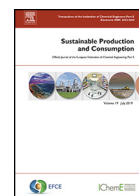




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Exploring food waste during the COVID-19 pandemic among Malaysian consumers: The effect of social media, neuroticism, and impulse buying on food waste

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ABSTRACT

The amount of food being thrown away despite being in an edible condition has become alarming in countries with populations with medium and high incomes. Changes in consumer behaviour, such as overbuying, are some of the major impetuses of food waste. This study aimed to examine the relationship between food waste and social media usage, neuroticism, and impulse buying. The mediating role of impulse buying and the moderating role of neuroticism on food waste during the coronavirus (COVID-19) pandemic were also uncovered in this study. A self-administered online survey was distributed to a total of 274 consumers who had experienced a lockdown during the COVID-19 outbreak and were also regular buyers of food. Empirical findings supported the fact that social media usage, neuroticism, and impulse buying were positively related to food waste. Impulse buying mediates the relationship between social media usage and food waste, as well as between neuroticism and food waste. The study results also revealed that neuroticism positively moderates the relationship between social media usage and food waste. This paper offers new insights into efforts for sustainable food consumption to tackle the issue of food waste.

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1. Introduction

The coronavirus (COVID-19) pandemic has posed a threat not only to people's health but also to their mental well-being, whether or not they have been exposed to the disease (Duan and Zhu, 2020). The earlier understanding of sustainable consumption has had to be revisited now that the COVID-19 pandemic has amplified psychological issues such as stress, fear, depression, and anxiety (Dong and Bouey, 2020; Goyal et al., 2020). The pandemic has resulted in erratic behaviours such as panic buying (Dholakia, 2020; Hossain et al., 2020; Meyer, 2020) and even suicide in extreme cases (Goyal et al., 2020). As a basic necessity,

food has been one of the main items that consumers have hoarded or bought based on panicky feelings. Groceries have been stockpiled as outbreaks of COVID-19 occurred (Lufkin, 2020; Wang and Hao, 2020). COVID-19 has played a key role in changing habits of purchasing and consumption (Pappalar do et al., 2020).

COVID-19-related measures such as lockdowns and staying at home to curb the spread of the disease had increased the usage of social media by 10.5% as of July 2020 (Snyder, 2020). As of 2020, there were 3.6 billion social media users worldwide, an increase from 3.4 billion in 2019. The number is projected to increase to almost 4.41 billion in 2025 (Tankovska, 2021a). Facebook alone has more than 2.7 billion active users, making it the most prominent social networking site around the globe (Tankovska, 2021b). The emergence of social media has enhanced communication and relationship building among users of diverse backgrounds, creating a strong social structure through a wide range of communication websites (Kapoor et al., 2018). Social media offers an op-

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portunity for consumers to publicize products through product reviews and to post pictures and videos that enable individuals to go beyond just communicating to socializing with other users online (Appel et al., 2020). Although it has been argued that social media is an efficient tool in reducing food waste (Grainger and Stewart, 2017; Lazell, 2016; Närvänen et al., 2018), there has been very limited research on the effects of social media usage on food waste generation (Sainsbury's, 2016).

The combination of an increased frequency of social media usage and a new marketing pattern of food manufacturers may result in more impulse buying of food products (Tariq et al., 2019). Being unable to shop normally has caused a significant increase in food purchases made online. In fact, food manufacturers are encouraged to exploit online business as one of their resilience strategies (Ali et al., 2021). Lack of knowledge about COVID-19 has invoked neurotic behaviours correlated with negative emotions such as depression, anxiety, loneliness, fear of the unknown, and fear of product shortages (Yuen et al., 2020). Such emotions have increased people's social media usage (Fernandes et al., 2020) and influenced panicky impulse buying (Gazali, 2020). The literature has highlighted the fact that people with higher levels of neuroticism are keener on waste-prevention behaviours (Karbalaei et al., 2014; Opayemi et al., 2020). However, a food waste report by Rabobank (2020) showed that households were spending more on food delivery services but that almost 13% of the groceries were wasted. The literature showed that the fear of COVID-19 increased neurotic symptoms such as panic, which influenced food waste (Royte, 2020; Turnbull, 2020); this nullified conventional claims about the relationship between neuroticism and waste prevention behaviour. There is lack of research on the relationship between neuroticism and food waste in the context of COVID-19. Therefore, this research is warranted.

Even before the COVID-19 pandemic, approximately 1.3 billion tons of food, or one third of the food produced for human consumption per year, was wasted along the food supply chain (Gustavsson et al., 2011). It was expected that the lockdown measures would inflate this figure, largely due to panicky impulse buying and the use of food delivery services (Australian Associated Press, 2020; Deloitte, 2021). A recent report by the EAT-Lancet Commission (2019) noted that it is not possible to achieve a sustainable food system without addressing the challenge of food loss and waste. Unfortunately, COVID-19 has caused disruptions in food systems, including delays in harvesting and transportation, which have led to more wastage of perishable foods (UN, 2020). This has created a new norm and a consumption pattern that may have a negative snowballing effect on sustainable production and consumption in the food industry. The existing literature lacks an investigation of the antecedents of food waste in relation to consumer buying behaviours such as impulse buying, along with the use of social media and the emergence of the personality trait of neuroticism during the COVID-19 pandemic.

According to the Global Preparedness Monitoring Board (2020), the effects of COVID-19 will not soon disappear from our lives; the disease will also pose a threat in the future. Thus, understanding the effect of the pandemic on human psychology is critical for facing current and potential challenges (Zhang et al., 2020). A novel extension to the study on food waste and its associated determinants is important for understanding these challenges. The previous literature requires a revisit because of the new landscape of sustainable consumption.

The COVID-19 pandemic has increased people's level of engagement with social media and their neuroticism because of the fear and uncertainty they have experienced (Fernandes et al., 2020). As a response, people have resorted to panicky impulse buying (Gazali, 2020), and this has led to food waste (Australian Associ-

ated Press, 2020). These findings have given rise to the following research questions:

- 1 What is the effect of social media usage, neuroticism, and impulse buying on food waste?
- 2 Does impulse buying mediate the relationship between social media usage and food waste or between neuroticism and food waste?
- 3 Does neuroticism moderate the relationship between social media usage and food waste?

