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Ghost kitchens on the rise: Effects of knowledge and perceived benefit-risk on customers' behavioral intentions

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ABSTRACT

This study aims to reveal customers' perceptions and intentions towards the emerging disruptive restaurant business model of ghost kitchens. Through the theoretical lens of prospect theory, this study examines how customer knowledge and perceptions of benefits and risks influence their trust and behavioral intentions towards ghost kitchens. Exploratory factor analysis, confirmatory factor analysis, and structural equation modeling were applied on two subsamples of a total of 977 U.S. restaurant customers. Four types of benefit and risk perception of ghost kitchens are identified, namely personal benefits, societal benefits, personal risks, and societal risks. It's found that personal and societal benefits affect trust positively, while societal risks affect trust negatively. Trust affects customers' behavioral intentions positively. Differential effects of subjective and objective knowledge are also revealed. This study responds to the lack of research on the new phenomenon of ghost kitchens and provides timely marketing intelligence to the foodservice industry.

1. Introduction

The restaurant industry has observed unprecedented numbers of off-premises orders in 2020. A new report of Anon (2021) indicated that restaurant takeout and delivery have become a part of people's routines. With a 52% growth of online food delivery sales, the restaurant industry has witnessed an emerging trend of ghost kitchens optimized for the delivery economy (Christopher, 2020). Ghost kitchens, also known as virtual restaurants or cloud kitchens, are food operations for delivery-only meals with no physical storefronts or dining areas (Volpe, 2020). Currently, there are two types of ghost kitchen models - one is rented/shared kitchen space and the other is back-of-house only kitchens (Anon, 2020). Restaurant owners benefit from this new concept by significantly reducing labor and other overhead costs (Sebes, 2019).

The emergence of ghost kitchens predated the COVID-19 pandemic (hereafter as the pandemic) as part of the restaurant industry's response to the skyrocketing demand for off-premises orders and third-party online delivery providers (Rivera, 2019). For example, Uber Eats has more than 1500 ghost kitchens in North America. GrubHub and DoorDash launched their delivery-only concept collaborating with local and national chain restaurants including Chick-fil-A, Red Robin, Rooster & Rice, and Nation's Giant Hamburgers (Danley, 2019). The pandemic has accelerated the growth of this concept due to on-site dining closures and safety concerns (Volpe, 2020). This phenomenon will likely become a mainstay as market research estimates that ghost kitchens or delivery-only restaurants would be a $1 trillion business by 2030 (Hawley, 2020).

Many restaurant owners perceive ghost kitchens as a paradox (Snyder, 2020). On one hand, ghost kitchens provide leverage for restaurants to reduce the upfront cost and outsource their underutilized kitchen space/facilities. On the other hand, with the boom of ghost kitchens, criticisms also arise on losing authentic restaurant experience (Sugar, 2021). Restaurant customers are also cautious about ordering from ghost kitchens due to their unfamiliarity with this new concept. It is reported that 72% of customers preferred ordering food deliveries from bricks-and-mortar restaurants as opposed to ghost kitchens (Anon, 2021).

As a new phenomenon, there is a lack of understanding of customers' perception and acceptance of ghost kitchens, despite a recent research stream in understanding new consumer behaviors for online delivery

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providers (e.g., Cai and Leung, 2020; Gunden, Morosan, and DeFranco, 2020; Yang et al., 2021). No empirical research thus far has been conducted to explore this disruptive innovation to provide insights and guidance to the restaurant industry. This study, therefore, aims to fill the research gap by applying prospect theory to explicate the underlying mechanisms that connect antecedents with customers' behavioral intentions toward ghost kitchens. More specifically, the objectives of the current study are to identify customers' perceived benefits and perceived risks of ghost kitchens and examine how customer knowledge and benefit-risk perceptions influence customer trust and behavioral intentions. This study contributes to the existing literature by providing new knowledge regarding a new food service phenomenon that has not yet been explored. The findings of this study would provide restaurant practitioners with a better understanding of customers' attitudes and behavior towards ghost kitchens and offer valuable insights for them to develop new marketing and management strategies.

2. Theoretical foundation: prospect theory

Developed by Kahneman and Tversky (1979), prospect theory explains customer decisions when risk or uncertainty is involved (Kahneman and Tversky, 1979). The central proposition of prospect theory asserts that customers evaluate gains and losses against a reference point to form perceived values, based on which customers make decisions (Kahneman and Tversky, 1979). As one of the most popular economic models, prospect theory has been applied in various disciplines, including economics, decision sciences, organization management, and marketing (Masiero, Pan, and Heo, 2016). In the hospitality field, the extant literature has also widely adopted prospect theory and related principles in studying message framing (e.g., Chi, Denton, and Gursoy, 2021; Grazzini et al., 2018), product/service pricing (e.g., Hernandez--Maskivker et al., 2019; Nicolau, 2011), and asymmetric impacts of product attributes (e.g., Masiero et al., 2016; Mellinas, Nicolau, and Park, 2019; Román and Martín, 2016).

Recently, hospitality researchers have applied prospect theory to explain purchase intentions in risky situations as the results of loss and gain evaluations. For example, Olya and Han (2020) developed a research model of motivation and risk antecedents in shaping the behavioral intentions of space travelers. Zolfagharian et al. (2018) identified drivers of medical tourism as both loss evaluations such as domestic medical costs, patient privacy concerns, and medical restrictions, and gain evaluations such as foreign destination desirability. Other studies (Liang, Choi, and Joppe, 2018; Mao and Lyu, 2017) found perceived values and perceived risks as important determinants of customers' repurchase intentions of Airbnb. In the same vein, this study uses perceived risks and perceived benefits as predictors of customers' behavioral intentions in the context of ghost kitchens. The next section discusses the constructs that build the research framework in this study.

