Waste sorting practices of cambodians during covid-19

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ABSTRACT
The waste produced swings regardless of individual consumption patterns and social norm variations. People have been required to adapt their everyday dynamics due to the current context imposed by the Covid-19 outbreak. These adaptations in tradition have undoubtedly impacted the environment regarding waste generation and management. Hence, reducing the environmental harm of residential waste through waste segregation and handling is a practical approach. This work used a quantitative method and constructed a research instrument to investigate (398 participants) the determinants influencing Cambodian waste separating intentions and behaviours using the theory of planned behaviour (TPB) during the Covid-19 pandemic. The data was collected and analysed using PLS-SEM. The findings suggested that attitudes, social norms, and moral norms significantly impacted the intention to engage in waste separation and, hence, waste separation behaviour. In addition, the intention construct was found to be the most significant determinant of Cambodian social explicit waste sorting behaviour, suggesting that enhancing the intention of waste separation practice substantially affects waste separation behaviour.

Introduction
A tragic event may have severe adverse effects on the economy, human lives, physical and psychological well-being of the individuals affected (Rajak et al. 2021). For instance, the Covid-19 outbreak that emerged in late 2019 has expanded rapidly worldwide. Many nations have implemented numerous precautions and preventions since the World Health Organization (WHO) identified the novel coronavirus Covid-19 as a public health emergency of international concern. There have been many governments that have used extraordinary measures like lockdowns as preventive measures. In addition, governments at all levels have proposed unprecedented actions such as proper manner hygiene (regular hand washing), social distancing, school and workplace closures, travel restrictions, and self-isolation to combat the outbreak. Accordingly, WHO and other agencies involved with disease control have developed several guidelines. Masks and gloves are among the approaches used for infection prevention for individuals. Due to all these adaptations occurring in a shorter period, the proportion of waste disposal has increased dramatically. As a result, there appears to be a waste problem due to the enormous accumulation of gowns, gloves, shields, and other protective equipment and gear in homes and healthcare facilities (Ma et al. 2020). Also, improper waste management in medical facilities and households has the potential to exacerbate the development of Covid-19 via secondary infection. In addition, the possibility of widespread dumping, incinerating, and destruction could adversely impact health and air quality due to toxic exposure (World Health Organization 2020). Indeed, conventional waste management systems are not prepared to deal with such a spike in the garbage, so the safe treatment and disposal of such waste are seen as one of the most significant concerns. Likewise, the challenge of handling unconventional waste sustainably while decreasing air pollution, limiting secondary virus transmission, and eliminating potential health risks emerges. When massive amounts of waste are generated, instances of waste incineration and unmanaged waste disposal cannot be ruled out. This would result in increased littering, pollution, ecological destruction, and an increased risk of viral disease from waste.

According to Mathiyazhagan et al. (2021), developing countries generate large amounts of waste due to their production and consumption patterns. Similarly, the number of products disposed of by consumers is growing (Sathiya et al. 2021). Consequently, emerging countries could have major concerns that lack proper waste management systems and pandemic-response regulations. According to Commendatore (2020), numerous recommendations have been suggested, including appropriate municipal solid waste management through the use of personal protective equipment (PPE), safety procedures, and administrative controls; medical waste contaminated with Covid-19 must be managed as regulated medical waste; recycling solid waste while adhering to safety precautions to avoid illness and cross-contamination, and using ultraviolet irradiation for inactivation and hypochlorite and peracetic acid for oxidation in wastewater management. Hence, this article aims to shed light on how Cambodians perceived solid waste management throughout this Covid-19 outbreak.
Respectively, Cambodia is no exception to this daunting phenomenon. Waste management is a severe concern to Cambodia’s urban and rural residents. It is no longer viewed as a merely technical issue but rather as a social one requiring institutional and human change (Fagan 2003; Vergara and Tchobanoglous 2012). Sorting household waste is frequently the beginning point for waste management (Tai et al. 2011; Vergara and Tchobanoglous 2012). Effective waste sorting significantly improves resource sustainability and decouples human progress from the environment (Nizami et al. 2017; Singh and Ordoñez 2016). Also, the proper disposal of waste is essential from a sanitation perspective because of the environmental and economic benefits (Rathi 2006). Thus, scholars and practitioners are becoming increasingly interested in the impact of government action on waste management behaviour. Other studies have also found that the perception of government activity influences individual environmental attitudes and behaviour (de França Doria 2010; Weber 2010).

