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The use of virtual tours to stimulate consumers' buying and visit intentions: an application to the Parmigiano Reggiano cheese

F. De Canio[1] · E. Martinelli[1] · M. Peruzzini[2] · G. Marchi[1]

Abstract

The purpose of this paper is to explore how the use of virtual tours may represent a lever to improve customers' intention to buy food products and/or visit places where products are manufactured. Emerging virtual reality and augmented reality can allow people to interact with products and places where products are produced even from very distant places, with a positive impact on their purchase intentions. Applying the theory of planned behaviour, this study focuses on the Parmigiano Reggiano cheese, one of the most exported Italian foods. A sample of consumers was surveyed online to explore the role of virtually visiting the food production place on consumers' intention to physically visit the production place and on their intention to buy the food. The empirical results deriving from a structural equation model developed on 399 completed and valid questionnaires indicate that the opportunity to experience products through virtual tours positively influences consumer behaviours. Young males show the highest intention to physically visit the food production place and to buy the cheese. Findings provide new insights for the emerging literature on the use of virtual reality to experience products through virtual interaction and the impact that interactive technologies have on consumer purchase intentions. Local areas can use virtual tours to improve food tourism and stimulate food product sales. To our knowledge, this paper represents one of the first empirical endeavours aimed at exploring the impact of virtual tours on consumers' buying and visiting intentions when a food product and a dairy are concerned.

Keywords Virtual tours · Virtual reality · Intention to buy · Intention to visit · Food products · Structural equation model

✉ F. De Canio
   francesca.decanio@unimore.it

Extended author information available on the last page of the article

1 Introduction

Digitalization is opening up new opportunities and challenges for agri-food operators to find new and interactive ways to build a relationship with final consumers. Modern consumers are increasingly digital; in the next years, almost 70% of worldwide people will buy foods online (Nielsen & Food Marketing Institute, 2018). The current spread of Covid-19 and governmental lockdown measures have accelerated this phenomenon, promoting remote working and, in general, remote experiences, including online food shopping. The underway pandemic spread, which is affecting hundreds of countries worldwide, is facilitating the shift from offline to online, making consumers more familiar with digital channels also when food is concerned (Hoekstra & Leeflang, 2020). Thus, for example, during the Covid-19 emergency, the Italian online shopping for groceries and fresh food products increased by 349% (Statista, 2020). Similar increases were found in all countries affected by the pandemic, with positive deltas still persistent even in the waning phases of the contagion waves.

Further, agri-food operators should consider the growth of consumers travels choices determined by food motives. Food tourism is becoming a core element in the definition of the destination image (Henderson, 2009). Year after year, tourism is increasingly centred on local foods and agriculture. Thus, for example, in 2019, TripAdvisor recorded a very significant growth in bookings for food and wine tours (e.g., +779% distillery tours; +195% chocolate tours; +67% wine tours—data retrieved from Rapporto sul Turismo Enogastronomico Italiano, 2020). The Italian report on the food and wine tourism shows also that tour operators are improving their "food & wine tour" offer to encounter the growing demand (e.g., +83% visits to the winery; +70% visits to dairies; +67% visits to agri-food companies—Rapporto sul Turismo Enogastronomico Italiano, 2020). Thus, food products can become a source for destination attraction as customers desire to directly experience products' originality, locality, authenticity and uniqueness (Björk & Kauppinen-Räisänen, 2016).

Last but not the least, emerging virtual reality (VR) and augmented reality (AR) technologies are allowing people to interact with products and places where products are produced, even from very distant areas, overcoming the logistic boundary and offering impressive remote experiences. The reproduction of virtual scenarios, widely used in the entertainment and gaming sectors, as well as in tourism (Paulo et al., 2018; Wei, 2019), can allow food companies to introduce the consumer into the food production site while comfortably seated on the sofa (Loureiro et al., 2019; Tlauka et al., 2005; Visinescu et al., 2015). Further, nowadays the digital reality allowing consumers to view product variants, with positive returns on companies' process efficiency (Haase et al., 2018; Peruzzini et al., 2018), is becoming a powerful tool to replicate online a seamless customer experience across various contexts (Cowan & Ketron, 2019). VR can support consumers geographically distant to consult a book in an overseas library (Xiao, 2000) and improve learning (Chiao et al., 2018), as well as visit a museum or a city of art (Harada et al., 2018; Nisi et al., 2018). VR is showing to be a valuable tool

