The Role of Sensory Attribute Categories in Online Fresh Food Purchase Behavior

Completed Research

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Abstract

Many people are reluctant to buy fresh foods online. We seek to find out why. To this end, we created a research model that builds on findings regarding the hindering effect of perceived product performance risk on people's online purchase behavior. We drew from studies on food choice behavior in the offline context as well as studies on the human senses to build hypotheses regarding the influence of four factors on perceived product performance risk in the context of *online* fresh food purchases: *perceived importance of (a) flavor*, (b) *texture*, (c) *aroma*, and (d) *appearance as an evaluation criterion of fresh foods*. After surveying 151 participants and analyzing the data using PLS-SEM, we confirmed the influence of factors (a) and (b) but not of factors (c) and (d). We will provide practical implications for our findings and an explanation for the two insignificant relationships.

Keywords

Appearance, Aroma, Flavor, Fresh Food, Sensory Attributes, Texture, Online Shopping.

Introduction

Selling food is a large business for retailers. However, despite the strong growth trajectory of Internet shopping in general, customers still rarely buy fresh foods[1] online. More specifically, the market share of the fresh foods segment is comparatively low online, especially when compared to other product categories such as fashion items or entertainment electronics (cf. A.T. Kearney 2016).

Several surveys on online food retailing commissioned by the industry or carried out by business consultants have concluded that a major reason for the reluctance to buy fresh foods online is that customers cannot inspect upfront the specific products they intend to buy (A.T. Kearney 2016; Bitkom 2016; Oliver Wyman 2018). However, these studies do not provide any insights into which evaluation criteria's absence exerts influence on people's online fresh foods purchase behavior, and they also do not provide any rationale for the influences.

In order to address this gap, we will draw from different streams of literature, i.e., studies on food choice behavior, human senses and risk perception, to examine the potential influence factors of online fresh foods purchase behaviors. More specifically, most people are still used to buying fresh foods in-store. During the purchase, they try to use specific sensory attribute categories as evaluation criteria to assess a

[1] According to the US Food and Drug Administration, the term *fresh* in the context of food labeling "(a) … means that the food is in its raw state and has not been frozen or subjected to any form of thermal processing or any other form of preservation … The following do not preclude the food from use of the term 'fresh:' (i) The addition of approved waxes or coatings; (ii) The post-harvest use of approved pesticides; (iii) The application of a mild chlorine wash or mild acid wash on produce; or (iv) The treatment of raw foods with ionizing radiation not to exceed the maximum dose of 1 kiloGray … A food meeting the definition in paragraph (a) of this section that is refrigerated is not precluded from use of 'fresh' …" (FDA 2018).

fresh food product's quality: *flavor*, *texture*, *aroma* and *appearance* (e.g., Cardello 1994; Gains 1994; Grunert 2005; Imram 1999; Pollard et al. 2002; Steptoe et al. 1995). However, when buying fresh foods online, they cannot rely on their preferred evaluation criteria since they cannot taste, touch, smell, or see the specific product they are buying. We now believe that if a customer perceives a specific evaluation criterion as important to assess the quality of fresh foods in-store, its corresponding absence in the online context will lead to a higher risk perception, which can be defined as "the nature and amount of risk perceived by a consumer in contemplating a particular purchase decision" (Cox and Rich 1964, p. 33). After building corresponding hypotheses, we evaluated them using an online survey with 151 participants from the US and analyzed the data by applying a structural equation modeling approach. Our results indicate that both customers' *perceived importance of flavor as evaluation criterion of fresh foods* and customers' *perceived importance of texture as evaluation criterion of fresh foods* exert a positive influence on the *perceived product performance risk* in the context of fresh foods online shopping. This, in turn, negatively influences the *behavioral intention to buy fresh foods online*. In contrast, we did not find similar influences of either customers' *perceived importance of aroma as evaluation criterion of fresh foods* or their *perceived importance of appearance as evaluation criterion of fresh foods*.

In the next section, we will provide the theoretical foundations of food choice behavior, human senses and their relation to sensory attributes and perceived product performance risk, especially in the context of online shopping. Following this, we will present our hypotheses and our research design. Next, we will present the evaluation of our measurement model as well as the results of our study. We will conclude by summarizing our findings, discussing important business implications, revealing the limitations of our study and providing an outlook on further research.

