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Ou Wang, Simon Somogyi,

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Ou Wang
School of Accounting, Finance and Economics, University of Waikato, Hamilton, New Zealand, and
Simon Somogyi
School of Hospitality, Food & Tourism Management, University of Guelph, Guelph, Canada

Abstract

Purpose – The purpose of this paper is to explore the impacts of innovation-adoption characteristics on Chinese consumers' adoption of online food shopping. It also examines consumers' online purchase preferences for specific food categories and the consumer segments shopping for food online in China.
Design/methodology/approach – The data were collected through a web-based survey ($n = 643$, in three cities: Beijing, Guangzhou and Chongqing). Descriptive analysis, cluster analysis, factor analysis and structural equation modeling were employed for data analysis.
Findings – Participants had strong online purchase intentions toward snack and imported food, while they had weak online purchase intentions toward fresh food products such as meat, eggs, vegetables, fish and seafood. Two consumer segments were found: online-food-conservative (42 percent) and online-food-pioneer (58 percent). Factor analysis resulted in an adjusted factorial structure of the innovation-adoption characteristics, which was considered more appropriate within the context of Chinese consumers when shopping for food online. Path analysis found that Chinese consumers' attitudes and/or purchase intentions were positively linked to their perceived incentives and negatively associated with their perceived complexity for online food shopping.
Originality/value – This is the first study to explore consumer segments, consumption psychology (innovation-adoption characteristics) and product preferences related to online food shopping with a sample from China, the largest e-commerce country. The findings can help food producers and marketers to better understand Chinese consumers' online food shopping behaviors in order to meet the needs of consumers and have further success in this major market.

Keywords Structural equation modelling, Segmentation, Chinese consumer, Innovation-adoption characteristics, Online food shopping

Paper type Research paper

Introduction

Due to rapid developments in e-commerce, online food shopping has conquered many obstacles identified by researchers a decade ago such as long web loading time, transaction problems, payment security and receiving low-quality food products (Amir and Rizvi, 2017; Hansen, 2005). Today, it has been adopted by more and more consumers as a part of their daily lives (Amir and Rizvi, 2017; Hansen, 2005). This is particularly the case in China – the world's largest online retail market which delivered 40 percent of the world's e-commerce packages in 2016 (Harkell, 2017; Tong, 2017; Xu and Zhao, 2016; Yuan, 2017). China is experiencing a dramatic growth in the online food retail market due to a huge population base, low delivery cost, weak offline retail market and major investments to improve the online retail environment by Chinese e-commerce giants such as Alibaba and JD (Amir and Rizvi, 2017; Harkell, 2017; Tong, 2017; Xu and Zhao, 2016; Yuan, 2017). Approximately, 20 percent of fresh food and soft drinks were purchased online in China in 2015 (Xu and Zhao, 2016). There was also a growth rate of 86 percent for online fresh food shopping in China between 2015 and 2016 (Yuan, 2017).

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The rise of China's online food retail market has created an innovative and more effective channel for global food producers and marketers to reach Chinese consumers. As an example, approximately 60 percent of Chinese participants reported their purchase of imported food products through online retail channels in a recent marketing survey by Verot (2016). As a result, global producers, policy makers and marketers have started to collaborate with Chinese e-commerce giants to promote their local food products in China (Jensen, 2017; Zhang, 2017). A need exists for these stakeholders to better understand Chinese consumers' online food shopping behaviors in order to meet the needs of consumers and have further success in this major market.

Online shopping behavior has been widely studied by global researchers (e.g. Häubl and Trifts, 2000; Miyazaki and Fernandez, 2001; Zhou *et al.*, 2007). A number of attempts have also been made to capture knowledge regarding consumer behavior in online shopping for food. Hansen (2005) developed a theoretical model for online food shopping adoption, in which consumers' adoption of online food shopping was influenced by five innovation-adoption characteristics: perceived social norm, perceived complexity, perceived compatibility, perceived relative advantage and perceived risk. Many empirical studies have included some of these factors by exploring their influences on consumers' attitudes, purchase intentions or consumptions for shopping food online (Anesbury *et al.*, 2016; Hansen *et al.*, 2004; Hansen, 2008; Kang *et al.*, 2016; Kaur and Shukla, 2016; Morganosky and Cude, 2000; Mortimer *et al.*, 2016; Ramus and Asger Nielsen, 2005; Sreeram *et al.*, 2017; Yeo *et al.*, 2017). Furthermore, previous studies have also shown that having prior experience in online food purchase, product attributes and socio-demographics has significant influences on online food shopping consumer behavior (Chintagunta *et al.*, 2012; Chu *et al.*, 2010; Degeratu *et al.*, 2000; Kang *et al.*, 2016; Kaur and Shukla, 2016; Hansen, 2005, 2008; Morganosky and Cude, 2000; Mortimer *et al.*, 2016; Ramus and Asger Nielsen, 2005). In addition, some researchers recognized the differences and similarities in choice behaviors and influencing factors of online food shopping between different consumer segments, e.g. between non-frequent and frequent online (food) buyers and between offline and online (food) buyers (Chu *et al.*, 2010; Hansen, 2005, 2008; Morganosky and Cude, 2000; Mortimer *et al.*, 2016).

However, there is still a lack of understanding on consumer behavior in online food shopping in the world's largest e-commerce market – China which has different food consumption patterns and cultures from western countries (Wang *et al.*, 2016; Wang and Somogyi, 2018). Only a recent study contributed knowledge about the effects of socio-demographics and consumption experiences on Chinese consumers' willingness to pay online for fresh fruit and vegetables within a portfolio of produce (Jin *et al.*, 2017). To our knowledge, no study can be found related to the influences of the innovation-adoption characteristics, product preferences and consumer segments on the adoption of online food shopping in China.

