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# Consumer intention to express packaging recycling in China's digital economy: an expansion of the theory of planned behavior

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**Abstract**
The thriving development of e-commerce and the digital economy in China has given rise to the issue of excessive express packaging waste. As a result, the recycling and reuse of express packaging have become increasingly critical. In this study, we utilize an extended version of the theory of planned behavior model (TPB) to examine consumers' behavioral intentions and the factors that influence their decision to recycle express packaging in China. We collected data from 1114 valid questionnaires and tested our hypotheses using partial least squares structural equation modeling. The results revealed that six latent variables, namely attitude, subjective norm, perceived behavioral control, policy and publicity, degree of convenience, and recycling habit, all exert positive effects on consumers' behavioral intention. Additionally, the degree of convenience, perceived behavioral control, policy and publicity, and recycling habit have positive indirect impacts on actual recycling behavior through mediating effects. Notably, the degree of convenience emerges as the most influential factor affecting consumer's behavioral intention, and it plays a pivotal role as the primary mediating path to actual recycling behavior. In conclusion, this study adds to the body of research on waste recycling intentions, providing valuable insights for policymakers and consumers seeking to adopt more energy-efficient behaviors and facilitate the eco-friendly transformation of the express industry.

**Keywords** Express packaging recycling · An extension of the theory of planned behavior · Structural equation model · Policy and publicity · Degree of convenience · Recycling habit

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## 1 Introduction

The rapid development of the digital economy has fueled the growth of e-commerce and logistics industries. Consumers are increasingly relying on online shopping and express delivery services. According to statistics released by China's State Post Bureau covering the years from 2014 to 2022, the size of China's express delivery market has expanded at a remarkable rate of nearly 10 billion parcels per year since 2014, indicating a clear trend of rapid growth. Consequently, the average annual growth rate of the express delivery business has consistently exceeded 25%, as depicted in Fig. 1. By 2022, the cumulative volume of postal and delivery services in the postal industry had surpassed 110 billion pieces, with the number of packages constituting more than half of the world's total. In 2022 alone, there were 11.058 billion pieces of express deliveries, which resulted in the consumption of a staggering 9 million tons of express boxes (China, 2022). China's express delivery industry is estimated to generate over 9 million tons of paper waste and 1.8 million tons of plastic waste annually (China, 2016). This translates into a quantity of tape used for wrapping that could circle the Earth thousands of times. The vast volume of express deliveries unavoidably leads to environmental pollution stemming from the extensive production of packaging waste.

Excessive packaging significantly increases the environmental burden, with many packaging materials like plastic products and tapes often disposed of as regular garbage, not in compliance with relevant regulations. This improper disposal damages the ecological environment and depletes valuable resources (Ding et al., 2023; Fan et al., 2022). However, express packaging waste contains a significant amount of recyclable resources, including cardboard boxes and woven bags, which can mitigate resource depletion and environmental pollution, ultimately reducing production costs for businesses. While some EU countries have achieved high plastic recycling rates, with Switzerland, Denmark, and Germany reaching rates as high as 99.5%, 96.5%, and 96.3%, respectively. China's express packaging recycling rate remains only about 10% (Xiao et al., 2020). Due to the lack of proper recycling channels, massive quantities of express packaging waste end up mingling with

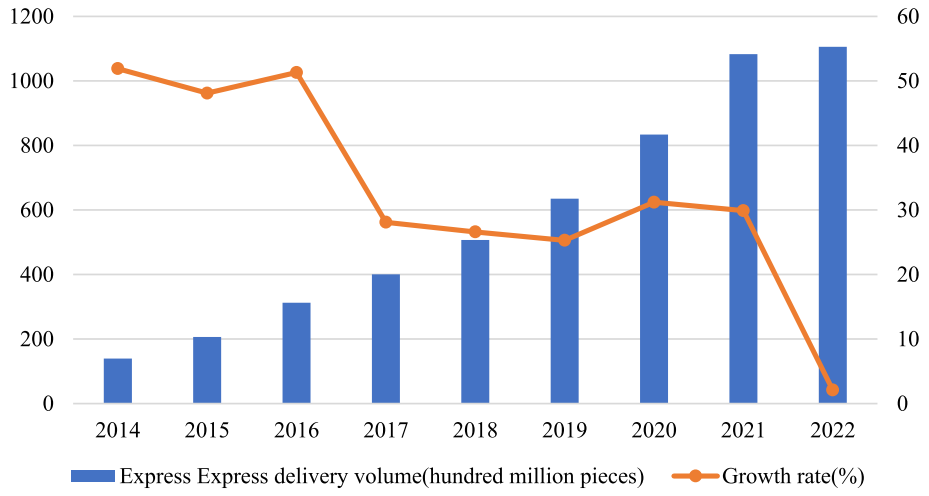


**Fig. 1** Volume and growth rate of China's express delivery business from 2014 to 2022

household garbage and are primarily disposed of through landfilling or incineration, leading to the release of harmful pollutants and greenhouse gases, contributing to climate change (Cudjoe & Wang, 2022; Mollica & Balestieri, 2020; Yang et al., 2021a, 2021b), and exacerbating resource depletion, pollution issues (Di, 2022), and social management costs (Muller et al., 2018). Therefore, recycling stands out as the most effective means to reduce the environmental impact of express packaging waste (Hu et al., 2017).

The Chinese government has recently turned its attention to pollution caused by express delivery packaging and has issued multiple policies and regulations pertaining to express packaging. In May 2019, the 'Green Packaging Evaluation Methods and Criteria' were introduced. In November 2020, the 'Opinions on Accelerating the Green Transformation of Express Packaging' were released, outlining measures like improving standards for express packaging, promoting recyclable packaging products, and bolstering express packaging recycling. Many Chinese express delivery companies have actively responded to these government's policies. For example, JD Logistics has deployed new energy vehicles in multiple cities in China to promote green transportation and launched the 'Green Stream Plan' aimed at achieving low-carbon and eco-friendly packaging, warehousing, and transportation. SF Express has unveiled the 'Zero Carbon Future' plan, encompassing various green environmental protection measures, including reusable express delivery boxes that can be used more than 70 times.

Express packaging recycling is a widely studied topic employing various research methods. Some studies delve into the behavioral traits of individuals in recycling models (Hua et al., 2021) driven by market, government, and cooperation (Yang et al., 2021a, 2021b). Differences in behavior and attitudes toward express packaging waste management among urban and rural populations have also been compared (Cai et al., 2021), and the effects of express packaging recycling policies have been analyzed (Xiao et al., 2020). Most scholars have considered residents' subjective psychological factors when exploring the motivations behind recycling behaviors, given that customers from the foundation of every reverse supply chain and play a pivotal role in the receipt and processing of express delivery (Kumar, 2019). However, there is a need for further exploration from the consumer's perspective on packaging recycling behavior. Existing literature has analyzed factors influencing residents' recycling behavior from various dimensions, including consumer personal subjective factors (Cai et al., 2021), government management perspectives (Guo et al., 2021), psychological perceptions (Chen et al., 2019; Ding et al., 2021b), environmental awareness (Ding et al., 2023), and others. Yet, these studies tend to overlook the interactive effects between multiple dimensions, such as policy promotion, convenience, and consumer behavior habits. Furthermore, among the numerous influencing factors, there is currently no authoritative answer regarding which factor holds the greatest significance. The policy environment is influenced by national differences. While, existing literature has discussed the consumers' willingness to recycle waste in countries like Japan (Ishimura, 2022), the UK (Abbott et al., 2011), and India (Kautish et al., 2021), there is limited research focusing on the recycling behavior of residents in China after the implementation of policies promoting the greenization of courier packaging. Additionally, there have been cases where scholars collected insufficient data samples, leading to inaccurate representations of the actual situation (Ding et al., 2021; Dong & Hua, 2018).

Considering these limitations, this paper aims to enhance the reliability and representativeness of the study by introducing new perspectives and increasing the quantity and diversity of research samples. While, some scholars have added new dimensions such as moral norms and past behavior (Uzun & Kilis, 2020; Wang et al., 2021a), there is a lack of research from the perspectives of policy and publicity, degree of convenience, and

recycling habit. Consumers, end-users in the supply chain, are crucial for recycling and reusing packaging materials. They not only receive express parcels directly but also play a crucial role in initiating further recycling and reuse of express packaging (Xing, 2019). However, the recycling rate of express packaging in China remains low, and consumer participation and enthusiasm have seen little improvement since the policy's implementation. Many people have not engaged in express packaging recycling and are unaware of its importance (Wang et al., 2021b). The main factors influencing consumers' willingness to participate in express packaging recycling and reuse are their environmental awareness and perceived benefits (Al-Debei et al., 2015; Sun & Li, 2021). Age, educational attainment, and frequency of online purchases represent the underlying fundamental factors contributing to the gap between willingness and behavior (Jia & Zhang, 2022). Thus, we investigate consumer recycling habits, expecting that habits can prompt changes in individual behavior. Additionally, we examine the impact of policy and publicity on consumer behavior from an external perspective. This paper combines national policies with an analysis of consumer information channels, encompassing the degree of convenience. It explores these three perspectives innovatively, proposing new ideas and explanations with the aim of enhancing research on individual behavior prediction.

In response to the research gaps described above, the prime objective of the current research was to develop a theoretical structure that clarifies customers' recycling behavior toward express packaging. The study aims to address its three research questions (RQs):

RQ1: What factors influence consumer participation in express packaging recycling in China?
RQ2: Do policy and publicity, degree of convenience, and recycling habits have an impact on consumers' participation in express packaging recycling?
RQ3: Among these factors considered in this study, which factor has the greatest impact on consumers' participation in express packaging recycling?

Our study contributes to the literature in three aspects. Firstly, it examines the organic development of a digital economy and green economy by addressing the environmental issues (Qalati et al., 2023a, 2023b) associated with China's digital economy and the prosperity and development of e-commerce. Building upon the concurrent rapid expansion of China's digital economy and the government's proposal for a green transformation of express packaging, this study analyzes consumer behavior in express packaging recycling. It contributes to the verification of the actual effectiveness of green policies for express packaging and provides a reference value for the development of the Chinese digital economy and environmental problem-solving in emerging countries.

Secondly, this study conducts a comprehensive analysis of consumers' inclination to engage in express packaging behavior and examines the significant factors that influence the behavior and lifestyle of Chinese residents. The extension of the theory of planned behavior (hereafter called *TPB*) research framework complements the three dimensions of policy and publicity, degree of convenience, and recycling habit, aligning it more closely with the national conditions of China. This is also one of the most important innovations in this paper, filling the gaps in previous research and expanding into new areas of study. This paper predicts consumers' behavior in the recycling and reuse of packaging materials from multiple internal and external perspectives and examines the mechanisms through which these perspectives influence consumers.

