

## RESEARCH ARTICLE

# Impact of COVID-19 pandemic on consumer behavioural intention to purchase green products

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## Abstract

This study examined the fear of COVID-19 pandemic and its impact on consumer behavioural intention to purchase green products. The data was collected from consumers of Malaysia in hypermarkets. A total of 491 respondents were analyzed using the partial least square technique. The results indicated that the fear of the COVID-19 epidemic has a significant impact on health concerns, social media information, intolerance of uncertainty, and personal relevance, which in turn affect consumers' behavioural intention to purchase green products. With a serial mediating effect the results identified that fear of COVID-19 epidemic is associated with behavioural intention to purchase the green product. The findings of this study are crucial for understanding the swings in the green product purchase behaviour due to the ongoing uncertainty of COVID-19 crisis.

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## Introduction

The COVID-2019 pandemic, with its high rate of dissemination and high death rate, has brought the world health community to provide vaccinations and infection control strategies [1–3]. Fear about COVID-19 pandemic, particularly fear of the pandemic affecting loved ones or personal relevance, health concern, social media information, and intolerance of uncertainty are the crucial elements that may reflect consumers' behavioural intention to purchase green products [4], particularly for their healthy life. People's concerns about COVID-19 pandemic are related to various issues [5], for instance, fear of infection might intensify pre-existing mental health conditions or cause acute anxiety reactions [6]. Sun et al. [7] identified that immediate physical contact with a close one from the family or friends who have COVID-19 infection that leads to post-traumatic stress disorder.

The people's different fear about the ongoing uncertainty of COVID-19 pandemics such as fear for important people or loved ones, fear of ignorance, and fear of inaction can increase

people's health concerns [8]. In line with these concerns, people may have behavioural intention to purchase a green product for their health safety, and security. In addition, due to the COVID-19 pandemic, people are paying attention to the environment, ecological products, and organic foods, which influence the changes in private ways of life and values. On account of understanding the significance of green products and the environment, numerous consumers understand that their buying behavioural decisions will affect green products. Customers started to change their ways of life and intended to increase the consumption behaviour of green products. Green products can improve health, and are environmental-friendly by saving resources and reducing harmful materials, contamination, and the utilization of poisonous substances. Compared with traditional products, it is believed that green products might be decomposable, recyclable, and have less impact on the climate [9, 10]. Green products present less risk to the climate and carry high expectations for living standards to consumers and society [11], particularly during and after the COVID-19 diffusion. Thus, this study investigates the impact of COVID-19 pandemic on health concerns of people, social media information, intolerance of uncertainty personal relevance towards consumers' behavioural intention to purchase green products.

Although there is an available vaccine for COVID-19 in the global market, however, people are still concerned about the fear of the COVID-19 pandemic and fear of different panic such as the new 'omicron' virus, which is a thread for their life. Many studies focus on the COVID-19 pandemic and its impact on the tourism industry, food supply, and supply chain management areas [5, 12, 13]. In addition, Degli et al. [14], Brzustewicz and Singh [15], and Yang [16] focused on sustainable consumption behaviour in the Era of COVID-19, while Qi et al. [17] and Qi et al. [18] on green food purchase intention during the COVID-19 pandemic in the different context of the countries. In this study, based on the review of literature, we explore a particular factor fear of COVID-19 pandemic and its impact on health concerns, intolerance of uncertainty, social media information, and personal relevance towards the purchase of green products behaviour in the context of Malaysia, which was ignored in the previous studies. There is a gap between fear of COVID-19 pandemic and human purchasing behavioural intention toward green products, thus, this study aims to investigate the impact of COVID-19 pandemic on health concerns, intolerance of uncertainty, social media information, and personal relevance, which in turn affect consumers' behavioural intention to purchase the green products.

The emergence of COVID-19 has significantly affected the global food systems of producers, processors, and consumers, at different levels [19, 20]. The people's hygiene behaviours [21] and consumption patterns have changed due to the COVID-19 epidemic [22, 23]. The COVID-19 pandemic may move consumer behaviours toward a more ecological and nutritious direction and stimulate demand for local food items due to food safety concerns [22]. On the other side, many people had to quarantine at home during the COVID-19 pandemic, which led to a significant level of emotional distress [24]. In addition, the broad media coverage of the rapid increase in disease and deaths and the lack of available diagnostic tests have extremely spread panic among the general people [25].

Doszhanov and Ahmad [26] believed that consumers' behavioural intention toward purchasing green products can be influenced by consumers' health concerns and social media information due to the ongoing uncertainty of the COVID-19 pandemic. According to Xie et al. [20], the COVID-19 crisis changed consumers' perceptions and attitudes about organic food due to its healthier properties resulting in a change in customers' future diets. The COVID-19 pandemic's longevity is unknown in society. Rahman et al. [27] indicated that green products are healthier, safer, and sustainable properties thus, additional data and information are needed to investigate the impact of COVID-19 pandemic on consumers'

behavioural intention to purchase green products particularly for long-term health concerns due to the ongoing uncertainty of the pandemic.

## Review of literature

### Underpinning theory

This study uses the concept of pathogen-stress theory [28], and the theory of planned behaviour (TPB) [29] to evaluate the impact of COVID-19 pandemic on consumers' behavioural intention to purchase green products. The concept of the pathogen-stress theory is used for evaluating the impact of COVID-19 pandemic on health concerns, intolerance of uncertainty, social media information about the COVID-19 pandemic, and personal relevance. Pathogen-stress theory emphasizes human behaviours and solves societal issues. Meleady et al. [30] explored the influence of pathogen threat in the context of Covid-19 epidemics. TPB is not only considered the attitudes toward specific behaviour. In this study, the concept of TPB is used for measuring the consumers' behavioural intention to purchase green products due to the uncertainty of the COVID-19 pandemic. Qi and Ploeger [31] applied TPB for investigating Chinese consumers' green food purchase intention during the pandemic. Generalizing the concept of pathogen-stress theory and TPB, we explore the fear of COVID-19 epidemic and its impact on consumer behavioural intention towards purchasing green products during and after the pandemic. The findings of this study have important practical and theoretical consequences for various stakeholders, including academicians, green product manufacturers, marketers, managers, and regulators. The study outcomes may help stakeholders to understand the critical role of the COVID-19 pandemic and consumers' behavioural intention to purchase green products for a healthier life, particularly due to the uncertainty of the COVID-19 pandemic.

### Fear of COVID-19 pandemic

Beyond reality, the fear of COVID-19 epidemic is associated with hedonic and utilitarian motives [32]. According to Tannenbaum et al. [33], and Witte [34], fear appeals refer to scaring individuals by resending awful outcomes of ignoring a particular caution [35]. Fear is a subjective idiosyncrasy-based emotion. This study explores the impact of fear of COVID-19 pandemic on consumers' health concerns, intolerance of uncertainty, personal relevance, and social media information about the ongoing uncertainty of COVID-19 epidemic. The fear of COVID-19 pandemic may be segmented into fear and danger control. Fear control guides emotional responses and danger control leads to adaptive behaviour to avoid threats and risks. Moreover, the impact of the COVID-19 epidemic on daily life and emotional disorders caused significant changes in consumers' consumption behaviour. For instance, Barnes et al. [34], indicated the uncertainty of the COVID-19 crisis whereas buyers could presume anxious behaviour and buy things on impulse because of fears. Sun et al. [7] identified that due to the fear of the COVID-19 pandemic as well as the universal environmental crisis which is alarming both human health and standards of living and as a result consumer will focus on more interest in green products.

From the scientific literature, numerous plausible predictors such as psychological risk-related factors such as health concerns, and social media information about the panic of COVID-19 may raise fear among the people [36]. Healthcare system overload and healthcare concerns may mislead normal or harmless medical signs and assume that one has a dangerous illness [37, 38]. Blakey and Abramowitz [39] and Wheaton et al. [40] reported that students are concerned with the increasing anxiety of the Swine flu outbreak and the Zika virus spread from 2015–2016. In line with this aspect, we believe that fear of a COVID-19 pandemic could

affect health concerns during the COVID-19 pandemic. Besides this, buying green products could enhance customers' well-being and it also inspires the growth of green products industries, especially in this uncertain COVID-19 crisis moment [41]. Therefore, consumers are more focused and pay attention to safe food items and healthy life in order to protect their life from COVID-19 epidemic.

