



# Unearthing mask waste separation behavior in COVID-19 pandemic period: An empirical evidence from Ghana using an integrated theory of planned behavior and norm activation model

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## Abstract

The outbreak of the COVID-19 pandemic has precipitated a surge in mask usage around the world. This situation could spur environmental consequences which when not well managed, may compound waste and waste management, and further drive the spread of viral infections. Therefore, this study explores the antecedents of mask waste separation behavior in Ghana using an integrated model composed of the theory of planned behavior and the norm activation model. With the use of the questionnaire survey approach, data was drawn from 570 respondents, and further analyzed using the structural equation modeling technique. Results revealed that the relationship between awareness of consequences and other constructs, except attitude, and the relationship between ascription of responsibility and other constructs, except attitude, are significant. Moreover, significant relationships between subjective norm and attitude, subjective norm and personal norm, and subjective norm and perceived behavior control were validated. However, no significant relationship exists between awareness of consequences and attitude, and between awareness of responsibility and attitude. On the basis of the study findings, insightful implications for policy and suggestions for future research are presented.

**Keywords** Mask waste · Waste separation · COVID-19 · Norm activation model · Theory of planned behavior · Ghana

## Introduction

Since the outbreak of the novel coronavirus and the later declaration of the situation as a public health emergency of global concern by the World Health Organization (WHO), the coronavirus has spread across low to middle and high-income

countries, and subsequently, exerted varying degrees of impacts on societies and economies. Consequently, with authorities in various jurisdictions facing challenges from this issue, the coronavirus situation has apparently affected global governance (Anthony et al., 2020; Wang, 2021; WHO, 2020). This assertion is proven by the confirmed 110,224,709 COVID-19 cases around the world, including 2,441,901 deaths as of February 20, 2021. Africa's share of the confirmed cases for the same period stands at 2,770,485 (WHO, 2021). Ghana confirmed its first two cases of COVID-19 on March 12, 2020. Confirmed COVID-19 cases and death rates in Ghana stand at 79,665 and 572, respectively, as of February 20, 2021 (Ghana Health Service, 2021).

The outbreak of the pandemic has led to the institution of stringent measures, including the enactment of the Imposition of Restrictions Act (IRA) 2020, pursuant to which the President of Ghana issued an Executive Instrument (E.I. 64). Subsequently, the Minister of Health, acting *intra vires* to Section 169 of the Public Health Act of 2012 (Act 851) declared a public health emergency (Addadzi-Koom, 2020). These legislative measures, among other things, enforced COVID-19 protocols including social distancing and mask

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wearing as some of the protective mechanisms to stem the rise in COVID-19 cases. Against the backdrop of rising COVID-19 cases around the globe, including Ghana, the demand for disposable surgical face masks can be projected to increase (Wang et al., 2020). Nowadays, people use masks and occasionally or regularly discard them on a daily basis.

Discarding masks could potentially not be only wasteful, but also generate environmental waste (Parkinson, 2020; Yeh, 2020). The volume of mask waste generated around the world, and more particularly in Ghana on a daily basis is inestimable. At the moment, Ghana is battling filth and waste management. On top of this situation comes mask waste, which poses substantial environmental challenges (Klemeš et al., 2020). Considering that mask waste could pose detrimental environmental challenges and erupt medical complications such as secondary infections (Yang et al., 2020), mask waste separation behavior needs to be promoted in Ghana.

Currently, environmental sustainability issues have come into prominence, perhaps partly due to the global goals stated in the Sustainable Development Goals (SDG'S). Entant literature such as Chen et al. (2019), Ma et al. (2020), Ulhasanah and Goto (2018), Wang et al. (2019) and Xu et al. (2018) mainly focused on household waste separation, and sought to explore the determinants of household willingness to separate waste. People in Ghana now wear masks to protect themselves from COVID-19 infection. Therefore, individual willingness to separate mask waste from other forms of waste including, but not restricted to household, workplace, and other forms of waste, is crucial to fighting the COVID-19 pandemic. Hence, mask waste separation behavior needs to be investigated extensively to derive a better comprehension of underlying factors. Nonetheless, to the best of our knowledge, studies on mask waste separation behavior in pandemic times are lacking.

Clarifying underlying factors relative to mask waste separation behavior can provide guidelines and pointers to streamline the formulation of relevant policies targeted at health promotion. In this study, mask waste separation behavior is conceptualized as an individual's initiative, action, and intent to sort used and discarded masks from other waste forms (Zhang, Liu, et al., 2017, Zhang, Geng, Sun (2017). Mask waste separation intention behavior refers to the tendency or possibility of the individual to separate mask waste from other waste. This study aims to unearth individual mask waste separation intention behavior during the COVID-19 pandemic and provide relevant implications for government, non-government organizations, and other relevant stakeholders that work with the environment and health sectors.

Our study presents a theoretical framework anchored on the theory of planned behavior (TPB) and the norm activation model (NAM) for the investigation. This study will help delineate proximate crucial underlying factors relative to mask waste separation behavior during the COVID-19

pandemic. The study will also help identify social and psychological variables that strongly influence the determination and/or prediction of mask waste separation behavior whilst testing the predictive and explanatory potency of the integrated model composed of TPB and NAM. By corroborating the salience of the integrated model in executing pro-social and/or pro-environmental behavior, this study enriches and expands waste separation research. The proposed model was verified via structural equation modeling (SEM) of data drawn from regions across Ghana.

## Literature Review

### Mask Waste Separation Intention Behavior

The combined effects of rapid development, industrialization, and urbanization have engendered a dramatic rise in consumer products, thus paving the way for waste generation in the global ecological system (Matsuda et al., 2018; Wang et al., 2019). Globally, 1.3 billion tons of solid waste are generated, of which two-thirds, which are largely urban generated, are household sourced (Ikhlayel et al., 2016). An increase in waste from 5.6 million to 7.65 million (representing 28%) was recorded from 1997 to 2007. Until the end of 2020, this figure was projected to surge by 30%. Moreover, against the backdrop of a projected 48% increase in waste generation (approximately 1.3 billion tons in 2012), waste generation is anticipated to hit 2.2 billion tons by the close of 2025 (Maskey, 2018). At the sub-regional level, sub-Saharan Africa was reported to generate 0.46 kg of waste a day in 2016. The entire region presently generates a cumulative 174 million tons and is projected to experience an increase by 2050 (World Bank, 2018). This situation is no different from what pertains to Ghana, who reportedly generate 0.51 kg waste daily—a volume beyond the regional average threshold of 0.46 kg/day (Abalo et al., 2018; Owusu-Sekyere, 2019). During this time of pandemic, when medical waste and waste from mask usage generated by the public is on the rise, one can imagine the impacts of the volume of generated waste on the ecological system and human well-being. Considering the need for environmental sustainability and the need to promote health and well-being in pandemic times, the Environmental Protection Agency (EPA), a statutory body tasked with ensuring environmental sustainability, initiated a mask waste separation campaign (EPA, Environmental Protection Agency, 2021). Ensuring the success of this initiative requires an investigation of underlying factors. Waste separation refers to putting the same or similar waste together (Agovino et al., 2018). Within the scope of this study, mask waste separation refers to putting mask waste together. Mask waste separation behavior constitutes an altruistic

pro-social social/environmental behavior and health protection behavior. Moreover, it could be captured as a self-interest behavior that is meant to augment dividends and either minimize or assuage inherent potential health risks (Agovino et al., 2018; Zhang, Geng, & Sun, 2017; Zhang, Liu, et al., 2017). In view of this idea, one of the extensively used rational choice-based altruistic paradigms is proposed, which is composed of NAM (Schwartz, 1973) and TPB (Ajzen, 1991), and replicated to investigate mask waste separation behavior during the COVID-19 pandemic. This topic remains a researchable, yet unexplored subject matter.