3. Hypothesis development and research framework

3.1. Perceived benefits and risks

Prior studies have hinted at integrating risk-benefit analysis with prospect theory to reveal how individuals differ in their evaluation and decision-making (e.g., Hansson and Lagerkvist, 2014). The risk-benefit framework implies that individuals' evaluation of the benefits and risks associated with a given behavior is likely to depend upon the risk and benefit domain (Weber, Blais and Betz, 2002). Perceived benefit is based on heuristics and concrete experience, while risk perception is to a larger extent the result of cognitive information processing (Kahneman et al., 1982). Customers evaluate risks based upon the risk probabilities, outcomes as well as contextual variables (Cardello, 2003). Customers' perception of a benefit can often be turned into a risk, or vice versa, depending on the context, as a product attribute can offset an undesirable consequence (Ueland et al., 2012). Therefore, a benefit-risk analysis captures customers' views more holistically.

Albeit a new business model for restaurants, customers' risk and benefit perceptions of ghost kitchens are still related to industry-specific attributes such as taste, quality, variety of choice, and value for money (Hwang and Choe, 2019; Ray and Bala, 2021). Previous food service studies have identified different types of risks influencing consumption behaviors (e.g., Hwang and Choe, 2019, 2020; Olya and Al-ansi, 2018; Peng, 2020). For example, Youn and Kim (2018) examined food quality risks regarding taste and value for money and food safety risk in ethnic restaurants. Huang and Choe (2020) evaluated quality risk, psychological risk, health risk, financial risk, environmental risk, time-loss risk, and social risk pertaining to edible insects. Prior studies have implied that risks can be at two levels: behavioral/personal and environmental/societal levels (e.g., Bensaou and Venkatraman, 1996). In the ghost kitchen context, customers may worry about the taste, quality, and time-related risks that will influence them at the personal level. Meanwhile, ghost kitchens may also introduce societal risks that influence the local economy, employee welfare, and public health.

On the flip side, customers' benefit perceptions about food are often related to extrinsic product attributes and added value through convenience, value for money, and ethical concerns (van Kleef et al., 2005). Health and environmental benefits are also important for customers' acceptance of food-related consumption (Ronteltap et al., 2007). Ghost kitchens are perceived to benefit customers by providing convenient and fast service, as well as a variety of choices on unified platforms (Rowe, 2020). Customers may also perceive ghost kitchens as beneficial to the local economy by providing new business opportunities for existing and new restauranteurs since they can expand or enter a market with limited overhead costs. Additionally, ghost kitchens are perceived to help reduce car traffic, carbon emissions, and food waste (Fabricant, 2020; Wiener, 2020).

Ghost kitchen is considered a disruptive innovation for the foodservice industry. Such disruptive technologies introduce two levels of disruption (Schuelke-Leech, 2018). The first level influences the industry and the market, and the second influences the society at a macro level. This study follows a similar vein and adopts two levels of perceived risks, personal and societal risks, as suggested by previous literature, and two levels of perceived benefits, personal and societal benefits, as appropriate in the current context. Based on the aforementioned discussion, this study has proposed and verified a new framework of perceived benefits and risks for ghost kitchens in the subsequent sections.

3.2. Customer knowledge

Prospect theory strengthens the role of reference points in forming customers' evaluations (Kahneman and Tversky, 1979). This principle, known as a reference-dependent preference, asserted that individuals make judgments about gains or losses by comparing the potential outcomes to a personal reference point (Tversky and Kahneman, 1991). Previous research suggested that the reference point is formed based on past experiences and knowledge (Chi et al., 2021; Masiero et al., 2016; Mellinas et al., 2019). Chi et al. (2021) indicated that knowledge plays an essential role in situations involving high levels of uncertainty or risk. Previous consumer research treated customer knowledge as a multidimensional construct, which consists of objective knowledge, referring to what people actually know, and subjective knowledge, representing how much they think they know (Park, Mothersbaugh, and Feick, 1994). Subjective and objective knowledge show different effects on customer information processing and subsequent decision making (Raju et al., 1993). For example, both Raju et al. (1993) and Pieniak, Aertsens, and Verbeke (2010) found that subjective knowledge impacts customers' decision more than objective knowledge, while Lee and Lee (2009) revealed that customers with high objective knowledge (versus subjective knowledge) are less likely to be affected by negative product cues. In a wine purchasing study, Dodd et al. (2005) found that objective

knowledge is positively related to using impersonal information sources while subjective knowledge is positively related to using both impersonal and self-experience information sources.

Customer knowledge plays a critical role in food consumption (Pieniak et al., 2010). Both subjective and objective knowledge is found to be related to perceived benefits and risks in the hospitality and tourism context, although different knowledge type exerts different influences (e.g., Klerck and Sweeney, 2007; Sharifpour et al., 2014). Zhang and Liu (2015) revealed that objective knowledge significantly influences both perceived benefits and risks of genetically modified foods. Klerck and Sweeney (2007) found that objective knowledge significantly decreases perceived performance and psychological risks on genetically modified food. Sharifpour et al. (2014) discovered that subjective knowledge significantly reduces tourists' risk perceptions on traveling to the Middle East, including physical, destination-specific, and general risks. Based on the previous literature, this study measures both subjective knowledge and objective knowledge regarding ghost kitchens as customers' reference points that influence their perceived benefits and perceived risks. Thus, the following hypotheses are developed:

H1. Subjective knowledge is positively related to perceived benefits (a. personal benefits; b. societal benefits).