Thirdly, through path analysis and mediating effect testing, this paper identifies the degree of convenience as the most significant factor influencing enterprises' express

packaging recycling behavior. Creating a convenient environment can effectively promote consumer participation in recycling behavior. In addition to the degree of convenience, factors such as attitude, subjective norm, perceived behavioral control (hereafter called *PBC*), policy and publicity, and recycling habits all have a positive impact on consumer behavior. This conclusion enlightens the government and enterprises that should optimize the express packaging recycling service. This study enriches the literature on consumers' intention to recycle and reuse packaging materials within the context of the green economy.

Guided by these research questions and with the objective to find what factors influence consumer participation in express packaging recycling in China, this paper made an extension of the theory of planned behavior and add three new factors which are policy and publicity, degree of convenience and recycling habit. To answer these research questions, we using partial least squares structural equation modeling to analyze 1114 valid questionnaires and tested our hypotheses. Employing the model as a tool, this paper explores which factor has the greatest impact on consumers' participation in express packaging recycling. Through path analysis and mediating effect testing, this paper identifies the degree of convenience as the most significant factor influencing enterprises' express packaging recycling behavior. This study adds to the body of research on waste recycling intentions.

The remaining sections of this study are arranged as follows. Section 2 develops the theoretical background and research hypotheses. Research methods are presented in Sect. 3. Section 4 of the study details the empirical analysis of structural equation modeling. Discussions are presented in Sect. 5. Lastly, conclusions are presented in Sect. 6.

## 2 Theoretical background and research hypotheses

### 2.1 Theoretical background and framework

The TPB, which was proposed by Ajzen (1991) and is rooted in the theory of rational behavior, stands as a classic theory frequently employed in the study of individual behavior. This theory establishes a connection between an individual's beliefs and their behavior, providing insights into the psychological underpinnings of human behavior (Ahmed et al., 2021). It aids in understanding how people predict and modify their behavior patterns, elucidating individual behavior (Qalati et al., 2022). This theory posits that attitude, subjective norm, and PBC directly influence consumer behavioral intention, which, in turn, determine actual behavior. Attitude signifies people's subjective evaluations, subjective norm represents perceived environmental influence, and PBC pertains to an assessment of the behavior's level of difficulty. There have been numerous studies on consumer behavior and their different behavioral intention based on TPB.

As research in this field advances, many scholars adapt the TPB model to specific contexts and introduce new factors to enrich the study of consumer behavior. For instance, Qalati et al. (2022) employed a TPB framework in the context of households energy-saving intentions and behavior, incorporating the constructs of descriptive norms and moral responsibility. Ahmed et al. (2021) included environmental awareness and concerns to predict young consumers' buying intention toward organic food. Tonglet et al. (2004) expanded the TPB by integrating ethical norms and recycling consequences to investigate recycling behavior among UK residents.

This study introduces a novel framework by supplementing the TPB with policy and publicity, degree of convenience, and recycling habits. Figure 2 depicts the extended framework of the TPB.

## 2.2 Hypotheses

### 2.2.1 Attitude

According to the TPB model, a positive attitude toward a behavior increases the intention to engage in that behavior (Ajzen, 1991). Conversely, a negative attitude can impede willingness to act (Kumar, 2019). Attitudes can reliably predictor behavior, as they reflect the decisions individuals are likely to make. The more positively consumers perceive and embrace express packaging recycling, believing that participating in such behavior is highly beneficial, the greater their desire to engage in express packaging recycling. On the other hand, if consumers hold a negative evaluation or perception of this behavior, considering express packaging recycling to be useless, it will hinder the formation of behavioral intentions. Therefore, we propose the following hypothesis:

**H1** Attitude has a positive impact on behavioral intention to engage in express packaging recycling.

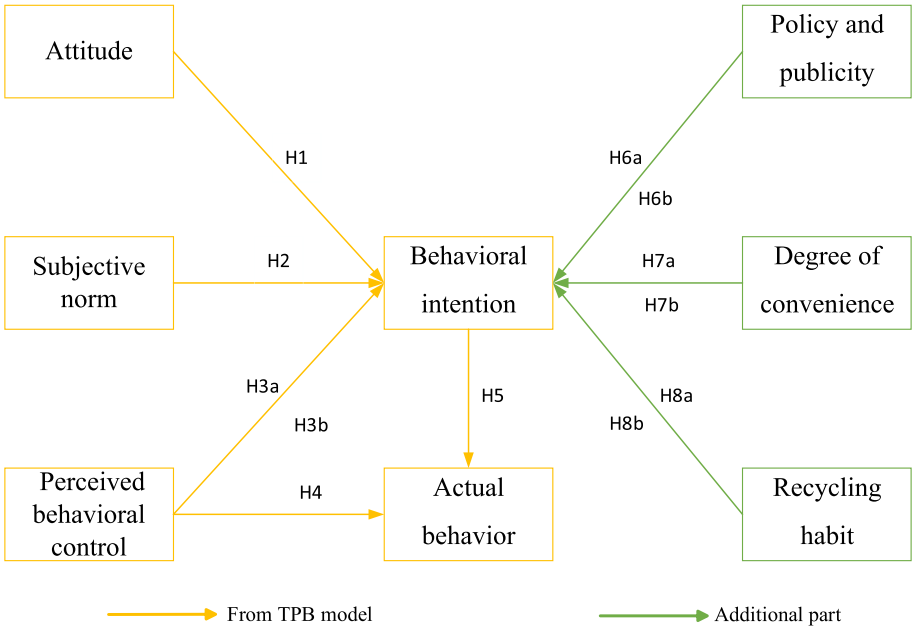


**Fig. 2** Extension of TPB model

### 2.2.2 Subjective norm

Subjective norm represents the social pressure individuals feel regarding a specific behavior (Ajzen, 1991), reflecting the influence of others or groups. These norms are influenced by various factors, including social order, moral standards, laws and regulations, and personal experiences. Individuals may conform to social pressures even if they hold unfavorable attitudes toward a particular system or innovation. The theory of organizational behavior suggests that people's plans for their actions are often influenced by external factors, and individuals rarely make rational decisions in isolation (Si et al., 2020b). In collectivist cultures such as East Asia, subjective norms hold significant importance (Shi et al., 2017). Consequently, individuals consider the constraints of their environment before taking specific actions. Previous research has shown the significant influence of subjective norms on pro-environmental intentions, such as agricultural refuse recycling (Jiang et al., 2018) and plastic waste management (Farhana Khan et al., 2019). Therefore, we propose the following hypothesis:

**H2** Subjective norm has a positive impact on consumers' intention to recycle express packaging.

### 2.2.3 Perceived behavioral control (PBC)

Perceived behavioral control (PBC) refers to individuals' perception of their ability to engage in a particular behavior. It reflects individuals' confidence and control over that behavior, thereby influencing their decision to adopt it (Ajzen, 1991). PBC is related to individuals' perceived control over specific behaviors and is influenced by self-efficacy and the perception of controllability. Individuals' decisions are influenced by their subjective evaluations of the ease of performing related behaviors, while their intention to act is influenced by the level of control they believe they have over their behavior. Perceived control variables can measure an individual's perception of the level of ease or difficulty associated with a particular behavior (Vamvaka et al., 2020). People are more likely to engage in recycling activities if they have a clear understanding of the 'how, what, and when' of recycling, as opposed to those who feel they have little influence over current or upcoming restrictions.

The strong positive impact of PBC on the intention to recycle has been supported by numerous studies (Faisal Khan et al., 2018; Russell et al., 2017; Taylor & Todd, 1995). Stronger recycling intentions are likely to influence the occurrence of actual recycling behavior, suggesting the possibility and rationality that PBC indirectly influences actual behavior through recycling intentions. Therefore, the following hypotheses are proposed:

**H3a** PBC has a positive impact on behavioral intention to recycle express packaging.

**H3b** PBC has an indirect positive impact on consumers' actual behavior through their intention.

**H4** PBC has a direct positive impact on consumers' actual behavior.

**H5** Consumers' behavioral intention has a direct positive impact on their actual behavior.

### 2.2.4 Policy and publicity

Government policies and regulations exert a significant influence on consumer behavior, given their public nature. Research by Liang Li et al. (2020) demonstrated that public environmental policies positively affect consumers' behavioral intentions and actions. Specifically, low-carbon policies have been shown to have a substantial impact on the behavior of the youth population. This is not surprising, considering the widespread implementation of compulsory education, which has led to an overall improvement in the population's quality. Conversely, middle-aged and older individuals tend to have their behavioral intentions influenced more by subjective norms (Li et al., 2021). However, it is important to note that the impact of policies on actual behavior is weaker than their influence on behavioral intentions. Policies may create intentions but do not always result in corresponding actions.

Publicity serves as a deliberate means of disseminating information to shape people's thoughts and behaviors. When publicity enhances individuals' understanding of the significance and value of a policy, it can boost their behavioral intentions. It is worth noting that residents' inclination to recycle e-waste is not directly affected by information publicity; rather, it is indirectly influenced by personal norms and attitudes toward recycling (Wang et al., 2018). In some cases, positive propaganda is not the only necessity. Appropriate negative propaganda can also influence consumers' perceptions and intentions, helping them adopt a dialectical perspective and enhance their cognitive understanding (Ouyang et al., 2020). Therefore, policy and publicity related to the transformation of greener express delivery practices and waste recycling are likely to impact residents' behavioral intentions.

**H6a** Policy and publicity have a positive impact on consumers' behavioral intention to recycle express packaging.

**H6b** Policy and publicity have an indirect positive impact on consumers' actual behavior through their intention.

### 2.2.5 Degree of convenience

Convenience plays a pivotal role in consumers' decision-making, enabling them to reduce non-monetary costs, like time and effort. Notably, convenience stands out as a paramount factor influencing the usage intentions of young Chinese consumers as observed by Wang et al. (2021b). For instance, convenience exerts a positive influence on the online shopping intentions of college students, as indicated by Duarte et al. (2018). Similarly, convenience can act as a behavioral catalyst, motivating individuals to participate in recycling activities. When the recycling process is simple, accessible, and minimally effortful, people are more likely to engage in it. In the context of express packaging recycling, providing easily accessible recycling bins or drop-off points in convenient locations can significantly enhance participation rates. On the contrary, if recycling expresses packaging entails a time-consuming or complicated process, like sorting materials or traveling to distant recycling centers, people may be less inclined to recycle. Therefore, this study introduces the concept of convenience in express packaging recycling as a significant factor in the original theoretical framework.