Even though views of environmental governance are crucial for understanding human behaviour in environmental contexts, there has been little research on the impact of public attitude on waste sorting, particularly in Cambodia. Contradictory results have been found in a limited number of studies. Hence, this study used the constructs through the Theory of Planned Behaviour (TPB) to establish which factors leading, attitudes, subjective norms, and moral norms impact the intention to perform solid waste separation behaviour and, consequently, waste separation attitude in the wake of the Covid-19 epidemic.

**Solid waste and covid-19**

The volume of waste generated varies according to the consumption dynamics and changes in the social habits of individuals. Because of the current context imposed by the Covid-19 epidemic, they have been compelled to adjust their routine dynamics. For example, increasing the time spent at home was transformed from a self-care gesture to a preventive isolating restriction. These transformations in living have unquestionably affected the environment in terms of waste generation and management. Because changes in consumption affect the amount of waste generated (Van Doremalen et al. 2020), factors contributing to waste generation include having people at home, suspending school courses in both public and private, and discontinuing commercial, recreational activities. Consequently, waste management agencies must adjust collection routes and schedules to their specific needs (Klemеš et al. 2020; Nzeadibe and Ejike- Alieji 2020).

The virus may be discovered in the waste of infected individuals. Although individuals infected with Covid-19 are managed in hospitals, the same cannot be said for those infected in their homes. Thus, people exposed to Covid-19 should dispose of PPE, and other wastes separate from those generated in their residences (Feng et al. 2020). In addition, precautions are needed to avoid the transmission of contagions from discarded scraps generated by disposables and protective apparel. Therefore, overcoming appropriate solid waste management (SWM) barriers during the epidemic requires public and individual collaboration and commitment. Also, it is necessary to raise awareness about the critical nature of waste sorting at the source and the transportation of non-contaminated waste to SWM facilities. Infectious wastes must be sorted from others and enclosed in containers before handling to waste collection services. Although society currently lacks knowledge in proper waste management, there is a potential for individuals to behave appropriately and supportively amid a pandemic. Humans are intertwined, and people influence them through patterns defined by their aspirations or ambitions. Ecosystems have been disrupted, and severe environmental damages have been produced for years due to human activity.

**Challenge of SWM**

Cambodians appear to have a lack of understanding of waste management. It is demonstrated by the routine dumping of garbage or solid waste into open spaces, along streets, or on vacant lots adjacent to residential buildings (Sethy, Sothun, and Wildblood 2014). Waste management is a significant concern for governments, and the unmanaged and inappropriate handling of waste has resulted in severe problems. Specifically, the environmental impact of Covid-19 waste is substantial. The volume of medical waste generated during the epidemic has increased more than any other type of waste. As a result, excessive medical waste has become a significant problem for the environment and public health in the wake of the global breakout of Covid-19. In addition, PPE contributes to significant medical waste, for example, face shields, hats, accessories, and headgear. The criticality of SWM in preventing disease spread has been widely documented throughout history (Paleologos et al. 2020). It is especially true in emerging nations where MSW is often confined to 30–35% of its population in metropolitan areas. With the high infectivity and pathogenicity of Covid-19, the SWM industry is experiencing numerous new struggles, and enhancing general practices throughout the SWM chain is essential to preventing and controlling a pandemic (Tang et al. 2020). Besides hazardous and non-hazardous waste, healthcare and medical waste constitute a significant part of solid waste. According to Ansari et al. (2019), the non-hazardous portion varies from 35%-98.7% in developing nations, while the hazardous category ranges from 1.30%-65.0%, depending on socioeconomic status and per capita GDP.

