never", [2] Scale (for items in each factor): 1 "I fully agree" to 7 "I fully disagree". * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$. ^{a,b,c} values with different superscript letters are statistically significant different ($\alpha = 0.05$) according to Games–Howell or Tukey. ATB: attitude towards the behavior, PNAW: personal norms on animal welfare, SN: subjective norms, PNR: personal norms on regional products, PBC: perceived behavioral control. Source: authors' own calculations.

4. Discussion

Our results showed that 85% of the participants were aware of the killing of day-old chicks. This high awareness has also been confirmed in previous studies with European consumers [4,10,67]. As this practice will be forbidden in Germany starting January 2022, current animal friendly alternatives such as using dual-purpose chicken breeds and how to market these products need to be researched extensively.

4.1. Consumers' Preference for Each Attribute

In this study, the importance of each attribute is only valid with the particular combination of attributes and levels used here. Results of the present study show that, in the whole sample, price was the most important attribute considered when purchasing chicken meat. Price has been shown to play a major role in a consumer's purchase decision [68,69]. After price, feed origin and product origin had an important weight when purchasing chicken meat, particularly when the feed or product origin was regional or German. Studies have shown that consumers prefer and are usually willing to pay more for local products [49,70–72]. Schnettler et al. [73] show that consumers prefer and have a higher WTP for beef products of local origin than non-local origin. However, Rahbauer et al. [74] show that the elasticity in German consumers' WTP for meat products varies depending on the type of meat—beef shows a higher elasticity, while poultry and pork show a lower elasticity, suggesting consumers would still purchase chicken meat if prices increase slightly. Additionally, Feldmann and Hamm [49] find that consumers' preference and WTP for local products depends on the type of product—higher for plant products than for animal products. Similarly, Becker et al. [75] show that the country of origin is more important for beef than for pork and chicken.

The type of breeding only accounted for a small percentage of importance when purchasing chicken meat. Finally, the type of breed played a minor role in consumers' preferences when purchasing meat. This could be attributed to consumers' lack of familiarity with different chicken breeds [76]. Additionally, the "meat-paradox" (i.e., liking meat but disliking killing an animal for food) could have an important effect in this attitude, since research has shown that consumers do not like to associate any living animal to food, especially meat [77,78].

4.2. Preferences of Each Consumer Segment

While the theory of planned behavior is usually employed to predict consumers' intention to carry out a certain action, in this case we used it to explain what motivates consumers to carry out the specific action. It is suggested that consumers which have a positive ATB, SN, and PBC have a stronger intention to purchase a product; however, this decision making process takes into account additional product attributes (e.g., price, quality) that can hinder this intention. Therefore, by combining the motivations behind a purchase and actual product attributes, we can better understand what our target group values most. As we see from these results, the TPB would not have been enough to describe the purchasing motivations behind the purchase of our specific products. Although this theory helps understand how society influences consumers' decisions and how the attitudes towards a specific behavior in question influence the purchasing decision, this theory lacked the elements of animal welfare and regional products that this particular research question needed. Therefore, the use of an extended TPB seems like a suitable option to understand motivations and/or values beyond the usually employed.

Although, for the sample as a whole, price was the most important attribute, and this differed between consumer segments. Price was the attribute with the highest importance for two consumer segments, while (feed and product) origin was the most important attribute for the third segment. Our results confirm that although the price of a product usually plays a major role in a consumer's purchase decision [68], consumers' willingness to pay might be affected when involving credence attributes such as animal welfare [79–81] and place of origin [73].

The origin of either the product or feedstuff was a valued attribute for all consumer segments in this study. This has also been tested in other studies [41,82] where local or regional food is preferred to other attributes. In our study, while Class 1 preferred German product and feed origin, Classes 2 and 3 preferred regional over German origin. This was also reflected in each segment's personal norms on regional products (PNR) and on their claimed purchase behavior of regional products. These results showed a slight difference between the behavior of Class 1 and 2, but a clear difference between Class 3 and the other two classes. Consumers' preference for local foods has been related to positive attitudes towards environmental, social, and quality motives [49,70]. This was also reflected in this study, where "origin-oriented consumers" (Class 3) also shows a more positive result towards animal welfare (PNAW), has a more positive attitude towards dual-purpose breeds (ATB), and consumes organic products and products with "animal welfare" labels more frequently than the rest.

The role of the breeding form in the purchase of chicken meat was less important than origin of the product or feed. "Price-sensitive and product origin-oriented consumers" (Class 2) preferred the breeding of the brother and organic over DPB. The ATB of this consumer segment also reflected this preference, as this segment has the less positive attitude towards DPB. Although "price-conscious consumers" (Class 1) showed a positive attitude towards dual-purpose breeds (ATB) and the utilities for this breeding form were the second highest, other product attributes (such as price) had a higher weight on their purchase decision. This supports related research [4,10], which indicates that although consumers are interested in DPB, attributes like price influence their final decision. On the other hand, Class 3 showed a higher preference towards dual-purpose breeds versus Segments 1 and 2. This engagement with DPB was also seen in the factors obtained from the TPB, where Class 3 had the most positive attitude towards DPB, the highest personal norms on animal welfare, and their stated purchase frequency of animal products with an "animal welfare" label. Since consumers have evaluated the breeding of dual-purpose chickens as an "animal-friendly" practice [4], our study showed that there was a group of consumers willing to pay a higher price for chicken meat where animals were raised under animal-friendly standards. Even though, in general, consumers' attitude towards DPB is positive, many consumers are not willing to pay more for meat and eggs from this production system [4,67], while others would also have to consider other product attributes when purchasing these products [4,10,67].

Other elements of the extended TPB also show significant differences between groups. Subjective norms (SN) have a lower influence in Class 2 when compared to Classes 1 and 3. This could also contribute to the lower preference of DPB, more negative ATB, and in general a lower purchase frequency of animal products with an "animal welfare" label. Additionally, perceived behavioral control (PBC) also shows differences between groups, which can also influence the overall preference for DPB. Class 3 showed a higher utility for DPB, which is also reflected in their PBC; this can also be associated to the place of purchase of chicken meat as about 25% of participants in this group usually purchase their chicken meat in "non-typical" (i.e., supermarket or discounter) venues.

Segments for potential consumers of dual-purpose chicken breeds have also been created by Busse et al. [67]. However, the approach used in that study involved conditions for a potential purchase of these products; among the conditions included were knowledge of the product, regular availability, price, regional origin, and taste. That particular study showed that various aspects contribute to determining purchase criteria, such as access to information and trust in the given information. However, although their most promising cluster stated a higher willingness to pay for DPB products, it is still unknown how much more they would pay and which compromises or under which conditions this price would be paid. Our study did that by showing that although consumers might be willing to pay a premium price for certain attributes such as animal welfare conditions, other attributes are equally or more important. In our case, the most promising consumer class gives a higher importance to the origin of the product and feed than to other attributes.

The overall low preference for DPB products could be associated to the fact that this topic (dual-purpose chicken breeds) is unknown to most European consumers [10,67,83]. Therefore, for this particular alternative production system (dual-purpose breeds fed with German field beans), it is necessary to communicate what dual-purpose breeds are and to specifically market the regional origin of the feedstuff, along with the sustainability and ethical advantages of this product when compared to conventional chicken meat. A proper communication of the advantages of these products could justify a higher price and more consumer engagement in these topics. By increasing communication of these particular products, consumers would be more aware of their decisions and the impact these have on sustainability issues like animal welfare (e.g., killing of day-old chicks), sustainability (e.g., supporting local economy, conserving biodiversity through the use of traditional chicken breeds), and environmental issues (e.g., avoiding imports of protein feedstuff for animals).

The major limitation of the present study is that since this product is still not available in a mainstream market, consumers had to make their choices assuming the product was available without having prior experience. Although potential consumers of DPBs show a higher engagement towards DPBs, and a higher engagement to animal welfare and regional origin, important aspects such as organoleptic properties and availability can heavily influence the final behavior. This study is also limited by the use of a method that indirectly measures consumers' WTP. As participants do not have to actually pay for the products they are selecting, there are no actual financial consequences for their decisions. This lack of financial consequences creates a hypothetical willingness to pay [84].

5. Conclusions

In order to create a successful marketing strategy for alternative production methods for poultry, it is necessary to understand which product characteristics consumers value the most. From this study it can be concluded that, after price, consumers value most the information about the origin of the product and origin of the animal feedstuff. Three classes were obtained from the latent class analysis based on their preferences for certain attributes: (1) price-conscious consumers (where price is the most important attribute), (2) price-sensitive and origin-oriented consumers (where price and origin are of importance), and (3) origin-oriented consumers (where origin importance is the highest). We conclude that the target consumer for meat of DPB fed with German field beans is Class 3 "origin-oriented consumers". Although consumers in this segment are interested in the idea of dual-purpose breeds, this attribute alone is not enough to influence their purchase behavior. Since animal welfare standards and region of origin are important to them, an approach to promote dual-purpose breeds could highlight these particular attributes rather than the specifics of the breeding.

The results of this study support the idea of using alternative production methods in the poultry industry. This is of particular relevance to this industry since the killing of day-old chicks will be prohibited in Germany starting 2022 and alternatives have to be implemented. Moreover, these results are also relevant to breeders of DPBs and growers of faba beans in Germany as consumers showed interest in these products.

Further research should test how to integrate and communicate different concepts related to these accepted attributes in chicken meat. Additionally, future studies could research organoleptic acceptance (sensory testing) with consumers along with an experimental auction, where consumers actually have to purchase the product, as this could show a real WTP and preference for these products when including experience and credence attributes.

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Appendix A

Table A1. Statements used to measure the extended TPB (translated from German).

Predictors		Wording
ATB [53]	1	The purchase of products from DPB (eggs and meat) is interesting for me.
	2	It is a good idea to buy products from DPB (eggs and meat).
	3	It is important for me to buy products from DPB (eggs and meat).
	4	The purchase of products from DPB (meat and eggs) is good.
SN [53,60,62]	1	People who are important to me think that I should buy products from DPB (eggs and meat).
	2	People who are important to me want me to buy products from DPB (eggs and meat).
	3	People whose opinions I value would prefer that I buy chicken and eggs from DPB.
	4	The positive opinion of my friends influences me to buy products from DPB (meat and eggs).
PBC [62]	1	I know where I can buy chicken and eggs from DPB.
	2	I am confident that I will buy chicken meat and eggs from DPB.
	3	I see myself in a position to buy chicken meat and eggs from DPB in the future.
	4	I am ready to invest more time and money in purchasing chicken meat and eggs from DPB.
	5	Products from DPB (meat and eggs) are available in the shops where I usually go shopping.
PNAW [61]	1	People should do everything to improve animal welfare.
	2	I feel a moral obligation to buy DPB products (meat and eggs) regardless of what others do.
	3	I feel guilty buying meat and eggs where the day-old chicks were killed.
	4	I feel morally obliged to consider animal welfare in my daily behavior.
PNR [61]	1	People should do everything possible to increase the consumption of regional products.
	2	I feel a moral obligation to buy products from this region, regardless of what others do.
	3	I feel guilty if I buy chicken and eggs from other countries or regions.
	4	I feel obliged to consider regional consumption in my daily behavior.

ATB: attitude towards the behavior, SN: subjective norms, PBC: perceived behavioral control, PNAW: personal norms on animal welfare, PNR: personal norms on regional products; DPB: dual-purpose breeds. Source: adapted from [53,60–62].

Table A2. Information provided to participants prior to the choice experiment (translated from German).

Current poultry farming system "The intensive poultry husbandry of chickens is characterized by specialized laying breeds (egg production) and fattening breeds (meat production). For modern meat production, specialized fattening breeds are used, which reach a weight of 2.6 kg within 6 weeks and can then be slaughtered. Specialized laying breeds are used in egg production, which lay up to 330 eggs in a laying period of 56 weeks. These laying breeds are thin and do not produce much meat, even when fully grown. The problem with the laying breeds is that only the female animals can lay eggs. Since this breed produces little meat and the male chicks do not lay eggs, these (male chicks) are generally killed today on the first day of life. This practice is carried out today by almost all farmers in conventional farming and by the vast majority in organic farming."
Dual-purpose breeds "A possible solution to avoid the direct killing of male chicks is the use of "brother cocks". These are the male siblings of the laying hens, which are reared as broilers. However, the use of brother cocks is regarded as a transitional solution until there are solid dual-purpose breeds, because these chickens are relatively expensive. A dual-purpose breed is a breed that can be used for both production systems (eggs and meat). This means that the female hens lay relatively many eggs, the male hens gain weight relatively well. Both are not as good as the specialized breeds, but they can do both, which also explains the name "dual-purpose breed". Since these breeds are not only for egg production, chicks do not have to be killed and can be used for meat production. This prevents the male chicks from being killed directly and then new chickens from being bought for meat production only. At the moment it is possible to buy products from dual-purpose chickens. However, these products are not very common as they are only available in certain regions and shops."
Current poultry feed situation "Another current problem with chicken production is that many farmers in Germany produce only a small part of the feed for their animals themselves. In most cases, this is purchased from feed manufacturers. A supply bottleneck (i.e., less produced than used) exists throughout the EU, especially for protein feed (protein). For the protein supply of livestock in Germany, 27% of this feed component must be imported. Most of the imported raw protein is in the form of soybeans and soy extraction meal, which are mainly produced in the USA or South America (e.g., Brazil). In the public debate, some interest groups are calling for the import of protein feed to be reduced and for only domestic raw materials to be used. One reason for this is, for example, the criticism of genetically modified varieties. In order to solve this problem, farmers and scientists are looking for other protein sources with correspondingly available protein quantity and quality."

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Perceived Consequences: General or Specific? The Case of Palm Oil-Free Products

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Abstract: Palm oil production and consumption involve several consequences, the perception of which are significant factors that influence consumer behavior. The aim of our research is to explore which health, environmental, or social consequences associated with palm oil influence consumers most in their behavior to avoid palm oil. We examined the three risk types from two approaches: from the viewpoint of generally perceived consequences, and the viewpoint of consequences perceived specifically in relation to palm oil. We collected data through an online consumer survey (n = 336), and we applied the method of structural equation modeling to achieve our research aim. According to our results, depending on the approach, all three consequence types influence consumer purchase intentions. Of them, the perceived effects of palm oil on health have the strongest influence on consumption intent, followed by environmental damage caused by palm oil production. The effect of general health consequences show indirect significance through information seeking, which also indicates the importance of the approach to consequence perception. Indirectly or directly, only general social consequences influence purchase intent. Our research suggests that companies developing palm oil-free products could benefit from a label on the product stating their palm oil-free nature.

Keywords: consumer behavior; green products; palm oil free; structural equation modeling; SEM

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1. Introduction

Palm oil is the plant oil with the highest worldwide consumption [1], and its production shows an increasing trend [2]. Large-scale production and consumption lead to numerous negative environmental and social effects, such as deforestation, biodiversity loss, water pollution, exploitation of growers, and child labor [3]. The expansion of production can be explained by the positive qualities of palm oil, among others its cheapness, versatile application, and effective rate of yield per hectare [4]. In Hungary, the rapid spread of palm oil is partly due to a regulation that took effect in 2013 which limits the maximum quantity of trans fatty acids in food [5]. Following the publication of the regulation, a significant number of producers modified their production technology or replaced their previously used fats with palm oil [6]. Palm oil has a unique composition among fats, therefore it is suitable for many food applications, such as creams, fillings, and margarine [7]. As Berger [8] summarized, there are several reasons for the success and widespread use of palm oil beyond those already mentioned: its cost-effective production, suitability for baking, and its advantage over other vegetable oils in that it can be solid at room temperature, so it does not need to be hydrogenated, and thus it is trans-fatty acid-free. It is due to these qualities that the processed food market accounts for about 72% of palm oil production [9].

Although palm oil possesses several positive characteristics, there are still products on the food market that communicate their palm oil-free nature to the consumers. The question arises if palm oil is an ingredient with many beneficial features from several aspects, what is it that still encourages consumers to purchase palm oil-free products, and whether the business practice to communicate palm oil-freeness can be justified. To date, there are several so far unresearched questions related to consumer familiarity with and attitudes to palm oil [10], but it is obvious that consumers possess little knowledge about palm oil-related issues [11–14].

The palm oil industry creates negative associations in consumers [15], thus consumers may have formed unique negative attitudes and beliefs towards such products, which can affect their purchasing behavior [11]. We can identify three different risk types associated with palm oil: impacts on the environment, health, and society [16].

Previous research on the health effects of palm oil has investigated its contribution to the development of coronary heart disease; however, compared to other oils, the effect of palm oil on cholesterol levels can be considered neutral [17]. Several studies point out the health effects of palm oil as the main factor influencing its consumption [18,19]. According to the results of Verneau and colleagues, it is the alleged detrimental health effects of palm oil consumption that motivate consumers to avoid products that contain it. It has become a widely held belief that palm oil-free products are healthier than those containing palm oil [11,20], even though there is no scientific evidence that palm oil is harmful to health [11]. On the other hand, Aguiar and colleagues [15] argue that consumers may consider palm oil a natural ingredient, and as such, it may contribute to a healthy life.

In recent years, several studies have investigated different aspects of consumer behavior related to sustainability (e.g., [21–23]) and numerous review articles have summarized what we have learned so far (e.g., [24–26]). Sustainability and environmental risks are also an issue highlighted in palm oil-related consumer research. Guadalupe et al. [27] maintain that the environmental risks accompanying palm oil production are perceived in both the importing and the producing countries. In their comparison based on Spanish and Peruvian samples, respondents from both countries viewed the environmental impacts of palm oil production negatively [27]. The unregulated expansion of palm oil cultivation poses a serious threat to biodiversity in Southeast Asia [28]. Results show that the more consumers are familiar with this ingredient and the environmental impact of its production, the more they intend to reduce consumption [14], and the more they consider palm oil-free products more sustainable [11].

The third consequence type, the possible negative social effects (e.g., exploitation, child labor, etc.) are less known to consumers, and thus they are less worried about them than about the other two risks [16]. At the same time, palm oil consumption indirectly results in job opportunities in the producing countries, which may thus also develop positive attitudes in the consumer in that they help the economies of the producing countries by consuming palm oil [15].

Because of the harmful effects perceived by consumers of palm oil, earlier research was aimed at reducing or replacing palm oil in food [14,29]. At the same time, researchers rightly ponder whether consumers pay attention to this product ingredient [12,15,27,30,31] and whether it influences purchasing or consumer behavior [13]. Due to the functionality of palm oil, it is a technological challenge to the food industry to replace it with other fats. The commercially available alternatives for palm oil are based on liquid oils, fully hydrogenated fats, and different exotic fats like shea butter. Blending these ingredients could be an opportunity for substitution [32].

2. Aim of Research

The aim of our research is to explore how much Hungarian respondents know about palm oil, and how they perceive its impact on health, the environment, and the societies of producing countries. The many technological advantages of palm oil notwithstanding, a niche market has emerged for palm oil-free products, presumably due to the perceived

negative effects of palm oil. We also strive to identify the consequence factor with the strongest influence on consumers to purchase palm oil-free products. To examine this latter aim, Verneau et al. [19] have already modeled consumer behavior with the statements we applied, and their research included more indirect relations than what we explored in our current study. That study did not, however, investigate personal beliefs. That is, what consumers specifically think about the risks associated with palm oil, how they perceive their significance. Verneau et al. acknowledged this omission and indicated it as a limitation of their study. By examining consequences and risk factors in our model in general, and in relation to palm oil in particular, we sought to answer whether the intention to purchase palm oil-free products was influenced by problems perceived in general or by perceptions related to palm oil in particular.

2.1. Hypotheses

2.1.1. Perceived Consequences and Their Impact on Purchase Intent

Sodano et al. [16] identified three risk types (health, environmental and social) associated with products containing palm oil. Further research has explored consumer perceptions of these risk types from different perspectives, and how these factors influence purchase intent [3,11,18–20,30,33,34]. Numerous studies have examined specific problems arising during the process of palm oil production [3,11,20,30,33] and only a few were based on the impact of risks perceived in general [18,19,34]. This duality can result in different outcomes for specific consequences. Our first hypothesis was based on this assumption.

Hypothesis 1 (H1). *All three consequence factors, both generally and specifically, directly and significantly influence purchase intent for palm oil-free products.*

Little research has been done on consumer perceptions of the health effects of palm oil [20]. At the same time, many scholars have investigated the perceptions of its environmental effects [3,14,30,31,33–35]. Some studies compare the effects of these consequences. Some results show that environmental consequences have a bigger influence on consumer perceptions [18], while other results show that health consequences do, even if only indirectly [19]. Yet others show that the two consequence types influence consumers to a similar extent [12,16].

Several studies have pointed out that consumer knowledge of palm oil is scant [11–14], and mostly associated with its health and environmental consequences. Meanwhile, consumers have difficulty perceiving social risk, as it carries both positive (e.g., employment, income generation) and negative (e.g., conflicts, housing conditions) effects [36]. According to the results of Sodano et al. [16], of the three risk types, social risk worries consumers the least.

Related to the perceived consequences, we formed the following two hypotheses:

Hypothesis 2 (H2). *Of the three consequence factors, health consequences motivate consumers the most to purchase palm oil-free products, followed by environmental consequences, and finally social consequences.*

Hypothesis 3 (H3). *Health and environmental consequences primarily influence purchase intent directly as perceived in association with palm oil, while social consequences do so in association with general consequence perception.*

2.1.2. The Relationship between Information Seeking and Purchase Intent for Palm Oil-Free Products

The demand for information and information-seeking are significantly determined by the perception of specific risks [37]. In relation to health risks, in some scenarios, responsive individuals are more open to seeking information, whereas "avoidant individuals" are less open [38]. The relationship between the perception of environmental risk and seeking

information is more tangible for people who are more exposed to a specific environmental problem, such as a flood [39]. For more eco-friendly products, providing information is essential to increasing purchase intent [40]. Available information also plays an important role in the assessment of the negative and positive impacts of social risk [36].

Information, especially negative information, and emerging consumer beliefs strongly influence purchase intent [12]. The results of the model of Verneau et al. [19] demonstrated that information seeking directly influences consumers in their purchase intent, more so than the consequences.

Hypothesis 4 (H4). *Information seeking significantly and positively influences purchase intent for palm oil-free products.*

Hypothesis 5 (H5). *Perception of the consequences associated with palm oil influences consumers to seek information about palm oil more than general risk perception.*

Figure 1 illustrates the conceptual model.

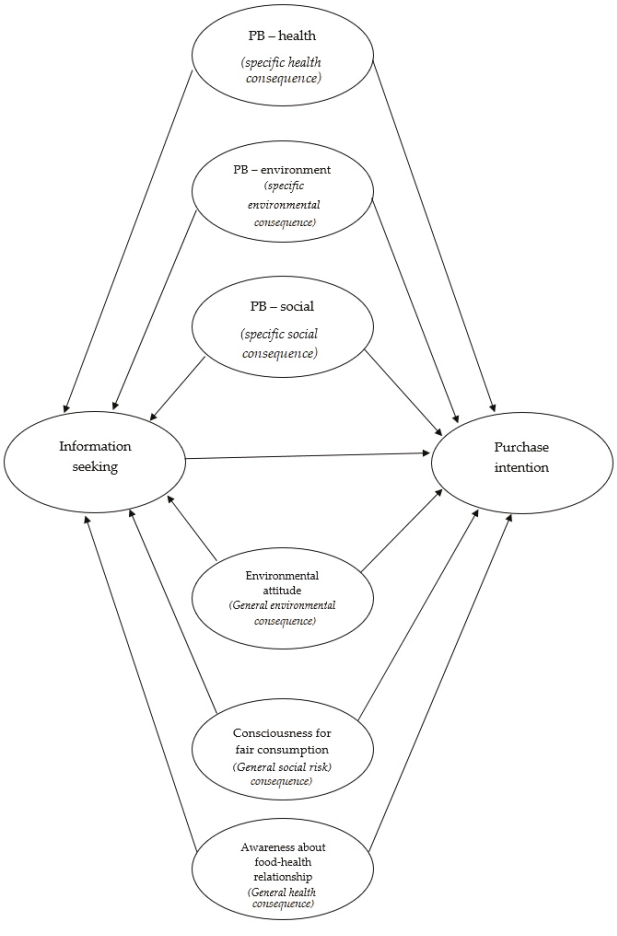

Figure 1. Conceptual framework (PB-Personal beliefs about palm oil).

3. Materials and Methods

In this study, we used a quantitative research tool, namely consumer surveys. Hungarian respondents were contacted through online social media to complete the survey, so completing it was voluntary. Respondents gave written consent for their answers to be analyzed. The surveys were administered from 15 May 2020 through 1 June 2020. Over this period, we received answers from 336 respondents.

In the first part of the survey, we used Lange and Coreman's [14] "knowledge scale" to assess respondents' familiarity with the environmental, health, and social impacts of palm oil. In this context, in the second part of the survey, we asked respondents to rate on a 1–5-point Likert scale how healthy they considered three food products whose palm oil content was explicitly pointed out to them in the questions to be, how environmentally harmful they considered products that contain palm oil to be, and how harmful they thought palm oil production was to the societies of palm oil-producing countries. In the third part of the survey, we explored attitudes towards palm oil with the help of the scales devised by Capecchi et al. [18]. Of the 41 items they specified in the scale, we used 31 statements relevant to our research. Finally, we collected respondents' demographic and other information, as summarized in Table 1.

Table 1. Respondents' demographic and other data (n = 336).

Variables		Sample Composition %
Gender	Male	21.4
	Female	78.6
Age group	18–25 yrs	18.8
	26–35 yrs	23.2
	36–45 yrs	25.3
	46–55 yrs	19.6
	56 yrs and older	13.1
Completed education	Max. 8 yrs of elementary school	3.9
	Vocational school	16.1
	High school certificate	37.8
	Tertiary education	42.3
Residence	Capital	26.2
	Greater capital area	8.6
	Countryside town (not in the greater area)	50
	Village/settlement outside of the greater area	15.2
Perception of income	Very tight	7.4
	Tight	18.2
	Average	51.5
	Good	20.5
	Very good	2.4
Person in the household responsible for buying groceries	Respondent	44.6
	Other	7.1
	Shared	48.2
Household size	1 person	7.4
	2 persons	32.7
	3 persons	28.0
	4 persons	17.0
	5 or more persons	14.9

Data Analysis

To measure attitude statements and knowledge level, we used descriptive statistical methods.

For the structural equations modeling, we worked with SmartPLS software [41]. To construct the conceptual model, we used the attitude statements mentioned earlier. The points of the model were designed based on the categories applied by Capecchi et al. [18]. The focus was on the category "purchase intention," which we measured with three statements. Since we constructed a reflective model, we used the consistent PLS algorithm and the consistent bootstrapping methods in our calculations. Table 2 summarizes the elements of the model.

Table 2. Items and constructs (based on Capecchi et al. [18]).

Construct and Indicators
Purchase intention
When I have a choice, I buy products without palm oil
I am willing to pay more for products without palm oil
I always tell my friends to buy products without palm oil
Personal beliefs—environment
Reducing palm oil production contributes to curbing deforestation
Reducing palm oil production can help counteract the effects of climate change
Reducing palm oil production can slow down the extinction of many animal species
Personal beliefs—health
Consumption of refined palm oil can be harmful to human health
Consumption of refined palm oil can promote the onset of cancer
Consumption of refined palm oil can promote the onset of cardiovascular disease
Personal beliefs—social
Reducing palm oil production contributes to counteracting exploitation of child labour
Reducing palm oil production contributes to counteracting abuses against plantation workers
Reducing palm oil production contributes to improving working conditions of peasant families in all producing Countries
Environmental attitude
Melting of the polar ice caps may result in a flooding of shores and islands.
Poisonous metals are introduced into the food chain, for instance, via ground water
The world climate will probably massively change if CO_2 continues to be emitted into the atmosphere in as huge amounts as it is now
Over the next several decades, thousands of species will become extinct
Pollution generated in one country harms people all over the world
Consciousness for fair consumption
I only buy a product if I believe that in its production the workers' rights were adhered to
I only buy a product if I believe that in its production no worker was subjected to forced labour
I only buy a product if I believe that in its production no illegal child labour was involved
I only buy a product if I believe that in its production workers were not discriminated
I only buy a product if I believe that in its production the working conditions complied with the international labour standards
I only buy a product if I believe that in its production the workers were treated fairly or were fairly compensated
Awareness about food-health relationship
Food plays an important role in keeping me in good health
I know which food is healthy for me
My health is determined by the food I eat
I feel I am eating in a healthier way now as compared to three years ago
Information seeking
Over the last six months I have been looking for information on palm oil
I always talk to my friends/relatives about the effects of palm oil consumption
If I read news about palm oil, I try to study it in depth
I know well which brands have eliminated palm oil from their products

4. Results

4.1. Respondents' Knowledge about Palm Oil

In the first part of the survey, we used Lange and Coreman's [14] "knowledge scale" to assess how much respondents think they are aware of the effects of palm oil on the environment, health, and the societies of the producing countries.

The results are summarized in Table 3.

Table 3. Respondents' knowledge about palm oil (n = 336).

	Impact on Health	**Impact on the Environment**	**Impact on Society**
	Knowledge Scale		
	%	%	%
Not at all	16.1	15.5	25.3
Barely	28.3	19.0	27.7
To some extent	38.4	37.8	32.7
Quite well	13.7	21.1	12.2
Very well	3.6	6.5	2.1

The results in Table 3 clearly show that most respondents were not at all, barely, or only to some extent aware of the effects of palm oil on the environment, society, and health. Regarding the three consequence types, a higher proportion of respondents thought that they were not at all aware of social consequences, while they thought they were the most aware of the impacts on the environment.

4.2. Perception of the Effects of Palm Oil on Health, the Environment, and Society

We examined perceptions of the effects of palm oil on health through products that contain it because respondents do not encounter palm oil by itself, but they do encounter products containing it. We asked them how healthy they considered palm oil-containing bakery, chocolate, and margarine goods to be, as consumers know that palm oil is commonly used for their production [34]. We examined the perceptions of the effects on the environment and society with one question each. The results of these questions are summarized in Table 4.

Table 4. Perception of the effects of palm oil-containing products on health, society, and the environment (n = 336).

	Effect on Health			**Effect on the Environment**	**Effect on Society**
	How concerned are you about the consequences of palm oil containing products?				
	Margarine	Bakery	Chocolate		
	%	%	%		
Not at all	25.9	20.8	23.5	16.4	17.0
Barely	21.7	26.2	23.5	14.0	13.7
To some extent	27.4	27.4	25.6	16.7	29.8
Quite much	14.0	17.0	17.3	25.3	25.0
Very much	11.0	8.6	10.1	27.7	14.6

Our results show that nearly half of the respondents did not consider palm oil-containing products to be healthy at all, or considered them to rather not healthy, and only one in four respondents considered palm oil-containing products to be healthy.

Of the three consequences we examined, respondents were the most divided on the perception of the effects of palm oil production on society, as they could not assess whether such a risk existed or not.

Of the three consequence types, respondents considered the effect on the environment to be the most harmful. Despite low consumer knowledge compared to the other two consequence types, more than 50% of respondents thought the effect on the environment to be rather or completely harmful.

4.3. Attitudes Influencing Purchase Intent for Palm Oil-Containing Products—Structural Equation Modeling

4.3.1. Construct Reliability and Validity of the Model

We constructed the model with the help of the attitude statements used in the quantitative research phase. The reliability of the model is supported by several indices, such as Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and the items' outer loadings. The values of Cronbach's alpha consistently exceed 0.7, as recommended by the literature [42], and our lowest value was 0.869. The values of composite reliability must also exceed 0.7 [43], in our study they fell between 0.872 and 0.969. The values of the average variance extracted (AVE) were between 0.640 and 0.884, also conformed to the expected minimum of 0.5 [44]. The outer loading values were between 0.680 and 0.990. Bagozzi and Yi [45] state the expected value to be over 0.7. In social research, this value often happens to be lower than 0.7 [46]. Hair et al. [47] opine that deleting the indices with an outer loading of 0.40 through 0.70 is necessary if it results in an increase in composite reliability. We examined the model without the two statements in question, but the composite reliability values increased only by one-thousandth. Thus, we kept the two statements in the model. Overall, based on the indicators presented so far, the reliability of our model can be considered good.

Table 5 summarizes the construct reliability and validity values.

Table 5. Construct reliability and validity.

Construct and Indicators	Outer Loading
Purchase intention (CA = 0.869, CR = 0.872, AVE = 0.696)	
When I have a choice, I buy products without palm oil	0.881
I am willing to pay more for products without palm oil	0.867
I always tell my friends to buy products without palm oil	0.749
Personal beliefs—environment (CA = 0.958, CR = 0.958, AVE = 0.884)	
Reducing palm oil production contributes to curbing deforestation	0.900
Reducing palm oil production can help counteract the effects of climate change	0.959
Reducing palm oil production can slow down the extinction of many animal species	0.960
Personal beliefs—health (CA = 0.939, CR = 0.938, AVE = 0.835)	
Consumption of refined palm oil can be harmful to human health	0.952
Consumption of refined palm oil can promote the onset of cancer	0.901
Consumption of refined palm oil can promote the onset of cardiovascular disease	0.888
Personal beliefs—social (CA = 0.901, CR = 0.908, AVE = 0.772)	
Reducing palm oil production contributes to counteracting exploitation of child labour	0.973
Reducing palm oil production contributes to counteracting abuses against plantation workers	0.946
Reducing palm oil production contributes to improving working conditions of peasant families in all producing Countries	0.688
Environmental attitude (CA = 0.922, CR = 0.921, AVE = 0.702)	
Melting of the polar ice caps may result in a flooding of shores and islands.	0.890
Poisonous metals are introduced into the food chain, for instance, via ground water	0.792
The world climate will probably massively change if CO_2 continues to be emitted into the atmosphere in as huge amounts as it is now	0.734
Over the next several decades, thousands of species will become extinct	0.891
Pollution generated in one country harms people all over the world	0.869
Consciousness for fair consumption (CA = 0.969, CR = 0.969, AVE = 0.838)	
I only buy a product if I believe that in its production the workers' rights were adhered to	0.946
I only buy a product if I believe that in its production no worker was subjected to forced labour	0.990
I only buy a product if I believe that in its production no illegal child labour was involved	0.946
I only buy a product if I believe that in its production workers were not discriminated	0.869

Table 5. *Cont.*

Construct and Indicators	Outer Loading
I only buy a product if I believe that in its production the working conditions complied with the international labour standards	0.838
I only buy a product if I believe that in its production the workers were treated fairly or were fairly compensated	0.894
Awareness about food-health relationship (CA = 0.888, CR = 0.886, AVE = 0.662)	
Food plays an important role in keeping me in good health	0.746
I know which food is healthy for me	0.893
My health is determined by the food I eat	0.782
I feel I am eating in a healthier way now as compared to three years ago	0.826
Information seeking (CA = 0.876, CR = 0.876, AVE = 0.640)	
Over the last six months I have been looking for information on palm oil	0.745
I always talk to my friends/relatives about the effects of palm oil consumption	0.893
If I read news about palm oil, I try to study it in depth	0.783
I know well which brands have eliminated palm oil from their products	0.827

(CA = Cronbach's alpha, CR = composite reliability, AVE = average variance extracted).

4.3.2. Model Fit, Discriminant Validity and Explanatory Power of the Model

To examine the fit of the model, we present the standardized root–mean square residual (SRMR) and the normed fit index (NFI) values. Hu and Bentler [48] state that an SRMR value lower than 0.08 shows a good model fit, as does an NFI value higher than 0.95. However, these numbers were not applied as as cutoff values, as the values of these indicators can vary depending on several factors [49]. According to our results, the model fit was adequate (SRMR = 0.053, NFI = 0.816). The low NFI value can be attributed to the relatively small sample, which often causes this index to underestimate the fit [50].

To measure discriminant validity, we present two methods, the Fornell–Larcker test (Table 6) and the heterotrait–monotrait (HTMT) criterion (Table 7).

According to the Fornell–Larcker test, a specific latent construct must better explain the variance of its own index than the variance of any other latent construct [51]. As the results in Table 6 attest, this was true for our model.

The results in Table 7—HTMT criterion—also confirmed that discriminant validity had been established, as the values obtained were all below 0.9 [52].

The explanatory power of the model is illustrated by the values of R^2 and adjusted R^2, as summarized in Table 8. The model explains 59.7% of the purchase intention (adjusted R^2 = 0.596). The model constructed by Verneau et al. [19] explained 46% of purchase intention, so by expanding on it, we achieved a 14% increase in explanatory power.

4.3.3. Presenting the Results of the Structural Model

To determine the significance level of each correlation and the values of T and f^2, we used bootstrapping (number of subsamples = 5000). Table 9 and Figure 2 show the results.

Based on our model, and similar to the study by Verneau et al. [19], information-seeking had the strongest influence (H4, ß = 0.340, p = 0.000) on the consumer behavior of Hungarian respondents in avoiding palm oil. But this effect was not outstandingly high compared to other direct effects.

Table 6. Fornell–Larcker test of discriminant validity.

	Awareness about Food-Health Relationship	Consciousness for Fair Consumption	Environmental Attitude	Information Seeking	Purchase Intention	Personal Beliefs—Environment	Personal Beliefs—Health	Personal Beliefs—Social
Awareness about food-health relationship	0.814							
Consciousness for fair consumption	0.459	0.915						
Environmental attitude	0.610	0.415	0.838					
Information seeking	0.473	0.426	0.264	0.800				
Purchase intention	0.526	0.462	0.434	0.584	0.834			
Personal beliefs—environment	0.520	0.358	0.670	0.322	0.606	0.940		
Personal beliefs—health	0.399	0.317	0.492	0.280	0.605	0.697	0.914	
Personal beliefs—social	0.429	0.336	0.586	0.291	0.536	0.805	0.710	0.878

Table 7. Discriminant validity: heterotrait–monotrait (HTMT) criterion.

	Awareness about Food-Health Relationship	Consciousness for Fair Consumption	Environmental Attitude	Information Seeking	Purchase Intention	Personal Beliefs—Environment	Personal Beliefs—Health	Personal Beliefs—Social
Awareness about food-health relationship								
Consciousness for fair consumption	0.461							
Environmental attitude	0.614	0.414						
Information seeking	0.466	0.426	0.259					
Purchase intention	0.525	0.462	0.429	0.589				
Personal beliefs—environment	0.523	0.356	0.670	0.317	0.603			
Personal beliefs—health	0.400	0.315	0.491	0.276	0.604	0.696		
Personal beliefs—social	0.436	0.339	0.591	0.288	0.532	0.812	0.717	

Table 8. Results illustrating the explanatory power of the model.