Theoretical Background

Food Choice Behavior

Food choice behavior involves customers' decisions and behaviors regarding the food they buy and consume. To explain people's food choice behavior, a number of behavioral models have been developed and evaluated (e.g., Cardello 1994; Gains 1994; Khan and Hackler 1981; Pilgrim 1957; Randall and Sanjur 1981; Shepherd 1985; Steptoe et al. 1995). These models helped to identify, categorize and evaluate the influence factors of customer food choice (Shepherd and Sparks 1994). In summary, three dimensions of influencing factors have been identified: the customer dimension, the context (or situational) dimension, and the food dimension (Gains 1994).

The customer dimension covers attributes such as culture, personality, psychosocial characteristics, socio-demographic characteristics, mood and cognitive factors (Cardello 1994; Gains 1994; Shepherd 1989; Steptoe et al. 1995). Here are some examples of the factors that influence food choice behavior: the contribution of food to social interaction, the expression of social status through the consumption of exquisite food (Sanjur 1982), the impact of weight control linked to cultural beauty ideals, the growing awareness for the environment expressed through the penchant for natural ingredients and packaging (Steptoe et al. 1995), or the preference of highly educated families with young children to purchase minimally-processed vegetables and fruits (Ragaert et al. 2004).

The context (or situational) dimension contains attributes such as time and place, among others (Gains 1994). In the search situation of the pre-purchase phase, attributes such as price, which can be evaluated by customers prior to the product purchase, are very important drivers for food choice behavior. In contrast, other attributes become more important *after* the actual product purchase: Flavor, for example, cannot be tested prior to consumption in the case of convenience food (cf. Grunert 2005; Grunert et al. 2000).

Finally, the food dimension contains sensory attribute categories such as flavor and appearance, as well as packaging and other informational cues (Gains 1994). In the next section, we will take a closer look at the sensory attribute categories of food as well as at the senses that perceive them.

Senses and Sensory Attribute Categories of Food

In general, humans perceive their environment through five primary senses: sight (also referred to as vision), hearing, smell, taste, and touch. Each of the senses uses specific sense organs that are sensitive to

specific stimulus receptors and inform us about physical and chemical changes (Amerine et al. 1965): Our eyes are sensitive to light; our ears to sound; our olfactory organs to odor; our taste buds to taste; and our skin to touch, pain, temperature, and other sensations. After sense organs receive a stimulus, they translate the stimulus into nerve impulses and transmit them through the sensory nerves to the brain, where the impulses will be perceived and interpreted as sensations (Amerine et al. 1965; Fulkerson 2016).

In line with this, the physicochemical characteristics that food possesses through ingredients, preparation, storage variables, etc., is detected by humans' primary senses (Imram 1999) with the most important and well-explored sensory attribute categories of food products being *flavor, texture, aroma and appearance* (e.g., Cardello 1994; Gains 1994; Grunert 2005; Imram 1999; Pollard et al. 2002; Steptoe et al. 1995). In contrast, the sensory attribute category of *sound* only plays a minor role in the evaluation of food's sensory attributes (Kramer 1975) and thus is left mostly unconsidered in food choice literature.

Flavor is a sensory attribute category that is detected by several senses, i.e., smell and taste, which jointly create the flavor perception of humans through their nose and tongue. The smell-part of flavor is even more important because smell contributes more to the recognition of flavor than taste does (Lawless and Heymann 2010; Murphy and Cain 1980). Flavor contains sensory attributes such as sweet, salty, bitter, metallic, astringent, and umami (Lawless and Heymann 2010), and plays an important role in the acceptance of a food (Costell et al. 2010; Imram 1999). Although it is still unclear whether the like or dislike of certain flavors is innate or a result of individuals' development, multiple studies have shown that at least certain flavors are preferred or rejected, respectively, from birth onwards (cf. Cardello 1994).