To uncover the answers to these questions, this study aimed to examine whether the predictive factors of social media usage, neuroticism, and impulse buying have affected the amount of food waste during the COVID-19 pandemic. The role of impulse buying as a mediator and the role of neuroticism as a moderator of food waste will also be explored. Specifically, the aims of this study were as follows:

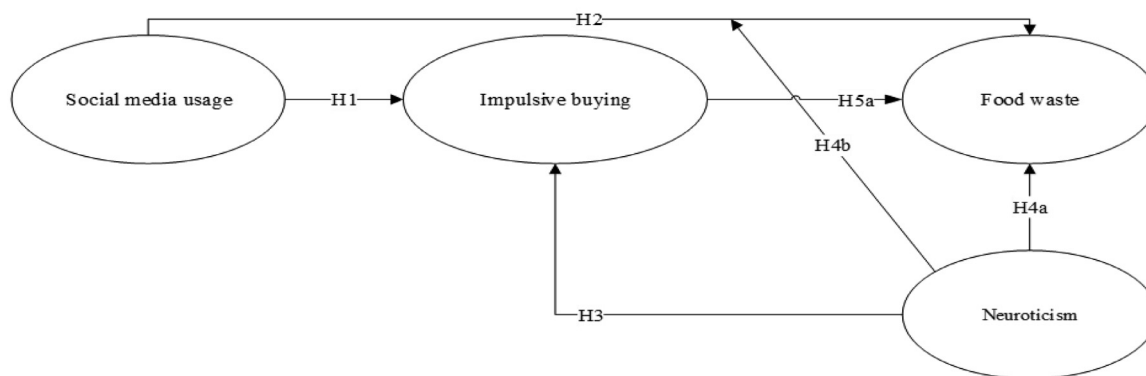
- 1 To examine the direct relationship between food waste and social media usage, neuroticism, impulse buying.
- 2 To investigate the mediating role of impulse buying in social media usage and food waste and in neuroticism and food waste among consumers.
- 3 To investigate the moderating effect of neuroticism in the relationship between social media usage and food waste.

This study posited that the revealed relationships would provide deeper insights into consumers' patterns of behaviour concerning food during the COVID-19 pandemic, during which levels of social media usage and neuroticism intensified, influencing impulse buying behaviour. This research addressed the relationship of these factors with food waste generation. This study could contribute to the knowledge base on food waste from the perspective of consumer behaviour and provide marketing insights and the incorporation of a scale to measure impulse buying. Moreover, this study could extend the empirical literature on food waste in Malaysia, which has been limited, especially during the COVID-19 pandemic.

This study is presented as follows. Section 2 discusses the conceptual background and development of hypotheses. Section 3 explains the method and analysis undertaken, Section 4 lays out the results of this study, and Section 5 discusses the findings and their implications. Section 6 offers conclusions about the findings and suggests opportunities for future study.

2. Conceptual background and development of hypotheses

Food waste is a complex, multifaceted issue that has several determinants (Gao et al., 2021; Schanes et al., 2018). Thyberg and Tonjes (2016) defined food waste as "Food which was originally produced for human consumption but then was discarded or was not consumed by humans. It includes food that spoiled prior to disposal and food that was still edible when thrown away." Due to mounting evidence of the quantities of food wasted all over the world, food waste is increasingly acknowledged as a pressing issue among governments, businesses, other concerned entities, and the general public (Schanes et al., 2018). In response, the United Nations has included responsible consumption and production (Goal 12) in its Sustainable Development Goals. The target is to halve the current amount of food waste by 2030 (UN, 2015). Private households are some of the largest contributors to food waste along the food supply chain (Food Print, 2021; Stancu et al., 2016). Food waste is not only a major environmental concern, but it also has social implications because the lost food could have satisfied the hunger of one in every nine people in the world that go hungry (Dagiliūtė and Musteikytė, 2019; WFP, 2018). Wasting food ignores the food needs of the present generation and threatens the food



H5b: Social Media Usage -> Impulse Buying During Covid19 -> Food Waste

H5c: Neuroticism -> Impulse Buying During Covid19 -> Food Waste

Fig. 1. The proposed research framework

needs of future generations. This makes food waste one aspect of a possible failure to sustain the feeding of the human population (Aschemann-Witzel et al., 2016). Food waste by consumers or at the final stage of the food supply chain also wastes the natural and monetary resources that have been contributed at earlier stages of the chain, giving rise to negative economic consequences (Gustavsson et al., 2011; Lang et al., 2020).

Consumer impulse buying is one of the important determinants of food waste (Porpino et al., 2015; Schmidt, 2016). It is estimated that around 62% of in-store purchases are based on impulses and that online buyers are more susceptible to impulse buying (Chamorro-Premuzic, 2015). Every year, billions of dollars are spent on impulse purchases, and food and other groceries appear to be the most popular of the unplanned or impulse purchases (Garcia, 2018). Social media is argued to be a main contributor to food impulse buying (Aragoncillo and Orus, 2018). This can be attributed to the strong interest in food prevalent on social media. The most-liked photograph on Instagram in 2020 was of an egg (Richardson, 2021). Pinterest has over 1.7 billion recipe pins (Arnold, 2019), and a food-related page on Instagram, @buzzfeedtasty, has more than 39.4 million followers. Unlike in the past, consumers do not only receive product information, but they also generate and distribute information based on their preferences and experiences, provide recommendations, and interact with product or service providers (Khokhar et al., 2019). These actions enhance consumption behaviour in terms of impulse buys (Zafar et al., 2020), as well as lead to the generation of food waste (Sainsbury's, 2016). In addition, behaviours around food waste are associated with neurotic behaviour and environmental conditions (Boeve-de Pauw et al., 2011; Milfont and Sibley, 2012; Opayemi et al., 2020). Neuroticism is related to a negative affect. It is a response with which people try to relieve negative emotions; neurotic individuals are driven by behaviours such as impulse buying that give them immediate gratification (Fenton-O'Creedy et al., 2018). In light of this information, a proposed research framework connecting all the hypotheses as depicted in Figure 1 was developed. The framework has four constructs and eight hypotheses.