H2. Objective knowledge is positively related to perceived benefits (a. personal benefits; b. societal benefits).

H3. Subjective knowledge is negatively related to perceived risks (a. personal risks; b. societal risks).

H4. Objective knowledge is negatively related to perceived risks (a. personal risks; b. societal risks).

3.3. Trust

Trust refers to beliefs about perceived predictability, dependability, and confidence in a person or an object (Rempel, Holmes and Zanna, 1985). In the service industry, building trust has been essential to the success of the hospitality businesses given the intangibility and inseparability nature of service (Isaeva, Gruenewald and Saunders, 2020). Trust helps customers reduce uncertainty and insecurity, and thus facilitate their decision-making (Zhang et al., 2020). In today's technology era, trust in technology has been shown to significantly influence technology acceptance and adoption (Kuriyan, Kitner and Watkins, 2010). In the online hospitality and tourism context, the unobservability and impersonal features of the Internet infrastructure lead to uncertainty among customers. Trust in e-commerce has thus become more influential in customer decision-making and the topic has attracted abundant research interests (Kim and Kim, 2020; Rafiq et al., 2013; Zhang et al., 2020).

The relationships between trust and perceived benefits and risks have been implied in previous literature, particularly with relation to innovative products (Bronfman and Vázquez, 2011). Park et al. (2019) study supported a positive relationship between perceived benefits and trust and a negative relationship between perceived risk and trust when it comes to using mobile payment. Similar relationships have also been tested in customers' trust in gene technology (Siegrist, 2000), automated driving (Liu, Yang and Xu, 2019), and nuclear power (Siegrist et al., 2000). In food research, the positive relationship between trust and perceived benefits and the negative relationship between trust and perceived risks have also been verified in various contexts, such as the consumption of organic food (Saba and Messina, 2003), edible insect food (Legendre and Baker, 2020), and genetically modified food (Ali et al., 2021). As suggested by previous literature, the study proposes perceived risks and perceived benefits to be antecedents of customer trust in ghost kitchens, a phenomenon combining foodservice with technology. Specifically,

H5. Perceived benefits (a. personal benefits; b. societal benefits) are positively related to customers' trust in ghost kitchens.

H6. Perceived risks (a. personal risks; b. societal risks) are negatively related to customers' trust in ghost kitchens.

Trust plays a critical role in customers' decision-making process and behavioral intentions. McKnight, Choudhury and Kacmar (2002) proposed that customer trust in e-commerce leads to trusting behaviors such as purchase intention. In restaurant research, trust has been tested to significantly influence customers' restaurant preference (Erkmen and Hancer, 2019), restaurant satisfaction and loyalty (Jin et al., 2016), intention to visit and recommend a restaurant both offline and online (Anaya-Sánchez et al., 2019). In the context of ghost kitchens, the study examines how trust affects two important customer behaviors: purchase intention and word-of-mouth intention, and put forward the following hypothesis:

H7. Customers' trust in ghost kitchens is positively related to their behavioral intentions (a. purchase intentions; b. positive word-of-mouth intentions).

Fig. 1 demonstrates the conceptual framework of this study.

4. Methods

4.1. Procedures and measurements

To conceptualize perceived risk and perceived benefit in the new context of ghost kitchens, we followed a multi-step procedure to develop and validate the measurements (Churchill, 1979; DeVellis, 1991). Firstly, a focus group of 18 restaurant professionals was conducted to solicit their perception of ghost kitchens. The second step included a comprehensive review of literature about perceived benefits and risks. An initial item pool was generated based upon the results from the focus group and literature review. A sample of 24 college-aged restaurant customers was recruited at a large research institution in the U.S. to ensure the face and content validity of the initial measure, consisting of 29 items, 14 for the perceived benefit and 15 for the perceived risk, which was used to gather data for subsequent analysis. Further steps to purify and verify the measurement were discussed in the result section.

Measurements of other core constructs were adopted from prior studies with a slight modification to fit the current context. Trust consisted of 5 items like "I trust that ghost kitchens will be reliable when I order food" (Belanche et al., 2014). Subjective knowledge comprised 5 items like "I know pretty much about ghost kitchen" (Flynn and Goldsmith, 1999). Objective knowledge was measured by 5 multiple choice type questions like "Ghost kitchens offer: a) delivery meals only; b) both delivery and takeout; c) delivery, takeout and dine in". Intention to order from ghost kitchens were administered by three items like "I will order food from ghost kitchens." (Liu and Jang, 2009). Electronic word-of-mouth intentions were tested by 4 items like "I will write positive comments about ghost kitchens on websites" (Lu and Gursoy, 2017). All items used a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

4.2. Data collection and analysis

The data was collected on Amazon MTurk (www.mturk.com) from November 2020 to January 2021. MTurk is chosen for its reliable results for researchers from an array of disciplines (Buhrmester et al., 2016). We employed rigorous exclusion methods suggested by recent studies (Buhrmester et al., 2018; Chmielewski and Kucker, 2020; Lu et al., 2021) such as recruiting MTurkers with a 95% approval ratio or higher, collecting data on weekends, several attention checks, time expectation, and open-text questions throughout the survey. The online survey was administered via Qualtrics with a link in MTurk. A small monetary incentive was provided upon completion. U.S. based adult participants who have ordered online food deliveries in the past 6 months were instructed to read a short essay about ghost kitchens. Customers with past experience of ordering food deliveries online were chosen for their familiarity with and likelihood of ordering food from ghost kitchens in the future. The essay was developed based on an extensive review of literature related to ghost kitchens from the mainstream news media and