	R^2	Adjusted R^2
Purchase intention	0.606	0.597
Information seeking	0.298	0.285

Table 9. The results of the structural equation modeling.

Relation	Direct Effect		Indirect Effect		Total Effect		Cohen's f^2	Supported?
	Effect Size	T Value	Effect Size	T Value	Effect Size	T Value		
Awareness about food-health relationship → Information seeking	0.381 **	4.586	-	-	0.381 **	4.586	0.116	Yes
Awareness about food-health relationship → Purchase intention	0.117 n.s.	1.509	0.130 **	3.494	0.246 **	3.212	0.017	No
Consciousness for fair consumption → Information seeking	0.268 **	4.138	-	-	0.268 **	4.138	0.077	Yes
Consciousness for fair consumption → Purchase intention	0.118 *	2.123	0.091 **	3.209	0.209 **	3.548	0.025	Yes
Environmental attitude → Information seeking	−0.184 *	2.013	-	-	−0.184 *	2.013	0.021	Yes
Environmental attitude → Purchase intention	−0.084 n.s.	1.058	−0.062 n.s.	1.943	−0.146 n.s.	1.833	0.008	No
Information seeking → Purchase intention	0.340 **	5.474	-	-	0.340 **	5.474	0.206	Yes
Personal beliefs—environment → Information seeking	0.082 n.s.	0.723	-	-	0.082 n.s.	0.723	0.003	No
Personal beliefs—environment → Purchase intention	0.261 **	2.699	0.028 n.s.	0.708	0.289 **	2.754	0.046	Yes
Personal beliefs—health → Information seeking	0.040 n.s.	0.508	-	-	0.040 n.s.	0.508	0.001	No
Personal beliefs—health → Purchase intention	0.308 **	4.291	0.014 n.s.	0.497	0.322 **	4.236	0.108	Yes
Personal beliefs—social → Information seeking	0.050 n.s.	0.460	-	-	0.050 n.s.	0.460	0.001	No
Personal beliefs—social → Purchase intention	−0.032 n.s.	0.370	0.017 n.s.	0.447	−0.015 n.s.	0.165	0.001	No

(* $p < 0.05$, ** $p < 0.01$, n.s.—non-significant). Model fit: SRMR = 0.053, NFI = 0.816

We hypothesized that all three consequences had a direct and significant effect on purchase intent (H1). This was supported by the model, but the nature of consequence perception greatly influences the effect of consequences on purchase intent. In our second hypothesis, we hypothesized that purchase intention was influenced the most by the health consequences, followed by the environmental consequences, and the social consequences. This was supported by our results. Whereas the environmental (ß = 0.261, $p = 0.007$) and health consequences (ß = 0.308, $p = 0.000$) showed a significant effect in the context of the consequences perceived in relation to palm oil, the social consequences did so in connection with issues related to the societal problems perceived in general (ß = 0.118, $p = 0.034$). However, if we examine them in general, neither the health nor the environmental consequences showed a significant effect. Thus, our third hypothesis was confirmed.

In addition to direct effects, we also examined the indirect effects of the consequence factors in our model perceived both in general and specifically in association with palm oil via information-seeking as mediating variable. We assessed the nature of the mediation effect based on the types demonstrated by Hair et al. [47]. For health consequences perceived in general, indirect-only mediation exists. The results summarized in Table 9 show that the direct effect was not significant, but the indirect effect was (ß = 0.130, $p = 0.000$). Thus, the perception of the health consequences of food consumption did not directly influence the purchase intent of palm oil-free products but did influence respondents' information-seeking on palm oil. Through this mediating variable, we already experienced a significant effect (total effect ß = 0.246, $p = 0.001$). However, for attitudes

related to general environmental outcomes, there was no significant effect even in this case, as neither the direct nor the indirect effect (ß = −0.062, $p = 0.055$) was significant. The effect of non-palm oil-specific social outcomes was intensified by the mediating variable, thus complementary mediation exists. However, the thusly emerging total effect was no longer so important (ß = 0.209, $p = 0.000$) as in the case of the health risks (ß = 0.246, $p = 0.001$). In the case of the environmental and health consequence perceived in relation to palm oil, we found direct-only nonmediation, as there was a significant effect only for the direct relationship, and for the social consequences, no significant effect was found at all (no-effect nonmediation). Whereas two of the risks perceived in general did not have a direct significant effect on purchase intent, they do have one through information seeking. Problems specifically associated with palm oil only directly influenced purchase intent for palm oil-free products, and information-seeking did not mediate it for any of the risks.

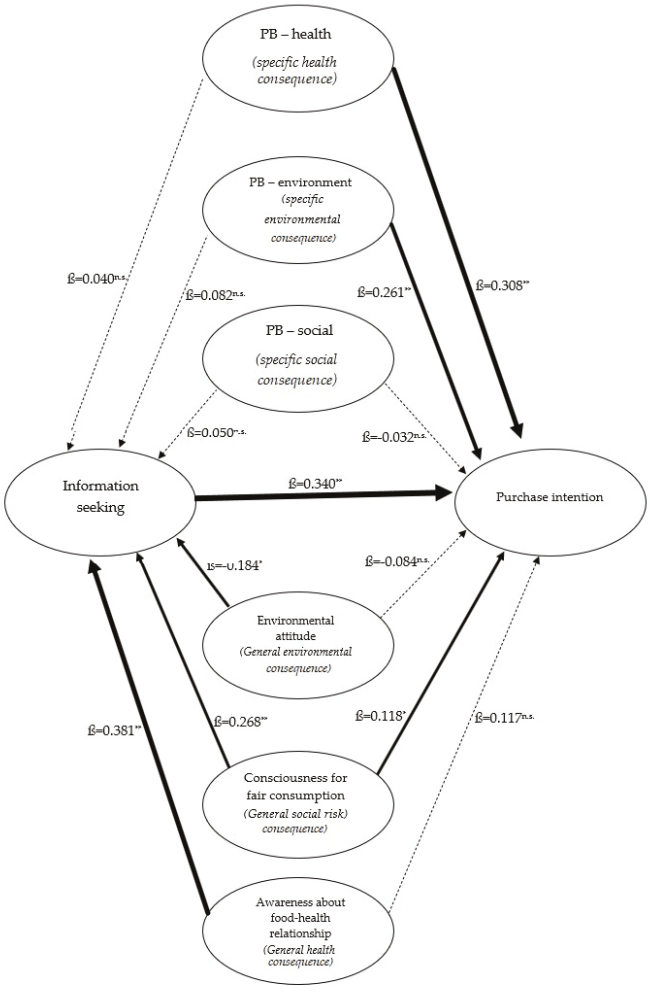

Figure 2. The results of structural equation modeling—direct effect sizes. (* $p < 0.05$, ** $p < 0.01$, n.s.—non-significant).

Although we hypothesized in our fifth hypothesis that the consequences perceived in relation to palm oil would motivate consumers more to seek information about it, we

have demonstrated this effect precisely for the risks perceived in general. That is, even though respondents know little about the effects of palm oil, they tended to start looking for information when they perceived one of the three consequences in general.

5. Discussion

In our study, we explored consumer knowledge about the three consequence types—health, environmental, and social—associated with palm oil, and we assessed the perceptions of these risks. In addition, we used structural equation modeling to examine whether the three risk types had a stronger effect on palm oil-avoiding behavior if they were perceived in general or specifically in association with palm oil.

Of the three outcome types, respondents thought they were the least familiar with social risk, and the most familiar with environmental risk. Only a small proportion of respondents considered the examined palm oil-containing products to be healthy.

Our research is one of the first to examine the purchase intent for palm oil-containing products with the method of structural equation modeling, through the three consequence types associated with palm oil. Information seeking and consumer personal beliefs about palm oil are also included in our model. The addition of this latter element proved to be extremely important in exploring the factors influencing purchase intent for palm oil-free products. All three associated consequences influenced consumers' palm oil-avoiding behavior, but a defining aspect is whether we examined a general or a palm oil-specific risk. The health and environmental outcomes associated specifically with palm oil had a direct effect on purchase intent, while the environmental and health risks perceived in general had an effect only through the mediation of information seeking. In the case of social risk, the model shows the opposite.

Although previous research revealed that the environmental and health effects of palm oil influenced consumers in their purchase intent related to palm oil [14,18,19], our results show that these factors only affect consumers if they perceived them specifically in the context of palm oil. Based on our model, the general and palm oil-specific risk (total effect) that has the strongest influence on palm oil-avoiding consumer behavior is the health risk.

6. Conclusions

Palm oil is the most-used vegetable oil used in the greatest amount in the world, and it is also used in the food industry in many ways due to its beneficial technological properties. At the same time, the production, processing, and consumption of palm oil have brought about consumer resentment. Our research aim was to assess which palm oil-related consequence, whether health, environmental, or social, influenced the purchase intention to buy palm oil-free products the most.

Based on our results, it has market relevance that a food processing company offering palm oil-free products communicates this product feature to consumers. This is because communicating palm oil-freeness gives consumers the opportunity to reduce the negative consumer feelings associated with the production, processing, or consumption of palm oil. Given the importance of the health consequence, palm oil-free products should be positioned among the healthier foods. The communication of individual consequences can be an important part of the communications of companies developing palm oil-free products, but it matters which consequences are mentioned. It is important to assess which general consequence concerns their target group the most: if it is the health or environmental consequence, then the consumer might be made aware either that the potentially harmful health effects of this ingredient can be avoided or that it is more eco-friendly than its palm oil-containing counterparts. As a result of such a statement, these consumers may already begin to gather more information about palm oil. However, if it is the social risk, then consumers could be motivated to gather information about such effects of palm oil production, because it has an impact on consumer behavior only indirectly, through information seeking.

7. Limitations and Further Research

Although the explanatory power of the model is already quite high for consumer research (adjusted R^2 = 0.597), further research should explore other factors that may influence consumers, for example by including the elements of the theory of planned behavior [53] or the food-related lifestyle model [54,55] and expanding on the model.

Our results suggest that it would benefit food processing companies to place palm oil-free information or a logo on their products. However, the importance of such a sign is questionable in an over-communicated environment where consumers already have to consider a number of factors on the packaging [56]

Our research does not separately address the perception of palm oil coming from sustainable sources. It would be worthwhile to examine it with the factors influencing purchase intention used in the present study.

Our study is not based on a representative sample, so further research should test the model on such a sample, too. Also, our sample was limited to one country, and it would be important to investigate the importance of the individual factors in an international comparison.

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Sustainable Consumption of Food: Framing the Concept through Turkish Expert Opinions

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Abstract: The scarcity of natural resources together with the exponentially increasing world population has made the sustainable consumption of food (SCF) a crucial issue, as it has impacts on a variety of environmental, health, economic, and social dimensions. Considering the rarity of a holistic view in previous studies, this study aims to assess the current situation in sustainable food consumption and develop suggestions from all aspects, depending on the opinions of experts. In this direction, semi-structured interviews are conducted with 25 experts from Turkey to frame the concept of SCF, reveal the level of consumers' awareness, and provide suggestions to support SCF implications. Experts have considered SCF from ecologic, social, economic, and health perspectives; ecologic aspects being the most important, followed by economic and social perspectives. Deficits on the consumer side are lack of awareness, unplanned shopping, and mistakes in post-consumption behavior. Lack of awareness about the consequences of meat production, difficulties in changing lifestyles and lack of motivation of adults were identified barriers to SCF. Finally, suggestions of the experts for achieving sustainability are mostly relevant to raising awareness on balanced nutrition and food waste, with the help of training programs and the efficient use of communication channels, such as social media.

Keywords: sustainable food consumption; food waste; consumer behavior; theoretical framework; sustainability

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1. Introduction

Sustainability is a key concept for individuals, organizations and societies as well as future generations to survive. Thus, clarification of this concept, which is the aim of this study, becomes more important with the increase in world population. In line with this fact, the 2030 Agenda for Sustainable Development provides a global blueprint for dignity, peace, and prosperity for people and the planet, now and in the future. At its heart are the 17 Sustainable Development Goals (SDGs) as an urgent call to action by all countries—developed and developing—in a global partnership. The fact that food is the basic resource for life highlights the need for a comprehensive goal that can be achieved by reducing food waste, promoting healthy and balanced nutrition, raising awareness of the society on responsible food consumption and developing policies on food consumption by regulatory authorities in connection with ensuring the sustainability of food consumption. Therefore, ensuring sustainable food consumption can also be seen as a generic goal that can be supported by almost all SDGs. Among all SDGs that are related to food in the context of responsible consumption, SDG 12—Ensure sustainable consumption and production patterns—is the most relevant.

According to the Sustainable Development Goals Report 2018, which was prepared by the United Nations [1], by 2018, 108 countries had national policies on sustainable consumption and production. People rely on such materials to meet basic needs for food, clothing, water, shelter, infrastructure, and many other aspects of life. Across much of the developing world, an increase in the material footprint is required to enhance the living standards of growing populations. At the same time, it is important to decrease reliance on raw materials and increase their recycling to reduce environmental pressure and impact [2].

In addition, SDG 2—Zero Hunger, SDG 3—Health, and SDG 4—Education can also be clearly associated with ensuring the sustainability of food consumption. It also constitutes a reference point for the achievement of SDG 2, as reducing food waste through sustainable food consumption will facilitate the fight against hunger and ensuring food security. At the same time, ensuring healthy lives and promoting well-being, which is the basis of SDG 3, is in a tight relationship with nutritional behaviors, which is a dimension of sustainable food consumption. Therefore, the components of sustainable food consumption such as balanced diet, conscious consumption and environmental protection will only be possible with the development and dissemination of effective education programs, raising universal awareness and realizing actions that will create behavioral change in people, thus supporting the goals of SDG 4.

Certainly, the sustainable consumption of food (SCF) is one of the most important issues of recent years. Over the last few years, many studies have revealed the dramatic view of food loss and waste for many countries and identified this as a global problem. Food consumption accounts for almost one-third of households' total environmental impact [3] and is thus of prime importance. These environmental impacts include climate change, soil degradation, water pollution, water scarcity, loss of habitats, and biodiversity. Food waste entails unnecessarily used resources, such as water, cropland, fertilizers, or fossil fuels, as well as greenhouse gas (GHG) emissions [4]. In the report of the Institute for Climate Economics, Rogissart et al. [5] estimated that GHG emissions from food consumption in 2010 were around 28% of global emissions with 13.8 GtCO2e (±3.6 GteqCO2). Around 75% of GHGs are emitted during the production phase, 15% between the farm gate and the retail store, and 10% after retail. Similarly, Sandström et al. [6] confirmed that the food consumption of European Union (EU-28) countries' citizens generated 540 MtCO2 eq in 2010, including land-use changes. Barrett and Scott [7] suggested that GHG emissions can be reduced significantly through changes in the food sector. The European Commission [8] stated that the food sector was the cause of approximately 22% of global warming in Europe.

In terms of the total world population, in some regions people suffer from hunger and poor nutrition because of the inaccessibility of safe food and water [9,10]. On the other hand, in some other regions people are overweight or obese and still have an increasing tendency to dietary shifts toward more sugar, animal protein, and trans fats [11]. There are approximately 155 million overweight or obese children on this planet, whereas 148 million children are undernourished [12]. To achieve sustainability in food consumption, food security and food safety issues should be considered together for both under- and over-consumption regions. Additionally, policymakers should pay more attention to complex interdependencies along the food chain and the complexities of modern global food systems [11].

There is also a moral aspect of the sustainable consumption of food because consumers are assumed to feel guilty or uneasy about wasting food [13–15]. However, in a recent study, Watson and Meah [16] report that consumers are not conscious of the environmental impacts of food waste, and only a few accept social impact as a reason for feeling guilty about their food waste. Additionally, the most important drivers for consumers that prevent food waste are found to be time and money. Nevertheless, food consumption is not only an environmental and economic problem but also a social and ethical one. According to Ayala [17], the perception of needs and desires; understanding of quality of life, progress, growth, and development in society; as well as cultural and ethical values, which are linked to consumption patterns, need to be emphasized.

There are some indexes that evaluate the countries according to food sustainability indicators. One of these indexes is the Food Sustainability Index (FSI). The FSI ranks 67 countries in terms of the sustainability of food systems. Environmental, social, and economic performance indicators are the three key indicators of this index. This index, which evaluates this concept in the three categories of "food loss and waste," "sustainable agriculture," and "nutritional challenges," was formed by qualitative and quantitative evaluations of 38 indicators and 90 individual scales. France is in first place among 35 high-income countries in the 2018 edition of the FSI, followed by the Netherlands and Canada. In this index, Turkey is ranked as 58th out of 67 countries [18].

The sustainable consumption of food has become one of the key priorities of national strategies and policies. The 2013–2017 Strategic Plan of Ministry of Food, Agriculture and Livestock of Turkey identifies three main missions—ensuring access to safe food and high-quality agriculture products, which are demanded by Turkish and global markets; ensuring sustainable usage of agricultural and ecological resources; and determining and implementing policies to increase the standard of living in rural areas [19].

At this point, it is essential to reveal how sustainable consumption is perceived by experts who are related to SCF. The opinions and suggestions of the experts are so important and remarkable due to their impact and their leadership and regulatory roles in the field of SCF. Despite the existence of many prior studies, no study examines in a holistic approach the scope, dimensions, features, challenges, barriers, and strategies to promote the sustainable consumption of food. In particular, the concept was studied with many different angles. However, these studies have mostly investigated the various aspects of the concept from a consumer perspective. This situation points out the deficiency in revealing the perspectives and views of the experts in the field, which is another crucial aspect of the topic. It is believed that providing an in-depth explanation of sustainable food consumption can only be possible using a qualitative methodology. This study sets out to fill this gap and present the advantage of a suitable methodological framework by using qualitative research. Offering a comprehensive point of view by experts from various fields, such as academia, non-governmental organizations (NGOs), governmental bodies, and industry, will make the concept of SCF easier to understand and evaluate. Thus, this study aims to do the following: (i) explore all aspects of SCF to reveal a framework that considers a holistic perspective, (ii) discuss the details of each element for providing a theoretical foundation, and (iii) reveal the concept of SCF within the framework of consumers from the perspective of experts.

2. Theoretical Background

2.1. Sustainable Development and Consumption

The concept of sustainability is accepted as an important issue to examine by a variety of disciplines, such as economics, marketing, and environmental sciences. Nkamnebe [20] defines sustainability as " . . . a global approach towards securing lasting welfare for the entire human race." It has primarily risen from environmental or ecological aspects, followed by economic, social, and political dimensions [21]. Within this framework, sustainable development represents development that meets the present needs without compromising the abilities of future generations to meet their needs [22]. However, it is possible only through the integration of environmental, economic, and social components of development [23]. In terms of sustainable development, sustainable solutions should protect social equity; respect cultural pluralism; be ecologically sound and economically viable; be based on science, which considers the material and non-material bases of life equally; adapt to technologic developments; and be designed to empower and develop human capacity and potential. Sustainable development aims to find a balance amongst these objectives [24]. With the widespread objectives and scope of sustainability, sustainable consumption is an important topic that has attracted much attention in research and industry.

In the marketing context, sustainable consumption is mostly discussed from economic and societal aspects. Wolff and Schönherr [25] define sustainable consumption as

a socially and ecologically concerned way of buying, using, and disposing of goods and services. From a more comprehensive and analytical perspective, it covers the complex social, economic, and political drivers of global environmental change, including global climate change [26]. Thus, the focus is on a resource-efficient and low carbon economy. Lee [27] also suggests that ecological and socially responsible citizens make their private consumption decisions focusing on environmental concerns. Kymäläinen et al. [28] focus on Generation Z, the future consumers, and their habits relating to sustainable food consumption, and suggest that the consumption behavior in the future can be associated with large-scale global concerns relating to sustainability, intertemporal consumer choices and life cycle models. They found that the attitudes of younger generations towards sustainable food consumption came from their families and that their spontaneous lifestyles made it difficult to manage their food waste behaviors. Additionally, the economic factors, e.g., price, are found to be more important than the environmental aspects, so that studying their attitudes required a business perspective. According to Jones et al. [29], sustainable consumption requires an integrated approach including the individuals' consumption decisions, marketers' business policies, and authorities' supervision and monitoring. Finally, Balan [30] focuses on retailers' role in engaging consumers in sustainable consumption and states that retailers must accomplish consumers and shoppers during the entire chain from awareness creation to waste reduction. The retailers are supposed to have many effective tools to engage consumers in sustainability, such as merchandising techniques, assistance to consumers throughout the sales process, promotions, etc., in order to provide sustainable choices to consumers, staging shopping experiences that enable consumers to make sustainable choices, reshaping norms to foster sustainable consumption, etc. [30].

Although it is not explored and well defined yet, sustainable consumption has three main aspects: caring for the environment, considering the needs of future generations, and meeting basic needs wisely. In studies such as Vermeir and Verbeke [31], sustainability is explained with the combination of economic, ecological, and social aspects. Furthermore, from the consumers' point of view, sustainable consumption incorporates attitudinal, cognitive, and behavioral aspects. While attitudes, beliefs, and knowledge about food are suggested to influence the food consumption choices, according to Wongprawmas et al. [32], personality, social groups, and socio-cultural position of individuals cause differences in the effects these factors create on them. In other words, sustainable consumption practices cannot be assured only by the behavioral aspect; it also requires individuals' positive intention and deep commitment [33]. Thus, there is no exact consensus on the aspects of sustainable consumption in the existing literature.

2.2. Sustainable Food Consumption: Concept, Aspects, Challenges, and Strategies

In terms of the politics regarding sustainable consumption and production, food consumption is a major issue with its impact on the environment, individual and public health, social cohesion, and the economy. The sustainable consumption of food has been studied using various approaches. Some studies focused on meat consumption [34–37] and organic foods [38,39], while many others include environmental impact [40,41] and nutrition and health [42–45]. Some others have studied psychosocial determinants [46,47] as well as challenges and barriers [11,48]. Food consumption behavior on an individual level is mostly affected by cultural traditions, norms, fashion, and physiological needs. Grunert and Juhl [49] found that environmentally concerned people are more likely to buy more sustainable foods. Similarly, Nguyen et al. [39] also state that consumers with greater environmental concern are more likely to engage in environmentally friendly behaviors. Additionally, personal experiences such as tastes, health, and exposures, such as the availability of foodstuff, are other determinants. Furthermore, affordability, time availability, and household decision-making are effective in food consumption choices. Wongprawmas et al. [32] have also researched the determinants of food consumption choice and classified the factors as biological determinants (e.g., hunger, appetite, and taste), psychological determinants (e.g., mood, stress, and guilt), physiological determinants (e.g., access, education,

and time), social determinants (e.g., culture, family, and peers), and economic determinants (e.g., cost, income, and availability). In addition, restricted food, green consumption, local consumption, and meat and protein substitutes are the derived factors for sustainable food consumption [50]. In demographic characteristics of households' context, there are remarkable differences in terms of age as well as gender. For example, women tend to behave more sustainably [51–53]. In terms of age, there are controversial findings in the literature. For instance, Verain et al. [54] revealed that consumers with a less sustainable lifestyle are younger, while Azzurra et al. [51] found older people tend to be low-intensity consumers. Using these behavioral and demographic factors, some studies determined consumer typologies. De Barcellos et al. [55] identified consumer clusters of indifferents, environmentally conscious, or sustainability-oriented citizens, while Bulut et al. [56] classify consumers as "indifferents", "sustainability enthusiasts", or "sustainability pioneers".

One of the primary consumption areas that has the largest impact on the environment is food consumption, which creates almost one-third of households' total environmental impact [3]. A Life Cycle Assessment (LCA) defines the environmental impacts as an open loop with an approach called "cradle-to-grave." LCA is suggested to be associated with only environmental components such as emissions, resource consumption, and environmental and health impacts associated with processes, products, or activities over their entire life cycles [57,58]. Consumers' behaviors during the handling and preparation stages also cause environmental impacts, through storage, cooking, and dishwashing. In addition, consumers affect the environment with their nutrition styles and diets. It is proven by many researchers that consumers are either unaware of or underestimating the relationship between food consumption and climate change [59–63]. In the study of Truelove and Parks [62], a survey performed in the US found that only 10% have associated meat consumption with climate change. According to the study of Lea and Worsley [60], 22% of respondents in Australia believe that it would provide an environmental benefit to consume less meat. Heiskanen et al. [64] highlighted the role of education to promote sustainable consumption. There is no doubt that nutrition lifestyle not only has an impact on our health but also on the health of the planet. However, these prior studies have focused on the impact of food consumption on the environment. They are limited in explaining the influence of consumers' knowledge and awareness on avoiding the unsustainable consumption of food.

As a measure of how consumers' activities affect the environment and sustainability from different aspects, knowledge of different types of footprints is important because footprints are the quantitative expressions of the appropriation of natural resources by humans [65]. Herva et al. [66] proposed the ecological and carbon footprints to be the most appealing indicators for enterprises. As an addition to this study, the OPEN: EU Project within the Seventh Framework Program has extended the integrated footprint family by adding the water footprint in collaboration with an environmentally extended multiregional input-output (MRIO) model [67]. The existing literature also accepts these three footprints (ecological, carbon, and water) as the most important indicators together with the energy footprint because they refer to four worldwide concerns over threats to human society: food security, energy security, climate security, and water security [68].

Apart from environmental issues, many factors are identified in the literature in terms of motives and barriers to the sustainable consumption of food. Nutrition, health consciousness, social identity, concern for farmers, ethical concerns, food security, perceived availability, store reputation, and concerns about animal welfare are among the factors that influence the purchase of sustainable products, whereas high prices, time limit, access, lack of information, trust in labelling, limited marketing communication, and unawareness of environmental impact are the main barriers [61,69–73]. More specifically, Sidali et al. [74] found five main motivations of consumers toward sustainable foods: ethical attributes, naturalness, health-related aspects, terroir, and innovation. On the other hand, Gorgitano and Sodano [75] defined three main obstacles: the rebound effect, the knowledge-action gap, and the behavior-impact gap, which are limiting the sustainable consumption of food.

At the individual level, lack of planning and purchasing, shopping routines, and lack of knowledge about the storage, preparation, and reuse of food were defined as the major causes of the unsustainability of food [15,76].

At this point, two broad behavioral strategies toward sustainable food consumption can be distinguished. The first strategy is to make sustainable product choices concerning the way the product is produced, such as organic, free-range, or fair-trade products. The second strategy is to choose sustainable dietary patterns concerning dietary composition, consumption curtailment, and reduced quantity within product categories such as reduced meat consumption [54]. In addition, consumer behavior is also affected by perceptual biases, such as the halo effect, where products that are perceived as ecological are also perceived as better in other aspects, such as nutrition, health, etc. For example, an eco-labeled product may not only taste better and have a smaller environmental impact than the non-labeled alternative, but it is also perceived to be healthier [77]. This situation also reflects the fact that consumers may have limited factual knowledge about the environmental impact (footprint) of food [78]. Another bias is "compensatory green beliefs," according to which some consumers feel that every individual is entitled to a certain budget of resources, so that savings in some resources gives them the right to offset by consuming more of other resources (or increasing waste), within the limits of this budget. Combined with the "negative footprint illusion," this idea most likely causes consumers to engage in acts of green consumption without actually lowering their total environmental impact [41]. Despite the huge body of psychological, sociological, and anthropological literature about consumer behavior, there is still confusion about how to induce long-term behavior changes for a healthier and more sustainable lifestyle. Nudging consumers toward a more sustainable lifestyle seems to be promising, but it still needs more research for specific guidelines for practitioners [79,80].

3. Food Consumption in Turkey

While the animal-based food consumption is at the center of the nutrition patterns in developed countries, according to Food and Agriculture Organization of the United Nations (FAO) [81], the consumption of grain and grain products is ranked as the most consumed food groups in Turkey. Additionally, red meat is consumed as the main source of animal protein in Turkey, especially lamp and beef. According to the Ministry of Agriculture and Forestry Agricultural Economic and Policy Development Institute (TEPGE) (2020), red meat consumption per capita in Turkey is lower than in developed countries. However, when the consumption of red meat in the last five years is examined, it shows that the annual consumption per person is increasing [82]. In addition, in terms of fruit consumption Turkish consumers do not eat sufficient amounts compared to developed countries, although Turkey is one of the leading fruit producers worldwide [83].

However, Turkey has a diverse consumption pattern, mostly depending on cultural, demographic and geographical aspects. Besides, Turkey still has significant changes in food consumption patterns in recent years. The most influential factors related to these changes are urbanization, migration to big cities, the rising share of women in the labor force, changes in socio-economic and demographic factors, developments in technology, and increased consumption of ready-made food. Especially the increase in female labor force triggered the transformation of consumption patterns towards ready-made foods. The changes experienced in recent years have also affected the eating habits of consumers and the demand for animal products over time due to changes in income level, purchasing power, and social status of the consumer. For example, as the income level has increased, carbohydrate foods have been replaced by protein foods, to some extent [84].

In terms of household expenditures, the food expenditures have gained a higher share day-by-day. Households spend 20.8% of their expenditures on food. However, this increase in spending resulted in increased food waste as well. As food waste is mostly generated at household level, consumer food waste is of major concern [28,85,86]. According to The United Nations Environment Programme (UNEP) report, Turkey has 93 kg waste per

capita yearly, and this is about 30% more than the global average of 74 kg per capita of food wasted each year [81]. Out of all EU-27 countries, Luxembourg has the highest food waste at household level with 54.4 kg per capita, and the Netherlands has the lowest with 28.2 kg, to put the Turkish food waste into context [85]. Similarly, the Food Sustainability Index (FSI) developed by the Barilla Centre for Food and Nutrition Foundation (BCFN), in cooperation with The Economist Intelligence Unit, ranks Turkey as 57th out of 67 countries considered [18]. France, the Netherlands and Canada are leading countries in this index. Russia, Bulgaria and the United Arab Emirates are ranked at the end [18].

In this context, the food sustainability scores of Turkish people are found to be relatively low compared to other countries, especially because of very low scores on food loss and waste. On the other hand, Turkey is ranked as 33rd with a more-than-average score in terms of the nutritional challenges dimension of FSI, with the sub-dimensions quality of life (32nd in 67), life expectancy (43rd in 67) and dietary patterns (47th in 67) [18].

4. Materials and Methods

The data for this study were collected as part of an EU Project, which focuses on changing adults' behavior toward the sustainable consumption of food. The data collection process was conducted by using a semi-structured interview format, which included related questions about SCF. The main data collection form consists of a set of questions relating to the definition of SCF, concepts and aspects of SCF, knowledge and awareness of consumers about SCF, challenges and carriers in SCFs, and strategies and suggestions for SCF. The following questions were asked:

- How do you define the concept of SCF?
- Which dimension would you apply to evaluate the concept of sustainable food consumption?
- How much are adults aware and how much do they know about sustainable food consumption? Please answer this in respect to the knowledge and awareness of different social classes.
- What are (if any) the obstacles that hinder adults to change their food consumption habits?
- When you compare the recommendations for sustainable food consumption with everyday food consumption habits, where is the biggest discrepancy between recommended food consumption and actual food consumption? Or in other words, what food habit should consumers change first to have the biggest positive effect on sustainability?
- What are your suggestions to enhance the current food consumption habits of adults?
- What are your suggestions to adults to achieve sustainable food consumption; before purchase, during preparation and consumption and after consumption of food products?
- Which communication channels do you think are more effective in sharing information about sustainability and food?

These interview questions were formulated by the authors based on a literature review. Before they were finalized, the questions were also assessed by three academics, two food engineers, and two sustainability experts from the private sector. Two questions were revised according to their suggestions. In addition, interviewers were encouraged to be flexible about asking some additional open-ended questions to main questions. These follow-up questions and communication between interviewees and interviewers served to obtain answers about the concept in detail.

The snowball sampling method was used in this study. To contact the first participants from different areas and professions, various ways were followed. To select interviewees from academics and the civil sector, participant lists of conferences in the field of sustainable consumption and food were used. Academics and professionals from NGOs who attended these scientific meetings and presented their studies were invited via e-mail to join the study. To invite participants from the business and governmental sector, mostly different social media channels have been used. Their shared materials, such as photos, tweets, texts, etc., and their followers and networks were analyzed. Additionally, some social

media tags related to sustainability and food, such as sustainable consumption, food consumption, etc., have been defined, and people who share content by adding these tags have been specified. They were reached via e-mail and social media messaging platforms and asked to join the research. In addition, national authorities on consumption and food from the Chamber of Food Engineers, the Ministry of Agriculture and Forestry, the Izmir Metropolitan Municipality, etc., were reached and interviewed. Once a participant had been interviewed, other related experts were asked by that participant to extend the sample. In total, 32 experts were invited to attend the study to answer the interview questions. Three of them did not answer, and four of them replied that they were not able to join the study. Interviews were conducted with 25 Turkish experts whose works or professions were linked to SCF. The expert panel includes seven academics, nine businesspeople, three civils, and six people from the state. The civils include two participant from NGOs, whose area of interest is to decrease/eliminate food waste and raising awareness for environmental issues. Additionally, an influencer who dedicates himself/herself to attracting the attention of many people on zero waste and sustainability issues is included as one of the civil participants. As we have selected sub-samples from four different professional areas, the sampling gives the opportunity to have a more comprehensive point of view. A diagram of the sampling process is shown in Figure 1.

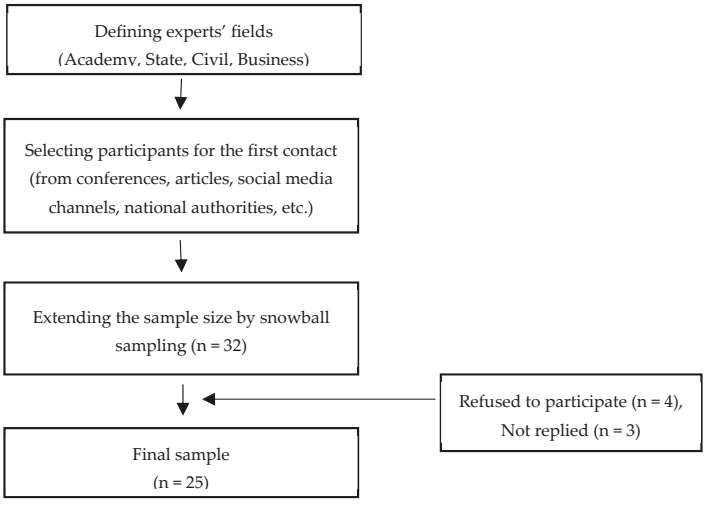

Figure 1. Diagram of Sampling Process.

Interviews were conducted in March and June 2019, mainly via face-to-face conversations, and a few interviewees were reached through video conferences and telephone calls. They were given general information about the research and their support was requested. The average duration of the interviews was 61 min (range 37–79 min). Detailed information about the experts and the interviews is presented in Table 1.

Table 1. Characteristics of the Sample.

Interviewee	Code	Gender	Age	Interview Type	Profession
Academic 1	P1	F	37	Face-to-face	Marketing
Academic 2	P2	F	35	Video Call	Food Engineer
Academic 3	P3	F	46	Face-to-face	Environmental Engineer
Academic 4	P4	M	40	Face-to-face	Food Engineer
Academic 5	P5	M	57	Face-to-face	Business and Management
Academic 6	P6	F	41	Telephone	Environmental Engineer
Academic 7	P7	M	40	Telephone	Gastronomy
Business 1	P8	F	55	Face-to-face	Consultant
Business 2	P9	F	39	Face-to-face	Manager
Business 3	P10	M	42	Face-to-face	Food Engineer
Business 4	P11	F	29	Face-to-face	Dietitian
Business 5	P12	M	30	Telephone	Food Engineer
Business 6	P13	M	49	Face-to-face	Food Engineer
Business 7	P14	M	42	Face-to-face	Dietitian
Business 8	P15	M	41	Face-to-face	Dietitian
Business 9	P16	M	37	Face-to-face	Dietitian
Civil 1	P17	M	28	Face-to-face	Blogger and Influencer
Civil 2	P18	M	45	Face-to-face	NGO's Agent
Civil 3	P19	M	41	Face-to-face	NGO's Agent
State 1	P20	F	39	Face-to-face	Health Manager
State 2	P21	M	45	Face-to-face	Civil Servant
State 3	P22	M	44	Video Call	Civil Servant
State 4	P23	M	42	Video Call	Agriculture and Livestock
State 5	P24	M	35	Face-to-face	Civil Servant
State 6	P25	F	36	Video Call	Inspector

The results section summarizes the responses of experts to the predetermined questions and follow-up questions in a semi-structured interview format. Once all interviews were completed, three researchers encrypted the interview forms independently, according to the main subjects: definition, concept and aspects, knowledge and awareness, challenges and barriers, and strategies and suggestions. Researchers also selected the specific expressions in each main subject. Furthermore, these researchers have drawn the frames for SCF. Finally, another researcher controlled the encryption forms and frames and then created the final framework of SCF according to the common findings. This frame can be seen in Figure 2.

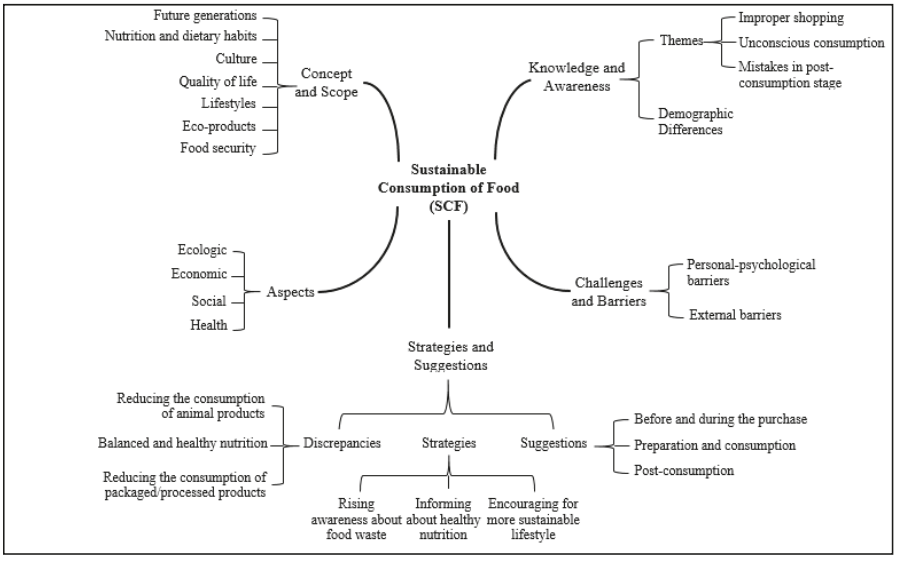

Figure 2. The Framework of Sustainable Consumption of Food (SCF).