2.1. Social media usage and impulse buying

The product information shared by friends or acquaintances on social media is considered valuable and trustworthy advice that can influence purchasing behaviour (Voramontri and Klieb, 2019). Social media is a powerful tool for boosting impulse buying (Aragoncillo and Orus, 2018). Studies by Ansari et al. (2019) and McClure and Seock (2020) proved that consumer purchase deci-

sions were influenced by information shared on social networking sites. Social media users describe their shopping experiences and product information to others online. These actions contribute to social commerce or the buying and selling of products and services through social media or social networking sites (Hossain and Kim, 2020). The recommendations and word-of-mouth comments not only influence consumers' purchasing decisions but also aid in creating positive brand images that, in turn, further stimulate impulse purchases (Nuseir, 2020). Recent figures show that the time spent daily on social media is, on average, 144 minutes (Henderson, 2020). Due to the active and strong presence of consumers on social media, businesses are willing to invest more money to advertise and market their products and services on social media platforms (Lee et al., 2018). Despite the disruption caused by COVID-19, Cramer-Flood (2020) stated that global digital ad spending was expected to increase by 2.4% in 2020. Therefore, the growing usage of social media (Snyder, 2020) and investments from food manufacturers on social media are affecting consumer behaviour, leading to impulse buying when consumers make purchase decisions (Aragoncillo and Orus, 2018; Zafar et al., 2021). This has especially been the case during the COVID-19 pandemic. Moreover, information disseminated on social media during the pandemic has created fears, such as fears of price increases and product scarcity, and they have enhanced panicky impulse buying (Naeem, 2020). Thus, the following hypothesis is proposed:

H1 : Social media usage is related to impulse buying.

2.2. Social media usage and food waste

Learning sustainable practices, such as behaviours related to preventing food waste, is subject to sociopsychological structures and guiding social norms of individuals (Gössling, 2018). Unfortunately, the individualization and competition that exist in society challenge the guiding moral norms (Gössling et al., 2018). Individuals use social media to fulfill their personal life needs, such as gaining a sense of belonging or self-presentation, and they market themselves on social networking sites by drawing on these needs and their fulfillment (Nadkarni and Hofmann, 2012). Among the plethora of content shared on social media, food has become a popular way of indicating a consumer lifestyle. Hundreds of millions of posts related to food have been shared on social media, and it is believed that they have helped to show others what people are up to and have made people feel good about themselves as they post photos of gourmet food on attractive plates (Atanasova, 2016). Social media can deter critical debate but at the

same time negatively impact social norms related to sustainable behaviours such as preventing food waste (Turkle, 2015). A study conducted by Sainsbury's (2016), the second-largest supermarket chain in the United Kingdom, blamed Instagram for food waste. The premise was that the desire to have exciting food and look good on an Instagram feed made people buy exotic ingredients with which they were not familiar and that these purchases eventually ended up being wasted. It can be further argued that with the increased social media usage due to the movement restriction measures related to the COVID-19 pandemic (Snyder, 2020), the more frequent exposure to food-related content encouraged consumers to use food delivery services too extensively, and this ultimately led to food waste (Australian Associated Press, 2020). This is supported by Rabobank (2020), who found that food waste was reported twice as much by people who used food delivery services during the COVID-19 pandemic. Based on the above argument, we propose the following hypothesis:

H2: Social media usage is related to food waste.

2.3. Neuroticism and impulse buying

Neuroticism involves several characteristics, including a negative affect, a reactivity to stress, a difficulty in resisting urges, and a lack of the ability to delay gratification. Therefore, impulse buying can be a way of achieving immediate satisfaction and compensating for a lack of control (Olsen et al., 2016). Individuals lacking the ability to control their actions are reckless, careless, and unlikely to plan their activities (Parsad et al., 2019). For individuals with a high level of neuroticism, negative responses are frequent and out of proportion to the given situation (Ormel et al., 2013). Neurotic individuals engage in behaviours such as buying in order to reduce or escape from negative moods (Fenton-O'Creevy et al., 2018). They have a tendency to want immediate satisfaction of their desires. A feeling of being deprived by not buying something is even more challenging to deal with if a product may not meet their needs (Parsad et al., 2019). Although some studies (Fenton-O'Creevy and Furnham, 2020; Olsen et al., 2016; Parsad et al., 2019) showed that neuroticism was a positive predictor of impulse buying, Turkuyilmaza et al. (2015) found a negative relationship between neuroticism and online impulse buying. To further confirm the effect of neuroticism and impulse buying behaviour, we propose the following hypothesis:

H3: Neuroticism is related to impulse buying.

2.4. Neuroticism and food waste

According to Hirsh (2010), people with a high level of neuroticism are more worried about negative outcomes, and their concern for the environment makes them anxious about the environmental damage that waste can cause. Opayemi et al. (2020) have found neurotic individuals to be positively associated with waste-prevention behaviours. Similarly, neurotic individuals are more inclined toward proenvironmental behaviours (Boeve-de Pauw et al., 2011; Milfont and Sibley, 2012). Much evidence has been documented on the impact of neuroticism on waste prevention (Karbalaie et al., 2014; Opayemi et al., 2020) or proenvironmental behaviours (Boeve-de Pauw et al., 2011; Milfont and Sibley, 2012). However, in the context of food waste, Jamaludin et al. (2020) attempted to investigate neuroticism and the intention for food waste reduction but failed to establish a link. Therefore, the relationship between neuroticism and food waste remains unknown.

The COVID-19 pandemic has aroused distressing emotions such as fear and anxiety (Dong and Bouey, 2020; Goyal et al., 2020). The emotional disturbances that impact an individual reflect neuroticism (Caci et al., 2020; Kroencke et al., 2020). For example,

COVID-19 has increased mental health complaints, which include anxiety and depression (Hyland et al., 2020). On the other hand, emotional problems such as stress, depression, and anxiety, which are those experienced by a neurotic person, have been associated with social media addiction (Wong et al., 2020). Even before the COVID-19 pandemic, studies showed that social media offered a form of escapism (i.e., gave people a way to cope with stress by escaping from unsatisfying life circumstances); it allowed individuals to manage a low mood or negative emotions (Király et al., 2020) by resorting to high levels of social media usage (Kircaburun and Griffiths, 2019). In addition, research conducted to examine the effect of social media usage on food waste generation is scarce, and an investigation of how individuals' neuroticism during COVID-19 influenced those relationships is lacking (Sainsbury's, 2016). Therefore, to better understand the relationship between social media usage and food waste, neuroticism has been included as a moderating variable. Based on the above review of the literature and prior research findings, the following hypotheses are proposed:

H4a: Neuroticism is related to food waste

H4b: Neuroticism moderates the relationship between social media usage and food waste

2.5. Impulse buying and food waste

Earlier studies conceptualized impulse buying as unplanned purchases and often used both terms synonymously (Stern, 1962). However, not all unplanned purchases can be considered impulse purchases (Kacen et al., 2012; Verhagen and van Dolen, 2011). A person can make an unplanned purchase because he or she forgot to buy a needed product at another time, whereas impulse buying is driven by irrationality or strong desires that lack regard for any consequences (Amos et al., 2014). Factors that motivate impulse buying include internal (i.e., personal) and external (i.e., environmental) characteristics (Iyer et al., 2020; Muruganatham and Bhakat, 2013). Internal factors of impulse buying are related to an individual's personality and internal cues such as an emotional state (Muruganatham and Bhakat, 2013). External factors triggering impulse buying include social influences (Mattila and Wirtz, 2008) and the environment of a store (Liao et al., 2009), in which sounds (Holbrook and Anand, 1990), colours (Valdez and Mehrabian, 1994), and scents (Mattila and Wirtz, 2001) stimulate and excite consumers to buy. It has been found that experiencing a positive affect leads to more impulse buying than experiencing a negative affect (Amos et al., 2014; Flight et al., 2012).