even during the mobility constraints dictated by the spread of the Covid-19. The 3.8 million views recorded by the 21 VR interactive exhibitions offered by the Uffizi Museum, during the Covid-19 pandemic, is an example of the VR potential for destinations. VR represents a valid alternative to visitors' presence on site for the museum and art sector (Maccaferri, 2020). Apart from suiting specific temporary needs related to the circulation restrictions due to the Covid-19 pandemic, VR technologies are used to enhance the customer journey in all its phases and across a wide range of product categories, from luxury and apparel to automotive or food (Paulo et al., 2018; Wedel et al., 2020). Through the interactive story-telling of the product history, the description of its territory and of the production company, the virtual visit to the production site and the digital reconstruction of the main processing phases, the virtual tour can stimulate the emergence of positive emotions and engage consumers (Kang et al., 2020; Schlosser, 2003). Thus, impacting on the customer experience, VR can have a positive impact on customer satisfaction and loyalty (McLean et al., 2018) and on customer buying intentions (Fiore et al., 2005; Papagiannidis et al., 2013; Schlosser, 2003).

The paper explores how the opportunity to experience a 360° visit into a Parmigiano Reggiano dairy reproduced through the VR technology—the so-called virtual tour (VT)—may influence consumers' behavioural intentions to visit the dairy and to buy the Parmigiano Reggiano cheese. The Parmigiano Reggiano cheese was chosen for the study because of its high reputation and its key role in the national and international Italian agri-food system strategies: it is second among the Italian cheeses for exports and it is the third Italian agri-food product searched on the web by foreign consumers (Martinelli & De Canio, 2021). In this scenario, our research makes several contributions to the human–computer interaction literature, as well as to the consumer behaviour literature, showing how VR may influence buying and visit intentions. Specifically, this study shows that developing virtual tours able to replicate the main phases of the process behind the production of local agri-food excellence products (i.e., Parmigiano Reggiano) with augmented and interactive functionalities, will both attract visitors in the local area—as interested to visit physically the food production place previously visited towards the virtual tour—and improve sales. Although recent studies agree on the unique way VR allows consumers to access commercially relevant contents, little is known about its impact on consumer behaviour (Javornik, 2016). Within this context, the present study aims at contributing to the literature exploring the possible impact that virtually touring a dairy can have on consumer behaviour. Even if from 2011 to 2018 there has been a drastic increase of published articles on VR/AR, particularly in the tourism domain (Wei, 2019), the role exerted by VT in a food production place to stimulate the food tourism and consumers' buying intentions has been neglected by extant literature.

To predict and explain the consumers' propensity to experience the virtual tour in a Parmigiano Reggiano dairy, the Theory of Planned Behaviour is applied (Ajzen, 1985, 1991). "Straight-forward applications to new behaviours or behaviours in novel settings" make the TPB a factual theory to predict intentions and behaviours (Ajzen, 2011, p. 1124).

The paper progresses as follows: in the next section, we describe the theoretical background featuring the study. The research hypotheses and the theoretical model

are derived. Then, an empirical analysis investigating the role of the proposed virtual tour on consumers' visit and purchase intentions is proposed. Administering an online survey to a sample of consumers, 399 structured questionnaires were collected. The dataset was then used to build a structural equation model, presented in the fourth section together with the relationships between constructs. A final section addressing general discussions, main theoretical and managerial implications, as well as limitations and possible future research paths, is presented.