### Theory of Planned Behavior

TPB (Ajzen, 1991), a derivative of the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980), has been extensively replicated in behavior studies across diverse space of disciplines. Established as a robust framework, the TPB has been tried, tested, and proven effective in accurately and precisely predicting pro-social environmental, non-environmental, and health protection behavior (Arkorful, Hammond, et al., 2020; Arkorful, Lugu, et al., 2020; Arkorful, Shuliang, et al., 2020; Armitage & Conner, 2001). The theory is anchored on a tripod of factors composed of; attitude toward behavior (i.e., the individual's positive/favorable or negative/unfavorable appraisal of behavior in question), subjective norm (i.e., individual anticipated pressure to perform or engage in a behavior), and perceived behavior control (i.e., the individual's perception of ease or difficulty relative to the performance of or engagement in a behavior). Perceived behavior control is also conceptualized as the amalgam of perceived enhancers and hindrances to behavior performance premised on prior experiences (Arkorful, Hammond, et al., 2020; Arkorful, Lugu, et al., 2020; Arkorful, Shuliang, et al., 2020).

Notably, the determination and prediction of attitude is hinged on the additive and incremental contribution of variables such as attitude, subjective norm, and perceived behavior control. The TPB has been extensively deployed in empirical studies on environmental behavior prediction (Chao, 2012; Fielding et al., 2008; Fox-Cardamone et al., 2000; Wang et al., 2016), recycling (Chen & Tung, 2010; Wang et al., 2016), energy use efficiency (Zhang et al., 2014), and technology adoption (Arkorful, Hammond, et al., 2020; Arkorful, Lugu, et al., 2020; Arkorful, Shuliang, et al., 2020).

### Norm Activation Model

The NAM, which was developed by Schwartz (1973), largely focuses on studying pro-social and/or altruistic behavior.

Like the TPB, the NAM is hinged on a tripod of elements made up of; personal norm, awareness of consequences, and ascription of responsibility. The NAM is entirely hinged on personal norm. In other words, the core of the model proposed by Schwartz (1973) is personal norm, which refers to the individual obligation to indulge in or abstain from the performance of behavior. Awareness of consequences (another strand of the model) is also referred to as the individual's consciousness relative to the ramifications of behavior performance or otherwise. Notably, awareness of consequences is triggered or awakened by personal norm. Ascription of responsibility refers to the attribution of behavior outcomes regarding the performance of behavior or otherwise. Since the proposition of the NAM, it has been used extensively to probe pro-environmental behavior (Garling et al., 2003; Harland et al., 2007; Han, 2014; Han, 2015), transport studies (Bamberg et al., 2007) and energy studies (De Groot & Steg, 2009; Zhang, Wang, & Zhou, 2013; Zhang, Yang, & Bi, 2013). These studies have essentially established the appropriateness and potency of NAM in behavior studies investigation.

### Studies Integrating TPB and NAM

The NAM and TPB are prototypical binary theories employed to illuminate and predict behavior from the lens of individual consciousness (Si et al., 2021). Taken together, the potency of the TPB and NAM is embedded in their prediction and interpretation of social and psychological variables (Ru et al., 2019; Wang et al., 2018; Wang et al., 2019). A plethora of studies targeted at predicting behavior have wedded these theories (Asadi et al., 2019; Zhang, Geng, & Sun, 2017; Zhang, Liu, et al., 2017). The predictive potency of the binary theories is confirmed by Kim et al. (2018), Wang et al. (2019) and Zhang, Liu, et al., 2017, Zhang, Geng, Sun, 2017. With a sample of 1587, Wang et al. (2018) extended NAM by integrating information publicity and information quality (as a moderating variable) to investigate residents' waste separation behavior across various areas in China. In essence, this study corroborates the salience of an extended NAM model. In a study employing a sample of 1958, Zhang, Liu, et al. (2017), Zhang, Geng, and Sun (2017) probed the environmental complaint behavior of residents in 43 cities across the prefectures and provinces in China, and further confirms the potency of an integrated framework comprising TPB and NAM.

In another related study, Wang et al. (2018) investigated electronic waste recycling behavior using an integrated model. The study, which utilized a sample of 462, confirms not only the indirect effect of information publicity through personal norm and attitude, but also the appropriateness of a merged model. In a more contemporary study, Kim and Hwang (2020) used a sample of 401 study participants and

investigated individual eco-friendly behavior in the context of food delivery. The study, which reinforced the salience of the integrated model, found that all proposed 16 hypotheses were supported. Kiatkawsin et al. (2020) determined smart tourist pro-social environment behavior by using an integrated framework with a sample of 554. Esfandiar et al. (2021) investigated tourist binning behavior in national parks by using a sample of 219 and established the pertinence of an integrated TPB and NAM model.

These previous studies set the germane basis validating the relevance of the dual theories for investigating behavior. Nonetheless, studies on the use of the same theories to investigate mask waste separation behavior during the COVID-19 pandemic are lacking. In view of the prior studies by Chen (2016) and the recommendations to integrate variables to test the predictive potency of theories, this study investigates mask waste separation behavior by employing TPB and NAM (Fig. 1). This study’s various hypotheses are discussed below.

### Theoretical Framework and Hypotheses Development

As reiterated, the study proposes an empirical framework premised on the TPB and NAM. These theories are used to study pro-social/environmental behavior and correspondingly shed light on their underpinnings. The motivation to merge TPB and NAM in this seminal study is based on the objective of verifying both self-interest and pro-social/environmental behavior, which are essentially the proximate focus of this study. Given the intricately interlocked nature of self-interest and pro-social behavior (as they all inform each other), a comprehensive insight into the foundations and their relations to the individual decision-making process