Therefore, this study aims at contributing knowledge to the lack of understanding area in Chinese consumers' online food shopping behavior. The objective of this paper is threefold: recognize the impacts of innovation-adoption characteristics on Chinese consumers' online food shopping behavior; identify consumer segments for online food shopping in China; and recognize Chinese consumers' preferences for specific food categories when shopping online.

Theoretical background and conceptual model

A conceptual model is proposed in Figure 1. This section will discuss the theoretical background underpinning it.

As mentioned in the Introduction, Hansen (2005) developed the five innovation-adoption characteristics that influence consumers' adoption of online food shopping. Perceived social norm refers to the perceived opinions of other people (e.g. friends and family members) on a person's adoption of online food shopping, and it is positively linked to the attitudes, purchase intentions or consumptions for online food shopping (Hansen *et al.*, 2004; Hansen, 2005, 2008).

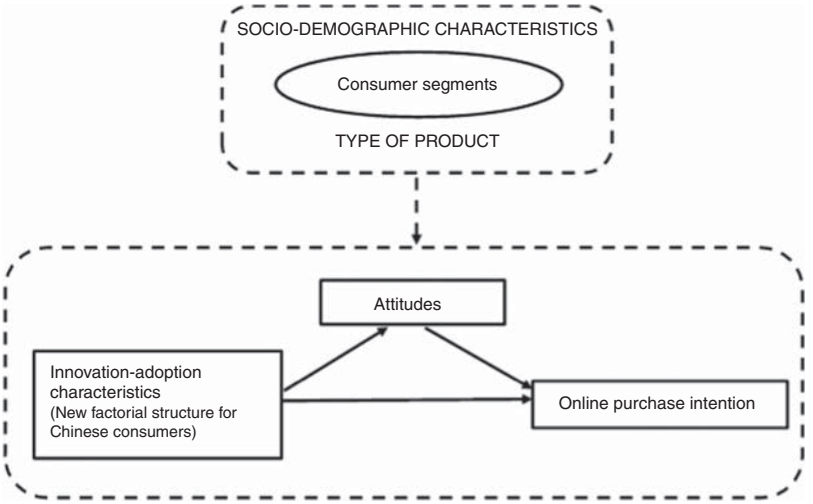

Figure 1.
Conceptual model of this study

Perceived compatibility represents the perceived degree that online food shopping fits with a person's current and past lifestyles and values, and it has a positive relationship with the attitudes, purchase intentions or consumptions for online food shopping (Hansen *et al.*, 2004; Hansen, 2005, 2008). Perceived relative advantage is the perceived degree of the superiority of online food shopping compared to existing offline food shopping (Hansen, 2005). Previous studies indicated that consumers perceive two main advantages of online food shopping compared to traditional offline shopping: purchase convenience (e.g. time saving) and price advantage (e.g. money saving), which positively influence consumers' attitudes, purchase intentions or consumptions for online food shopping (Anesbury *et al.*, 2016; Chu *et al.*, 2010; Hansen, 2005; Morganosky and Cude, 2000; Raijas, 2002; Ramus and Asger Nielsen, 2005; Yeo *et al.*, 2017). Perceived complexity is the degree of the usage complexity of online food shopping perceived by consumers, and it is negatively linked to the attitudes, purchase intentions or consumptions for online food shopping (Hansen *et al.*, 2004; Hansen, 2005, 2008; Sreeram *et al.*, 2017; Yeo *et al.*, 2017). Perceived risk represents consumer perceptions about the possible loss and harm related to online food shopping (e.g. payment security, exchange problems and receiving low-quality food products), and it is negatively linked to the attitudes, purchase intentions or consumptions for online food shopping (Hansen, 2005; Mortimer *et al.*, 2016; Ramus and Asger Nielsen, 2005).

However, no confirmatory study can be found to test this original five-factorial structure[1] with consumers, and this is especially true in regard to a consumer sample in the world's largest e-commerce market – China. Furthermore, previous studies have indicated that the factorial structure of consumers' food choice motives varies across populations with different cultural settings (e.g. between western countries and China) (Wang, De Steur, Gellynck and Verbeke, 2015). In this perspective, the factorial structure of consumers' online food shopping motivations (the innovation-adoption characteristics) might also not fit with a Chinese sample of consumers, because it was initially developed based on a sample from the USA – a typical western country that differs greatly from China in dietary consumption behaviors (Chang *et al.*, 2010; Sun and Collins, 2004; Wan, 1995; Wang *et al.*, 2016, 2017; Zhang *et al.*, 2009). Therefore, in the conceptual model, the innovation-adoption characteristics are assumed to have a new or more suitable factorial structure for the Chinese sample in this study.

Previous researchers have pointed out that consumers' beliefs, perceptions and motivations had direct influences on consumers' attitudes, purchase intentions and

consumption, and indirect influences on their purchase intentions and consumption through the attitudes toward a product or service (Chiou, 1998; Pieniak *et al.*, 2009; Steenkamp, 1997; Vanhonacker *et al.*, 2010; Wang, De Steur, Gellynck and Verbeke, 2015; Wang and Somogyi, 2018). The five innovation-adoption characteristics are consumer perceptions toward social norm, compatibility, relative advantage, complexity and risk of online food shopping (Hansen *et al.*, 2004; Hansen, 2005, 2008). They have been found to have direct and/or indirect influences on consumers' purchase intentions and attitudes when shopping for food online (Anesbury *et al.*, 2016; Chu *et al.*, 2010; Hansen *et al.*, 2004; Hansen, 2005, 2008; Morganosky and Cude, 2000; Mortimer *et al.*, 2016; Raijas, 2002; Ramus and Asger Nielsen, 2005; Sreeram *et al.*, 2017; Yeo *et al.*, 2017). Therefore, in the conceptual model, Chinese consumers' innovation-adoption characteristics are assumed to have direct impacts on their online purchase intentions for food as well as indirect influences on the online purchase intentions through their attitudes toward online food shopping.