2 Theoretical background and hypotheses development

To contribute to the emerging literature on the role played by VR technologies on consumer behavioural intentions, this study explores the role of a possible virtual tour on consumers' visit and purchase intentions. The theoretical model is developed by applying the Theory of Planned Behaviour (TPB). TPB is widely used as a theoretical framework to study consumers' intentions and behaviours of adopting emerging technologies (Alzahrani et al., 2017).

"Attitudes towards the VR are based on customers' subjective evaluations of the overall VR experience" (Lee et al., 2020a, p. 4). This construct represents the attitude of users to respond, favourably or not, to the experience they perceive to live during the virtual tour. In TPB, and its previous Theory of Reasoned Action (TRA—Fishbein, 1979), attitude has been considered among the main determinants of the intention. Following Lee et al. (2020a) results, we postulate a positive and significant relationship between attitude towards the virtual tour and the intention to experience the virtual tour itself, as follows:

> **H1:** Attitude towards the virtual tour (ATTVT) positively impacts the intention to visit a food production place using VT (VISVT)

Subjective norms represent the perceived social pressure to act in a certain way or to adopt a commonly accepted behaviour (Ajzen, 1991). Unlike, perceived behavioural control expresses the perception of the individual to be able to perform a specific activity (Ajzen, 1991). Alzahrani et al. (2017) found a significant and positive relationship between both dimensions and students' intentions to interact with the game virtual reality. In their study, Becerra and Stutts (2008) postulated a positive relationship between both dimensions and the virtual world use, finding the former to be significant. Thus, we empirically explore the role of subjective norms and perceived behavioural control on the intention to use a virtual tour to experience the place where the food product is produced. The subsequent HPs are as follows:

> **H2:** Subjective norms (SN) positively impacts the intention to visit a food production place using VT (VISVT)
> **H3:** Perceived behavioural control (PBC) positively impacts the intention to visit a food production place using VT (VISVT)

In recent years, new emerging technologies have improved the way travellers plan their holidays and trips. The technological tools development has allowed travellers

to virtually experience a tourism destination. Thus, for example, previous studies have demonstrated that pre-visiting a destination through a virtual tour has a positive impact on destination image and accordingly on travellers' intention to visit the place (Frias et al., 2008). Analysing the museum experience towards VR, Lee et al. (2020b) found a positive relationship between the virtual experience and the intention to visit the museum offline. Accordingly, we postulate the fourth hypothesis of our study as follows:

H4: The intention to visit a food production place using VT (VISVT) positively impacts the intention to physically visit the food production place (VISP)

Since the first studies on VR, scholars have highlighted the great potential of virtual tours in determining purchase choices (e.g., Papagiannidis et al., 2008). During the pre-purchase phase, augmented reality, virtual reality and mixed reality can be decisive in influencing customers' purchasing choices as they allow consumers to test and directly experience the product and provide useful information during an entertaining and funny experience (Hoyer et al., 2020). Thus, the interaction with the virtual environment has a positive impact on consumers' willingness to purchase (Fiore et al., 2005). In the recent experiment conducted by Kang and colleagues (2020), the authors tested several virtual tours more focused on informativeness and playfulness. In both 3D virtual reality stores, the authors found that virtual reality stimulates shopping. Accordingly, our fifth hypothesis is postulated as follows:

H5: The intention to visit a food production place using VT (VISVT) positively impacts the intention to buy the food (BUY)