5. Results

The results consist of four parts: first, we have explored the experts' understanding of the sustainable consumption of food (SCF). Second, experts provided their opinions on consumers' level of knowledge and awareness about the sustainable consumption of food, based on consumers' demographic and social profiles. Third, they formulated the challenges and barriers that hinder consumers' sustainable consumption of food behavior. Fourth, they proposed suggestions on changing consumption habits, recommendations on adults' behavior, and communication strategies for disseminating ideas about more sustainable consumption of food. In the following sections, findings from the interviews with 25 Turkish experts are structured according to the final coding and illustrated by interviewees' specific statements.

5.1. Definition, Concept, and Aspects of Sustainable Consumption of Food (SCF)

At the beginning of each individual interview, we invited participants to discuss how they defined the concept of sustainable consumption of food. Participants were allowed to create their own definitions of the concept. This enabled us to reveal the various aspects, dimensions, and scope of the concept. This allowed the concept to be handled and investigated in the widest form by experts. The majority of the interviewed experts represented a shared understanding of SCF as the realization of food consumption in a way that will not harm future generations.

> *Principles that can ensure that the world population can nourish without harming the ecosystem today and that the next generations can live with a healthy and sufficient diet without having trouble in accessing food.*
>
> (P4, M, 40)

> *It is the process of creating consumers, who absorb sustainability at the cultural level in order to leave a cleaner, more livable world to the next generations by converting the wastes arising from the consumption of food as much as possible or making the wastes that cannot be reduced to be reused by recycling.*
>
> (P5, M, 57)

Consumption with zero waste philosophy considering the future generations and the status of food sources.

(P19, M, 41)

In particular, several interviewees described different ways of SCF; no one associated the concept with excess purchases of food.

It is to reach the food that is provided with hygienic conditions that will provide adequate and balanced nutrition, whenever and wherever it is needed, and to ensure its continuity.

(P12, M, 30)

Protection of food from production to consumption.

(P21, M, 45)

Balancing production and consumption by using raw materials and natural resources effectively.

(P10, M, 42)

Appropriate preparation and consumption of food that is least harmful to the environment.

(P17, M, 28)

A waste preventing diet.

(P11, F, 29)

Experts emphasized that sustainable food consumption can be realized by changing dietary habits, and that the new habits acquired should be compatible with the culture. There is a need for consumers who have digested the sustainability concept at the cultural level to achieve SCF. Apart from consumption habits and culture, other concepts associated with and included in the scope of SCF were quality of life, lifestyles, and eco-products. More than half of the interviewees mentioned these concepts when identifying SCF. In addition, there is a consensus among experts that SCF also includes the concept of food security, which was mostly defined as ensuring the continuity of consumers' access to healthy, nutritious, safe, and adequate food.

Interviewees classified aspects of SCF in two different ways. A group of experts defined "ecological," "economic," "social," and "health" aspects, while another group divided them further into sub-dimensions, without naming them, and made their explanations accordingly. When interpreting the answers, these two perspectives were evaluated together. Evaluations revealed that the ecological aspects and related issues emerged as the most important aspects by almost all experts (96%). Important issues related to the ecological aspects of SCF are natural resources and energy use, waste management, the production of carbon footprints, water footprint, the packaging of food (recycled packaging, etc.), positive impacts of consumption of products in season, and local producers' supply on the environment. The environmental impact was generally emphasized by the experts in addition to the ecological effects of food products from the production stage onwards. In fact, it was underlined that SCF started at the production stage. In particular, experts working in the food production departments of agro-based industrial enterprises stated the negative effects of pesticides and harmful chemicals used in the production process. Experts stated that since the environmental impacts of food consumption cannot be cancelled out due to production, procurement processes, and consumption habits, food consumption should be carried out in a way to give the least harm to the environment.

Increasing consumption of local and seasonal foods may be a broad-impact solution for sustainable consumption of food.

(P24, M, 35)

The ecologic motivation behind sustainable consumption, according to me, consists of the preference of ecologic foods and the consumption of renewable natural resources and products.

(P3, F, 46)

> *These are individuals who especially care about the environmentalist perspective, and those who can think of the future of their own children. For example, I can say that individuals expecting a child care more about natural nutrition and pay more attention to environmental problems. Apart from that, I do not think that people from the perspective of "The whole world, the entire universe, all living things exist only for the happiness of people" have sustainable food consumption consciousness.*
>
> (P20, F, 39)

The ecological aspects of SCF were followed by economic and social aspects. In the context of economic aspects, it is emphasized to make appropriate, better quality, and healthier food products available for a reasonable price for everybody. Moreover, the current imbalance of food distribution and wastage was frequently mentioned. It was stated that the regional development will accelerate, distribution costs will be eliminated, and the cost of the products will decrease with the intensification of purchases from local producers. It is also stated that sustainable food consumption has significant economic effects for all stakeholders involved in food production and consumption processes.

> *Consumers' preference for packaged food products is effective in decreasing the number of small agricultural businesses and agricultural land. The increase in the number of concrete buildings replacing the agricultural land causes climate change. This problem reveals the effects of unconscious food consumption in the social, economic, and ecological dimensions.*
>
> (P6, F, 41)

In the social dimension, it is stated that sustainable food consumption processes will create more informed and conscious consumers, which in turn will eliminate the injustice among the societies with high food wastage and the societies that suffer from hunger.

> *Individual actions on sustainable food consumption can be effective in combating the hunger problem in the world if it is persistent and consistent enough to mobilize public actions. However, if individual movements do not turn into social movements, they are not effective. In this sense, it will be ensured that individual efforts will be transformed into a movement of society and cause changes in food and agriculture policies by influencing policymakers.*
>
> (P1, F, 37)

However, none of the participants addressed issues such as fair working conditions (fairness, fair trade, fair payment), individual well-being, societies' development, values, identity-seeking, quality of life, lifestyles, etc. On the dimension of health, participants stated that sustainable food consumption will lead to food safety in the production, harvesting, storage, transportation, processing, and distribution of food. SCF will also enable individuals to have healthy eating habits, healthier generations to emerge, and chronic and nutritional diseases to be reduced.

> *There should be a change in issues such as consumption of local and seasonal foods, avoiding fast food, decreasing the serving size, increasing the welfare of the society for access to healthy food, balanced nutrition, slow eating, planned shopping, re-utilization, and minimization of waste.*
>
> (P14, M, 42)

> *Vegetable food is the most sustainable food among all types of food, and they have many health benefits in terms of vitamins, minerals, pulp, healthy carbohydrates, and antioxidants. Therefore, consumers should consume natural food products and more vegetable food, which will be effective in reducing the risk of diseases such as cardiovascular diseases, digestive system diseases, and cancer.*
>
> (P7, M, 40)

> *SCF would increase the agricultural practices without medicines, reduce the consumption of food products with high environmental impact, and reduce the demand for processed*

products . . . all these would have significant positive effects on public health in the long term.

(P20, F, 39)

Many of the interviewees specified that the aspects of SCF should be taken into consideration within a comprehensive approach. Experts generally indicated the relation between ecologic and health issues. Although aspects of the concept were asked in the question, the experts made some suggestions additionally in the context of SCF. Besides, the most emphasized suggestions were about the prevention of food waste.

It should be evaluated with its ecological and economic dimensions and with a holistic perspective. The priority should be the ecology dimension. Then the individual should evaluate his economic interaction from a holistic perspective. Continuation of all species without harm should be the main goal.

(P5, M, 57)

Reducing the consumption of products that are packaged, processed, and include an additive, which threatens both human health and the environment, is a must.

(P8, F, 55)

Individuals should be aware of the nutrients they need and change their eating habits through balanced and healthy nutrition programs . . . the daily share of consumption of both healthy and less environmental impact products like a legume, cereal, fruit, and vegetables can be increased in overall food consumption.

(P16, M, 37)

5.2. Knowledge and Awareness of Consumers about SCF

Almost all interviewees stated that the knowledge and awareness levels of adults about SCF were insufficient. Around two-thirds of the interviewees indicated that most adults lack basic knowledge about sustainable consumption. Three themes emerged in the interviewees' discussion about the knowledge of consumers: improper shopping, unconscious consumption, and mistakes in post-consumption behavior. The lack of knowledge about reading labels such as confusing best before dates and expiry dates or thinking that the two are the same, the size of the packaging of the products, not making a shopping list, and unplanned shopping, such as buying more than needed or impulsive buying, were the main indicators of improper shopping. Unplanned shopping is mentioned as the first by 20 of the 25 experts.

Individuals go shopping without planning their purchases and therefore they could buy more than they needed, even products that they don't need at all . . . this is actually very basic information, and they have to adapt to their daily life.

(P17, M, 28)

. . . a lot of people buy more food than they can consume and then throw it out . . . they are not able to estimate the real amount of food they need, and they do not consider costs for food as very high, so they buy not only rationally but emotionally.

(P1, F, 37)

More than 50% of the interviewees indicated that consumers did not store food products under appropriate conditions or that they did not know the appropriate storage conditions for products. This is the primary statement mentioned in the theme of unconscious consumption. The size of the servings, the lack of time to cook due to intense work pressure, the deterioration of the food products purchased, the expiration of the shelf-life, and the loss and wasting of food during preparation and cooking were stated as other indicators of the lack of knowledge and awareness about SCF.

Unconscious consumption occurs as food loss and waste. Natural resources on earth are limited, and the foods that are over-produced and disposed causes the inefficient use of

these resources. Also, this causes a negative impact on the environment and climate by polluting the atmosphere and global warming.

(P6, F, 41)

I think the level of awareness of adults on this issue is very poor. There are many data supporting this idea. For example, annual bread waste, food waste amounts, obesity frequencies, and results of research studies.

(P23, M, 42)

However, almost half of the interviewees opposed this view and stated that individuals are becoming more conscious day by day and that the positive results of these developments have started to appear. Nevertheless, they stated that the level of consciousness is not too high considering the scope of SCF behavior. For this reason, these seemingly contradictory opinions were evaluated together and gathered in the theme of unconscious consumption.

The level of awareness of adults is increasing day by day, and accordingly, searches for information continue. Nowadays, access to information is very easy, but information pollution is equally high. Therefore, even if the level of consciousness of adults is rapidly increasing, they can acquire wrong consumption habits due to the wrong information they obtain.

(P15, M, 41)

When the current consumption models are examined, we can say that there is an increase in the level of knowledge and awareness thanks to the developments in the field of gastronomy. I can state that there is an increase in the level of consciousness in young adults with progressing age, where the fast food habit is at the forefront.

(P16, M, 37)

The lack of sufficient effort to utilize the remaining products is the most emphasized issue about post-consumption behavior mistakes. Lack of knowledge about composting and re-using of excess foods and the low-level of awareness about sharing foods with people in need were other determinants of mistakes in post-consumption behavior.

Although the experts did not specify sharp differences between social classes, they pointed out the difference between the levels of knowledge and consciousness of consumers with demographically different characteristics. The first comparison was between younger and older adults. There are two points that they have drawn attention to. One of them is the detection of food waste.

Older adults behave more sensitive to avoid waste and try to utilize their products in different ways, as much as possible. However, young adults are not stated as sensitive about waste as older adults.

(P9, F, 39)

Young adults have more fast-food habits, and older adults have more cooking and consuming habits at home.

(P11, F, 29)

The second subject that demographically compared the adults was related to whether they had children or not. Adults with children are found to seek more information and are more sensitive to food safety, healthy nutrition, production processes of foods, and environmental impacts compared to adults with no children. From the education perspective, it is stated that academic studies are still not sufficient, although they increase the information sources available to consumers. On the other hand, experts have also claimed that unreliable resources on the internet and rumors about SCF are prevalent.

The most important obstacle in this regard is that consumers do not define their bad habits in food consumption as a problem due to their low level of knowledge and awareness about food consumption. Lack of education and especially information pollution caused

by technological developments (social media, etc.) prevent the consumption habits from changing positively.

(P18, M, 45)

. . . Nutritional ignorance. It is necessary to know what to eat, how much, and what foods to choose.

(P14, M, 42)

Fast life and work life in the modern age negatively affect the quality of food and drink. As a result, it is mostly directed toward fast food consumption.

(P22, M, 44)

The biggest obstacle is that this issue is not perceived as a problem. Even the awareness that animal food production and consumption is not sustainable at present is not widespread. "What is the benefit of a small step I take? Why would I tire myself?" Unfortunately, this view prevents mass changes.

(P23, M, 42)

Our study suggests that, for many experts, there are a variety of obstacles that hinder adults to change their food consumption behavior. Thus, we tried to categorize and identify these challenges and barriers. Accordingly, we classified challenges and barriers as "personal-psychological" and "external barriers." Under the heading of personal-psychological barriers, "being affected by the spread of consumption culture," "the consumption of individuals to socialize," "lack of knowledge about proper nutrition," and "lack of reading habits" are indicated as the prominent issues.

Food consumption is seen as a means of socializing among people. Consumption has now become a piece of our culture. (Popular culture)

(P17, M, 28)

Lack of adequate knowledge of family income, health claims on food products, or private labels, logos, and production methods. For example, the prices of organic certified products, UTZ certified products, rainforest certified products are higher due to high certification prices. It is an important obstacle that these products are not consumed by everyone.

(P1, F, 37)

Tradition and wannabe psychology in young people lead this. There are advertisements and popular culture in the background of this. In particular, young people should be educated and educated in this regard. I don't think there is another way.

(P9, F, 39)

Under the heading of external barriers are: "population growth," "the effect of capitalism," "marketing and advertising policies of enterprises and their effect on consumers," "lack of time to prepare food due to intense work pressure," "lifestyles that lead to rapid and poor-quality food consumption," "household income," and "higher accessibility of foods with negative effects on environment and health obstacles."

Shopping centers encourage people to consume food.

(P22, M, 44)

Uncontrolled population growth is one of the biggest obstacles to positive changes in food consumption habits. Unconscious production by producers due to economic concerns reduces the efficiency of natural resources and hinders sustainable food consumption.

(P25, F, 36)

Marketing influence of large companies and global competition . . . Most foods that have negative effects on health and environment are more economically accessible. That's why I say economic obstacles.

(P19, M, 41)

5.3. Strategies and Suggestions for SCFs

Participants were asked to investigate three topics: (1) discrepancies between the recommended food consumption and actual food consumption of adults, (2) strategies to provide SCF and the tools for implementing strategies, and (3) suggestions to make current and future food consumption behavior more sustainable.

Regarding the discrepancies, there are three concepts frequently emphasized by the interviewees. The first one is the need to reduce the consumption of animal food products, which have a high degree of negative impact on the environment, to the minimum levels. Secondly, they emphasized that individuals should change their eating habits and apply balanced nutrition programs that are determined to be in line with the nutrients they need. Thus, the daily share of the consumption of both healthy and lower environmental impact products, such as legumes, cereal, fruit, and other vegetables, can be increased in overall food consumption. Finally, reducing the consumption of products that are packaged, processed, and include an additive, which threatens both human health and the environment, was pointed out. In addition, they stated that there should be a change in issues such as the consumption of local and seasonal foods, avoiding fast food, decreasing the serving size, increasing the welfare of the society for access to healthy food, balanced nutrition, slow eating, planned shopping, re-utilization, and the minimization of waste.

> *Adults need to decrease the demand for packaged additives. If sustainable foods are considered more expensive than current dietary habits, the solution is undoubtedly to increase the welfare level of societies.*
>
> (P19, M, 41)

> *I think that when they reach more information about adequate and balanced nutrition as well as about the production methods of the relevant food and their purchasing power increases, they will tend to change it . . . Having a good nutritional knowledge and therefore a nutritional habit; they need to know what, when, and how much they need.*
>
> (P2, F, 35)

> *I think fast food consumption should be avoided. For a balanced diet, individuals should consume not only meat and meat products, but also vegetables, cereals and the required amount of fruits. One must also avoid processed foods.*
>
> (P22, M, 44)

> *I think they should change their way of life. They need to apply the facts they know . . . Consumption of local foods, consumption of seasonal foods, and reducing consumption of foods that cause the most damage to the environment (e.g., red meat).*
>
> (P6, F, 41)

According to the experts, the most significant strategy that makes the current food consumption habits of adults more sustainable is raising awareness about food waste, especially eligible food waste in households. Additionally, more than 70% of the interviewees emphasized that demonstrating the negative effects of food waste on the environment and giving information to consumers about the nutritional values of the products and the nutrients they need may be listed as feasible strategies. Last, encouraging them to transform lifestyles by enhancing healthy and balanced nutrition such as preferring local foods was defined as an important strategy.

> *Increasing the level of awareness about food waste, the effects of foods on the environment, the importance of local food, taking part in the concept of sustainable nutrition, ensuring that children grow up with this awareness starting from their kindergartens, and that healthy foods are economically accessible.*
>
> (P20, F, 39)

> *First of all, I recommend that they consume local foods for themselves and for a healthy generation. Food consumption should not be overlooked and also waste should be prevented.*
>
> (P16, M, 37)

I recommend local farmers and eco-foods, natural farming farmers, to minimize animal food consumption, to increase pulses, vegetables, and fruits and not to consume packaged food . . . Additionally, we should develop education materials and disseminate them as much as possible with adults. Even, with the young ones.

(P5, M, 57)

I think we should get them to read, research, acquire knowledge and examine the link between consumption and health.

(P7, M, 40)

I believe that people should learn about the products and the nutrients (vitamins, etc.) they provide, and the needs of their bodies.

(P15, M, 41)

As it can be seen from the clear statements of the interviewees, developing training programs and designing training materials is the most important and practical way to implement strategies to achieve SCF. Thus, education emerges as the primary tool for implementing the mentioned strategies. Families and education policymakers have important tasks in this matter with respect to the experts.

The experts have underlined the importance of communication tools and strategies in order to implement the mentioned strategies and to have a wide range of effects. The most emphasized communication channel that may be used for promoting more sustainable food consumption is social media with a rate of 80%. When considering the frequency of using social media in Turkey by both young and older adults, this is not a surprise. Social media platforms (especially YouTube) may be effective, especially for young adults. Similarly, public service ads were chosen by more than 65% of the experts. In addition to social media and public service ads, television and other written/visual press and outdoor advertising elements were listed. Academic studies on SCF and seminars were also defined as important tools for the dissemination of true and stimulating information. Furthermore, experts have recommended that informative documents for consumers, which may be presented at food courts and healthy product advertisements through producer and government cooperation, may help to achieve successful results from strategies. A mechanism is needed to control advertisements that encourage waste and unbalanced nutrition. Some interesting suggestions were also identified, such as:

The packages can contain descriptions/instructions on how waste can be used.

(P13, M, 49)

Mobile applications based on gamification can be prepared and presented to people. Suggestions here can help people. But of course, it is necessary to pay attention to a good design and options such as rewards, points, etc. that will motivate people to use this application.

(P1, F, 37)

. . . Public service ads. Trainings to raise awareness and awareness about sustainable food consumption. Social responsibility projects. Encouraging the sustainability responsibilities of marketing activities and businesses with legal regulations. Awareness raising campaigns and maybe awards on social media.

(P9, F, 39)

Despite the strong preference of the experts for increasing awareness and consciousness as well as understanding the environmental impact of food consumption as the foremost issues, consumers should prioritize changing their attitudes and behavior as well. A significant number of the interviewees stated what needs to be undertaken at the stages of food consumption separately. Thus, we categorized the suggestions of the experts in line with the stages of food consumption using the following naming convention: before and during the purchase, during the preparation and consumption, and post-consumption.

The most emphasized suggestion of the interviewees regarding the behaviors before and during the purchase phase is "planned shopping." They stated that consumers should make a weekly diet plan and buy enough quantities of food products according to this plan. Experts emphasized that weekly plans for shopping are better than a plan for longer-term, and this is both more sustainable and controllable. They also emphasized the need for the water and carbon footprints; in other words, the environment should be taken into consideration when choosing products during shopping. Apart from these, they suggested purchasing local and seasonal products from local producers (e.g., small farmers) to ensure that the products are stored correctly and to gain the habit of reading labels.

> *Adults should read food packaging and labels and learn about the relevant legal limits, albeit small. Parameters such as nutritional properties and expiration dates of foods should be examined, and packaging should be checked.*
>
> (P18, M, 45)

> *Consumers need to be conscious about the production conditions of food and the environmental damage during production before the purchase decision.*
>
> (P21 M, 45)

> *Conscious shopping habits should be introduced at the consumer level, awareness about the issue should be increased, the lack of information about efficient food use should be eliminated, appropriate shopping planning should be made, and information should be given on the size of packaging and portion.*
>
> (P15, M, 41)

> *. . . research and purchase of carbon and water footprints of food accordingly, purchase of local and seasonal foods, shopping from these establishments to support small farmers.*
>
> (P6, F, 41)

Regarding the preparation and consumption phase, experts suggested the preparation of food at appropriate portions according to the number of people, developing the creativity of cooking by making new trials to minimize the waste generated, and keeping the prepared products under the right conditions.

> *During the preparation, you should make new experiments by focusing on creating benefits for each part.*
>
> (P7, M, 40)

> *. . . during their consumption, they compare the benefits and harm relationships that that food will create for them.*
>
> (P11, F, 29)

> *I propose to adults to investigate what happened during the cultivation, production, and packaging stages of the purchased product and to raise awareness of the consumers in this regard.*
>
> (P25, F, 36)

> *. . . I recommend that they act with the awareness of the difficulties of the production stages in food consumption.*
>
> (P23, M, 42)

One of the main issues targeted in sustainable food consumption is zero waste at the stage of post-consumption. Therefore, appropriate measures should be defined before and during consumption. If there are redundancies, they should be delivered to those in need when they are primarily consumable (e.g., neighbors, municipal houses, social institutions, animal shelters, etc.). However, if they are not consumable, then they should be buried in the soil to take advantage of them as fertilizers or should be disposed of. It is also stated that the municipalities that collect waste have a high duty and responsibility. Additionally, by using these food wastes, energy and fertilizer can be produced, and large economic

outputs can be provided. It is also mentioned that the packaging materials of packaged food products should be recycled. Finally, some experts expressed that major policies and projects on zero waste in Turkey were carried out in recent times.

> *. . . different assessment of food waste (giving to animals etc.)*
>
> (P21, M, 45)

> *not only the people's own efforts are enough, but I also encourage people around them to contribute to the process as much as they can.*
>
> (P17, M, 28)

> *Many foods that can actually be eaten are thrown away. Before being thrown away, it must be checked whether it can be renewed or not. In addition, the ingredients that remain idle while preparing food should be re-evaluated. For example, the stems of vegetables can be used in many ways. But of course, people should be informed about this first.*
>
> (P19, M, 41)

> *. . . research on reuse of emerging wastes after consumption, re-use instead of disposing to waste or sorting trash for recycling.*
>
> (P21, M, 45)

> *. . . If the remaining food becomes spoiled, composting techniques should be used.*
>
> (P18, M, 45)

Additionally, purchasing packaged products that are closer to their expiration dates, carrying shopping bags, properly preserving leftovers for future consumption, and preventing over-consumption by serving smaller portions can be considered as contributions to experts' suggestions.

According to the findings, a framework for the sustainable consumption of food is created and presented in Figure 2.

The framework provides a holistic approach to the concept of SCF. The framework consists of five components. Concept and scope deal with the conceptual structure of SCF. This component draws the boundaries of the concept and reveals the general structure of the concept of SCF. It also identifies other similar and related concepts. The aspects of the concept indicate more specifically in which dimensions it is examined. Besides, the SCF concept has four aspects that are relevant. Attitudes affecting the behaviors in the stages of shopping, consumption, and post-consumption and demographic characteristics of the consumers constitute the basis for differences in terms of knowledge and awareness levels about SCF. Thus, knowledge and awareness are the third component of the concept. On the other hand, there are two main obstacles facing consumers in SCF. These can be classified as personal-psychological and external barriers. Lastly, strategies and suggestions have been asserted as the final component of SCF. Discrepancies that need to be addressed, strategies, and suggestions to be developed are presented in the framework. Within the framework, discrepancies have three pillars: reducing the consumption of animal products, balanced and healthy nutrition, and reducing the consumption of packaged processed products. The suggestions are set up in three areas in accordance with the themes. In addition, three generic strategies are identified that should be applied for these suggestions to be successful and create behavior change.

6. Discussion

This study addressed the main concepts and scope related to SCF. The prominent concepts are future generations, nutrition and dietary habits, culture, quality of life, lifestyles, eco-products, and food security. Although many of these concepts were discussed in previous studies such as Alsaffar [42] and Vassallo et al. [47], the future generation and leaving a livable world to them are highlighted in this study. With a responsible production pattern, it will be possible to leave healthier and adequate foods for future generations. This study provides a certain theoretical contribution in terms of the aspects of SCF. These aspects

are consistent with the dimensions of sustainable consumption, which is debated in the literature. We propose four aspects of SCF: ecological, economic, social, and health. This is inconsistent with the previous findings of Pretty et al. [21], Jørgensen et al. [23], Wolff and Schönherr [25], Zhao and Schroeder [26], and Lee [27], none of which identify "health" as a dimension. As opposed to Pretty et al. [21] and Zhao and Schroeder [26], our findings do not support a political dimension as part of the framework we proposed. Among all, experts asserted that the ecological aspect is the most remarkable one, and it includes many sub-dimensions such as use of energy and natural resources, waste management, footprints, and packaging. This is consistent with the previous findings of Pretty et al. [21], Lee [27] and Vermeir and Verbeke [30], except for Zhao and Schroeder [26], who do not consider an ecological aspect.

Our findings have shown that there is a lack of knowledge and awareness about the sustainable consumption of food. The reason for this is that adults do not see this as a problem, and those who are aware of this problem cannot access sufficient and reliable sources of information. In accordance, we defined three themes, which refer to the background of the unsustainable behavior of consumers. These are improper shopping, unconscious consumption, and mistakes during the post-consumption stage. Our findings show that two-third of experts have pointed out the need for education about fundamental knowledge even regarding basic issues. For instance, not making shopping lists and the impulse buying of food, improper storage conditions, and avoiding oversized servings can be counted as skills and behaviors that need to be improved. We agree with Heiskanen et al. [64] in highlighting the need for education as the most significant factor to achieve sustainable behavior. Additionally, the demographic component of knowledge and the awareness level of consumers have been discussed and listed in this study. According to our findings, the gender difference is not significant, in contradiction to Azzurra et al. [51], Kottala and Singh [52], and Vermeir and Verbeke [53]. In terms of age, older people exhibit more sustainable behavior, such as eating at home and preventing food waste. This finding is in line with Verain et al. [54], but it is opposed to Azzurra et al. [51] with no consensus reached. Contributing to the literature, we have asserted that families with children are more sensitive about the sustainable consumption of food.

Our findings about the barriers on adopting SCF are in line with Tobler et al. [61], Chakrabarti [69], Chakrabarti and Baisya [70], Hughner et al. [71], Vittersø and Tangeland [72], and Yadav et al. [73]. However, from the perspective of challenges and barriers, we classified barriers into two groups: personal-psychological and external barriers. The most important obstacles defined as internals are social norms, such as being affected by a consumption culture and consumption for socializing. Nevertheless, population growth, the rising number of marketing and advertising efforts of companies, and lack of time were listed by the experts as the determinants of external barriers.

Finally, strategies and suggestions for more sustainable consumption of food were investigated. Reducing the consumption of animal products and packaged products versus balanced and healthy nutrition are the factors that were underlined by the experts as the difference between the actual and recommended consumption of food. This is consistent with Verain et al. [54] and Wiedmann et al. [77]. Furthermore, three stages of food consumption (before and during the purchase, preparation and consumption, and post-consumption) were associated with the experts' suggestions. Many specific suggestions were identified in each stage from the fundamental to the advanced. For instance, experts suggested reading the labels of foods during shopping as a fundamental behavior of consumers and fertilizing from food waste to gain economic outputs as an advanced level effort that can be accomplished under the coordination of consumers and local governments. For individual efforts to produce expected positive results and needs to be transformed into a mass movement, public policies should play a regulatory and mobilizing role.

7. Conclusions

The sustainable consumption of food is a critical issue for consumers, industry, and the public. With the exponential growth of attention toward sustainability, existing studies in the field of the sustainable consumption of food are generally focused on consumers' attitudes and behavior. Thus, unlike the previous studies, this paper is built based on the opinions of experts from various fields including academics, NGO managers, public representatives, and professionals from the food industry. Moreover, this study aims to reveal a framework that includes all components of SCF. To do this, data were collected from 25 experts via in-depth interviews, and some of the findings are highlighted. The main conclusion of this study is to exhibit a framework that provides a holistic approach to SCF. The framework includes the experts' perception about the SCF concept and the scope, aspects, consumers' knowledge, and awareness about SCF, together with the challenges and barriers. Moreover, this study points out some specific strategies and suggestions for providing more sustainable consumption of food.

To implement these suggestions, we have identified three key strategies: raising awareness, informing consumers about healthy nutrition, and encouraging a sustainable lifestyle. It will be possible to increase the level of knowledge and awareness about SCF by organizing various training on all aspects. Effective communication should be created using contemporary communication channels, such as social media, public service announcements, and new and interactive technologies, including webinars as well as traditional channels such as informative brochures. Relevant public institutions and organizations, universities, academicians, social organizations, and consumers should work in collaboration to achieve the sustainable consumption of food. In addition, policy makers can make regulations for both consumers and producers/sellers. For instance, additional taxes can be levied on unsafe foods for consumers. Additionally, public service ads prepared and presented by public authorities may drive consumers to pay more attention to reading labels and acting accordingly. On the other side, less or recycled packaging can be supported with grants by governments.

Considering food waste, authorities may apply policies to reduce or organize over-consumption. For example, excess foods can be collected from restaurants, food suppliers, etc., and distributed to those who need them or an organization could be created to recycle or reuse. These collected foods can be used in feeding animals or converted into another form of food (for example, tomatoes to gravy) or things such as fertilizers. From a long-term perspective, to make consumer behavior more sustainable, policymakers or public authorities may play significant roles in establishing agro-food networks and consumer cooperatives. Moreover, policymakers have a responsibility to organize related groups such as universities, NGOs, industry representatives, and consumer associations to determine effective policies and implications to support sustainable lifestyles.

There is a remarkable limitation in generalizing the findings of this study. This study is built on the opinions of the experts and ignores the view of consumers. In further studies, the opinions of consumers need to be explored and evaluated in line with these findings. Additionally, because we used snowball sampling, community bias can occur. Although sampling has been started by selecting samples from four different fields of expertise in order to avoid the community bias that may arise due to the nature of snowball sampling, this bias can be prevented further by reaching a higher number of experts from each field in future studies. In addition, different experts from other countries could be involved, cultural diversities could be explored and different demographic characteristics and fields of expertise could be considered for a more comprehensive point of view.

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Community-Based Tourism through Food: A Proposal of Sustainable Tourism Indicators for Isolated and Rural Destinations in Mexico

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Abstract: Purpose: this article presents a conceptual framework for examining community tourism as a sustainable livelihood through food tourism, considering the significant increase in community-based tourism in Mexico and the impact this activity has on rural and vulnerable destinations. The main aim of this research is to generate a proposal for a set of sustainable tourism indicators for rural and isolated communities through food strategies geared towards tourism development. Methodology: this information can then be used to generate a first list of indicators for creating and evaluating community tourism proposals in a region. Said theoretical list includes four dimensions (socio-cultural, environmental, tourist, and economic), which comprise 27 indicators in total. Findings: the results, validated by different participants related to the tourism sector, show that a lack of information for quantifying indicators is one of the main limitations when evaluating a vulnerable destination and that participation by the private sector and public administrations will be essential in generating these data. Approach: this research will therefore contribute to the development of new action strategies that allow not only the strengthening of the current localized agri-food systems, but also the revaluation of forgotten food systems.

Keywords: food tourism; community-based tourism; sustainable development; community engagement; rural development; food heritage

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1. Introduction

Tourism has often been deemed a detrimental activity for local communities and sustainable development [1]. Consequently, a better understanding of how the agri-food system fits within ecological and social systems is required [2]. In this regard, local community participation in the fields of disaster preparedness and mitigation has been acknowledged as a key element by governments and NGOs, even in relation to disaster response and recovery after a natural disaster [3]. Furthermore, several authors adopt a poststructuralist perspective to argue how certain types of "tourism development" display traits that promote local economic sustainability and greater community equality, in addition to contributing to the reduction and recovery of disaster risk and poverty [4]. A review of the literature reveals that community-based tourism is considered to serve as a tool for locally led development, and effective disaster risk reduction and recovery.

The aim of the present study is to explore the connection between the development of community-based tourism and food as drivers for sustainable tourism development. To explore the connection, a proposal of indicators to measure the role food has in this development will be provided after reviewing the existing literature on sustainable tourism indicators and approaches to gastronomic tourism. The indicators are considered in light of the following four criteria: the relevance of STIs to Sustainable Development Goals, the role of local community participation as an important element of sustainability, the stakeholders involved, and the importance of local gastronomy in rural destinations. Therefore, this

study seeks to highlight the literature on community tourism, contribute to the formation of existing sustainable tourism indicators, and offer recommendations for the development of indicators with which to measure the role food plays in sustainable tourism in rural and isolated destinations. Therefore, the main outcome of this work is the proposal of a system of indicators. The system is divided into four dimensions, with key areas for measuring local sustainability in vulnerable communities related to the destination's gastronomy. Traditional gastronomy and ethnic food are tools for the construction of nations and the emergence of collective social identities, which empower and provide an opportunity for sustainable livelihood in vulnerable and marginalized communities. Community-based tourism can help promote food-related values among visitors and improve the livelihoods of locals. Thus, CBT is considered to be a negotiation between the sectors specifically involved in gastronomy, aimed at achieving a balance between the preservation of natural and cultural heritage, economic viability, and social equity [5].

The paper is structured as follows. In the first section, the theoretical framework related to gastronomic tourism, culinary heritage within communities, and community development through community tourism is presented. Secondly, in the methodology section, authors present the tools used to create community tourism indicators aimed at developing sustainable strategies through local gastronomy. In the discussion of the results, the indicators selected are developed, highlighting the connection with food and supporting the results with data from some case studies.

2. Community and Gastronomy, the Perfect Match for Sustainable Development

Tourism has the potential to contribute, directly or indirectly, to each of the UN's 17 SDGs' [6], and has been identified as playing a particularly important role in the pursuit of goals 2 (Zero Hunger), 8 (Inclusive and sustainable economic growth), 12 (Sustainable consumption and production), and 14 (Sustainable use of oceans and marine resources) [6]. It can be argued that sustainable human development consists of human encouragement and personal self-promotion in a specific societal and community context in which personal aspirations, capacities, means, and possibilities may be achieved and contribute to improving society and the quality of life of a person and those around them [7].

The approach that UNWTO and UNDP [6] have adopted towards SDGs has been criticized for its emphasis on measurement and surveillance, reflecting the application of scientific and utilitarian economic approaches in the service of resource utilization and economic development [8]. Development can be referred to as the process of creating opportunities, and "sustainable development" as the process that promotes adaptive competencies whilst creating opportunities [9]. In this context, culture and tourism are tools that can be used to boost quality of life [10]. Some philosophers have also highlighted the importance of culture, mentality, attitude, and values in achieving a more sustainable society that should be based on a change of consciousness [11].

As mentioned in the SDG objectives, food sustainability is the key to promoting agriculture development, food safety, nutrition, sustainable food production, and biodiversity conservation [12]. Implementing sustainable gastronomy contributes to fulfilling objective number two of the Sustainable Development Goals: a #ZeroHunger world is possible by 2030. It is important to understand the concept of food sovereignty when aiming to achieve sustainable development based on food production. With respect to this, there is the need for a better understanding of the role played by the agri-food system in ecological and social systems [13]. A lack of food not only contributes to the malnutrition of the population but, on a wider scale, is also the main slowing element of rural territories, resulting in hunger, poverty, and unemployment [14]. Gastronomical traditions reflect a variety of socio-ecological conditions that are inherent in definitions of place and ethnic identity [4].

Food sovereignty was defined at the NGO/CSO Forum in 2002 as "the right of peoples, communities, and countries to define their own agricultural, labor, fisheries, food and land policies so that they are ecologically, socially, economically and culturally appropriate

for their unique circumstances. This includes the right to food and food production, which means that all peoples have the right to safe, nutritious and culturally significant food, resources for food production and the ability to maintain themselves and their societies" [15].

Food sovereignty aims to encourage and support quick individual and community access and control over resources (land, seeds, credit or economic support from the government, etc.), respecting the rights of use of indigenous and native communities, with special emphasis on access to resources by women [16]. Consequently, it has been proposed to assess the benefits of small-scale agriculture, which accounts for the production of 39% of basic foods (mainly corn, beans, and fruits), generates 63.4% of agricultural employment, is a supplier of agribusiness chains (beer, tobacco, sugar), and protects agricultural biodiversity [17].

Indeed, food, cuisine, and culinary traditions are among the most basic elements of culture [4]. As regards the heritage-ilization of products and dishes, these include those expressions of regional or local cuisine that can demonstrate a strong connection with a specific territory over a long period [18]; that is, they are rooted in local history, and are associated with a set of specific knowledge and practices [19]. Institutions such as UNESCO have defined gastronomy as the use and representation of techniques that are transmitted from generation to generation, instilling a sense of identity and continuity in a community, thus contributing to the promotion of respect and human creativity. This can mainly be seen in agricultural activities, which are found in tourism as an activity that can complement income generation [20].

Therefore, gastronomy has become a catalyst for inclusion and sustainable development of tourist destinations [21,22] which fosters planning, sustainability, and inclusion of the population [23], as well as a pleasant experience that defines individual and social well-being [24]. Culinary tourism is a growing element of cultural tourism because it helps countries and regions define what they are and what it means to be from there [4,25]. Also, regional cuisines enhance a destination's image abroad, and many locations therefore promote their culinary heritage as a means of creating a place-bound image and firming up their own cultural identities [4], using it as a tool for socio-economic development through tourism [26].