**H7a** Degree of convenience has a positive impact on consumers' intention to recycle express packaging.

**H7b** Degree of convenience has an indirect and positive impact on consumers' actual behavior through their intention.

#### 2.2.6 Recycling habit

Habit, as described by Wood et al. (2014), represents an automatic behavior that has been ingrained to accomplish a specific goal. Changing one's habits serves as the foundation for changing behavior, and it is through repetition that habits can modified (Yue et al., 2021). Habits exhibit the characteristics of stability and consistency, which exert a positive influence on behavioral intentions (Sarmento & Loureiro, 2021). Individuals who have established recycling habits do not typically deliberate on whether to recycle or not because their behavior aligns with established norms. In contrast, individuals with a propensity for recycling are more likely to engage in consistent, long-term recycling of delivery packaging rather than adopting a temporary recycling approach, as highlighted by Carden and Wood (2018).

It is evident that future behavior can be reliably predicted based on past habits. The interaction between habits and intentions plays a significant role in shaping actual behavior, with intentions occasionally exerting a weaker influence than habits as suggested by Danner et al. (2008). Once recycling habits evolve into an individual's core values and behavioral guidelines, they are more strongly motivated to engage in actions that align with their beliefs. This motivation encourages them to consistently recycle express packaging. Consequently, this study places great importance on habits as a critical factor in assessing residents' intentions and actual behavior concerning the recycling of packaging materials. To summarize, we propose the following hypotheses.

**H8a** Habit has a positive impact on consumers' intention to recycle express packaging.

**H8b** Habit has an indirect and positive impact on consumers' actual behavior through their intention.

## 3 Research methods

The study's aim and the hypothesized model dictate that data analysis is being carried out using partial least squares structural equation modeling with IBM SPSS AMOS v. 26.0. We will adhere to the guidelines provided by Hair (2009) to calculate the model fit indices and assess the reliability and validity of measurements. This comprehensive section encompasses questionnaire design, data collection, data inspection, reliability testing, convergent validity testing, discriminant validity testing, and correlation analysis.

### 3.1 Questionnaire design

The empirical research relies on a questionnaire as its primary data collection method. The questionnaire's design draws from the theory of planned behavior, offering a unique

perspective. The questionnaire was made available online for individuals to complete, resulting in a total of 1,114 responses.

The questionnaire consists of two main sections. The first section gathers essential personal information, including gender, age, education, occupation, frequency of online shopping, and frequency of receiving and sending express packages. The second section delves into the factors that influence consumers' engagement in express package recycling. This section is further divided into eight dimensions, each containing distinct measurement items. A detailed list of measurement items from the questionnaire can be found in Table 1.

### 3.2 Data collection

The questionnaire, comprising 1,114 valid responses, was accessible on the Internet through a QR code or a provided link. The respondents were drawn from 30 provinces, autonomous regions, and municipalities across China.

The questionnaire was administered using a 7-point Likert scale, a widely recognized tool developed by the American psychologist Rensis Likert. This scale finds common use in psychological, social, and various research fields due to its simplicity in compilation and implementation as highlighted by Bertram (2007). It is worth noting that within a specific range, the scale's discriminatory power improves with an increase in the number of levels. Employing the same sample size allows for more precise findings. Consequently, the 7-point scale surpasses the 5-point scale by offering a wider array of choices, enhancing accuracy and objectivity.

Table 2 presents the sample characteristics and distribution. Concerning gender, male applicants totaled 580, making up 52.1% of the total, while there were 534 female applicants, constituting 47.9% of the sample. This near-equal gender distribution is notable. In terms of age, the majority of respondents fell within the range 18–30 age range, with 802 participants accounting for 72% of the total. The second largest age group was 31–45 years old, comprising 197 participants (17.7%). This diverse age distribution signifies that the questionnaire reached respondents of various age groups, with a focus on younger consumers who are the primary audience for online shopping. Their responses contribute to the questionnaire's reliability as a source of information. Regarding educational background, the majority of respondents were undergraduate students (565 participants), followed by master's students. This indicates that most of the participants had received higher education. In terms of occupation, students constituted the majority of respondents, with 588 participants making up more than half of the total. This distribution aligns with the nature of online shopping, primarily driven by college students and thus a reasonable target group for the survey. Campuses generate a significant amount of express packaging, making recycling behavior necessary.

Furthermore, nearly half of the respondents reported monthly earnings of less than 2000 yuan. On average, the majority of respondents engaged in online shopping 2–5 times a month, accounting for 30% of the total. Additionally, the average monthly online shopping frequency exceeded 4 times, highlighting a substantial demand for recycling express packaging. Over 60% of respondents expressed a significant need for monthly package collection and delivery.

### 3.3 Data inspection

This study uses SPSS-AMOS software to conduct data analysis and testing.

**Table 1** Survey items about green recycling express package

| Variable | Number | Item | References |
|---|---|---|---|
| Attitude (ATT) | ATT1 | I think it is both ethical and quality behavior to recycle express packaging | Wang et al. (2021b) |
| | ATT2 | I believe actively taking part in the recycling of express packaging will contribute to resource conservation and environmental protection | Ru et al. (2019) |
| | ATT3 | I think it is meaningful to recycle express packaging and it is worth spending time on it | Han (2015), Oztekin et al. (2017), Wan et al. (2012) |
| | ATT4 | I think participating in express packaging recycling can make me feel happy and joyful | Kautish et al. (2019) |
| Subjective norm (SN) | SN1 | My family and friends are very supportive of my participation in express packaging recycling | Paul et al. (2016), Kumar (2019) |
| | SN2 | If a lot of people around me are participating, then I will also participate in recycling activities | Tonglet et al. (2004) |
| | SN3 | The guidance of public opinion in the social environment will affect my implementation of express packaging recycling | |
| Perceived behavior control (PBC) | PBC1 | I am able to control my own behavior and decide whether to participate in express recycling or not | Shi et al. (2017), Wang et al. (2021b) |
| | PBC2 | If I want to, I can do a good job of package recycling | Si et al. (2020b), Chi et al. (2014) |
| | PBC3 | I have the time and energy to take part in express packaging recycling | |
| Policy and publicity (PP) | PP1 | I understand the national and local governments' current laws and policies on express packaging recycling | Nnorom et al. (2009) |
| | PP2 | The community I live in often has environmental promotion activities which are about express packaging and so on | |
| | PP3 | I can get promotional information about express packaging from newspapers, TV, the Internet, and other media | |

**Table 1** (continued)

| Variable | Number | Item | References |
|---|---|---|---|
| Degree of convenience (DC) | DC1 | There is a convenient express recycling site around me | Cao and Liu (2019), Thach et al. (2013) |
| | DC2 | There is a door-to-door express waste recycling service around me | Knussen et al. (2004) |
| | DC3 | If the recycling site is close to where I live, I might decide to take part in express packaging recycling | |
| | DC4 | If express packaging recycling is simple and easy to operate, I will be more actively involved in express packaging recycling | |
| | DC5 | The school/work unit will arrange and organize express packaging recycling regularly | |
| Recycling habit (RH) | RH1 | It's a daily habit of mine to collect and reuse used delivery boxes | Aboelmaged (2021) |
| | RH2 | I hope to recycle express packaging as a daily habit | |
| | RH3 | I am used to throwing away the express packages as garbage | |
| Behavioral intention (BI) | BI1 | Future express packaging recycling initiatives are something I'm willing to take part in | Chi et al. (2014) |
| | BI2 | I would like to use green packages such as shared delivery boxes, recycling bags, and biodegradable delivery bags | Francis et al. (2004) |
| | BI3 | I will take the initiative to encourage my friends, classmates (colleagues), and family members to carry out express packaging recycling activities | |
| Actual behavior (AB) | AB1 | I have taken action to participate in the express packaging recycling activity | Shirokova et al. (2016) |
| | AB2 | I am already using green packages such as recycling bags, biodegradable express bags, etc. | Zhang et al. (2020) |
| | AB3 | I will persist in the activity of recycling express packages | |

**Table 2** Description of sample characteristic distribution

| Variable | Option | Frequency | Percentage |
|---|---|---|---|
| Gender | A. Male | 580 | 52.1 |
| | B. Female | 534 | 47.9 |
| Age | A. Under 18 years old | 15 | 1.3 |
| | B.18–30 | 802 | 72.0 |
| | C.31–45 | 197 | 17.7 |
| | D.45–60 | 84 | 7.5 |
| | E. Over 60 years old | 16 | 1.4 |
| Educational background | A. Below high school | 107 | 9.6 |
| | B. Senior high school | 155 | 13.9 |
| | C. Undergraduate | 565 | 50.7 |
| | D. Master | 202 | 18.1 |
| | E. Doctor | 62 | 5.6 |
| | F. Other | 23 | 2.1 |
| Current occupation | A. Student in school | 588 | 52.8 |
| | B. Enterprise employee | 230 | 20.6 |
| | C. Civil servant | 62 | 5.6 |
| | D. Personnel of public institutions | 91 | 8.2 |
| | E. Freelancer (including self-employed) | 94 | 8.4 |
| | F. Other | 49 | 4.4 |
| Work unit | Q4 is choice A (without work) | 588 | 52.8 |
| | A. State-owned enterprise | 124 | 11.1 |
| | B. Three-capital enterprises (Sino-foreign joint ventures, Sino-foreign cooperative enterprises, wholly foreign-funded enterprises) | 116 | 10.4 |
| | C. Private enterprise | 168 | 15.1 |
| | D. Other types of enterprises | 65 | 5.8 |
| | E. Non-enterprise unit | 53 | 4.8 |
| Average monthly income | A. Less than 2000 RMB | 480 | 43.09 |
| | B.2001–4000 | 270 | 24.24 |
| | C.4001–6000 | 131 | 11.76 |
| | D.6001–8000 | 80 | 7.18 |
| | E.8001–10000 | 88 | 7.90 |
| | F. Over 10,000 RMB | 65 | 5.83 |
| Average monthly frequency of online shopping | A.0–1 | 145 | 13.0 |
| | B.2–5 | 334 | 30.0 |
| | C.6–10 | 279 | 25.0 |
| | D.11–15 | 166 | 14.9 |
| | E.16–20 | 102 | 9.2 |
| | F. Over 20 | 88 | 7.9 |
| Average monthly frequency of collecting and delivering | A.0–1 | 167 | 15.0 |
| | B.2–5 | 284 | 25.5 |
| | C.6–10 | 290 | 26.0 |
| | D.11–15 | 194 | 17.4 |
| | E.16–20 | 112 | 10.1 |
| | F. Over 20 | 67 | 6.0 |

### 3.3.1 Reliability testing

Reliability pertains to the degree of consistency in the results obtained when the same object is repeatedly measured using the same method. The reliability coefficient increases as the trustworthiness, stability, and consistency of the test findings improve. When multiple measurements of the same object yield consistent results, it signifies the findings are trustworthy. Reliability can be categorized into two types, internal and external, depending on the specific focus of concern. Internal reliability measures the degree of consistency among a set of questions within a survey that assesses the same concept. The most commonly used indicator of internal reliability is Cronbach's alpha coefficient. On the other hand, external reliability, commonly assessed using test–retest reliability, involves administering the same questionnaire to the same object at different times and calculating the degree of consistency between the results.