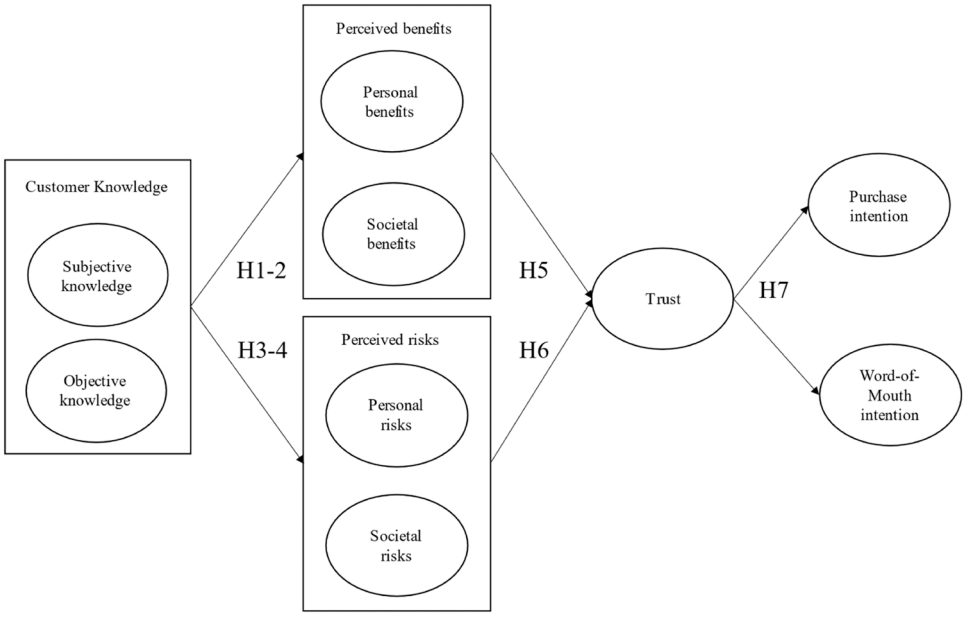

Fig. 1. Conceptual framework.

major business periodicals (e.g., Bromwich, 2019; Fabricant, 2020; Issac and Yaffe-Bellany, 2019; Snyder, 2020; Volpe, 2020). The essay includes a description of ghost kitchens and a discussion of the influence of ghost kitchens on the restaurant industry and customers (see Appendix A). After that, participants were asked to answer questions regarding knowledge, perceived benefit and risk, trust, and behavioral intentions. Manipulation checks and attention checks were applied. Responses that failed to pass any of the checks were removed from the data analysis. The first sample of 442 usable responses was retained for exploratory factor analysis of perceived benefit and risk, and the second sample of 511 valid responses was retained for confirmatory factor analysis and structural equation modeling. Table 1 summarizes sample demographics.

Table 1
Sample demographics.

	Sample 1 (N = 442)		Sample 2 (N = 511)	
Gender	Frequency	Percent	Frequency	Percent
Female	198	48.6	231	45.3
Male	215	44.8	273	53.5
Other	6	1.4	6	1.2
Age				
18–24	12	2.7	21	4.1
25–34	146	33.0	197	38.6
35–50	172	41.1	193	37.8
51–65	64	15.3	78	15.3
65 and over	14	3.3	20	3.9
Ethnicity				
Caucasian	336	74.3	375	73.4
African American	39	8.6	55	10.8
Asian/Pacific Islander/Indian	33	7.3	27	5.3
Hispanic/Latino	35	7.7	48	9.4
Other	9	2.0	6	1.2
Education				
Highs school graduate/G.E.D.	42	9.5	30	5.9
Associate degree	38	8.6	41	8.0
Bachelor's degree	203	45.9	268	52.4
Master's or doctoral degree	85	19.4	98	19.2
Other	51	12.2	73	14.3

Note: [a]Missing 23 values; [b]Missing 1 value

5. Results

5.1. Results of exploratory factor analysis

The appropriateness of the 442 responses was examined. The skewness and kurtosis of each item were within 1, indicating a normal distribution of each item. Sampling adequacy was assessed by Kaiser-Meyer-Olkin (KMO). The KMO values for perceived benefit (0.820) and perceived risk (0.897) both exceeded the suggested value of 0.5. Bartlett's Test of Sphericity was applied and significant ($p < 0.001$) for perceived benefit and risk, suggesting sufficient correlation among variables. Individual KMO and communalities were applied, and all items showed values above the cut-off point of 0.5, thereby all 29 items were retained for EFA. EFA was conducted using principal component analysis with varimax rotation using SPSS26. The structure of the scale was determined by the rotated component matrix. The dimensions were identified when the eigenvalue is higher than 1. Items were further removed if cross-loadings were higher than 0.5 or item-to-factor loadings were lower than 0.5. After iterative rounds of analysis, four items for personal benefits and four items for societal benefits were retained to explain 61.88% (cutoff value = 60%) of the variance. For perceived risks, five items of personal risks and five items of societal risks were retained. The two-factor structural explained 73.65% of the variance. Internal consistency of each factor was evaluated by Cronbach's alpha and all factors showed substantial values higher than 0.7 (0.727–0.926), thereby confirmed reliability among items in the proposed factorial structural. Table 2 summarizes EFA results.