Taking Mexico as an example, food has long played both a divisive and uniting role in the process of national development. In colonial Mexico, it was an important marker of social and political status [4]. Other authors have defined it as a process in rural development that improves the quality of life and well-being of people in working-class areas [27]. Rural communities can benefit from the marketing of local products [28]; followed by food traditions, they involve many elements of heritage, including indigenous peoples and their folklore, living conditions, celebrations and rituals, religious rites, interpersonal relationships, family habits, recipes, and common kitchen utensils [29,30].

It is also worth mentioning "foodways"—or social and economic cultural practices related to food production and consumption [31,32]. Due to human development, the tourism and agriculture industries are local actions that affect economic activity and sales as a result of community business [20]. This results in the acquisition of human capital, understood as "the acquired knowledge and skills that the individual contributes to an activity" [33]. This allows for cooperation and management relationships to be formed within a group, the aim of which is to define complex and adaptive systems for the social life of a community [34]. Furthermore, a Sustainable Livelihood Framework (SLF) focuses on the interests of communities and recognizes the complexity of people's lives.

Therefore, the concept of community reveals the importance of finding ways of working together and collaborating; and, of course, a community provides a defined identity within the community that links its members around universes of meaning [35]. According to Willmott (1986), community means "having something in common", and, as this author stated, it is anchored in three elements: place, interest, and attachment [36]. That

is, it involves a process aimed at improving living conditions with the available natural, social, human, physical, and financial resources [37].

A wealth of opportunities exists for tourist destinations with regard to agricultural food industries [38]. Properly managed agriculture, forestry, and aquaculture can provide nutritious food to the entire planet, as well as generate a decent income [12]. The agricultural sector is the world's largest employer and provides livelihoods for 40% of today's worldwide population [12]. As mentioned by the National Human Development Report [39], rurality can be defined as follows: "The response that is obtained from the relationships between the components: the territory as a source of natural resources, support of economic activities and the scenario of exchanges and political and cultural identities; the population that lives its life linked to natural resources and the earth and shares a certain cultural model".

Furthermore, in terms of tourism, positive food experiences encourage repeat visits [40]. For all of the above reasons, food tourism has the potential to revive regional gastronomies, food heritage, and special foodways, which, in turn, enhance residents' community pride and the authenticity of the tourist experience [41]. For many people, sustainable cultural tourism development is synonymous with CBT involving local people [42]. Indeed, at the start of this paper, we defined "community-based tourism" as a means of addressing pressing needs such as poverty alleviation [43], but it can also be understood as a business that is self-managed by communities (family groups, rural communities in the population of a region, cooperatives or indigenous villages), integrating this type of activity in a complementary way with the traditional activities carried out in rural areas [44].

In Mexico, the definitions of community tourism and indigenous tourism share a great similarity within the Indigenous Tourism Network, as tourism which is practiced in indigenous territories, with a focus on local culture, traditions, and customs [45]. Additionally, the indigenous peoples of the country have been able to protect the knowledge that has perpetuated their agrifood systems over time [14].

In fact, community-based tourism in Mexico has proliferated in contexts of indigenous and vulnerable populations with systems of communal land tenure [46]. Protecting an ecosystem also protects its native languages and cultures, as well as culinary heritage [47]. These indigenous peoples preserve languages and cultures rooted in the ecosystems and rhythms of their land [11].

Figure 1 shows destinations that highlight their gastronomic resources in the studied communities and some others positioned as the most representative within community and rural tourism at the gastronomic level in Mexico.

Figure 1 shows the gastronomic regions of Mexico in terms of communities and rural destinations where dishes and drinks receive tacit recognition in the international arena. The country's culinary wealth is also based on plurality and cultural roots, which has resulted in it occupying a relevant place in the world gastronomic scene [48].

The figure identifies the agave landscape and the old industrial facilities of Tequila. This was recognized as a cultural landscape by UNESCO in 1972 due to the production of cocoa and its route through Tabasco, Chiapas, Veracruz, and Oaxaca [49]. It is worth highlighting coffee production and destinations renowned for their culinary tradition and humanity heritage, such as Puebla and the State of Mexico, where the Tourism Office has launched the "Mesas Poblanas" program to bring together Puebla's best gastronomy, especially that of the historic center, which appears on the World Heritage List [50]. This initiative is made up of a selection of restaurants offering traditional Puebla cuisine. Finally, there are those destinations with specific traditional dishes such as "Tlayuda" in Oaxaca [51]. These are just a couple of examples of local actions aimed at developing tourism in rural destinations.

Figure 1. "Local gastronomic regions in Mexico". Source: authors; data-based tourist office in Mexico (2020).

Thus, CBT can be seen to foster productive ventures, with the community actively participating in the management of these and the profits being distributed in the local context. As a result of government action or self-managed community initiatives, there are currently 998 companies dedicated to advertising Mexico's alternative tourist services and activities, seven of them with indigenous participation. They are based in 729 locations, within 27 federal entities, and forming part of 414 municipalities, 16.82% of the total 2461 reported by the national municipal department [52].

Indigenous communities began developing tourism companies in Latin America almost three decades ago. This came about as a result of a combination of factors, including tourist activity becoming part of government policy following a rise in awareness regarding its relevance for development and the existence of a large wealth of natural resources present in the indigenous territories, which constitute an important attraction for new tourist activities [29,52].

Community-based tourism is notable for targeting the most disadvantaged sectors, allowing for an equitable distribution of income for regions in areas such as agriculture, heritage, and the environment [23]. Six dimensions are proposed for measuring the sustainability of CBT: political, social, ecological, economic, technological, and cultural indicators [53]. In this regard, the theory of "Government of the commons" [33] considers communities to be made up of individuals capable of reaching agreements and setting rules for the use of common resources. To sum up, community-based tourism seeks to promote the development of a community based on the collaborative work of its members. If we look at it from a Maslowian perspective, it can be seen as a pedagogical approach to the theory of self-actualization [7]. Furthermore, economic empowerment exists in a destination when jobs are created via tourism and result in regular, reliable, and lasting incomes for community members [54]. CBT therefore plays an important role in poverty alleviation by contributing to community development and sustainability [55].

3. Materials and Methods: A Proposal of Indicators to Assess Sustainable CBT

Different phases were designed to develop the indicators. The first consisted of a systematic revision of the literature and an analysis of different indicator systems. A systematic scoping review was employed to assess the literature on Sustainable Tourism Indicators with respect to four criteria, including the relevance of STIs to the SDGs, the role of local community participation as an important element of sustainability, the stakeholders involved, and the importance of local gastronomy in rural destinations in Mexico. This methodological proposal for a system of indicators is based on a bibliographic review, management models, and methodologies for the implementation of this sustainable development plan [56,57]. Other researchers have proposed a new indicator-based tool to assess the degree of progress and regress in tourism sustainability, the latter being an issue that is often ignored in indicator research [58]. Scoping reviews are increasingly more commonplace in the social sciences [57], including tourism [59], and are often used to provide an exploratory overview of a topic, map the literature, and identify key concepts, theories, and sources of evidence. They are most useful when an area is complex or has not yet been comprehensively reviewed [60]. This situation has far-reaching consequences with respect to tourism's contribution to sustainability, given the importance of appropriate indicators to effectively assess and manage tourism impacts [8,61,62].

The present study reviewed articles focusing on sustainable tourism indicators and indices with which to measure the sustainability of rural and isolated destinations published in Scopus-indexed journals and Google Scholar up until December 2020. A keyword search was performed of the title, abstract, and keywords using the search term "sustainable tourism indicators." This initial search resulted in the identification of 945 articles. Another keyword search for food tourism indicator articles returned only 162 articles, while a third search with the keyword "sustainable food tourism indicator" resulted in 49 articles. In total, 1156 articles were identified in the three searches. This figure was reduced to 740 after eliminating duplicates. Selecting abstracts for their relevance to sustainable tourism indicators further reduced this figure to 120. Finally, 92 journal articles were reviewed for this study.

The second phase consisted of the selection of indicators based on the different models identified in the previous phase. For the purposes of the present study, emphasis was placed on certain indicators specifically designed for CBT, and a set of sustainability indicator systems was analyzed to this end. Among the systems analyzed, the sets of indicators proposed by the following stand out: the World Tourism Organization [62], the Sustainable tourism program in Mexico [63], and the European Tourism Indicators System for Sustainable Tourism [64] together with some models proposed by academics [65–67]. Generally speaking, most of the indicator systems consider sustainability dimensions (sociocultural, environmental, tourism-related, and economic) and involve the participation of the local community subject of the study, as well as considering the views of other groups involved in the research.

The third phase was the validation of the indicators selected using different evaluation tools. Regardless of the number of indicators used, previous studies have strongly recommended a broad participation of key stakeholders during indicator development [53,62,68,69].

This phase involved developing a questionnaire with questions related to tourism and the use of local products. For example: what is the importance of the participation of local communities in food production and the participation of different actors (agents, NGOs, etc.) in decision-making processes? Or the level of importance of the use of ancestral techniques and methods in the preservation and cooking of food? Or the perspective of the contribution of tourism to the destination's economy?

In total, 50 answers were collected, while 30 surveys were administered to groups of scholars specialized in tourism heritage, history, and sustainability. These scholars had been intentionally selected on the basis of their experience and knowledge. Professors in the Department of Tourism Studies at different universities in Ecuador, Spain, and Mexico were selected due to their geographic proximity to the study area and their experience in the

subject under discussion. A total of 10 surveys were administered to leaders and experts in community-based tourism and entrepreneurs in gastronomic tourism in Mexico, including Komutravel, La Ruta del Origen, Turismo con Pao Sonora, Telar Social, and Agave Tourism, to mention a few. To ensure broad participation, 10 surveys were administered to tourists and local residents so that they could also participate in the evaluation process. The surveys were distributed using Google Forms during January and February 2021.

In addition to the survey, a series of interviews were conducted with different community tourism associations, including travel agencies, entrepreneurs, academics, and foundations in Mexico. These semi-structured interviews lasted approximately 30–45 min and an attempt was made to capture the diverse opinions of 10 actors consulted for this purpose. During these interviews, respondents were asked to see and share their comments on the primary purpose of indicators, and give their opinion on the importance of gastronomy in this rural destination and the development of tourism products related to CBT. These interviews were also conducted in January and February 2021.

Finally, the combination of qualitative (expert judgment) and quantitative (survey) methods allowed us to develop and validate the sustainability indicators [69]. Although 24 potential indicators were initially collected from the literature review, following the third phase, the list of indicators numbered 27, divided into four dimensions linking CBT development and gastronomy: socio-cultural, environmental, tourism, and economic. To explain and better understand the indicators proposed, different case studies have been analyzed for some of the regions presented in Figure 1.

The three case studies selected encompass the culinary tradition of Mexico. The first focuses on Ecatzingo, which is located in central Mexico and was affected by the 2017 earthquake, the epicenter of which was located at around 55 km (34 mi) south of the city. The earthquake caused damage in the Mexican states of Puebla, Morelos, and the State of Mexico. Ecatzingo is a rural destination located in the state of Mexico, and is home to much of the state's gastronomy, including the production of sausages, jams, honey, exotic stews, pulque, and other liquors. For the analysis conducted in this research, visits and interviews were carried out with local people and female cooks in Ecatzingo to discover the potential of the local gastronomy. The next case study was Michoacán, a city acknowledged as having UNESCO's Intangible Cultural Heritage of Humanity since 2010. Michoacán is considered the cradle of traditional Mexican cuisine. A literary review of Michoacán and its traditional gastronomy was considered necessary in order to conduct the analysis and validation. Thirdly, there are the regions where agave is grown, including places such as Jalisco, Sonora, State of Mexico, Nayarit, Oaxaca, and Mexico City. For the diagnosis and validation of indicators at these destinations, we enlisted the support of different travel agencies and foundations, including Komutravel and Agave Tourism.

4. Results. Indicator Selection for Food Strategies in CBT

In the literature review, the connection between food and community-based tourism has been explored. The authors propose a selection of indicators with the aim of proposing different indicators that allow a better understanding of this connection and the importance it may have in the sustainable development of vulnerable communities. Well-developed and properly validated sustainability indicators have an important role to play in assessing progress towards tourism sustainability, yet they are still missing in any real sense [70,71]. In this respect, sustainable tourism development is not easy to measure without breaking it down into smaller issues represented by indicators. Since there is no "one-size-fits-all" approach to assessing progress towards sustainable tourism development, devising a comprehensive methodology represents a huge challenge [70], and the first action by any country should be to measure its level of sustainability [72] using systematic and scientific methods of sustainability assessment [71].

With the above considerations in mind, the authors of this paper obtained a comprehensive list of sustainability indicators from an extended literature review and semi-structured interviews with some key informants.

Table 1 shows the final selection of indicators for assessing food strategies based on the research of the different authors mentioned, and the validation process involved in this research. The result is a list of 27 indicators, divided into four dimensions: socio-cultural, environmental, tourism, and economic. The socio-cultural dimension is related to human and social capital, while the environmental dimension relates to natural capital and the economic dimension focuses on financial capital. The tourism dimension has been added in order to assess the role that tourism can play in food strategies at the destination.

Table 1. Initial CBT indicators for assessing food strategies.

Objectives	Indicator	Dimension	Description
Professional skills and abilities attributed to the level of schooling, training in community tourism, food production and traditional knowledge.	Socio-cultural	1. Existence of plans to protect food heritage or food production.	1. Determine how many plans exist at the destination for the protection of tangible and intangible heritage, especially related to food and traditional food production.
		2. Engagement of local communities in food-producing and involvement of different stakeholders in decision-making processes.	2. Quantify the participation of groups in different actions and activities in their region.
		3. Traditional food knowledge (handcrafts, recipes, gastronomy culture, ancestral methods) (cultural heritage, tangible and intangible).	3. Evaluate the population's knowledge regarding their traditions, traditional dishes and community.
		4. Role of food traditions in social cohesion.	4. Determine the role of food as an element of social cohesion (social events related to food, charity, etc.).
		5. Employment in the food and tourism sectors.	5. Quantify the number of jobs related to food production and related to tourism.
		6. Average salary of women in the tourism and gastronomy industry.	6. Determine the role of women in the industry and ascertain their salary.
		7. Recognition of women's work within the community.	7. Determine the level of Recognition of women's work within the community.
Conservation actions ancient recipes with traditional vegetation. Diversification of food production.	Environmental	8. Level of community involvement in tourism	8. Identify the % of community involvement in tourism.
		9.Use of local products in food preparation.	9.Determine origin of ingredients and food elements (how much of food production comes from local producers).
		10. Use of endogenous seeds.	10. Identify how many endogenous seeds are used in gastronomy.
		11. Level of biodiversity in seeds and food-related elements.	11. Identify how many different species and seeds there are in the local food traditions.
		12. Use of ancestral techniques in agriculture.	12. Identify and list ancestral practices in agriculture.
		13. Use of ancestral techniques and methods in conservation and cooking of food.	13. Identify and list ancestral conservations and cooking techniques.
		14. Use of renewable energies or techniques respectful of the environment.	14. Identify best practices in agriculture with regard to sustainability.
		15. Percentage of the region under a protection plan (natural heritage).	15. Ascertain percentage of region covered by a protection plan or declaration.
		16. Regenerative community tourism agenda.	16. Identifying the destination has a regenerative community tourism agenda.
Loss of agricultural, forest, wetlands, infrastructure for lodging, food and equipment for tourists.	Tourism	17. Infrastructure for hospitality managed by local communities.	17. Determine percentage of hospitality infrastructures (hostels, rooms, etc.) run by locals.
		18. Suppliers of restaurants or food establishments run by local communities	18. Determine percentage of food-related services run by locals.
		19. Number of local tour guides.	19. Determine number of local tour guides compared with external tour guides.
		20. Number of travel agencies, tour operators or external agents involved in tourism activities.	20. Determine number of intermediaries in tourism activities and conditions under which they operate (percentage of benefits for locals).
		21. Percentage of tourists and visitors regarding the local population	21. Determine number of visitors per establishment.
		22. Average visitors per day, length of stay and level of seasonality in tourism	22. Determine main visitor traits, especially regarding seasonality.
		23. Percentage of tourists that are satisfied with the visit and experience in the local community	23. Determine tourists' level of satisfaction regarding the experience they have with locals.

Table 1. *Cont.*

Objectives	Indicator	Dimension	Description
Economic resources of the organization. Employment and job opportunities for the community.	Economic	24. Changes in land tenure.	24. Identify changes in land tenure caused by tourism activities.
		25. Capital for reinvestment.	25. Identify where income from tourism is spent and level of reinvestment in activities supporting the community.
		26. Contribution of tourism to the destination's economy.	26. Determine the importance of tourism as economic activity among all economic activities in the community.
		27. Daily spending per tourist in local communities (accommodation, food, handcrafts not in intermediaries or external companies).	27. Determine the average expenditure per tourist in the community, without considering the money spent on intermediaries or other companies outside the community

Source: authors' data based on different indicators systems [16,63,66,67].

The proposed system is based on four dimensions of indicators: socio-cultural, environmental, tourism and economic.

4.1. Socio-Cultural Indicators

Socio-cultural indicators reflect the knowledge of the local population regarding the culinary culture itself, at the level of recipes, traditions, methods of food production and conservation, etc. For example, Indicators 1, 3, and 4 (Table 1) refer to food preservation and tradition. These indicators are supported by the fact, for example, that Michoacán has a UNESCO gastronomic heritage protection plan. Throughout Figure 1 and the literature review, this destination is considered the cradle of traditional cuisine; currently, there are more than 80 traditional cooks in the area, from regions such as Tierra Caliente, the Lacustrine Zone, the Coast Region, the East Region, the West Zone, and the Morelia Region. They are dedicated to preserving the traditional flavors originating in the state [48], and rural communities can benefit from the marketing of local products [28]. Likewise, the places where agave is grown, specifically for the Tequila in Jalisco, the Bacanora in Sonora, and the Mezcal in Oaxaca, validate this same indicator as it is a Designation of Origin product with a protection plan for culinary heritage [41]. Furthermore, in the case of Ecatzingo, the result of applying this indicator shows that the site does not have an official heritage protection plan; however, the community is commited to food sovereignty as they decide on their own agricultural, labor, fisheries, food and land policies.

On the other hand, Indicators 2, 6, and 7 (Table 1) refer to the "Recognition of women's work within the community". In the case sudy of Ecatzingo, it was easier to apply this indicator using the number of food establishments there that are run by women—which was less than the average; the results of the interviews conducted at this destination revealed that women have the role of housewife and little access to work. An opposite example is found in the case of Michoacán, where a high recognition of women's role and work is payed by UNESCO, and most of the establishments and recipes pertain to the female population. Finally, with regard to places that produce agave, recognition for women is low according to the interview done with Komutravel, since most of those who promote and work within this area are men.

4.2. Environmental Indicators

As for environmental indicators, they reflect the importance of the agroecosystem's ecological diversity with regard to developing agriculture, feeding, and the multiple forms of adaptation coexisting therein [14].

The environment plays a very important role in sustainable development. In the area of food-related indicators, it is important to take into account the relationship established between the means of food production and sustainable development. As our review of the literature shows, SDG 2 is related to food, and some of the topics mentioned are the promotion of small farms, the recovery of traditional techniques, and the application

of techniques that are respectful of the environment. The proposed indicators should determine the number of local products used in the kitchen and identify the methods employed to produce them.

By way of example for Indicator 9 (Table 1), the interview with Armando Vazquez from "Agave Tourism" contributed information from the case of Zacazonapan, a municipality in the State of Mexico, where mature cheese production is a traditional activity that has been carried out for over 150 years. Its continuity is at risk today because the producers are older women and young people are not interested in maintaining it. The proposed indicators can be used to identify practices such as this and develop a proposal for heritagization. The aim here would be to relaunch this productive activity, which represents a contribution not only to the family but also the local and regional economies [73].

Indicators 11, 14, 15, and 16 (Table 1) can help in the development of plans for protecting the environment and achieving sustainable development at the site without damaging it, as also mentioned in the following UN SDGs: 8 (inclusive and sustainable economic growth), 12 (sustainable consumption and production), and 14 (sustainable use of oceans and marine resources) [6]. In the three case studies evaluated, Michoacán displayed active participation in terms of intangible gastronomic care, but not in destination sustainability, while Ecatzingo —through its regional government—has plans to ensure protection of the soil and regeneration of the environment, and the same is true in those regions where agave is planted.

4.3. Tourism Indicators

This indicator highlights the importance of using food heritage as a strategy to improve the competitiveness of local tourist activity and, at the same time, strengthen the identities and cultural traits of rural groups. In this case, it is important to quantify the number of restaurants and accommodation establishments in vulnerable destinations, in order that communities be properly developed through sustainable tourism. As the indicators show, it is also necessary to focus on evaluating land tenure and changes in this, in order to generate tourism experiences that do not affect the environment. Equal importance should be given to quantifying the intangible and natural heritage of a vulnerable tourist destination in order to make it sustainable, taking into account all the tourist attractions and the potential of the evaluated community.

Indicators 21, 22, and 23 refer to "average visitors per day". Although these data are available, in some cases it is only at the national level and, in some cases, the regional level, but very rarely at the municipal level. Other issues are related to the origin of tourists. However, the lack of data for municipalities or even regions is an obstacle in this regard.

With regard to gastronomy, Indicator 18, "suppliers of restaurants or food establishments managed by local communities", the main problem is that there is no database available in most cases, so data must be collected by contacting each individual rural destination. Generally speaking, for the three case studies here, we find more local establishments than foreign ones, due to the isolated and/or rural location of the destinations.

4.4. Economic Indicators

Isolated and rural communities face different challenges, and sustainability is one of them. In most cases, when it comes to vulnerable communities, sustainability is about how to maintain traditions and how to survive. The information collected using this system of indicators should allow for a diagnosis of the destination, highlighting the strengths and threats in developing the community.

With indicators 26 and 27, for example, "daily spending per tourist in local communities (accommodation, food, handcrafts not in intermediaries or external companies)," it is particularly interesting to determine tourists' daily expenditure and the level of employment in the rural destination. This can be especially useful if it is comparable between rural and isolated areas. However, it is difficult to obtain data disaggregated by municipalities

or regions, and adaptation or customization for rural areas is therefore not possible in most cases.

An example of the above can be found in a long-term project underway in Sonora (Agave Case), which aims to promote the Sierra Alta de Sonora by creating a gastronomic route through the region [74]. The research carried out here shows that these routes may benefit small producers in the region and restaurants in the community, as well as sales by typical food and street vendors. However, there is a lack of an institutional and community gastronomic tourism inventory [75], and this makes it difficult to identify traditional practices and the preservation actions that should be undertaken.

During the interviews and surveys, as well as being asked about the different indicators, respondents were also asked to identify those areas or indicators that they considered most important for the sustainable development of their community. Figure 2 shows the results obtained. Indicators were scored based on a scale of three levels (low, medium, and high), taking the difference between the four dimensions as a basis.

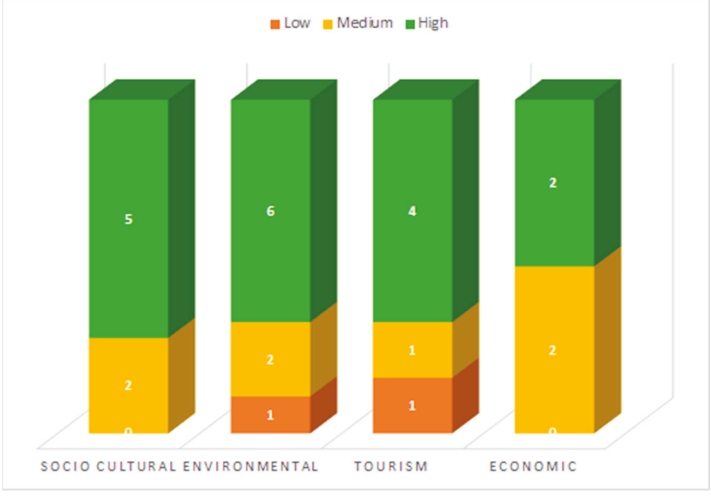

Figure 2. Level of importance Sustainable Tourism Indicator. Source: authors' own work.

As can be observed in Figure 2, the socio-cultural and environmental dimensions are considered to be most important, with five and six indicators, respectively, while the economic dimension is considered to be less relevant. According to the respondents, the dimensions that have more weight in decision-making and strategies in rural destinations are the socio-cultural and environmental dimensions.

As for which indicators are considered to be most relevant, in the socio-cultural dimension we find Indicators 1, 3, 4, 6, and 7 (Table 1). Indicators 1, 3, and 4 refer to the role food has in the preservation of local traditions and the tools available to protect this knowledge. Indicators 6 and 7 refer to the role played by women, considered fundamental as keepers of food knowledge in most of the communities analyzed. As for the environmental dimension, the selected indicators were 8, 9, 12, 13, 14, and 15 (Table 1). Indicators 9, 12, and 13 are related to the use of local food and traditional techniques in agriculture and food production, which are also closely related to the socio-cultural dimension.

5. Conclusions and Discussion

This systematic review of the research literature and validation of indicators has focused on the following aspects: the relevance of STIs to the UN's SDGs, the role of local community participation as an important element of sustainability, the actors involved, and the importance of local gastronomy in rural destinations. To effectively develop

and implement sustainability metrics for tourism, it may be necessary to provide new opportunities in destinations for actors who may previously have been excluded from the policy process [8]. A further aim of this article has been to develop and validate sustainability indicators that might help monitor tourism activity and its impacts. As mentioned above, subjective indicators refer to the opinions of actors, academic groups, and travel agencies, as well as tourists' experiences, perceptions, and satisfaction levels; these indicators refer to the context of Mexico. A participatory and systematic approach has been followed, and the results show how it is possible to develop and validate very useful sustainability indicators.

In many places where agave is grown, the locals make distillates of tequila, mezcal, and bacanora. As Figure 1 shows, the label "Agave production" is widespread throughout the gastronomic regions of Mexico. With regards to Table 1, the economic and tourist dimensions show a wide contribution of tourism to destinations' economies through promotion by travel agencies, products offered by local restaurants and local tourist guides, and the role played by food traditions in the social cohesion of these regions. In fact, in many areas, such as Tequila in Jalisco or Bacanora in Sonora, these culinary traditions represent an identity and the Denomination of Origin product stands out in developing gastronomic tourism for the entire country.

Also, in relation to the socio-cultural, tourism, and economic dimensions, there are several ways in which a solid gastronomic identity can be created and maintained as a way of promoting tourist destinations [4]. These are differentiation, authentication, and aestheticization (playing with emotions, pleasures, desires, and moods). Complementary activities such as agritourism have now also emerged due to people's need to relive memories of earlier times spent on a farm, picking and eating the wholesome foods of their youth [20]. Thus, the aim of tourism indicators is to identify the weight of food-tourism strategies in a community's tourism plans.

The above notwithstanding, it is important to bear two things in mind. First, vulnerable communities face challenges in devising a proper sustainability-oriented plan, and need to avoid damaging the quality of life of their inhabitants, a loss of heritage, negative economic impacts, and environmental degradation. Second, sustainable tourism can be achieved through food sovereignty and cuisine heritage, a process that requires the interest and constant participation of government administrations and the private sector.

This review provides a platform to potentially help policymakers, businesses, and researchers to better understand how gastronomy tourism indicators can be used to address the UN's SDGs on various scales within a common approach, but one that targets isolated and vulnerable destinations. Researchers must also address the relationships existing between the different modes of governance within Mexico and the development of indicators, as well as the monitoring and evaluation process.

In the case of isolated and vulnerable destinations in Mexico, such as Ecatzingo or Zacazonapan in the State of Mexico, which have a very low level of tourism and are not easily accessible, this article has shown that it is possible to develop indicators at the national level for rural and isolated destinations. These, in turn, have a broad gastronomic diversity and natural resources in their environment, promoting sustainable development and potential tourism trade for the local community.

This study makes some important contributions. First, it is necessary to mention the contribution of Figure 1, which shows the gastronomic resources in rural communities of Mexico. Desite the high levels of gastronomic tourism, there is little clarity on where to find it and how to identify it. This study therefore makes a small contribution to identifying and highlighting the gastronomic areas of Mexico in rural and isolated spaces. By way of example, the country's official tourism website only highlights the alternative tourism regions in Mexico, and a small section on "where to eat in Mexico". It was therefore necessary to compile a map to highlight these forgotten destinations. Second, it is worth mentioning the participation of numerous actors, including university professors from three universities (in Mexico, Spain, and Ecuador), tourists, local residents, and directors and experts

from the offices of culture and tourism. Third, unlike most previous research, this study has considered the local gastronomy framework in the process of developing indicators. Carefully refined and developed indicators can bridge the gap between information and action [62,76]. Finally, this study takes the existing literature on tourism sustainability as a starting point and adds new approaches derived from community tourism and its relationship with gastronomy. Identifying the problems and areas where action is most urgently needed would prove a thankless task without using well-developed and validated sustainability indicators. Despite its limitations, this study introduces the local gastronomic approach to isolated regions of Mexico, based on the premise that well-developed indicators will help detect sustainability problems in rural destinations.

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What Stirs Consumers to Purchase Carbon-Friendly Food? Investigating the Motivational and Emotional Aspects in Three Studies

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Abstract: As part of diminishing climate change, food consumption needs to be addressed to reduce greenhouse gases. In order to change food consumption habits to carbon-friendly eating patterns, consumers may be targeted by information campaigns and legal regulation. The current paper studies consumers' diets and food purchase behavior. In particular, it aims to understand consumers' motivational and emotional aspects that influence their behavior. Study 1, an interview study, aims to understand the development of and motivations for climate-friendly nutrition. Identifying eco-friendly motives also revealed that emotions seem to play an important role in nutrition and the purchase of climate-friendly products. Study 2 aims at identifying consumers' positive and negative emotions when it comes to consuming carbon-friendly food. Again, qualitative interviews revealed a variety of positive and negative emotions. Study 3 quantitatively tested the theory of planned behavior, including positive and negative emotions and predicted carbon-friendly food purchases. The results show that attitudes, perceived behavioral control and positive emotions predict carbon-friendly food purchases. Derived from these findings, recommendations for information campaigns and legislation to foster carbon-friendly food purchases are presented.

Keywords: carbon-friendly food; theory of planned behavior; emotions

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1. Introduction

For decades, climate change has been a pressing problem of humanity, becoming increasingly challenging and central from year to year. Food consumption is responsible for up to 30 percent of greenhouse emissions in Western countries [1]. Thus, not only regulators, but also consumers, are asking how greenhouse gas emissions (especially carbon dioxide (CO_2)) from food consumption can be reduced so that climate change can decelerate. One approach is to change food consumption habits to carbon-friendly eating patterns utilizing information campaigns and legal regulation. The current research aims to build on established theories to understand antecedents and drivers of consumer behavior regarding carbon-friendly food, to make sure that powerful campaigns and legal regulation can be designed to meet the end of increasing carbon-friendly food consumption.

Such campaigns and legal regulations are particularly important as consumers are often unaware of which behaviors can be classified as carbon-friendly [2,3]. Guidebooks [4] for consumers offer a variety of behaviors on how to reduce CO_2 in everyday life. Concerning food consumption, consumers should focus on (a) changing the kinds of foods they consume (e.g., more plant-based diet instead of animal products), as well as consider (b) the production process (e.g., more organic food, but less processed food), (c) the method of transportation (e.g., local food, minimizing chilled or frozen food) and (d) the packaging (e.g., no or minimal packaging). Thus, consumers have several ways of reducing greenhouse gas emissions and, therefore, also CO_2 by changing their food consumption habits.

Introducing these behavioral changes can decrease the individual greenhouse gas and CO_2 emissions related to food consumption by 85 percent [4].

To create information campaigns and as a basis for regulation, businesses and legislators need to base their efforts on what antecedents and drivers determine consumers' food consumption practices. The theory of planned behavior (TPB [5]) is an adequate model to point out the relevance of different motivational aspects (attitudes, subjective norms, perceived behavioral control). While the TPB postulates that motivation (termed intention in the original publication) is strongly related to actual behavior, some research [6] indicates that one essential motivational aspect is missing in the TPB, which is necessary to explain sustainable behavior. This research gap can be addressed by investigating consumers' emotions and incorporating them into the TPB. According to Parrott [7], there are six different primary emotions: sadness, love, anger, joy, surprise and fear, that altogether can be summarized into negative and positive emotions and which impact consumers' carbon-friendly food-related behavior. Therefore, the current research aims to investigate the relationship of motivational aspects as in the TPB (attitudes, subjective norms, perceived behavioral control) and emotions with consumers' purchase behaviors regarding carbon-friendly food.

Based on the investigation of the TPB, including emotions, the research is structured as follows: first, it gives an overview of the theoretical background focusing on carbon-friendly food behavior, the TPB and emotions, whereby this chapter closes with the consolidation of the TPB and emotions in consumer behavior and presents the theoretical research model. Second, it presents three empirical studies: two explorative interview studies and one representative questionnaire study, which examine the relationship between motivations and carbon-friendly food behavior (Study 1), the relationship between emotions and carbon-friendly food behavior (Study 2) and the overall theoretical research model integrating the TPB and emotions to explain carbon-friendly food behavior (Study 3). The research is concluded with a discussion on the results of the three studies from a theoretical and practical perspective.

2. Theoretical Framework

Inducing consumers to purchase carbon-friendly food is certainly, on the one hand, an integral approach to reduce greenhouse gas emissions, specifically CO_2; on the other hand, it is a difficult endeavor that has been sought for some years now but was not easily achieved. Specifically, the determinants of carbon-friendly food purchases are not clear. However, the current research sheds light on these determinants, i.e., the factors of the theory of planned behavior (TPB: attitudes, subjective norms, perceived behavioral control [5]) and emotions [7]. Therefore, the present theoretical framework touches on carbon-friendly food purchases in general, on the determinants (TPB [5], emotions [7]) stipulating carbon-friendly food purchases, on the incorporation of emotions in the TPB and the consequential research questions.

2.1. Carbon-Friendly Food Purchasing

Although the majority of consumers are talking about the pressing need to reduce CO_2 in the atmosphere, it is not totally clear how this can be achieved with consumer choices regarding food purchases. Several aspects define whether a food item can be perceived as carbon-friendly: (a) the kind of food is crucial for CO_2 emissions, meaning that a plant-based diet instead of animal comestibles is less responsible for CO_2 emissions [8,9]. (b) Another aspect essential for CO_2 emissions based on food consumption is the production process of the respective food. Organic food, in general, produces less CO_2 in the production process, unlike processed food, such as frozen pizza or microwave dinners [9], which are responsible for much more CO_2 in the production process. (c) Additionally, the mode of transportation of food is very important. Food that is transported a very short distance, i.e., regional food and fresh food that needs neither chilling nor freezing, is connected to less CO_2 than food transported long distances in a chilled or even frozen

state [8]. (d) A final aspect of CO_2 pollution based on food consumption is a not-so-obvious feature, namely food packaging. The less packaging a food item is wrapped in, the fewer CO_2 emissions are produced. Thus, no packaging would be optimal for all food items. Nevertheless, this is not always possible because of legal hygiene standards, e.g., meat needs to be wrapped [4]. This is a rather long and diverse list of how carbon-friendly food can be defined.

Unfortunately, these different aspects of the definition do not always go hand in hand with each other. For instance, some fresh fruit might be organic and therefore carbon- friendly, but it might reach the consumers after a long-distance transport from another continent. Therefore, these fruits cannot be described as carbon friendly. Another example is fresh vegetables, which are certainly carbon-friendly in comparison to frozen vegetables, but they might be packed in several layers of plastic to make transportation more convenient. Again, such items cannot be defined as carbon-friendly food due to the excessive packaging. Under these circumstances, it is difficult for consumers to decide which food items to purchase to stop the excessive increase in CO_2 emissions. Nevertheless, more and more consumers are determined to change their purchase behaviors and acquire carbon-friendly foods.

Thus, if consumers are truly interested in buying carbon-friendly food, what is driving them to do so? There has been research on the drivers of purchases of carbon-friendly food. For instance, consumers' knowledge regarding the effect of CO_2 on the climate and the concern regarding the risk of climate change could be predictors for the willingness to spend more money on carbon-friendly food [10]. The surprising finding was that neither knowledge nor concerns significantly impact paying extra for carbon-friendly food. Thus, being aware of the problem is not sufficient to change consumer behavior. Other predictors could be different values, attitudes, social norms and perceived behavioral control. Aertsens et al. [11] collected research on the drivers of consumers who were purchasing organic food, and found that values such as security, hedonism, universalism, benevolence, stimulation, self-direction and conformity, when linked to organic food, positively impacted attitudes towards the purchase of organic food. Additionally, they showed that these attitudes, social norms and perceived behavioral control influenced the purchase and consumption of organic food. Thus, personal factors such as values, attitudes and perceived behavioral control definitely affect organic food purchase behavior. Therefore, labeling products as carbon-friendly might stimulate specific values, attitudes and social norms that stimulate consumers to buy carbon-friendly food. Studies [12,13] found a clear connection between labels for carbon-friendly food and the willingness to purchase such food items. Thus, a variety of different drivers to purchase carbon-friendly food has already been researched. Whereas some drivers are effective (personal aspects such as values, attitudes and social norms; labels), others do not impact purchase behavior (knowledge on climate change, concern regarding climate change).

Although some drivers for carbon-friendly food purchases have been identified by now, thus far the psychological process has not been fully detected. While values, attitudes, social norms and perceived behavioral control are psychological factors that have an impact, other psychological determinates of carbon-friendly food purchase are missing. As consumer research [14] shows, consumers' emotions have a significant effect on purchase behavior. Thus, why should consumers' emotions not also determine the purchase of carbon-friendly food? A preliminary empirical study indicates that emotions play a role in purchasing organic food [15]. With the current studies, we incorporate emotions into the purchase decision process and investigate how emotions, attitudes, subjective norms and perceived behavioral control impact the purchase of carbon-friendly food.