The overall theoretical model, presented in Fig. 1, has been extended with demographic control variables to provide an insight into the complex and recent phenomenon of virtually touring agri-food farms and dairies. Accordingly, age, sex and educational background have been included to control for possible demographic
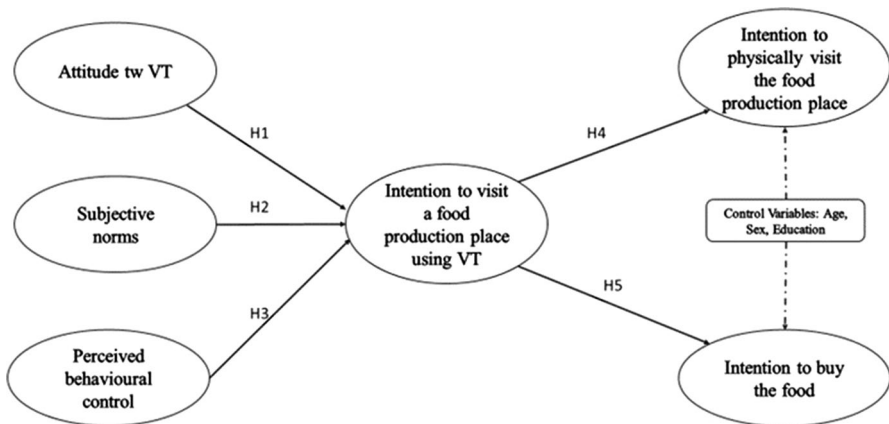

Fig. 1 Theoretical model and hypotheses

characteristics of the sample concerning consumers' intentions to buy Parmigiano Reggiano after experiencing the virtual tour of the Parmigiano Reggiano's dairy and/or consumers' intention to physically visit the dairy after experiencing the visit through the proposed virtual tour.

3 Methodology

The purpose of this research is to examine how the opportunity to virtually experience the Parmigiano Reggiano's dairy using a virtual tour may influence consumer intentions to physically visit the food production place (i.e., a dairy) and/or consumers' intention to buy the food (i.e., the Parmigiano Reggiano cheese). Consumers were surveyed online. A structured questionnaire developed using Google Module was shared among forty-one Facebook's groups identified selecting thematic pages related to food and PDO/PGI products. The use of social networks for data collection is becoming mainstream in studies evaluating consumers' adoption intentions of emerging technologies (Mangiò et al., 2020). Data were collected over 3 weeks in the second mid of August 2020. Only completed and valid responses were considered useful for the empirical analysis. In total, the dataset is composed of 399 questionnaires.

3.1 The sample

Respondents were 69.2% female with an average age of 45 years old (min. 18, max. 77 years). Well represented are the clusters of middle age users (36–50 years old), consisting of 31.3% of the sample, and mature shoppers (51–65 years old) representing 38.6% of the sample. Over 95% of the sample has at least a college degree and over; 76% of the sample has a monthly family income higher than 1300€. In terms of composition of the family unit, the most representative clusters are those of 3 (27.6%) or 4 (37.6%) members. More than 50% of respondents have a monthly family consumption of Parmigiano Reggiano between 250 and 500 g (Table 1).

3.2 Measures

The first section of the structured questionnaire contained measurement items derived from extant literature and adapted to the context of this study: an application of the theory of planned behaviour to the virtual tour context for a food product. Items, previously pre-tested and validated, were measured using a 7-point Likert scale anchored by "strongly disagree—1" and "strongly agree—7". Following the recommended translation procedure, a double translation English-Italian, Italian-English was used to reduce translations bias. To reduce response bias, the order of measurement items was shuffled (Danaher & Haddrell, 1996). Measures are reported in Table 2.

Table 1 Socio-demographic characteristics of the sample

Measure	n (N = 399)	%
Gender		
Male	123	30.8
Female	276	69.2
Age		
< 25	60	15.0
25–35	41	10.3
36–50	125	31.3
51–65	154	38.6
> 65	19	4.8
Monthly family income		
0–600€	8	2.0
601–1.300€	45	11.3
1.301–2.600€	141	35.3
2.601–3.600€	88	22.1
3.601–5.000€	69	17.3
> 5.000€	48	12.0
Educational background		
Primary school	18	4.5
Secondary school	181	45.4
University level	166	41.6
Postgraduate	34	8.5
Family members		
1	22	5.5
2	71	17.8
3	110	27.6
4	150	37.6
5 or more	46	11.5
Parmigiano Reggiano monthly consumption		
0 g/month	15	3.8
> 250 g/month	105	26.3
250–500 g/month	202	50.6
500–750 g/month	39	9.8
750–1000 g/month	20	5.0
1–2 kg/month	14	3.5
> 2 kg/month	4	1.0