5.2. Results of confirmatory factor analysis

Confirmatory factor analysis (CFA) was applied to validate the 18-item measurements of perceived risk and benefit using Mplus 7. Table 2 summarizes the results of CFA. The model demonstrated a good fit, indicated by a set of goodness-of-fit indexes. The Chi-square to the degree of freedom ratio was 2.49 (< suggested value of 3), Comparative Fit Index (CFI) and Turker-Lewis Index (TLI) were beyond the suggested value of 0.90 (CFI=0.951, TLI=0.941). Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) were within the suggested range of below 0.08 (RMSEA=0.054 (90% CI: 0.047–0.062), SRMR = 0.042).

Reliability, convergent, and discriminant validity of the factors were

Table 2
Factor analysis results.

Factors/Items	EFA (N = 442) Mean	SD	Item-to-factor loadings	CFA (N = 511) Mean	SD	Item-to-factor loadings
Personal benefits			0.727[a]			0.716[a]
Ordering food from a ghost kitchen is convenient.	5.53	0.919	0.651	5.50	0.876	0.637
Ordering food from a ghost kitchen offers a variety of choices.	5.30	0.949	0.781	5.32	0.924	0.767
Ordering food from a ghost kitchen provides options for quality food.	5.18	0.960	0.753	5.23	0.969	0.799
Ordering food from a ghost kitchen supports new restaurant concepts and local entrepreneurs.	5.34	0.963	0.662	5.39	0.954	0.647
Societal benefits			0.745[a]			0.731[a]
Ordering food from a ghost kitchen protects the environment by reducing car traffic and carbon emission.	5.14	1.32	0.712	5.13	1.30	0.723
Ordering food from a ghost kitchen reduces food waste.	5.01	1.24	0.749	5.01	1.19	0.755
Ordering food from a ghost kitchen creates more jobs for the local economy.	4.75	1.24	0.711	4.70	1.24	0.709
Ordering food from a ghost kitchen makes contributions to the local community.	4.98	1.01	0.740	4.94	1.03	0.840
Personal risks			0.887[a]			0.897[a]
I worry that my order from a ghost kitchen would be of low food quality.	3.91	1.69	0.812	3.86	1.67	0.927
I worry that my order won't be fulfilled correctly by a ghost kitchen.	3.90	1.74	0.817	3.82	1.70	0.923
I worry that my order from a ghost kitchen would be more expensive than I expected.	4.13	1.67	0.831	4.13	1.65	0.838
I worry that ordering food from a ghost kitchen would remove authentic dining experiences.	4.31	1.73	0.636	4.14	1.69	0.763
I worry that food delivery from a ghost kitchen would take too much time.	3.57	1.69	0.781	3.63	1.72	0.777
Societal risks			0.926[a]			0.924[a]
I worry about the cleanliness of a ghost kitchen.	4.56	1.76	0.793	4.47	1.78	0.906
I worry about the hygiene standards of a ghost kitchen.	4.55	1.76	0.790	4.41	1.76	0.766
I worry about the working conditions of ghost kitchen workers.	4.37	1.67	0.869	4.34	1.71	0.873
I worry about the pay and benefits of ghost kitchen workers.	4.33	1.70	0.805	4.32	1.67	0.944
I worry about the food sourcing of ghost kitchens.	4.58	1.72	0.859	4.42	1.70	0.938

Note: [a]Cronbach's alpha

examined, and the results showed high reliability and validity of the measurement scale. All factors demonstrated composite reliability scores ranging from 0.806 to 0.936, higher than the suggested value of 0.70 (Bagozzi and Yi, 1991). Convergent validity was assessed by examining the significance of item-to-factor loadings and the average variance extracted (AVE). All the item-to-factor loadings were ranged from 0.637 to 0.944 and the AVE values were higher than the cutoff value of 0.5. The results indicate substantial convergent validity of the measurement scale. Discriminant validity was evaluated with two criteria. Correlations between each pair of factors were assessed and none of the paired correlation exceeded 0.80. We then compared the inter-correlations between the factors with the square root of the AVE, and none of the correlations surpassed the AVE square root.

5.3. Results of structural equation modeling

Structural equation modeling (SEM) was undertaken to examine the proposed model. We followed the two steps suggested by Anderson and Gerbing (1988). First, a CFA was conducted to confirm an adequate model fit of the underlying factors. The CFA provided a good model fit: $\chi^2/df = 2.20$, CFI = 0.94, TLI = 0.93, SRMR = 0.05, RMSEA = 0.05 (90% CI: 0.045–0.052), therefore no modification was applied. Structural relationships were then evaluated. The model fit indices of SEM suggested a good fit: $\chi^2/df = 2.12$, CFI = 0.94, TLI = 0.94, SRMR = 0.08, RMSEA = 0.05 (90% CI: 0.043–0.051). Discriminant and convergent validity were assessed following similar procedures in 4.2. The results indicated substantial validity of the measurements of all factors in the model (see Table 3).

The SEM results showed that subjective knowledge positively influenced personal benefits ($\beta = 0.47$, $p < 0.001$; H1a) and societal benefits ($\beta = 0.47$, $p < 0.001$; H1b). Objective knowledge positively affected personal benefits ($\beta = 0.21$, $p < 0.001$; H2a) and negatively affected personal risks ($\beta = -0.40$, $p < 0.001$; H4a) and societal risks ($\beta = -0.25$, $p < 0.001$; H4b). Personal benefits ($\beta = 0.44$, $p = 0.028$; H5a) and societal benefits ($\beta = 37$, $p = 0.053$; H5b) positively impacted trust, while societal risks negatively impacted trust ($\beta = -0.35$, $p = 0.004$; H6b). Trust led to purchase intentions ($\beta = 0.76$, $p < 0.001$; H7a) and positive WOM intentions ($\beta = 0.71$, $p < 0.001$; H7b). Table 4 summarizes the testing results of the proposed hypotheses. Fig. 2 demonstrates the results of the proposed model.