2.2. Theory of Planned Behavior

The theory of planned behavior (TPB [5]) is often applied in consumer behavior research that bases purchase decisions on three main determinants: attitudes, subjective norms and perceived behavioral control towards the purchase. These determinates again

result in the intention to purchase, which finally ends in the actual purchase. While this theory was originally developed to explain the influence of significant others as a social-psychological theory, it was adopted by consumer research and used to explain purchase behavior of different kinds [5,16–19].

Describing the three determinants, the theory of planned behavior [5] postulates that attitudes towards a certain behavior—in our case, the purchase of carbon-friendly food—are the evaluations of the behavior as positive or negative [20]. Thus, some consumers believe that buying carbon-friendly food is a vital behavior that needs to be undertaken to slow down climate change. In contrast, other consumers think that buying carbon-friendly food is a waste of money because climate change is not man-made and, for that reason, cannot be detained by humans. Thus, while the first consumers positively evaluate the purchase of carbon-friendly food, the second ones think of the same behavior negatively. Regarding subjective norms, a social aspect is central: subjective norms specify what significant others expect the decision-maker to do and to what extent the decision-maker wants to follow the others' claims. In the case of carbon-friendly food purchases, the person who decides to purchase carbon-friendly food can be influenced by other important persons, who indicate that purchasing carbon-friendly food is important. Additionally, subjective norms also include the consideration of the decision-maker, whether to follow the recommendations of significant others or not. The third determinant, i.e., perceived behavioral control, is defined as the perceived effort deciders have to put into the undertaking of the behavior. Regarding carbon-friendly food purchases, consumers consider how easy or difficult it is to purchase carbon-friendly food. For instance, aspects are summarized, including whether consumers have the necessary knowledge to recognize carbon-friendly food under all the possible food options, or if there is a store nearby to buy carbon-friendly food from. Thus, all three determinants of the theory of planned behavior are excellent drivers of carbon-friendly food purchases.

These three determinants (attitudes, subjective norms, perceived behavioral control) influence the intention to undertake the respective behavior [20]. The intention to undertake a certain behavior is seen as a person's motivation to undertake the behavior. With carbon-friendly food purchases, the intention, i.e., motivation, is the driver to actually buy carbon-friendly food, go to the shop and actively look for food that is low in CO_2 production. This motivation or intention is then directly linked to behavior. Although there is a direct link, the connection is not 100 percent. There might be a strong motivation to undertake the respective behavior, but the behavior is still not performed. In this case, perceived behavioral control could impact the behavior. If there is no possibility perceived as to how to undertake the behavior, the behavior is not performed despite the strong motivation to do so. For carbon-friendly food purchases, this specifically means that if consumers perceive that there is no shop nearby that sells carbon-friendly food, they will not buy such items, even if highly motivated to do so. In summary, the theory of planned behavior is an excellent theory to predict the purchase of carbon-friendly food [16], nevertheless one important aspect seems to be missing in this theory, i.e., emotions [21], to precisely predict carbon-friendly food purchases.

2.3. Emotions

Emotions are defined as "a mental state of readiness that arises from cognitive appraisals of events or thoughts; is accompanied by physiological processes; is often expressed physically (e.g., in gestures, posture, facial features); and may result in specific actions to affirm or cope with the emotion, depending on its nature and meaning for the person having it" [22] (p. 184). Therefore, emotions are an important psychological determinant of decision-making, thus also in deciding to purchase carbon-friendly food. Nevertheless, there are several taxonomies of emotions [23,24], so in the current manuscript we focus on the list of emotions in social psychology [7].

This list of emotions differentiates between primary, secondary and tertiary emotions [7], whereby a number of emotions on the tertiary level (e.g., arousal, desire, lust,

passion, infatuation) comprises one emotion on the secondary level (e.g., lust) and similarly, a number of emotions on the secondary level (e.g., affection, lust, longing) comprises one emotion on the primary level (e.g., love). For all emotions on the primary and secondary level [7], see Table 1. In the current study, we focus on these emotions, specifically on emotions on the primary and secondary levels, following other research in consumer behavior that highlights this systematization [25,26].

Table 1. Primary and secondary emotions [7].

Negative Emotions		Positive Emotions	
Primary Emotion	**Secondary Emotion**	**Primary Emotion**	**Secondary Emotion**
Anger	Irritation	Love	Affection
	Exasperation		Lust
	Rage		Longing
	Disgust	Joy	Cheerfulness
	Envy		Zest
	Torment		Contentment
Sadness	Suffering		Pride
	Sadness		Optimism
	Disappointment		Enthrallment
	Shame		Relief
	Neglect	Surprise	Surprise
	Sympathy		
Fear	Horror		
	Nervousness		

Although the various taxonomies differentiate between many different emotions [7,23], some taxonomies fall back on a simple differentiation between positive and negative emotions [24]. Although we value the fact of being able to differentiate between various qualities of emotions, in the current manuscript, we also summarize the six primary emotions [7] into negative (sadness, anger, fear) and positive emotions (joy, surprise, love). We consider the different characteristics of these six emotions but reduce the complexity of dealing with their manifoldness.

Earlier research has already focused on specific emotions regarding sustainable consumer behavior. For instance, guilt as a negative emotion was investigated in the context after the consumption [27], showing that the consumption of unsustainable products can stipulate guilt in consumers. Contrarily, the consumption of sustainable products can provoke the positive emotion of pride [27]. Although research on the impact of emotions on the purchase and consumption of sustainable products exists, to our knowledge, studies on the impact of manifold emotions on carbon-friendly food are scarce. Therefore, the current studies focus on the list of emotions in social psychology [7], investigating their relation to the purchase behavior of carbon-friendly food.

2.4. Theory of Planned Behavior & Emotions

As stated above, we build on the theory of planned behavior [TPB, 20] and adjust it with additional variables, namely negative and positive emotions [7]. As earlier research [21] has identified, although the TPB [5] is a very comprehensive social-psychological theory excellently predicting behavior, it is missing one essential aspect: the state of emotions when humans consider undertaking a behavior. A meta-analysis [28] shows that the incorporation of emotions enhances the predictive power of the TPB [5]. This is the reason why we base our theoretical model on the TPB [5] and emotions [7].

Earlier research [6,29] did incorporate emotions; specifically, the emotions of regret or fear, in the TPB [5] to explain sustainable food-related behavior, i.e., purchasing organic food or selecting an eco-friendly restaurant. However, to our knowledge, the whole range of emotions was never incorporated. Furthermore, emotions were shown to affect purchasing intentions for organic food [15] but independently from the TPB [5]. Nevertheless,

carbon-friendly food purchases incorporate more than only the purchase of organic food. For that reason, we not only incorporate a whole range of emotions [7] in the TPB [5], but also investigate the predictors of the comprehensive behaviors of carbon-friendly food purchases, i.e., plant-based diet instead of animal products, more organic food but less processed food, preferring local food over chilled or frozen food and no or minimal packaging. Based on all these considerations, we formulated the following research questions:

Research Question 1: What are the motivations to purchase carbon-friendly food?
Research Question 2: Which emotions emerge with the purchase of carbon-friendly food?
Research Question 3: Can the theory of planned behavior [5], including negative and positive emotions, explain the purchase of carbon-friendly food?

Figure 1 illustrates the proposed relationships that will be tested in our studies. Starting with the TPB [5] and incorporating positive and negative emotions [7], the model is supposed to explain comprehensively different kinds of carbon-friendly food purchases.

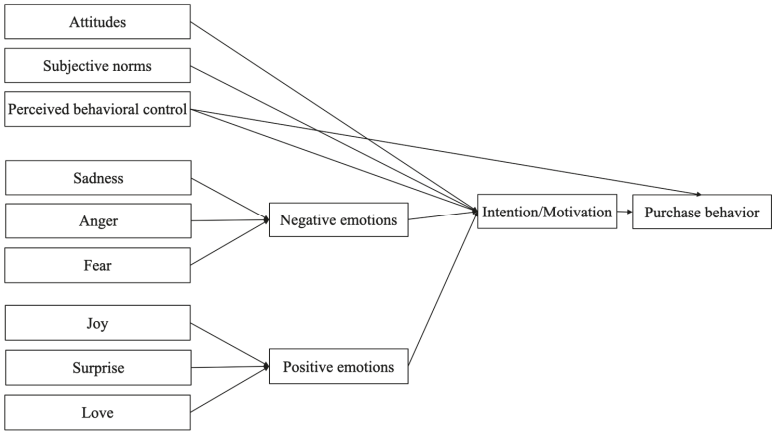

Figure 1. Theoretical model including emotions [7] in the TPB [5].

Answering these research questions, two explorative interview studies and one representative questionnaire study were conducted. They examine the relationship between motivations and carbon-friendly food behavior (Study 1), the relationship between emotions and carbon-friendly food behavior (Study 2) and the overall theoretical research model integrating the TPB and emotions to explain carbon-friendly food behavior (Study 3).

3. Study 1

3.1. Method

To answer *Research Question 1* (*What are the motivations to purchase carbon-friendly food?*), we searched for participants who adhere already to a carbon-friendly diet, such as vegetarian or vegan diets, and ten participants agreed. Eight out of the ten participants were female, which is acceptable since in general female respondents are more willing to participate in such studies. Their ages ranged between 19 and 53 years (M = 29.80, SD = 10.86). Six participants were students, and the others worked in various professions. Seven participants adhered to a vegetarian diet, and three adhered to a vegan diet, whereby all of these participants were vegetarians before becoming vegan (Table 2).

The interviews were conducted in German, audio-recorded and transcribed afterward. The developed interview guidelines aimed at studying motivations concerning carbon-friendly food behavior. The different parts included (1) questions about participants' vegetarian or vegan diet, (2) their motives for changes in their diet as well as (3) reactions from the social environment. In addition, aspects concerning the (4) actual purchasing

behavior, such as the place of purchase and the product itself, were discussed. In this paper, part (3) will not be considered further.

Table 2. Socio-demographics of participants in Study 1.

Coded Name [1]	Sex	Age	Occupation	Diet
John	M	23	Student	Vegetarian
Nina	F	23	Student	Vegetarian
Lisa	F	20	Student	Vegetarian
Max	M	24	Student	Vegan
Sarah	F	33	Biologist	Vegetarian
Sandra	F	39	Student	Vegetarian
Melanie	F	39	Master tailor	Vegan
Laura	F	22	Student	Vegan
Maria	F	22	Student	Vegetarian
Eva	F	53	Flight attendant	Vegetarian

[1] The coded name is fictitious and not related to the actual name of the participant; M = male, F = female.

Data were analyzed following qualitative content analysis [30] to identify relevant categories and patterns to explain the relationship between motivations and carbon- friendly food behavior.

3.2. Results

After a comprehensive analysis, it turns out that mainly four groups of motivations for a vegan as well as a vegetarian diet prevailed: (1) ethical concerns about animal rights, (2) personal health concerns, (3) environmental sustainability and (4) disgust towards meat. While all these motivations were present for both vegans and vegetarians, some motivations were more present for one or the other group.

Regarding (1) the ethical concerns about animal rights, respondents named animal suffering and cruel living conditions of animals in factory farming as reasons for stopping eating meat. For instance, Nina (23 yrs.) informed herself about the living conditions of animals and decided to become a vegetarian. Max (24 yrs.) explained his vegan diet by saying, "Each and every living being is valuable and eating meat is simply wrong" (all verbal quotes were translated from German into English). In a similar vein, Sarah (33 yrs.) describes her feelings as follows: "It always has been an effort to eat dead animals; the ethical aspect prevailed at my side." In sum, more than half of the participants listed animal rights as the dominant motivation for their vegan or vegetarian diet.

(2) Acute health problems or wanting to do something for their personal body health, in general, were important reasons for respondents to change their diets; particularly for those becoming vegan, personal health was a major driver. For instance, Eva (53 yrs.) stated, "I followed a vegetarian diet because I wanted to do something for my health. At that time, I was sure that it was beneficial for my health, which is why I started step by step." Some respondents realized the impact of animal protein on their health. Respondents mentioned a documentary [31] as having had a major impact on their diet change. Not only did the documentary reveal the shocking effects of Western diets on health, but it also presented a solution to the problem, i.e., a mainly plant-based diet. Laura (22 yrs.) suffered from lactose intolerance and became vegan.

(3) Environmental sustainability was mentioned in a rather broad sense. For example, Melanie (39 yrs.) states, "I care about the climate. I am a bit worried about the environment." Lisa (20 yrs.) also says, "I believe the consumption of meat can be a severe problem for our environment. Well, the intense factory farming (of meat)." More specific aspects for becoming vegan or vegetarian related to resources, for instance, as Sandra (22 yrs.) puts it, "Once you realize how much water is needed to eat one kilogram of beef compared to eating one kilogram of beans, both having similar nutritional values, then it is a difference of 10,000 or 20,000 kg of water, I guess." However, environmental sustainability did not

appear to be the sole concern for our respondents, but mentioned in conjunction with animal rights and health concerns.

Another reason behind becoming vegan or vegetarian includes (4) disgust or dislike of meat. The meat-specific unpleasant experiences of taste, smell, look or texture were mentioned. Lisa (20 yrs.) argued that initially, she thought that animal welfare influenced her but she realized that "it did not taste pleasant. I justified becoming vegetarian by saying 'I feel sorry for animals', but it was more that it didn't taste good." Emotional reactions such as dislike or disgust towards meat often represented a basis for the change to a vegetarian or vegan diet but seldom served as principal motivation.

For most of the respondents, multiple motivations were relevant. Some of these became more important over time (e.g., environmental sustainability), partly because of increased exposure to information and increased awareness. As Sandra (22 yrs.) puts it: " . . . the environmental aspect also turned up, I wasn't aware of it earlier." In this respect, it was interesting to hear that previously vegetarians changed to a vegan diet, and their transition seems to be easier and quicker because they already have some knowledge and experience in this field. For instance, Melanie (39 yrs.), now vegan, states: "I was vegetarian before. I actually tried it all my life. I mean, as a child, I was not allowed to, but I refused to eat meat most of the time."

Other aspects were also important for participants' motivation to engage in carbon-friendly food behavior. Regarding the origin and production of products, the majority of participants (seven out of ten interviewees) listed either organic or regional as important characteristics of food for their purchasing decision. Vegetarian consumers tend to purchase more carbon-friendly compared to vegans. Several vegetarians explained in detail how important the origin and the way of production are for their choice of products. This contrasts with some vegans, who mentioned that they might buy organic products sometimes or do not pay too much attention to them.

In this respect, some mention the importance of the price–performance ratio for their buying decision and, owing to that, reject buying organic apples, instead choosing regional ones. As John (23 yrs.) states: "When it comes to buying apples, which sometimes cost up to three times as much when they are organic, it is sufficient to buy Austrian apples." Moreover, all participants purchased their food mainly in supermarkets, as the convenience and price were appealing. Of course, some bought certain products in organic supermarkets, but in general, limited budgets were constraints.

Regarding substitute products, only one interviewee mentioned that she regularly purchases vegetarian substitute products (such as vegetable patties). Reasons for not adopting substitutes related to perceived unhealthiness are the high amount of food additives included in those products or tastes. Instead, alternatives were consumed; for instance, Laura (22 yrs.) states, "I hardly buy substitute products. I think, in the first year, I mainly ate only (a substitute) yogurt. It is now one year that I've tried out some . . . But I don't think that they should be a fixed part of my diet." Food additives play an important role in purchasing decisions in general. Half of the participants explicitly noted that they pay attention to additives and binders included in certain products when buying food.

Labels of vegetarian and vegan products were discussed highly controversially during the interviews. A clear and consistent marking seems to be important to clarify the ingredients of a product, which is important for vegetarian and vegan consumers. Nevertheless, the image and perception others have regarding vegetarians and vegans and their lifestyle is a critical issue. Therefore, labeling or packaging which highlights the product as vegetarian or vegan, in a too dominant, overdesigned manner is perceived as unattractive. Two vegetarian interviewees complained about the packaging and the labeling of vegetarian products. Particularly, they mentioned the green color of the products as well as the label "vegetarian." As a vegetarian, they do not want to be excluded from other consumer groups. Lisa (20 yrs.), for instance, argues, "They give you the experience of being different, but in a negative way." Another respondent finds the green packaging of vegetarian products misleading and argues that this choice of color should imply that the product is healthy

which, is often not the case for vegetarian food. Maria (22 yrs.) says, "I find packaging usually disgusting because of their green color. Vegetarian is automatically perceived as healthy, which is nonsense." Nevertheless, even if it is clear for some products, the labeling "vegan" still facilitates the purchase of food.

3.3. Discussion

An important reason for switching their diet is concern about animals raised for food [32]. Ethical concerns represent the major motivations for vegetarians to stop their meat consumption. Consumers state in particular animal rights and the quality of life of animals as main concerns in this regard [33,34]. We also identified personal health as the main influencer for the adoption of a vegetarian diet. Moreover, consumers expressed negative emotions, such as disgust and dislike regarding meat consumption, indicating that emotions are important drivers to pursue carbon-friendly food behavior.

Ecological sustainability is getting increasingly important for consumers who follow a vegan diet for some time [32], which was also observed in our study; in addition, the engagement of persons on plant-based nutrition tends to rise over time. Market-related factors such as retail stores, product offerings and labeling as well as pricing are taken into consideration when shopping carbon-friendly, in our case for vegan or vegetarian food products.

4. Study 2

4.1. Method

To answer *Research Question 2* (*Which emotions emerge with the purchase of carbon-friendly food?)*, participants' diet was not treated as selection criterion to allow enough breadth of insights into consumers' emotions.

Seven out of the ten participants were female, which again is acceptable since in general female respondents are more willing to participate in such studies. Overall, the age range was between 23 and 60 years (M = 34.20, SD = 14.80). Half of the sample were students; the others were working in various jobs. Regarding the participants' diets, five were omnivores, eating all kinds of foods, three were flexitarians, mainly focusing on vegetables and dairy products with sometimes meat or fish, and two were vegetarians, eating vegetables and dairy products (Table 3).

Table 3. Socio-demographics of participants in Study 2.

Coded Name [1]	Sex	Age	Occupation	Diet
Mara	F	23	Student	Flexitarian
Linda	F	24	Student/Part-time Job	Omnivore
Hannah	F	23	Student	Omnivore
Stefanie	F	54	Office worker	Omnivore
Anna	F	52	Architect	Omnivore
Jakob	M	26	Student/Part-time Job	Vegetarian
Charlotte	F	28	CEO of an organization	Vegetarian
Franz	M	60	Office worker	Flexitarian
Viktoria	F	25	Student/Part-time Job	Omnivore
Stefan	M	27	Technician	Flexitarian

[1] The coded name is fictitious and not related to the actual name of the participant; M = male, F = female; Flexitarian = a mainly vegetarian diet with meat or fish sometimes, Omnivore = a diet consisting of meat, fish, dairy products and vegetables, Vegetarian = a diet consisting of vegetables and dairy products.

All interviews were conducted in German, audio-recorded and transcribed afterward. The study aimed at assessing the relationship between emotions and carbon- friendly food behavior. The interview guidelines of this study followed a structured market research method, i.e., ZMET [35]. Part of this technique was to instruct participants (about one week prior to the interview) to think about food that is produced organically or is producing less CO_2 in the production, transportation, consumption and disposal process, and to collect

10–15 pictures (independent of medium) that express their respective thoughts. Data were analyzed following qualitative content analysis [30] with the aim of identifying relevant categories and patterns to explain the relationship between emotions and carbon-friendly food behavior.

(1) The first step of the ZMET interview included "storytelling." Participants were asked to describe each of the pictures and their related thoughts and explain possible issues that may relate to the pictures. The closing question in step 1 was on participants' feelings when purchasing sustainable food products. (2) The second step of the technique was to let participants sort their pictures into meaningful categories. (3) Step three ("most representative picture") included the question about which picture is best associated with the topic. (4) In step four ("missing images"), it was asked whether participants were unable to find a specific picture; while in (5) step five, participants were asked to select one picture that is least associated with the topic ("opposite image"). Eventually, (6) in step six ("summary image"), the participants created a summary image (collage) of all collected pictures as part of the interview.

Concerning the "most representative image," participants selected a variety of pictures (e.g., a farmers' market with an elderly woman selling products, seasonal vegetables, a wheat field, a quotation of Mahatma Gandhi, etc.)

Regarding "missing images," nearly all participants found all the pictures they were looking for. When looking at the "opposite image," participants selected a variety of pictures (the brand "JA! Natürlich" (products and the mascot pig), sign with the word "sustainability" on it, mountain water, a ray in the sea, etc.).

4.2. Results

In order to analyze the relationship between emotions and carbon-friendly food behavior, the participants categorized their collected pictures. The most often used category was "own products/own garden/home-made" (f = 7). Five participants choose the category "local products/local farmers' markets/local resources." In addition, categories "seal of quality/food brands" (f = 3), "organic farming" (f = 2) and "zero-waste/packaging/model for the future" were used to group pictures. All other 23 categories were only mentioned once, e.g., "the first step to sustainability," "natural protein source" or "shopping." Overall, participants sorted their pictures into 28 different categories.

Regarding the question of which emotions were evoked, in the following negative and positive emotions will be described, following the framework of emotions by Parrott [7].

4.2.1. Positive Emotions

The positive emotions, which the participants mentioned, are the primary emotion joy, with its secondary emotions optimism (joy) and pride (joy), and its tertiary emotions happiness (joy), satisfaction (joy), enthusiasm (joy) and desire (love). Additionally, other emotions were stated, such as affiliation, trust and feeling good.

When thinking of sustainable food consumption, participants named joy in connection with growing their own vegetables. For instance, Hannah (23 yrs.) explained: "It somehow shows me that you can enjoy fruits and vegetables that grow in their natural habitat, which have not artificially been produced." Stefanie (54 yrs.) feels joyful when she buys organic food products at farmers' markets. She said: "Farmers from nearby come to offer their organic products here, and it is such a joy to walk through (the market) and experience the seasonality of their products."

In one specific case, a participant felt joyful when she collected chanterelle mushrooms in the forest. Shopping in a zero-waste supermarket induced joy for Stefan (27 yrs.), who mentioned it as a great opportunity to reduce waste from packaging. In addition, Anna (52 yrs.) feels joyful when she thinks about the different forms of vegetables that are available: "It brings me unbelievable joy to have such a variety, and I can imagine that each form is related to different substances. That all these pumpkins differ in terms of colors, smells and tastes."

Many participants feel optimistic about the future's sustainable food production and consumption. They think that everyone can contribute to a fairer allocation of the world's resources. For instance, Linda (24 yrs.) is sure that every step counts; according to her, "Everyone can make a difference. No matter how small it is, for instance, instead of eating meat three times a week, eat it only once a week. I believe this is extremely valuable; if everyone does that, it sums up. Even a small amount will make a difference."

Pride was also mentioned a lot by the participants. Mara (23 yrs.) is proud that the family grows their own vegetables, "one is very proud about having themselves collected or grown it and then cooks it themselves," and Linda (24 yrs.) mentions that her family's diet is a source of pride and unites them. She says, "Not every family values these things. I think my children are very proud and are happy about this too."

Some participants feel happy and satisfied if they prepared food on their own or eat the vegetables they grow on their own. For instance, when growing her own vegetables under difficult conditions, Anna (52 yrs.) feels satisfied, as her work was successful. She says: "I was so happy that for the first time this year we succeeded in growing carrots. These carrots are a symbol of success and joy in the unexpected success."

The enthusiasm, which is felt if they consume sustainable food, can be illustrated with Franz's (60 yrs.) statement about his homegrown garlic: "I eat it now with enthusiasm, and I couldn't care less about the imported garlic."

In a similar vein, a special sustainable food product evoked desire (love) as Stefan (27 yrs.) expresses it as follows: "The bread looks really crunchy and fresh. You just want to eat it!"

Some respondents feel affiliated with their families when they think of consuming sustainable food. As Linda (see above regarding optimism) did, Stefanie (54 yrs.) also mentioned that she feels close to people who have the same interests as her. According to her, the feeling "of solidarity, of being a part of a group or community, evokes a strong feeling of unity."

Participants talked about trust when thinking of ecologically sustainable food brands, such as Mara (23 yrs.), who states, "You can't know for sure, I have no control over it, but I trust products are organic if they come from organic agriculture." Food produced in Austria is trusted more; for instance, Jakob (26 yrs.) says, "I ultimately trust products made in Austria more."

Eventually, a more general positive expression was used: to feel good. If a chicken lives a good life, Mara (23 yrs.), for instance, feels good too. For Jakob (26 yrs.), too, spending his holidays on farms makes him feel good, and he is not surprised that a supermarket's private brand uses farm images to evoke such nostalgic feelings. A variety of animals and plants is mentioned in this context and in general, as Franz (60 yrs.) states: "The most important thing is to sustain the variety of species and plants to preserve a habitat where you feel good and can live a happy and healthy life."

4.2.2. Negative Emotions

We identified negative emotions that are categorized by Parrott [7] as the primary emotion of sadness. Related secondary or tertiary emotions are sympathy, guilt, rejection and a sense of shame. In addition, anger was reported as well as shock (fear).

Participants feel the primary emotion of sadness when thinking of food waste caused by supermarkets and society. As Mara (23 yrs.) puts it, "I find it very bad, and I feel sadness. It is a pity that this problem can't be solved otherwise and the vegetables are thrown away." She also feels sad when she thinks of chickens coming from intensive livestock farms. The destruction of nature and the planet is mentioned by Hannah (23 yrs.) as follows, "It makes me sad because this is nature, and by putting waste out there, we destroy it rather than preserve it." In regards to the closing down of traditional small-scale food companies, Franz (60 yrs.) states: "It makes me feel sad to see a picture of the butcher shop, which was no longer profitable. It's sad in principle, because the personal relationship got lost." Additionally, the lack of appreciation towards food products are elements that make

participants such as Stefan (27 yrs.) feel sad: "As a baker's son, I feel very sad (. . .) in realizing that products are not seen as a craft anymore but as mass products."

Sympathy is evoked by seeing pictures of the consequences of bad weather conditions, such as loss of harvest. For example, Mara (23 yrs.) feels sympathy for farmers whose livelihoods are at risk when losing their harvest.

Participants feel guilty when they think of today's situation of livestock farming, for instance, Linda (24 yrs.), feels guilty eating meat: "I like to eat meat, and I am cautious to get good meat. However, that's not always possible. Sometimes you don't have the time, or you don't take the time," and Hannah (23 yrs.) realizes the responsibility of consumers and feels guilty that (small-scale) farmers in Austria may disappear if consumers do not consider buying from them.

Some participants reject buying products that are shipped to the supermarket, for instance, fruits and vegetables that are out of season but available all year round, as Franz (60 yrs.) states, "You get all varieties of fruits and vegetables all year round. I strongly reject that, personally." Likewise, Stefanie (54 yrs.) feels ashamed when she thinks of today's trade of food products.

Next, the primary emotion of anger was felt. For example, Linda (24 yrs.) gets angry when thinking of food waste. She admits, "Of course it makes me angry. However, I have a feeling that nothing will change because the industry regulates it."

Finally, Charlotte (28 yrs.) was shocked to learn how many desserts included the ingredient palm oil.

In addition to the emotions identified by Parrott [7], we found that most of the participants mentioned that they have doubts about the credibility of seals of quality or sustainable food brands. For instance, Stefanie (54 yrs.) states, "In the supermarket, it is not always organic or sustainable, even if it says so." Moreover, they question if imported products are still healthy and rich in nutrients, as Hannah (23 yrs.) says: "It is questionable how many vitamins are lost on their way and how the logistic chain really works."

Other negative emotions, such as annoyance, as mentioned by Charlotte (28 yrs.): "You mustn't say: Don't eat that, or buy less. It annoys people," or dissatisfaction as expressed by Mara (23 yrs.), reacting to the fact that conventional vegetables come from Spain, are found as well.

4.3. Discussion

The results regarding the relationship between emotions and carbon-friendly food behavior extend earlier research [27], which focused only on the emotions of guilt and pride in the context of sustainability. Our results show a great variety of evoked emotions, as identified by Parrott [7], concerning sustainable food products.

We found the positive emotions joy, optimism, pride, happiness, satisfaction, enthusiasm and desire. Additionally, affiliation, trust and feeling good were mentioned. On the other hand, the negative emotions were sadness, sympathy, guilt, rejection and a sense of shame. In addition, anger and shock as well as annoyance and dissatisfaction were mentioned.

This study has provided valuable insights into consumers' emotions regarding sustainable food products. Both positive and negative emotions were evoked; the primary emotions, joy (positive) and sadness (negative), were mentioned the most.

Nevertheless, this research is limited as only ten participants took part in the qualitative study. Therefore, an additional study on motives and emotions in combination, and the effect of emotions and motivations on behavior, is the next step. For that reason, we designed a third study assessing data on predictors (motivations, emotions) for purchase behavior of carbon-friendly food (Study 3).

5. Study 3

5.1. Method

To answer *Research Question 3* (*Can the theory of planned behavior [5], including negative and positive emotions, explain the purchase of carbon-friendly food?*), we designed a quantitative study building on the conceptual framework established previously (see Figure 1). Data were gathered through an online survey by a market research company; the questionnaire was developed based on results from Study 1 and Study 2 as well as the literature. The questionnaire was filled in by a representative Austrian sample of 1000 consumers (50.1% females, M_{age} = 44.81, SD_{age} = 14.55, representative for the nine Austrian countries) (Table 4). Of the 1000 Austrian consumers, most described themselves as omnivores (88.6%), eating animal as well as vegetable foods; only 11.3 percent described their diet as vegetarian (9.4%) or vegan (1.9%) (Table 4).

Table 4. Socio-demographics of participants in Study 3.

Age		**M = 44.81**	**SD = 14.55**
Gender	Female	501	
	Male	498	
	Divers	1	
Country of Austria	Vienna	219	
	Lower Austria	187	
	Upper Austria	165	
	Styria	141	
	Tyrol	86	
	Salzburg	63	
	Carinthia	61	
	Vorarlberg	44	
	Burgenland	34	
Personal Net Income	0 EUR–500 EUR	80	
	501 EUR–1000 EUR	136	
	1001 EUR–1500 EUR	191	
	1501 EUR–2000 EUR	227	
	2001 EUR–2500 EUR	172	
	2501 EUR–3000 EUR	106	
	More than 3000 EUR	88	
Education	Primary school	49	
	Vocational school	317	
	Middle school	136	
	Higher school certificate	272	
	University degree	226	
Job Situation	Student	73	
	Homemaker	53	
	Employed	530	
	Self-employed	54	
	Unemployed	52	
	Pensioner	201	
	Others	37	
Persons Living in the Household	1	245	
	2	383	
	3	197	
	4	119	
	5	42	
	6 and more	14	
Diet	Animal and vegetable foods	886	
	Vegetarian	94	
	Vegan	19	
	Others	1	
Grocery Shoping Primarily in Family		M = 5.48	SD = 1.70

The measures used for data collection (Attitudes, Subjective norms, Perceived behavioral control, Emotions, Intention to purchase carbon-friendly food, Purchase of carbon-friendly food) were all multi-item constructs and answerable via a seven-point Likert scale, ranging from 1 "strongly disagree" to 7 "strongly agree." The scale Attitudes was assessed with six items (e.g., Buying carbon-friendly foods is, for me, a good idea.) following research on organic food [36]. Subjective norms were measured using four items adapted from previous research [36] (e.g., Most people I value would buy carbon-friendly food.). Perceived behavioral control was operationalized using a three-item scale, again based on items used in previous research [36] (e.g., I think it is easy for me to buy carbon-friendly food.). The scale Emotions was measured with 29 self-developed items based on the primary and secondary emotions presented in the theoretical background [7] (e.g., Purchasing carbon-friendly food, I feel joy.). For further analyses, the emotions were grouped into the six primary emotions (Sadness, Love, Anger, Joy, Surprise, Fear) that again were grouped to Negative emotions (Sadness, Anger, Fear) and Positive emotions (Love, Joy, Surprise). Intention to purchase carbon-friendly food was again measured using three items [36] (adapted, e.g., I plan to buy carbon-friendly food). The final scale, Purchase of carbon-friendly food, was assessed with eight self-developed items based on the definition of carbon-friendly food in the theoretical background [4] (e.g., I deliberately buy vegetables instead of meat to reduce CO_2.). Additionally to the scales above, nine Demographic variables were measured (Age, Gender, Country of Austria, Personal net income, Education, Job situation, Persons living in the household, Person primarily doing grocery shopping, Diet). Overall, reliability for all scales was very good ($0.75 < \alpha < 0.95$; see Table 5). Nevertheless, to achieve a very good Cronbach-α, one item had to be omitted; the secondary emotion "sympathy" was excluded from the primary emotion scale Sadness because of incongruence with the remaining secondary emotions.

Table 5. Reliability and correlations of scales and variables.

Scales/Variables	α	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Attitudes	0.95										
(2) Subjective norms	0.88	0.53 ***									
(3) Perceived behavioral control	0.75	0.42 ***	0.47 ***								
(4) Sadness	0.94	−0.18 ***	−0.04	−0.12 ***							
(5) Anger	0.93	−0.22 ***	−0.08 *	−0.18 ***	0.70 ***						
(6) Fear	0.92	−0.20 ***	−0.04	−0.16 ***	0.61 ***	0.72 ***					
(7) Love	0.91	0.26 ***	0.42 ***	0.31 ***	0.17 ***	0.17 ***	0.18 ***				
(8) Joy	0.95	0.40 ***	0.51 ***	0.38 ***	−0.03	−0.06	−0.04	0.68 ***			
(9) Surprise		0.11 ***	0.29 ***	17 ***	0.25 ***	0.22 ***	0.25 ***	0.57 ***	0.48 ***		
(10) Intention	0.93	0.55 ***	0.54 ***	0.51 ***	−0.23 ***	−0.29 ***	−0.26 ***	0.37 ***	0.58 ***	0.16 ***	
(11) Behavior	0.87	0.50 ***	0.53 ***	0.48 ***	−0.11 ***	−0.14 ***	−0.12 ***	0.39 ***	0.54 ***	0.24 ***	0.71 ***

*** = $p < 0.001$, * = $p < 0.05$.

5.2. Results

Answering the overall research question, what factors are related to carbon-friendly consumer behavior, we tested our theoretical model by employing a structural equation model (see Figure 1). Using IBM SPSS AMOS 26 [37], an unconstrained model test was undertaken. The analysis verified the explanatory power of the theoretical model relating Attitudes, Subjective norms, Perceived behavioral control, and Negative emotions (Sadness, Anger, Fear) and Positive emotions (Love, Joy, Surprise) via Intention to purchase carbon-friendly food to Purchase behavior of carbon-friendly food (CMIN (1,1144) = 3791.42, $p < 0.001$, CMIN/df = 3.32, RMSEA = 0.05, Hoelter (0.05) = 323, CFI = 0.94). As the chi^2 test specified that data differed significantly from the theoretical model, additional relevant statistical tests confirmed that the significance was due to the large sample size (total 1000 respondents). For instance, CMIN/df of below 5 indicates a reasonable fit [38], and the Hoelter (0.05) measure above 200 indicates that if the sample size was reduced to 323 respondents, the chi^2 would not be significant [39]. Finally, the CFI, above 0.90, is a sign for an acceptable fit [40]. This confirmed that from an overall perspective, our theoretical model held (for regression coefficients in the observed model, see Table 6).

Table 6. Standardized regression coefficients in the observed model.

Regressions			
Predictor	**Dependent Variable**	**β**	
Attitudes	Intention	0.26	***
Subjective norms	Intention	0.18	***
Perceived behavioral control	Intention	0.26	***
Negative emotions	Intention	−0.25	***
Positive emotions	Intention	0.35	***
Perceived behavioral control	Purchase behavior	0.25	***
Intention	Purchase behavior	0.63	***

*** = $p < 0.001$.

5.3. Discussion

In answering Research Question 3, whether the theory of planned behavior (TPB [5]) including negative and positive emotions [7] can explain the purchase of carbon-friendly food, we find that the TPB including negative and positive emotions is an adequate theoretical vehicle to predict carbon-friendly food purchases. While motivational factors such as attitudes, subjective norms and perceived behavioral control show a rather medium positive influence on purchase intention, negative emotions also show medium negative effects and positive emotions a positive effect. Thus: (a) the more consumers associate positive evaluations with carbon-friendly food purchases; (b) the more important they perceive others to also favor carbon-friendly food purchases; (c) the more they have the feeling they actually *can* buy carbon-friendly food; (d) the more positive emotions they feel when buying carbon-friendly food; and (e) the less negative emotions experienced with carbon-friendly food purchases the higher their intention to buy carbon-friendly food and, subsequently, the higher the likelihood of their actual purchasing behavior. This is certainly in line with earlier research, in which certain emotions (e.g., the negative emotion guilt) are combined with the TPB to show their impact on specific carbon-friendly food purchases (e.g., buying organic food) [6,29]. With Study 3, we have expanded on the earlier findings. We not only used several different emotions to predict carbon-friendly food purchases, but we also focused on the whole range of carbon-friendly food purchases. This includes the well-researched buying of organic food and taking into account the length of transfer, the packaging, the production of food, and the kind of food (plant-based instead of meat).

6. Discussion

In light of the enormous impact food consumption has on greenhouse gas emissions, means of reducing food-related CO_2 need to be found to decelerate climate change. Our approach focuses on changing food consumption habits to carbon-friendly eating patterns utilizing information campaigns and legal regulation. In this respect, we investigated what antecedents and drivers determine consumers' food consumption practices. Furthermore, following the theory of planned behavior (TPB [5]) and incorporating emotions [7], we analyzed motivational aspects (attitudes, subjective norms, perceived behavioral control) and emotions by means of three empirical studies, guided by three research questions.

To answer Research Question 1 (What are the motivations to purchase carbon- friendly food?) and Research Question 2 (Which emotions emerge with the purchase of carbon-friendly food?), two qualitative studies were conducted. First, regarding the motivations, we found that ethical concerns and personal health are the main drivers for carbon-friendly food consumption. In particular, food production, for instance, of meat, and the effects of food on consumers seemed to be central. In contrast, the environmental aspect was mentioned only as a consequence of other aspects. In addition, consumers also reported negative emotions.