Similarly, the texture of food is also a sensory attribute category that is detected by several senses. More specifically, texture is defined in the context of food choice behavior as "the sensory and functional manifestation of the structural, mechanical and surface properties of foods detected through the senses of vision, hearing, touch and kinesthetics" (Szczesniak 2002, p. 215). When texture is perceived (1) by the sense of vision, it is referred to as visual texture; when it is perceived (2) by the sense of hearing, it is referred to as auditory texture; and when it is perceived (3) by the sense of touch, it is referred to as tactile texture. Moreover, the latter can be further divided into hand-feel texture, which describes the perception of a food product by the hand or tools like a knife or a spoon, and the oral-tactile texture, which describes the mouthfeel characteristics of a product (Lawless and Heymann 2010). Each of these sensory attribute subcategories of texture can contain a variety of sensory attributes, depending on the respective subcategory, such as roughness for visual texture, crispness for auditory texture, adhesiveness for oral-tactile texture, and firmness for hand-feel texture. Generally, if a customer's perception of a food product's texture is not as they expect it to be, they will reject it (Cardello 1994; Szczesniak and Kahn 1971). In other words, the recognition of a defect in one or more of the above-mentioned sensory attribute subcategories of texture causes a customer to not accept a food product.

Aroma is a sensory attribute category that is perceived by the human sense of smell, which is detected through the nose and contains sensory attributes such as spicy, sweet, fruity, woody, green, floral, among many others (Lawless and Heymann 2010). It has been shown that the aroma of food plays an important role in the evaluation of food quality and thus, has a strong influence on consumers' food acceptance (Lawless 1991). In line with this, Kälviäinen et al. (2003) found that aroma is the most important sensory attribute category, at least for the young.

The appearance of food contains sensory attributes such as shape, size, translucency, gloss, and color (Cardello 1994; Wadhera and Capaldi-Phillips 2014). It is sensed by the eyes and most frequently the initial contact with a food product (Wadhera and Capaldi-Phillips 2014). In line with this, appearance has a strong impact on customers' first impressions of a food product and its quality perception (Imram 1999) and, thus, is highly relevant for the customers' acceptance or rejection (Gifford and Clydesdale 1986; Hutchings 1994). Many studies define color as the most influential attribute of food's appearance (e.g., Cardello 1994; Gifford and Clydesdale 1986; Hetherington and MacDougall 1992; Imram 1999; Wadhera and Capaldi-Phillips 2014). Moreover, multiple studies (e.g., Christensen 1983; Stevenson and Oaten 2008) have identified that product color also influences customers' perception of other sensory attribute categories such as flavor.

Perceived Product Performance Risk on the Web

Risk, in general, can be defined as "the extent to which there is uncertainty about whether potentially significant and/or disappointing outcomes of decisions will be realized" (Sitkin and Pablo 1992, p.10). Perceived Risk in the context of buying decisions can be understood as "the nature and amount of risk perceived by a consumer in contemplating a particular purchase decision" (Cox and Rich 1964, p. 33).

Even before the wide acceptance of the Web, several studies examined the perceived risk of in-home shopping decisions such as mail order in contrast to in-store shopping decisions. The results indicated a higher perceived risk for in-home shoppers, because since the products could not be inspected before ordering, they did not necessarily receive what they thought they would (e.g., Akaah 1988; Cox and Rich 1964). In line with this, Internet-shoppers also perceive a higher risk compared to in-store shoppers (e.g., Forsythe et al. 2006; Forsythe and Shi 2003; Jiuan Tan 1999; Samadi and Yaghoob-Nejadi 2009) with perceived product performance risk being one of the most important perceived risk categories with regards to online shopping. It is defined as "the uncertainty and consequences of a product not functioning at some expected level" (Bruner et al. 2005, p. 474) and, hence, "relates to the risk that the product will not function as expected, often due to the lack of accurate product examination and evaluation prior to purchase" (Yu et al. 2012, p. 254) (cf. Cases 2002; Jiuan Tan 1999).

The importance of perceived product performance risk in the online shopping realm can be explained by the potential weak product choice of a customer. Indeed, customers only have limited opportunity to adequately assess the quality of a product online since they cannot, e.g., touch the product and have only limited information about important attributes such as realistic product colors (Bhatnagar et al. 2000; Forsythe and Shi 2003).