Cronbach's alpha coefficient analysis is primarily employed to evaluate the internal consistency of data measured on ordered categorical and continuous scales. This method is well-suited for assessing the reliability of attitude and opinion surveys. For the overall scale, a reliability coefficient falling within the range of 0.9–1 is considered very reliable, between 0.8–0.9 is deemed reliable, and between 0.7–0.8 is acceptable. For sub-scales, a reliability coefficient above 0.7 is considered excellent, and between 0.6–0.7 is acceptable. If the Cronbach's alpha coefficient falls below 0.6, it is recommended to consider redesigning the questionnaire.

As presented in Table 3, the Cronbach's alpha coefficient for the overall scale stands at 0.965, indicating a high level of internal consistency and reliability in the test results. Additionally, Cronbach's alpha coefficients for attitude, subjective norm, PBC, policy and publicity, degree of convenience, recycling habit, behavioral intention, and actual behavior all exceed 0.7, demonstrating strong reliability, consistency, and stability in the questionnaire.

### 3.3.2 Convergent validity and composite reliability

To assess the convergent validity and composite reliability of each dimension within the scale, we performed a rigorous examination. This process involved computing the standardized factor loadings of each measurement item on its corresponding dimension using a well-established confirmatory factor analysis model. The outcome for convergent validity specifically the average variance extracted (AVE) and composite reliability

**Table 3** Reliability analysis of green scale of express package

| Variable | Cronbach's alpha coefficient | Number of terms |
|---|---|---|
| ATT | 0.898 | 4 |
| SN | 0.852 | 3 |
| PBC | 0.845 | 3 |
| PP | 0.848 | 3 |
| DC | 0.782 | 5 |
| RH | 0.816 | 3 |
| BI | 0.842 | 3 |
| AB | 0.794 | 3 |
| Total scale | 0.965 | 27 |

(CR) are summarized in Table 4. Assuming that λ represents the standardized factor load value and n represents the number of items within the measurement, the formula for calculating AVE is as follows:

$$\mathrm{AVE} = \left(\sum \lambda^2\right)/n$$

The formula for calculating CR is expressed as:

$$CR = \left(\sum \lambda\right)^2 / \left[\left(\sum \lambda\right)^2 + \Sigma_\varepsilon\right]$$

Using these respective formulas, we calculated the AVE and CR values for each dimension. Table 4 shows that all AVE values for each dimension in this fundamental dimensional measurement scale validity test surpass 0.5, while all CR values exceed 0.7 (Qalati et al., 2023a, 2023b). These results collectively affirm the robust convergent validity and composite reliability of each dimension.

**Table 4** Convergent validity and composite reliability testing

| Path relation | Estimate | AVE | CR |
|---|---|---|---|
| ATT1 ← ATT | 0.838 | 0.688 | 0.898 |
| ATT2 ← ATT | 0.831 | | |
| ATT3 ← ATT | 0.816 | | |
| ATT4 ← ATT | 0.833 | | |
| SN1 ← SN | 0.797 | 0.656 | 0.851 |
| SN2 ← SN | 0.814 | | |
| SN3 ← SN | 0.819 | | |
| PBC1 ← PBC | 0.790 | 0.643 | 0.844 |
| PBC2 ← PBC | 0.779 | | |
| PBC3 ← PBC | 0.836 | | |
| PP1 ← PP | 0.795 | 0.652 | 0.849 |
| PP2 ← PP | 0.831 | | |
| PP3 ← PP | 0.795 | | |
| DC1 ← DC | 0.770 | 0.524 | 0.836 |
| DC2 ← DC | 0.808 | | |
| DC3 ← DC | 0.801 | | |
| DC4 ← DC | 0.796 | | |
| DC5 ← DC | 0.311 | | |
| RH1 ← RH | 0.812 | 0.622 | 0.831 |
| RH2 ← RH | 0.848 | | |
| RH3 ← RH | 0.698 | | |
| BI1 ← BI | 0.791 | 0.642 | 0.843 |
| BI2 ← BI | 0.819 | | |
| BI3 ← BI | 0.793 | | |
| AB1 ← AB | 0.814 | 0.657 | 0.852 |
| AB2 ← AB | 0.806 | | |
| AB3 ←AB | 0.811 | | |

**Table 5** Discriminant validity test results of each dimension of the basic dimension scale

| Variable | ATT | SN | PBC | PP | DC | RH | BI | AB |
|---|---|---|---|---|---|---|---|---|
| ATT | **0.688** | | | | | | | |
| SN | 0.577 | **0.656** | | | | | | |
| PBC | 0.658 | 0.801 | **0.643** | | | | | |
| PP | 0.635 | 0.752 | 0.847 | **0.652** | | | | |
| DC | 0.740 | 0.641 | 0.860 | 0.861 | **0.524** | | | |
| RH | 0.624 | 0.767 | 0.856 | 0.856 | 0.678 | **0.689** | | |
| BI | 0.638 | 0.764 | 0.865 | 0.821 | 0.677 | 0.754 | **0.622** | |
| AB | 0.610 | 0.630 | 0.837 | 0.867 | 0.704 | 0.695 | 0.745 | **0.657** |
| The square root of the AVE value | 0.829 | 0.810 | 0.876 | 0.887 | 0.724 | 0.830 | 0.801 | 0.810 |

**Table 6** The results of the Pearson correlation coefficient analysis between each dimension

| Dimension | ATT | SN | PBC | PP | DC | RH | BI | AB |
|---|---|---|---|---|---|---|---|---|
| ATT | 1 | | | | | | | |
| SN | .767** | 1 | | | | | | |
| PBC | .747** | .754** | 1 | | | | | |
| PP | .729** | .724** | .713** | 1 | | | | |
| DC | .705** | .686** | .697** | .708** | 1 | | | |
| RH | .702** | .722** | .708** | .713** | .703** | 1 | | |
| BI | .728** | .733** | .730** | .695** | .699** | .710** | 1 | |
| AB | .709** | .682** | .691** | .727** | .717** | .720** | .691** | 1 |

**At level 0.01 (double tail), the correlation was significant

### 3.3.3 Discriminant validity testing

Discriminant validity is a crucial concept used to establish that the observed indicators exhibit stronger correlations with their respective categorical variables than with other categorical variables, or no sometimes, they have no correlation at all. The standard method for assessing this is to compare the square root of the AVE with the correlation coefficients between categorical variables. The results of the discriminant validity tests for each dimension are presented in Table 5. In each case, the square root of the AVE value for a given dimension is smaller than the standardized correlation coefficients between that dimension and others. This finding indicates that each dimension effectively exhibits good discriminant validity.

### 3.3.4 Correlation analysis

Correlation analysis involves the examination of two or more correlated variables to quantify the extent of the correlation between them. This analysis is employed to determine the presence of a relationship, the strength of the relationship, or its magnitude. Table 6 displays the results of the Pearson correlation coefficient analysis between each dimension. It

is clear from Table 6 that a notable correlation exists between all variables in this analysis, and they all demonstrate statistical significance at the 99% level. Based on the results of the correlation coefficient analysis, it is evident that the correlation coefficient (r) between each variable is greater than 0. As a result, we can confidently conclude that a significant positive correlation exists among all the variables in this analysis.

## 4 Empirical analysis of structural equation modeling

In this section, we employed structural equation modeling (SEM) to test our hypotheses. We conducted path analysis and mediating effect tests to examine the relationship among all the factors. SEM is a quantitative technique that allows for the representation and analysis of complex causal relationships between sample data using model equations that correspond to these relationships. It serves as a method for establishing, estimating, and testing models of causal relationships. SEM is particularly valuable for analyzing data that involves latent variables, which cannot be directly observed or measured. A latent variable often corresponds to multiple observed variables and can be considered an abstraction and generalization of those observed variables. Observed variables, in contrast, are directly measurable variables, such as gender and age. SEM typically consists of two components: the measurement model, which describes the relationship between observed variables and latent variables, and the structural model, which utilizes path analysis to depict the connections between latent variables.

### 4.1 Construction of structural equation model

This study employed SEM to verify the relationships proposed by our hypotheses and analyze the factors influencing consumer behavior in express packaging recycling activities, using SPSS-AMOS software (Wang et al., 2021a). Based on the interrelationships among variables, we developed a conceptual model diagram, as depicted in Fig. 3. In the model

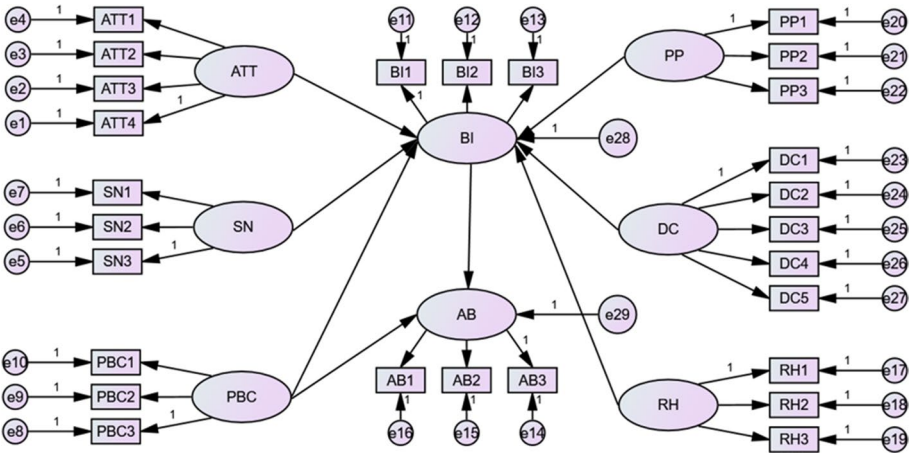


**Fig. 3** Structural equation model diagram of factors affecting recycling behavior of express packaging

diagram, rectangular boxes represent observed variables, while ellipsoids represent latent variables. As per the earlier hypothesis, it is evident that attitude, subjective norm, PBC, policy and publicity, degree of convenience, and recycling habit all exert a direct positive influence on behavioral intention. Moreover, PBC and behavioral intention have a direct positive impact on actual behavior. Additionally, PBC, policy and publicity, degree of convenience, and recycling habit indirectly influence actual behavior through their impact on behavioral intention.