According to Mohan et al. (2013), impulse buying can be triggered by marketing stimuli. For example, price discounts for products are related to purchasing behaviour (Omar et al., 2021). If more discounts are given as a consumer buys larger quantities, the consumer will be tempted to buy too much, and this situation may eventually contribute to food waste (Lyndhurst and WRAP, 2012). Similarly, special offers that encourage excessive purchases (e.g., Buy One, Get One Free) are criticized because they result in subsequent wastage (Welch et al., 2018). Poor planning and impulse purchases lead to excessive shopping, which in turn drives food waste (Bond et al., 2013; Priefer et al., 2013). Consequently, Porpino et al. (2015) and Schmidt (2016) have identified impulse buying as an antecedent of food waste. Because of the physical distancing policies and limited physical movement during the COVID-19 pandemic, the external factors that often influence impulse buying could be argued to have become ineffective. The volume of online business has skyrocketed during the pandemic, and this suggests that impulse buying now occurs more due to internal factors (Donthu and Gustafsson, 2020). The pandemic has forced food manufacturers to market and sell online (Ali et al., 2021), heightening the amount of food information shared on social media plat-

forms. The availability of information on both COVID-19 and necessary products such as food and other groceries has contributed to a new pattern of consumption and behaviour. Such behaviour has driven the wastage of nearly 13% of groceries (Rabobank, 2020). Also, the movement restrictions and lockdowns during the pandemic have created fear and anxiety resulting from neuroticism (Dong and Bouey, 2020), causing panicky impulse buying and subsequent wastage (Australian Associated Press, 2020). Based on the above analysis, we propose the following hypotheses:

H5a: Impulse buying is related to food waste

H5b: Impulse buying mediates the relationship between social media usage and food waste

H5c: Impulse buying mediates the relationship between neuroticism and food waste.

3. Research methods

3.1. Research design and sampling

This study has sought to examine the relationship between social media usage, neuroticism, impulse buying, and food waste during the COVID-19 pandemic in Malaysia. Consumers who were experiencing lockdown during the COVID-19 outbreak and were also regular buyers of food (before the incident) were chosen as the sample for this study. To ensure the representativeness of the participants, the survey questions were properly designed, including the choice of words and the appearance and sequence of the questions (Babin et al., 2019). To filter eligible respondents for the research, some screening questions were also developed in which participants were asked if they were using social media and purchasing food during the pandemic or when they heard the news about a lockdown. This study applied convenience sampling coupled with a cross-sectional, self-administered online survey questionnaire to collect data from the respondents. In April 2020, during the data collection period, Malaysia was ranked 34th in the world based on the number of positive COVID-19 cases (Worldometer, 2020). The threat of COVID-19 had become worse in March 2020. The first Movement Control Order, or lockdown, was imposed from March 18 to 31, 2020, and then it was extended until May 3, 2020. Due to the outbreak and the restriction orders imposed by the government, online convenience sampling was adopted to reach the targeted population (individuals who had experienced the first lockdown and were involved in food purchasing) through several media platforms, such as Messenger, WhatsApp, and Facebook (Gosling et al., 2004). Using Google forms, a link to an invitation to participate was sent to the targeted population on these social networks. A “chain referral” recruitment strategy (Khatiwada et al., 2021) was promoted, in which each participant was encouraged to share contacts and roll out the survey invitation link to as many participants as desired. Therefore, the link was further shared with potential respondents apart from the first point of contact, and so on.

This method has been employed widely in prior studies to collect data regarding the food purchasing behaviour of customers (Chisnall, 2018; Mehrolia et al., 2021). Questions about other attributes of the participants, such as their email addresses and the amount they spent on food before and after the pandemic, were also included. The data collection strategy provided an advantage in that it reached a large number of respondents and covered wide geographical areas. The data were collected in April and May of 2020. A structured, closed-ended questionnaire method was applied so that respondents could easily and quickly answer the questionnaire and were not demotivated to participate in the study. A cover letter that explained the objective of the study and

promised to maintain the respondents' anonymity was included with the questionnaire. The respondents were asked to fill in an anonymous online questionnaire that would take about 15 minutes. The participants were reminded about the voluntary nature of the research and told that they could exit the survey at any time. A total of 450 participants were approached to participate in this study. Only 274 participants agreed to be involved, representing a response rate of 61 percent. According to Sheehan (2001), response rates to email surveys have decreased since the late 1980s, with 25% to 30% of original contacts declining to follow up with email. Although there has been increasing growth in the use of online-based surveying, reviews of electronic survey research point to response rates similar to those obtained via mailed survey methodologies (Converse et al., 2008). Schaefer and Dillman (1998) and Babbie (1995) suggested that email surveys incorporating multi-mode approaches with response rates as high as 60% to 70% are considered good. Likewise, several previous studies that used electronic surveys managed to get an overall response rate of 65% (Mariño et al., 2012).

In addition, recent researchers suggested the use of power analysis to determine the sample size (Hair et al., 2019). G*Power was used because it is the most common choice for business and social science researchers (Hair et al., 2017). For this study, the F test of regression was used via the G*Power application. To determine the accurate sample size, the power analysis was set for multiple regression comprising four predictors. The test used the alpha of 0.05, a power of 0.80, and a medium effect size of ($f^2 = 0.15$). This is considered the most common and acceptable power in most social and business studies (Hair et al., 2017). The G*Power estimates that the minimum sample size for medium effect size and required for the research model is 85 (Green, 1991). Some researchers claim that researchers should look beyond the response rate as an indicator of quality (Bethlehem and Kersten, 1985; Wright, 2015).