Research Model

In the following section, we will use the theoretical foundations explained above to build hypotheses with regard to people's online purchase behavior of fresh foods. In general, product performance risk has been found to be one of the most important reasons for not shopping online (Dai et al. 2014; Forsythe and Shi 2003). More specifically, perceived product performance risk has often been shown to exert a negative influence on people's actual online shopping behavior or the behavioral intention to do so, respectively (e.g., Bhatnagar and Ghose 2004; Bhatnagar et al. 2000; Forsythe et al. 2006; Forsythe and Shi 2003; Jiuan Tan 1999; Samadi and Yaghoob-Nejadi 2009). Moreover, in the specific context of fresh food products, perceived product performance risk seems to be the main concern that hinders people's online purchase of fresh food (Bhatnagar et al. 2000). We hypothesize that: *There is a negative influence of Perceived Product Performance Risk on the Behavioral Intention to Purchase Fresh Foods Online* ***(H1)***.

Customers perceive a higher degree of product performance risk when they fear that they will not get a product that matches what they want it to be (e.g., Akaah 1988; Cox and Rich 1964). In other words, if customers cannot fully inspect products before ordering, they can be expected to perceive a higher amount of product performance risk with regard to that very product. In the context of online shopping, this can be expected to be of particular importance for fresh food purchases.

Indeed, when purchasing fresh foods online, customers do not have the ability to physically examine the specific products (cf. Bhatnagar et al. 2000; Dai et al. 2014; Yu et al. 2012). In particular, they are not able to evaluate the fresh foods based on the four general sensory attribute categories that are known to be important for the evaluation of fresh foods (i.e., flavor, texture, aroma and appearance). If a customer perceives one or more of these sensory attribute categories as important for the evaluation of fresh foods' quality in-store, they can be expected to experience a higher degree of product performance risk when purchasing such products online, since they are unable to use their preferred evaluation criteria. We hypothesize that: *There is a positive influence of customers' perceived importance of (a) flavor, (b) texture, (c) aroma, and (d) appearance as an evaluation criterion of fresh foods*[2] *on the perceived product performance risk in the context of fresh food online shopping (****H2a, H2b, H2c, H2d****).*

[2] We define the *perceived importance of (a) flavor, (b) texture, (c) aroma, and (d) appearance as an evaluation criterion of fresh foods* as the degree to which a customer perceives (a) flavor, (b) texture, (c) aroma, and (d) appearance, respectively, to be an important criterion to evaluate the quality of fresh foods in-store.

Research Design

Data Collection

For the empirical evaluation of our research model, we used Amazon's Mechanical Turk for the recruitment of English-speaking participants who reside in the US. We offered a payment of 1 $ per completed questionnaire. We received in total 158 questionnaires, of which we dropped 7 records from further analyses: four respondents did not finish the questionnaire at all, one respondent failed our first attention check and two respondents failed our second attention check.[3] Thus, we had a final sample size of 151 data records at our disposal. Table 1 presents the demographics of our sample.

Age	Range	Mean	StdDev	N				N	
	21-71	39.85	10.95	Abs.	in %			Abs.	in %
Gender	Male			87	57.6	Educational Background	Some high school, no diploma	1	.7
	Female			63	41.7		High school diploma or equivalent	25	16.6
	Other			1	.7		Some college credit, no degree	20	13.2
Household Income	Less than $20,000			25	16.6		Trade/technical/ vocational training	7	4.6
	$20,000.00 to $30,000			17	11.3		Associate degree	28	18.5
	$30,000.01 to $40,000			20	13.2		Bachelor's degree	54	35.8
	$40,000.01 to $50,000			28	18.5		Master's degree	12	7.9
	$50,000.01 to $60,000			16	10.6		Professional degree	2	1.3
	More than $60,000			45	29.8		Doctorate degree	2	1.3
Main Occupation	Students			2	1.3	Marital Status	Unmarried/Single	74	49.0
	Currently Employed			135	89.4		Married, or in a domestic partnership	65	43.0
	Unemployed			9	6.0		Divorced	8	5.3
	In Retirement			3	2.0		Widowed	2	1.3
	Other			2	1.3		Other	2	1.3

Table 1. Demographics

Measurement

In order to ensure the reliability and validity of our measurement model, we decided to apply established scales from the literature for the measurement of our constructs. To measure the *perceived importance of flavor, texture, aroma, and appearance as an evaluation criterion of fresh foods*, we adapted the items from the *Sensory Appeal Sub-Scale* of the *Food Choice Questionnaire* by Steptoe et al. (1995). For the measurement of *perceived product performance risk*, we applied the three-item scale created by Dai et al. (2014) and for *behavioral intention to buy fresh foods online*, we used the three-item scale by Venkatesh et al. (2003). All items were measured using a seven-point Likert-type scale ranging from "strongly disagree" to "strongly agree". Table 2 gives an overview of our constructs, their measurement items and the corresponding sources.