Harman's single factor test was applied to address common method bias (Podsakoff et al., 2003). The four-factor model was compared to the

Table 3
Discriminant and convergent validity.

Factor	CR[b]	AVE[c]	PB	SB	PR	SR	Trust	PI	WOMI
Personal benefits	0.806	0.513	0.716[a]						
Societal benefits	0.844	0.575	0.537	0.758[a]					
Personal risks	0.927	0.720	-0.162	0.071	0.849[a]				
Societal risks	0.949	0.720	-0.106	0.074	0.743	0.849[a]			
Trust	0.886	0.660	0.519	0.484	-0.192	-0.277	0.812[a]		
Purchase intention	0.909	0.770	0.527	0.531	-0.182	-0.195	0.731	0.877[a]	
WOM intention	0.936	0.784	0.463	0.662	-0.014	-0.080	0.638	0.775	0.885[a]

Note: [a]Square root of AVE; [b]CR=Composite reliability; [c]AVE=Average variance extracted; PB=Personal benefits; SB=Societal Benefits; PR=Personal risks; SR=Societal risks; PI=Purchase intention; WOMI=Word-of-mouth intention.

Table 4
Results of structural model hypothesis (H1-H7).

	Hypothesized relationships	Testing results	Status
H1a.	Subjective knowledge→ Personal benefits	$\beta = 0.469$, $p < 0.001$	Supported
H1b.	Subjective knowledge→ Societal benefits	$\beta = 0.470$, $p < 0.001$	Supported
H2a.	Objective knowledge→ Personal benefits	$\beta = 0.217$, $p < 0.001$	Supported
H2b.	Objective knowledge→ Societal benefits	Nonsignificant	Not supported
H3a.	Subjective knowledge→ Personal risks	Nonsignificant	Not supported
H3b.	Subjective knowledge→ Societal risks	Nonsignificant	Not supported
H4a.	Objective knowledge→ Personal risks	$\beta = -0.400$, $p < 0.001$	Supported
H4b.	Objective knowledge→ Societal risks	$\beta = -0.250$, $p < 0.001$	Supported
H5a.	Personal benefits→ Trust	$\beta = 0.439$, $p = 0.028$	Supported
H5b.	Societal benefits→ Trust	$\beta = 0.370$, $p = 0.053$	Supported
H6a.	Personal risks→ Trust	Nonsignificant	Not supported
H6b.	Societal risks→ Trust	$\beta = -0.347$, $p = 0.004$	Supported
H7a.	Trust→Purchase intentions	$\beta = 0.758$, $p < 0.001$	Supported
H7b.	Trust→WOM intentions	$\beta = 0.711$, $p < 0.001$	Supported

one-factor model that treated the 18 items as a common factor. The results ($\chi^2/df = 11.48$, CFI = 0.56, TLI = 0.52, SRMR = 0.16, RMSEA = 0.14 (90% CI: 0.138–0.149)) suggested that the four-factor model had superior model fit, thereby ruled out the common method bias.

6. Discussions and implications

6.1. Discussions

This study is amongst the first attempts to discuss the disruptive innovation of ghost kitchens and explores customers' perceptions of the novel phenomenon leveraging the prospect theory and perceived benefit and risk framework. Perceived benefit and perceived risk are usually specific to the context. The present study provides first-hand empirical evidence to identify the sub-dimensions of perceived benefit and perceived risk in the ghost kitchens context, namely personal benefits, societal benefits, personal risks, and societal risks. Rigorous procedures were followed to develop and confirm the measurement scale for the four factors, which were then used to test the proposed framework.

The present study investigates the differential effects of perceived benefit and perceived risk on customers' trust. The findings suggest that perceived personal benefits, societal benefits, and societal risks significantly affect trust, which in turn, influence customers' behavioral intentions. The results reiterate the importance of perceived benefit and risk in establishing customer trust. When customers perceive higher personal benefits such as convenience, variety of quality food choices, and societal benefits such as traffic and food waste reduction, job creation, and economic contribution, they would formulate a higher level of trust and are more likely to consider ghost kitchens in the future. The societal risk that captures customers' concerns over employee welfare, cleanliness/hygiene standard, and food sourcing significantly erodes customer trust. Personal risk such as food quality, incorrect order / slow delivery, and pricing, however, did not demonstrate significant effects on trust.

Customers tend to lack the knowledge to comprehend a new and innovative service such as a ghost kitchen. Findings of this study provide empirical evidence that knowledge matters and can increase customers' perceived benefit and lower their perceived risk about ghost kitchens. The results further reveal the distinct effects of subjective knowledge and objective knowledge. Specifically, subjective knowledge helps customers to recognize the benefits, whereas objective knowledge lessens the perceived risk, which in turn increases customers' trust and intention to order from ghost kitchens. The distinct roles of subjective and objective knowledge echo prior studies about customer knowledge (Klerck and Sweeney, 2007; Zhang and Liu, 2015).

Subjective knowledge reflects individuals' feelings of comprehension of a given topic. Our findings suggest that customers who think that they know a lot about ghost kitchens are more likely to focus on the benefits that this new business model can bring. Such links are not surprising as customers who perceive themselves knowledgeable may consider themselves more capable of completing a task and perceive a higher level of control, thereby may overlook the risks (Klerck and Sweeney, 2007).