3.2. Measures

This study used an established measurement scale adapted from previous studies with slight modification for this research context (Table 1). A seven-point Likert scale, ranging from “1 = strongly disagree” to “7 = strongly agree,” was used in this research to measure the constructs. All of the constructs of this study were designed and operationalized as reflective constructs. The questionnaire was administered in both English and Bahasa Malaysian; the original English had to be translated into Malay, which is the national language of Malaysians. There are few procedures that can be used for translation (Harkness et al., 2004). The current study applied the back-translation procedure because it is the procedure most commonly recognized and used for translation (Behling and Law, 2000). The quality and clarity of the translation were evaluated and ensured by a monolingualistic Bahasa Malaysia expert from the Malaysian Institute of Translation and Books.

Social media usage, which is the sharing of opinions and posting with others through social media platforms (Lai and Turban, 2008), was measured by adapting seven items from Xu et al. (2012). Impulse buying, which is the behaviour of making sudden food purchases during the COVID-19 pandemic without considering any alternatives or the future implications of the behaviour (Rook, 1987), was measured by adapting nine items from Rook and Fisher (1995).

The construct neuroticism, which is one of the Big Five personality trait dimensions, was adapted from Sun et al. (2004). Seven measurement items on a seven-point Likert scale with anchors from 1 = strongly disagree to 7 = strongly agree were included in the questionnaire. Participants were asked to rate how well the statements described the participant's personality (Nikčević et al., 2021). Higher scores showed higher levels of the neuroticism trait.

Table 1
Constructs and items

Constructs	Item	Source
Neuroticism	I see myself asmoody more than others ...emotions go way up and down ...testy/Bad-tempered more than others ...temperamental/Cranky ...fretful/uneasy ...jealous ...touchy/sensitive	Sun, Wu and Youn (2004)
Social Media Usage	On average, each week I use social media often For each log session, I use social media long On social media, I often post something On social media, I often view something On social media, I often share something On social media, I often reply to others On social media, I often play website games	Xu et al. (2012)
Impulse buying	I often buy food spontaneously "Just do it" describes the way I buy food I often buy food without thinking "I see it, I buy it" describes my food shopping behavior "Buy now, think about it later" describes my food shopping behavior Most of the time I buy food without planning in advance I buy food according to how I feel at the moment I do not plan most of my food purchases Sometimes I am a bit reckless about the food I buy	Rook and Fisher (1995)
Food waste	I always have food leftover on my plate after a meal I cook food more than what is needed I often save food but eventually not use them I often open products (cans, sauces, etc...) but eventually not use them I waste food whenever I go out with friends/family I waste food whenever I have guests at home I waste food at work/school I waste food at home whenever I am due to travel	Abdelradi (2018) and Aktas et al. (2018)

The dependent variable "food waste," which referred to food that was intended for human consumption but was thrown away or not consumed by humans (including food that was edible and food that was spoiled when discarded), was measured by adapting eight items from Abdelradi (2018) and Aktas et al. (2018). The questionnaire is presented in the supplementary information.

3.3. Data Analysis

The descriptive statistics regarding food purchasing behaviour were analyzed by using the frequency analysis in Statistical Package for the Social Sciences (SPSS) version 26. Structural equation modeling (SEM) using the partial least squares (PLS) method was employed to analyze the validity and reliability of the measurement model and also to analyze the structural model of this research. Of the 274 participants in the sample, 61.3% were female and 38.7% were male. Among the respondents, 63.5% were single and 29.6% were married with children. Most of the respondents were ages 23 to 38 years (64.2%), followed by those ages 18 to 22 years (20.8%) and those ages 39 to 54 years (14.2%). The number of consumers who participated in this study who possessed a certificate or diploma was 40.5%, followed by those who had earned a bachelor's degree (38.7%). The descriptive statistics also demonstrated that 60.6% of the respondents purchased food more than four times a month. In addition, 37.2% and 24.5% of the respondents spent RM 200–RM400 and RM401–RM600, respectively, on food per month.

This study used PLS modeling with SmartPLS 3.2.8 (Ringle et al., 2015) as the statistical tool to examine the measurement and structural model because it does not require a normality assumption and the survey research is not normally distributed

(Chin et al., 2003). Additionally, the research model in the current study has five direct hypotheses, two mediation hypotheses, and one moderator hypothesis. The complexity of the model indicates the appropriateness of using PLS-SEM (Richter et al., 2016; Rigdon, 2014).

The data were collected using a single source; thus, the major downside of data collection within a single survey instrument is the common method variance (CMV) (Podsakoff et al., 2012). In order to reduce the CMV, this study used two statistical methods, the marker variable technique (Podsakoff et al., 2003) and the full collinearity test (Kock and Lynn, 2012). The marker variable technique measures the assumed source of method variance as a covariate in the statistical analysis (Podsakoff et al., 2003). The marker variable can be selected from the variables in the study by incorporating a scale that is theoretically unrelated to the study (Lindell and Whitney, 2001). The marker variable in this study was adopted from Miller and Chiodo (2008) and Simmering et al. (2015) by asking about the colour preferences of the respondents. Because the markers are merely proxies and do not directly measure the CMV, the selected markers should be negligible or have no significant variance with the variables (Simmering et al., 2015). The PLS marker variable approach was used to create a method factor (Rönkkö and Ylitalo, 2011). As shown in Table 2, there was no significant difference of R^2 changes in the endogenous construct with the addition of the marker variables. Thus, this test concluded that common method bias was not a concern.

In addition, a full collinearity test was performed to determine whether any constructs reflected the variance inflation factor (VIF) values of equal to or greater than 3.3 (Kock and Lynn, 2012). The results indicate that pathological VIFs for all constructs ranged

Table 2
R square of PLS marker variable approach

	Without Marker Variable	With Marker Variable	Difference
Food Waste	0.337	0.339	0.2%
Impulse Buying During Covid 19	0.304	0.307	0.3%

Table 3
VIF value of full collinearity test

Social Media Usage	Impulse Buying During Covid-19	Neuroticism	Food Waste
1.420	1.561	1.238	1.457

from 1.238 to 1.561, as shown in Table 3, confirming again that the CMV was not a serious concern in this study.

Finally, to ensure that nonresponse bias was not a concern in the study, missing values should be dealt with when using PLS-SEM (Hair et al., 2017). The observations that contained the missing values were deleted to ensure the reliability of the data as per the suggestion by Hair et al. (2017). Furthermore, the model constructs were the same throughout the data collection stages, and responses were collected individually (Hair et al., 2017). Hence, nonresponse bias was not a concern of this study.