Therefore, the goal of Study 2 was to identify different emotions that relate to carbon-friendly food consumption. This extends previous research that focused on selected emotions with regard to sustainable consumption. Our results show that positive and

negative emotions can be evoked regarding carbon-friendly food. Using pictorial material, consumers reported the positive emotion *joy* and related emotions. They were caused by realizing the variety and quality of fresh products available, and how enjoyable producing and preparing one's own food can be. The main negative emotion discussed was *sadness*, and it was felt in relation to the consequences of industries' or consumers' behaviors on the environment. These feelings also included *guilt* or *shame*, two commonly investigated emotions. Overall, the variety of emotions and their causes revealed the importance of identifying them. For instance, the way food is produced and handled can cause positive and negative emotions. Consumer-felt control over their diet and food choice leads to positive emotions. In addition, business practices evoke consumers' emotions, which may become influential in purchase situations.

Consequently, Research Question 3 tested whether the theory of planned behavior [5], including negative and positive emotions [7], can explain the purchase of carbon-friendly food. We conducted a survey with a representative sample in Austria and found significant influences of attitudes, subjective norms and perceived behavioral control, as well as both negative and positive emotions, on the intention and subsequent purchase of carbon-friendly food. This means that consumers, in general, would purchase carbon-friendly food; they view it as something meaningful.

Regarding consequences for informational campaigns, we conclude that using emotions, preferably positive emotions, in communication with consumers will influence their intention to purchase carbon-friendly food. From a more legal and regulative perspective, we found that consumers' perceived behavioral control affects their intention and purchase behavior. Thus, the more consumers feel that they can make a difference and choose, the higher the likelihood of their carbon-friendly food purchase. Factual information, in the form of labels or packaging would help consumers learn which products are actually carbon-friendly to make their choice.

In our research, we mainly focused on negative and positive emotions. Thus, in future research, a more fine-grained inspection of different emotions, as identified in Study 2, would help understand exactly which emotions influence the purchase of particular food items. For instance, as suggested in Study 2, would *disgust* negatively influence meat purchases? In addition, it is rare that in purchase decisions only one emotion alone occurs; different emotions are felt. A further research avenue could include the analysis of mixed emotions concerning carbon-friendly food purchases.

Concluding, we can say that drivers to stir carbon-friendly food purchases are certainly motivations (attitudes, subjective norms, perceived behavioral control) as well as negative and positive emotions. It is a merit of the current research on the one hand that the theory of planned behavior [5] is extended by emotions [7] in the context of carbon-friendly food purchase and on the other hand that the whole range of carbon-friendly food purchase is included in the research model. Therefore, we can recommend necessary strategies for information campaigns and legal regulation.

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To Purchase or Not to Purchase? Drivers of Consumers' Preferences for Animal Welfare in Their Meat Choice

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Abstract: This study investigates the relevance of psychological constructs in determining consumer intention to buy and Willingness-To-Pay (WTP) for a processed meat product, cured ham, differentiated by the attributes of animal welfare, ham variety, and price. Data obtained from an online survey conducted in Germany was used to estimate an integrated choice and latent variable (ICLV) model, which is based on an extension of the Theory of Planned Behavior (TPB) framework. There are two consumer segments that are identified: one that is highly price sensitive in its product choice and one that gives roughly equal weight to the animal welfare, ham variety, and price attributes. The ICLV model shows consistency across the two groups regarding the importance of psychological constructs—moral norms, attitude, and perceived behavioral control—in explaining respondent intentions to buy cured ham and their stated product choice. Subjective norms, however, are only a significant determinant of consumer intention to buy cured ham for the price sensitive consumer group.

Keywords: animal welfare; cured ham; discrete choice experiment; latent construct model

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1. Introduction

Animal welfare is acknowledged at the national and global level [1,2] as a core element of sustainable development and has become a highly debated issue in media, politics, in the meat sector, and among consumers/citizens in many Western countries, including Germany [3–5]. German citizens generally take a critical stance regarding the rearing conditions of farm animals. In 2006, 78% of the population believed that farm animal welfare protection needed to be improved [6], with this figure rising to 83% in 2015 and to 87% in 2017 [7,8].

Complying with above-legal animal welfare (AW) standards can be linked to a considerable surge in costs along the whole value chain, though this is especially the case at the farm level. Farmers who adopt higher farm animal welfare (FAW) standards need to introduce FAW-improving technologies. Depending on the level of AW standards, these can induce high capital requirements (e.g., housing, new breeds), a need for additional land as well as high-level management and marketing skills, whilst reducing productivity and increasing price risk [9,10]. However, costs from complying with AW standards also occur further downstream in the value chain, for example, with respect to transportation and slaughtering, but also due to the need for market segregation along the whole value chain [11]. Though the need for government involvement (e.g., in form of regulation and subsidies) is increasingly acknowledged [1,12], the economic viability of high animal welfare husbandry systems also crucially depends on consumer willingness to pay a premium for welfare-enhanced meat products. It is therefore necessary to obtain an accurate assessment of the potential price premiums that consumers and specific consumer segments are willing to pay as well as insights into the determinants of consumer preferences in order to recognize the market potential for welfare-enhanced meat products and to identify relevant consumer-oriented measures.

The importance of these topics is reflected in the growing literature investigating different aspects of the complex issue of FAW [13–16], with many studies analysing consumer Willingness-To-Pay (WTP) for FAW [17] and the drivers of consumer purchasing and consumption of FAW products [13–17]. However, research that integrates information on consumer choices in an extant theoretical framework of consumer behavior is missing.

The majority of consumer research on FAW assesses the willingness of consumers to pay a premium for improving the welfare of farm animals. In their meta-analyses, Lagerkvist and Hess [18], and more recently Clark et al. [19], investigate respective studies and arrive at the conclusion that consumers have a positive, though small, WTP for livestock products characterized by higher animal welfare standards. While this holds regardless of animal type, the premium consumers are willing to pay is higher for beef and dairy products and is lower for pork. Variability is also found to exist between regions, even within Europe, with higher WTP estimates for Southern compared to Northern European countries. Furthermore, consumer WTP depends on socio-demographic variables, increasing with income and education and decreasing with age [19]. Recent studies largely confirm those previous findings and add interesting additional insights by broadening knowledge of the factors that influence the premium that consumers are willing to pay for FAW. Those include consumer experience with FAW products, the presence of competing labels, the way animal welfare practices are regulated, and how much the consumer likes the product [18–25]. Furthermore, while several DCE studies point to the existence of preference heterogeneity with respect to consumer WTP for FAW, there are only a few studies that consider behavioral factors as drivers of heterogeneity in preferences [26,27].

A separate stream of literature explicitly explores behavioral factors as determinants of consumer preferences towards farm animal welfare products [28–33] without however, investigating consumer choice or WTP. Several of those studies are based on the Theory of Planned Behavior (TPB) model and extend this framework beyond its classical elements—attitude, social norm perceived behavioral control, and behavioral intention—by constructs such as trust, knowledge, and moral norms [28–30] to explain consumer intention to consider FAW in their purchasing or consumption. Those studies, in general, confirm the relevance of the classical TPB constructs and highlight the relevance of additional psychological constructs, such as moral norms as significant predictors of purchase intention for FAW meat.

Our study adds a theory-driven analysis to the literature that integrates the analysis of consumer meat choices with an investigation of the psychological factors influencing consumer preferences in an Integrated Choice and Latent Variable (ICLV) model. Applying latent class analysis with respect to our choice data and estimating a multi-group ICLV model allows for a better understanding of consumer choice processes and of the drivers of consumer preference heterogeneity with respect to animal welfare labeled meat products. While ICLV models have been applied in the context of transportation [34] mode choice since 1998 [34], they have only recently been introduced in the consumer research literature [35]. To the best of our knowledge, no previous study has applied multi-group ICLV.

The key objectives of the paper are (1) to derive and test an extension of the TPB using a multi-group ICLV model and thereby (2) to gain a better understanding of the drivers of consumer choice and the sources of preference heterogeneity. Furthermore, given the increasing relevance of multi-level FAW labels in the market, we aim towards (3) obtaining insights into consumer WTP for different levels of FAW. For this reason, we extend previous research by considering a two-level FAW label, more specifically, the entry level (1-star) and the premium level (2-star) "For More Animal Protection (Für mehr Tierschutz)" label. Cured ham was selected as the study object, as it is one of the most frequently consumed processed meat products in Germany [36,37].

2. Theory Framework and Research Hypotheses

The ICLV model used in this study combines Discrete Choice Experiments (DCE) and Latent Variable Model (LVM). The ICLV model provides a comprehensive framework to test an extension of the theory of planned behavior and thereby the drivers of product choice and the sources of preference heterogeneity [38]. DCE has its theoretical foundation in Random Utility Theory (RUT) [39] and Lancasterian consumer theory [40] which assumes that the product's attributes determine the utility that consumers derive from the product [40]. The utility U_{ijt} that an individual i derives from a choice alternative (product) j in a choice task t can be decomposed in an observed utility component V_{ijt} and a random unobserved error term ε_{ijt} [39].

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} = \beta_i x_{ijt} + \varepsilon_{ijt} \quad j = 0, 1, \ldots J; t = 1, 2, \ldots, T \tag{1}$$

The observable component is determined by x_{ijt}, the attribute levels of alternative j in choice set t, and a vector of coefficients β_i, which represents an individual's preference. The stochastic component is assumed to be independently and identically distributed (IID) over alternatives and individuals [41]. Among a given set of alternatives, consumers choose the product that maximizes their utility [39].

Considering preference heterogeneity in a population of individuals and gaining insights into the drivers of consumer choices have been key extensions in DCE research over the last two decades. The classic approach to accounting for preference heterogeneity with respect to product characteristics is to apply a random parameter mixed logit choice model specification [41–43]. In this approach, the utilities of the alternative attributes are allowed to vary randomly among respondents according to pre-specified distributions (i.e., usually normal distribution). An alternative method to incorporate unobserved heterogeneity in respondent preferences is the Latent Class Model. In this approach, it is not a continuous but rather a discrete distribution of the random parameters that is assumed. Heterogeneity is captured by membership to a specific class while preference homogeneity is assumed within a class. However, both approaches provide no information on the driving forces behind preference heterogeneity and thus no answer to the question "why we want what we want [38]". Thus, this representation of consumer choice ignores that individual preferences not only depend on the extrinsic and intrinsic characteristics of the products to be purchased but also on the fact that non-product-related characteristics such as attitudes and norms play an important role in explaining variations in consumer behavior [27,44].

To overcome those limitations, an increasing number of studies extend their analysis to better understand and explain the divers and complex causes of preference heterogeneity (e.g., Louviere et al. [45]; Hess [46]) by including, for example, psychological factors in the DCE and interacting them with the attribute levels. However, latent constructs such as attitude are not directly measurable and, thus, including them as explanatory variables in DCE can lead to measurement errors and a risk of endogeneity bias [47]. Other studies followed the approach by Boxall and Adamowicz [48] and estimated Latent Class Models in a first step while investigating the determinants of class membership by a latent segmentation model (multinominal logit model) in a second step [49]. Though this latter approach explains class membership (e.g., by psychological factors), it does not explain observable behavior.

ICLV overcomes those deficiencies by explicitly taking the latent behavioral constructs in the modelling framework into account and thereby enhancing the representation of the decision-making process [50,51]. ICLV models have especially been applied in the context of transportation [34] mode choice (see review by Bouscasse [34]). The key strength of ICLV models is to provide a tool to better understand how behavior is formed and enables the integration of behavioral theories and discrete choice models.

The theoretical framework applied in this study is an extension of Ajzen's Theory [52] of Planned Behavior (TPB): one of the most frequently applied models for explaining behavior, including food related behavior [53]. Thus, the TPB forms the basis for the LVM that

is derived. According to the TPB, behavior is determined by the intention of an individual to pursue the behavior. Behavioral intention itself is influenced by three latent constructs: attitude, subjective norms, and perceived behavioral control (PBC). Attitude provides information regarding an individual's evaluation of the positive and negative consequences associated with the behavior and can—according to Crites et al. [54]—be differentiated by cognitive and affective dimensions. Subjective norms refer to the "the perceived social pressure to perform or not to perform the behavior" in question ([52], p. 188) while PBC considers the level of control an individual has over pursuing a specific behavior [52]. The consideration of PBC proves to be especially relevant if the behavior being investigated is influenced by factors that are not entirely under the person's control [55]. Regarding the purchase of animal-friendly meat and meat products, this is likely to be the case due to the lack of availability of specifically desired products (e.g., a specific variety of a cured ham) in the store visited and due to the considerably higher prices for those products compared to their respective counterparts without an animal welfare label. Based on the TPB, the following five hypotheses can be formulated:

Hypothesis 1 (H1): *A behavioral intention to buy cured ham with an AW label positively affects the decision to buy cured ham with an AW label.*

Hypothesis 2 (H2): *A favourable attitude towards AW labelled cured ham positively affects the behavioral intention to buy cured ham with an AW label.*

Hypothesis 3 (H3): *Subjective norms that are in favour of AW labelled cured ham positively affect the behavioral intention to buy cured ham with an AW label.*

Hypothesis 4 (H4): *A high perceived behavioral control with respect to buying AW labelled cured ham positively affects the behavioral intention to buy cured ham with an FAW label.*

A number of extensions of the TPB have been suggested to the subject area of investigation. The present study extends the TPB with the construct of moral norms [56,57]. A moral norm is defined as a belief that something is right or wrong for performing a specific behavior and refers to a feeling of obligation that people hold with respect to a certain behavior [56,57]. According to Fretschner [58], moral norms form a person's attitude towards the behavior. Dean et al. [59] also show at the example of organic products that they are important drivers of an individual's attitude. Beldad and Hegner [28], who investigated intentions of Dutch consumers to purchase meat products with a FAW label, reveal the relevance of moral norms in predicting purchase intention. This finding is confirmed in the study by McEachern et al. [30], who focused on Scottish shoppers. Thus, literature reveals that consumers have become increasingly conscious of the moral implications of their food (meat) consumption. In particular, the view that farm animals deserve moral considerations has generated widespread public attention [28]. Thus, an additional hypothesis can be derived based on the suggested extension:

Hypothesis 5 (H5): *Personal moral norms that are in favour of AW labelled cured ham positively affect attitudes with respect to AW labelled cured ham.*

The five hypotheses lead us to the structural model illustrated in Figure 1.

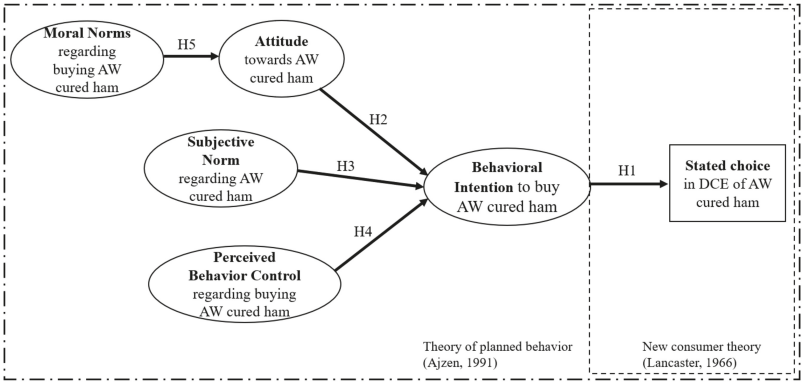

Figure 1. Structural model for consumer purchasing decision of AW labelled cured ham.

3. Methodology, Data and Analysis

3.1. Choice Experimental Design

In this study, three attributes were defined in the DCE: (1) animal welfare, (2) variety of cured ham, and (3) price (see Table 1). For the first attribute, three levels of animal welfare were distinguished: the minimal level of animal welfare as defined in legislation and the two graded labels "For More Animal Protection" (Für mehr Tierschutz) (i.e., 1-star, 2-star) from the German Animal Protection Society (German Tierschutzbund). At the time of study, the label "Für mehr Tierschutz" was the most prevalent animal welfare label in the German meat market. The entry level (1-star) and the premium level (2-star) "For More Animal Protection" labels were introduced into the German meat and animal product market in 2013 and have since been further developed via a multi-stakeholder approach (participation of research, agriculture, marketing, retail, and various societal groups). Species-specific criteria were used to set requirements at the level of animal husbandry (e.g., stocking densities, access to materials for investigation, and manipulation), transportation (e.g., distance and time of transport), and slaughtering, which go beyond legal standards and are more stringent for the premium compared to the entry level (e.g., stocking density for fattening pigs of at least 1.1 m^2 per pig at the entry level and of at least 1.5 m^2 per pig at the premium level; for comparison, the legal requirement is 0.75 m^2 per pig) [60]. (For a more detailed overview see Appendix A).

Table 1. Attributes and levels used in the DCE.

Attributes	Level 1	Level 2	Level 3	Level 4
Animal welfare labelling	None	One-star AW label	Two-star AW label	
Variety of cured ham	Generic ham	PGI-labelled Holsteiner Katenschinken	PGI-labelled Schwarzwälder Schinken	
Prices	EUR 1.29	EUR 1.79	EUR 2.29	EUR 2.79

Regarding the second attribute—the variety of cured ham—three attribute levels were considered: the generically named Bauernschinken (farmer ham), Holsteiner Katenschinken cured hams, and Schwarzwälder Schinken cured hams. The latter two levels carry Protected Geographical Indication (PGI) labels and thus could be perceived as competing labels. Finally, four price levels were defined that reflect the 2018 market price range for 80 g of cured ham found in German supermarkets at the time of the study (EUR 1.29;

EUR 1.79; EUR 2.29; EUR 2.79). Survey participants could see the animal welfare labels as well as the PGI label in the DCE without being provided with further information regarding the underlying criteria of the labels' certification. This best corresponds to the situation consumers face when grocery shopping.

Respondents were asked to imagine themselves in the supermarket where they usually buy food and to assume that the cured hams they are able to select from are all of their preferred brand. Furthermore, to reduce the risk of social desirability bias, which is especially prevalent in hypothetical purchase experiments, a cheap talk script was applied [61,62]. The survey respondents were requested, when making a purchase decision, to take into account their typical budget to spend at the supermarket and to assume that this purchase will reduce the amount of money that they have available for other purchases.

A D-efficient design with zero prior parameter values (i.e., D-optimal orthogonal design) was generated using NGENE version 1.1 [63]. The design had 120 choice profiles that were blocked into 20 scenario sets of 6 choice tasks each. Respondents were randomly assigned to 1 of the 20 scenario sets. Each choice task consisted of three alternatives (options 1–3 depicted three varieties of cured ham), which differed in the respective levels of the three attributes alongside an opt-out option (option 4, a no-buy alternative). The latter option 4 ensured that participants did not choose a cured ham they would not normally purchase. In order to make the choice experiment as tangible as possible, the products with their respective attribute levels were visualized with high resolution pictures (see Figure 2).

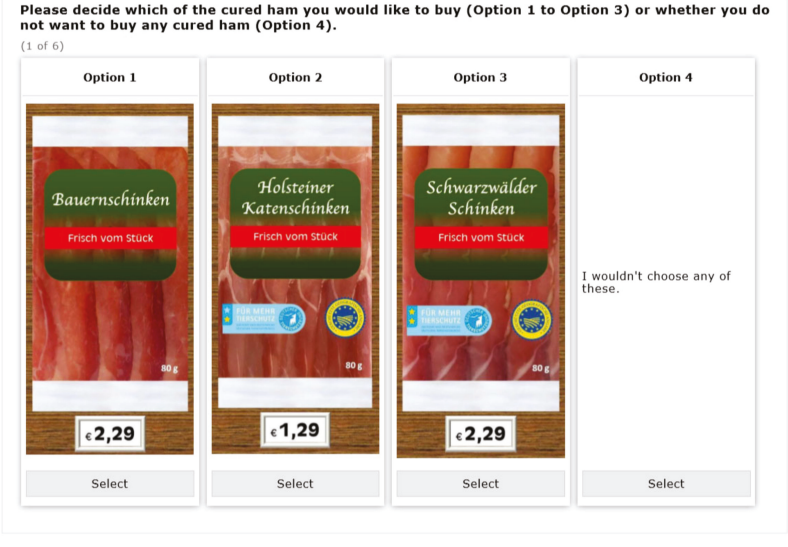

Figure 2. Example of a cured ham DCE.

3.2. Definition of Measurement System of the LVM

In order to test the theoretical model derived in Figure 1, the five structural variables—attitude, subjective norms, perceived behavioral control, behavioral intention, and moral norms—were set up in the form of reflective constructs. These constructs were defined by three variables for each but attitude, which was defined by six points. The scales for all of the constructs were derived from previous literature. An overview of the variables for each of the constructs and the respective scientific source is provided in Table 2. All items were measured on a seven-point Likert scale.

Table 2. Measurement of latent constructs used in the Integrated Choice and Latent Variable (ICLV) model.

Construct	Items	References
Attitude (ATT) *	Buying cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards makes me feel: Unsatisfied/satisfied [Code: ATT1]. Unhappy/happy [Code: ATT2]. Bad/good [Code: ATT3]. I think that buying cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards is: Meaningless/meaningful [Code: ATT4]. Harmful/beneficial [Code: ATT5]. Unimportant/important [Code: ATT6].	Adapted from Povey et al. [64]; Fishbein and Ajzen [65]
Subjective Norms (SN) **	Most people who are important to me would like me to buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards [Code: SN1]. My close friends and family expect me to buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards [Code: SN2]. Most of my close friends and family generally buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards [Code: SN3].	Ajzen [52]; Fishbein and Ajzen [65]
Perceived Behavioral Control (PBC) **	Whether or not I buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards on a regular basis is completely up to me [Code: PBC1]. I am confident that I can buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards on a regular basis [Code: PBC2]. For me, buying cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards on a regular basis is easy [Code: PBC3].	Ajzen [52]
Behavioral Intention (BI) **	I intend to buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards on a regular basis [CODE: BI1]. I will make an effort to buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards on a regular basis [CODE: BI2]. In the future, when you buy cured ham, how often will you buy cured ham produced in line with higher animal welfare standards? [CODE: BI3]	Adapted from Fishbein and Ajzen [65]
Moral Norms (MN) **	Buying cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards: Would feel like I am making a personal contribution to something better [Code: MN1]. Would feel like the morally right thing to do [Code: MN2]. Makes me feel like a better person [Code: MN3].	Dean et al. [59]; Arvola et al. [66]

* Measurement on a 7-point bipolar scale, ** measurement on a seven-point Likert Scale from strongly disagree (1) to strongly agree (7).

3.3. Sampling and Data Collection

Data were collected via an online survey in Germany in the summer of 2018 through a market research company. Respondents received a small payment for completing the questionnaire.

The survey started with three screening questions as well as some questions with respect to socio-demographic variables. Regarding the former questions, only people living in Germany, who were at least co-responsible for food shopping in their household, and who had bought cured ham in the last three months could take part in the survey. In the second part of the survey, the participants were asked to complete the DCE for cured ham, while the third section of the survey covered questions referring to the constructs of an extended Theory of Planned Behavior (TPB) [52]. The final section of the questionnaire requested information on certain additional socio-demographic variables, such as income. Prior to the final section of the questionnaire, consumer evaluations of a modified EU food quality label were investigated. The information from this part of the survey is not considered in the present study.

3.4. Data Analysis

The DCE data were first analyzed using a hierarchical Bayesian mixed logit model [41]. The Bayesian estimation approach accounts for preference heterogeneity among respondents at the individual level [41], thus allowing for the estimation of individual level coefficients of each attribute. This Bayesian approach consists of two stages that are performed in an iterative process [67,68]. At the first stage, the individual-level parameters are calculated via an assumed multivariate normal distribution characterized by a vector of mean values and a matrix of covariances. In the second stage, given an individual-level parameter, respondent probabilities of choosing specific products can be further estimated by a traditional logit model [67,68]. For the attributes 'ham variety' and 'AW label', utilities were calculated based on part-worth utilities for each attribute level. The price attribute was set as a linear term. Accordingly, a single utility score for the price attribute was obtained.

Based on the findings of the DCE analysis, we further simulated individual-level normalized utilities over all ham varieties, the two AW labels, and prices that were then entered into the ICLV model.

For marketing purposes, it is of relevance to know whether consumer segments exist, with consumer preferences that are heterogeneous between segments but that are homogeneous within the same segments. This allows companies to customize products and marketing strategies for each segment. Following the procedure implemented by Boxall and Adamowicz [48], we applied standard Latent Class Analysis (LCA) to categorize respondents into classes that share unobserved characteristics that affect their choices: in our study, the choice of cured ham. Thus, the preferences of respondents are assumed to differ between but be similar within classes [41,48]. Class membership for each respondent is used in estimating a multi-group ICLV model. The model in turn enables the investigation of whether consumer segments that differ according to their purchase behavior are also distinct with respect to the psychographic variables that drive their intention to buy and their stated purchase behavior with respect to AW labeled ham. Individual-level normalized utilities over all ham varieties that enter the multi-group ICLV are calculated as described above.

In order to estimate the ICLV model, we followed a two-step procedure [69–71] by first assessing the reliability, convergent, and discriminant validity as well as the goodness of fit of the measurement model and next examining the structural model.

4. Results

A total of 900 persons were recruited to participate in the survey. After excluding those not living in Germany, not being at least partially responsible for their household food shopping, and not having purchased cured ham in the last three months resulted in a valid sample of 401 responses that were used for the further analysis. This sample is

close to being representative in terms of gender and age [72], while it is biased in favour of respondents living in rural areas [73] and who are better educated [74], wealthier, and have more children than the German average [74]. Table 3 summarizes the sample characteristics.

Table 3. Sample structure and descriptive analysis.

Total N	**900**
Valid N	**401**
Qualified N % (Valid N/Total N)	**0.45**
Gender	
Female (%)	48.88
Male (%)	51.12
Average age	43.77
Living area	
Rural area (%)	38.40
Urban medium town (%)	22.94
City (%)	38.65
Education	
Lower secondary/primary education or below (%)	16.96
Upper secondary education (%)	16.21
University or college entrance qualification (e.g., A-levels, vocational certificate, technical diploma) (%)	39.90
Bachelor's degree or equivalent level (%)	11.97
Master, Postgraduate, or doctoral degree (%)	14.96
Household size	2.41
Number of children (<18 year) in a household	0.47
Household monthly net income	
HHI< EUR 900 (%)	3.74
EUR 900 $\leq$ HHI < EUR 1300 (%)	7.98
EUR 1300 $\leq$ HHI < EUR 2000 (%)	16.21
EUR 2000 $\leq$ HHI < EUR 3600 (%)	38.90
EUR 3600 $\leq$ HHI < EUR 5000 (%)	18.70
EUR 5000 $\leq$ HHI (%)	7.98
Preferred not to provide information (%)	6.48

Table 4 presents the results of the mixed logit model applying Bayesian estimation and of the Latent Class Analysis and provides information on the average importance scores for the attributes of animal welfare, cured ham variety, and price as well as on the average utility associated with the attribute levels considered in the analysis. In the present study, the DCE choice data was effect-coded [75], and the average utilities reported in Table 4 are zero-centered, implying that attribute levels with a positive (negative) average utility value are preference increasing (decreasing) relative to other attribute levels with a lower positive (negative) value and are even more so relative to an attribute level with a negative (positive) average utility value. The final row shows the average utility of the opt-out option, calculated as the mean value of the individual specific constants.

Table 4. Hierarchical Bayesian mixed logit model and LCA of the DCE data.

Model	Mixed Logit Model			Latent Class Analysis					
N	401								
				Group 1: Product and Process Quality Supporters			Group 2: Price Sensitive Consumers		
Segment Size				62%			38%		
	Avg. Imprt. [a] (S.D.)	Avg. Utilities [b] (S.D.)	WTP	Imprt. [c] (%)	Utilities (S.E.)	WTP	Imprt. [c] (%)	Utilites (S.E.)	WTP
Variety of cured ham	28.06 (16.91)			31.21			7.80		
Generic ham		−14.31 (41.73)	−0.71		−39.68 (0.04)	−1.33		−0.02(0.08)	0.00
Holsteiner Katenschinken		−11.38 (34.65)	−0.56		−14.28 (0.05)	−0.48		−11.67 (0.09)	−0.13
Schwarzwälder Schinken		25.69 (37.20)	1.27		53.96 (0.04)	1.81		11.69(0.08)	0.13
Animal welfare labelling	22.32 (14.05)			38.93			4.34		
None		−34.03 (31.59)	−1.68		−77.63 (0.05)	−2.60		−6.67 (0.08)	−0.08
One star AW label		17.82 (16.01)	0.88		38.48 (0.04)	1.29		0.33 (0.09)	0.00
Two stars AW label		16.22 (24.40)	0.80		39.15 (0.04)	1.31		6.34 (0.08)	0.07
Price	49.62 (24.35)	−40.57 (37.57)		29.86	−29.86 (0.03)		87.87	−87.67 (0.09)	
NONE		−139.97 (192.85)			−363.06 (0.18)			60.68 (0.12)	

[a] Avg. Imprt. = Average importance in percentage. [b] Average utilites (Avg. Util.) are zero-centered. Standard deviations (S.D.) in parenthesis. [c] Imprt. (%) = Attribute importance in percentage.

The results of the mixed logit model indicate that price is by far the most important attribute (Avg. Imprt. = 49.62). Variety follows, though with a considerable distance (Avg. Imprt. = 28.06), while animal welfare labelling is the least important (Avg. Imprt. = 22.32) of the three attributes considered in the DCE. Based on the estimated average utilities, we can see that Schwarzwälder Schinken is preferred relative to Holsteiner Katenschinken and even more so compared to generic ham. As expected, results show respondents prefer a cured ham with an AW label compared to an unlabeled product. Interestingly however, average utility is almost identical for the one- and two-star labels. Finally, the results reveal that, as expected, utility declines with increases in price.

To choose the optimal number of latent segments derived from Latent Class Analysis, the model fit criteria shown in Appendix B—Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Chi-square, and log-likelihood measures—were used. A two-segment solution (Appendix B and Table 4) was selected. Although the indicators further improve as more classes are added, the differences between the two- and three-class models are smaller in comparison to the move from a one- to two-class model. Furthermore, model interpretability is considered to be as important as the statistical tests [76] and best for the two-segment model. In addition, this solution secures a large enough sample size for each segment, with class 1 accounting for 62% and class 2 for 38% of the consumer sample. As revealed in Table 4, attribute importance scores considerably differ between the two segments. For members of class 1, referred to from here on as *Product and Process Quality Supporters*, the three attributes are of similar importance (attribute importance 31.21 for ham variety, 38.93 for AW label and 29.86 for price), while for class 2, price is by far the most important attribute, as revealed by an importance score of 87.87%. Accordingly, we refer to this latter group as *Price Sensitive Consumers.* This group reveals a positive coefficient for the constant that implies that if the products in the choice task do not closely align with their preferences, which most likely implies that they do not have an acceptable (low) price, respondents are in favour of the opt-out alternative. In contrast, findings for participants from the first segment indicate a high negative value for the constant. Thus, those consumers are in favour of making a choice and dislike the opt-out option. Regarding the utility linked to different attribute levels, we find similarities and differences between the two groups. Consumers from both segments prefer Schwarzwälder Schinken compared to the other two ham varieties. However, while generic ham is the least preferred among the *Product and Process Quality Supporters*, Holsteiner Katenschinken is the least preferred among the *Price Sensitive Consumers*. Considering the attribute levels for FAW, consumers from both class 1 and class 2 prefer ham with an AW label. Furthermore, the findings show that the *Product and Process Quality Supporters* obtain high above-average utility from both AW labels although utility is only slightly higher for the two-star label. In contrast, the *Price Sensitive Consumers* value the two-star label to a considerably higher degree than the one-star label. At this point, however, it must be noted that this second class attached little importance to AW information in the first place (the share of attribute importance equals 4.34%). As expected, the price coefficient is negative in both groups, with a considerably stronger magnitude in Group 2.

In the next step, we investigated the extent to which the five behavioral constructs derived in the theoretical part of the paper influenced the consumer choice of ham for both of the previously identified consumer segments. The properties of the items behind the five constructs of the SEM are analyzed with respect to their distributional characteristics (means, standard deviations, skewness, and kurtosis). An overview of the descriptive statistics for all of the items that enter the ICLV is provided in Table 5, with the items being coded based on the abbreviations used in Table 2.

Table 5. Descriptive statistics and factor loading for the behavioral construct items for both consumer segments.

		Group 1 Product and Process Quality Supporters $N = 249$					Group 2 Price Sensitive Consumers $N = 152$					Comparison Group 1/Group 2	
Construct	**Item Code**	**M**	**SD**	**S**	**K**	**Std. Factor Loadings**	**M**	**SD**	**S**	**K**	**Std. Factor Loadings**	**Mean Diff.**	**Sig.**
Attitude	ATT1	6.03	0.97	−1.01	0.97	0.78 ***	5.49	1.26	−0.88	0.88	0.76 ***	0.54	***
	ATT4	5.95	1.21	−1.5	2.77	0.81 ***	5.28	1.47	−1.03	0.96	0.78 ***	0.67	***
	ATT5	5.95	1.29	−1.56	2.59	0.63 ***	5.53	1.22	−0.5	−0.18	0.78 ***	0.42	***
	ATT6	6.09	1.18	−1.39	1.72	0.80 ***	5.34	1.49	−0.7	0.02	0.80 ***	0.76	***
Subjective Norm	SN1	4.47	1.62	−0.43	−0.09	0.86 ***	3.59	1.58	−0.25	−0.51	0.94 ***	0.88	***
	SN2	4.08	1.67	−0.25	−0.47	0.79 ***	3.32	1.65	−0.13	−1.06	0.90 ***	0.75	***
	SN3	4.40	1.41	−0.38	0.17	0.76 ***	3.53	1.57	−0.06	−0.46	0.80 ***	0.87	***
Perceived Behavior Control	PBC2	5.33	1.31	−0.65	0.22	0.88 ***	4.50	1.44	−0.35	0.35	0.88 ***	0.83	**
	PBC3	5.02	1.44	−0.50	−0.02	0.76 ***	4.26	1.50	−0.32	−0.06	0.76 ***	0.76	***
Behavioral Intention	BI1	5.39	1.33	−0.74	0.41	0.89 ***	4.47	1.52	−0.32	0.05	0.90 ***	0.92	***
	BI2	5.60	1.27	−0.81	0.5	0.88 ***	4.53	1.65	−0.64	−0.09	0.82 ***	1.07	***
	BI3	5.12	1.19	−0.57	0.73	0.84 ***	4.34	1.30	−0.02	0.47	0.85 ***	0.78	***
Moral Norm	MN1	5.53	1.40	−1,00	0.79	0.89 ***	4.68	1.69	−0.61	−0.13	0.94 ***	0.85	***
	MN2	5.67	1.34	−0.99	0.79	0.86 ***	4.86	1.60	−0.74	0.33	0.91 ***	0.81	***
	MN3	5.09	1.48	−0.55	0.01	0.72 ***	4.37	1.66	−0.47	−0.17	0.84 ***	0.72	***

, *; $p < 0.01, 0.001$. Note: M = Mean; SD = Standard deviation; S = Skewness; K = Kurtosis; We did not consider item 2 and item 3 of Attitude (ATT) or item 1 of PBC in both groups in this table, as they do not enter the following ICLV modelling procedure due to the fact that their low factor loadings (i.e., 0.55 and 0.63 for ATT2 and ATT3 and 0.56 for PBC1 in Cluster 1 and 0.59 and 0.61 for ATT2 and ATT3 and 0.50 for PBC1 in Cluster 2) deviate considerably from the threshold value of 0.7.

The mean values of the four items defining attitude are well above 5 in both groups, indicating that on average, respondents have a positive attitude towards buying AW labelled cured ham though values are significantly higher for the *Product and Process Quality Supporters* (ranging from 5.95 for ATT4 and ATT5 to 6.09 ATT6) compared to the *Price Sensitive Consumers* (5.28 for ATT2 to 5.53 for ATT5). Members of both segments perceive little social pressure to buy cured ham with an AW label, and this is even less of an issue for the *Price Sensitive Consumers* (values ranging from 3.32 for SN2 to 3.59 for SN1) compared to the *Product and Process Quality Supporters* (values ranging from 4.08 for SN2 to 4.47 for SN1). Both consumer segments indicate having some control over the decision to purchase cured ham in line with higher animal welfare standards; however, *Product and Process Quality Supporters* perceive having a higher level of control (5.33 for PBC2 and 5.02 for PBC3) compared to the *Price Sensitive Consumers* (4.50 for PBC2 and 4.26 for PBC3). In line with the values for PBC in the former consumer segments, we found values that were well above 5 for behavioral intention in most cases as well as for moral norms, and in the latter group of consumers, we found values well below 5 (*Price Sensitive Consumer* values ranging from 5.12 for BI3 to 5.60 for BI2 and 5.09 for MN3 to 5.67 for MN2; *Product and Process Quality Supporter* values ranging from 4.34 for BI3 to 4.53 for BI2 and 4.37 for MN3 to 4.86 for MN2). Applying mean comparison for all items used in the ICLV model between the two consumer segments (see Table 5, last two columns) reveals significantly higher values for all items in the *Product and Process Quality Supporters* group compared to the *Price Sensitive Consumers* group.

Confirmatory Factor Analysis (CFA) revealed sufficient factor loadings (close or well above 0.7) for all of the original items of all of the constructs depicted in Table 2 but not for item 2 and item 3 of attitude (ATT) or for item 1 of PBC in both groups (see note Table 5). In order to overcome those shortcomings, a four-item construct was defined for ATT with the exclusion of ATT2: "Buying cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards makes me feel unhappy/happy", and ATT3: "Buying cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards makes me feel bad/good", and a two-indicator construct was defined for PBP excluding the indicator PBC1: "Whether or not I buy cured ham produced in line with higher animal welfare standards instead of cured ham in accordance with legal standards on a regular basis is completely up to me". Results for the adjusted constructs are displayed in Table 5. Table 6 confirms reliability and convergent validity for all of the behavioral factors with values for Composite Reliability (CR) and Average Variance Extracted (AVE) all being well above the threshold values of 0.7, 0.6, and 0.5 [77,78]. Discriminant validity was measured according to Fornell and Larcker [79] by comparing the square root of the AVE of a construct and the correlations of the respective construct with all other constructs. If the latter is larger than the former, discriminant validity is confirmed. Table 6 indicates that sufficient differentiation between the constructs exists for all behavioral constructs in case of Cluster 2. With respect to Cluster 1, this does not hold for attitude with moral norms and attitude with behavioral intention. In the first case, the square root of the average variance extracted is equal to the correlation between the two constructs (Square root of AVE of MN = 0.82; correlation ATT & MN = 0.82) and thus can still be considered acceptable. In the second case, it exceeds the correlation between the constructs (Square root of AVE of ATT = 0.76; correlation ATT & BI = 0.85). From theory, a close association between the two constructs was expected (see also Crites et al. [54] and Lorenz et al. [80]). Furthermore, measures of the overall fit of the measurement model (RMSEA = 0.046; CFI = 0.961; TLI = 0.964; chi-square Test of Model Fit = 290.915, d.f. = 204; p-value = 0.000) suggest a good model fit. For a good model fit, the Root Mean Squared Error of Approximation (RMSEA) should be less than 0.05, and the values for the Comparative Fit Index (CFI) and for the Tucker–Lewis Index (TLI) should exceed a threshold value of 0.95 (Byrne, 2012).