Accordingly, MSW can be handled with regular operational practices in many regions with no or few proven cases of infection. However, skilled workers, disinfection of MSW, and specialised carriage should be considered in areas with a high number of confirmed incidences. This can be supplemented with targeted testing of waste fractions most likely to contain the virus, including PPE, to avoid unnecessarily burying medical landfills (Chandana et al. 2021; Liu et al. 2020). The existing MSW has been significantly strained, as evidenced by the increased accumulation of waste and used PPE, and general waste, such as meal boxes and food, infusion containers, and nurse bags, have seen a dramatic rise during the outbreak (Wei and Manyu 2020).

Additionally, Covid-19 has affected the economy several ways (Kahlert and Bening 2020). The closing of schools, eateries, and other facilities that usually gained large
quantities of food had a tremendous impact on food producers in the US (Kulkarni and Anantharama 2020). The large volumes of waste and materials generated by households rose during the Covid-19 pandemic. While public waste collection volume has soared, waste disposal return rates have temporarily decreased due to transportation challenges and disease concerns (Kahlert and Bening 2020). Because of the pandemic, MSW processes and procedures are being affected by waste treatment regulations, safety and health measures for staff, and general processes (ACRPlus 2020). Comparably, the MSW has received little attention. Although it is critical to avoid increasing transmissible infections, it is rarely emphasised in public health crisis communications (Nghiem et al. 2020). Hence, the MSW is an essential service that must be done routinely.

**The theory of planned behaviour (TPB)**

The TPB is involved with the behaviour of individuals concerning the action they intend to take. It is a theoretical framework that can be applied to better understand public perceptions of various initiatives’ effectiveness (Ajzen 1991). Recyclability and other environmentally friendly behaviours have been studied using the TPB to date (e.g. Davis et al. 2006; Omran et al. 2009; Williams and Kelly 2003). The application of this notion is essential to understand the reactions of individuals to waste separating activities, which are required to underpin these decisions (Tonglet, Phillips, and Read 2004). The concept posits that individuals act rationally and examine the consequences of their acts, and it was developed from the previous theory of reasoned action (TRA). TPB theory informed this study because Kassim et al. (2017) argued that individuals develop positive attitudes about a particular activity when they feel that the specific behaviours they are engaged in yield a positive outcome. The fundamental premise of this model is that the strongest predictor of observed behaviour is an individual’s intention to conduct a behaviour (Ajzen 1991) and that attitudes, or the individual’s concern about the possible consequences of a particular action, subjective norms, and moral norm all influence behavioural intention. According to TPB, behaviour has an immediate antecedent as behavioural intention. Intentions are affected by two factors: attitude (an individual’s practical assessment of performing behaviour) and subjective norms (an individual’s impression of societal pressure to perform or refrain from performing a behaviour).

Individuals must put in much effort because waste must be sorted, packaged, and stored to practice waste separation. Consequently, the separation determination is typically more complicated, requiring consideration of several issues. The TPB provides a model for methodically determining the factors that influence separating waste. Additionally, the TPB permitted those with positive attitudes to believe in proper normative acceptance and belief in their ability to participate in the activity readily have a significant behavioural intention (Fielding, McDonald, and Louis 2008). However, the stronger the behavioural intention, the more likely individuals will act on them.

**Attitude**

An attitude towards waste segregation can be described as an individual assessment and implementation of waste segregation. Numerous studies demonstrate that attitude appears to be a strong predictor of subsequent behaviour. For example, Stoeva and Ariksson (2017) discovered significant positive attitudes towards waste separation led to waste separation at home among 223 Swedish and Bulgarian participants. As a result, attitudes and intentions to recycle positively correlate (Chen and Tung 2010). Also, attitudes towards recycling of individuals in Thailand affect their willingness to pay for enhanced recycling services (Vassanadumrongdee and Kittipongyises 2018).