Results

We used partial least squares structural equation modeling (PLS-SEM) for our analyses using SmartPLS 3.2.8 (Ringle et al. 2015). With 151 data records, we met the suggested minimum sample size threshold of "ten times the largest number of structural paths directed at a particular latent construct in the structural model" (Hair et al. 2011, p. 144). For the testing of the significance levels, we used the integrated Bootstrap function of SmartPLS with 5,000 samples (Hair et al. 2011).

[3] In the questionnaire, we placed two attention check items. More specifically, the first one asked the respondents to "please select agree for data quality purposes", and the second, presented at a later stage of the survey, asked the respondents to "please select disagree for data quality purposes".

Construct	Items (label)	Adapted from
Perceived Importance of Flavor as an Evaluation Criterion of Fresh Foods (PI.Flavor)	When I make a purchase decision for fresh food, it is important to me that the product has a good flavor (PI.Flavor1)	Steptoe et al. (1995)
	A good flavor is an important criterion for me when I buy fresh food products in-store (PI.Flavor2)	
	When I buy fresh food products in-store, it is important to me that they have a good flavor (PI.Flavor3)	
Perceived Importance of Texture as an Evaluation Criterion of Fresh Foods (PI.Texture)	When I make a purchase decision for fresh food, it is important to me that the product has a pleasant texture (PI.Texture1)	
	A pleasant texture is an important criterion for me when I buy fresh food products in-store (PI.Texture2)	
	When I buy fresh food products in-store, it is important to me that they have a pleasant texture (PI.Texture3)	
Perceived Importance of Aroma as an Evaluation Criterion of Fresh Foods (PI.Aroma)	When I make a purchase decision for fresh food, it is important to me that the product smells nice (PI.Aroma1)	
	A nice smell is an important criterion for me when I buy fresh food products in-store (PI.Aroma2)	
	When I buy fresh food products in-store, it is important to me that they smell nice (PI.Aroma3)	
Perceived Importance of Appearance as an Evaluation Criterion of Fresh Foods (PI.Appearance)	When I make a purchase decision for fresh food, it is important to me that the product looks nice (PI.Appearance1)	
	A nice look is an important criterion for me when I buy fresh food products in-store (PI.Appearance2)	
	When I buy fresh food products in-store, it is important to me that they look nice (PI.Appearance3)	
Perceived Product Performance Risk (P.ProdPerf.Risk)	Buying fresh food products in an online store makes it difficult to adequately judge their quality (P.ProdPerf.Risk1)	Dai et al. (2014)
	Buying fresh food products in an online store makes it difficult to compare their quality to the quality of similar products (P.ProdPerf.Risk2)	
	Fresh food products that are bought in an online store may not be as I expect them to be (P.ProdPerf.Risk3)	
Behavioral Intention to Buy Fresh Foods Online (BI)	I predict that I will order fresh food products from an online store in the next 6 months (BI1)	Venkatesh et al. (2003)
	I intend to order fresh food products from an online store in the next 6 months (BI2)	
	I plan to order fresh food products from an online store in the next 6 months (BI3)	

Table 2. Items of our Measurement Model

Measurement Model

In this section, we first evaluate our measurement model by examining its construct reliability, indicator reliability, and discriminant validity. Table 3 depicts the Average Variance Extracted (AVE) and Composite Reliability (CR) of our model on the diagonal as well as the correlations between constructs. All AVE values were higher than the suggested threshold of .50 and all CR values were higher than the suggested threshold of .70, thus, confirming the *construct reliability* of our model (Hair et al. 2010).