Intolerance of uncertainty can be regarded as a potential psychological vulnerability factor, which may be demonstrated as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" [42]. Intolerance of uncertainty can be connected to fear of the coronavirus, considering that there is indeed a great deal of uncertainty in the existing coronavirus environment. Health concerns are linked to a higher intolerance of uncertainty [42–44]. Social networking sites or social media information can spread information about COVID-19 pandemic to general people [45]. A recent study examining general public awareness and attitudes toward COVID-19 in the U.S. and the U.K. revealed various misconceptions and misinformation on social media [46]. Many people believed in social media news. Inaccurate social media information about the COVID-19 pandemic may result in psychological discomfort and undesirable consequences for a health concern, intolerance of uncertainty, social media information regarding the pandemic, and personal relevance or a loved one's infection of COVID-19 pandemic. Moreover, information of social media regarding the uncertainty of COVID-19 that may also reflect the customers' psychological desire to buy green products [47], because the information on social media on green products during the crisis of COVID-19, may increase the anxiety and fear among consumers.

It is necessary to assess if the threat is personally meaningful to oneself or their loved one [48] for the threat of the COVID-19 pandemic. People are concerned if the person is more personally vulnerable, for example, if the health of a loved one is worse or threatened by the family, such as grandparents. Fear of the virus can also be anticipated by a person's infection from other sources. In health concerns, infection is a common indicating factor [49, 50]. The greater personal relevance of the threat to oneself and loved ones can increase coronavirus fear. This study investigates the impact of COVID-19 pandemic on health concerns, social media information about the COVID-19 pandemic, intolerance of uncertainty of COVID-19 pandemic, and personal relevance or loved one's concern about the infection of COVID-19 pandemic from family members. Thus, we postulated that:

**H1:** Fear of the COVID-19 pandemic has a significant impact on (a) healthcare concerns, (b) social media information, (c) intolerance of uncertainty, and (d) personal relevance.

## Healthcare concern

Healthcare concern implies that an individual is inclined to misinterpret common or mild health symptoms and imagine that the person has serious diseases [37, 38]. The COVID-19 pandemic and different virus such as 'Omicron' has been rising gradually, which increases pressure on healthcare concerns. COVID-19 affects people's lifestyles and will have an impact on healthcare in the near and long future. Healthcare concern means that an individual is inclined to misinterpret common or mild health symptoms and imagine that the person has serious diseases [37, 38]. However, during the pandemic, people see the low quality of healthcare systems in many countries as a threat to their healthcare wellbeing [51]. The world's economics and medical systems have generated a great deal of health concern, stress, and insecurity in people all around the globe [52, 53]. Previous studies have found a significant link between the consumption of nutritious meals and customer purchasing habits [54].

Consumers' risk perceptions may affect their purchasing intentions while purchasing organic food during a pandemic [55]. Consumers believed that natural and organic items are more genuine than other non-organic food items [56]. Consumers are more focused on their health security and safety; thus, they are more prone to purchase green products in the uncertainty of the outbreak. In this study, we proposed that:

**H2:** Healthcare concern has a significant impact on consumers' behavioural intention to purchase green products during the COVID-19 pandemic.

### **Social media information**

Social media information in the aspect of COVID-19 pandemic which refers to anyone can get a limitless stream of COVID-19 news, exchange information, knowledge sharing on different sorts of virus, observations, and individual thoughts and emotions regarding the COVID-19 epidemic through various types of digital and social media platforms [57, 58]. Previous studies have shown that green food information comes mostly from online or mass communication and it has a significant impact on consumers' behavioural intention to purchase organic food and products [59, 60]. Xie et al. [20] reported that there has always been some unfavorable news on the internet regarding adulterating green food and not meeting standards, which considerably enhanced the respondents' fears and anxieties. Moreover, factors that affect consumer fear of buying products during the uncertainty of Covid-19 on social media platforms were authorities' communication, universal rationale, product inaccessibility resilience, buying as persuasion, uncertainties and lack of confidence proof, and professional opinion [53]. The reliable information and favourable content on social networking sites can reflect consumer decisions for purchasing green products. Ali Taha et al. [61] reported that buyers considerably influence purchasing of green products via social networking platforms. Their findings also revealed that there was a relationship between the usage of social media and the e-shop purchasing behaviour during the COVID-19 pandemic, that are advertised on social media. Thus, we suggested that:

**H3:** Social media information significantly impacts consumers' behavioural intention to purchase green products during the COVID-19 pandemic.

### **Intolerance of uncertainty**

Intolerance of uncertainty can be regarded as a psychological vulnerability factor, which can be defined as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" [42]. In this study, intolerance of uncertainty refers to the uncertain situation of the COVID-19 pandemic that may affect people's behavioural thinking to purchase a green product for protecting their virus and healthy life. The link beyond the intolerance of uncertainty of the COVID-19 crisis, social anxiety disorder, and obsessive-compulsive disorder are linked to a higher intolerance of uncertainty [42, 44]. Fear of COVID-19 seems to reflect a common tendency to have calamitous feelings, where health concerns and intolerance of uncertainty are concerned with health-relevant matters and the circumstances of uncertainty. Those views and feelings of uncertainties could be reflected in other human psychological behaviour such as purchasing healthy and organic green food. Schmidt et al. [62] investigated whether high intolerance of uncertainty was accompanied by an increase in buying quantities but not buying frequency; anxiety trait has been closely linked to the intolerance of uncertainty. Their findings also implied that people who had gathered a large amount

of information on the COVID-19 epidemic preferred to purchase in higher quantities products. The consumer with a high level of intolerance of uncertainty of the COVID-19 pandemic may increase behavioural intention to purchase green products and increase the purchase quantities [62]. Therefore, we have postulated that:

H4: Intolerance of uncertainty significantly impacts consumers' behavioural intention to purchase green products during a COVID-19 pandemic.

### Personal relevance

Personal relevance refers to the individual's or loved one's COVID-19 positive case that may affect other family members due to the COVID-19 pandemic. In addition, personal relevance refers to the degree to which information is considered appropriate to one's specific condition and can also affect a statement's persuasion under certain mood conditions. The previous studies indicated that involving an individual with a health problem might affect the influence of message framing on behaviour [63–65]. It is necessary to examine if the risk is personal, for the individual or their loved ones [48]. If an individual feels greater personal harm during the COVID-19 pandemic (e.g., due to overall health becoming worse) or a danger to friends and families, one would predict higher concern and anxiety (e.g., grandparents). Personal relevance and stress were also discovered to show a substantial impact on purchasing intentions and actual purchase behaviour [66, 67]. Mehta and Chahal [68] discovered that the association between personal relevance and consumer readiness to buy products during COVID-19 was favourable. On the contrary, purchasing behaviour between utilitarian and hedonic products with nutrition benefits could be motivated by individual and behavioural characteristics such as stress, anxiety, and depression [69]. Su et al. [70] found the significant link between intra-personal and shopping behavior at retailers practicing sustainable grocery packaging. In addition, Chen et al. [71] identified that during the uncertainty of the outbreak individual behavioural intention on purchasing green products was influenced by buying attitude, social influence, green product orientation, green product literacy, and their outcome is also mediated between personal behavioural intention and continue to purchase green products. Thus, this study has proposed the following hypothesis:

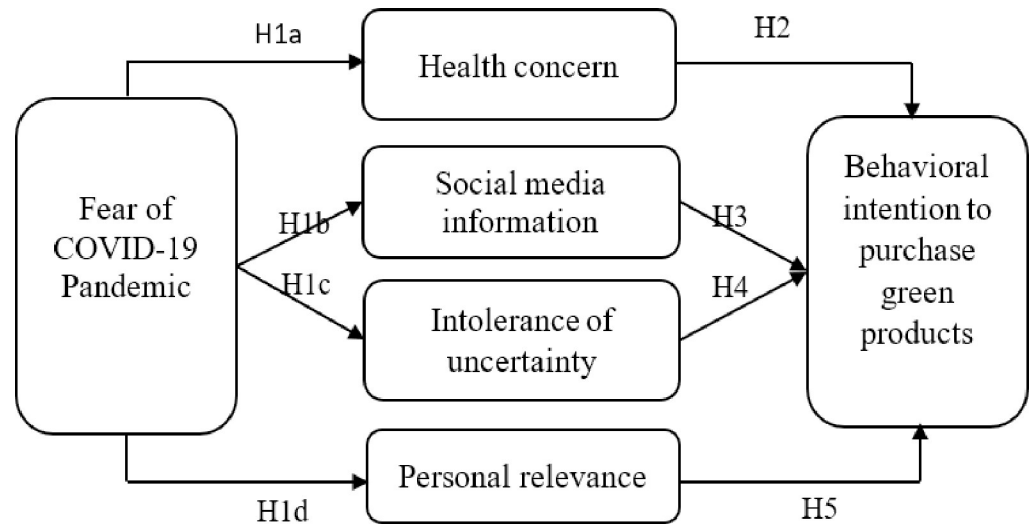
H5: Personal relevance significantly impacts consumers' behavioral intention to purchase green products during the COVID-19 pandemic.