4 Empirical model and results

4.1 Model identification and measurement model fit

The theoretical model was empirically tested using a Covariance-Based Structural

Table 2 Measures, Items loading and reliability

Measures	FA	T	CA	AVE	CR
Intention to buy the food (BUY) (Adapted from Fiore et al., 2005; Papagiannidis et al., 2013)			0.908	0.704	0.911
I will be buying Parmigiano Reggiano in my next cheese purchase	0.958	n.a			
I am willing to buy Parmigiano Reggiano in the future	0.834	22.387			
Next time I go shopping, I'll buy Parmigiano Reggiano	0.842	25.364			
Intention to physically visit the food production place (VISP) (adapted from Lee et al., 2020b)			0.902	0.659	0.904
I will likely visit a dairy that produces Parmigiano Reggiano in the future	0.855	n.a			
Given the opportunity, I will visit a dairy that produces Parmigiano Reggiano	0.819	20.651			
I will visit a dairy that produces Parmigiano Reggiano	0.935	24.591			
Intention to visit a food production place using VT (VISVT) (adapted from Lee et al., 2020a)			0.951	0.871	0.953
The likelihood that I will take a virtual tour of a Parmigiano Reggiano dairy in the future is high	0.927	n.a			
I am planning to take a virtual tour of a Parmigiano Reggiano dairy in the future	0.969	42.353			
When I can, I will participate in a virtual tour of a Parmigiano Reggiano dairy	0.903	35.215			
Attitude towards the virtual tour (ATTVT) (Lee et al., 2020a) My attitude towards the virtual tour is:			0.977	0.905	0.977
Bad—Good	0.972	n.a			
Negative—Positive	0.975	58.652			
Unfavourable—Favourable	0.951	53.565			
Subjective Norms (SN) (adapted from Choo et al., 2016)			0.942	0.891	0.942
Most people who are important to me would approve my decision to take a virtual tour of a Parmigiano Reggiano dairy	0.925	n.a			
People who are important to me would like me to take a virtual tour of a Parmigiano Reggiano dairy	0.962	52.446			
Perceived Behavioural Control (PBC) (adapted from Choo et al., 2016)			0.915	0.774	0.911
If it depends on me, I'd be sure to take a virtual tour of a Parmigiano Reggiano dairy	0.913	n.a			
I think it is easy to take a virtual tour of a Parmigiano Reggiano dairy	0.829	26.971			

Table 2 (continued)

Measures	FA	T	CA	AVE	CR
I have the resources, time and desire to take a virtual tour of a Parmigiano Reggiano dairy	0.896	33.003			

F.L. = Standardised Factor Loading, T = T-statistic, CA = Cronbach's alpha, AVE = Average Variance Extracted, CR = Composite Reliability, n.a. = not available.

Equation Model (CB-SEM) employing the software Lisrel 8.80 (Jöreskog & Sörbom, 2006). The six constructs were modelled using a two-step approach as recommended by Anderson and Gerbing (1988): a confirmatory factor analysis (CFA—to test the unidimensionality and convergent validity of the constructs) followed by a structural equation model (SEM) to measure path and significance among the latent factors.

The analysis of the psychometric scales included in the theoretical model brings us to assess both convergent and discriminant validity as follows. All measures' factors loadings (Table 2) exhibited a high item-total correlation and indicated their capability to measure the constructs investigated (above 0.70) and are significant (Hu & Bentler, 1999). Values of the Average Variance Extracted (AVE) and Composite Reliability (CR), presented in Table 2, assess the convergent validity of the investigated constructs; both indicators for all the constructs are greater than the thresholds cited in the relevant literature (AVE > 0.5 and CR > 0.7: Fornell & Larcker, 1981).