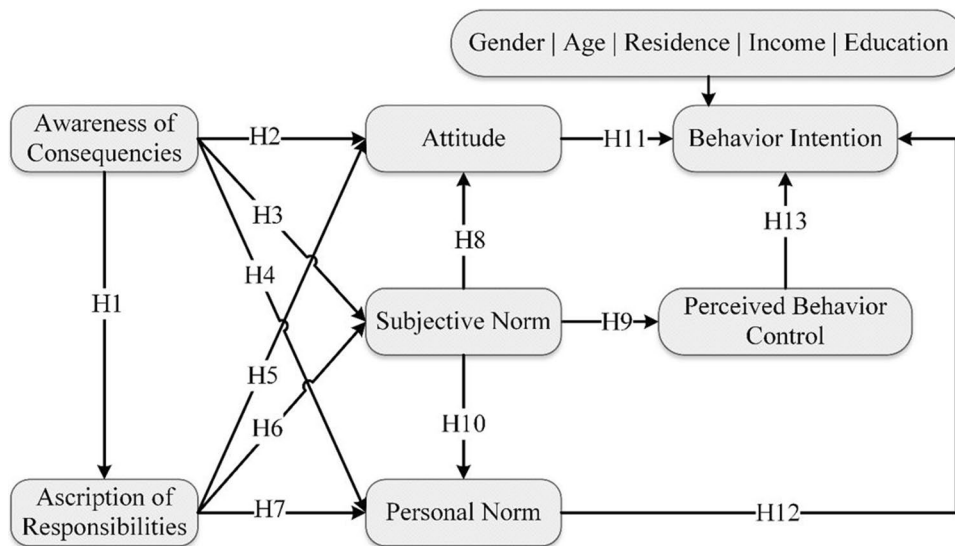
should be investigated and identified (Bamberg & Möser, 2007). This concept has led to strong recommendations for the integration of these two theories to augment behavior prediction (Han et al., 2017).

### Norm Activation Model and Waste Separation Intention Behavior

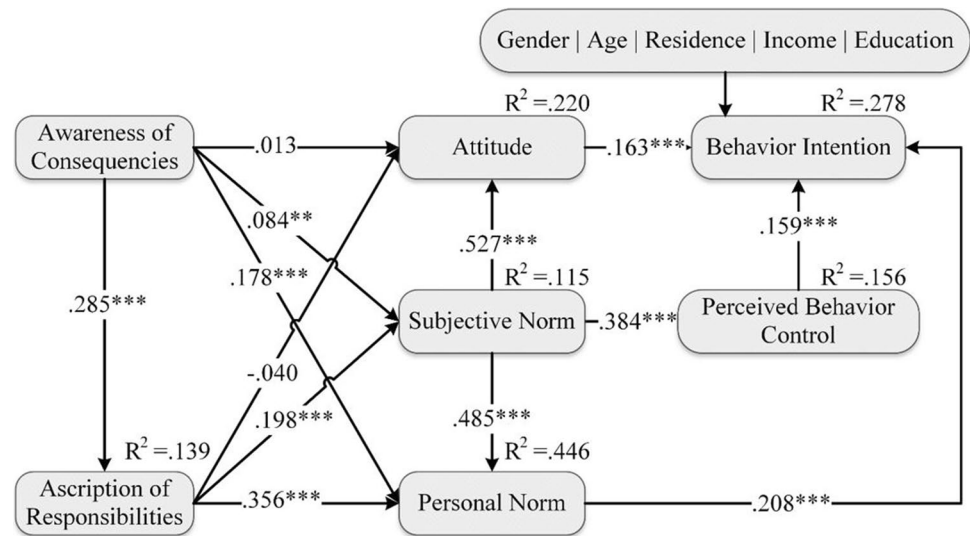
NAM was proposed by Schwartz (1973) as a rational choice, self-interest, and pro-social behavior paradigm, and it has been applied to study a myriad of behaviors ranging from energy saving, transport use, and waste separation (Bamberg et al., 2007; Wang et al., 2019; Zhang, Wang, & Zhou, 2013; Zhang, Yang, & Bi, 2013). The theory is based on awareness of consequences, ascription of responsibility and personal norm. Awareness of consequences refers to the individual consciousness of the adverse consequences of not performing pro-social/environmental behavior. Ascription of responsibility pertains to the individual’s sense and/or feeling of responsibility stemming from the negative ramifications of not performing pro-social/environmental behavior. Personal norm represents the innate moral obligation to perform pro-social behavior or otherwise (Fig. 2).

Within the purview of Schwartz’s NAM, the realization of the negative outcomes of not engaging in or performing pro-social behavior by the individual, culminates in a situation in which the individual tends to attribute the adverse outcomes to themselves (Wang et al., 2019). This way, the individual is likely to undergo a self-behavior assessment or interrogation, during which he or she tends to reflect on the adverse behavior outcome, thereby forming an ascription of responsibility that compels him or her to take responsibility for the negative outcome (Saphores et al., 2012). The formation of an ascription of responsibility behavior further impels the individual to develop a positive attitude towards pro-social

Fig. 1 Proposed conceptual model with research hypotheses



**Fig. 2** Structural equation modeling results



behavior. The development of a positive attitude is dependent on the appreciation for the performance of behavior and the inherent benefits provided by the performance of such a desirable behavior. On this basis, the individual cultivates the urge, inner motivation, and moral obligation to act or perform positive behavior in tandem with pro-social behavior (Zhang, Geng, & Sun, 2017; Zhang, Liu, et al., 2017).

On this score, the individual development of these traits is likely to exert an appreciable degree of influence on other referent groups or social networks (i.e., subjective norm). The contagious imitative effect of such behavior is likely to trigger the performance of pro-social behavior. Park and Ha (2014) confirm that a greater degree of awareness of consequences will consequently engender greater subjective norm and, by extension, a more positive and favorable attitude towards pro-social/environmental behavior. A significant number of studies have explored and established the significant relationship between awareness of consequences and ascription of responsibility, attitude, subjective norm, and personal norm (Bamberg et al., 2007; Wang et al., 2018; Zhang, Geng, & Sun, 2017; Zhang, Liu, et al., 2017; Zhang, Wang, & Zhou, 2013; Zhang, Yang, & Bi, 2013). Within the context of this study, we generalize on the basis of prior study findings that individual awareness of the consequence of mask waste separation behavior will likely trigger an individual’s sense of responsibility to perform pro-environmental behavior by separating mask waste from other waste forms.

Furthermore, we generalize that the individual awareness of the consequence of performing a desirable behavior (i.e., mask waste separation behavior) will inform the individual’s appreciation of pro-social/environmental behavior. Consequently, whereas the individual awareness of the consequence of performing mask waste separation behavior will likely exert some influence on others to act or behave in the same light, the study also posits that individual awareness

of the consequence of performing pro-social/environmental behavior may accordingly inform the development of his or her sense of obligation. In view of the above discourse, we hypothesize the following:

- H1. Awareness of consequences has a significant positive relationship with ascription of responsibility.
- H2. Awareness of consequence has a significant positive relationship with attitude toward mask waste separation.
- H3. Awareness of consequence has a significant positive relationship with subjective norm.
- H4. Awareness of consequence has a significant positive relationship with personal norm.