On the other hand, objective knowledge that measures how deeply people understand an issue may stimulate the cognition to balance between risk and benefit perception, reduce the uncertainties about the issue, and therefore minimize the perceived risk. Findings of this study connote prior studies that objective knowledge helps mitigate customers' perceived risk and fear, in the case of genetically modified wine (Lu, Rahman and Chi, 2017) and genetically modified foods (House et al., 2004). Similarly, objective knowledge has been found to decrease customers' perception of function risk and social risk in financial investment (Munnukka, Uusitalo and Koivisto, 2017).

6.2. Theoretical implications

This study sheds new light on prospect theory by extending the benefit-risk framework to the novel and crucial context of disruptive innovation in the restaurant and foodservice industry. Since customers' benefit-risk perceptions are highly context-specific, measurement and instrument should be content-specific as well to reflect the differences (Bredahl, 2001). As a response to a research call in understanding new customers in the era of prevailing online delivery providers (Rivera, 2019), this study is amongst the first to conceptualize customers' benefit-risk perceptions in the new ghost kitchens context. While prior research has discussed benefits and risks that may motivate customers to engage in different behaviors, a lack of clarity exists in distinguishing

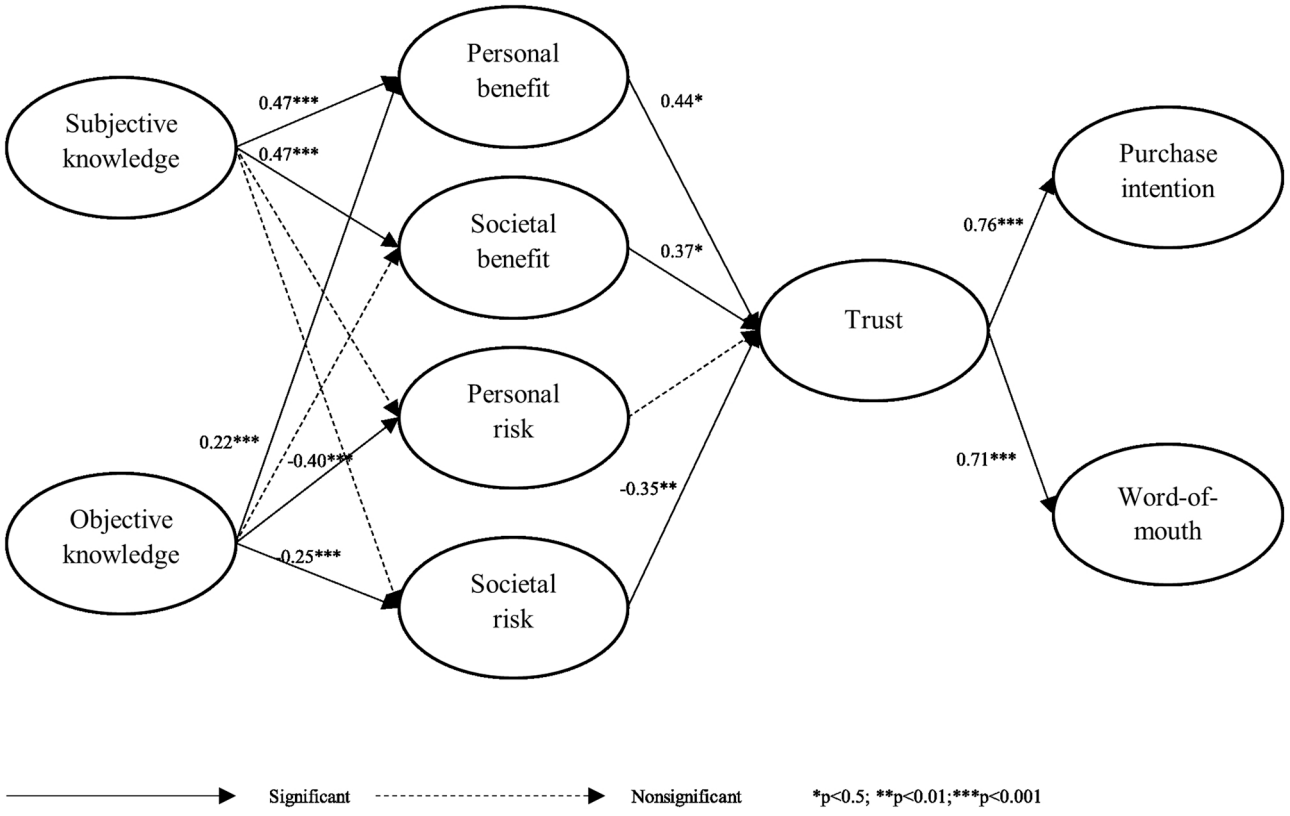

Fig. 2. SEM results of the proposed model.

benefit and risk perceptions at personal and societal levels, especially in the hospitality field. Additionally, prior studies suggest that new categories of risk perception should be included for disruptive innovation and new technologies (Grunwald, 2018). This study responds to calls to distinguish between different types of risk and resonate the importance of personal and societal perceptions of risk (Lee, Kim, and Chock, 2020), particularly when the issues are both of personal relevance and can influence society in general, such as in the ghost kitchen context. Risk and benefit are often inversely related, and customers constantly make decisions based upon the balance between the two. The present study thereby provides empirical evidence of the trade-offs by conceptualizing personal and societal benefits in parallel with risks. We then develop and validate the measurement of the four dimensions of perceived benefit and risk in the context of ghost kitchens.