Based on the underpinning theory and review of literature, we have proposed the conceptual model (Fig 1).

## Methodology

### Sample size and data collection

The data was collected from the customers using social media platforms through online advertisements, such as LinkedIn, Facebook, Twitter, WeChat, and WhatsApp. In this study, the target respondents' emails, WhatsApp, LinkedIn, and Facebook were collected in visiting the hypermarkets in Kuala Lumpur and Kota Bharu areas in Malaysia. A structured questionnaire was developed and the initial version was revised based on the comments and suggestions of four expert academics who have knowledge about green products and services. Before distributing the final survey, a pre-test study was conducted with five business professionals that gave inevitable adjusting chances to create an instructive, clear, and good-structured survey questionnaire.



**Fig 1. Conceptual model.**

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The target respondents were politely approached to participate in this study. A google form link of the questionnaire was sent to the potential respondents in which a cover letter was attached and clearly indicated the purpose of the study. Participation was entirely voluntary and ensured that their identities would be kept strictly confidential and would remain anonymous. The survey data were analyzed in aggregate forms and used only for academic purposes. The Ethics Committee approved this study by the University of Malaysia's Faculty of Entrepreneurship and Business. A personal computer/laptop, tablet, or smartphone might be used to complete the online survey. The questionnaire included 30 open-ended questions and was completed within about 10–15 minutes.

Between May and July 2021, 700 people gave their consent to take part in this study. The data were collected using a cross-sectional design as the respondents of this study were different individual consumers of hypermarkets in Malaysia. Nevertheless, 209 people did not complete the survey, maybe they were engaged in shopping or other activities. As a result, the final sample included 491 people, with a completion rate of 70.14%.

In this study, employees of hypermarkets were excluded to reduce the sampling bias. Non-response bias was tested using the concept of Armstrong and Overton [72]. The early respondents to the studies were contrasted and the late respondents. We compared the responses from the early and late participants to the study and identified no measurably significant contrasts ( $p > 0.05$ ). Moreover, the high response rate of 70.14% in this study implied the respondents were likely to provide the information, which might be a solution to non-response bias [73]. The study reduces the social desirability bias which signifies the participant's tendency to be motivated by filling in the survey from others, which may affect the validity of the questionnaire [74]. To reduce response bias, this study used three distinct ways to promote privacy and obscurity. Firstly the participants of the survey were hidden their background, secondly, this survey investigation ensured the confidentiality of the information, and thirdly, the participants were politely approached to fill in the questionnaire, which indicated that there was no response bias.

This study has a minimal sample size based on the computation of G\*Power 3.1. We planned to enroll at least 138 respondents based on the results with 5 predictors and an effect size of 0.15 since this would give sufficient statistical power (0.95). We planned to enroll at

least 138 respondents based on the results with 5 predictors and an effect size of 0.15 since this would give sufficient statistical power (0.95). According to Reinartz et al. [75], the minimal sample size for the partial least square (P.L.S.) method is 100. In this study, we have collected 491 valid responses from the consumers, exceeding the minimum sample size requirement. Thus, the sample size of this study is acceptable and adequate for the analysis.

## Materials and procedure

A five-item questionnaire constructed specifically for this study was used to assess fear of a COVID-19 pandemic modified from Bitan et al. [76] and Mertens et al. [47]. These elements were chosen because they connect to several aspects of fear, including subjective sensations (worrying), selective biases, and avoidance strategies. Five items adapted from Bitan et al. [76] and Mertens et al. [47] were used to assess consumers' worries about their health concerns. Social media information is evaluated by using five items modified from Mertens et al. [47]. To assess the intolerance of uncertainty, five items were modified from Bitan et al. (2020). Five items were adopted from Bitan et al. [76] and Mertens et al. [47] to evaluate the personal relevance, and consumers' behavioural intention to purchase the green product was evaluated using five items modified from Chen and Deng [77]. On a 5-point Likert scale (from 1 to 5, 1 = strongly disagree, 5 = strongly agree), respondents were asked to score their level of agreement with each statement.

The common method variance (CMV) in scientific methods of social science measurement is based on a single source of data and a single point of time [78]. Podsakoff et al. [78] suggested using a single-factor test by Fuller et al. [79] in the study constructs. Harman's single-factor test showed that there was no CMV because the highest component accounted for only 22.518% of the variance, far below the required limit of 50%.

## Data analysis

**Demographic information.** Women made up the majority of our sample (47.5%), and a significant proportion of the respondents lived in cities (81.6%) (Table 1 provides a detailed breakdown of our sample's demographics). The results suggest that a larger percentage of respondents (38.0%) were between the ages of 31 to 40. Regarding the respondents' marital status, the results revealed that the majority of them were married (59.7%). A low S.S.C. was obtained by 11.1% of the sample, while a bachelor's degree was identified in 37% sample. The majority of the participants said they were working in healthcare (76.7%). The findings are shown that the majority of respondents were privately employed (40.2%), followed by government-employed (33.6%), and unemployed (26.2%). Respondents reported that most of the caregiver during Covid-19 was parents (35.7%), which had slightly low family members (34.2%). In terms of the background of Covid-19, the findings revealed that 38% had no diseases of Covid-19. Approximately 98.6% reported that they had no Covid-19 death in the family, 94.2% reported that they had no Covid-19 infected in their family, 5.8% reported that Covid-19 had infected their family, and 1.4% reported that they had Covid-19 death in the family. The majority of the respondents purchased green products weekly (78.3%) (Table 1 provides a detailed breakdown of our sample's demographics).

## Measurement model analysis

SmartPLS 3.0 software is used through the structural equation modelling approach to assess the model of this study, and reliability analysis. The findings revealed that composite reliability (C.R.) ranged from 0.852–0.912, while the accepted threshold value is  $>0.70$  (Hair et al., 2016). It implies that all items are sufficient to represent the respective constructs and that all



**Table 1. Demographic information.**

Characteristics	%	Characteristics	%
<b>Gender</b>		<b>Employment status</b>	
Male	47.5	Unemployed	26.2
Female	52.5	Government employed	33.6
<b>Age</b>		Private employed	
Below 20	12.4	<b>Caregiver during Covid-19</b>	
20–30	34.2	Family members	34.2
31–40	38.0	Spouse	23.1
41–50	11.9	Parents	35.7
51–60	2.3	Others	7.0
Above 60	1.2	<b>Background of Covid-19</b>	
<b>Marital status</b>		No diseases	38.7
Single	38.2	Covid-19 exist	10.0
Married	59.7	Not sure	51.3
Others	2.1	<b>Family member infected of Covid-19</b>	
<b>Education</b>		No Covid-19 infected in family	94.2
S.S.C	11.1	Covid-19 infected in family	5.8
H.S.C/Diploma	19.2	Family member dying of Covid-19	
Bachelor degree	37.0	No Covid-19 death in family	98.6
Master degree	31.2	Yes Covid-19 death in family	1.4
PhD	1.5	<b>Residency status</b>	
<b>Work in healthcare</b>		Urban	81.6
Yes	23.3	Rural	18.4
No	76.7	<b>Purchasing green products</b>	
		Weekly	78.3
		Monthly	21.7

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constructs are reliable. The Cronbach's alpha ( $\alpha$ ) values are ranged between 0.788 and 0.872, and rho\_A is reflected in the range between 0.823 and 0.872 [80], the threshold value is  $>0.70$ , satisfying the internal consistency reliability. The factor loading (F.L.) ranged from 0.719–0.877, which showed sufficient internal reliability [81]. The average variance extracted (AVE) for all variables is shown in ranging from 0.535 to 0.723. It suggests that the constructs explained adequate convergent validity [80].