Table 6. Reliability and discriminant validity statistics for measurement models for both consumer segments.

	Group 1 Product and Process Quality Supporters $N = 249$						Group 2 Price Sensitive Consumers $N = 152$					
Construct	**Cron-Bach's Alpha**	**CR**	**AVE**	**Sqrt. of AVE**	**Highest Corr. Coef. with Other Construct**	**Correlated Relation-ship**	**Cron-Bach's Alpha**	**CR**	**AVE**	**Sqrt. of AVE**	**Highest Corr. Coef. with Other Construct**	**Correlated Relation-ship**
Attitude	0.88	0.84	0.58	0.76	0.85	ATT-BI	0.88	0.86	0.61	0.78	0.60	ATT-PBC
Subjective Norm	0.84	0.84	0.64	0.8	0.60	SN-PBC	0.92	0.91	0.78	0.88	0.80	SN-PBC
Perceived Behavior Control	0.80	0.80	0.67	0.82	0.80	PBC-BI	0.79	0.80	0.67	0.82	0.80	PBC-SN
Behavioral Intention	0.91	0.90	0.76	0.87	0.85	BI-ATT	0.89	0.89	0.73	0.85	0.69	BI-PBC
Moral Norm	0.86	0.86	0.68	0.82	0.82	ATT-MN	0.92	0.92	0.80	0.89	0.54	MN-PBC

As for the estimation of a multi-group model, a common model structure is necessary; the derived model specification was accepted, and the structural model was estimated.

The ICLV model allows latent constructs to be identified as a function of the indicators and to capture the causal relationships between explanatory variables and the latent constructs. By simultaneously integrating DCE and LVM, the latent constructs can be treated as explanatory variables in the functions of the stated cured ham choices. Thus, for the estimation of the ICLV model, the results from the DCE should be added. As indicated above, for each attribute level, we arrived at individual utility scores; this holds for the attribute of FAW as well as for ham variety. In contrast, a single utility score for the price attribute was obtained, as the price levels entered the Latent Class model as a linear term. Based on the information derived from the DCE data, we calculated the utility arising from consuming a product with a one-star FAW label for each of the three cured ham varieties for each participant. The same calculation was performed with respect to the two-star FAW label across all three cured ham varieties. Thus, we obtained six utility measures for six configured cured ham products (3 cured ham varieties × 2 animal welfare labels) for each participant. We estimated an ICLV model, inserting the mean utility over those six utility measures. Thus, in this model, we considered the average utility an individual obtains from buying cured ham in line with higher animal welfare standards over all three of the different ham varieties.

A standard method for estimating an ICLV model is through the covariance based Maximum Likelihood estimation of the model parameters with standard errors and a mean- and variance-adjusted chi-square test statistic [81] so that divergencies between the observed variance–covariance matrix of measured indicators and the theoretically derived model is minimized in an iterative process. The Maximum Likelihood method assumes a normal distribution for all of the items included in the ICLV model. Table 5 reveals that the values for skewness and kurtosis of all items considered in the model are below the proposed threshold values with respect to the assumption of normality (for skewness < ±2; for kurtosis < ±7) [77,82].

Table 7 shows that the estimates of the multi-group ICLV that support the derived model with a good overall model fit (CFI = 0.969; TLI = 0.965; RMSEA = 0.040) [83,84]. The findings indicate that the model has a high explanatory power for both consumer segments with respect to attitude ($R^2_{Attitude-Group\ 1} = 0.68$ and $R^2_{Attitude-Group\ 2} = 0.60$) and even more so regarding behavioral intention ($R^2_{Behavioural\ Intention-Group\ 1} = 0.89$ and $R^2_{Behavioural\ Intention-Group\ 2} = 0.76$). In contrast, only about 10% of the variance in stated choice can be explained by the model ($R^2_{Stated\ Choice-Group\ 1} = 0.08$ and $R^2_{Stated\ Choice-Group\ 2} = 0.12$) (see Table 7). For the *Price Sensitive Consumers*, all of the assumed relationships of the derived extended TPB framework are confirmed. As is revealed in Table 7 and Figure 3, attitude (H2: $\beta_{Attitude-Group\ 2} = 0.52$, $p < 0.001$), subjective norm (H3: $\beta_{Subjective\ Norm-Group\ 2} = 0.27$, $p < 0.001$), and perceived behavioral control (H4: $\beta_{PBC-Group\ 2} = 0.29$, $p < 0.05$) are all significant predictors of consumer behavioral intention to consume cured ham with higher animal welfare standards, which again, significantly determines the stated choice of AW ham (H1: $\beta_{Stated\ Choice-Group\ 2} = 0.36$, $p < 0.001$). Furthermore, as hypothesized, personal consumer moral norms towards AW labeled cured ham is a significant determinant of attitude in this group (H5: $\beta_{Moral\ Norms-Group\ 2} = 0.77$, $p < 0.001$). For the first consumer segment—the *Product and Process Quality Supporters*—all but one of those relationships are also confirmed (H2: $\beta_{\ Attitude-Group1} = 0.59$, $p < 0.001$; H4: $\beta_{\ PBC-Group1} = 0.48$, $p < 0.001$; H1: $\beta_{\ Behavioural\ Intention-Group\ 1} = 0.28$, $p < 0.01$; H5: $\beta_{\ Moral\ Norms-Group1} = 0.83$, $p < 0.001$). Subjective norms are not a significant determinant for the behavioral intention to buy AW labeled cured ham for this group ($\beta_{\ Subjective\ Norms-Group1} = 0.01$, $p > 0.05$). A multi-group SEM analysis applying the chi-square test between constrained and unconstrained models confirms a significant difference between the coefficients $\beta_{\ Subjective\ Norms-Group1}$ and $\beta_{\ Subjective\ Norms-Group2}$ while all of the other coefficients of the ICLV do not differ at a 10% level between the group of *Product and Process Quality Supporters* and the group of *Price Sensitive Consumers*.

Table 7. Results of the multi-group ICLV model for AW cured ham.

Group	Hypotheses	LVM Path	β	Testing Results	R^2	Model Fit Measures
Group 1: Product and Process Quality Supporters	H1	Behavioral Intention→ Stated Choice	0.28 **	Support	$R^2_{choice} = 0.08$, $R^2_{BI} = 0.89$, $R^2_{Att} = 0.68$	RMSEA = 0.040 CFI = 0.969 TLI = 0.965 Chi-Square Test of Model Fit = 275.320 d.f. = 208 p-value = 0.001
	H2	Attitude → Behavioral Intention	0.59 ***	Support		
	H3	Subjective Norms → Behavioral Intention	0.01	Not Support		
	H4	Perceived Behavioral Control → Behavioral Intention	0.48 ***	Support		
	H5	Moral Norms → Attitude	0.83 ***	Support		
Group 2: Price Sensitive Consumers	H1	Behavioral Intention → Stated Choice	0.36 ***	Support	$R^2_{choice} = 0.12$, $R^2_{BI} = 0.76$, $R^2_{Att} = 0.60$	
	H2	Attitude → Behavioral Intention	0.52 ***	Support		
	H3	Subjective Norms → Behavioral Intention	0.27 ***	Support		
	H4	Perceived Behavioral Control → Behavioral Intention	0.29 *	Support		
	H5	Moral Norms → Attitude	0.77 ***	Support		

*, **, ***; $p < 0.05, 0.01, 0.001$.

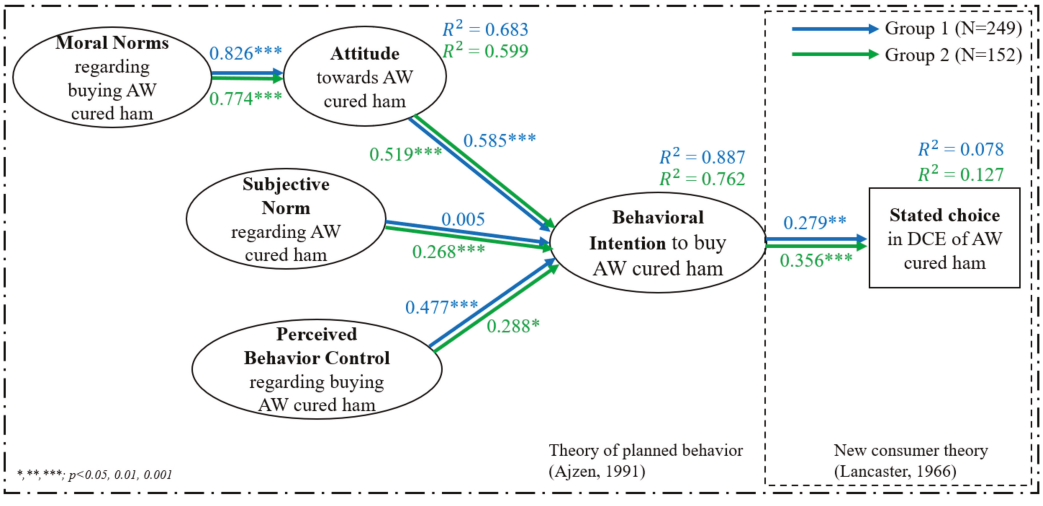

Figure 3. Results of the multi-group ICLV model for AW cured ham.

5. Discussion

The present study uses an extension of the TPB to investigate the role of a two-tier AW label in the purchasing decisions for German consumers for cured ham. More specifically, we test an extension of the TPB model and thus investigate the extent to which attitudes, social norms, perceived behavior control, and personal moral norms influence consumer choice by applying an Integrated Choice and Latent Variable (ICLV) model. The analysis of the DCE choice data reveals that two segments of consumers can be differentiated: *Product and Process Quality Supporters* and *Price Sensitive Consumers*. The first segment that accounts for 62% of all consumers attaches about equal weight to the three attributes of ham variety, FAW, and price, while the second segment (38% of the sample) is strongly price-oriented in its purchasing decisions with rather little interest in the product or process characteristics. Other studies support the finding of the existence of consumer heterogeneity regarding their purchase decision of meat products differentiated by FAW. Identified segments in those studies differ depending on the product and the country investigated and the number and kind of FAW as well as the competing attributes that were considered (e.g., Grunert et al. [85]; Eldesouky et al. [23]; Xu et al. [86]; Sonoda et al. [87]; de Jonge et al. [88]).

Focusing on the relevance of the different attribute levels, our findings indicate that consumers prefer PGI labelled products compared to generic products though some heterogeneity exists. More specifically, we show that consumers are strongly in favour of PGI labelled Schwarzwälder Schinken compared to the other varieties in both consumer segments. We also reveal that the *Product and Process Quality Supporters*, and thus the larger segment and the one that attaches value to ham variety in the first place, also favour the other PGI ham—Katenschinken—compared to generic ham though to a much lower extent compared to the PGI Schwarzwälder Schinken. Thus, for this segment, our results are in line with the findings from Aprile et al. [89], Caputo et al. [90], and Maza et al. [91] that PGI labeled ham is preferred by consumers compared to generic ham. However, our study goes beyond previous analysis in that we considered two different PGI labelled ham varieties and thus can show that it is not the PGI label per se that forms consumer preference for a ham. This result becomes even more obvious for the second cluster. *Price Sensitive Consumers*, though having a preference for PGI labeled Schwarzwälder Schinken, dislike the PGI labeled Katenschinken compared to the generic cured ham. Regarding the attribute levels for FAW, our results confirm previous findings that consumers prefer

animal products that carry an AW label compared to those without any label [87,92,93]. This holds for both consumer segments. More interestingly, we notice that the *Product and Process Quality Supporters*, and thus those consumers who attach value to the attribute FAW, hardly differentiate between a one-star and a two-star AW label. This is in line with the findings by Trudel and Cotte [94], who found that consumers value ethically produced T-shirts compared to a standard T-shirts but do not differentiate between different levels of ethical production. Thus, for this consumer group, increasing levels of FAW did not lead to higher partworth utilities and thus also did not lead to the willingness to pay higher price premiums. An explanation for our findings might be that we did not provide any additional explanation of the two-tier label. This is in line with a normal supermarket setting. Nevertheless, it might have resulted in a lack of knowledge regarding the differences between the labels and thus the issue of comprehensibility [33]. The comparably high value consumers assigned to the one-star AW label, however, could also be due to the compromise effect [95], which proposes that an alternative gains attractiveness when the situation becomes a compromise or a middle option. In contrast to the *Product and Process Quality Supporters*, the *Price Sensitive Consumers* have a higher WTP for the two-star AW label compared to the one-star AW label. However, in the market, this hardly plays any role, as they attach little importance to the attribute of FAW in the first place (the share of attribute importance equals 4.34%). Finally, turning to the price attribute levels, our results reveal a negative price elasticity for the demand for the consumers of both segments, though with a considerably higher price sensitivity in the second cluster.

To better understand the drivers of consumer purchase decisions, we investigated the extent to which behavioral constructs influence stated choices. Descriptive findings reveal significant differences between the *Price Sensitive Consumers* and the *Product and Process Quality Supporters* in that the latter have a more positive attitude, reveal higher levels of subjective as well as moral norms, perceive higher control over their behavior, and a higher level of intention to buy AW labeled cured ham. Thus, differences in the purchase decisions as revealed by the DCE is in fact mirrored in the behavioral constructs.

Based on the results of a multi-group ICLV model, we show that all but one of our hypotheses derived from the extended TPB model are confirmed. More specifically, consumer attitudes impact their intention to buy AW labeled cured ham and, consistent with previous findings, have the strongest influence on intention (e.g., Hoeksma et al. [96]; Rex et al. [97]; Jamieson et al. [29]; Spence et al. [98]). In addition, as predicted by the TPB and as shown in earlier AW related work [96], perceived behavioral control has a significant impact on consumer intention to buy cured ham characterized by higher FAW standards. Furthermore, our results regarding the relevance of moral norms in forming attitudes are confirmed for both consumer segments. Thus, in line with previous studies, we found that moral norms are a significant predictor of attitude [59,66,99,100]. While the findings regarding the relevance of attitude, perceived behavioral control, and moral norms hold for both consumer segments, subjective norms are only a significant predictor of intention for the *Price Sensitive Consumers* segment. This finding indicates that though the perceived social pressure to buy AW labeled cured ham is stronger in the segment of *Product and Process Quality Supporters*, it is not driving the behavioral intentions of the respondents. In this group, the latter is determined by their attitude and perceived behavioral control over the behavior. Finally, the analysis reveals that intention significantly influences behavior.

The ICLV model explains a high proportion of variance with respect to the constructs attitude and intention for both subgroups. In contrast, the explanatory power of the model with respect to stated choice is low. The latter might reflect the well-known attitude–behavior gap, which implies that individuals with a highly positive intention, here the intention to buy cured ham produced with higher animal welfare standards, might not necessarily make their purchasing decision accordingly [101–106]. Carrington et al. [101] suggest that there are a number of moderators and mediators influencing the relationship between intention and behavior exist. The situational factor could be one of them and would refer to the ham varieties and prices available in the shopping experiment in our

DCE [101]. A lack of understanding and comprehension of the labels [107–109] might explain why a positive attitude and intention with respect to buying cured ham with higher AW standards might not lead to the purchase of a product with an unknown AW label. Furthermore, social desirability bias, which implies that respondents feel social pressure to answer in a way that they perceive to be socially acceptable, is likely a larger issue with respect to the measurement of attitude and intention than with respect to the DCE results, which is somewhat closer to the situation in the grocery store [101].

Using a sample from across the German population, thus considering consumers with a large variety of socio-demographic and psychographic characteristics, increases the external validity of our findings and thus can be considered as a strength of the current study. Furthermore, combining DCE with LVM allows for more comprehensive insights. However, as with all empirical studies, some limitations must be acknowledged. First, a potential drawback of this study is the hypothetical nature of the choices. To reduce this problem, we used a cheap talk script [110], included an opt-out alternative, and visualized the options based on high resolution pictures. Nevertheless, we are aware that this does not completely eliminate bias [61]. Second, a further extension of the framework might be desirable given the public good characteristics of FAW [4]. In this respect, extension of the framework through the construct "perceived effectiveness" might be a promising avenue to follow, as consumers who feel that their purchase decisions have little impact on the overall well-being of farm animals might abstain from buying those products. Finally, extending the analysis by considering socio-demographics, purchase habits such as previous purchase experience regarding AW labeled products (e.g., Cao et al. [20]) as well as consumer understanding and comprehension of the investigated labels could provide additional insight into the understanding of consumer purchase behavior with respect to AW labeled products.

6. Conclusions

We derived and tested a model based on an extension of the TPB and combines DCE and a Latent Variable Model, thereby allowing for a better understanding of consumer choice processes with respect to animal welfare labeled meat products. Our results confirm a preference heterogeneity in our sample of 401 German consumers based on their stated purchase decisions, resulting in a larger group of *Product and Process Quality Supporters* who are interested in product and process qualities other than price and a smaller group of *Price Sensitive Consumers*, who almost exclusively focus on price.

The personal determinants of attitude, perceived behavioral control, and personal moral norms proved to be important in both consumer segments, and subjective norms were seen to be of additional importance in the *Price Sensitive Consumer* segment in the determination of consumer intention to buy and their stated choice with respect to AW labeled products. Thus, interventions that address those personal or social norms seem promising for stimulating the demand for AW labeled meat. Furthermore, as the two consumer segments considerably differ by personal and social determinants, those interventions are also promising because they could induce a reallocation of consumers from the latter into the former group.

The DCE findings indicate that the *Product and Process Quality Supporters* and thus those consumers who consider FAW in their purchase decisions perceived both of the AW labels similarly. Thus, they did not reward higher AW standards with a willingness to pay a higher premium. Further research is needed to better understand whether this lack of differentiation is due to a lack of comprehension of the AW labels, which could be overcome by promotional campaigns revealing the differences between the labels or whether other reasons lie behind this outcome.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Animal welfare standards for fattening pigs—Comparison of the 2-level Label "Für mehr Tierschutz" and legal requirements.

	Für Mehr Tierschutz 2-Star	Für Mehr Tierschutz 1-Star	Legal Requirements
Stock size	Maximum of 3000 fattening places	Maximum of 3000 fattening places	No requirements
Outdoor climate	Outdoor access	Access to different climate zones	No requirements
Stocking density (Pigs with a weight 50–110 kg)	1.5 m^2/animal	1.1 m^2/animal New enterprises 1.3 m^2/animal	0.75 m^2/animal
Castration of male piglets	With anaesthesia and analgesia	With anaesthesia and analgesia	Castration without anaesthesia is legally prohibited since 1 January 2021
Tail docking	Not allowed	Not allowed (Exceptional cases one third of the tail can be docked)	Allowed
Resting	(Straw) bedding on solid lying surface	Bedding on solid lying surface	No requirements
Light	Direct contact due to outdoor access	Contact with daylight through translucent side panels of the stable	Translucent area in the stable —Complemented by lighting schemes when required
Manipulable materials	Long-stalk straw or similar material	Straw or similar organic material	No requirements
Slatted floor	Only permitted in the activity area, not in the resting area	Requirements for new enterprises with outdoor climate stables: Slatted floors prohibited in the resting area	No requirements
Thermal regulation	Choice between indoor and outdoor area. Additional cooling options (e.g., water spraying) have to be available	Cooling options (e.g., water spraying) have to be available	No detailed requirements
Transportation to slaughterhouses	Maximum 200 km, and 4 h (exceptions possible)	Maximum 200 km and 4 h (exceptions possible)	Maximum 8 h

Source: Deutscher Tierschutzbund [60].

Appendix B

Table A2. Summary of fit measures for chosing the optimal number of segments.

Null Log-Likelihood = −3335.42				
Number of Groups	**Log-Likelihood**	**AIC**	**BIC**	**Chi-Square**
2	−2530.57	5087.15	5162.36	1609.70
3	−2371.02	4782.05	4897.76	1928.80
4	−2289.93	4633.86	4790.08	2090.99
5	−2247.43	4562.87	4759.58	2175.98

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Empirical Detection and Quantification of Price Transmission in Endogenously Unstable Markets: The Case of the Global–Domestic Coffee Supply Chain in Papua New Guinea

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Abstract: Price transmission through global–domestic agricultural supply chains is a fundamental indicator of domestic market efficiency and producer welfare. Conventional price-transmission econometrics test for a theory-based spatial-arbitrage restriction that long-run equilibrium prices in spatially distinct markets differ by no more than transaction costs. The conventional approach is ill-equipped to test for price transmission when endogenously unstable markets do not equilibrate due to systematic arbitrage-frustrating frictions including financial and institutional transaction costs and biophysical constraints. We propose a novel empirical framework using price data to test for market stability and price transmission along international-domestic supply chains incorporating nonlinear time series analysis and recently emerging causal-detection methods from empirical nonlinear dynamics. We apply the framework to map-out and quantify price transmission through the global-exporter–processor–producer coffee supply chain in Papua, New Guinea. We find empirical evidence of upstream price transmission from the global market to domestic exporters and processors, but not through to producers.

Keywords: market instability; nonlinear empirical dynamics

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1. Introduction

Price transmission concerns the extent to which price changes from one market pass through to spatially distinct markets, and consequently, is a fundamental indicator of market integration along global–domestic supply chains, domestic market efficiency, and economic welfare of exporters, processors, and producers [1]. Price transmission is also a fundamental indicator of the economic sustainability of regional supply chains and the social sustainability of domestic participants. The Brundtland Commission (1987) defined sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [2]. Arrow et al. (2004) took this to mean that "intertemporal social welfare must not decrease over time" [3]. In this context, policymakers rely on "before-and-after" measures of price transmission to empirically determine whether global trade policies have had an adverse welfare impact on domestic markets [1]. For price transmission to be a reliable welfare measure, there is critical need for theory and empirical practice to correspond to real-world global–domestic supply-chain price dynamics.

1.1. Past Work

The theory of price transmission, given by the Law of One Price, holds that equilibrium (*e*) prices of the same commodity in distinct markets will differ by market transactions costs

(tc): $p_1^e - p_2^e = tc$. A *spatial-arbitrage* condition restricts p_1^e and p_2^e to be stable in the face of external random market shocks. Driven by forces of supply and demand, markets self-correct so that, at each point in time, re-equilibrating prices differ at most by transactions costs: $p_{1t} - p_{2t} \leq tc$. Complete price transmission occurs when prices have re-equilibrated; however, transmission remains incomplete during an adjustment period whose length depends on the speed of adjustment [4].

Early empirical practice, based on linear time series analysis, detected price transmission by testing temporal price series data for *cointegration*; simply put, price co-movement through time driven by the spatial-arbitrage condition. Cointegration is the gateway to analysis [5]: First, cointegrated prices are *Granger-causally* interactive in at least one direction. *Granger-causality* testing must be subsequently done to determine the directions. Second, cointegrated prices are amenable to an *error correction model* (ECM) specification, which allows computation of the completeness and speed of price transmission as self-correcting markets adjust to long-run equilibrium.

Empirical practice reached a threshold as recognition grew that key factors—especially asymmetric price response and high transactions costs—could inhibit spatial arbitrage in real-world markets, and that modeling this behavior was beyond the reach of conventional linear cointegration analysis [1,6]. Asymmetric price response occurs when the rate of transmission abruptly shifts around some factor; for example, global prices. Intermediate entities in the supply chain (e.g., wholesalers) with market power over price may adopt strategies resulting in incomplete and slow price transmission to upstream entities (e.g., producers) when global prices are high, but complete and fast price transmission when margins are squeezed by low global prices. High transaction costs—due, for example, to domestic trade policies and substandard transportation and communication infrastructure—can frustrate spatial arbitrage by squeezing marketing margins [6,7]. Studies addressed these real-world complications by modeling price adjustments as nonlinear functions of disequilibrium errors with ECM variants built off of asymmetric ECM and threshold cointegration models [8]. Revised empirical practice continues to impose the conventional restriction of market stability with autoregressive linear-stochastic dynamic models. Recently, Ghoshray and Mohan (2021) investigated the margin between retail and international coffee price dynamics with a momentum threshold autoregressive model [9]. For detailed coverage of conventional linear-stochastic price transmission methods, we direct the reader to a comprehensive diagram and discussion in Rapsomanikis et al. (2003).

1.2. Contribution

We contend that the empirical practice of detecting and measuring price transmission in spatially distinct markets has reached another threshold in the age of nonlinear dynamics. Just as early linear error-correction modeling was deemed incapable of handling nonlinear price adjustment scenarios, current threshold cointegration modeling is ill-equipped to capture nonlinear price dynamics when systematic impediments to spatial arbitrage render markets endogenously unstable. Chavas and Holt (1993) presciently questioned reflex reliance on self-correcting linear agricultural market models in light of then emerging results demonstrating that instability can emerge endogenously from deterministic nonlinear dynamic systems [10]. Market stability may be prevented by destabilizing systematic factors including highly inelastic demands [11,12]; nonlinear cobweb price expectations [13], and financial, institutional, and biophysical constraints frustrating supply from matching demand [14]. In response to the 2008 financial crisis, *The Economist* recommended that "like physicists, [economists] should study instability instead of assuming that economies naturally self-correct" [15].

We address the research question of how to detect and measure price transmission when markets are endogenously unstable—a question that has not been considered in the literature. We propose a novel empirical framework that adopts emerging methods from empirical nonlinear dynamics capable of reconstructing market dynamics from price data in economic application [16,17], and in doing so, tests whether market dynamics concealed

in volatile observed prices are most likely generated by stable linear-stochastic market dynamics or endogenously unstable nonlinear-deterministic dynamics—both legitimate theory-based alternatives [14,18–21]. When stable linear-stochastic market dynamics are detected, conventional modeling of price transmission remains appropriate. Alternatively, when unstable nonlinear-deterministic market dynamics are detected, we turn to recently developed causal-detection methods from mathematical ecology that can identify and quantify price transmission in economic application. We can postpone imposing either alternative until it is supported with rigorous data-centric evidence of real-world market dynamics, and consequently avoid possible false-negative rejection of price transmission based on failure of observed prices to equilibrate. We are better able to meet a professional responsibility to demonstrate "the *degree of correspondence* between the model and the material world it seeks to represent" when "public policy and public safety are at stake" [22].

As a relevant and timely case study, we apply this framework to a novel investigation of price transmission through the global-exporter–processor–producer coffee supply chain in Papua, New Guinea (PNG). PNG industry officials have expressed concern that pricing strategies of exporters and processors prevent changes in supply and demand conditions in the global coffee market from being fully transmitted upstream to producers (especially small holder producers). In particular, there is concern that exporters and processors may engage in *price leveling* behavior by holding their buying prices stable in the face of the rising world market prices; thereby preventing producers from benefitting from rising global market prices [23].

2. Materials and Methods

2.1. PNG Coffee Industry and Price Data

The PNG coffee industry supplies a small fraction of the world's coffee (~1%), but is a major contributor to the domestic agricultural economy and employment. Coffee is traded as cherries, parchment (ripe cherries are pulped, washed, and dried), and green bean (unroasted coffee beans). The prices for these different types of coffee are converted to a green bean equivalent (GBE) with conversion ratios accounting for weight loss during processing: 5 kg cherry = 1 kg parchment; 6.25 kg cherry = 1 kg GB; 1.33 kg parchment = 1 kg GB, where GB denotes green bean [24]. PNG produces mostly Arabica coffee exported under several GB grades reflecting bean quality attributes and liquoring characteristics. The highest grade coffees are Grade A and Grade X, produced mostly by estates and block holdings. Lower-grade coffees are Grade PSC followed by Grade Y1, produced by smallholders. Smallholders account for the majority of coffee production followed by the plantation sector (15%) and block holders (10%). Smallholders produce parchment coffee traded between producers or sold to roadside buyers (middlemen) or directly to factories. Approximately one third of the plantation sector is vertically integrated through to the export sector. These plantation-based exporters account for 57% of exports. Intense competition among a large number of exporters and processors for limited PNG coffee production often leads to price wars [23].

Monthly average price records along the PNG coffee supply chain are kept by the Economics Unit of the PNG Coffee Industry Corporation [24]. All bean grades are exported at a *free-on-board* (FOB) value loaded on ship at the Lae Wharf, Morobe Province. The FOB price differs from the global (New York futures) price by a *differential* determined by the quality of coffee exported and market conditions. High A and X grades generally export at a premium and lower grades (PSC and Y1) at a discount against the New York price. We convert the New York and FOB prices from dollars into the domestic currency (Kina (PGK)) using exchange rates published by the Central Bank of PNG [25], so that both are in units of toea/kg (PGK 1 = 100 toea). We take the arithmetic average of monthly FOB prices across grades and destinations. The *delivery-in-store* (DIS) price (toea/kg) is paid by exporters to processors by coffee grade. Exporters deduct a margin to cover target profits. We take the arithmetic average of monthly DIS prices across grades. Finally, the *factory door*

(FDR) price (toea/kg) is paid by processors to producers. We take the arithmetic average of monthly FDR prices from all suppliers.

Figure 1A shows the plots of the world and domestic coffee prices extending from January 1999 to December 2017 (period-of-record is 228 months). We observe that the world price (WP) (black curve) was consistently volatile over time. Detecting whether this volatility is driven by exogenous shocks to an otherwise stable market or by endogenous nonlinear behavior of an inherently unstable market is critical to selecting appropriate empirical methods for studying price transmission and market integration. We further observe that WP initially trended upward reaching a large peak in 2011 which has been attributed primarily to low inventories in importing countries. The exporter price (FOB) (red curve) most closely tracks WP while other domestic price series also resemble WP but are shifted increasingly downward as they are more remote ("upstream") from the world market. Figure 1B demonstrates that, as WP trended upward toward the 2011 peak (black curve), the differential between FOB and WP (blue area) was negative. However, after 2011, the differential switched to positive during months of sustained WP decrease (red segments). This suggests *price leveling* behavior by exporters.

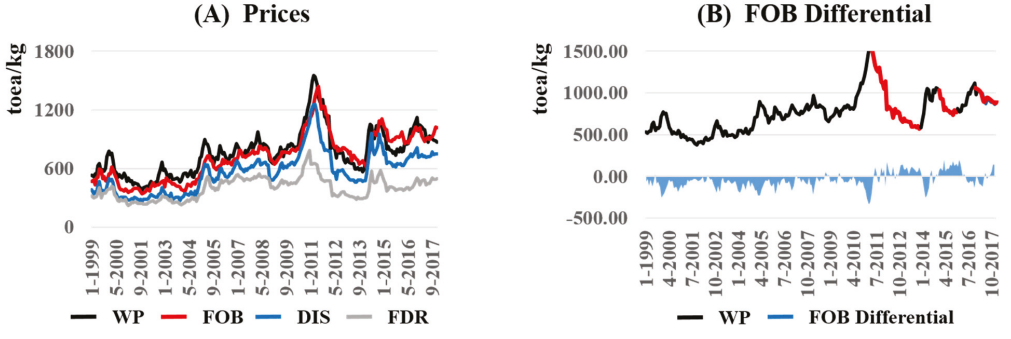

Figure 1. World and domestic coffee prices. (**A**) The monthly price series extend from January 1999 to December 2017 (period-of-record is 228 months). The world price (WP) is the New York futures price. Domestic coffee prices in the Papua New Guinea (PNG) market include: (1) the Free-on-Board price (FOB)—the export price—which adds a premium or deducts a discount from WP (called the *differential*) determined by the quality grade of coffee (A and X are premium grades) and market conditions; (2) the delivery-in-store price (DIS) paid by exporters to processors; (3) the factory door price (FDR) paid to growers. (**B**) As WP trended upward toward the 2011 peak (black curve), the differential between FOB and WP (blue area) was negative. However, after 2011, the differential switched to positive during months of sustained WP decrease (red segments). This is suggestive of price leveling behavior by exporters.

2.2. A Framework for Empirically Detecting and Quantifying Price Transmission

Figure 2 outlines a four-stage framework of analysis. We initially prepare price time-series data for empirical nonlinear dynamic methods with signal processing to remove noise and test for nonlinear stationarity. We subsequently reconstruct market dynamics from denoised stationary price data, and statistically test whether reconstructed dynamics are most likely driven by stable linear-stochastic or endogenously unstable nonlinear-deterministic market dynamics. Test results guide us to causal detection and quantification methods corresponding best to real-world markets. We provide intuitive introductory descriptions of empirical nonlinear methods below. Extended descriptions are available in recent economic applications [19,20].

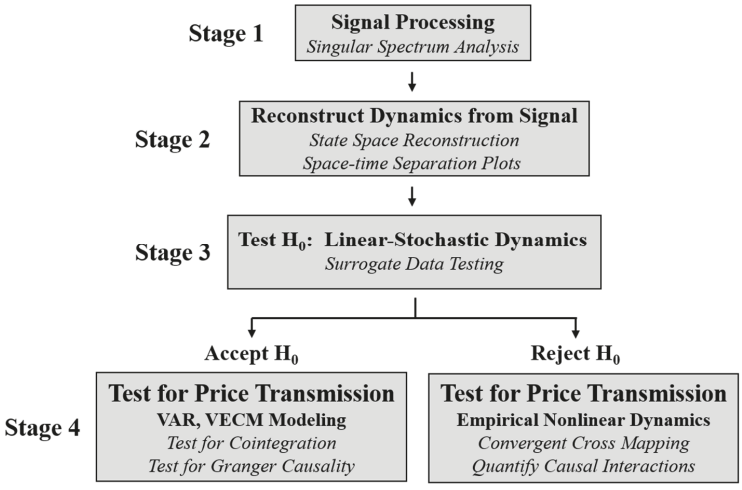

Figure 2. A framework for empirically detecting and quantifying price transmission. Stage 1 initially prepares price time-series data for empirical nonlinear dynamic methods with signal processing to remove noise and test for nonlinear stationarity. Stage 2 reconstructs market dynamics from denoised stationary price data, and Stage 3 statistically tests whether reconstructed dynamics are most likely driven by stable linear-stochastic or endogenously unstable nonlinear-deterministic market dynamics. In Stage 4, test results guide us to causal detection and quantification methods corresponding best to reconstructed real-world market dynamics.

Stage 1: Signal processing. We standardize each price series by removing the series average from each observation and dividing by the series standard deviation. When a standardized price is zero, the series equals its long-term average. When a standardized price is above (below) zero, the series is standard deviations above (below) its long-term average. We apply *singular spectrum analysis* (SSA) signal processing to each standardized price series. SSA decomposes each series into structured variation composed of trend and cyclical components (signal) and unstructured variation (noise) [26]. We first run SSA to detect and remove low-frequency trend components that violate nonlinear stationarity requiring that the "duration of the measurement is long compared to the time scales of the systems" [27]. (For example, we cannot learn much about 100-year floods with only 100 years of data.) We subsequently reapply SSA to the detrended residuals to remove noise from higher-frequency signal components.

Stage 2: Reconstruct market dynamics from price signals. We next reconstruct market dynamics from each detrended and denoised price series. In general, system dynamics are portrayed in state-space plots whose coordinates are provided by system variables. Each n-dimensional point in state space records the levels (states) of n system variables at a point in time, and trajectories connecting these points depict the co-evolution of system variables from given initial states. In nonlinear dynamic systems, trajectories converge toward an attractor—a geometric object bounded within a subset of state space. Once a trajectory reaches an attractor, it never escapes [28].

A *shadow* copy of state space can be reconstructed from even a single system variable using *delayed-coordinate embedding* [29]. Time-delayed copies of a single variable serve as surrogates for omitted system variables. Figure 3 provides a simple example using the time series $x(t) = (1, 2, 3, 1, 2)$. We first construct an *embedded data matrix* whose first column is the observed time series and remaining columns are forward-delayed copies. The figure shows the 3×3 embedded data matrix for $x(t)$ with a forward delay of a single period (*embedding delay*) and three lagged copies which serve as the coordinate axes of reconstructed phase space (*embedding dimension*). Shaded observations are lost in the lagging process. The rows

of this matrix are multidimensional points of a trajectory on the reconstructed state-space attractor. State space reconstruction has been generalized so that real world attractors can be reconstructed from combinations of observed co-variates and their lagged copies [30]. Takens (1980) proved that topological properties of the original phase space are preserved in a reconstructed space so long as the embedding dimension is sufficiently large to contain the original attractor. Since we lack this information in practice, we rely on recommended empirical tests to estimate the embedding delay and embedding dimension [16].

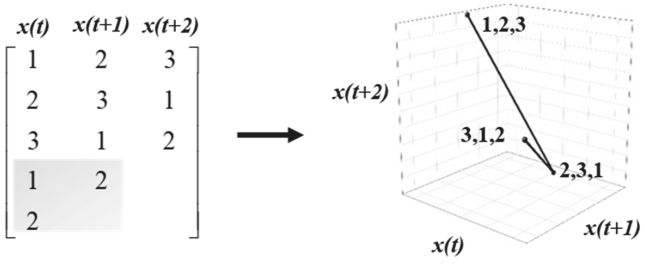

Figure 3. Delayed-coordinate embedding. We illustrate the use of *delayed-coordinate embedding* to reconstruct state-space dynamics from a single time series: $x(t)$ = (1, 2, 3, 1, 2). First, an *embedded data matrix* is constructed whose first column is the observed time series and remaining columns are lagged copies. The figure shows the 3×3 embedded data matrix for $x(t)$ with a time delay of a single period (*embedding delay*) and three lagged copies which serve as the coordinate axes of reconstructed phase space (*embedding dimension*).