### 4.2 Model fitting degree analysis

Following the construction of the model diagram, the study's objective is to validate and meticulously assess the model's outcomes to evaluate the significance and degree of fit of the theoretical framework. Table 7 presents the results regarding the model's fitness. The results indicate that CMIN/DF equals 2.193, which falls within the reasonable range of 1–3. A lower CMIN/DF value suggests a higher level of model fit. RMSEA is calculated as 0.066, within the range of 0.05–0.08, indicating a good fit of the model to the data. Additionally, the test results for IFI, TLI, and CFI all exceed 0.9, signifying an excellent level of fit. Overall, all the data point toward a satisfactory level of model fit, providing confidence in the interpretation of both standardized and non-standardized coefficients.

### 4.3 Path analysis

Path analysis is employed to scrutinize the connections between variables within the model and validate the underlying hypotheses. By inputting the questionnaire data into the constructed model, we derive the factor loadings and assess the significance of the observed variables on the latent variables. Greater factor loadings indicate a stronger correlation between the observable variables and the latent variables. The structural equation model offers a clear representation of the relationship between the observed variables and the latent variables. Table 8 displays the outcomes of the path relationship test pertaining to the development of green express packaging.

The effect of attitude on behavioral intentions is significant, with a path coefficient of 0.791 and a high level of significance ($p < 0.001$). Similarly, the path coefficient between subjective norm and behavioral intention is 0.864, which is also highly significant at the level of $p < 0.001$. PBC significantly influences behavioral intention, indicated by a path coefficient of 0.866 and a significance level of $p < 0.001$. Moreover, PBC has a significant impact on actual behavior, with a path coefficient of 0.846 and a significance level of $p < 0.001$. This confirms the validity of hypotheses *H1*, *H2*, *H3a*, and *H4*.

**Table 7** Model fitness test

| Index | Reference standard | Result |
|---|---|---|
| CMIN/DF | 1–3 is excellent and 3–5 is good | 2.193 |
| RMSEA | Less than 0.05 is excellent, and less than 0.08 is good | 0.066 |
| IFI | Greater than 0.9 is excellent, and greater than is good | 0.937 |
| TLI | Greater than 0.9 is excellent, and greater than 0.8 is good | 0.982 |
| CFI | Greater than 0.9 is excellent, and greater than 0.8 is good | 0.929 |

**Table 8** Hypotheses testing

| Hypothesis | Path relation | Estimate | S.E | C.R | P |
|---|---|---|---|---|---|
| H1 | BI ← ATT | 0.791 | 0.032 | 24.598 | *** |
| H2 | BI ← SN | 0.864 | 0.036 | 24.274 | *** |
| H3a | BI ← PBC | 0.866 | 0.037 | 23.704 | *** |
| H4 | AB ← PBC | 0.846 | 0.038 | 23.253 | *** |
| H5 | AB ← BI | 0.845 | 0.038 | 22.716 | *** |
| H6a | BI ← PP | 0.820 | 0.036 | 22.632 | *** |
| H7a | BI ← DC | 0.895 | 0.037 | 23.977 | *** |
| H8a | BI ← RH | 0.854 | 0.036 | 23.36 | *** |

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

The path coefficient between behavioral intention and actual behavior is 0.845, signifying a strong and significant relationship at the $p < 0.001$ level. Furthermore, the observed path coefficient between policy and publicity concerning behavioral intention is 0.820, which is statistically significant at a $p$-value of less than 0.001. Additionally, the path coefficient between the degree of convenience and behavioral intention is 0.895, also highly significant at the $p < 0.001$ level. Likewise, the path coefficient between recycling habit and behavioral intention is 0.854, showing strong significance at the $p < 0.001$ level. These results confirm the validity of hypotheses *H5*, *H6a*, *H7a*, and *H8a*.

### 4.4 Mediating effect

In the model constructed for this study, there are four pathways involving mediating variables, and in each of these paths, behavioral intention acts as the mediating variable. These four intermediary paths are:

1. PBC → BI → AB.
2. PP → BI → AB.
3. DC → BI → AB.
4. RH → BI → AB.

To further evaluate the mediating effect, the percentile Bootstrap method was employed. The hypotheses were tested by calculating a 95% confidence interval through 5,000 repeated resampling. The results of the Bootstrap mediation effect with a 95% confidence interval are presented in Table 9.

**Table 9** Mediation effect test based on Bootstrap

| Hypothesis | Indirect effect value | BootSE | BootLLCI | BootULCI | Ratio of indirect to total effect (%) |
|---|---|---|---|---|---|
| H3b (PBC→BI→AB) | 0.208 | 0.020 | 0.168 | 0.247 | 42.28 |
| H6b (PP→BI→AB) | 0.176 | 0.018 | 0.141 | 0.210 | 34.38 |
| H7b (DC→BI→AB) | 0.143 | 0.015 | 0.115 | 0.172 | 38.44 |
| H8b (RH→BI→AB) | 0.253 | 0.025 | 0.205 | 0.304 | 35.79 |

For the path of PBC → behavioral intention → actual behavior, the confidence interval is [0.168, 0.247], excluding 0, with a mediating effect value of 0.208. This indicates that behavioral intention mediates the relationship between PBC and actual behavior.

In the path of policy and publicity → behavioral intention → actual behavior, the confidence interval is [0.141, 0.210], excluding 0, with a mediating effect value of 0.176. Here, behavioral intention mediates the relationship between policy and publicity and actual behavior.

In the path of the degree of convenience → behavioral intention → actual behavior, the confidence interval is [0.115, 0.172], excluding 0, with a mediating effect value of 0.143. This reveals that behavioral intention serves as the mediating variable between the degree of convenience and actual behavior.

In the path of recycling habit → behavioral intention → actual behavior, the confidence interval is [0.205, 0.304], excluding 0, and the mediating effect value is 0.253. This signifies that behavioral intention acts as the mediating variable between recycling habit and actual behavior. In all four of these paths, behavioral intention plays a significant mediating role.

## 5 Result analysis and discussion

### 5.1 Attitude, subjective norm, PBC, and behavioral intention

The coefficient of the influence of attitude on behavioral intention is 0.791, indicating that consumers' attitudes have a positive impact on their behavioral intention. Consumers' choices are shaped by their individual assessments of behavior, aligning with earlier research findings (Kumar, 2019; Liang Li et al., 2020). The measurement items for attitude include consumers' awareness of environmental protection, as well as their personal feelings and thoughts regarding participation in activities (Bagheri et al., 2019). Consumers are more inclined to act and make changes if they hold a positive and affirmative attitude toward the recycling of express packaging. Conversely, consumers are less likely to engage in recycling activities if they harbor doubts, negative attitudes, or lack understanding regarding the recycling of packaging materials (Soorani & Ahmadvand, 2019). To promote attitude change among certain consumers, government agencies can collaborate with the media to raise awareness among the general public. Additionally, releasing short, easily understandable videos on various platforms can help provide insights into new policies. These measures aim to transform consumers' attitudes and perspectives, assisting them in cultivating a proper mindset. When it comes to the recycling of express packaging, consumers should have a precise understanding and appreciation of its significance in resource conservation and protection.

The coefficient of the subjective norm on consumer behavioral intention is 0.864, and it has a direct positive effect on consumer behavioral intention. This research conclusion is in line with existing research viewpoints, suggesting that the subjective norm reflects individuals' social pressure when influenced by the external environment to some extent. Social pressure surrounding an individual can significantly influence their behavior. Higher external expectations for consumers to use recyclable packaging are associated with a stronger willingness to do so (Al-Swidi et al., 2014). The involvement of family members, friends, or colleagues in express packaging recycling and reuse will undoubtedly influence the consumer's behavioral intention to some extent (Oztekin et al., 2017). Government publicity

can also exert social pressure on consumers. Therefore, all stakeholders in society should actively participate in the activities of express packaging recycling to create a conductive atmosphere. This collective effort, involving businesses, consumers, logistics, and others, is essential for embracing the concept of sustainable development and actively contributing to building a green and conservation-oriented society. The creation of a better society necessitates the collective contributions of each individual.

The coefficient of the impact of PBC on consumer behavioral intention is 0.866. PBA has both direct and indirect positive impacts on actual behavior, exerting a significant positive impact on behavioral intention. The direct impact coefficient of PBC on actual behavior is 0.846, which is consistent with current research viewpoints, suggesting that PBC is an individual's perception of the behavior's difficulty, which influences their decision-making (Park & Ha, 2014). If consumers perceive that participating in express packaging recycling is easy, requires minimal time and energy, and they are capable of doing it well, they are more likely to actively engage in recycling activities (Cao & Liu, 2019). People tend to choose what they perceive as simple and manageable, which results in a sense of satisfaction and fulfillment. Additionally, behavioral intention significantly affects actual behavior. PBC also has an indirect positive impact on consumer actual behavior through behavioral intention (with an impact coefficient of 0.824), playing a partial mediating role. This can be attributed to consumers' growing preference for straightforward and effective methods in their fast-paced lifestyles and their increased appreciation for the spiritual satisfaction derived from the process.

### 5.2 Policy and publicity, behavioral intention and actual behavior

The coefficient of the impact of policy and publicity on consumer behavioral intention is 0.820, indicating a significant positive influence on behavioral intention. Policies and regulations are pivotal external factors that shape consumer behavior, a conclusion consistent with existing research perspectives, which can at times compel consumer participation (Liang Li et al., 2020; Record, 2017). These policies play a dual role, both constraining and guiding. To promote green express packaging, the government should establish and strengthen relevant laws and policies, define a robust punishment system, introduce incentive systems like tax exemptions and suitable rewards, and implement dynamic regulatory policies to ensure accuracy and applicability. The use of technologies such as big data and cloud computing can enhance regulatory efficiency. Coordinating all levels of entities and reinforcing enforcement efforts are crucial. The government not only needs to improve the infrastructure of rural and urban areas to bolster the construction of recycling stations but also standardize the use of packaging materials for express delivery and encourage businesses to adopt green packaging materials. The utilization of policy regulations is an effective means to promote the greenification of express packaging. To address the challenges of reverse logistics in recyclable courier packaging, sharing is crucial. Currently, different companies introduce circular packaging within their individual enterprises. If circular packaging can be shared among various companies, the costs of reverse logistics can be further reduced. The prerequisite for sharing is the establishment of standardized protocols, which should be promoted by the government.