4. Result

This study employed the PLS technique in the validation of the measurement model and testing of the hypotheses. Unlike the covariance-based SEM, the PLS is a variance-based method that is less affected by model misspecification and is well suited for exploratory research (Hair et al., 2019). This study followed the suggestions of Anderson and Gerbing (1988) about testing the model developed using a two-step approach. First, this study tested the measurement model on the validity and reliability of the instruments, and then the structural model was run to test the hypothesis developed.

4.1. Measurement Model

For the measurement model, this study first assessed the outer loadings, Cronbach alpha (CA), composite reliability (CR), and average variance extracted (AVE). As shown in Table 4, the outer loading was higher than the recommended threshold of 0.708 (Hair et al., 2019). Meanwhile, the CA and CR values for each construct were higher than 0.7 (Hair et al., 2011) and the AVE values exceeded the minimum value of 0.5 (Hair et al., 2017). Therefore, the necessary conditions for reliability and validity were met. Then this study assessed the discriminant validity using the heterotrait–monotrait (HTMT) ratio of correlations criterion suggested by Henseler et al. (2015) and updated by Franke and Sarstedt (2019). As shown in Table 5, the values of the HTMT were all lower than the stricter criterion of 0.85 or less; this indicated that the respondents understood that the four constructs were distinct. Taken together, both these validity tests showed that the measurement items were both valid and reliable.

4.2. Structural Model

4.2.1. Direct hypotheses testing

The PLS structural model was used in testing the hypotheses. This study reported the path coefficients, standard errors, t-values, and p-values for the structural model using a 5,000-sample re-sample bootstrapping procedure (Hair et al., 2019). The result of the direct hypothesis testing is shown in Table 6. This study found that social media usage was a significant predictor of impulse buying during the COVID-19 pandemic ($\beta = 0.462, p < 0.001$) and of

Table 4
Result of convergent validity

Construct	Indicators	Loadings	CA	CR	AVE				
Social Media Usage	SMU2	0.759	0.759	0.862	0.676				
	SMU3	0.875							
	SMU5	0.829							
	Impulse Buying	IBB1				0.721	0.924	0.938	0.655
		IBB2				0.817			
IBB3		0.873							
IBB4		0.873							
IBB5		0.876							
IBB6		0.820							
IBB8		0.764							
IBB9		0.710							
Neuroticism	NEUa	0.842	0.915	0.936	0.747				
	NEUb	0.826							
	NEUc	0.918							
	NEUd	0.898							
	NEUe	0.832							
Food Waste	FW1	0.785	0.930	0.943	0.673				
	FW2	0.729							
	FW3	0.792							
	FW4	0.847							
	FW5	0.848							
	FW6	0.836							
	FW7	0.870							
	FW8	0.846							

food waste ($\beta = 0.172, p < 0.01$). Hence, H1 and H2 were supported. Meanwhile, neuroticism was positively significant towards impulse buying during the COVID-19 pandemic ($\beta = 0.203, p < 0.001$) and food waste ($\beta = 0.272, p < 0.001$), and this indicated that H3 and H4a were supported. Finally, this study also found a significant relationship between impulse buying during the COVID-19 pandemic and food waste ($\beta = 0.286, p < 0.001$). Therefore, H5a was supported.

4.2.2. Indirect hypotheses testing

This study examined three indirect hypotheses involving two mediation effects (H5b and H5c) and a moderation effect (H4b). For mediation hypothesis testing, this study followed the suggestion by Preacher and Hayes (2008) and Hair et al. (2017) by bootstrapping the indirect effect of Impulse Buying During COVID-19 in the relationship of Social Media Usage and Food Waste for H5b. Meanwhile, H5c examined the mediating effect of Impulse Buying During COVID-19 in the relationship of Neuroticism and Food Waste. Table 7 shows the result of the bootstrap bias-corrected confidence intervals. The lower and upper levels of H5b were 0.067 and 0.202, and the confidence intervals for H5c were 0.022 and 0.105. This indicated that the interval does not straddle in between zero and revealed a significant effect for both hypotheses. Therefore, Impulse Buying During COVID-19 mediated the relationship of Social Media Usage and Neuroticism towards Food Waste, and this revealed that H5b and H5c were supported.

Table 5
Results of discriminant validity (HTMT criterion)

	Food Waste	Impulse Buying During COVID-19	Neuroticism	Social Media Usage
Food Waste				
Impulse Buying During COVID-19	0.490			
Neuroticism	0.437	0.349		
Social Media Usage	0.455	0.604	0.309	

Table 6
Results of direct hypotheses testing

Description	Std. Beta	Std. Error	t-value	p-value	Effect Size (f^2)	Coefficient of Determination (R^2)	Decision
H1 Social Media Usage -> Impulse Buying During COVID-19	0.462	0.050	9.291	0.000	0.286	0.304	Supported
H2 Social Media Usage -> Food Waste	0.172	0.065	2.640	0.009	0.033	0.337	Supported
H3 Neuroticism -> Impulse Buying During COVID-19	0.203	0.054	3.797	0.000	0.055	0.304	Supported
H4a Neuroticism -> Food Waste	0.272	0.052	5.216	0.000	0.099	0.337	Supported
H5a Impulse Buying During COVID-19 -> Food Waste	0.286	0.068	4.223	0.000	0.086	0.337	Supported

Table 7
Result of mediation analysis

Description	Std. Beta	Confidence Interval		Std. Error	t-value	p-value	Decision
		5%	95%				
H5b Social Media Usage -> Impulse Buying During COVID-19 -> Food Waste	0.132	0.067	0.202	0.035	3.723	0.000	Supported
H5c Neuroticism -> Impulse Buying During COVID-19 -> Food Waste	0.058	0.022	0.105	0.020	2.854	0.004	Supported

Table 8
Result of moderation analysis

Description	Std. Beta	Std. Error	t-value	p-value	f^2	Decision
H4b Social Media Usage*Neuroticism -> Food Waste	0.153	0.041	3.756	0.000	0.034	Supported