**Impact of Ascription of Responsibility on Attitude toward Waste Separation Behavior, Subjective Norm, and Personal Norm**

Schwartz (1973) views ascription of responsibility as one of the critical factors that impel individual pro-social/environmental behavior performance. Ascription of responsibility refers to the feelings of individual guilt and the subsequent assigning of responsibility to him or herself, partly owing to the individual’s refusal or inability to perform pro-social behavior. Schwartz (1973) seems to underscore the influence of ascription of responsibility on the individual assessment or evaluation of pro-social behavior, and the influence between them. In this vein, an appreciable activation of the individual’s sense of responsibility in relations to the performance of behavior or otherwise, will significantly, and altogether, impact behavior. Going forward, the individual’s ascription of responsibility, borne out of the development of pro-social consciousness, may also exert a consuming effect on the performance of behavior of others in either a referent group or a social network (Megeirhi et al., 2020).

Bamberg et al. (2007) and Zhang, Liu, et al. (2017), Zhang, Geng, and Sun (2017) affirmed that, individuals are willing to exude moral obligation to perform pro-social waste separation behavior when they feel the urgency and a sense of responsibility for the adverse consequences of not performing the same behavior. The inability of individuals to assign themselves the responsibility for the adverse outcome of not performing pro-social behavior is likely to engender the likelihood to form personal norm (Bamberg et al., 2007; Zhang, Geng, & Sun, 2017; Zhang, Liu, et al., 2017). In view of this situation, ascription of responsibility apparently has a relationship with personal norm such that the formation of the sense of individual sense of responsibility to separate waste will likely result in the performance of waste separation (Zhang, Geng, & Sun, 2017, Zhang, Liu, et al., 2017). The dearth of moral obligation may consequently hamper or impair the formation and performance of waste separation behavior. (De Groot & Steg, 2009). Several studies explored the significant relationship between ascription of responsibility and attitude and personal norm (De Groot & Steg, 2007; Wang et al., 2018c; Wang et al., 2019; Zhang, Yang, & Bi, 2013, Zhang, Wang, & Zhou, 2013). In light of these prior study findings, we hypothesize the following in the context of our study on mask waste separation behavior:

- H5. Ascription of responsibility has a significant positive relationship with attitude toward mask waste separation.
- H6. Ascription of responsibility has a significant positive relationship with subjective norm.
- H7. Ascription of responsibility has a significant positive relationship with personal norm.

### **Impact of Subjective Norm on Attitude toward Mask Waste Separation, Perceived Behavior Control and Personal Norm**

Subjective norm refers to the individual perception of others expecting him or her to perform a certain behavior. Whereas attitude refers to the individual positive or negative evaluation of an action or behavior, personal norm refers to the individual's sense of responsibility or obligation to perform behavior. These factors have been established as very important to the decision-making process relative to the formation of intention and performance of pro-social behavior. Bamberg and Möser (2007) and Park & Han (2014) confirmed the imperativeness of these relationships. According to Bamberg and Möser (2007) and Park & Han (2014), the relationship between subjective norm and attitude could presumably be interpreted to suggest that the individual's perception of others expecting him or her to perform behavior could compel him or her to accordingly perform behavior, including a pro-social behavior such as mask waste separation. This idea

reinforces the imperativeness of contagious imitative behaviors across populations and relationship networks, as raised by Arkorful, Hammond, et al. (2020). In this same vein, the contagious effects of behavior could trickle down to impact the individual's sense of ease or difficulty in performing behavior by either enhancing or influencing the performance of the same behavior. Consequently, subjective norm (i.e., the individual's anticipation of people expecting him or her to perform certain behavior) could be exploited as a conduit to either validate, seek validation, or determine the validity of the behavior to be performed or performed. Against this backdrop, the performance of behavior, its germaneness, rationality, or uprightness could be determined via subjective norm. In view of the above discourse, and more particularly against the prior studies of Bamberg and Möser (2007) and Park & Han (2014), we propose the following hypotheses:

- H8. Subjective norm has a significant positive relationship with attitude toward mask waste separation intention.
- H9. Subjective norm has a significant positive relationship with perceived behavior control.
- H10. Subjective norm has a significant positive relationship with personal norm.

### **TPB and NAM Variables Relationships**

A literature review (Esfandiar et al., 2021; Kiatkawsin et al., 2020; Kim & Hwang, 2020; Megeirhi et al., 2020; Si et al., 2021; Wang et al., 2018; Wang et al., 2019; Zhang, Geng, & Sun, 2017; Zhang, Liu, et al., 2017) underscores the fact that pro-social behavior performance does not occur in a vacuum. Rather, it is dependent on certain rational, self-interest, and psychological factors with significant bearing on both TPB and NAM. Prior studies have tested the direct effect of attitude, personal norm, and perceived behavior control in predicting pro-social behavior (Esfandiar et al., 2021; Gao et al., 2017; Han & Hwang, 2016). Drawing motivation from these afore cited prior studies, in our attempt to test the determinants of pro-social/environmental mask waste separation behavior, we speculate that attitude toward mask separation behavior, personal norm, and perceived behavior control could facilitate the formation, and further enhance the prediction of behavior (i.e., mask waste separation behavior). In addition, on the basis of what prior studies seem to suggest, we also seek to test their mediating potency in enabling the performance of behavior in the context of mask waste separation during the COVID-19 pandemic. To this end, the study proposes the following hypotheses:

- H11. Attitude toward mask waste separation has a positive relationship with behavior intention.
- H12. Personal norm has a significant positive relationship with behavior intention.

H13. Perceived behavior control has a significant positive relationship with behavior intention.

## Methodology

### Settings, Research Method, Data Collection, and Sampling Technique

The sample population for the study was composed of individuals from across the regions in Ghana. Most of the study respondents were Ghanaian residents. Ghana was selected as the study setting for investigating mask waste separation behavior because the country is currently recording rising cases of COVID-19, which is why the government is encouraging mask use. Thus, mask waste is gradually increasingly being generated in cities and other areas. This situation needs to be controlled to stem the spread of infection. In response to this situation, the Environmental Protection Agency (EPA) of Ghana is leading an advocacy for mask waste separation. Without relevant research at the moment, behavior-related evidence needs to be investigated and established. The research outcome will provide pointers to city authorities and other stakeholders within and outside Ghana on how to promote mask waste separation during a pandemic, and further help counteravail possible negative ramifications. These conditions informed the selection of Ghana for this study. Considering that Ghana is a large country, and more particularly given the need to ensure representativeness and heterogeneity in the study, a cross-sectional approach was employed to draw data from November 25, 2020, to January 31, 2021. To reveal the complexities in mask waste separation behavior among the study participants, the study complied with the suggestion of Agyei-Mensah and Owusu (2010) and Songsore (2003), and segmented the study areas into low-, middle- and high-income areas. The low-income areas are characterized by congestion, poor road networks and accommodation facilities, as well as a dearth of rudimentary social services. In comparison, middle-income areas are characterized by less congestion and basic living standards with restrained access to social amenities such as water, washrooms, and electricity. Participants from the high-income areas are of predominantly higher socioeconomic backgrounds, experience little or no congestions, and have access to good road networks and other social services. Participants were randomly selected by using convenient sampling. The basic requirement for the selection of study participants was mask usage; as such, only mask users were selected, and non-users were not selected. The composition of the study sample included heterogeneous populations, with recourse to gender, age, education, and residence (Table 1). The sample size was determined according to the recommendation of Hair et al. (2010) and Kline (2010) who indicated 200 and 300 respectively, as the ideal sample size for SEM analysis. Against this backdrop, the study set a

minimum sample threshold of 400 with an assumption of 5% sampling error and 95% confidence interval.