Publicity is another important factor that shapes behavioral intention. The study's findings align with earlier research, indicating that consumers can gain a deeper understanding of policy intention through publicity, which subsequently influences their final choices (Wang et al., 2018, 2019). Many consumers have limited awareness of the importance and

necessity of express packaging recycling, environmental protection, and resource conservation. Promoting the green transformation of express delivery requires robust government and media publicity efforts to capture consumers' attention (Si et al., 2020a). Regular environmental publicity activities can take place in consumers' living environments, such as workplaces, schools, and communities. Public service announcements can be produced to provide consumers with additional sources and channels for obtaining relevant knowledge and information, fostering a favorable atmosphere for publicity. Schools can leverage campus radio stations, and new media platforms, establish community organizations, and create specialized recycling publicity platforms. Publicity and education efforts should involve various stakeholders, including the government, schools, communities, individuals, parents, and other relevant parties. The content of publicity should be diversified, encompassing not only positive aspects but also highlighting incorrect recycling behavior to raise awareness among residents (Ouyang et al., 2020). Government and media publicity efforts can enhance consumers' knowledge and understanding of express package recycling, improve their personal literacy, and guide them toward more reasonable and standardized behaviors.

### 5.3 Degree of convenience, behavioral intention, and actual behavior

The degree of convenience significantly influences behavioral intention, with a coefficient of 0.895. Among all the influencing factors, the degree of convenience has the highest coefficient and the most significant impact. Regarding the mediating effect, the coefficient of the degree of convenience on actual behavior through behavioral intention is 0.888, making it the most influential factor among the four mediating paths.

In line with current research, this study suggests that convenience enhances consumers' experience and engagement, improves satisfaction, and reduces the likelihood of wasting time and energy (Chang & Polonsky, 2012; Duarte et al., 2018; Jih, 2007). Additionally, the availability of recycling channels and facilities also influences consumers' perception of convenience. A recycling and reuse system can be established in schools, communities, and other places while enhancing operational guidance. Door-to-door collection can also be adapted to enhance convenience and further increase consumers' behavioral intentions (Sheth, 2020). Both the government and companies should make it as convenient as possible for consumers to complete deliveries at nearby locations, ensuring proximity and convenience to maintain consumer loyalty toward a specific behavior (Pham et al., 2018). Unlike previous studies that emphasized the influential role of factors such as environmental consciousness (Ding et al., 2023; Shen et al., 2023), moral norms (Botetzagias et al., 2015; Jia et al., 2023), and legal regulations (Thi Thu Nguyen et al., 2019), our study identifies convenience as the key mediating factor driving consumers toward actual recycling behaviors, corroborating findings from related research on waste recycling and clean energy usage (Jebarajakirthy & Shankar, 2021; Lingyan Li et al., 2022; Pakravan & MacCarty, 2020; Wang et al., 2019).

### 5.4 Recycling habit, behavioral intention, and actual behavior

Recycling habit has a positive and significant impact on behavioral intention, with a coefficient of 0.854. Regarding the mediating effect, the recycling habit has a positive influence on actual behavior through behavioral intention, with a coefficient of 0.803. This study, consistent with current research, suggests that habit change is the foundation for behavior

change, as repeated actions can lead to habit formation. Habits are stable and repetitive behaviors that can be used to predict future actions (Danner et al., 2008; Sarmento & Loureiro, 2021). Developing a recycling habit is crucial for ensuring long-term consumer participation in packaging recycling. A good recycling habit is the outcome of comprehensive efforts and is influenced by various factors. Developing good habits will make people more conscious and proactive in their recycling efforts. Measures such as a points system can be adopted to encourage the development of this habit among consumers. Government departments can offer relevant courses to students to foster positive recycling habits (Hamilton et al., 2020). Education received during their youth can contribute to cultivating a positive habit of recycling. Moreover, raising students' crisis awareness can help them understand the severe environmental harm caused by negative habits (Chen et al., 2021). Promoting green environmental concepts and guiding consumers toward habit change can optimize the recycling system and drive consumer behavior modification. Furthermore, strengthening laws and regulations can also drive changes in consumer behavior habits (Aboelmaged, 2021; Popa et al., 2019).

## 6 Conclusions

### 6.1 Conclusions and suggestions

Low-carbon, green, and digital economies are the prevailing concepts in modern social development. The research and innovative methods presented in this study can foster the advancement of digital and green economies, contributing to the realization of green economy development. This research serves as a practical reference for the seamless integration of digital and green economy. Using the extended theory of planned behavior and conducting questionnaire analysis, this study performed empirical research. The model demonstrates a high degree of fit, further validating its rigor and scientific validity. It offers valuable insights into the factors influencing consumer behavior intention in the realm of express packaging. Consequently, this study explores the following findings:

Firstly, the empirical based on the TPB results reveal that six latent variables, namely attitude, subjective norm, PBC, policy and publicity, convenience, and recycling habits, have a direct or indirect positive impact on consumers' intentions and actual behaviors. It is noteworthy that the impacts of attitude, subjective norm, and PBC on recycling intentions align with previous studies (Mohamad et al., 2022; Song et al., 2023; Wang et al., 2021a). It contributes to the verification of the actual effectiveness of green policies for express packaging and provides a reference value for the development of the Chinese digital economy and environmental problem-solving in emerging countries.

Secondly, policy and publicity, along with convenience, positively impact recycling behaviors. This research effectively bridges a gap in the study of policy and publicity, convenience, and recycling habits in the context of express packaging recycling (Cai et al., 2021; Hua & Dong, 2022; Song et al., 2023). This is also one of the most important innovations in this paper, filling the gaps in previous research and expanding into new areas of study. This study predicts consumers' behavior in the recycling and reuse of packaging materials from multiple internal and external perspectives and examines the mechanisms through which these perspectives influence consumers.

Thirdly, this study unveils the paramount role of convenience in shaping consumers' behavioral intentions, highlighting its significance as the primary consideration for

consumers. Customers' willingness to recycle and reuse express packaging is most strongly influenced by the degree of convenience, and it is a factor that consumers often consider. Consumers often prioritize the proximity of recycling locations and the ease of participation. Convenience can act as a behavioral catalyst, motivating individuals to participate in recycling activities. When the recycling process is simple, accessible, and minimally effortful, people are more likely to engage in it. In the context of express packaging recycling, providing easily accessible recycling bins or drop-off points in convenient locations can significantly enhance participation rates. Convenience, in this context, encompasses not just proximity but also operational aspects (Duarte et al., 2018; Pham et al., 2018). These novel insights constitute a significant contribution, to addressing gaps in the field of express packaging recycling (Li et al., 2023; Zhan et al., 2023).

Lastly, the recycling of express packaging necessitates comprehensive efforts and is influenced by various factors. It is not solely reliant on consumers to execute the entire recycling and reusing process independently. Multiple parties need to be involved (Lu et al., 2020; Sun & Li, 2021). As discussed in this paper, policy, and publicity are primarily the responsibilities of the government and media (Yang et al., 2022), whereas recycling habits are formed at an individual level (Huang et al., 2020). The government must create a favorable environment for society (Sun & Li, 2021). Therefore, this study offers inspiration and suggestions from various perspectives. The government bears the responsibility for fostering a positive social atmosphere, while enterprises should continuously enhance their green packaging measures for express delivery and improve consumer services. Consumers need to cultivate positive habits and increase their awareness of environmental protection. Establishing a recyclable system for express packaging is pivotal component of circular economic development, furthering ecological construction and aligning with green strategies. The vigorous development of express packaging recycling is not only just a present necessity but an imperative measure for the future.

### 6.2 Limitations and future research

It is important to acknowledge certain limitations that should be addressed in future research. In this study, the questionnaire was collected from various provinces in China without providing a detailed breakdown of the number of questionnaires collected from each province. Furthermore, this model only incorporates the factors of policy and publicity, degree of convenience, and recycling habits. Additionally, this study has limitations related to conducting online surveys, such as the absence of real-time interaction, the inability to observe non-verbal cues, and concerns about credibility and truthfulness.

There are several implications for future research in this area. From the theoretical perspective, future research could prioritize the refinement and expansion of other behavioral models to more comprehensively capture the intricacies of consumer decision-making within the realm of express packaging recycling. This endeavor may entail incorporating additional psychological and sociocultural factors that wield influence over recycling behavior. Subsequent analyses could delve into exploring the varied influencing factors affecting consumer express packaging recycling behavior across different regions, thereby accounting for regional disparities.

From the practical perspective, future research can adopt a combined approach that integrates online and offline methods, addressing these limitations in survey design and analysis to ensure the accuracy and reliability of results. It is worthwhile to study the policy impact assessment of promoting express packaging recycling. Researchers can also explore

the effectiveness of behavioral interventions, such as nudges and incentives, in encouraging consumers to adopt sustainable recycling practices. Gaining a deeper understanding of the psychology behind these interventions and their long-term impact is crucial for designing effective strategies.

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**Availability of data and materials** Data are available on request from the authors.

## Declarations

**Competing interests** The authors declare no conflict of interest.

## References

Abbott, A., Nandeibam, S., & O'Shea, L. (2011). Explaining the variation in household recycling rates across the UK. *Ecological Economics, 70*(11), 2214–2223.

Aboelmaged, M. (2021). E-waste recycling behaviour: An integration of recycling habits into the theory of planned behaviour. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2020.124182

Ahmed, N., Li, C., Khan, A., Qalati, S. A., Naz, S., & Rana, F. (2021). Purchase intention toward organic food among young consumers using theory of planned behavior: Role of environmental concerns and environmental awareness. *Journal of Environmental Planning and Management, 64*(5), 796–822. https://doi.org/10.1080/09640568.2020.1785404

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Al-Debei, M. M., Akroush, M. N., & Ashouri, M. I. (2015). Consumer attitudes towards online shopping: The effects of trust, perceived benefits, and perceived web quality. *Internet Research, 25*(5), 707–733.