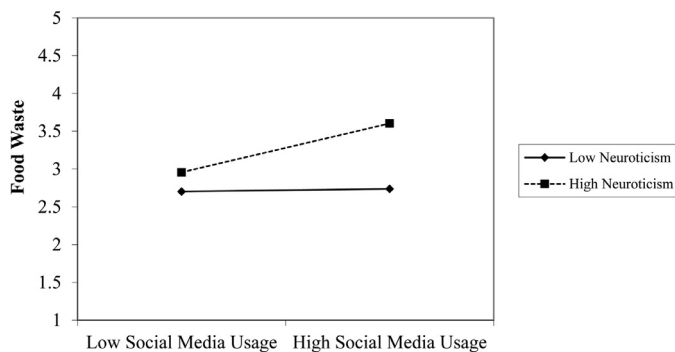


Fig. 2. Interaction plot of moderation analysis

Further, this study examined the moderation effects of neuroticism in the relationship of Social Media Usage and Food Waste, or hypothesis H4b. The moderation assessment followed the orthogonalising approach and the most appropriate approach for testing the strength of the moderation effects (Henseler and Chin, 2010). Referring to Table 8, the f^2 value of 0.034 indicated a small effect size (Cohen, 1988). Further, the bootstrapping result in Table 8 shows that the interaction term of social media usage*neuroticism was significant (t-value = 3.756). Therefore, it can be concluded that hypothesis H4b was accepted. To further understand the interaction of the moderating variable, Dawson (2014) suggested drawing an interaction plot. As seen in Figure 2, the line for high neuroticism has a steeper gradient than the line for low neuroticism, indicating that a positive relationship is indeed stronger when neuroticism is high. Therefore, based on the hypothesis, it can be concluded that the influence of social media usage on food waste was stronger when the level of neuroticism was higher.

4.2.3. Effect size

According to Cohen (1988), the evaluation of the effect size (f^2) is crucial when estimating the structural model. Thus, this study followed Cohen’s criteria for interpreting the f^2 , where 0.02, 0.15, and 0.35 indicated small, medium, and large effect sizes, respectively. As shown in Table 6, Social Media Usage had a relatively medium effect size on Impulse Buying During COVID-19 but a small effect size on Food Waste. Meanwhile, Neuroticism had a small effect size on Impulse Buying During COVID-19 and Food Waste. Similarly, the impact of Impulse Buying During COVID-19 was also small on Food Waste.

4.2.4. Coefficient of determination (R^2)

This study examined the explanatory power of our model based on the coefficient of determination (R^2). The R^2 computes the model’s predictive power, and the value ranges from 0 to 1, with a higher value indicating a higher level of predictive accuracy (Hair et al., 2017). As shown in Table 6, the R^2 value for Impulse Buying During COVID-19 was 0.304, which explained a 30.4% variance. Meanwhile, the R^2 value for Food Waste was 0.337, which explained the 33.7% variance.

4.2.5. Partial least squares predict (PLSpredict)

Shmueli et al. (2019) proposed the PLSpredict method, a holdout sample-based procedure that generates case-level predictions on an item or a construct level using the PLSpredict with a 10-fold procedure to check for predictive relevance. Shmueli et al. (2019) suggested comparing the item differences between PLS and the linear regression model (PLS-LM) with the item value in LM. If the item differences (PLS-LM) are smaller than the item value in LM, there is strong predictive power and vice versa for no predictive power. Meanwhile, if the majority value of item differences (PLS-LM) is lower, then there is moderate predictive power, and if the minority value is lower, there is low predictive

Table 9
PLSpredict

	PLS	LM	PLS-LM	Q ² _predict
Items	RMSE	RMSE	RMSE	
FW1	1.691	1.708	-0.017	0.192
FW2	1.593	1.632	-0.039	0.146
FW3	1.573	1.560	0.013	0.173
FW4	1.380	1.345	0.035	0.188
FW5	1.485	1.564	-0.079	0.161
FW6	1.479	1.540	-0.061	0.181
FW7	1.356	1.471	-0.115	0.190
FW8	1.493	1.462	0.031	0.128

power. As is shown in Table 9, all the errors of the PLS model were lower than those of the linear model (LM). Thus, this study concluded that our model had a medium predictive power.

5. Discussion

Conventional food buying patterns are commonly stimulated by both internal and external factors (Iyer et al., 2020; Muruganatham and Bhakat, 2013). However, during the COVID-19 pandemic, buyers' physical activities were restricted, and they had to stay at home. The time spent online increased, and the food buying pattern shifted to more online purchasing than in the past. The external stimuli, such as food availability, price, restaurant ambiance, and previous experience, all were diluted and overcome through social media. Food availability is enhanced by social media because of associated delivery services, and prices of foods can be compared online. The restaurant ambiance was not important in this situation because the food purchased was consumed at home. The previous experience with food could be enhanced by the reviews and feedback online.

Knowing the importance of mitigation and the multiple sources of food waste, it is important to investigate how consumers react during times of uncertainty such as the COVID-19 pandemic and how technology influences food purchasing behaviour. The results indicated that food waste has been strongly influenced by social media usage, neuroticism, and impulse buying. The results contradicted the findings of past studies, which argued that social media could be an effective tool in reducing food waste (Grainger and Stewart, 2017; Lazell, 2016; Närvänen et al., 2018). The interesting findings provide a theoretical contribution to the topic of whether social media use affects food waste, but they are inconclusive. Specifically, this research provides empirical evidence that social media is a source of food waste generation. The study also extends and validates the findings of Sainsbury's (2016), blaming social media for driving food waste. Sainsbury's (2016) research was carried out in the United Kingdom, and similar findings yielded in this study proved that the impact of social media usage on food waste was supported in Malaysia's context. Hence, the study's results have increased the generalizability of the theoretical perspective on the positive relationship between social media usage and food waste.