Similarly, Ghani et al. (2013) found substantial evidence that positive attitudes are the best determinants of intention to undertake waste sorting at home. Recently studied by Liao et al. (2018) also found a significant correlation between attitude and intention. Accordingly, when individuals have an idealistic attitude towards waste separation, they are more likely to take action in the future. Thus, this work suggests that

**H1: Attitudes have a significant impact on the intention towards solid waste separation**

**Subjective norm**

In the TPB model, subjective norm refers to perceived social pressure to engage in or avoid (Ajzen 1991). It refers to the social constraints imposed on an individual by influential ones, such as family and friends, neighbours, colleagues, and peers. According to normative ideas, if an individual’s significant others believe he or she should execute particular conduct and the individual is driven to conform with the social referents, the subjective norm is positively influenced. Numerous research studies have demonstrated that subjective norms significantly affect intention, particularly waste separation intention (Chen and Tung 2010; Tonglet, Phillips, and Read 2004; Vassanadumrongdee and Kittipongyises 2018; Xu et al. 2017). Alternatively, an individual’s attitude might be shaped by the normative ideals shared by his or her social contacts. Hence, the study proposes:

**H2: Subjective norms have a significant impact on the intention towards solid waste separation**

**Moral norm**

Internal stimuli associated with waste separation reflect ethical considerations and a sense of social obligation related to pro-social behaviour. Moral norms are deeply embedded moral ideals; the more deeply internalised these morals and values are, the more self-disciplined one’s actions become. In behavioural research, moral norms are frequently a significant predictor of conduct bearing moral considerations. Botetzagias, Dima, and Malesios (2015) believe that moral norms significantly
affect attitudes towards recycling. Also, it is an essential antecedent of behaviour towards recycling (Chan and Bishop 2013). According to a recent investigation, perceived moral commitment is a powerful indicator of attitude (Xu et al. 2017). Therefore, this work proposes:

H3: Moral norm has a significant impact on the intention towards solid waste separation

**Intention**

The intention is the significant component directly related to behaviour In the TPB concept. It is believed to encompass the incentives that influence behaviour and the significance of the willingness and preparedness of an individual to undertake the behaviour. Also, the potential of an individual engaging in behaviour will increase if he or she has a full behavioural intention (Ajzen 1991). Likewise, the further strengthening the intentions, the more likely individuals will behave following them. For example, Pakpour et al. (2014) discovered a significant correlation between the choice to recycle and recycling behaviour. In contrast, Ghani et al. (2013) found a significant and positive but modest association with behaviour. Thus, this study suggests:

H4: Intention has a significant influence on the behaviour of waste separation

**Methods**

This study sought to discover Cambodian knowledge, attitudes, and practices regarding waste management during the Covid-19 outbreak. Equally, the GPower calculator was used to determine the sample size. Hence, there could be a maximum of four arrows pointing to a single construct. Assuming an effect size of 0.05, the power of the study was 0.90, and 313 samples had to be collected. Also, it used a questionnaire-based quantitative research approach. The data were analysed using structural equation modelling (SEM). PUC-IRB evaluated the survey questionnaires and exempted them from ethical review. The survey was purely voluntary, and no incentives were offered for participation. There are two widely used approaches in structural equation modelling: covariance-based and partial least squares (PLS) techniques. This work accepted PLS-SEM over covariance-based testing because it is more accurate in assessing nonparametric and unprecedented studies (Henseler 2018) and evaluating the emerging complexity of existing theories (Hair et al. 2019). Statistical Package for Social Science (SPSS) version 26 was applied for statistical analysis, and a significance level of .05 was specified. The Kaiser–Meyer–Olkin (KMO) sampling adequacy measure and Bartlett’s sphericity test were used to determine whether the sample was appropriate for this study. The total variance explained was 72.85%. Also, Fornell and Larcker (1981) claim that acceptable internal consistency requires Cronbach’s alpha > 0.70. Likewise, when the $\chi^2$/df value is less than 5.0, hypothesis models correspond to the analysed data (Marsh and Hocevar 1985). Additionally, SmartPLS3 was used for structural equation analysis.