	PI.Flavor		PI.Texture		PI.Aroma		PI.Appearance		P.ProdPerf.Risk		BI	
PI.Flavor	.734	.891										
PI.Texture	.266		.899	.964								
PI.Aroma	.264		.423		.866	.951						
PI.Appearance	.265		.376		.517		.862	.949				
P.ProdPerf.Risk	.242		.282		.182		.145		.814	.929		
BI	-.026		-.071		.037		-.079		-.333		.967	.989

Table 3. Correlations Between Constructs (AVE & CR on the Diagonal)

Table 4 shows the factor loadings (λ) and t-values (t) of all our items. Each item's loading on its respective parent factor was significant and met the suggested threshold of .70, thus confirming *indicator reliability* (Hair et al. 2011). Additionally, all items loaded highest on their respective parent factor and the square root of the AVE of each construct was larger than the absolute value of the construct's correlations with its counterparts, which indicates *discriminant validity* (Fornell and Larcker 1981; Hair et al. 2011).

	PI.Flavor		PI.Texture		PI.Aroma		PI.Appearance		P.ProdPerf.Risk		BI	
	λ	t	λ	t	λ	t	λ	t	λ	t	λ	t
PI.Flavor1	.937	21.815	.291		.191		.213		.278		-.077	
PI.Flavor2	.763	6.609	.137		.223		.188		.111		.022	
PI.Flavor3	.861	8.574	.206		.302		.293		.174		.033	
PI.Texture1	.290		.932	20.918	.359		.347		.271		-.033	
PI.Texture2	.218		.953	22.079	.420		.366		.277		-.059	
PI.Texture3	.250		.959	21.425	.427		.357		.251		-.115	
PI.Aroma1	.312		.468		.896	11.736	.427		.167		.038	
PI.Aroma2	.180		.330		.940	11.344	.523		.172		.005	
PI.Aroma3	.245		.386		.954	12.238	.492		.168		.062	
PI.Appearance1	.200		.401		.480		.894	7.103	.121		-.097	
PI.Appearance2	.197		.289		.470		.940	7.521	.155		-.058	
PI.Appearance3	.354		.376		.493		.950	8.058	.123		-.071	
P.ProdPerf.Risk1	.208		.280		.152		.119		.944	50.636	-.349	
P.ProdPerf.Risk2	.278		.203		.205		.172		.864	15.762	-.207	
P.ProdPerf.Risk3	.182		.271		.144		.111		.897	28.012	-.328	
BI1	-.089		-.104		.024		-.117		-.336		.973	37.189
BI2	.011		-.047		.032		-.055		-.328		.988	35.129
BI3	.004		-.059		.055		-.061		-.316		.988	35.467

Table 4. Loadings & T-Values

Structural Model

In this section, we will present the path coefficients and significance levels of each of our hypothesized relationships as well as the R^2s of both dependent variables. We will also provide a potential reason for the two insignificant relationships of our empirical evaluation.

P.ProdPerf.Risk has a negative influence on BI (β=-.333, p<.001), which confirms hypothesis 1. PI.Flavor (β=.173, p<.05) and PI.Texture (β=.218, p<.05) both exert a positive influence on P.ProdPerf.Risk, thus confirming hypotheses 2a and 2b. In contrast, hypotheses 2c and 2d cannot be confirmed since both PI.Aroma (β=.048, p=.637) and PI.Appearance (β= -.008, p=.933) have no significant influence on P.ProdPerf.Risk. Overall, our research model included two significant predecessors of P.ProdPerf.Risk, and one significant predecessor of BI (P.ProdPerf.Risk). By taking this into account, the explanatory power of our structural model is acceptable, since it explains 11.1 percent of the variances of P.ProdPerf.Risk and 11.1 percent of the variances of BI.