The sample size was increased by the research team to strengthen the replicability and generalizability of the study findings. Therefore, 600 printed questionnaires were distributed. USB flash drives, pens, exercise books, and stationeries were offered as souvenirs to participants to show appreciation and not to influence responses. Participation in the study was voluntary. Overall, the study gathered 585 useable questionnaires, representing an 84% response rate. A total of 570 questionnaires remained after the questionnaires were reviewed, and incomplete ones were discarded. Data was drawn using a structured questionnaire (Appendix Table 8). Considering the negative effects of common method bias (CMB) on research studies and study items, the study acknowledged CMB (Zhu et al., 2013). Therefore, Harman's one-factor test was performed, revealing a value of 30.3%, which indicated that CMB was not an issue (Harman, 1976).

### Scale Development and Pretesting

Prior to drawing data for the study, a pilot test was conducted to evaluate the constructs and their respective items (Fig. 1). The piloting was conducted to enhance clarity and test the robustness of the study constructs and their efficiency in yielding consistent responses while restructuring the questions to deepen their quality, understanding, content

**Table 1** Demographic characteristics of respondents

Demographics	Frequency	Percentage
Gender		
Female	269	47.2
Male	301	52.8
Age		
46+	53	9.3
41–45	87	15.3
36–40	110	19.3
26–35	168	29.5
18–25	152	26.7
Area of Residence		
Rural	167	29.3
Urban	210	36.8
Peri-Urban	193	33.9
Education level		
Post Graduate (Masters, PhD)	88	15.4
Bachelor	101	17.7
Diploma	114	20.0
High School	165	28.9
Primary School	102	17.9
Total	570	100

validity, and relevance within the study scope. Two rounds of piloting were restricted to two groups composed of academics (with significant research relations with and interest in health research) and a sample of the target populations. The initial round of pilot engaged the team of academic researchers whose suggestions and recommendations culminated in the rewording and deletion of study items, as well as the arrangement of the study's items and scales. The final pilot, which was composed of a randomly sampled portion of the targeted population, was conducted as face-to-face interviews. These steps further refined the study items to make them easily comprehensible whilst improving their face validity in the study context.

### Measurement of Constructs

The variables utilized in this study were all measured with multiple item scales. All items were adapted from prior studies that had established their validity and reliability. The questions were further refined to fit the study scope. The measurement of the questions was anchored on a five-point Likert scale ranging from “*strongly disagree*” (1) to “*strongly agree*” (5). A 5-point scale was used because it can ensure better understanding (Dawes, 2008; Arkorful, Hammond, et al., 2020). The measurement items for “*awareness of consequences*” (3 items), which captures the individual's realization of the negative consequences of his or her behavior, were adapted from Wang et al. (2019) and Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, (2017). The items for measuring “*ascription of responsibility*” (3 items), signifying the individual's feelings of responsibility for the negative outcomes of not performing a certain behavior, were adapted from Wang et al. (2019). The items for “*attitude*”, representing the individual's negative or positive evaluation of behavior, was measured with 5 items developed by Wang et al. (2017), Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, (2017), and Arkorful, Hammond, et al. (2020). “*Subjective norm*”, which was measured with 3 items adapted from Arkorful, Hammond, et al. (2020) and Wang et al. (2017), highlights the effects of individual perception on others in the performance of behavior. “*Personal norm*” (4 items) encapsulates the moral obligation to perform behavior and was adapted from Wang et al. (2017) and Zhang, Liu, et al. (2017), Zhang, Geng, Sun (2017). “*Perceived behavior control*” (4 items) demonstrates the perception of ease or difficulty in performing behavior and was also adapted from Arkorful, Hammond, et al. (2020), Wang et al. (2017) and Zhang, Liu, et al. (2017), Zhang, Geng, Sun (2017). Lastly, “*intention*” expresses the culmination in behavior performance and was similarly measured with 4 items adapted from Arkorful, Hammond, et al. (2020), Wang et al. (2017) and Zhang, Liu, et al. (2017), Zhang, Geng, Sun, (2017). Age, gender, education, and area of residence were

employed as control variables and were measured by asking study participants to choose a range of options that best applies to their characteristic.

## Data Analysis and Results

### Data Analysis Method

In view of the empirical nature of the study which sought to verify the proposed research framework and evaluate the proposed hypothesis paths between and among the respective constructs, SEM was employed (Chin, 1998). SEM was used primarily because it can effectively (a) evaluate a series of direct and indirect relationship within a model simultaneously; (b) examine relationships between latent and observed variables; (c) examine latent variables by utilizing a cluster of indicators while testing their hypothesis at construct levels; and (d) provide precise measurements by modeling random errors in observed variables (Arkorful, Hammond, et al., 2020; Hair et al., 2010). Data analysis was conducted by using the Analysis of Moment of Structures (AMOS) and Statistical Package for Social Scientists (SPSS) software package version 24.0. SEM-based data analysis is composed of two disparate yet interrelated models: the measurement model and the structural model (Anderson & Gerbing, 1988). The measurement model was utilized to verify the correlation between variables and their associate items, while the structural model was employed to evaluate relationships between constructs. The following section presents data analysis detailing estimates of measurement and assessment of construct validity and reliability, as well as SEM results delineating relationships between constructs.

### Measurement Model Analysis

The study conducted exploratory factor analysis (EFA) to examine the values of factor loadings greater than 0.7 (Bondzie-Micah et al., 2021; Fornell & Larcker, 1981; Hair et al., 2010). EFA results confirmed that the indices are consistent with the benchmark values, thereby validating the proposed study model. The recorded values were between .763 and .966 (Table 2).

We also tested the reliability through Cronbach's alpha and composite reliability. These two indicators all exceeded the recommended threshold of .70 (Arkorful, Lugu, Hammond, & Basiru, 2021; Arkorful, Lugu, Hammond, Basiru, Afriyie, & Mohajan, 2021; Hair et al., 1998; Wu, 2010). Measurement model validity was accessed via convergent validity (average variance extracted [AVE]) and discriminant validity (Fornell-Larcker criterion and HTMT ratio). AVE values greater than .50 represent



good convergent validity for the questionnaire (Arkorful, Shuliang, et al., 2020; Arkorful, Lugu, et al., 2020; Fornell & Larcker, 1981).

With the use of the Fornell-Larcker criterion, the square root of each construct’s AVE (in boldface) on the diagonal must be greater than the intercorrelated constructs, as shown in Table 3. HTMT analysis is a more recent method for verifying discriminant validity (Table 4). Values less than .850 (Kline, 2010) or .90 (Henseler et al., 2015) were obtained, thus indicating that this study meets all the required thresholds for measurement model analysis.