Al-Swidi, A., Mohammed-Rafiul-Huque, S., Haroon Hafeez, M., & Noor Mohd Shariff, M. (2014). The role of subjective norms in theory of planned behavior in the context of organic food consumption. *British Food Journal, 116*(10), 1561–1580.

Bagheri, A., Bondori, A., Allahyari, M. S., & Damalas, C. A. (2019). Modeling farmers' intention to use pesticides: An expanded version of the theory of planned behavior. *Journal of Environmental Management, 248*, 109291.

Bertram, D. (2007). Likert scales. *Retrieved November, 2*(10), 1–10. doi:https://doi.org/10.1016/j.resconrec.2021.10449

Botetzagias, I., Dima, A.-F., & Malesios, C. (2015). Extending the theory of planned behavior in the context of recycling: The role of moral norms and of demographic predictors. *Resources, Conservation Recycling, 95*, 58–67.

Cai, K., Xie, Y., Song, Q., Sheng, N., & Wen, Z. (2021). Identifying the status and differences between urban and rural residents' behaviors and attitudes toward express packaging waste management in Guangdong Province, China. *Science of the Total Environment, 797*, 148996. https://doi.org/10.1016/j.scitotenv.2021.148996

Cao, X., & Liu, C. (2019). *Research on customers' willingness to participate in express package recycling.* Paper presented at the IOP Conference Series: Earth and Environmental Science.

Carden, L., & Wood, W. (2018). Habit formation and change. *Current Opinion in Behavioral Sciences, 20*, 117–122.

Chang, Y.-W., & Polonsky, M. J. (2012). The influence of multiple types of service convenience on behavioral intentions: The mediating role of consumer satisfaction in a Taiwanese leisure setting. *International Journal of Hospitality Management, 31*(1), 107–118. https://doi.org/10.1016/j.ijhm.2011.05.003

Chen, F., Chen, H., Yang, J., Long, R., & Li, W. (2019). Impact of regulatory focus on express packaging waste recycling behavior: Moderating role of psychological empowerment perception. *Environmental Science Pollution Research, 26*(9), 8862–8874. https://doi.org/10.1007/s11356-019-04416-7

Chen, F., Lou, J., Hu, J., Chen, H., Long, R., & Li, W. (2021). Study on the relationship between crisis awareness and medical waste separation behavior shown by residents during the COVID-19 epidemic. *Science of the Total Environment, 787*, 147522.

Chi, X., Wang, M. Y. L., & Reuter, M. A. (2014). E-waste collection channels and household recycling behaviors in Taizhou of China. *Journal of Cleaner Production, 80*, 87–95. https://doi.org/10.1016/j.jclepro.2014.05.056

China, S. P. B. o. t. P. s. R. o. (2016). *Report on the Current Status and Trends of Green Packaging Development in China's Express Delivery Industry*. Retrieved from https://cnki.com.cn/Article/CJFDTotal-ZBZZ201601007.htm

China, S. P. B. o. t. P. s. R. o. (2022). *Chinese statistic bulletin of post business in 2022*. Retrieved from https://www.mot.gov.cn/tongjishuju/youzheng/202301/t20230130_3747917.html

Cudjoe, D., & Wang, H. (2022). Plasma gasification versus incineration of plastic waste: Energy, economic and environmental analysis. *Fuel Processing Technology, 237*, 107470.

Danner, U. N., Aarts, H., & de Vries, N. K. (2008). Habit vs intention in the prediction of future behaviour: The role of frequency, context stability and mental accessibility of past behaviour. *British Journal of Social Psychology, 47*(2), 245–265. https://doi.org/10.1348/014466607X230876

Di, H. J. (2022). A new integrated management mode of enterprise green logistics under the constraints of resources and environment. *Environmental Engineering, 40*(1), 266–267. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7iJTKGjg9uTdeTsOI_ra5_XfBxbcN3RHoxDb1a-ejXQRY1HgTT5KpxDLohg7ZHW27_&uniplatform=NZKPT

Ding, L., Guo, Z., & Xue, Y. (2023). Dump or recycle? Consumer's environmental awareness and express package disposal based on an evolutionary game model. *Environment, Development Sustainability, 25*(7), 6963–6986. https://doi.org/10.1007/s10668-022-02343-1

Ding, Z., Sun, J., Wang, Y., Jiang, X., Liu, R., & Sun, W. (2021). Research on the influence of anthropomorphic design on the consumers' express packaging recycling willingness: The moderating effect of psychological ownership. *Resources, Conservation Recycling, 168*, 105269.

Dong, F., & Hua, Y. (2018). Are Chinese residents willing to recycle express packaging waste? Evidence from a Bayesian regularized neural network model. *Sustainability, 10*(11), 4152.

Duarte, P., Silva, S. C., & Ferreira, M. B. (2018). How convenient is it? Delivering online shopping convenience to enhance customer satisfaction and encourage e-WOM. *Journal of Retailing Consumer Services, 44*, 161–169.

Fan, M., Khalique, A., Qalati, S. A., Gillal, F. G., & Gillal, R. G. (2022). Antecedents of sustainable e-waste disposal behavior: The moderating role of gender. *Environmental Science and Pollution Research, 29*(14), 20878–20891. https://doi.org/10.1007/s11356-021-17275-y

Francis, J. J., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy, R., et al. (2004). Constructing questionnaires based on the theory of planned behaviour. *A manual for health services researchers, 2010*, pp. 2–12.

Guo, Y., Luo, G., & Hou, G. (2021). Research on the evolution of the express packaging recycling strategy, considering government subsidies and synergy benefits. *International Journal of Environmental Research Public Health, 18*(3), 1144. https://doi.org/10.3390/ijerph18031144

Hair, J. F. (2009). Multivariate data analysis,7th Edn. Pearson Education, New Delhi.

Hamilton, K., van Dongen, A., & Hagger, M. S. (2020). An extended theory of planned behavior for parent-for-child health behaviors: A meta-analysis. *Health Psychology, 39*(10), 863. https://doi.org/10.1037/hea0000940

Han, H. (2015). Travelers' pro-environmental behavior in a green lodging context: Converging value-belief-norm theory and the theory of planned behavior. *Tourism Management, 47*, 164–177. https://doi.org/10.1016/j.tourman.2014.09.014

Hu, C., Liu, X., & Lu, J. (2017). A bi-objective two-stage robust location model for waste-to-energy facilities under uncertainty. *Decision Support Systems, 99*, 37–50. https://doi.org/10.1016/j.dss.2017.05.009

Hua, Y., & Dong, F. (2022). Can environmental responsibility bridge the intention-behavior gap? Conditional process model based on valence theory and the theory of planned behavior. *Journal of Cleaner Production, 376*, 134166.

Hua, Y., Dong, F., & Goodman, J. (2021). How to leverage the role of social capital in pro-environmental behavior: A case study of residents' express waste recycling behavior in China. *Journal of Cleaner Production, 280*, 124376. https://doi.org/10.1016/j.jclepro.2020.124376

Huang, J., Antonides, G., & Nie, F. (2020). Social-Psychological factors in food consumption of rural residents: The role of perceived need and habit within the theory of planned behavior. *Nutrients, 12*(4), 1203.

Ishimura, Y. (2022). The effects of the containers and packaging recycling law on the domestic recycling of plastic waste: Evidence from Japan. *Ecological Economics, 201*, 107535.

Jebarajakirthy, C., & Shankar, A. (2021). Impact of online convenience on mobile banking adoption intention: A moderated mediation approach. *Journal of Retailing Consumer Services, 58*, 102323.

Jia, Q., Islam, M. S., Hossain, M. S., Li, F., & Wang, Y. (2023). Understanding residents' behaviour intention of recycling plastic waste in a densely populated megacity of emerging economy. *Heliyon, 9*(8).

Jia, Y., & Zhang, X. (2022). Influence of environmental cognition and perceived benefits on the deviation between consumers'willingness and behavior to participate in the classified recovery of express packaging. *Resources Science, 44*(10), 2060–2073.

Jiang, L., Zhang, J., Wang, H. H., Zhang, L., & He, K. (2018). The impact of psychological factors on farmers' intentions to reuse agricultural biomass waste for carbon emission abatement. *Journal of Cleaner Production, 189*, 797–804. https://doi.org/10.1016/j.jclepro.2018.04.040

Jih, W.-J. (2007). Effects of consumer-perceived convenience on shopping intention in mobile commerce. *International Journal of E-Business Research, 3*(4), 33–48. https://doi.org/10.4018/jebr.2007100102

Kautish, P., Paul, J., & Sharma, R. (2019). The moderating influence of environmental consciousness and recycling intentions on green purchase behavior. *Journal of Cleaner Production, 228*, 1425–1436. https://doi.org/10.1016/j.jclepro.2019.04.389

Kautish, P., Sharma, R., Mangla, S. K., Jabeen, F., & Awan, U. (2021). Understanding choice behavior towards plastic consumption: An emerging market investigation. *Resources, Conservation Recycling, 174*, 105828.

Khan, F., Ahmed, W., & Najmi, A. (2019). Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country. *Resources, Conservation and Recycling, 142*, 49–58. https://doi.org/10.1016/j.resconrec.2018.11.020

Khan, F., Eker, O. F., Khan, A., & Orfali, W. (2018). Adaptive degradation prognostic reasoning by particle filter with a neural network degradation model for turbofan jet engine. *Data, 3*(4), 49.

Knussen, C., Yule, F., MacKenzie, J., & Wells, M. (2004). An analysis of intentions to recycle household waste: The roles of past behaviour, perceived habit, and perceived lack of facilities. *Journal of Environmental Psychology, 24*(2), 237–246. https://doi.org/10.1016/j.jenvp.2003.12.001

Kumar, A. (2019). Exploring young adults' e-waste recycling behaviour using an extended theory of planned behaviour model: A cross-cultural study. *Resources, Conservation and Recycling, 141*, 378–389. https://doi.org/10.1016/j.resconrec.2018.10.013

Li, L., Fan, F., & Liu, X. (2022). Determinants of rural household clean energy adoption intention: Evidence from 72 typical villages in ecologically fragile regions of western China. *Journal of Cleaner Production, 347*, 131296.

Li, L., Long, X., Laubayeva, A., Cai, X., & Zhu, B. (2020). Behavioral intention of environmentally friendly agricultural food: The role of policy, perceived value, subjective norm. *Environmental Science and Pollution Research, 27*(15), 18949–18961. https://doi.org/10.1007/s11356-020-08261-x

Li, P., Ru, Y., & Wu, J. (2023). Influential factors affecting recycling behavior toward cardboard boxes in the logistics sector: An empirical analysis from China. *Sustainability, 15*(18), 13343.