Segmentation analysis is widely conducted in marketing and consumer studies to recognize different consumer segments based on their perceptions, attitudes and behaviors toward food and non-food categories (Morton *et al.*, 2017; Pieniak *et al.*, 2010; Wang *et al.*, 2018). Previous studies have showed that the influences of certain factors (e.g. innovation-adoption characteristics and socio-demographics) on the adoption of online food shopping varied across different consumer segments, e.g., consumers with higher income were more willing to pay extra money for the "organic" and "green" attributes of fresh produce portfolios than their counterparts with lower income in an e-commerce environment (Jin *et al.*, 2017). Furthermore, Kang *et al.* (2016) indicated that different consumer segments varied in online shopping preferences toward specific food categories, e.g., consumers who attached less importance to health and taste and more importance to money saving were more likely to adopt online vegetable shopping, while consumers who attached more importance to freshness were more likely to adopt online grain shopping. Thus, in the conceptual model, the impacts of the innovation-adoption characteristics on Chinese consumers' adoption of online food shopping are assumed to vary depending on consumer segments with different online purchase preferences for specific food categories.

Methods and materials

Participants and procedures

Quantitative data were collected during December 2016 through an online survey. A Chinese research agency was employed for the fieldwork data collection. Three cities (Beijing, Guangzhou and Chongqing) were chosen for the data collection in order to understand the similarities and differences of consumers' online food shopping behaviors between first-tier cities (e.g. Beijing and Guangzhou) and second-tier cities (e.g. Chongqing). First-tier cities are more developed in their economies, education sectors and other social interaction than other cities in China (Liu *et al.*, 2011; Wang and Somogyi, 2018; Wang *et al.*, 2017).

A web-based questionnaire was sent to registered members of an online consumer panel recruited and maintained by the research agency. It was distributed with a quota sampling method by using gender, age, cities and education as dimensions for quota stratification (Wang *et al.*, 2017; Wang and Somogyi, 2018). Participants were shown survey questions in a random order to increase the validity of the study.

A total of 643 valid responses were gained – 214 from Beijing, 221 from Guangzhou and 208 from Chongqing (for socio-demographics of the sample, please refer to Table III). All valid participants received a monetary incentive from the research agency. Cross-tabulations with χ^2 tests revealed that the three city subsamples did not differ in the distribution of gender, age, marital status, income, education, occupation and household size[2].

Measures

Participants' innovation-adoption characteristics were measured by 16 items within a factorial structure of five dimensions, shown in Table I. They were developed from the original measurement design and questions of the innovation-adoption characteristics for online food shopping used by Hansen (2005). A seven-point Likert agreement scale was used as response categories for the 16 measurement questions: 1 = disagree strongly, 2 = disagree moderately, 3 = disagree slightly, 4 = neither agree nor disagree, 5 = agree slightly, 6 = agree moderately and 7 = agree strongly (Wang, De Steur, Gellynck and Verbeke, 2015).

Participants' attitudes about online food shopping were measured by two seven-point semantic differential scales using bipolar adjectives: unhappy/happy (variable code: A1) and dull/excited (variable code: A2). This approach has been widely used to assess consumers' general attitudes toward food products (e.g. Pieniak *et al.*, 2009; Wang, De Steur, Gellynck and Verbeke, 2015; Wang and Somogyi, 2018).

Participants' online purchase intentions toward food (as a general concept) were measured by two items with the same response categories as in the measurement part of innovation-adoption characteristics: "I expect to purchase food/beverage from online shops" (variable code: PI1) and "I am willing to buy food/beverage online" (variable code: PI2). These two measurement items were derived from previous studies that examined consumers' purchase intentions when (food) shopping online (McElroy *et al.*, 2007; Mortimer *et al.*, 2016).

Participants' online purchase intentions toward 17 food categories were measured by a single item: "I expect to purchase [food category]," with the same design as in the measurement part of their online purchase intentions toward food as a general concept. It included food categories that had high recent growth rates in the Chinese online retail: meat (e.g. pork, beef, mutton and chicken), dairy products, vegetables, eggs, fruit, soft drinks, alcoholic drinks, snacks, imported food/drink, upscale food/drink, upscale shellfish (e.g. lobster and king crab), normal shellfish (e.g. mussels and shrimp) and seafood (non-shellfish, e.g. sea cucumber) (Blake, 2016; Harkell, 2017; Jenkins, 2016; Tong, 2017; Verot, 2016;

Table I.
Measurement items of the innovation-adoption characteristics when shopping online

Code	Factor and measurement item
PSN	Perceived social norm
PSN1	Members of my family think that it is a good idea to buy food/beverage online
PSN2	Most of my friends and acquaintances think that shopping food/beverage online is a good idea
PCL	Perceived complexity
PCL1	Online shopping of food/beverage is complex because I cannot really see and feel the products
PCL2	Online shopping of food/beverage is in general very complex
PCL3	With online shopping of food/beverage it is difficult to order products
PCT	Perceived compatibility
PCT1	Online shopping of food/beverage is attractive to me in my daily life
PCT2	Buying food/beverage online is well suited to the way in which I normally shop groceries
PCT3	In general, online shopping of food/beverage is problem free
PCT4	Buying food/beverage online is beneficial to me
PRA	Perceived relative advantage
PRA1	Using online shopping of food/beverage saves much time
PRA2	Shopping food/beverage online is favorable as it makes me less dependent on shop opening hours
PRA3	There is a lot of money to be saved through online food/beverage shopping
PR	Perceived risk
PR1	Return and exchange opportunities are not as good on the internet as in the supermarket/offline shop
PR2	A risk when buying groceries via the internet is receiving low-quality products or incorrect items
PR3	Security around payment on the internet is not good enough
PR4	There are too many untrustworthy shops on the internet

Wells, 2016; Xu and Zhao, 2016) and other food categories that were commonly consumed by Chinese consumers: fish, staple foods (e.g. rice, noodles and bread), domestic food/drink and normal food/drink.