4.2 Structural model fit

The structural model procedure estimated with the robust procedure suggested by Satorra-Bentler provides a significant Chi-Square ($\chi_{S-B}^2(147) = 365.499$, $p < 0.00$). Similarly, significant is the value for the RMSEA = 0.0611 (p value = 0.0105). Thus, possible problems of multicollinearity may exist. As the Chi-Square is sensitive to the sample size, we analysed the chi-squared ratio. The value indicates that there are no specific problems of multicollinearity as lower than 3 (χ_{S-B}^2/df ratio = 2.486). To confirm the goodness of the model fit, the values of other indexes such as the Comparative Fit Index (CFI = 0.985) and the Normed Fit Index (NFI = 0.975) were calculated, reporting values higher than 0.95 (Hu & Bentler, 1999). Further, the Goodness of Fit Index (GFI = 0.894), higher than its cut-off of 0.8 (Kline, 2005), confirms that the estimated model properly fit the hypothesized theoretical model as higher than 0.80. Finally, the computation of the Standardised Root Mean Square Residual (SRMR = 0.0591) for the common factor model indicated an acceptable model fit (Hu & Bentler, 1999), as the root mean square discrepancy between the observed correlations and the model-implied correlations are close.

4.3 Results of the structural model

The empirical model shows a good predictive ability and a strong explanatory power in defining the intention to visit the Parmigiano Reggiano dairy ($R^2 = 36.5\%$), as well as the intention to buy the Parmigiano Reggiano cheese ($R^2 = 19.9\%$). Thus, the opportunity to experience a virtual tour of the Parmigiano Reggiano dairy is a relevant driver for both dependent variables.

Table 3 displays direct and indirect effects among the latent variables. The first aspect that consumers take into consideration in evaluating the opportunity to experience a virtual tour is their perceived behavioural control ($\beta = 0.731$, $p < 0.01$). Therefore, the third hypothesis is supported. In the context of virtual tours, attitude towards this digital instrument is weakly relevant although positive and significant

Table 3 Structural model results

Path	β	T-value	p value	Hypothesis
Attitude → Intention Virtual Tour	0.06**	2.01	0.04	Supported
Subjective norms → Intention Virtual Tour	0.20	1.33	0.18	Not supported
Perceived behavioural control → Intention Virtual Tour	0.73***	4.62	0.00	Supported
Intention Virtual Tour → Intention to visit	0.46***	8.83	0.00	Supported
Intention Virtual Tour → Intention to buy	0.33***	5.98	0.00	Supported
Sex → Intention to visit	-0.30***	4.56	0.00	Supported
Age → Intention to visit	-0.20***	4.23	0.00	Supported
Educational background → Intention to visit	-0.05	1.00	0.32	Not supported
Sex → Intention to buy PR	-0.26***	3.87	0.00	Supported
Age → Intention to buy PR	-0.14 **	2.76	0.01	Supported
Educational background → Intention to buy	0.02	0.29	0.77	Not supported
Mediation effects				
Attitude → Intention Virtual Tour → Intention to visit	0.03*	1.98	0.05	Supported
Subjective norm → Intention Virtual Tour → Intention to visit	0.08	1.31	0.19	Not supported
Perceived behavioural control → Intention Virtual Tour → Intention to visit	0.30***	4.18	0.00	Supported
Attitude → Intention Virtual Tour → Intention to buy	0.02*	1.90	0.06	Supported
Subjective norm → Intention Virtual Tour → Intention to buy	0.06	1.29	0.20	Not supported
Perceived behavioural control → Intention Virtual Tour → Intention to buy	0.24***	3.78	0.00	Supported

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$ → not significant path

($\beta = 0.063$, $p < 0.04$). Conversely, subjective norms represent an aspect not conditioning consumers' intention to visit the food production place using a virtual tour ($\beta = 0.198$, $p < 0.10$), not supporting H2.

In line with the predictive ability of the SEM technique, the intention to visit the Parmigiano Reggiano dairy using the virtual tour instrument is a positive and significant driver of both the intention to physically visit the Parmigiano Reggiano dairy and the intention to buy the food. Thus, the fourth and the fifth hypotheses are supported as follows: H4: $\beta = 0.457$, $p < 0.01$; H5: $\beta = 0.330$, $p < 0.01$.