To identify the collinearity problem in the model, the variance inflation factor (V.I.F.) is assessed whether factors are over exceeded correlation (multicollinearity), which could affect the model and p-values. Hair et al. [82] postulated that collinearity issues may occur if V.I.F. values exceed 5. The findings of the variance inflation factor (V.I.F.) ranged between 1.318 and 2.607, indicating that multicollinearity issue does not exist in this study (Table 2).

Third, in a greater way to confirm discriminant validity, we also check the Heterotrait-Monotrait Ratio (HTMT). The HTMT scores lower than 0.85 is considered satisfactory discriminant validity [83]. The findings reveal that all HTMT values of correlations have lower than 0.85, which indicates that all variables have satisfactory discriminant validity (Table 3).

We examine the cross-factor loadings to evaluate the discriminant validity of the measurement model. Table 4 shows the results of cross-factor loadings. Hair et al. [82] suggested that all indicators must have higher loadings to their respective variable. The findings indicate that all indicators have the highest value on their respective constructs; thus, it ensures the attainment of discriminant validity of the existing study.

Table 2. Convergent validity.

Factors, items and sources	V.I.F.	FL	$\alpha$	rho_A	CR	AVE
<b>Fear of COVID-19 Pandemic</b>						
I'm quite concerned about the consequences of the Covid-19 outbreak (cov1)	2.300	0.801	0.872	0.872	0.912	0.723
I'm taking efforts to avoid becoming infected (e.g., washing hands, avoiding contact with people, avoiding door handles) (cov2)	2.526	0.850				
I'm frightened of dying as a result of the coronavirus (coc3)	2.427	0.877				
In terms of my own health, I believe the virus is far more deadly than the regular flu (cov5)	1.695	0.871				
<b>Intolerance of Uncertainty</b>						
Unforeseen events of Covid-19 pandemic upset me greatly (ic1)	1.318	0.752	0.788	0.808	0.852	0.535
The unexpected Covid-19 pandemic annoys me since I don't have all the information I require (ic2)	1.560	0.700				
The unknown effects of the Covid-19 epidemic prevent me from enjoying a positive life (ic3)	1.467	0.735				
Many situations during the Covid-19 outbreak make me worry (ic4)	1.612	0.719				
I do not know how long I should wait for the recovery of the pandemic (ic5)	1.680	0.749				
<b>Social Media Information</b>						
I look up any information regarding the Covid-19 outbreak through the source of the regular newspapers/websites/T.V. news (sm1)	1.629	0.747	0.841	0.845	0.887	0.611
I look up information about the Covid-19 outbreak through the source of social media (e.g. Facebook, Twitter, and Instagram) (sm2)	1.780	0.781				
When I'm looking for new information, I pay close attention to the media outlet's source (sm3)	1.826	0.801				
I'm not sure if the government is offering us with all of the information we need concerning the Covid-19 outbreak. (sm4)	1.967	0.819				
I become frightened or worried when I see news and stories regarding the coronavirus on social networking sites (sm5)	1.619	0.759				
<b>Healthcare concern</b>						
I'm concerned about my wellbeing (hc1)	1.562	0.745	0.846	0.848	0.890	0.619
I spend a significant amount of time thinking about my health (hc2)	1.678	0.759				
I am constantly conscious of aches and pains in my body (hc3)	2.030	0.819				
I feel as much distress as most others (of my age) (hc4)	2.069	0.821				
I'm scared of getting infected by the virus and dying as a result (hc5)	1.766	0.788				
<b>Personal Relevance</b>						
My major fear regarding the COVID-19 is how longer I would be able to endure isolation (pr2)	1.540	0.778	0.821	0.823	0.881	0.650
Some people are underestimating the Covid-19 spread and the impact it has on us (pr3)	1.532	0.792				
I assume that individuals I care about (for example, grandparents) are at risk of becoming infected and critically ill as a result of the coronavirus outbreak (pr4)	2.420	0.833				
Ultimately, I think I can minimize or prevent coronavirus infection (e.g., by limiting social contact, washing hands, wearing a face mask, etc.) (pr5)	2.350	0.822				
<b>Behavioural intention</b>						
I am more likely to purchase green products (pg1)	2.394	0.767	0.848	0.851	0.891	0.621
I buy green products for my healthy life (pg2)	2.607	0.802				
I am interested in spending additional money on green products (pg3)	1.748	0.796				
The green consuming product brings me more benefits for health than non-green purchase products (pg4)	1.881	0.782				
My possibility of purchasing green products is very high during COVID-19 pandemic (pg5)	1.967	0.793				

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## Structural model analysis

It is crucial to determine the accuracy of the model's predictions (coefficient of determination R-square), therefore, the proportion of variance explained was used in the existing study. The results revealed that the R-square value of health anxiety, intolerance of uncertainty, personal relevance, and social media information was 0.548, 0.485, 0.376, and 0.306 explained by the fear of COVID-19 pandemic. The R-square value of consumers' behavioural intention to purchase green products was 0.580. The structural model was tested using bootstrapping [84], to

**Table 3. Discriminant validity (Heterotrait-Monotrait Ratio) (HTMT).**

	COVID-19	GP	HC	IC	PR	SM
Fear of COVID-19 Pandemic						
Behavioural intention	0.736					
Health concern	0.709	0.753				
Intolerance of Uncertainty	0.712	0.593	0.733			
Personal Relevance	0.645	0.812	0.686	0.522		
Social Media Information	0.811	0.723	0.502	0.744	0.630	

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determine the hypothesis relationship among the constructs. The result revealed that the fear COVID-19 pandemic has high significant impact on health anxiety ( $\beta = 0.741, p < 0.01$ ), social media information ( $\beta = 0.696, p < 0.01$ ) intolerance of uncertainty ( $\beta = 0.613, p < 0.01$ ), and personal relevance ( $\beta = 0.553, p < 0.01$ ), thus, hypothesis H1a, H1b, H1c, and H1d were accepted. The result also highlighted that health anxiety ( $\beta = 0.193, p < 0.01$ ), social media

**Table 4. Cross loadings.**

Items	COVID-19	GP	HC	IC	PR	SM
Coiv5	0.801	0.566	0.656	0.548	0.459	0.640
Cov1	0.850	0.480	0.600	0.510	0.431	0.560
Cov2	0.877	0.541	0.635	0.527	0.483	0.580
Cov3	0.871	0.581	0.621	0.497	0.503	0.580
Gp1	0.423	0.767	0.486	0.378	0.523	0.467
Gp2	0.501	0.802	0.492	0.364	0.449	0.475
Gp3	0.598	0.796	0.612	0.509	0.572	0.574
Gp4	0.460	0.782	0.441	0.349	0.558	0.453
Gp5	0.522	0.793	0.487	0.451	0.593	0.459
Hc1	0.658	0.445	0.745	0.512	0.464	0.647
Hc2	0.513	0.470	0.759	0.472	0.482	0.601
Hc3	0.591	0.573	0.819	0.514	0.442	0.623
Hc4	0.572	0.522	0.821	0.472	0.471	0.665
Hc5	0.571	0.516	0.788	0.512	0.427	0.687
Ic1	0.554	0.583	0.617	0.752	0.527	0.631
Ic2	0.379	0.268	0.312	0.700	0.226	0.353
Ic3	0.479	0.342	0.493	0.735	0.303	0.476
Ic4	0.365	0.313	0.366	0.719	0.292	0.358
Ic5	0.398	0.300	0.416	0.749	0.246	0.404
Pr2	0.522	0.505	0.538	0.489	0.778	0.506
Pr3	0.479	0.639	0.544	0.502	0.792	0.507
Pr4	0.377	0.531	0.385	0.200	0.833	0.350
Pr5	0.386	0.526	0.375	0.268	0.822	0.342
Sm1	0.496	0.409	0.631	0.474	0.335	0.747
Sm2	0.565	0.425	0.623	0.519	0.420	0.781
Sm3	0.546	0.581	0.661	0.482	0.492	0.801
Sm4	0.561	0.541	0.645	0.470	0.481	0.819
Sm5	0.551	0.446	0.645	0.548	0.354	0.759

**Abbreviation:** COVID-19 (Fear of COVID-19 pandemic), G.P. (Behavioural intention to purchase green products), H.C. (Health concern), I.C. (Intolerance of Uncertainty), P.R. (Personal Relevance), S.M. (Social Media Information).