Data analysis

The statistical software tools SPSS 24 and AMOS 24 were employed for performing all analyses in this study. The procedure of data analysis is shown in Figure 2. First, descriptive analyses (with mean values) were conducted for Chinese consumers' online purchase intentions for all of the 17 food categories. Second, cluster analysis was conducted using the online purchase intentions of the 17 specific food categories as segmentation variables, with a two-step approach: hierarchical clustering with Ward's method and squared Euclidean distance was first performed, followed by a K-means cluster analysis with the initial cluster centers from the first step (Wang, Gellynck and Verbeke, 2015; Wang *et al.*, 2018). Cross-tabulations with χ^2 tests were conducted to understand the significant differences across the consumer segments based on socio-demographics. Third, confirmatory factor analysis (CFA) was used to examine whether the original factorial structure of innovation-adoption characteristics for online food shopping (Hansen, 2005) had a good fit with the Chinese sample in this study (Jones *et al.*, 2002). Fourth, due to the fact that the factorial structure did not fit well with the sample, an exploratory factor analysis (EFA, a maximum likelihood estimation method with varimax rotation) was used to explore the appropriateness of the factorial structure of innovation-adoption characteristics for online food shopping for the Chinese sample (Jones *et al.*, 2002). Fifth, structural equation modeling was conducted to assess the association between the innovation-adoption characteristics (with the new factorial structure) and the attitudes and purchase intentions for online shopping for food (as a general conception) by Chinese consumers (Pieniak *et al.*, 2009; Trainor *et al.*, 2014; Urueña and Hidalgo, 2016). Path analysis for the total sample and

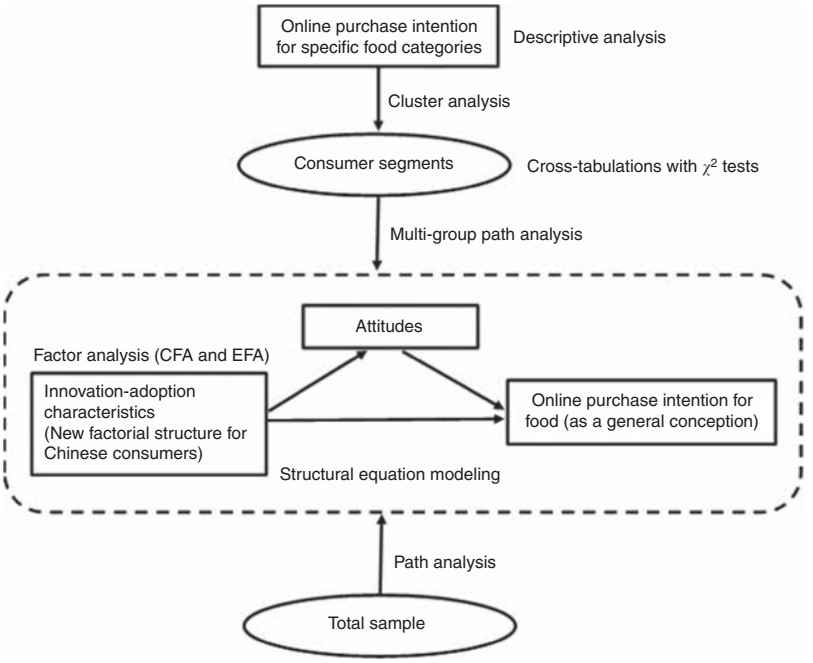

Figure 2. Procedure of data analysis

multi-group path analysis for the subsamples of consumer segments (based on the purchase intentions for the 17 specific food categories) were used to identify significant relationships among the innovation-adoption characteristics, attitudes and purchase intentions (Pieniak *et al.*, 2009; Trainor *et al.*, 2014; Urueña and Hidalgo, 2016).

Results

Online purchase intentions for specific food categories

As shown in Figure 3, the mean values of variables of the online purchase intentions for the 17 specific food categories ranged from 4.20 to 5.77. The highest mean values were found for snacks and imported foods (≥5.5), while the lowest mean values were recognized for eggs, vegetables, fish and meat (≤4.5). Therefore, Chinese participants were more willing to purchase snacks and imported food online than other food categories. By contrast, they were less willing to purchase eggs, vegetables, fish and meat online in comparison with other food categories.

Consumer segments

Participants were clustered based on their online purchase intentions toward the 17 specific food categories (as segmentation variables). A two-segment solution was gained. Table II indicates the mean values and the size per segmentation variable for the total sample. Segment 1 accounted for 42 percent of the total sample. Consumers in this segment had weak online purchase intentions toward all the 17 food categories in comparison with their counterparts in Segment 2, as the mean values of all segmentation variables were much lower than those for Segment 2. In particular, the mean values of eight segmentation variables were located on the negative anchor of response categories (below 4): meat, vegetables, fish, eggs, alcoholic drinks, upscale shellfish, normal shellfish and seafood (non-shellfish). While Segment 2 accounted for 58 percent of the total sample, participants in this segment had strong online purchase intentions toward all of the 17 food categories, as the mean values of all the variables exceeded 5.0. As such, Segment 1 was labeled as "online-food-conservative" and Segment 2 was named as "online-food-pioneer."