Interesting information is provided by the control variables included in the structured model. Young men represent the target of consumers that will be more willing to visit the PR dairy and buy Parmigiano Reggiano cheese after experiencing the virtual tour of the Parmigiano Reggiano dairy. Then, younger people resulted as the most prone to buy PR and visit the dairy pushed by the virtual tour experience. On the contrary, the educational background was found not significant, confirming that the educational level is not relevant in the context of technology acceptance and usage.

To estimate the indirect effects of TPB constructs on the intention to physically visit the dairy and the intention to buy Parmigiano Reggiano, the Sobel test was performed. Results, reported in Table 3, confirm the strong relevance of perceived behavioural control not only on the intention to visit the dairy using the virtual tour, but also indirectly on the intention to visit the dairy physically and the intention to buy the Parmigiano Reggiano cheese. Weak but significant the indirect effect of attitude towards the virtual tour instrument.

5 General discussion

The spread of technological tools and the increasing consumers' access to sophisticated but increasingly accessible technologies, such as VR, are opening up new opportunities for agri-food operators. The increase in food and wine physical tours is progressively supported by the spread of virtual technologies that replicate a seamless tour experience in the digital context. Indeed, thanks to virtual tours, customers geographically distant from the production site may experience the tour in the food or wine production place and when planning their holidays, as well as their food shopping, opting for the place/product experienced during the virtual tour.

5.1 Theoretical implications

From a theoretical point of view, this paper contributes to the consumer behaviour literature by applying the Theory of Planned Behaviour to the virtual tour context. The findings show the great and progressive relevance that emerging technologies are having in influencing consumers' behavioural intentions when interacting with a virtual tour. Although the TPB has been widely implemented in studies investigating consumer behaviour and interaction with online and digital contexts/tools, very limited is the number of studies that have previously implemented the TPB exploring

virtual experiences (e.g., Becerra & Stutts, 2008). To the best of our knowledge, no previous study has applied TPB to virtual tours concerning farms and dairies in which food products are produced. The results of the present study partially confirm the postulated hypotheses. Our findings show that perceived behavioural control in properly managing an innovative technology represents the main reason for individual's intentions, while attitude is less relevant, and subjective norms does not exert any effect. Similar results have been found by Sun et al. (2020) analysing customers' intention to use mobile payments. To this concern, it is possible to infer that when the technology is new and customers are not well acknowledged about its usage, the perceived ability to properly use the technology is determinant in developing consumers' intentions. Further, the present study contributes to the emerging literature exploring the role played by virtual tours in the marketing context, showing its positive impact on both customers' visit intentions and customers' buying intentions. Although an increasing interchange exists between the consumer behaviour discipline and the research on tourism issues, especially in regards to food products, studies aimed at jointly investigating those aspects are still scant. Further, emerging studies are showing how virtual and augmented reality are getting relevant in determining tourists' travel choices (Yung & Khoo-Lattimore, 2019). A recent study in the tourism literature is showing how food products can be a good driver to improve the destination image and attract travellers that want to experience at 360 degrees smells and tastes of their favoured food products (Henderson, 2009). Nevertheless, as assessed by Björk and Kauppinen-Räisänen (2016), pre-trip information is essential to support food tourism. Then, virtual reality and its augmented functionalities can be a powerful instrument to inform consumers and engage them. This study contributes to showing how virtual tours influence visit decisions and it extends the results of previous studies by verifying the role of the VR technologies in improving the food-place path and food tourism.