### Measurement and Structural Model Evaluation

We assess the goodness of fit of the measurement and structural measurement model to examine the significance of the various hypothesis paths. The indices that were examined to test the overall fitness of the model include degree of freedom, comparative fit index, normed fit index, and incremental fit index.

These fit indices are used to signify a diverse range of model fit measures (Arkorful, Lugu, et al., 2020). Table 5 presents fitness values with their respective levels of

**Table 2** Loadings and cross loadings

Constructs	Items	BI	PN	PBC	ATT	AC	AR	SN
Behaviour Intention (BI)	BI1	<b>.763</b>	.068	-.037	.006	-.044	.051	.068
	BI2	<b>.948</b>	-.012	.004	.025	-.005	.000	-.024
	BI3	<b>.818</b>	.017	.039	-.029	.029	-.043	.061
	BI4	<b>.966</b>	-.069	.006	-.008	.009	.010	-.062
Personal Norm (PN)	PN1	.045	<b>.815</b>	-.014	.029	.005	-.039	.049
	PN2	-.025	<b>.936</b>	-.049	.001	.021	.027	-.047
	PN3	.009	<b>.850</b>	.012	-.054	.030	.011	.010
	PN4	-.042	<b>.891</b>	.070	.020	-.059	-.003	.018
Perceived Behavior Control (PBC)	PBC1	.031	-.020	<b>.912</b>	.029	-.044	.029	-.002
	PBC2	-.005	.000	<b>.842</b>	-.013	.000	.091	-.048
	PBC3	-.002	.048	<b>.790</b>	.019	.035	-.094	-.013
	PBC4	-.008	-.012	<b>.815</b>	-.034	.024	-.031	.066
Attitude (ATT)	ATT1	.087	.085	-.008	<b>.801</b>	-.030	-.046	-.052
	ATT2	.021	-.025	-.032	<b>.763</b>	.038	-.034	.163
	ATT3	-.019	-.054	.009	<b>.830</b>	-.003	.085	-.020
	ATT5	-.077	-.007	.024	<b>.897</b>	.000	-.007	-.070
Awareness Consequence (AC)	AC1	.027	-.029	.014	.031	<b>.916</b>	.014	-.038
	AC2	.082	.030	-.037	-.033	<b>.912</b>	-.037	-.045
	AC3	-.116	-.004	.036	.002	<b>.859</b>	.029	.083
Ascription of Responsibilities (AR)	AR1	-.016	-.097	-.005	.008	-.018	<b>.937</b>	.072
	AR2	-.002	-.003	.018	-.009	-.003	<b>.930</b>	.011
	AR3	.044	.160	-.024	.009	.039	<b>.780</b>	-.088
Subjective Norm (SN)	SN1	.001	-.034	.014	-.058	-.039	-.002	<b>.896</b>
	SN2	.008	.024	.011	.054	.018	-.027	<b>.830</b>
	SN3	.014	.043	-.023	.004	.027	.055	<b>.806</b>

**Table 3** Results of factor analysis

Construct	CA	CR	AVE	ATT	SN	PN	AC	AR	BI	PBC
ATT	.842	.830	.552	<b>.743</b>						
SN	.819	.822	.607	.453***	<b>.779</b>					
PN	.898	.900	.694	.264***	.489***	<b>.833</b>				
AC	.878	.881	.713	.111*	.243***	.423***	<b>.844</b>			
AR	.880	.885	.720	.098*	.307***	.517***	.373***	<b>.848</b>		
BI	.904	.901	.699	.323***	.492***	.416***	.238***	.385***	<b>.836</b>	
PBC	.838	.861	.617	.170***	.383***	.250***	.055	.180***	.300	<b>.785</b>

CA, Cronbach Alpha; CR, Composite Reliability; AVE, Average Variance Extracted

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

**Table 4** HTMT analysis

Construct	ATT	SN	PN	AC	AR	BI	PBC
ATT							
SN	.425						
PN	.262	.509					
AC	.105	.256	.436				
AR	.104	.313	.545	.394			
BI	.337	.561	.490	.269	.450		
PBC	.141	.457	.323	.120	.188	.384	

acceptance, thereby confirming that all the measurements have good fits consistent with the recommended criterion (Arkorful, Hammond, et al., 2020; Arkorful, Lugu, et al., 2020; Jianxun et al., 2021).

### Hypotheses Testing and Effects

We then tested the proposed hypotheses after evaluating the validity of the measurement model. Empirical data analysis results revealed that awareness of consequences has a significant positive relationship with awareness of responsibility ( $\beta = .285$ ,  $t = 8.068$ ,  $p < .001$ ). However, the relationship between awareness of consequences and attitude toward behavior was insignificant ( $\beta = .013$ ,  $t = .406$ ,  $p > .050$ ). The relationship between awareness of consequences and subjective norm was positive ( $\beta = .084$ ,  $t = 2.801$ ,  $p < .01$ ). Moreover, awareness of consequences was confirmed to be positively related to personal norm ( $\beta = .178$ ,  $t = 5.308$ ,  $p < .001$ ). These outcomes confirm hypotheses 1, 2, 3, and 4. Data analysis results indicated that awareness of responsibility has a negative relationship with attitude toward mask waste separation behavior ( $\beta = -.040$ ,  $t = -.917$ ,  $p > .050$ ). Also, awareness of responsibility was significantly related with subjective norm ( $\beta = .198$ ,  $t = 4.965$ ,  $p < .001$ ), and ascription of responsibility was significantly related with personal norm

( $\beta = .356$ ,  $t = 7.727$ ,  $p < .001$ ), thus confirming hypotheses 5, 6, and 7. Subject norm was revealed to be positively related with attitude ( $\beta = .527$ ,  $t = 8.499$ ,  $p < .001$ ) and significantly related to perceived behavior control ( $\beta = .384$ ,  $t = 7.646$ ,  $p < .001$ ). The relationship between subject norm and personal norm was also confirmed ( $\beta = .485$ ,  $t = 7.974$ ,  $p < .001$ ). These findings are consistent with hypotheses 8, 9, and 10. Consistent with hypothesis 11, attitude was positively related with intention behavior ( $\beta = .163$ ,  $t = 4.888$ ,  $p < .001$ ). Personal norm was also positively related to intention behavior ( $\beta = .208$ ,  $t = 7.833$ ,  $p < .001$ ). Lastly, perceived behavior control was significantly related to intention behavior ( $\beta = .159$ ,  $t = 4.579$ ,  $p < .001$ ). These outcomes were in agreement with hypotheses 12 and 13 (Table 6).

### Results of Mediating Effect Analysis

By employing 5000 bootstrap subsamples using the PROCESS macro with 95% bias-corrected bootstrap confidence interval, we examined the specific indirect effect of the various constructs (Table 7). The result indicates that apart from ascription of responsibilities and attitude, which do not serially mediate the relationship between awareness of consequence and behavior intention, all the other variables significantly mediate the relationship between awareness of consequence and behavior intention.