We first use a reconstructed shadow attractor to test for nonlinear stationarity in the variable used in the reconstruction with a *space-time separation plot* [31] which scatterplots the spatial distance (vertical axis) and elapsed time (horizontal axis) between each pair of points on an attractor. This information is conventionally reformatted as equal-probability contour lines by plotting the percentage of pairs that are less than or equal to a given distance, and drawing curves through identical percentages across values of time. In time series exhibiting nonlinear dynamics, contours cycle and stationarity is diagnosed if the initial cycle is completed within an elapsed time that is short relative to the length of the price series (period-of-record). Otherwise, the temporal distance between points affects their spatial distance over long periods of time, indicating that a price series is non-stationarity. Nonstationary price signals are removed from further empirical analysis.

Stage 3: Test for market dynamics with surrogate price data. We test the null hypothesis that apparent geometric regularity visualized in reconstructed market attractors along the supply chain is most likely generated fortuitously by linear-stochastic dynamics as opposed to nonlinear-deterministic dynamics. The test is conducted by generating randomized *surrogate* data vectors that destroy temporal structure in a price signal while maintaining shared statistical properties providing stochastic explanations for a reconstructed attractor's apparent regularity [32]. We compute *PPS* surrogates with an algorithm formulated by Small and Tse (2002), which test for noisy linear dynamics in cyclic time-series records [33].

Discriminating statistics measuring hallmarks of deterministic nonlinear dynamic behavior are used to compare the attractor reconstructed from the price signal with those reconstructed from surrogate price vectors. We select permutation entropy—a conventional discriminating statistic—which modifies the classic Shannon H information measure for use with finite noisy data [34]. When $H = 0$, the time series is perfectly predictable from past values. H achieves a maximum value when time series observations are i.i.d. random variables. Since large values of H indicate more random behavior, we construct a lower-tailed test that rejects the null hypothesis of linearly stochastic market dynamics if entropy

computed from the price-signal attractor rests below the ceiling of the lower extreme values computed from surrogate attractors.

We run the lower-tailed test with nonparametric *rank-order statistics* [35]. An ensemble of $S = (k/\alpha) - 1$ surrogates is generated, where α is the probability of false rejection and k controls the number of surrogates and consequently the sensitivity of the test. Setting $\alpha = 0.05$ and $k = 20$, we accept the null hypothesis of linear-stochastic dynamics if permutation entropy taken from the shadow attractor reconstructed from the time series does not fall in the lower k permutation entropies taken from the ensemble of $S = 399$ surrogate attractors. Rejecting the null hypothesis indicates that untested dynamic structures (i.e., nonlinear-deterministic dynamics) remain viable.

Stage 4: Test for price transmission. Accepting the null hypothesis of linear-stochastic dynamics indicates the suitability of conventional price-transmission econometrics. Alternatively, rejecting the null hypothesis indicates that price transmission is most reliably investigated with empirical nonlinear dynamic methods; namely, the *convergent cross mapping* (CCM) algorithm [36].

Sugihara et al. (2012) emphasize the need to match causal-detection methods with system dynamics [36]. *Granger causality*—a fundamental underpinning of conventional price transmission econometrics—requires linear separability among factors. Linear separability implies that causal information is independently unique to the causative factor, and can be removed by eliminating that factor from the model. Consequently, price p_1 *Granger-causes* p_2 if the predictability of p_2 decreases when p_1 is removed from the set of possible causal factors. This provides empirical evidence that price information is transmitted from p_1 to p_2. However, *Granger causality* is no longer appropriate in nonlinear-deterministic systems. Causal information does not disappear when the causative factor is removed from the model because it is encoded into the dynamics of coupled factors. As noted by the famous naturalist John Muir (1911), "When we try to pick something up by itself, we find it hitched to everything else in the universe" [37].

Sugihara et al. (2012) developed the *convergent cross mapping* (CCM) method to detect causal networks in nonlinear-deterministic complex ecosystems. We import CCM to provide a revised understanding of price transmission in endogenously unstable nonlinear markets: Price p_1 causes p_2 (price information is transmitted) if CCM detects that the dynamics of p_1 are encoded into dynamics of p_2.

CCM detects price transmission from price p_1 to price p_2 when the attractor reconstructed from p_2 can be used to skillfully predict values on the attractor reconstructed from p_1 with a nonlinear prediction algorithm. The logic underlying CCM is that, if p_1 and p_2 interact in the same supply chain, then attractors reconstructed from delayed copies of $p_1(M_{p1})$ and delayed copies of $p_2(M_{p2})$ map 1-1 to the original system attractor (M), and consequently map 1-1 to each other. CCM tests whether a 1-1 mapping exists between M_{p1} and M_{p2} by measuring the skill with which one attractor can cross-predict values on the other. Detected causation evinces that the dynamics of the transmitting price (p_1) are embedded into the dynamics of the price receiving the transmission (p_2).

We apply the *S-mapping* method [38] to quantify detected nonlinear price interactions with partial derivatives measuring the marginal change in a price receiving the transmission given an incremental change in the transmitting price over the period-of-record. S-mapping first reconstructs a shadow attractor with state-space coordinates including p_1 and p_2, and then computes the curvature of state space at each point on the attractor with a locally weighted multivariate linear regression scheme. Estimated regression coefficients measure slopes in the direction of each price at each point, and these slopes serve as partial derivatives of the price receiving the transmission with respect to the transmitting price in each time period.

2.3. Code Availability

The following R packages are available to run methods in the framework: RSSA (singular spectrum analysis); spacetime (spacetime separation plots); tseriesChaos (mutual

information function, false nearest neighbors test, time-delay embedding); multispatial-CCM (convergent cross mapping); igraph (causal network diagrams). Wrap-around R code facilitating the use of these packages, and R code to run surrogate data analysis, are available in Huffaker et al. (2017). R code to run the S-mapping causality quantification algorithm is provided by Deyle et al. (2018). We used Origin 2020 [39] graphics software for 3-D plotting.

3. Results and Discussion

3.1. Stage 1: Signal Processing

We first run SSA to detect and remove low-frequency components that cannot be resolved statistically due to lack of data. In Figure 4A, we plot the low-frequency nonlinear trend cycle (blue curves) isolated from each price series (black curves). We extend the world price (WP) series (gray curve) and isolated nonlinear trend cycle (dashed blue curve) two years beyond the period-of-record of the domestic prices to demonstrate that the trend cycle has a length of about 18 years (2002–2020). Gelb (1977) also detected an 18-year cycle in a spectral analysis of historic US coffee prices, which he found similar to the "irregular, long-term shifts" that are predominate in "virtually all commodity markets" [40]. He and earlier investigators attributed the long-term trend in coffee prices to technological change and demand/supply conditions. Comparing annual-average prices along the nonlinear trend cycles with annual production and inventory data provided by the ICO supports a demand/supply explanation (Figure 4B). Coffee prices increased along the trend cycle until the 2011 peak, at which time the coffee inventory of the largest importing nations was at a 10-year minimum (red curve). After 2011, inventory increased rapidly with production (blue curve), and coffee prices decreased along the trend cycle.

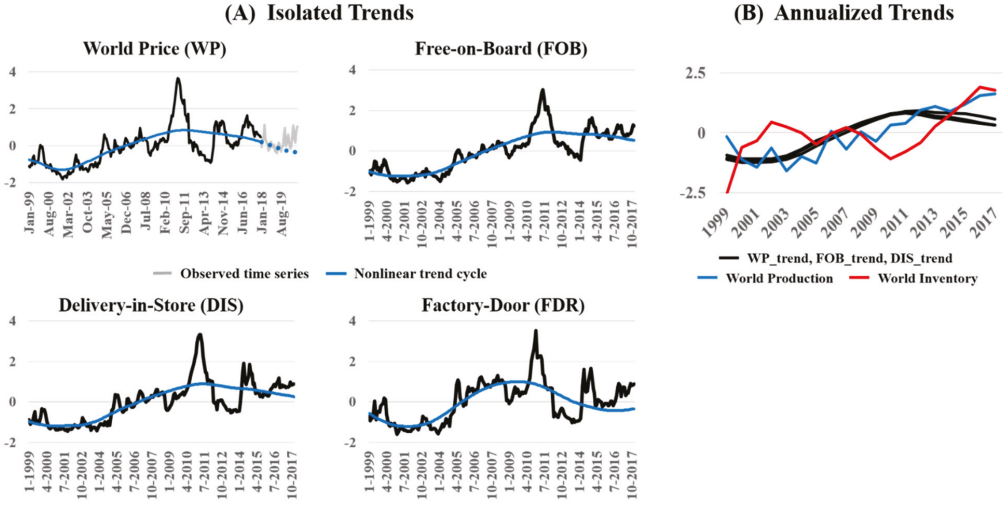

Figure 4. Stage 1: Signal processing to detrend prices. (**A**) Low-frequency nonlinear trend cycles (blue cycles) are removed because they cannot be adequately sampled from the observed price series (black curves). The world price (WP) series (gray curve) and isolated nonlinear trend cycle (dashed blue curve) are extended two years beyond the period-of-record of the domestic prices to demonstrate that the trend cycle has a length of about 18 years (2002–2020), a trend-cycle length also detected in an early spectral analysis of historic US coffee prices [40]. (**B**) To explain the market underpinnings of trended behavior, the trends are annualized (by taking the annual average of monthly prices) so that they can be compared with annual production and inventory data provided by the ICO. At peak WP in 2011, the coffee inventory of the largest importing nations was at a 10-year minimum (red curve). Inventory subsequently increased rapidly in response to upward trending production (blue curve) resulting in a sustained decline in trended prices through the end of the period-of-record.

We run a second stage of SSA to isolate cyclical components in the detrended residuals from the first stage of SSA. In Figure 5, the columns show signal processing results for each detrended price series. The top row plots isolated signals (black curves) against the detrended price series (gray curves). We observe that price signals track the detrended price series closely, indicating that structured variation accounts for a high percentage of total variation in each detrended series. The middle row plots the cycles comprising each price signal. The bottom row of the figure shows the unstructured variation (noise) isolated in each detrended price series (red curves). Noise is calculated as the difference between the detrended price series and the signal in each month. Table 1 shows the relative strengths of isolated signal components in accounting for total variation in the detrended price series. The percentages in the table are the portions of total variance in the price series attributed to each signal component and noise (i.e., partial variances). The partial variances for each price series sum to 100%. For example, total variation in WP (first row) is spread over the nonlinear trend cycle (53%), the higher-frequency cycles isolated from detrended WP (42%), and unstructured noise (5%). We observe that composite signal strength (penultimate column) is substantially greater than noise (last column) for each price series.

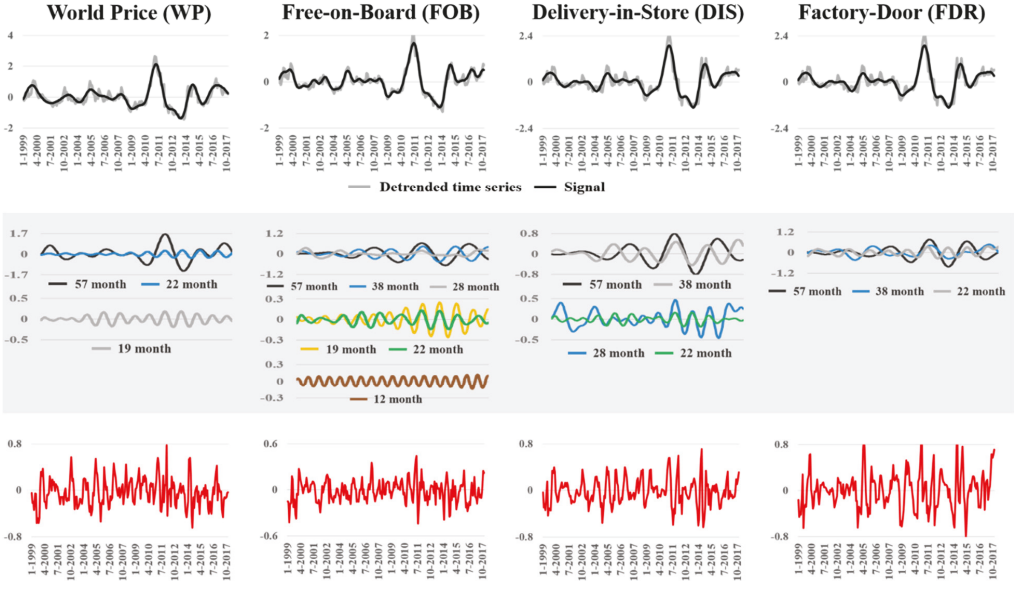

Figure 5. Signal processing of detrended prices. Higher-frequency cyclical components are isolated in the (detrended) residuals from the initial application of SSA. The columns of the figure show signal processing for each detrended price series. The top row of the figure plots isolated signals (black curve) against the detrended time series (gray curves). Signals tract the corresponding detrended price series closely, indicating that structured variation accounts for a high percentage of total variation in each detrended series. The middle row of the figure plots the oscillatory components of structured variation for each price signal. The bottom row of the figure shows the unstructured variation (noise) isolated in each detrended price series (red curves).

Table 1. Stage 1: Singular spectrum analysis signal processing of coffee price series.

	SSA-1 [b]	SSA-2 [d] Cycle Length (Months) Signal Strength [e]						Noise Strength [f]
	Trend	**19**	**23**	**28**	**38**	**57**		
WP [a]	53% [c]	2%	3%			37%	42%	5%
FOB	74%		1%	3%	7%	10%	21%	5%
DIS	62%		2%	7%	11%	13%	33%	5%
FDR	55%		4%		11%	20%	35%	10%

[a] World price (WP), free-on-board price (FOB), delivery-in-store price (DIS), factory door price (FDR). [b] Singular spectrum analysis (SSA) decomposes data into structured variation composed of trend and cyclical components (signal) and unstructured variation (noise). SSA-1 identifies and removes trend components that cannot be adequately sampled. [c] The percentages in the table are partial variances of isolated components; that is, the portion of total variation in a price series attributed to each component. [d] SSA-2 isolates higher-frequency cyclical components in the (detrended) residuals from SSA-1. [e] Signal strength in SSA-2 is the sum of the partial variances of detrended cyclical components. It measures the relative strength of signal components that can be adequately sampled with available data. [f] Noise strength accounts for residual variance in the data unattributed to signal components isolated in SSA 1 and 2. For example, noise strength in WP is: 5% = 100% − 53% − 42%.

The world price (WP) signal is composed of a 4.75-year (57-month) cycle (black curve), a biennial (23-month) cycle (blue curve), and a 19-month cycle (gray curve). These cycles are diffused throughout the domestic PNG supply-chain prices. The 4.75-year cycle accounts for the largest portion of composite signal strength in each detrended price series; the biennial cycle is a much weaker component (Table 1).

A 4-year cycle is characteristic of historical coffee prices as explained in early work by Jacob (1935) [41]:

> "Throughout the nineteenth century we can trace the history of anarchic cycles of overproduction and underproduction of coffee. Delight in a year when prices have been high is translated into an undue extension of planting, which, four years later, leads to the recurrence of rock-bottom prices. Then there is a panic. In the seventh year, the pendulum swings back once more toward the side of extended planting."

The 2-year cycle is explained by the biennial bearing cycle of Arabica coffee trees which has historically generated bumper harvests in one year followed by substantially lower harvests in the next in the largest producing countries. During productive "on" years, the tree allocates resources to bearing fruit at the expense of vegetative growth. This creates a shortfall in vegetative growth required to bear fruit in the following "off" year. The relative low signal strength of the biennial cycles in the world and PNG price series is likely explained by the success that major Arabica coffee producers have had in smoothing out biennial bearing with improved pruning strategies, better fertilizer application, increased irrigation, and improved coffee tree varieties [42].

3.2. Stage 2: Reconstruct Market Dynamics from Price Signals

We next test whether the substantial structure isolated in each price series with SSA results from stable linearly stochastic or endogenously unstable nonlinear-deterministic real-world market dynamics. We first reconstruct state-space market attractors from each (detrended and denoised) price signal. Reconstructed attractors display geometric regularity whose outer orbits are due to lower-frequency cycles isolated by SSA, and inner orbits to higher-frequency cycles (Figure 6A). The regularity in these attractors, for example, is in stark contrast to the scattering of points reconstructed from a randomized (uniform) time series (middle inset plot). We use reconstructed attractors to test for stationarity of corresponding price signals with *space-time separation plots* (Figure 6B). The plots indicate stationarity of each price signal since initial cycles are completed with an elapsed time of about 50 months, which is sufficiently short relative to the 228-month period-of-record for successful operation of empirical nonlinear dynamic methods.

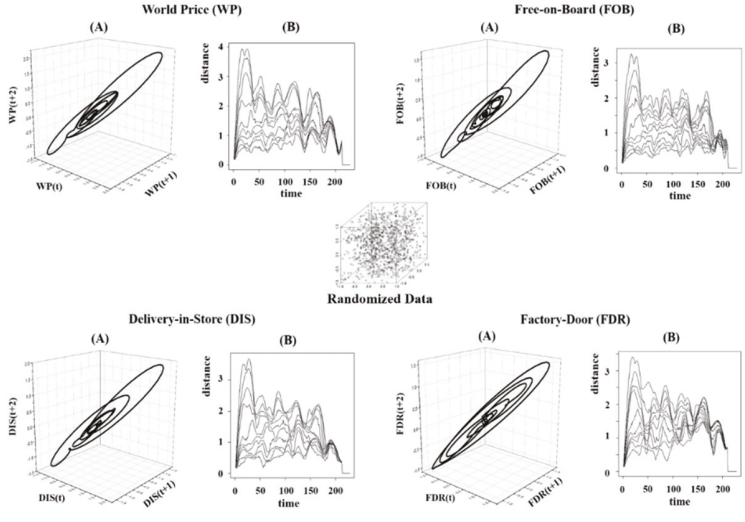

Figure 6. Stage 2: Reconstruct state-space dynamics from detrended price signals. (**A**) Reconstructed state-space market attractors from each detrended price signal exhibit a geometric regularity that, for example, is in stark contrast to the random scattering of points reconstructed from a randomized (uniform) time series (middle inset plot). (**B**) *Space-time separation plots* indicate that each price signal is stationarity since initial cycles (completed with an elapsed time of about 50 months) are short relative to the 228-month period-of-record.

3.3. Stage 3: Test for Market Dynamics with Surrogate Price Data

Surrogate testing strongly rejects the null hypothesis that observed geometric regularity in market attractors reconstructed from coffee price signals along the global–domestic supply chain is incidentally due to linear-stochastic stable market dynamics (Table 2). Permutation entropies computed from price-signal attractors are substantially below the ceiling of the lower extreme values computed from surrogate attractors. Rejection of the null hypothesis indicates that untested dynamic structures (such as nonlinear-deterministic dynamics) remain viable possibilities. In sum, we have diagnosed that market dynamics along the global-PNG coffee supply chain are most likely structurally unstable. Spatial arbitrage does not stabilize prices; instead, persistently volatile prices oscillate irregularly along nonlinear market attractors.

Table 2. Stage 3: Test H_0—linear-stochastic dynamics [a].

World Price	Signal [b]	Surrogate (low) [c]	H_0 [d]
Permutation entropy Free-on-Board	0.523	0.956	Reject
Permutation entropy Delivery-in-Store	0.631	0.957	Reject
Permutation entropy Factory Door	0.578	0.957	Reject
Permutation entropy	0.518	0.957	Reject

[a] Randomized PPS [33] surrogate price vectors are generated to test the null hypothesis that apparent geometric regularity visualized in empirically reconstructed market attractors is generated by linear-stochastic dynamics. The significance level is set at α = 95% with 399 surrogates generated. The discriminating statistic is *permutation entropy*. [b] Discriminating statistics are taken from the market attractor reconstructed from each price series. [c] A lower-tailed test rejects the null hypothesis (H_0) if permutation entropy computed from the price-signal attractor rests below the ceiling of the lower extreme values computed from surrogate attractors. [d] Rejection of H_0 indicates that untested dynamic structures (such as nonlinear-deterministic dynamics) remain viable possibilities.

Gelb (1979) also detected structurally unstable dynamics in an early study of US coffee prices, remarking that: "observers of the world coffee economy have sometimes also noted the existence of fairly slow but somewhat regular coffee price oscillations generally associated with severe structural disequilibria." Past work attributed persistent structural disequilibria to the somewhat regular "coffee cycle" in which myopic producer investment response to current price levels leads to recurrent wide swings in coffee production and prices [41,43,44], and to failed industry and national stabilization policies [44]. Gelb (1979) questioned how endogenous cyclical oscillations persist when rational agents could realize above-normal profits by employing countercyclical investment strategies that would smooth out price cycles. He attributed persistence to: (1) "the impracticability of buffering the sequence of structural disequilibria in the product market because of the cost of holding the vast volume of required stocks"; (2) "the technological limitations on short-term output adjustment"; (3) "the inability of producers to predict coffee cycles to the extent required to formulate countercyclical strategies given the "stochastic nature (variable period) of the cycle."

Our analysis of coffee prices after the turn of the 21st century offers compelling empirical evidence that—despite varietal, horticultural, infrastructural, and communicational advances—the above historic forces remain sufficiently strong that modern coffee markets continue to exhibit structural instability that, while having a stochastic appearance, is governed by nonlinear-deterministic dynamics.

Given that coffee prices in our study have a "deterministic" rather than a "stochastic" nature, why can producers not predict coffee cycles well enough to formulate countercyclical investment strategies? A surprising result of nonlinear dynamics is *deterministic unpredictability*: Long-term prediction in nonlinear dynamic systems is impossible even when governing laws are known with certainty due to *sensitivity to initial conditions* [16]. Trajectories emanating from two initially (very) close points on a nonlinear attractor diverge exponentially over time due to stretching and folding of the attractor. Given numerical imprecision of measuring initial conditions, computed trajectories along a nonlinear attractor will eventually evolve toward far different states. Although this limits the time horizon over which reliable predictions can be made, skillful short-term prediction is often possible.

3.4. Stage 4: Test for Price Transmission

Since we reject the null hypothesis of linear-stochastic stable market dynamics along the global-PNG coffee supply chain, we apply the CCM method to detect nonlinear price transmission in both upstream and downstream directions. CCM detects price transmission when the attractor reconstructed from the price receiving the transmission (M_{RT}) can be used to skillfully predict values on the attractor reconstructed from the transmitting price (M_T). The CCM plot for each pairwise price interaction is shown in Figure 7. Vertical axes measure predictive skill given by the Pearson correlation coefficient (ρ) between actual and predicted points on M_T. More skillful prediction is indicated as correlation coefficients converge to higher values (upper limit of one) as the *library* of price observations used to reconstruct M_{RT} increases (horizontal axis). Statistically significant cross-mappings must rest above upper 95% confidence bounds on the predictive skill of predicting point on M_T with attractors reconstructed from randomized surrogate prices (red curves). Above each CCM plot, we denote successful cross-mappings indicating price transmission by a solid black arrow, and unsuccessful cross-mappings indicating no price transmission by an outlined arrow with a line through it. Rightward (leftward) arrows indicate upstream (downstream) price transmission from WP→FOB→DIS→FDR (WP←FOB←DIS←FDR).

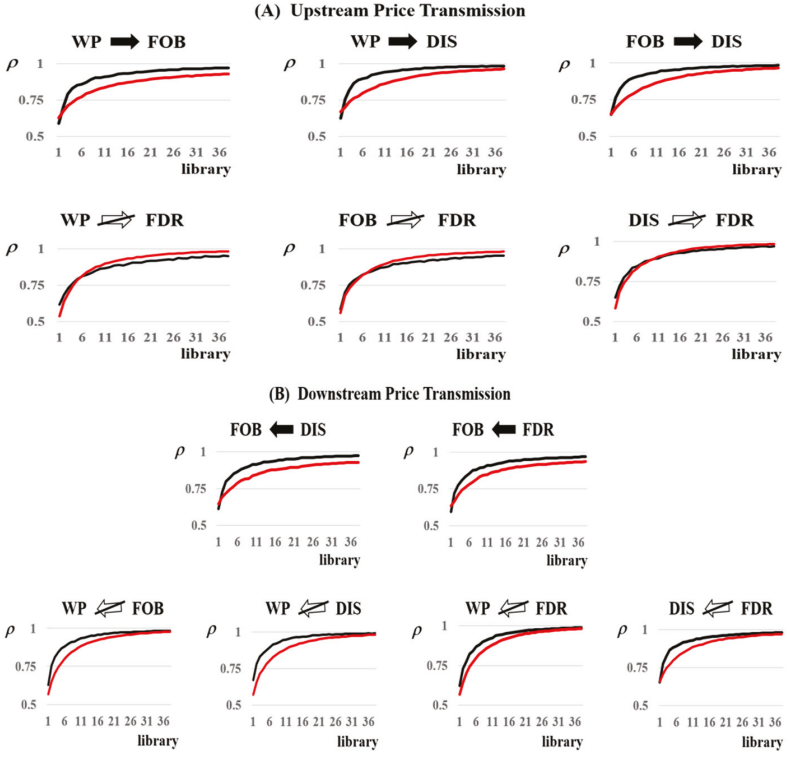

Figure 7. Stage 4: Test for price transmission with convergent cross mapping (CCM). The CCM algorithm of Sugihara et al. (2012) [36] detects price transmission when the attractor reconstructed from the price receiving the transmission (M_{RT}) skillfully predict values on the attractor reconstructed from the transmitting price (M_T). Vertical axes of CCM plots measure predictive skill given by the Pearson correlation coefficient (ρ) between actual and predicted points on M_T, and horizontal axes measure the *library* of price observations used to reconstruct M_{RT}. More skillful prediction is indicated as correlation coefficients converge to higher values (upper limit of one) as the library increases. Statistically significant cross-mappings must rest above upper 95% confidence bounds on the predictive skill of predicting point on M_T (red curves). Price transmission is denoted by a solid black arrow, and no price transmission by an outlined arrow with a line through it. Rightward (leftward) arrows indicate upstream (downstream) price transmission from WP→FOB→DIS→FDR (WP←FOB←DIS←FDR). (**A**) Upstream price transmission. CCM detects upstream price transmission from world prices (WP) to both exporter (FOB) and factory (DIS) prices, from exporter to factory prices, but no statistically significant upstream transmission to producer prices (FDR). (**B**) Downstream price transmission. CCM detects no downstream price transmission from the domestic market to world prices as expected since the PNG coffee exports a relatively small fraction of global supply. Both producer (DIS) and factory (FDR) prices are transmitted downstream to exporter prices (FOB) as factors determining the *differential* that exporters calculate to tie their prices to world prices.

In Figure 7A, CCM detects upstream price transmission from world prices (WP) to both exporter (FOB) and factory (DIS) prices, from exporter to factory prices, but no statistically significant downstream transmission to producer prices (FDR). In Figure 7B, CCM detects that both producer (DIS) and factory (FDR) prices are transmitted downstream to exporter prices (FOB) as factors determining the *differential* that exporters calculate to tie their prices to world prices. CCM detects no downstream price transmission from the

domestic market to world prices as expected since the PNG coffee exports a small fraction of global supply.

In Figure 8A, these detected pairwise price transmissions are summarized in a *price transmission diagram* in which circular nodes depict price signals and incoming (outgoing) arrows denote received (sent) price transmissions. The diagram clearly depicts how producers are isolated along the global-PNG coffee supply chain since no upstream price transmissions reach them.

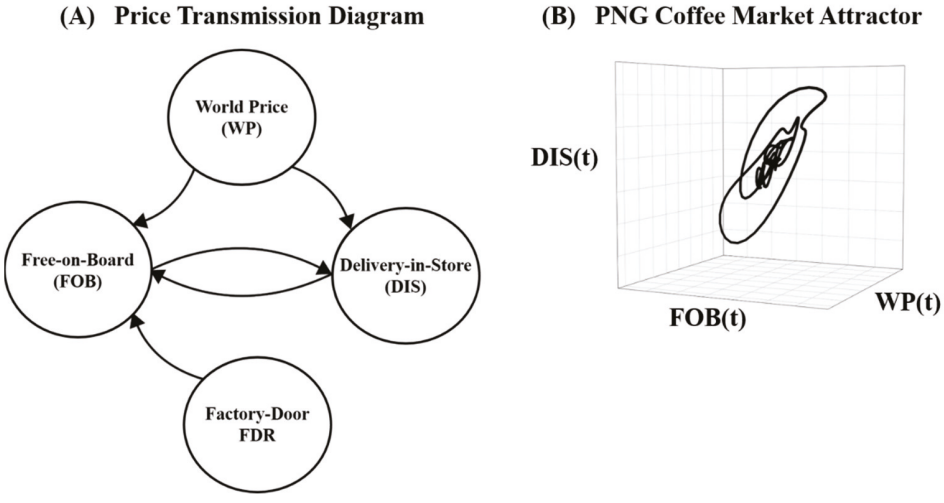

Figure 8. Price transmission in world-PNG coffee market. (**A**) In a *price transmission diagram*, circular nodes depict price signals and incoming (outgoing) arrows denote received (sent) transmissions. Producers are largely isolated along the global-PNG coffee supply chain since no upstream price transmissions reach them. (**B**) A market attractor for the PNG coffee market—composed of the interactive top (upstream) links of the supply chain (WP, FOB, and DIS)—is used to quantify the economic impact of detected price transmissions with *S-mapping* [38].

Market power along the supply chain is often identified as a major driver of incomplete price transmission, but there may be other forces at work [45]. Bettendorf and Verboven (2000) found that weak transmission of coffee bean prices to consumer prices in the relatively competitive coffee market in the Netherlands was due to the relatively large share of non-bean costs in a relatively competitive coffee market [46]. This might explain the failure of upstream price transmission to PNG producers given that: (1) exporters set price differentials paid to upstream processors and producers covering both bean and non-bean costs; (2) the PNG coffee market is relatively competitive with large numbers of exporters and processors competing for limited PNG coffee production [23].

3.5. Quantification of Price Transmission

In Figure 8B, we construct a market attractor for the PNG coffee market composed of the mutually transmissive price signals along the supply chain: WP, FOB, and DIS. The S-mapping method [38] uses this attractor to quantify the economic impact of detected price transmissions along the supply chain as partial derivatives measuring the marginal change in the price receiving the transmission given an incremental change in the transmitting price over each month in the period-of-record (Figure 9).

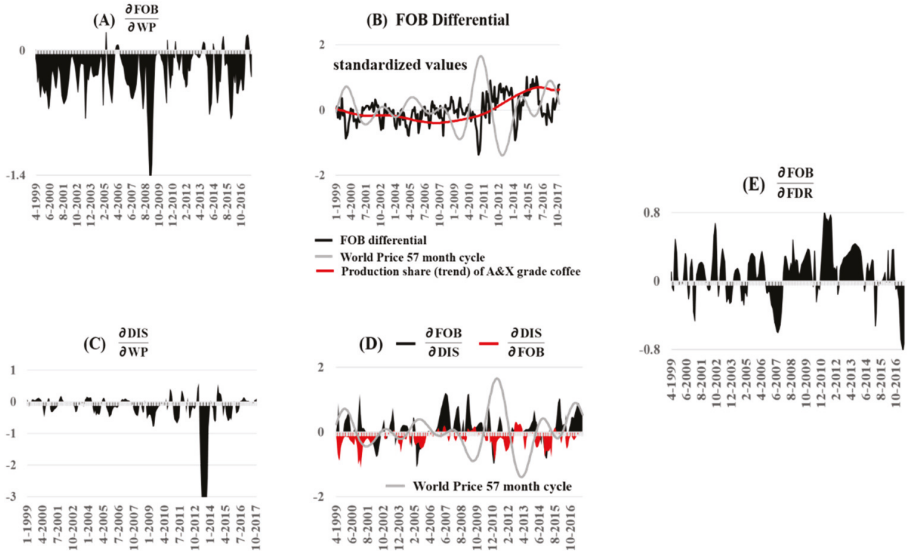

Figure 9. Stage 4: Quantify the economic impact of price transmission. The *S-mapping* method uses the PNG coffee market attractor constructed from the most interactive price signals along the supply chain (Figure 8B) to compute partial derivatives measuring the marginal change in the price receiving the transmission given an incremental change in the transmitting price over the period-of-record. (**A**) The marginal response of exporter prices to an incremental increase in global prices (∂FOB/∂WP) was overwhelmingly negative through time. (**B**) The rationale for this inverse relationship is illuminated by observing that differentials (black curve) were generally below average (standardized values negative) when world prices along the 57-month cycle (gray curve) were increasing, and above average when world prices along the 57-month cycle were decreasing. (**C**) Prices paid by exporters to factories (DIS) also displayed a strong inverse marginal response to WP. (**D**) Exporters and factories had bilateral price transmission. When WP cycled above average (standardized values positive), ∂FOB/∂DIS and ∂DIS/∂FOB were generally both negative suggesting a mutually detrimental *competitive* interaction. When WP cycled below average (standardized values negative), ∂FOB/∂DIS turned positive suggesting that the relationship between exporter and factory prices switched from *competitive* to *predator* (exporter)-*prey* (factory). (**E**) Exporter prices marginally increased in response to an incremental increase in producer prices (∂FOB/∂FDR > 0) in two thirds of the months in the period-of-record, and marginally decreased in the remaining third.

The marginal response of exporter prices to an incremental increase in global prices (∂FOB/∂WP) was overwhelmingly negative through time (Figure 9A). The roots of this perhaps unexpected inverse relationship appear linked with how *differentials* (black curve) behaved over time in response to a low-frequency (57 month) cycle in world prices (gray curve) isolated with SSA (Figure 9B). *Differentials* were generally below average (standardized values negative) when world prices along the 57-month cycle were increasing, and above average when world prices along the 57-month cycle were decreasing. This is especially obvious after the 2011 peak in world prices. Additionally, it is of interest that the magnitude and frequency of above-average *differentials* after 2011 accompanied the increasing trend in the fraction of higher-grade (A and X) coffees produced in the PNG market (red curve). Prices paid by exporters to factories (DIS) also displayed a strong inverse marginal response to WP (Figure 9C).

Exporters and factories bilaterally transmitted price information (Figure 9D). The increasing fraction of higher grades A and X means increasing supply from estates and block holders, and therefore an increasing share of vertically integrated firms who are producers, processors, and exporters. Therefore, bicausal information flows. The downstream marginal impact on factory prices of an incremental increase in exporter prices (∂DIS/∂FOB) was largely negative over time (red area). Alternatively, the upstream marginal impact of

factory prices on exporter prices (∂FOB/∂DIS, black area) resonated with the 57-month cycle in WP (gray curve). When WP cycled above average (standardized values positive), ∂FOB/∂DIS and ∂DIS/∂FOB were generally both negative. In an ecosystem analogy, the mutually detrimental prices were *competitive*. When WP cycled below average (standardized values negative), ∂FOB/∂DIS was generally positive. Paired with negative ∂DIS/∂FOB, we see that exporter prices marginally benefitted from incremental increases in factory prices while factory prices marginally declined in response to incremental increases in exporter prices. Continuing the ecosystem analogy, the relationship between exporter and factory prices switched from *competitive* to *predator* (exporter)-*prey* (factory).

Exporter prices marginally increased in response to an incremental increase in producer prices (∂FOB/∂FDR > 0) in two thirds of the months in the period-of-record, and marginally decreased in the remaining third (Figure 9E).

3.6. Implications for PNG Global–Domestic Supply Chain

Our results offer empirical evidence of upstream price transmission from the global market to domestic exporters and processors, but not through to coffee producers. The implications of these results for the PNG global–domestic supply chain depend on the factors causing weak price transmission. Past work emphasizes that price-transmission detection stops short of identifying causal factors [1,47], and consequently must be complemented with "qualitative information on the major factors that may determine the extent of transmission" [1]. Proposed causal factors have included "the degree of market power exerted by agents in the supply chain" [1], and raw commodity values that are only a small portion of final retail value [48]. Ghosray and Mohan (2021) detected asymmetric price adjustment between retail and international coffee prices that they attributed to "market concentration in the coffee supply chain at the coffee-roasting level, which allows coffee roaster to keep a higher share of the profits" [9]. Alternatively, Bettendorf and Verboven (2000) detected weak price transmission between coffee beans and final consumer price that they explained by "relatively large share of costs other than bean costs" [46]. Our description of the PNG coffee industry above (Section 2.1) does not support market concentration as a causal factor of weak (statistically insignificant) upstream price transmission to domestic producers since "[i] ntense competition among a large number of exporters and processors for limited PNG coffee production often leads to price wars." Rather, the wide margin between exporter/processing prices (WP/DIS) and producer prices (FDR) over time (Figure 1) offers a more compelling driving factor in line with Bettendorf and Verboven (2000). This indicates that weak transmission to producers is not a market failure but a reflection of the substantial processing required to transform raw production to an exportable good. Consequently, public policy should protect producer (rural) incomes with extra-market tools (such as price supports) rather than market interference.

4. Conclusions

In this paper, we followed an inductive science approach to infer causal structure from observational data. We provided positive analysis of behavior that "actually happened" supplemented with qualitative explanations drawn from past studies. Our diagnostics were data-driven and not biased by imposing self-correcting markets whose failure to hold in the real world would result in selection of inappropriate price-transmission detection methods. Our results provide an empirical benchmark corresponding to real-world coffee market dynamics that can guide subsequent theory-based modeling. This benchmark includes a geometric picture of real-world state-space dynamics along the market supply chain that model output should reproduce, and detection and quantification of price transmission.

We emphasize that neither conventional price-stabilizing linear-stochastic market dynamics or endogenously unstable nonlinear-deterministic market dynamics should be presumptively ruled out as a plausible explanation for observed price volatility. We recommend that price transmission studies take advantage of recent developments in

nonlinear dynamics to initially test for which explanation best corresponds to real-world markets before "straightjacketing" the analysis with either.

We conclude with a broad caveat: We cannot reasonably expect to successfully reconstruct deterministic nonlinear dynamics from observational data in every application. The dynamics of a real-world system might not evolve along a low-dimensional nonlinear attractor, or available data may not adequately sample an existing real-world attractor. We can reasonably expect to reconstruct a "sampling" of a real-world attractor [49] if available data adequately represent the dominant time scales of the system, or are not too noisy to detect deterministic behavior [49].

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Informed Consent Statement: This study did not involve animals or humans.

Data Availability Statement: Monthly average price records along the PNG coffee supply chain are kept by the Economics Unit of the PNG Coffee Industry Corporation [24] https://www.cic.org.pg/. (accessed on 12 August 2021) The price series data that we obtained from this source can be downloaded in csv format from: https://www.une.edu.au/staff-profiles/business/ggriffit. (accessed on 12 August 2021).

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