This study further explored the role of impulse buying and neuroticism in elucidating social media and food waste, and the impact of impulse buying on neuroticism and food waste, while extending the literature on the subject. The results have extended the literature in three ways. The first and second ways involve the strong association of social media and neuroticism with impulse buying that eventually leads to food waste. Even though a myriad of research has been conducted in examining the relationships between social media and impulse buying and between neuroticism and impulse buying, this research offered an insight into how important social media usage, as well as neuroticism, was in influencing impulse buying during the COVID-19 pandemic. Specif-

ically, this research argued that the role of impulse buying was being shaped more by internal factors at that time, and therefore it added fresh insights to the impulse buying literature. For example, Amos et al. (2014) and Flight et al. (2012) argued that positive situations commonly determine impulse buying, and this research argues that even during pressing and uncertain conditions such as the COVID-19 pandemic, the usage of social media and neuroticism can influence impulse buying (Ahmed et al., 2020; Gazali, 2020). Third, impulse buying was found to exert itself as a mediator in the relationship between social media usage and food waste, as well as between neuroticism and food waste. The restrictions on activities during the COVID-19 pandemic forced food businesses to channel their services online and strengthened their presence on social media platforms, increasing consumers' social media usage. The latter, coupled with the use of food delivery services, gave rise to more impulse buying behaviours. This supports the findings of Rabobank (2020) and Gazali (2020). Besides, this research confirms the work of Naem (2020), who argued that impulse buying was enhanced during the time of COVID-19 due to fears about the health crisis and product scarcity. Such neurotic behaviour was evident during the pandemic. It was due to the information consumers received, which led them to engage in impulse buying. Hence, the findings of Naem (2020) and Gazali (2020) were upheld. The increased spending on food impulse buys contributed to the skyrocketing amounts of food waste reported by Rabobank (2020) during the pandemic. Because the COVID-19 pandemic was an unprecedented situation, the mitigation approach taken by the government was uncertain and changed from time to time. Therefore, this study provided further evidence of the mediating role of impulse buying on the relationship between social media usage and food waste and the relationship between neuroticism and food waste while consumers were spending more time online and living with the fear and stress resulting from the pandemic (Fernandes et al., 2020).

In contrast to the previous research on neuroticism and food waste prevention (e.g., Boeve-de Pauw et al., 2011; Milfont and Sibley, 2012; Opayemi et al., 2020), the results of this research underscored the interesting findings on the significant effect of neuroticism on food waste. This implies that consumers were psychologically affected by the COVID-19 pandemic and even neurotic individuals had a positive relationship to food waste behaviours. In other words, this research argues that neurotic individuals are more inclined to worry about present necessities rather than a possible impact on the future. It can be seen from the hoarding and stockpiling behaviours during the earlier stages of the COVID-19 pandemic that such actions resulted in disruptions to both the consumption and the production of food supplies. COVID-19 has brought anxiety and fear because of the uncertainty of the times (Dong and Bouey, 2020; Goyal et al., 2020). Thus, the neurotic acts were inclined to satisfy an individual's needs and lessen the fear of what the pandemic may bring. According to a recent report by Big Commerce, the COVID-19 pandemic drastically changed what, how, and when people buy (Meyer, 2020). What is more, the impact of food waste may not be immediate and eminent in relation to in-house food security.

Finally, the findings also shed light on the unique contributions of neuroticism as a moderating variable between the interaction (social media*neuroticism) and the endogenous construct (food waste). More specifically, it emerged as a positive moderating effect, indicating that the relationship between social media usage and food waste becomes stronger when the level of neuroticism is high. Highly neurotic individuals managed their negative emotions through substantial levels of social media usage to escape from the unfavourable situation caused by the COVID-19 pandemic. This supports the findings of Kircaburun and Griffiths (2019); although their study was conducted before the pan-

demic, it showed that Instagram was used to escape from reality. In addition, the increased exposure to food-related content on social media and overconsumption generated food waste. Given that individuals with high levels of neuroticism use social media more, it is not surprising that neuroticism intensifies the effect of being exposed to social media on food waste. For less neurotic individuals, there were no significant changes in the effect of social media usage on food waste. Therefore, the findings indicated that when the level of neuroticism is low, the relationship between social media usage and food waste remains unchanged. Learning from this context, this research provides empirical evidence on the relationship between neuroticism and food waste that was not discovered by Jamaludin et al. (2020). This research further argues that neuroticism caused by the COVID-19 pandemic is temporary. Once the anxiety and fear of COVID-19 are overcome due to vaccination availability and other measures, the amount of food waste caused by social media usage remains constant.

6. Conclusion

In conclusion, this study advances the knowledge on sustainable consumption with the findings on the increased social media usage, neuroticism, and impulse buying that eventually drove food waste during the COVID-19 pandemic. Specifically, this study sheds some light on the mixed findings in the existing literature, such as the dyadic effect of social media that may also result in adverse outcomes such as food waste. The growth of social media usage has been proven to fuel food waste generation. Likewise, neuroticism has been found to positively impact food waste. Learning about the role of neuroticism or the emotional state caused by COVID-19 in influencing food waste expands the breadth of neuroticism research because the findings show that during the pandemic, the better impulse control of persons who were not neurotic could be a better solution to food waste. On the other hand, impulse buying mediates the relationship between social media usage and food waste, as well as between neuroticism and food waste, indicating that the role of advertising on social media and the influence of negative emotions are important determinants of purchasing behaviour. Besides, neuroticism moderates the relationship between social media usage and food waste, suggesting that sustainable consumption is largely influenced by consumers' emotional states.

Additionally, this study offers important insights to stakeholders. First, the direct impact of social media usage, neuroticism, and impulse buying on food waste must be interpreted with caution because this study was conducted during the uncertain time of COVID-19. Second, psychological factors play a bigger role than thought in determining impulse buying and, hence, the excessive buying that ultimately leads to food waste. This provides crucial information on the role of the decision-making process within the e-business marketplace. It is crucial for marketers to adopt more socially responsible marketing by giving thought to what is in the best interests of society and a sustainable future instead of recklessly promoting the excessive purchasing of products that will ultimately be wasted. The findings of this research can encourage marketers to be more creative in coming up with strategies for targeting consumers, for example, by promoting their brands as purpose driven in their efforts to tackle the issue of food waste. Third, the consumption behaviour affecting food waste is complex and requires further investigation because of the limitations of the study. They could be taken into consideration in future research and, hence, be useful in verifying the generalizations made. This research was undertaken during the early phases of the COVID-19 pandemic in Malaysia, and its findings may differ across other countries due to cultural differences. Hence, this study should be replicated and tested in other countries to further confirm the re-

sults. The study may also be limited in terms of issues of neuroticism that may change from time to time. Future research could replicate this study by using longitudinal research or time series of data collection that may further enhance the findings. Despite the fact that this research emphasizes the contemporary phenomenon of the COVID-19 pandemic in food waste, it would be interesting for future studies to focus on food waste avoidance behaviour. As society becomes more used to COVID-19, sustainable consumption may be rectified and adjusted to a new norm, and the longer-term impact may again play an important role among consumers. Finally, behaviour in the food waste context is dynamic, and its determinants can vary. As a result, the inclusion of social media usage, neuroticism, and impulse buying offers avenues for future research that could explore other factors that could facilitate a broader understanding of food waste.

Declaration of Competing Interest

None

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