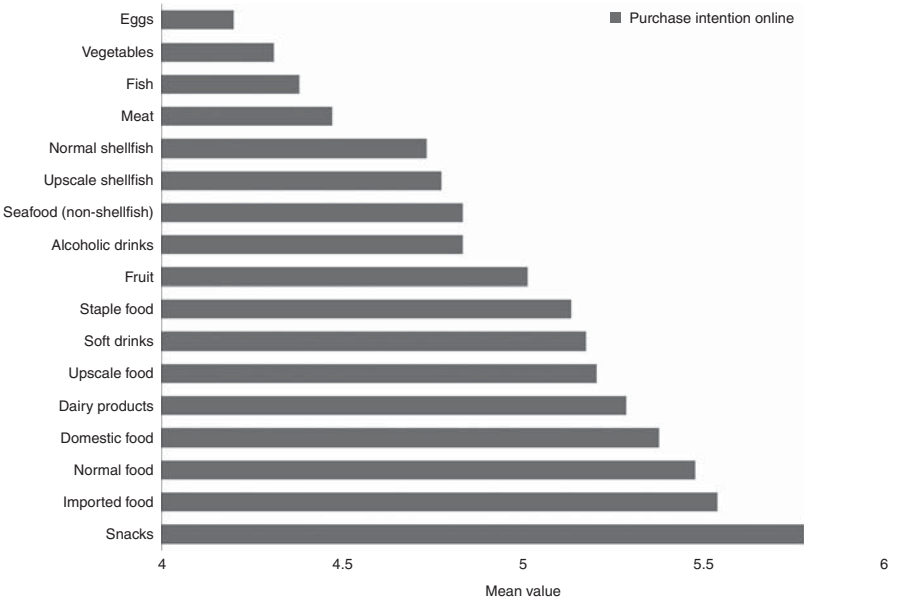

Figure 3.
Mean values of online purchase intentions toward the seven specific food categories

Food category	Segment 1 Online-food-conservative Mean	SD	Segment 2 Online-food-pioneer Mean	SD	F	p-value
Meat	3.26	1.17	5.36	1.12	531.330	0.000
Dairy product	4.43	1.36	5.91	0.86	281.378	0.000
Vegetable	3.27	1.20	5.08	1.27	333.342	0.000
Fish	3.23	1.16	5.21	1.11	481.474	0.000
Egg	3.10	1.26	5.01	1.32	338.818	0.000
Fruit	4.03	1.30	5.73	1.01	344.920	0.000
Staple food	4.15	1.39	5.85	0.96	335.690	0.000
Soft drink	4.26	1.29	5.84	0.90	334.577	0.000
Alcoholic drink	3.89	1.29	5.52	1.10	297.085	0.000
Snack	5.11	1.33	6.24	0.75	191.088	0.000
Imported food/drink	4.74	1.32	6.1	0.79	267.987	0.000
Domestic food/drink	4.57	1.25	5.95	0.82	287.208	0.000
Upscale food/drink	4.26	1.33	5.88	0.84	358.241	0.000
Normal food/drink	4.73	1.34	6.01	0.84	220.335	0.000
Upscale shellfish	3.55	1.26	5.65	0.98	562.599	0.000
Normal shellfish	3.64	1.21	5.52	1.00	464.273	0.000
Seafood (non-shellfish)	3.71	1.21	5.64	0.96	505.392	0.000
Segment size	271		372			
Share of the total sample ($n = 643$) (%)	42		58			

Table II.
Sizes, mean scores and SD scores of consumer segments based on their online purchase intentions toward the 17 specific food categories

Cross-tabulations with χ^2 tests revealed significant differences between the two segments for some socio-demographic variables, including income, marital status, occupation and age (Table III). The "online-food-pioneer" segment had a higher percentage of participants who had a medium or high income (RMB 5,001–10,000 or ⩾RMB 10,001 monthly), were married, had a high-level position (e.g. managing employee) or a self-employed position, and were aged 31–40 years. The "online-food-conservative" segment had a higher percentage of participants who had a low income (RMB 0–5,000 monthly), were unmarried (with a partner or single), had a medium- or low-level position (e.g. salaried employee or student), and were younger than 30 or older than 40 years. While no significant differences could be found for city distributions (Beijing, Guangzhou and Chongqing) between the two segments.

Confirmatory factor analysis (CFA)

Table IV indicates the results of the CFA for the original factorial structure of innovation-adoption characteristics for online food shopping (Hansen, 2005). The standardized factor loadings of the 16 items ranged between 0.558 and 0.903. The values of goodness-of-fit indices were within the acceptable limits: above 0.9 for CFI and below 0.08 for RMSEA (Trainor *et al.*, 2014). However, the correlation coefficients across three factors (perceived social norm, perceived compatibility and perceived relative advantage) were above 0.85. This indicated severe multicollinearity among these three factors based on the data (Pieniak *et al.*, 2009). Meanwhile the AVE scores of these three factors were lower than one or more squared correlation coefficients with other factors. The discriminant validity was therefore not established on the original factorial structure of innovation-adoption characteristics (Voorhees *et al.*, 2016). As a consequence, the original factorial structure with five innovation-adoption characteristics was not suitable for the present data in China.