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Table 5. Path coefficients.

HY	Relationship	Beta	SD	t-value	F <sup>2</sup>	Q <sup>2</sup>	R <sup>2</sup>	P-Values	Decision
H1a	COVID-19 -> HC	0.741	0.030	24.834	0.215	0.377	0.548	0.000	Accepted
H1b	COVID-19 -> SM	0.696	0.034	20.741	0.940	0.311	0.485	0.000	Accepted
H1c	COVID-19 -> IC	0.613	0.043	14.171	0.603	0.219	0.376	0.000	Accepted
H1d	COVID-19 -> PR	0.553	0.052	10.686	0.440	0.213	0.306	0.000	Accepted
H2	HC -> GP	0.193	0.052	3.705	0.125	0.359	0.580	0.000	Accepted
H3	SM -> GP	0.163	0.053	3.096				0.002	Accepted
H4	IC -> GP	0.093	0.042	2.207				0.040	Accepted
H5	PR -> GP	0.445	0.041	10.964				0.000	Accepted
Mediating effect		Beta	SD	t-value	LL	UL			
COVID-19 -> HC -> GP		0.143	0.039	3.663	0.299	0.517		0.000	Mediating
COVID-19 -> SM -> GP		0.114	0.037	3.034	0.319	0.621		0.002	Mediating
COVID-19 -> IC -> GP		0.057	0.026	2.166	0.179	0.291		0.031	Mediating
COVID-19 -> PR -> GP		0.246	0.035	7.050	0.128	0.310		0.000	Mediating

Abbreviation: HY = Hypothesis, SD = Standard deviation, UL = Upper level, LL = Lower level.

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information ( $\beta = 0.163, p < 0.01$ ) intolerance of uncertainty ( $\beta = 0.093, p < 0.05$ ), and personal relevance ( $\beta = 0.445, p < 0.01$ ), thus, hypothesis H2, H3, H4, and H5 were accepted.

The F-square ( $f^2$ ) values are computed using the effect size with the R-square ( $R^2$ ). The f-square value of 0.35 reflects a high effect size, while 0.15 and 0.02 are considered medium and small effect sizes [85]. Accordingly, the findings (Table 5) indicated that F-square 0.940, 0.603, 0.440 of social media information, intolerance of uncertainty, and personal relevance show a high effect size, while F-square 0.215, 0.125 of COVID-19 pandemic, and behavioural intention to purchase green product point out to medium effect size. Also, the predictive relevance is calculated using the Q-square ( $Q^2$ ) value. The findings revealed that the  $Q^2$  values for health anxiety 0.377, social media information 0.311, intolerance of uncertainty 0.219, personal relevance 0.213, and behavioural intention to purchase green products 0.359 were all larger than zero [86] which indicates the predicative relevance of consumers' behavioural intention to purchase the green product.

The study examines the mediating effect and the results indicated that health anxiety ( $\beta = 0.143, p < 0.01$ ), social media information ( $\beta = 0.114, p < 0.01$ ), intolerance of uncertainty ( $\beta = 0.057, p < 0.05$ ), and personal relevance ( $\beta = 0.246, p < 0.01$ ) mediate the relationship between fear of COVID-19 pandemic and behavioural intention to purchase green product. Social media information mediates the effect of fear of COVID-19 pandemic on behavioural intention to purchase the green product. Consumers' intolerance of uncertainty mediated the effect of fear of COVID-19 pandemic. The results of indirect effect show that ([LL = 0.299, UL = 0.6517], [LL = 0.319, UL = 0.621], [LL = 0.179, UL = 0.291], and [LL = 0.128, UL = 0.310]), which indicating the mediating effect of this study (Table 5).

### Importance-performance matrix

The importance-performance matrix (I.P.M.) identified that the fear of the COVID-19 pandemic is the most crucial factor for the consumers' behavioural intention to purchase green products (0.559; 77.238) during the COVID-19 epidemic. The next most significant factors for consumers' behavioural intention to purchase green products were the intolerance of uncertainty (0.173; 72.913), health anxiety (0.193; 65.678), social media information (0.163; 65.654), personal relevance (0.445; 64.625). Performance and total effects are shown in Table 6.

**Table 6. Performance and total effects.**

Characteristics	Target Construct: behavioural intention to purchase green products	
	Total Effect	Performance
Fear of COVID-19 Pandemic	0.559	74.238
Health Concern	0.193	65.678
Intolerance of Uncertainty	0.173	72.913
Personal Relevance	0.445	64.625
Social media Information	0.163	65.654

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## Discussion

This research has investigated the consumers' fear of COVID-19 impact on health anxiety, social media information, intolerance of uncertainty, and personal relevance towards behavioural intention to purchase green products during the pandemic. Zhuang et al. [10] conducted an empirical investigation on green purchase intention and their results indicated that green perceived value is positively related to green purchase intention. This study identified that the fear of the COVID-19 pandemic has a high noteworthy influence on health anxiety, social media information, intolerance of uncertainty, and personal relevance, reflecting consumers' behavioural intention to purchase green products. These factors have a higher value because of their significance with a 95% confidence interval and positive relationship with behavioural intention to purchase green products. All these factors contribute to the reduction of health risks and awareness of consumers during the post-COVID-19 epidemic. Customers are well aware of their health; thus, they willingly purchase green products for their health safety and security during the ongoing uncertainty of the pandemic.

Customers are motivated by their perceived value of the products and benefit from the products about good health and utility they gain while purchasing green products [87]. At the point when customers think about the value, safety, and security of green products and the eco-friendly environment from purchasing green products, they become more ready to purchase green products and services. Along these lines, enterprises need to expand the green products and consumers' perceived value of green products and services which can reduce the fear of the COVID-19 pandemic in terms of health and uncertainty, personal relevance, and social media information.

Based on the findings, it is observed that the fear of the COVID-19 pandemic has a highly significant impact on health concerns; thus, consumers are more willing to purchase green products for their health safety. The impact of ongoing uncertainty of COVID-19 diffusion on people's health concerns towards purchasing green products implies that enterprises can ensure to customers the environmental protection and health safety and security that green product offer. If customers are aware of health concerns and believe in environmental protection resulting from green consumption behaviour, customers' green purchase behaviour will increase [10]. This finding is relevant to Bitan et al. [76] study, and Qi and Ploeger [31] investigated the fear and effect of COVID-19 pandemic and health risk or health-conscious perceptions. There is an important link between COVID-19 fear and information in social media (e.g. information regarding the COVID-19-19 epidemic, wonder whether the government is providing accurate information about COVID-19 crisis, and nervous or anxious about pandemic) that reflect consumers' behavioural intention to purchase green products during and post-pandemic. This finding is relevant to Ali Taha et al. [61] reported that consumers have a considerable influence in purchasing green products via social media information during the COVID-19 pandemic. Mertens et al. [47] found that increased fear reflects social media use.

There is a positive and significant relationship between fear of the COVID-19 pandemic and intolerance of uncertainty, reflecting consumers' behavioural intention to purchase green products. It implies that the increase of intolerance of pandemic uncertainty greatly influences consumers' behavioural intention to purchase green products. This finding is associated with Bitan et al. [76], and Mertens et al. [47] measured the fear of the COVID-19 pandemic and indicated that the outbreak of COVID-19 is causing increased fear and uncertainty.