**Measurement instruments**

The research approach includes five variables: attitude, subjective norm, moral norm, intention, and behaviour to separate waste from the source. All items for measuring have been adopted and modified from previous studies (Ghani et al. 2013; Wan, Shen, and Yu 2014). All scales are rated their significance on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). In addition, confirmatory Factor Analysis (CFA) was used to validate the instrument for measuring the constructs. It was used to determine how observed variables are essential with the applied latent construct. This analysis is based on the strength of the regression model connecting the factors to the observed variables rather than the relationship of the variables (Byrne 2010).

**Participants and sampling**

Convenience sampling techniques were used because of their convenience and availability (Bryman 2016) through self-administered questionnaires among individuals in Cambodia during the COVID-19 epidemic that participated in this study from September 2021 to November 2021. The report yielded a total return of 398 distributed questionnaires. The sample size for this study was larger than the minimum required. The profile of respondents revealed that 54.3% were male, 45.7% were female, 88.2% were aged 18–35, and the remaining 11.8% were over 35 years of age. Equally, 77.1% resided in urban, and 22.9% was in rural areas.

**Assessment of measurement model**

The evaluation of the measurement model involves examining for internal consistency, convergent validity, and discriminant validity (Hair et al. 2016; Hair, Ringle, and Sarstedt 2011; Henseler, Ringle, and Sinkovics 2009). Outer loading values of 0.7 and above are significantly deemed appropriate (Hair et al. 2016). Composite reliability and Cronbach’s alpha values were used to compute the internal consistency of the constructs. All the CRs were higher than the recommended value of 0.70 (Fornell and Larcker 1981). Cronbach’s alpha of each construct exceeded the 0.70 thresholds. Convergent validity was acceptable because the Average Variance Extracted (AVE) was over 0.50. Table 1 summarises the detail of the measurement model assessment (loadings, Cronbach’s alpha, CR, and AVE).

Discriminant validity was evaluated using two procedures in this paper. First, it checks the square root of the AVE of each item to the relationship with the other factors, and when the square root of the AVE is greater than the corresponding correlations, the construct has adequate discriminant validity (Fornell and Larcker 1981). As a result of the findings, the square root of AVE for the construct was greater than the inter-construct correlation (See Table 2).

Furthermore, discriminant validity was also assessed by the heterotrait-monotrait ratio of correlations (HTMT). Henseler, Ringle, and Sarstedt (2015) set a threshold value of 0.9; therefore, a value of HTMT greater than 0.9 could be problematic when discriminant validity is contested. As illustrated (Table 3), the discriminant validity of all constructs was established.
Table 1. Construct reliability and validity.

| Main Constructs | Items | Loadings | Cronbach’s Alpha | CR | AVE |
|-----------------|-------|----------|------------------|----|-----|
| Attitude        | AT1   | 0.808    | 0.802            | 0.870 | 0.626 |
|                 | AT2   | 0.765    |                   |     |     |
|                 | AT3   | 0.786    |                   |     |     |
| Subjective norm | SN1   | 0.894    | 0.819            | 0.876 | 0.640 |
|                 | SN2   | 0.677    |                   |     |     |
|                 | SN3   | 0.830    |                   |     |     |
|                 | SN4   | 0.784    |                   |     |     |
| Moral norm      | MN1   | 0.776    | 0.775            | 0.855 | 0.597 |
|                 | MN2   | 0.788    |                   |     |     |
|                 | MN3   | 0.721    |                   |     |     |
|                 | MN4   | 0.803    |                   |     |     |
| Intention       | IN1   | 0.852    | 0.850            | 0.899 | 0.691 |
|                 | IN2   | 0.846    |                   |     |     |
|                 | IN3   | 0.744    |                   |     |     |
|                 | IN4   | 0.876    |                   |     |     |
| Behaviour       | BH1   | 0.762    | 0.764            | 0.846 | 0.579 |
|                 | BH2   | 0.726    |                   |     |     |
|                 | BH3   | 0.732    |                   |     |     |
|                 | BH4   | 0.820    |                   |     |     |