Exploratory factor analysis (EFA)

Table V shows the results of the EFA that attempts to explore an adjusted factorial structure of the 16 measurement items of innovation-adoption characteristics for the total

	Segment 1 Online-food-conservative ($n = 271$) (%)	Segment 2 Online-food-pioneer ($n = 372$) (%)	Total sample ($n = 643$) (%)
City			
Beijing	30.6	35.2	33.3
Guangzhou	34.3	34.4	34.4
Chongqing	35.1	30.4	32.3
Gender			
Male	48.3	51.1	49.9
Female	51.7	48.9	50.1
*Income (RMB)****			
0–5,000	52.4	31.7	40.4
5,001–10,000	36.5	44.1	40.9
⩾10,001	11.1	24.2	18.7
*Marital status**			
Single	19.9	12.4	15.6
No, but has a partner	13.3	12.6	12.9
Married	66.8	75.0	71.5
Educational level			
Junior college and below	48.7	43.8	45.9
University and above	51.3	56.2	54.1
*Occupation****			
Managing employee	23.6	39.2	32.7
Salaried employee	50.2	35.8	41.8
Student	9.2	5.4	7.0
Worker	10.0	9.1	9.5
Self-employed	2.6	7.5	5.4
Others	4.4	3.0	3.6
*Age**			
18–30	40.2	34.1	36.7
31–40	26.6	37.6	33.0
⩾41	33.2	28.2	30.3
Household size			
1–2	11.8	13.4	12.8
3	50.2	55.9	53.5
4	18.8	16.1	17.6
⩾5	19.2	14.5	16.5

Notes: *$p < 0.05$; ***$p < 0.001$

Table III. Socio-demographics of the two consumer segments

sample. A factorial structure with three factors was recognized. Two items, PCL1 and PR3 (for variable codes, refer to Table I), were deleted due to a low factor loading (< 0.40) or a high cross-loading (> 0.35) (Jones *et al.*, 2002). The discriminant validity of the adjusted factorial structure was confirmed by the high Cronbach's α scores (above 0.70) and the low correlation coefficients (below 0.5) for all of the three factors (Reichert *et al.*, 2016).

Three factors – perceived social norm, perceived compatibility and perceived relative advantage – in the old factorial structure loaded on a new factor in the adjusted factorial structure. The three factors had proved to have positive influences on consumers' adoption of online food shopping in previous studies (Anesbury *et al.*, 2016; Chu *et al.*, 2010; Hansen, 2005, 2008; Hansen *et al.*, 2004; Morganosky and Cude, 2000; Yeo *et al.*, 2017; Raijas, 2002;

Factor and item	Standardized factor loading	Composite reliability	Average variance extracted (AVE)		
Perceived social norm		0.88	0.79		
PSN1	0.903				
PSN2	0.876				
Perceived complexity		0.89	0.73		
PCL1	0.687				
PCL2	0.951				
PCL3	0.906				
Perceived compatibility		0.86	0.60		
PCT1	0.815				
PCT2	0.821				
PCT3	0.679				
PCT4	0.784				
Perceived relative advantage		0.79	0.55		
PRA1	0.657				
PRA2	0.798				
PRA3	0.764				
Perceived risk		0.75	0.43		
PR1	0.676				
PR2	0.544				
PR3	0.808				
PR4	0.558				
Correlation matrix		Correlation coefficient			
Factor	1	2	3	4	5
1. Perceived social norm	1				
2. Perceived complexity	−0.142**	1			
3. Perceived compatibility	0.891***	−0.140**	1		
4. Perceived relative advantage	0.876***	−0.188***	0.961***	1	
5. Perceived risk	−0.151**	0.540***	−0.134**	−0.092	1

Notes: PSN1 and PSN2, PCL1–PCL3, PCT1–PCT4, PRA1–PRA3 and PR1–PR4: the codes of measurement items of innovation-adoption characteristics when shopping food online (see Table I). Goodness-of-fit indices: RMSEA = 0.061, CFI = 0.961, $\chi^2 = 319.211$, df = 94, $p < 0.001$. Factor loading: the larger the number is, the stronger the relationship of each variable to the latent factor is, and vice versa (Byrne, 2001); composite reliability: the larger the number is, the higher the reliability of each factor composite is, and the vice versa (Byrne, 2001); average variance extracted: the larger the number is, the more a measure of the amount of variance captured by a latent factor related to the amount of variance due to measurement error is , and vice versa (Fornell and Larcker, 1981); correlation coefficient: the larger the absolute value of the number is, the stronger a linear relationship between two latent-factor-variables is, and vice versa (Byrne, 2001). **$p < 0.01$; ***$p < 0.001$

Table IV.
Results of the CFA and the correlation matrix based on the original factorial structure of innovation-adoption characteristics when shopping food online

Ramus and Asger Nielsen, 2005). As such, the new factor reflected the incentives that drove consumers to adopt online food shopping (e.g. perceived social norm, compatibility and relative advantages). In that perspective, the new factor was named perceived incentive.

Structural equation modeling

A structural equation model (SEM) was built to recognize the association between Chinese consumers' innovation-adoption characteristics (based on the adjusted factorial structure) and their attitudes and purchase intentions when shopping for food (as a general concept) online, with 5 latent variables and 18 observed variables. The observed variables regarding the attitudes and purchase intentions had good internal reliabilities due to the high Cronbach's α scores: 0.91 for the attitudes and 0.93 for the online purchase intentions.