The fear of the COVID-19 pandemic has a significant influence on personal relevance. It implies that increased fear of the pandemic was connected to personal relevance and perceived risks for loved ones. Fear of COVID-19 pandemic increases the concern about the isolated, infection, limiting social contact, washing hands, and wearing a facemask. This finding is related to Mertens et al. [47], and Bitan et al. [76] investigated the coronavirus outbreak and identified that fear of COVID-19 pandemic increases the risk for loved ones. This study revealed that consumers' health concerns, social media information, intolerance of uncertainty, and personal relevance are mediated by the relationship between fear of the COVID-19 pandemic and behavioural intention to purchase the green product. The fear of ongoing uncertainty of COVID-19 pandemic mainly reflects customers' stronger intention to purchase green products, thus, enterprises should provide customers with reliable information about the opportunities and benefits of green products. Accurate and reliable information can play a crucial role in the consumer's decision-making process and can increase confidence in their intention to purchase green products. These results suggest that the fear of the COVID-19 pandemic reflects health concerns, intolerance of uncertainty, social media information, and personal relevance, which in turn reflect consumers' behavioural intention to purchase the green product during the post-pandemic situation. Customers who pay attention to health concerns, have relevant knowledge of uncertainty of pandemics, personal relevance, social media information, and believe in the ecological environment, they more likely to purchase green products.

### Theoretical and practical implications

Based on the results of partial least square (PLS) analysis, this study provides a significant theoretical and practical contribution. Theoretically, the results of this study show that fear of the COVID-19 pandemic, consumers' health concerns, intolerance of uncertainty of the pandemic, and personal relevance are crucial factors that affect consumers' behavioural intention to purchase the green product. These findings can provide a reference for companies or the green products manufacturing industry to formulate marketing policies and strategies for customers' understanding of green products and services. Companies or enterprises can improve consumers' green product purchase behaviour and should embed consumers' green purchase behaviour including health concerns, personal relevance, social media information, and intolerance of uncertainty of pandemic issues in their long-term plan and policy.

Practically, the findings of this study can contribute to the marketers and enterprises to take initiative and long-term plan for improving the consumer purchase behaviour of green products. The markets can formulate marketing strategies to understand customers' perceptions of green products' purchase intention. Regarding the customers' behavioural intention to purchase green products, an enterprise can offer promotions and other methods to attract customers' attention to purchase green products. Companies can provide opportunities and establish a good image of the practicality of green products, and purchasing behaviour. The public authority can develop an individual's green consumption behaviour through social media information and spread the advantages of green products to the general people using different social media platforms. Green product production organizations can fortify the

ecological functions of green products that meet customer perceptions to improve purchasing behaviour toward green products.

An individual's purchase ability can lead to buying the products. From this point of view, enterprises should provide customers with accurate information on the benefits of green products. Accurate information is crucial to customers' decision-making process, which guarantees that consumers genuinely trust in their capacity to buy green products. To improve consumers' green consumption behaviour, enterprises need to transmit explicit ideas to buyers through green labels, influence them to partake in ecological protection programs, and illuminate customers on how they contribute to environmental protection by purchasing green products. Policymakers can practice energy-saving behaviour to protect the green environment, and use the social media platform to spread standards empowering more green purchasing behaviour.

## Conclusion

This study uses PLS analysis to investigate the impact of fear of the COVID-19 pandemic on consumers' health concerns, intolerance of uncertainty, social media information, and personal relevance toward Malaysian consumers' behavioural intention to purchase green products during the post-pandemic. The higher significant relationship between fear of the COVID-19 pandemic and health concerns indicates that the increasing fear of the COVID-19 epidemic leads to health concerns and consumers' greater behavioural intention to purchase green products. Our investigation findings have suggested that health concerns, social media information, intolerance of uncertainty, and personal relevance have played significant roles in behavioural intention to purchase green products during a pandemic crisis. This study attempted to explore the impact of fear of the COVID-19 pandemic on health concerns, social media information, intolerance of uncertainty, and personal relevance towards Malaysian consumers' behavioural intention to purchase green products. The findings of this study have explored a newly developed model to understand better how fear of the COVID-19 epidemic affects consumers' behavioural factors (e.g., health concerns, intolerance of uncertainty, social media information, and personal relevance) towards behavioural intention to purchase green products during a pandemic.

Certain limitations may be crucial for further research. For example, this study has investigated the fear of the COVID-19 pandemic and its impact on Malaysian consumers' behaviour towards their behavioural intention to purchase green products. The correlation between fear of COVID-19 pandemic and behavioural aspects is not always perfect for all nations; thus, a further study can extend our conceptual model for the international process of green products and different residents of consumers' behavioural intention to purchase green products. This study used an online survey platform for collecting data from Malaysian consumers. This approach may result in sample bias because consumers without internet access were not included in our samples. In the conceptual model, we have used a limited number of behavioural factors of consumers that attributed to fear of COVID-19 pandemic for consumers' behavioural intention to purchase green products. Future research should conduct on the importance of green product information and incorporate it into the conceptual model. The current coronavirus must constantly be changing, and there are uncertainties; thus, further study can modify our proposed conceptual model according to shifting consumers' behavioural aspects and consumption patterns.

## Author Contributions

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## References

1. Bloch E. M., Shoham S., Casadevall A., Sachais B. S., Shaz B., Winters J. L., et al. (2020). Deployment of convalescent plasma for the prevention and treatment of COVID-19. *The Journal of clinical investigation*, 130(6), 2757–2765. <https://doi.org/10.1172/JCI138745> PMID: 32254064
2. Dong E., Du H., & Gardner L. (2020). An interactive web-based dashboard to track COVID-19 in real time. *The Lancet infectious diseases*, 20(5), 533–534. [https://doi.org/10.1016/S1473-3099\(20\)30120-1](https://doi.org/10.1016/S1473-3099(20)30120-1) PMID: 32087114
3. Shi P., Dong Y., Yan H., Zhao C., Li X., Liu W., et al. (2020). Impact of temperature on the dynamics of the COVID-19 outbreak in China. *Science of the total environment*, 728, 1–13. <https://doi.org/10.1016/j.scitotenv.2020.138890> PMID: 32339844
4. Sorokowski P., Groyecka A., Kowal M., Sorokowska A., Białek M., Lebuda I., et al. (2020). Can information about pandemics increase negative attitudes toward foreign groups? A case of COVID-19 outbreak. *Sustainability*, 12(12), 1–15.
5. Rahman M. K., Gazi M. A. I., Bhuiyan M. A., & Rahaman M. A. (2021a). Effect of Covid-19 pandemic on tourist travel risk and management perceptions. *Plos one*, 16(9), 1–18.
6. Colizzi M., Sironi E., Antonini F., Ciceri M. L., Bovo C., & Zocante L. (2020). Psychosocial and behavioral impact of COVID-19 in autism spectrum disorder: an online parent survey. *Brain sciences*, 10(6), 1–14. <https://doi.org/10.3390/brainsci10060341> PMID: 32503172
7. Sun L., Sun Z., Wu L., Zhu Z., Zhang F., Shang Z., et al. (2020). Prevalence and risk factors of acute post-traumatic stress symptoms during the COVID-19 outbreak in Wuhan, China. *MedRxiv*, 1–17. <https://doi.org/10.1101/2020.03.06.20032425>.
8. Schimmenti A., Billieux J., & Starcevic V. (2020). The four horsemen of fear: An integrated model of understanding fear experiences during the COVID-19 pandemic. *Clinical Neuropsychiatry*, 17(2), 41–45. <https://doi.org/10.36131/CN20200202> PMID: 34908966
9. Dangelico R. M., & Pujari D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of business ethics*, 95(3), 471–486.
10. Zhuang W., Luo X., & Riaz M. U. (2021). On the factors influencing green purchase intention: A meta-analysis approach. *Frontiers in Psychology*, 12, 1–15. <https://doi.org/10.3389/fpsyg.2021.644020> PMID: 33897545
11. Ogiemwonyi O. (2022). Factors influencing generation Y green behaviour on green products in Nigeria: An application of theory of planned behaviour. *Environmental and Sustainability Indicators*, 13, 100164.
12. Aday S., & Aday M. S. (2020). Impact of COVID-19 on the food supply chain. *Food Quality and Safety*, 4(4), 167–180.
13. Aigbedo H. (2021). Impact of COVID-19 on the hospitality industry: a supply chain resilience perspective. *International Journal of Hospitality Management*, 98, 1–16.
14. Degli Esposti P., Mortara A., & Roberti G. (2021). Sharing and Sustainable Consumption in the Era of COVID-19. *Sustainability*, 13(4), 1903.
15. Brzustewicz P., & Singh A. (2021). Sustainable Consumption in Consumer Behavior in the Time of COVID-19: Topic Modeling on Twitter Data Using LDA. *Energies*, 14(18), 5787.
16. Yang X. (2020). Potential consequences of COVID-19 for sustainable meat consumption: the role of food safety concerns and responsibility attributions. *British food journal*, 123(2), 455–474.
17. Qi X., Yu H., & Ploeger A. (2020). Exploring influential factors including COVID-19 on green food purchase intentions and the intention–behaviour gap: a qualitative study among consumers in a Chinese context. *International Journal of Environmental Research and Public Health*, 17(19), 7106.
18. Qi X., & Ploeger A. (2021). Explaining Chinese consumers' green food purchase intentions during the COVID-19 pandemic: An extended Theory of Planned Behaviour. *Foods*, 10(6), 1200. <https://doi.org/10.3390/foods10061200> PMID: 34073514
19. Cranfield J. A. (2020). Framing consumer food demand responses in a viral pandemic. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 68(2), 151–156.
20. Xie X., Huang L., Li J. J., & Zhu H. (2020). Generational differences in perceptions of food health/risk and attitudes toward organic food and game meat: The case of the COVID-19 crisis in China.