Table 2. Correlations among constructs.

|               | Attitude | Behaviour | Intention | Moral norm | Subjective norms |
|---------------|----------|-----------|-----------|------------|------------------|
| Attitude      | 0.791    |           |           |            |                  |
| Behaviour     | 0.363    | 0.761     |           |            |                  |
| Intention     | 0.455    | 0.728     | 0.831     |            |                  |
| Moral norm    | 0.110    | 0.365     | 0.413     | 0.773      |                  |
| Subjective norms | 0.233 | 0.429     | 0.457     | 0.478      | 0.800            |

Table 3. Heterotrait-monotrait ratio of correlations (HTMT).

|              | Attitude | Behaviour | Intention | Moral norm |
|--------------|----------|-----------|-----------|------------|
| Behaviour    | AT1      | 0.428     |           |            |
|              | AT4      | 0.805     | 0.859     |            |
| Moral norm   | 0.136    | 0.467     | 0.498     |            |
| Subjective norms | 0.254 | 0.496     | 0.492     | 0.58       |

**Structural model**

After the construct validity and reliability were confirmed, an analysis of structural model findings was carried out. All constructs were tested for multicollinearity before this process, and the variance inflation factor (VIF) was calculated to confirm collinearity. According to Hair, Ringle, and Sarstedt (2011), PLS-SEM requires a VIF tolerance value between 2.00 and 5.00, and multicollinearity would be problematic if VIF is higher than 5.0 or lower than 2.00. The findings confirmed the absence of multicollinearity because the VIF values ranged from 1.8 to 3.5. Also, the model quality is evaluated on its ability to predict endogenous constructs. It is accessed based on the coefficient of determination (R2), cross-validated redundancy (Q2), path coefficients (β), and significance of paths. Standardised path coefficients test the degree to which hypotheses were confirmed. The goodness of the model is determined by the strength of each structural path (Gallardo-Vázquez and Sánchez-Hernández 2014). It was examined using the R2 value of the latent dependent variable. Thus, the desired values for each path between constructions should be at least equal to or greater than 0.1 (Falk and Miller 1992). The result in Table 4 revealed that all R2 values were greater than 0.1, indicating that the model is predictive capability. Also, the Stone-Gessier test or cross-validated redundancy Q2 was used to evaluate the predictive relevance of the endogenous constructs. A Q2 larger than 0 indicates that the model is predictively significant, whereas a Q2 less than 0 indicates that the model is flawed (Castro and Roldán 2013). Therefore, it can be concluded that the prediction of constructions is significant because a constructive Q2 value were 0.263, 0.284 of intention and behaviour, respectively, is achieved (See Table 4).

Similarly, it is possible to avoid model misspecification by adopting the standardised root mean square residual (SRMR) in PLS-SEM (Henseler, Hubona, and Ray 2016). Hu and Bentler (1999), precisely like Kenny (2020), defined SRMR as the standardised difference between the observed correlation and the predicted correlation. Accordingly, SRMR was applied to quantify the global model fit. However, no threshold of SRMR has been proposed in a PLS-SEM context yet (Hair et al. 2016). Therefore, it has been suggested that SRMR < .10 is a good model fit (Hu and Bentler 1998; Kara, Kirpik, and Kaya 2022; Worthington and Whittaker 2006). This finding has an SRMR of 0.08, indicating that this study was a good model fit.