Factor and item	Standardized factor loading	Cronbach's α	Percent explained variance
Perceived incentive		0.926	37.938
PSN1	0.840		
PSN2	0.819		
PCT1	0.803		
PCT2	0.805		
PCT3	0.671		
PCT4	0.769		
PRA1	0.728		
PRA2	0.781		
PRA3	0.646		
Perceived complexity		0.927	12.002
PCL2	0.897		
PCL3	0.882		
Perceived risk		0.720	11.280
PR1	0.540		
PR2	0.796		
PR4	0.681		
Correlation matrix		Correlation coefficient	
Factor	1	2	3
1. Perceived incentive	1		
2. Perceived complexity	−0.147***	1	
3. Perceived risk	−0.146**	0.464***	1

Table V.
Results of the EFA and the correlation matrix resulted in the adjusted factorial structure of innovation-adoption characteristics when shopping food online

Notes: PSN1 and PSN2, PCL1–PCL3, PCT1–PCT4, PRA1–PRA3, and PR1–PR4: the codes of measurement items of innovation-adoption characteristics when shopping food online (see Table I). Factor loading: the larger the number is, the stronger the relationship of each variable to the latent factor is, and vice versa (Byrne, 2001); Cronbach's α: the larger the number is, the higher the internal consistency of each factor composite is, and vice versa (Streiner, 2003); percent explained variance: the larger the number is, the more a measure of the amount of summative variance captured by a latent factor is, and vice versa (Thompson, 2004); correlation coefficient: the larger the absolute value of the number is, the stronger a linear relationship between two latent-factor-variables is, and vice versa (Byrne, 2001). $^{**}p < 0.01$; $^{***}p < 0.001$

Path analysis was conducted for the total sample. The SEM performed well due to the fact that the values of goodness-of-fit indices were within acceptance limits: below 0.08 for RMSEA and above 0.9 for CFI (Trainor *et al.*, 2014). Furthermore, multi-group path analysis was conducted for the subsamples of the two consumer segments (based on their purchase intentions for the 17 specific food categories) by using the SEM. The RMSEA and CFI values showed an acceptable fit for all restricted models: the RMSEA values from 0.046 to 0.055 and the CFI values from 0.910 to 0.946. This indicates the sufficiency of pooling the data of the two subsamples based on the SEM (Pieniak *et al.*, 2009; Wang, De Steur, Gellynck and Verbeke, 2015).

As shown in Table VI, consumers' attitudes for online food shopping had a significantly positive relationship with their online purchase intentions for food in both the total sample and the two subsamples. This indicated that the innovation-adoption characteristics that had a direct impact on the attitude also had an indirect impact on the purchase intention through the attitude.

Two innovation-adoption characteristics, perceived incentive and perceived complexity, were found to have significant relationships with the attitude and/or the purchase intention for the total samples and/or the two subsamples. However, perceived risk had no significant relationship with the attitude and the purchase intention for either the total sample or the two subsamples.

Regarding the total sample, perceived incentive was positively linked to the attitude and the purchase intention, while perceived complexity was negatively linked to the purchase intention. In other words, those Chinese consumers who perceived more incentives for online

food shopping would have positive attitudes and a strong intention for food shopping online. By contrast, those Chinese consumers who considered online food shopping as having a relatively high complexity would have a weak online purchase intention for food.

According to the two subsamples, similar with that for the total sample, the perceived incentive was positively linked to the attitude and the online purchase intention. However, there was a difference between the relationship of the perceived complexity and the purchase intention between the two subsamples. The perceived complexity was found to have a negative relationship with the purchase intention for the "online-food-conservative" segment. Such a significant relationship was not found in the subsample of the "online-food-pioneer" segment.

Discussion and conclusion

To our knowledge, this is the first study to explore consumer segments, innovation-adoption characteristics and product preferences related to online food shopping with a sample from China. The study has major importance as China is the largest country in the world for e-commerce and has different dietary cultures and customs from western countries. The original five-factorial structure of innovation-adoption characteristics for online food shopping was initially developed through a study that used a sample from a western setting a decade ago (Hansen *et al.*, 2004; Hansen, 2005, 2008). Through a CFA, we confirm that the original five-factorial structure does not fit with the data in current day China. With an EFA, we obtained an adjusted and more suitable factorial structure for the Chinese sample, with three factors: perceived incentive, perceived complexity and perceived risk.

Regarding the three factors of innovation-adoption characteristics for online food shopping, perceived incentive has both directly and indirectly positive effects on the online food purchase intention in both the total sample and the two subsamples of consumer segments. This new factor includes measurement items from three factors in the old factorial structure developed by Hansen (2005): perceived social norm, perceived compatibility and perceived relative advantage. This is in line with the reality in today's China, where consumers consider online food shopping as a normal part of daily life for themselves and their friends and families (Harkell, 2017; Tong, 2017; Verot, 2016; Xu and Zhao, 2016; Yuan, 2017). To these consumers this practice offers great advantages (e.g. savings of time and money), therefore they may not be able to clearly and psychologically differentiate between those three normal and positive factors related to online food shopping. Furthermore, the positive relationship between perceived incentive and the online food purchase intention corresponds with the positive effects of the three

Factor	Path	Factor	Total sample	Online-food-conservative	Online-food-pioneer
Perceived incentive	→	Attitude	0.738***	0.644***	0.623***
Perceived complexity	→	Attitude	ns	ns	ns
Perceived risk	→	Attitude	ns	ns	ns
Perceived incentive	→	Purchase intention	0.575***	0.590***	0.460***
Perceived complexity	→	Purchase intention	−0.074**	−0.084*	ns
Perceived risk	→	Purchase intention	ns	ns	ns
Attitude	→	Purchase intention	0.365***	0.363***	0.371***

Notes: Goodness-of-fit indices for the path analysis of total sample: RMSEA = 0.058, CFI = 0.967, $\chi^2 = 393.849$, df = 125, $p < 0.001$; goodness-of-fit indices for the multi-group path analysis of subsamples of the two consumer segments (unconstrained model): RMSEA = 0.046, CFI = 0.946, $\chi^2 = 589.913$, df = 250, $p < 0.001$. Regression weight: the larger the absolute value of the number is, the stronger a linear relationship between the independent and dependent variables is, and vice versa (Byrne, 2001). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table VI. Results of the path analysis for the total sample and the multi-group path analysis for the subsamples of the two consumer segments (see Tables II and III): standardized regression weights

original factors on online food shopping behavior found by previous studies such as Anesbury *et al.*, 2016; Chu *et al.*, 2010; Hansen, 2005, 2008; Hansen *et al.*, 2004; Morganosky and Cude, 2000; Raijas, 2002; Ramus and Asger Nielsen, 2005; Yeo *et al.*, 2017.