*International journal of environmental research and public health*, 17(9), 1–14. <https://doi.org/10.3390/ijerph17093148> PMID: 32366016

21. Głabska D., Skolmowska D., & Guzek D. (2020). Population-based study of the influence of the COVID-19 pandemic on hand hygiene behaviors—Polish adolescents' COVID-19 experience (PLACE-19) study. *Sustainability*, 12(12), 4930.
22. Ben Hassen T., El Bilali H., & Allahyari M. S. (2020). Impact of COVID-19 on food behavior and consumption in Qatar. *Sustainability*, 12(17), 1–16.
23. Yuen K. F., Wang X., Ma F., & Li K. X. (2020). The psychological causes of panic buying following a health crisis. *International journal of environmental research and public health*, 17(10), 1–14. <https://doi.org/10.3390/ijerph17103513> PMID: 32443427
24. Brooks S. K., Webster R. K., Smith L. E., Woodland L., Wessely S., Greenberg N., et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The lancet*, 395(10227), 912–920.
25. Wong. (2020). China Warns that Spread of Deadly Virus will Accelerate. *Financial Times*. <https://www.ft.com/content/7bb597c8-3ff7-11ea-a047-eae9bd51ceba>. Accessed, 2.
26. Doszhanov A., & Ahmad Z. A. (2015). Customers' intention to use green products: The impact of green brand dimensions and green perceived value. Paper presented at the S.H.S. Web of Conferences.
27. Rahman M. K., Masud M. M., Akhtar R., & Hossain M. M. (2021b). Impact of community participation on sustainable development of marine protected areas: Assessment of ecotourism development. *International Journal of Tourism Research*, 23(6), 1–11.
28. Fincher C.L., & Thornhill R. (2017). Pathogen-Stress Theory. In: Zeigler-Hill V., Shackelford T. (eds) *Encyclopedia of Personality and Individual Differences*. Springer, Cham. [https://doi.org/10.1007/978-3-319-28099-8\\_1556-1](https://doi.org/10.1007/978-3-319-28099-8_1556-1).
29. Ajzen I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179–211.
30. Meleady R., Hodson G., & Earle M. (2021). Person and situation effects in predicting outgroup prejudice and avoidance during the COVID-19 pandemic. *Personality and Individual Differences*, 172, 1–17.
31. Qi X., & Ploeger A. (2021). An integrated framework to explain consumers' purchase intentions toward green food in the Chinese context. *Food Quality and Preference*, 92, 104229.
32. Addo P. C., Jiaming F., Kulbo N. B., & Liangqiang L. (2020). COVID-19: fear appeal favoring purchase behavior towards personal protective equipment. *The Service Industries Journal*, 40(7–8), 471–490.
33. Tannenbaum M. B., Hepler J., Zimmerman R. S., Saul L., Jacobs S., Wilson K., et al. (2015). Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. *Psychological bulletin*, 141(6), 1–15. <https://doi.org/10.1037/a0039729> PMID: 26501228
34. Witte K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs*, 59(4), 329–349.
35. Barnes S. J., Diaz M., & Arnaboldi M. (2021). Understanding panic buying during COVID-19: A text analytics approach. *Expert Systems with Applications*, 169, 1–14.
36. Asmundson G. J., & Taylor S. (2020). How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know. *Journal of anxiety disorders*, 71, 1–16.
37. Abramowitz J. S., Deacon B. J., & Valentiner D. P. (2007). The Short Health Anxiety Inventory: Psychometric properties and construct validity in a non-clinical sample. *Cognitive Therapy and Research*, 31(6), 871–883. <https://doi.org/10.1007/s10608-006-9058-1> PMID: 32214558
38. Salkovskis P. M., Rimes K. A., Warwick H., & Clark D. (2002). The Health Anxiety Inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological medicine*, 32(5), 843–853. <https://doi.org/10.1017/s0033291702005822> PMID: 12171378
39. Blakey S. M., & Abramowitz J. S. (2017). Psychological predictors of health anxiety in response to the Zika virus. *Journal of clinical psychology in medical settings*, 24(3), 270–278.
40. Wheaton M. G., Abramowitz J. S., Berman N. C., Fabricant L. E., & Olatunji B. O. (2012). Psychological predictors of anxiety in response to the H1N1 (swine flu) pandemic. *Cognitive Therapy and Research*, 36(3), 210–218.
41. Di Renzo L., Gualtieri P., Pivari F., Soldati L., Attinà A., Cinelli G., et al. (2020). Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. *Journal of translational medicine*, 18(1), 1–15.
42. Carleton R. N. (2016). Into the unknown: A review and synthesis of contemporary models involving uncertainty. *Journal of anxiety disorders*, 39, 30–43. <https://doi.org/10.1016/j.janxdis.2016.02.007> PMID: 26945765