Further assessment of the goodness of fit, hypothesis was tested to establish the significance of the relationship. H1 evaluated whether attitudes have a significant impact on intentions. The results exposed that attitude has a statistically significant impact on the intentions to solid waste separation (β = .369, t = 7.422, p < .001). Thus, H1 was supported. Similarly, H2 predicted whether subjective norms significantly impact the intentions. As predicted, the findings (see Table 4) confirmed that the subjective norms have a statistically significant impact on the intentions towards solid waste separation (β = .250, t = 4.636, p < .001). Thus, H2 was robustly supported. Furthermore, when observing the significant influence of the moral norm-related factor on the intentions (H3), the results endorsed that there is a statistically significant (β = .252, t = 4.702, p < .001), and supported H3. Finally, the influence of the intention-related items on the waste separation behaviour was statistically significant (β = .728, t = 28.256, p < .001) and robustly confirmed H4.

Table 4. Hypothesis testing.

| Hypotheses                  | β-values | STD | t-value | p-value | Decision |
|-----------------------------|----------|-----|---------|---------|----------|
| H1: Attitude -> Intention   | 0.369    | 0.050 | 7.422   | 0.000   | Supported |
| H2: Subjective norms -> Intention | 0.250 | 0.054 | 4.636 | 0.000 | Supported |
| H3: Moral norm -> Intention | 0.252 | 0.054 | 4.702 | 0.000 | Supported |
| H4: Intention -> Behaviour  | 0.728    | 0.026 | 28.256  | 0.000   | Supported |
| Intention                   | R²       | 0.284 |         |         |          |
| Behaviour                   | Q²       | 0.263 |         |         |          |
Discussion

Recent policy and social debates have focused on properly regulating environmental pollution (Ding, Appolloni, and Shahzad 2022). Also, human activity harms the environment, which has become increasingly evident to environmental groups and the public at large (Mathivathanan et al. 2022). This study aimed to determine which contributing factors – attitude, subjective norms, and moral standards – significantly impact the intention to participate in solid waste separation behaviour and, consequently, waste separation behaviour during the Covid-19 outbreak. The TPB theory was used in this experiment to see if people in Cambodia possess specific qualities resulting from their past events, norms, and attitudes that would drive them to have positive perceptions towards practicing waste sorting and ultimately enhance their waste separation behaviours. Firstly, attitudes were found to have a statistically significant antecedent on intention, indicating that respondents intend to separate waste at the source. This finding indicated that the attitudes of the participants determined their intention to separate waste. It is in line with other studies stating a substantial correlation between waste separation attitudes and intentions (Chen and Tung 2010; Liao et al. 2018; Meng et al. 2019; Yu et al. 2018; Zhang et al. 2015). Positive attitudes were most strongly linked to individual conceptions that waste separation improves the environment and human well-being. Also, attitudes are relatively founded on the behavioural perspectives of individuals regarding the phenomenon of the mindset. Consequently, people tend to prefer or reject acts or practices that they consider good or bad (Ajzen 1991).

Furthermore, the findings were indicated that sorting waste behaviour intention is influenced by factors other than attitude. Subjective norms were considered to have a statistically significant and robust impact on intention towards waste separation. The results of this study are in line with other findings that social norms impact waste separation behaviour of individuals (Bortoleto, Kurisu, and Hanaki 2012; Botetzagias, Dima, and Malesios 2015; Carrus, Passafaro, and Bonnes 2008; López-Mosquera, García, and Barrena 2014; Mondejár-Jímenez et al. 2016). Also, the social norms that they consider other individuals or social groupings to hold profoundly influence their behavioural intentions (Do Valle et al. 2004; Shaw 2008). It was formed because of individuals’ social connections to their community and neighbours, including the collective responsibility to separate waste. These findings may have been due to the prevalence of collectivism among the societies sampled, particularly in Cambodia. Thus, the subjective norm significantly influences and promotes waste separation behaviour in Cambodia, whereas the social norm fosters peer support and induces waste separation. In the same vein, local authorities must increase their efforts to promote waste separation while encouraging cooperation and providing necessary information. There will be an increase in Cambodian social norms and commitments for waste separation due to environmental and community pressures.