The two insignificant relationships in our study are in contrast to the many studies that have identified both the aroma and the appearance of fresh food products as important purchase decision criteria for in-store food shopping situations (e.g., Gifford and Clydesdale 1986; Hutchings 1994; Imram 1999; Kälviäinen et al. 2003; Lawless 1991). We believe that these insignificant relationships may be due to people's expectations regarding the online retailer's personnel and processes: Perhaps people trust that the online retailer will pre-select the fresh food products, selling only those that both smell good & look good. Indeed, checking an entire box of sourced fruit for obvious appearance flaws is an easily manageable task for employees. Likewise, smelling an entire box of fruit to notice potentially unpleasant aromas can be accomplished efficiently and effectively by employees. In contrast, flavor and texture can only be evaluated at an individual product level. Indeed, a retailer's employee cannot touch every peach or taste every single grape from a cluster that is about to be sent to customers since it would take too much time or—in the case of many food products—would be impossible to do. Hence, customers might trust the quality checks of online retailers when it comes to the appearance and aroma of fresh food products, but not when it comes to their flavor or texture. As a result, customers who evaluate fresh food quality based on the latter two criteria, flavor and texture, may feel a higher degree of uncertainty when ordering fresh foods online than customers who evaluate fresh food quality based on appearance and aroma.

Conclusion

In our study, we examined potential influence factors of online fresh food purchase behavior. We found positive influences of customers' *perceived importance of (a) flavor and (b) texture as an evaluation criterion of fresh foods* on the *perceived product performance risk* in the context of fresh food online shopping. This construct, in turn, negatively influences the *behavioral intention to buy fresh foods online*.

However, we were unable to confirm the influences of customers' *perceived importance of (c) aroma and (d) appearance as an evaluation criterion of fresh foods* on the *behavioral intention to buy fresh foods online*.

These findings have important practical implications. First, our findings suggest that online retailers of fresh food need neither set up any special quality control processes for aroma and appearance, nor come up with any special or futuristic ideas in order to ensure good aroma and appearance (such as providing 360-degree pictures of every specific apple offered or building some kind of aroma-transmitting technologies). However, since both evaluation criteria that require physical contact with the product—that is, flavor and texture—drive the perceived product performance risk in online fresh food product purchases, online retailers have to consider how to mitigate this vulnerability. One idea might be the set-up and communication of clear quality control standards for texture and flavor that every fresh food product must comply with. However, due to the sheer number of sensory attributes such as hardness and sweetness, and the fact that these attributes can vary depending on the kind of food being evaluated, this might prove difficult to accomplish. Rather, we suggest that online retailers should deal with fresh foods the same way they do with other goods sold online: 'If you are not happy with a product, return it [or dispose of it] and get your money back'. Although this might lead to other problems (e.g., misuse by the customer), such assurances could build a trusted relationship with customers—a factor that is known to decrease perceived risk (e.g., Boyer and Hult 2006; Cases 2002; Harridge-March 2006; Hsin Chang and Wen Chen 2008)—and, thus, ensure the sustainable success of fresh foods online businesses.

Still, our study has some limitations. First, we focused only on four potential product performance risk influence factors. Hence, we neglected other factors that might also play an important role in customers' product performance risk perceptions in the context of fresh foods online purchases. Indeed, the R^2 of product performance risk in our study suggests that there are other, potentially stronger, predictors of this than PI.Flavor and PI.Texture. Furthermore, we only recruited English-speaking participants from the US and our sample consisted largely of employed people. As an outcome, results may not apply to people from other countries or to people from other social and cultural clusters. Moreover, our sample included only people aged 21 to 71 years (mean: 39,85, std. dev.: 10.95). Hence, our findings might not hold true for other age clusters. Finally, by using the Amazon Mechanical Turk service, we had to accept the possibility that our participants might have different attitudes to online services than people that do not use this online service.

In order to address these limitations of our study, we plan to extend our research in subsequent studies. First, we would like to roll out our survey to other countries and in particular include teens, young adults, and the elderly in our study sample. Moreover, we plan to use other means to survey our participants than Amazon's Mechanical Turk service, such as including our items into an existent consumer panel. Finally, we plan to further contribute to the field by examining other influencing factors of fresh foods online purchasing behavior, such as health, ethical concerns, and environmental protection aspects, which have become increasingly important in people's food choice behaviors, especially considering that more and more people are gravitating towards organic food (e.g., Lee and Yun 2015; Torjusen et al. 2001; Wirth et al. 2011). As a first step, we plan to do explorative interviews with younger people in order to gather insights into their online fresh food product purchases, as well as to identify further drivers of product performance risk for this younger age range.

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