5.2 Managerial implications

Our findings have relevant implications for managers as well. Limited is the practical knowledge about virtual tours and augmented reality influence on consumer behaviour. Those aspects are becoming increasingly relevant in the current context: the 2020 lockdowns due to the Covid-19 spread and the persistence of the virus presence in the months ahead have pushed consumers towards a rapid digitalization. Thus, the opportunity to let the consumer experience the place where agri-food products are produced may compensate for the lack of mobility and physical visit to the production place, increasing also the level of knowledge on these products. Indeed, the practice of many Parmigiano Reggiano producers that after the 2012 Emilia earthquake let consumers visit their dairy and directly experience the product in the place where it is produced led to an increase in satisfaction, product knowledge and sales (Menozzi & Finardi, 2019). Similarly, when the consumer is not able to physically visit the dairy, he/she may virtually tour the place where the product is produced with similar positive effects on sales. From this perspective, virtual and interactive technologies are an excellent tool to build and extend the relationship

with customers (Papagiannidis et al., 2013). Through the interaction with the virtual environment and eventually virtual guides, customers learn information about the product, its production process, ingredients and their origin and establish a strong bond with the product and with the producer. This is particularly important for food products like the Parmigiano Reggiano cheese, which are encountering difficulties in transmitting to consumers the product value in relation to its price. Thus, in a hypercompetitive global market, being able to be in contact and invite, although digitally, customers in the production site may be a powerful competitive advantage for agri-food producers. Results may be easily extended to other several product categories. At the same time, deploying a reputed local food at a global level and diffusing its knowledge through virtual tours can have positive implications on tourism, enhancing the local area attractiveness and stimulating individuals to reach that area to visit the place in which this food is produced. Though, not only local food producers but also public authorities should then incentive VR tools of local food production places to stimulate tourism.

6 Limitations and future research suggestions

The present study represents a first attempt to theoretically and empirically investigate the role of digital technologies, specifically virtual tours, in promoting and enhancing food experience and buying intentions. However, the novelty of the research topic evidence, on the one hand, some limitations that should be overcome in future research, and on the other hand, some points that should further explored in upcoming research. The study offers an application of the Theory of Planned Behaviour into the context of virtual tours. Nevertheless, next studies should extend the theoretical and empirical model including additional elements that may represent a barrier for a wide usage of the virtual tour, such as interactivity, technology usability and ease to use, perceived risk, system quality, user engagement, tour flow, user enjoyment. In this study, we tried to understand the possible consumer proneness to virtually visit a Parmigiano Reggiano dairy. Nevertheless, it represents a novel and quite limited research area. Future research may compare the VT of the dairy with a winery VT evidencing similarities and contrary findings when different local products are investigated. Further, the proposed model did not explore the possible improved customer knowledge derived from the virtual tour visit. For agri-food products like the Parmigiano Reggiano cheese, enhancing the level of customer knowledge on the valuable and healthy ingredients and the long production process to get the final product is key to be competitive on the market. Further, the proposed model did not explore the possible improved customer knowledge derived from the virtual tour visit. For agri-food products like the Parmigiano Reggiano cheese, enhancing the level of customer knowledge on the valuable and healthy ingredients and the long production process to get the final product is key to be competitive on the market. Besides, as we are acknowledged that the virtual tour offers a multisensory experience, in future studies the sensory stimulations generated by the interaction of the user with the virtual tour's tools should be further explored in order to understand how

the virtual experience may be compared with the real (i.e., physical) experience augmenting (or not) the overall customers' perceptions. Accordingly, future studies should theoretically and empirically investigate how the virtual multisensory augmented experience might affect the buying and visit choices of consumers.

Availability of data and materials Data are available on request.

Code availability Code is available on request.

Declarations

Conflict of interest We declare that the attached manuscript is original, unpublished and is not being submitted elsewhere. No conflict of interest exists for this paper.

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Authors and Affiliations

F. De Canio[1] · E. Martinelli[1] · M. Peruzzini[2] · G. Marchi[1]

E. Martinelli
elisa.martinelli@unimore.it

M. Peruzzini
margherita.peruzzini@unimore.it

G. Marchi
gianluca.marchi@unimore.it

[1] Department of Economics "Marco Biagi", University of Modena and Reggio Emilia, Viale Berengario, 51, 41121 Modena, Italy

[2] Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Via Vivarelli 10, 41125 Modena, Italy