Again, the findings demonstrated that moral norms significantly impact intention, notwithstanding attitude and subjective norms. This result is consistent with previous studies (Bortoleto, Kurisu, and Hanaki 2012; Botetzagias, Dima, and Malesios 2015; Chan and Bishop 2013; Zhang et al. 2019). The moral norm is a critical predictor of how individuals behave regarding waste separation activities. So, whether or not individuals are inclined to sort waste is contingent on their particular moral norms. Individuals with a greater sense of social responsibility are more likely to participate in garbage separating practices. Moral obligations and responsibilities play a significant role in citizens’ motivation to participate in waste sorting practices, and their moral norms influence this motivation. Because the individual norm creates sentiments of pride and remorse that control behaviour (Onwezen, Antonides, and Bartels 2013). Equally, it represents personal views and internalised feelings of personal obligation to act in a certain way (Schwartz 1973, 1977). It demonstrates the superiority of intrinsic motivation. Individuals acknowledge personal moral and societal duties when performing a specific act. All over again, individuals engage in waste sorting activities because they believe they have a moral obligation.

Finally, the intention construct was the most influential among the predictive factors for Cambodian social explicit towards waste separation behaviour. Also, the findings revealed that intention has a significant effect on behaviour, suggesting that improving the intention of waste separation practice substantially affects waste separation behaviour. Furthermore, it is aligned with existing evidence suggesting that individuals with stronger intentions are more likely than those with lower intentions to separate their wastes at the source (Boldero 1995). Thus, the intention is the most significant element that is intrinsically related to behaviour in the model. It is believed to include the factors that influence an individual’s motivation and readiness to carry out a particular action.

Conclusion

The TPB model was used to explore the predicting factors for waste separation behaviour among Cambodians in the context of Covid-19 and achieved several significant results. Firstly, the results showed that this theoretical framework is applicable. The original TPB can be used to investigate individual waste intentions and behaviour, which had a moral norm. Improving the TPB model offers a theoretical ability to anticipate and interpret. In addition, this research provided empirical evidence for the dynamic mechanisms behind Cambodian waste sorting behaviour. As a result, attitudes, social norms, and moral norms substantially affect the intention to engage in solid waste segregation conduct and, thereby, waste segregation behaviour. The intention was the strongest determinant of waste separation behaviours in these empirical findings, having the highest path coefficient of any TPB constructs included in the model.

It is important to note that the results of this study may have managerial implications for stakeholders as well. These findings suggest that many resources and policies should be directed towards instilling a positive attitude among residents to achieve successful waste separation conduct in Cambodia. Because these interventions will encourage recycling and waste collectors to view waste as a valuable product. Equally, the
influence of adequate end-of-life operations can turn waste into an input for new processes (Appolloni et al. 2022). Thus, the dumping of garbage into the open environment will be reduced. This may also result in less disease transmission and poor sanitation during and after the pandemic.

Limitations and future study

This study has some limitations that should be considered when evaluating the findings. First, the results cannot be generalised to other societies since this study only involved the Cambodian community with a small sample size. Thus, there should be cross-country comparisons and analyses of individuals in other communities in future research. Second, because of using only quantitative methods, it is difficult to examine more profoundly the factors that influenced the intentions and behaviour of Cambodians to engage in waste separation practices. Hence, it is crucial to consider qualitative and quantitative methods in future studies to get more detail on these findings. Also, a self-reporting method is incorporated into the survey questionnaires. Hence, it is possible to overstate participation in solid waste separation behaviours. Future research should observe at homes or waste-collection points to understand actual waste separation behaviour. Finally, the TPB model should be extended in the future to include more external factors of waste separation behaviour, such as socio-demographic variables and the roles of stakeholders, especially in larger systems. Although these limitations exist, the findings of this study do not weaken, invalidate, or diminish them in any way.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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