Perceived complexity has a directly negative effect on the online food purchase intention in the total sample and the subsample of the online-food-conservative segment. This is in line with previous findings that perceived complexity (e.g. the ease of use) is a major barrier to the adoption of online food shopping among consumers (Hansen, 2005, 2008; Hansen *et al.*, 2004; Sreeram *et al.*, 2017; Yeo *et al.*, 2017). In this case, global food producers, marketers and policy makers should continually improve their online retail or promotional platforms in order to meet Chinese consumers' expectations related to the ease of use for online food shopping.

Some recent studies indicate the significantly negative influence of perceived risk on consumers' adoption of online food shopping (Kaur and Shukla, 2016; Mortimer *et al.*, 2016) However, this study reveals that perceived risk is not a statistically significant influencing factor for the adoption of online food shopping among Chinese consumers. This may be a reflection of the fact that China, as the world's largest e-commerce market, has a more efficient and safe e-commerce environment than other regions of the world for the transaction and delivery of food products (Amir and Rizvi, 2017; Harkell, 2017; Tong, 2017; Xu and Zhao, 2016; Yuan, 2017). Thus, perceived risks (e.g. payment and receiving low-quality products) would be a less relevant factor for Chinese online food shoppers.

The study is the first to contribute a comprehensive understanding of Chinese consumers' online purchase preferences for specific food categories. Although China has recently seen a dramatic growth in online shopping for fresh food (Amir and Rizvi, 2017; Harkell, 2017; Xu and Zhao, 2016; Yuan, 2017), the findings in our study indicate that Chinese consumers are less willing to make online purchases of fresh food (e.g. eggs, vegetables, fish, meat, shellfish and seafood). This is in line with the findings from recent studies that online purchase is still not Chinese consumers' favorite channel to purchase some fresh food categories such as aquatic products (Fabinyi *et al.*, 2016; Wang and Somogyi, 2018). In contrast, Chinese consumers have a strong willingness to purchase snacks and imported foods when shopping online. This corresponds with findings by Chintagunta *et al.* (2012) that consumers are more likely to purchase bulky or packed items when shopping online (e.g. snack items). It is also in line with the findings from a marketing survey by Verot (2016) that most Chinese participants have had online purchase experiences with imported food. Therefore, it is strongly recommended that global food producers, marketers and policy makers use e-commerce channels to sell and promote imported bulky or packed items in China. However, regarding fresh food products, global producers, marketers and policy makers should put more attention on traditional offline retail channels (e.g. supermarkets, vegetable markets, restaurants and seafood markets) than online retail channels in China.

This study is also the first to recognize consumer segments related to online food shopping by using a strict statistical analysis approach: cluster analysis. Based on the online purchase intentions for specific food categories among Chinese consumers, two segments were obtained: online-food-conservatives and online-food-pioneers. These two consumer segments are significantly different in their online purchase preferences of specific food categories, socio-demographics (e.g. income, marital status, occupation and age) and the influences of some innovation-adoption characteristics on the adoption of online food shopping (e.g. perceived complexity). This is in line with previous findings that different consumer segments vary in the socio-demographics, adoption of online food shopping and online shopping preferences toward specific food categories (Chu *et al.*, 2010; Hansen, 2005, 2008; Jin *et al.*, 2017; Morganosky and Cude, 2000; Mortimer *et al.*, 2016). In general, consumers in the online-food-pioneer segment (who are more likely to have a medium or high income, be married, have a high-level job position or be self-employed, and/or be 31–40 years of age) have strong online purchase intentions for all food categories. Therefore, global food producers, marketers and

policy makers should attempt to sell or promote all their food categories to consumers in the online-food-pioneer segment through e-commerce retail channels. On the other hand, those consumers in the online-food-conservative segment (who are more likely to have a lower income, be unmarried, have a medium- or low-level job position, and/or be younger than 30 or older than 40) have weak online food purchase intentions. As such, global food producers, marketers and policy makers should only sell or promote food categories which are more likely to be accepted by this consumer segment through e-commerce retail channels, such as snacks. In addition, perceived complexity negatively influences the online-food-conservative consumers' online purchase intentions for food products. This may be caused by their low level of experience with online food shopping, and they are therefore unfamiliar with its transaction process and platforms comparing to the online-food-pioneer consumers (Chu *et al.*, 2010; Hansen, 2005, 2008; Morganosky and Cude, 2000; Mortimer *et al.*, 2016). In regard to this, global food producers, marketers and policy makers when promoting their products and online food channels to the online-food-conservative consumers should highlight the ease of use of online food shopping in China.

Notes

1. Factorial structure is the construct dimensions for a theoretical construct (Thompson, 2004), the innovation-adoption characteristics in this case.
2. Statistics of the cross-tabulations with χ^2 tests: gender ($\chi^2 = 0.022$, $p = 0.989$), age ($\chi^2 = 0.615$, $p = 0.961$), marital status ($\chi^2 = 2.413$, $p = 0.660$), income ($\chi^2 = 1.456$, $p = 0.834$), education ($\chi^2 = 5.993$, $p = 0.05$), occupation ($\chi^2 = 18.330$, $p = 0.05$) and household size ($\chi^2 = 2.987$, $p = 0.810$).

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Corresponding author
Ou Wang can be contacted at: ou.wang@waikato.ac.nz