Additionally, the present study enriches the prospect theory by testing the role of trust and knowledge. The inclusion of trust in the conceptual model responds to the recent discussion that trust is one of the most decisive variables in the digital hospitality market (Cai and Chi, 2021; Gursoy, 2019; Palácios et al., 2021). Our findings reiterate the importance of trust when the social environment of a new concept is complex (Siegrist, 2021), as in the case of ghost kitchens. We identify and examine personal benefit, societal benefit, and societal risk as the determinants of customers' trust in ghost kitchens. The findings extend the current discussion about how perceived benefits and risks are essential in trust building (e.g., Liu et al., 2019; Park et al., 2019). Our finding has also acknowledged the differential effect of subjective knowledge and objective knowledge on customer evaluation (e.g., Flynn and Goldsmith, 1999), which is understudied in the hospitality contexts (Dodd et al., 2005).

6.3. Practical implications

This study responds to the lack of research on the new phenomenon of ghost kitchens and provides timely marketing intelligence to the industry. Our findings suggest that customers constantly evaluate the benefit and risk regarding ghost kitchens from both personal and societal aspects. It is noteworthy that customers value the personal benefits derived from patronizing ghost kitchens, such as convenience and variety of food options; they also care about the societal benefits connected with the new phenomenon, such as reducing car traffic and food waste and contributing to job creation and local economy. Meanwhile, they are concerned with societal risks likely associated with ghost kitchens, such as cleanliness and hygiene standards, employee welfare and working conditions, and food sourcing. Although ghost kitchens follow the same level of regulations and inspections regarding food safety as brick-and-mortar restaurants, customers may not be aware of that and still be concerned about public health issues.

Our findings point to the urgent need for food businesses that have adopted the ghost kitchen model to raise the public's awareness about the benefits this new concept can bring to individuals as well as society as a whole. For instance, it should be communicated to the public that ghost kitchens lower the financial barrier to entry for new entrepreneurs, help create new job opportunities and stimulate the local economy. The proliferation of ghost kitchens also means more convenience, more variety, and higher quality of delivery choices for individual customers. On the other hand, it is critical for ghost kitchen operators to dispel the negative perceptions associated with the new business model by being transparent, and furnishing more information to the public, e.g., their adherence to food health/safety laws, the welfare, and benefits they provide to their employees, among others.

While there is more media coverage about ghost kitchens and their operations, there remains confusion among the customers about this new phenomenon, as indicated by our study – a lot of our respondents are not familiar with ghost kitchens. Our findings suggest that customers' knowledge of ghost kitchens affects their risk and benefit perceptions. Both subjective and objective knowledge increase customers' evaluation of the benefits of ghost kitchens; while objective knowledge reduces customers' perceived risks of ghost kitchens. Customers are

more likely to look for impersonal information in making a decision to order from ghost kitchens (Dodd et al., 2005). It is therefore imperative for this new booming sector of the food industry to educate the public about itself and take control of the narrative so as to establish a positive image among the public. Marketing efforts and community outreach, such as sponsoring new restaurant concepts, providing opportunities for new/young chefs, and supporting minority-owned businesses, not only increase public awareness but also develop public goodwill for this new business model.

7. Limitations and future studies

The study is not free of limitations. Amongst the first attempts to empirically test benefit and risk perceptions in the novel context of ghost kitchens, this study is still exploratory in nature. Although we identified and developed the measurements of the four dimensions underlying customers' perceptions of ghost kitchens, future studies can further validate the measurements and examine the possible changes of the proposed dimensions when customers gain more knowledge and familiarity of ghost kitchens. Future studies can also examine the mediating effects of perceived benefit, perceived risk and trust in the proposed relationships to provide more insights to both scholars and ghost kitchen operators. Secondly, this study recruited customers who resided in the U.S. The results may not be generalized since customers' acceptance of disruptive innovation varies across different cultures. Future studies can examine the generalizability of our findings in different cultures.

Appendix A

Short essay for participants to read before taking the survey questionnaire.

Ghost kitchens (also known as cloud kitchens or virtual restaurants) are food preparation and cooking facilities for delivery-only meals. Without physical storefronts or dining areas, they sell exclusively through online orders, phone orders or via third-party food delivery platforms such as Door Dash or Uber Eats.

Ghost kitchens were an emerging restaurant industry trend before the COVID-19 pandemic though the pandemic has greatly accelerated their growth. Both brick-and-mortar and online-only restaurants utilize ghost kitchens to prepare delivery-only meals to significantly save upfront overhead costs. During the pandemic, ghost kitchens help to feed Americans' growing appetite for food delivery because they minimize human contact, save time, and provide a variety of food choices. While ghost kitchens provide convenience, they also take away authentic dining experiences.

Ghost kitchens are subject to the same food-safety laws and inspections as bricks-and-mortar restaurants, though it is harder for customers to track their food-safety records due to the lack of physical premises. By providing delivery-only meals, ghost kitchens may help reduce carbon footprint and food waste. But some are also worried about the anonymity of food ingredients and food sourcing for ghost restaurants.

It remains unclear how ghost kitchens may affect employment. They could mean more hourly workers, or fewer well-paying jobs with benefits. While some people are worried that the rise of ghost kitchens can be a threat to casual dining and independent restaurants, others see opportunities to nurture new culinary concepts for local entrepreneurs. However, with lower financial barriers to entry, the competition is fiercer, which may lead to higher rates of business failures.

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