43. Boswell J. F., Thompson-Hollands J., Farchione T. J., & Barlow D. H. (2013). Intolerance of uncertainty: A common factor in the treatment of emotional disorders. *Journal of clinical psychology*, 69(6), 630–645. <https://doi.org/10.1002/jclp.21965> PMID: 23381685
44. Rosser B. A. (2019). Intolerance of uncertainty as a transdiagnostic mechanism of psychological difficulties: A systematic review of evidence pertaining to causality and temporal precedence. *Cognitive Therapy and Research*, 43(2), 438–463.
45. Wang Pan, Wan R., Tan X., Xu Y., Ho L., S. C., & Ho, R. C. (2020). Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *International journal of environmental research and public health*, 17(5), 1729. Retrieved from <https://www.mdpi.com/1660-4601/17/5/1729> <https://doi.org/10.3390/ijerph17051729> PMID: 32155789
46. Geldsetzer P. (2020). Knowledge and perceptions of COVID-19 among the general public in the United States and the United Kingdom: a cross-sectional online survey. *Annals of internal medicine*, 173(2), 157–160. <https://doi.org/10.7326/M20-0912> PMID: 32196071
47. Mertens G., Gerritsen L., Duijndam S., Salemink E., & Engelhard I. M. (2020). Fear of the coronavirus (COVID-19): Predictors in an online study conducted in March 2020. *Journal of anxiety disorders*, 74, 1–13.
48. Stussi Y., Brosch T., & Sander D. (2015). Learning to fear depends on emotion and gaze interaction: The role of self-relevance in fear learning. *Biological Psychology*, 109, 232–238. <https://doi.org/10.1016/j.biopsycho.2015.06.008> PMID: 26115928
49. Salkovskis P. M., & Warwick H. (2001). Meaning, misinterpretations, and medicine: A cognitive-behavioral approach to understanding health anxiety and hypochondriasis.
50. Vlaeyen J. W., & Linton S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain*, 85(3), 317–332. [https://doi.org/10.1016/S0304-3959\(99\)00242-0](https://doi.org/10.1016/S0304-3959(99)00242-0) PMID: 10781906
51. Schwappach D. L., & Gehring K. (2014). Silence that can be dangerous: a vignette study to assess healthcare professionals' likelihood of speaking up about safety concerns. *PLoS one*, 9(8), 1–17. <https://doi.org/10.1371/journal.pone.0104720> PMID: 25116338
52. Islam T., Pitafi A. H., Arya V., Wang Y., Akhtar N., Mubarak S., et al. (2021). Panic buying in the COVID-19 pandemic: A multi-country examination. *Journal of Retailing and Consumer Services*, 59, 1–14.
53. Naeem M. (2021). Do social media platforms develop consumer panic buying during the fear of Covid-19 pandemic. *Journal of Retailing and Consumer Services*, 58, 102226.
54. Mahmoud T. O., Ibrahim S. B., Ali A. H., & Bledy A. (2017). The influence of green marketing mix on purchase intention: The mediation role of environmental knowledge. *International Journal of Scientific & Engineering Research*, 8(9), 1040–1048.
55. Hesham F., Riadh H., & Sihem N. K. (2021). What have we learned about the effects of the COVID-19 pandemic on consumer behavior? *Sustainability*, 13(8), 4304.
56. Savarese M., Wismer W., & Graffigna G. (2020). Conceptualizing “free-from” food consumption determinants: a systematic integrative literature review focused on gluten and lactose. *Food Quality and Preference*, 104170.
57. Sharma M., Yadav K., Yadav N., & Ferdinand K. C. (2017). Zika virus pandemic—analysis of Facebook as a social media health information platform. *American journal of infection control*, 45(3), 301–302. <https://doi.org/10.1016/j.ajic.2016.08.022> PMID: 27776823
58. Yuan D., Rahman M. K., Issa Gazi M. A., Rahaman M. A., Hossain M. M., & Akter S. (2021). Analyzing of User Attitudes Toward Intention to Use Social Media for Learning. *SAGE Open*, 11(4), 1–13.
59. De Silva M., Wang P., & Kuah A. T. (2021). Why wouldn't green appeal drive purchase intention? Moderation effects of consumption values in the UK and China. *Journal of business research*, 122, 713–724.
60. Suki N. M., Majeed A., & Suki N. M. (2021). Impact of consumption values on consumers' purchase of organic food and green environmental concerns. *Social Responsibility Journal*, <https://doi.org/10.1108/SRJ-01-2021-0026>.
61. Ali Taha V., Pencarelli T., Škerhákóvá V., Fedorko R., & Košíková M. (2021). The Use of Social Media and Its Impact on Shopping Behavior of Slovak and Italian Consumers during COVID-19 Pandemic. *Sustainability*, 13(4), 1–18.
62. Schmidt S., Benke C., & Pané-Farré C. A. (2021). Purchasing under threat: Changes in shopping patterns during the COVID-19 pandemic. *PLoS one*, 16(6), e0253231. <https://doi.org/10.1371/journal.pone.0253231> PMID: 34106996

63. Jones L. W., Sinclair R. C., & Courneya K. S. (2003). The effects of source credibility and message framing on exercise intentions, behaviors, and attitudes: An integration of the elaboration likelihood model and prospect theory 1. *Journal of applied social psychology*, 33(1), 179–196.
64. Rothman A. J., Bartels R. D., Wlaschin J., & Salovey P. (2006). The strategic use of gain-and loss-framed messages to promote healthy behavior: How theory can inform practice. *Journal of communication*, 56(1), 202–220.
65. Rahman M. K., Newaz M. S., Hemmati M., & Mallick S. Y. (2021c). Analyzing healthcare service environment with Malaysian general practice clinics. *Health Education*, 121(3), 246–264.
66. Gleim M. R., Smith J. S., Andrews D., & Cronin J. J. Jr (2013). Against the green: A multi-method examination of the barriers to green consumption. *Journal of retailing*, 89(1), 44–61.
67. Joshi Y., & Rahman Z. (2015). Factors affecting green purchase behaviour and future research directions. *International Strategic management review*, 3(1–2), 128–143.
68. Mehta P., & Chahal H. S. (2021). Consumer attitude towards green products: revisiting the profile of green consumers using segmentation approach. *Management of Environmental Quality: An International Journal*, 32(5), 902–928.
69. López-Galán B., & de-Magistris T. (2020). Personal and Psychological Traits Influencing the Willingness to Pay for Food with Nutritional Claims: A Comparison between Vice and Virtue Food Products. *Foods*, 9(6), 733. <https://doi.org/10.3390/foods9060733> PMID: 32503136
70. Su D. N., Duong T. H., Dinh M. T. T., Nguyen-Phuoc D. Q., & Johnson L. W. (2021). Behavior towards shopping at retailers practicing sustainable grocery packaging: The influences of intra-personal and retailer-based contextual factors. *Journal of Cleaner Production*, 279, 1–13.
71. Chen X., Rahman M. K., Rana M., Gazi M., Issa A., Rahaman M., et al. (2022). Predicting Consumer Green Product Purchase Attitudes and Behavioral Intention During COVID-19 Pandemic. *Frontiers in Psychology*, 12, 1–10. <https://doi.org/10.3389/fpsyg.2021.760051> PMID: 35145450
72. Armstrong J. S., & Overton T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14, 396–402.
73. Rose D. S., Sidle S. D., Griffith K. H., Rose D. S., & Griffith K. H. (2007). A penny for your thoughts. *Organizational Research Methods*, 10(2), 225–240.
74. Nederhof A. J. (1985). Methods of coping with social desirability bias: A review. *European journal of social psychology*, 15(3), 263–280.
75. Reinartz W., Haenlein M., & Henseler J. (2009). An empirical comparison of the efficacy of covariance-based and variance-based S.E.M. *International Journal of research in Marketing*, 26(4), 332–344.
76. Bitan D. T., Grossman-Giron A., Bloch Y., Mayer Y., Shiffman N., & Mendlovic S. (2020). Fear of COVID-19 scale: Psychometric characteristics, reliability and validity in the Israeli population. *Psychiatry Research*, 289, 1–17.
77. Chen K., & Deng T. (2016). Research on the green purchase intentions from the perspective of product knowledge. *Sustainability*, 8(9), 1–15.
78. Podsakoff P. M., MacKenzie S. B., & Podsakoff N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual review of psychology*, 63, 539–569. <https://doi.org/10.1146/annurev-psych-120710-100452> PMID: 21838546
79. Fuller C. M., Simmering M. J., Atinc G., Atinc Y., & Babin B. J. (2016). Common methods variance detection in business research. *Journal of Business Research*, 69(8), 3192–3198.
80. Chin J. (2010). Theory and application of educational leadership. *Taipei, T.W.: Wunan*.
81. Hair J. F., & Sarstedt M. (2021). Data, measurement, and causal inferences in machine learning: opportunities and challenges for marketing. *Journal of Marketing Theory and Practice*, 29(1), 65–77.
82. Hair J. F., Ringle C. M., & Sarstedt M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results and higher acceptance. *Long range planning*, 46(1–2), 1–12.
83. Hensler S., Herren D. B., & Marks M. (2015). New technical design of food packaging makes the opening process easier for patients with hand disorders. *Applied Ergonomics*, 50, 1–7. <https://doi.org/10.1016/j.apergo.2015.02.002> PMID: 25959312
84. Wetzels M., Odekerken-Schröder G., & Van Oppen C. (2009). Using P.L.S. path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *M.I.S. quarterly*, 177–195.
85. Cohen S. (1988). Perceived stress in a probability sample of the United States.
86. Fornell, & Claes. (1994). Partial least squares. *Advanced methods of marketing research*, 5(3), 52–78.
87. Kim H. W., Xu Y., & Gupta S. (2012). Which is more important in Internet shopping, perceived price or trust?. *Electronic commerce research and applications*, 11(3), 241–252.