**Table 5** Fit indices for the measurement and structural model

Measurements	Indices	Criterion	Results	
			Structural model	Measurement model
Absolute fit measures	AGFI	> .80	.894	.899
	GFI	> .90	.912	.922
	RMSEA	< .08	.047	.051
	SRMR	< .08	.064	.050
Incremental fit measures	NFI	> .90	.914	.934
	CFI	> .90	.949	.960
	IFI	> .90	.950	.960
	CMIN/DF	< 5.00	2.281	2.454

**Table 6** Results of path coefficient

Path	Coefficient (β)	T values	Hypothesis	Interpretation
AC → AR	.285***	8.068	H1	Supported
AC → SN	.084**	2.801	H3	Supported
AR → SN	.198***	4.965	H6	Supported
SN → ATT	.527***	8.499	H8	Supported
SN → PN	.485***	7.974	H10	Supported
AC → ATT	.013	.406	H2	Rejected
AC → PN	.178***	5.302	H4	Supported
AR → ATT	-.040	-.917	H5	Rejected
AR → PN	.356***	7.727	H7	Supported
SN → PBC	.384***	7.646	H9	Supported
ATT → BI	.163***	4.888	H11	Supported
PN → BI	.208***	7.833	H12	Supported
PBC → BI	.159***	4.579	H13	Supported
Control Variables				
Age	-.006	-.398		Not Significant
Education	-.004	-.319		Not Significant
Residence	.058*	2.522		Significant
Gender	.046	1.249		Not Significant
Construct	R <sup>2</sup>			
AR	.139			
SN	.115			
PBC	.156			
PN	.446			
ATT	.220			
BI	.278			

### Discussion of Findings and Implications of the Study

On the basis of an integrated model composed of the TPB and NAM, this study investigates mask waste separation behavior in Ghana. Mask waste separation is not only important for waste management, but also, central to fighting the COVID-19 pandemic. This study provides insights for government authorities and other relevant stakeholders on waste separation as a sustainable conduit to fighting the COVID-19 pandemic. Our study obtains interesting and significant findings. First, in consonance with prior pro-social/environmental studies (Zhang et al., 2018; Zhang, Wang, & Zhou, 2013; Zhang, Yang, & Bi, 2013), our study confirmed a significant positive relationship between awareness of consequences and ascription of responsibility. Also, contrary to our expectation, awareness of consequences was confirmed to have an insignificant relationship with attitude. This outcome, which is irreconcilable with that of Kim and Hwang (2020), is confusing but interesting to explain. The outcome could be due to the following reasons: First, the study participants

**Table 7** Specific indirect effects and 95% bias-corrected bootstrap confidence intervals using OLS regressions to predict scores on behaviour intention (N=570)

Path	Estimate (95% CI)	Results
AC → ATT → BI	.017 (.002, .039)	Significant
AC → SN → ATT → BI	.007 (.002, .015)	Significant
AC → SN → PBC → BI	.010 (.005, .019)	Significant
AC → SN → PN → BI	.015 (.008, .024)	Significant
AC → AR → ATT → BI	.004 (-.001, .013)	Not Significant
AC → AR → SN → ATT → BI	.003 (.001, .006)	Significant
AC → AR → SN → PBC → BI	.003 (.001, .006)	Significant
AC → AR → SN → PN → BI	.003 (.001, .005)	Significant
AC → AR → PN → BI	.030 (.017, .045)	Significant

CI, Confidence Interval

were predominantly urban residents and educated people (Table 1). Individuals who are educated tend to be environmentally conscious and as such consciously perform pro-social behavior. Second, the study respondents were predominantly composed of young people between the ages of 26 to 35. These people are rational and mostly have their own opinions regarding behavior performance (Prud'homme & Raymond, 2013). The relationship between awareness of consequences and subjective norm was also affirmed.

Similarly, awareness of consequences was revealed to be positively related to personal norm. These findings find credence in a recent study by Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, (2017). These outcomes could be interpreted to mean that people's awareness of the adverse consequences of not performing a certain behavior (i.e., mask waste separation) could trigger an attitudinal change and enable them to develop a sense of responsibility to act positively (Zhang et al., 2018). This finding may likely engender effects across social networks and result in the development of a moral obligation to separate waste. Furthermore, contrary to the findings of Afshari et al. (2012), data analysis revealed that ascription of responsibility is insignificantly related to attitude toward mask waste separation. This outcome exposes a deficiency. Therefore, the public needs to be educated on the benefits of mask waste separation, and appeals to their conscience should be made. Ascription of responsibility was also affirmed to be positively related to subjective norm and personal norm, consistent with Megeirhi et al. (2020), Si et al. (2021) and Wang et al. (2019). Considering these outcomes in relation to mask waste separation, stakeholders such as health authorities and state and non-state environmental activists should conduct a massive public education campaign on the benefits of mask waste separation and the detrimental consequences of not doing so.

The data analysis results showed the significant relationship between subjective norm and attitude toward waste

mask separation behavior. Subjective norm was also indicated to have a significant relationship with perceived behavior control. In much the same way, subjective norm was further confirmed to be significantly related to personal norm. The significance of subjective norm to performing altruistic pro-social/environmental mask waste separation behavior could be explained in the light of the communal and collectivist nature and/or orientation of the Ghanaian society, which fosters a deep sense of a “we” feeling in individuals’ lives (Arkorful, Hammond, et al., 2020). In view of this situation, mask waste separation behavior could be fostered by identifying an influential referent group to initiate an advocacy campaign on mask waste separation. Stakeholders may consider using community leaders, credible celebrities, and other influential people who have mass social appeal. The significance of subjective norm in driving pro-social behavior is reinforced by Shi et al. (2017) and Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, 2017.

Moreover, the results vouched for the relationship between attitude toward mask waste separation, personal norm, perceived behavior control, and intention. The centrality of these variables to pro-social behavior is consistent with the findings of Esfandiar et al. (2021), Gao et al. (2017) and Kim and Hwang (2020) and Si et al. (2021). The study went further to explore the significance of demographics (i.e., age, gender, education, and area of residence) to predicting mask waste separation behavior. Our outcomes revealed the insignificance of age ( $\beta = -.006$ ,  $t = -.398$ ,  $p > .05$ ), education ( $\beta = -.004$ ,  $t = -.319$ ), and gender ( $\beta = .046$ ,  $t = 1.249$ ,  $p > .05$ ). Area of residence was revealed to be significant ( $\beta = .058$ ,  $t = 2.522$ ,  $p < .05$ ). Altogether, these findings have some practical implications that stakeholders could use to promote mask waste separation behavior during a pandemic. Considering the significance of the NAM variables (i.e., awareness of consequences, ascription of responsibility, and personal norm), stakeholders may collectively conduct public sensitization lectures on health protection, environmental management and conservation, and mask waste separation to forge a sense of awareness and responsibility about the benefits of mask waste separation, the disadvantages of not practicing mask waste separation, and the need subsequently form a positive attitude toward the practice. These will be critical to awakening people’s environmental consciousness. Moreover, the significance of subjective norm could be capitalized upon to improve people’s moral obligation and their sense of ease (via relationship networks) in performing mask waste separation intention behavior.

Essentially, the pursuit of these could be augmented by exploiting avenues like the media (i.e. print and electronic). Other platforms with far reaching potentials like social media (i.e., Facebook, WhatsApp, WeChat, YouTube, twitter, Instagram, Snapchat, and TikTok amongst others) could be deployed to create a population wide awareness regarding the imperativeness of mask waste separation. Moreover, given the

recent preponderance and effectiveness of community level communication avenues in Ghana, community radio could be used to promote environmental well-being engagements like mask waste activities. In all these, it is significant to reiterate that, much as information and communication is crucial and indispensable to behavior change, there is the need to make contents comprehensible, precise and instructive for recipients to feel the urge to perform mask waste separation behavior. In addition to this, communication should be deployed to serve the language needs of the various populations and sub populations in Ghana. Weaving together all these could impact on the individual’s awareness on mask waste separation consequences, the responsibility to promote it, and the need to develop a not only personal norm and a strong attitude, but also, a significant sense of control over performing mask waste separation behavior. The cumulative effects of these will elicit a favorable contagious behavior towards individual mask waste separation behavior performance.

## Conclusion, Limitations, and Suggestions for Future Research

From a broader context, promoting waste separation behavior is indispensable to reducing excess and removing other unwanted resource materials from the environment while freeing the ecological environment. More profoundly, mask waste separation during the COVID-19 pandemic is crucial not only to the environment, but also the global fight against the pandemic. In a country located on a continent characterized by under resourcefulness, substandard and weak health infrastructure, mask waste separation behavior is cardinal to winning the fight against the pandemic and its attendant negative environmental consequences largely engendered by the rising demand for, and use of mask in COVID-19 pandemic times. The relevance of mask waste separation behavior notwithstanding, studies on this subject matter are lacking.

This study marks a premier attempt to emphasize not only the relevance of mask waste separation, but also the underpinnings of such behavior. A questionnaire was used to draw data in Ghana to test the research hypotheses captured in the proposed study model anchored on an integrated model of the TPB and NAM. Data analysis results obtained through SEM confirmed the appropriateness and potency of the proposed research framework. Specifically, the study revealed a significant relationship between awareness of consequences and ascription of responsibility; awareness of consequences and subjective norm; ascription of responsibility and subjective norm; subjective norm and attitude; subjective norm and personal norm; awareness of consequence and personal norm; ascription of responsibility and personal norm; subjective norm and perceived behavior control; and attitude and

behavior intention, personal norm and behavior intention, and perceived behavior control and behavior intention. However, no significant relationship was found between awareness of consequences and attitude and between awareness of responsibility and attitude.

This empirical study has limitations that need to be delimited to guide future research and policy. Although intention serves as a conduit for shedding light on behavior, the study investigates mask waste separation intention without focusing on actual waste separation behavior, thereby

constituting a research gap (Wang et al., 2017). Thus, we strongly recommend that future studies cover this topic. Data for the study were drawn from across the administrative regions in Ghana. Although these areas may have common characteristics with others and with certain polities, some subtleties and complexities in behavior may need to be investigated. Future studies may consider concentrating on specific areas (either on a regional, rural, or urban basis) by using trend data. Nevertheless, these limitations do not in any way weaken, invalidate, or impair the research findings.

## Appendix

**Table 8** Constructs and measurement items

Constructs	Items	Source(s)
Awareness of consequences	<ol style="list-style-type: none"> <li>1. Mask waste separation helps minimize the negative environmental impacts on the wider environment for contemporary and future generations.</li> <li>2. Mask waste separation behavior helps reduce the harms caused by COVID-19 to people's health.</li> <li>3. Mask waste separation helps minimize COVID-19 infections and environmental degradation.</li> </ol>	Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, 2017 Wang et al. (2019)
Ascription of responsibility	<ol style="list-style-type: none"> <li>1. I feel jointly responsible for separating mask waste in my daily life during the COVID-19 pandemic.</li> <li>2. I feel jointly responsible for the negative consequences of not separating mask waste during the COVID-19 pandemic.</li> <li>3. I feel jointly responsible for the health and environmental consequences of not separating mask waste.</li> </ol>	Wang et al. (2019)
Attitude	<ol style="list-style-type: none"> <li>1. I think mask waste separation behavior is useful to protect the environment.</li> <li>2. I think mask waste separation is significant to further reduce COVID-19 spread and infection.</li> <li>3. I think separating mask waste will be valuable to alleviate COVID-19 burdens.</li> <li>4. I think mask waste separation is a wise behavior.</li> <li>5. I think mask waste separation is a prudent behavior.</li> </ol>	Wang et al. (2017) Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, 2017 Arkorful, Hammond, et al. (2020)
Subjective norm	<ol style="list-style-type: none"> <li>1. Most people who are important to me think I should separate mask waste.</li> <li>2. Most people whose opinion I value would prefer I separate mask waste.</li> <li>3. Separating mask waste will likely inform people who are important to me to act accordingly.</li> </ol>	Wang et al. (2017) Arkorful, Hammond, et al. (2020)
Personal norm	<ol style="list-style-type: none"> <li>1. I think I have a responsibility to separate mask waste.</li> <li>2. Separating mask waste is dependent on my own moral obligation.</li> <li>3. I would feel unhappy if I do not separate mask waste.</li> <li>4. Not separating mask waste would violate my moral principles.</li> <li>5. I will feel betrayed if I do not perform mask waste separation behavior.</li> </ol>	Wang et al. (2017) Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, 2017
Perceived behavior control	<ol style="list-style-type: none"> <li>1. I think that I am capable of separating mask waste.</li> <li>2. I think I have the knowledge and skills to separate mask waste.</li> <li>3. Separating mask waste or not is completely up to me.</li> <li>4. I think performing mask waste separation behavior is under my control.</li> </ol>	Wang et al. (2017) Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, 2017 Arkorful, Hammond, et al. (2020)
Mask waste separation intention	<ol style="list-style-type: none"> <li>1. I am willing to separate mask waste.</li> <li>2. I intend to engage in mask waste separation behavior.</li> <li>3. I will make an effort to separate mask waste.</li> <li>4. I am ready to perform mask waste separation behavior.</li> </ol>	Wang et al. (2017) Zhang, Liu, et al. (2017), Zhang, Geng, & Sun, 2017 Arkorful, Hammond, et al. (2020)

**Authors Contributions** Vincent Ekow Arkorful wrote the introduction and Literature Review, collected some data, formulated and tested hypotheses and performed the analysis. Benjamin Kweku Lugu revised the introduction and collected some data. Zhao Shuliang wrote the discussion and revised the paper. All authors read and approved the final manuscript.

**Data Availability** All the data are available from the corresponding author or first author.

## Declarations

**Conflicting Interests** The authors declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

**Ethical Issues** This is a social science research. Thus, ethical approval and consent to participate are not applicable.

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