Li, W., Zhao, S., Ma, J., & Qin, W. (2021). Investigating regional and generational heterogeneity in low-carbon travel behavior intention based on a PLS-SEM approach. *Sustainability, 13*(6), 3492. https://doi.org/10.3390/su13063492

Lu, S., Yang, L., Liu, W., & Jia, L. (2020). User preference for electronic commerce overpackaging solutions: Implications for cleaner production. *Journal of Cleaner Production, 258*, 120936.

Mohamad, N. S., Thoo, A. C., & Huam, H. T. (2022). The determinants of consumers & rsquo, E-waste recycling behavior through the lens of extended theory of planned behavior. *Sustainability, 14*(15), 9031.

Mollica, G. J. G., & Balestieri, J. A. P. (2020). Is it worth generating energy with garbage? Defining a carbon tax to encourage waste-to-energy cycles. *Applied Thermal Engineering, 173*, 115195.

Muller, N. Z., Matthews, P. H., & Wiltshire-Gordon, V. (2018). The distribution of income is worse than you think: Including pollution impacts into measures of income inequality. *PLoS ONE, 13*(3), e0192461.

Nnorom, I. C., Ohakwe, J., & Osibanjo, O. (2009). Survey of willingness of residents to participate in electronic waste recycling in Nigeria: A case study of mobile phone recycling. *Journal of Cleaner Production, 17*(18), 1629–1637. https://doi.org/10.1016/j.jclepro.2009.08.009

Ouyang, Z., Zhang, Y., & Hu, X. (2020). Negative publicity and potential applicants' intention to apply amid a discrimination scandal: A moderated mediation model. *Personnel Review, 50*(1), 129–142. https://doi.org/10.1108/pr-09-2019-0510

Oztekin, C., Teksoz, G., Pamuk, S., Sahin, E., & Kilic, D. S. (2017). Gender perspective on the factors predicting recycling behavior: Implications from the theory of planned behavior. *Waste Management, 62*, 290–302. https://doi.org/10.1016/j.wasman.2016.12.036

Pakravan, M. H., & MacCarty, N. (2020). What motivates behavior change? Analyzing user intentions to adopt clean technologies in low-resource settings using the theory of planned behavior. *Energies, 13*(11), 3021.

Park, J., & Ha, S. (2014). Understanding consumer recycling behavior: Combining the theory of planned behavior and the norm activation model. *Family Consumer Sciences Research Journal, 42*(3), 278–291. https://doi.org/10.1111/fcsr.12061

Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of Retailing and Consumer Services, 29*, 123–134. https://doi.org/10.1016/j.jretconser.2015.11.006

Pham, Q. T., Tran, X. P., Misra, S., Maskeliūnas, R., & Damaševičius, R. (2018). Relationship between convenience, perceived value, and repurchase intention in online shopping in Vietnam. *Sustainability, 10*(1), 156.

Popa, B., Niță, M. D., & Hălălișan, A. F. (2019). Intentions to engage in forest law enforcement in Romania: An application of the theory of planned behavior. *Forest Policy Economics, 100*, 33–43.

Qalati, S. A., Barbosa, B., & Ibrahim, B. (2023a). Factors influencing employees' eco-friendly innovation capabilities and behavior: The role of green culture and employees' motivations. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-023-03982-8

Qalati, S. A., Kumari, S., Tajeddini, K., Bajaj, N. K., & Ali, R. (2023b). Innocent devils: The varying impacts of trade, renewable energy and financial development on environmental damage: Nonlinearly exploring the disparity between developed and developing nations. *Journal of Cleaner Production, 386*, 135729. https://doi.org/10.1016/j.jclepro.2022.135729

Qalati, S. A., Qureshi, N. A., Ostic, D., & Sulaiman, M. A. B. A. (2022). An extension of the theory of planned behavior to understand factors influencing Pakistani households' energy-saving intentions and behavior: A mediated–moderated model. *Energy Efficiency, 15*(6), 40. https://doi.org/10.1007/s12053-022-10050-z

Record, R. A. (2017). Tobacco-free policy compliance behaviors among college students: A theory of planned behavior perspective. *Journal of Health Communication, 22*(7), 562–567.

Ru, X., Qin, H., & Wang, S. (2019). Young people's behaviour intentions towards reducing PM2.5 in China: Extending the theory of planned behaviour. *Resources, Conservation and Recycling, 141*, 99–108. https://doi.org/10.1016/j.resconrec.2018.10.019

Russell, S. V., Young, C. W., Unsworth, K. L., & Robinson, C. (2017). Bringing habits and emotions into food waste behaviour. *Resources, Conservation and Recycling, 125*, 107–114. https://doi.org/10.1016/j.resconrec.2017.06.007

Sarmento, E. M., & Loureiro, S. M. C. (2021). Exploring the role of norms and habit in explaining pro-environmental behavior intentions in situations of use robots and AI agents as providers in tourism sector. *Sustainability, 13*(24), 13928. https://doi.org/10.3390/su132413928

Shen, F., Li, J., Chen, J., & Wang, W. (2023). Exploring young consumers' intention to pay for shared express packaging: A multi-study analysis. *Journal of Business Research, 167*, 114153.

Sheth, J. (2020). Impact of Covid-19 on consumer behavior: Will the old habits return or die? *Journal of Business Research, 117*, 280–283.

Shi, H., Fan, J., & Zhao, D. (2017). Predicting household PM2.5-reduction behavior in Chinese urban areas: An integrative model of Theory of Planned Behavior and Norm Activation Theory. *Journal of Cleaner Production, 145*, 64–73. https://doi.org/10.1016/j.jclepro.2016.12.169

Shirokova, G., Osiyevskyy, O., & Bogatyreva, K. (2016). Exploring the intention–behavior link in student entrepreneurship: Moderating effects of individual and environmental characteristics. *European Management Journal, 34*(4), 386–399. https://doi.org/10.1016/j.emj.2015.12.007

Si, H., Shi, J.-G., Tang, D., Wu, G., & Lan, J. (2020a). Understanding intention and behavior toward sustainable usage of bike sharing by extending the theory of planned behavior. *Resources, Conservation Recycling, 152*, 104513.

Si, H., Shi, J.-G., Tang, D., Wu, G., & Lan, J. (2020b). Understanding intention and behavior toward sustainable usage of bike sharing by extending the theory of planned behavior. *Resources, Conservation and Recycling, 152*, 104513. https://doi.org/10.1016/j.resconrec.2019.104513

Song, J., Cai, L., Yuen, K. F., & Wang, X. (2023). Exploring consumers' usage intention of reusable express packaging: An extended norm activation model. *Journal of Retailing Consumer Services, 72*, 103265.

Soorani, F., & Ahmadvand, M. (2019). Determinants of consumers' food management behavior: Applying and extending the theory of planned behavior. *Waste Management, 98*, 151–159.

Sun, H., & Li, J. (2021). Behavioural choice of governments, enterprises and consumers on recyclable green logistics packaging. *Sustainable Production Consumption, 28*, 459–471.

Taylor, S., & Todd, P. (1995). An integrated model of waste management behavior: A test of household recycling and composting intentions. *Environment and Behavior, 27*(5), 603–630. https://doi.org/10.1177/0013916595275001

Thach, A. V., Brown, C. M., & Pope, N. (2013). Consumer perceptions about a community pharmacy-based medication take back program. *Journal of Environmental Management, 127*, 23–27. https://doi.org/10.1016/j.jenvman.2013.04.025

Thi-Thu-Nguyen, H., Hung, R.-J., Lee, C.-H., & Thi-Thu-Nguyen, H. (2019). Determinants of residents' e-waste recycling behavioral intention: A case study from Vietnam. *Sustainability, 11*(1), 164.

Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: A case study from Brixworth, UK. *Resources, Conservation and Recycling, 41*(3), 191–214. https://doi.org/10.1016/j.resconrec.2003.11.001

Uzun, A. M., & Kilis, S. (2020). Investigating antecedents of plagiarism using extended theory of planned behavior. *Educational Technology Research and Development, 144*, 103700.

Vamvaka, V., Stoforos, C., Palaskas, T., & Botsaris, C. (2020). Attitude toward entrepreneurship, perceived behavioral control, and entrepreneurial intention: Dimensionality, structural relationships, and gender differences. *Journal of Innovation Entrepreneurship, 9*(1), 1–26.

Wan, C., Zhang, X., Cheung, R., & Qiping Shen, G. (2012). Recycling attitude and behaviour in university campus: A case study in Hong Kong. *Facilities, 30*(13/14), 630–646. https://doi.org/10.1108/02632771211270595

Wang, Q., Zhang, W., Tseng, C.P.M.-L., Sun, Y., & Zhang, Y. (2021a). Intention in use recyclable express packaging in consumers' behavior: An empirical study. *Resources, Conservation and Recycling.* https://doi.org/10.1016/j.resconrec.2020.105115

Wang, Q., Zhang, W., Tseng, C.P.M.-L., Sun, Y., & Zhang, Y. (2021b). Intention in use recyclable express packaging in consumers' behavior: An empirical study. *Resources, Conservation and Recycling, 164*, 105115. https://doi.org/10.1016/j.resconrec.2020.105115

Wang, S., Wang, J., Zhao, S., & Yang, S. (2019). Information publicity and resident's waste separation behavior: An empirical study based on the norm activation model. *Waste Management, 87*, 33–42. https://doi.org/10.1016/j.wasman.2019.01.038

Wang, Z., Guo, D., Wang, X., Zhang, B., & Wang, B. (2018). How does information publicity influence residents' behaviour intentions around e-waste recycling? *Resources, Conservation and Recycling, 133*, 1–9. https://doi.org/10.1016/j.resconrec.2018.01.014

Wood, W., Labrecque, J., Lin, P., & Runger, D. (2014). Habits in dual process models. In *Dual process theories of the social mind* (pp. 371–385).

Xiao, L., Fan, R., Wang, C., & Wang, J. (2020). Policy analyses on promoting the recycling of express packages. *Sustainability, 12*(22), 9504.

Xing, C. (2019). *Study on Consumer Behavior Intention in Express Packaging Recycling*. (Master). Xidian University,

Yang, J., Long, R., & Chen, H. (2022). Decision-making dynamic evolution among groups regarding express packaging waste recycling under different reference dependence and information policy. *Waste Management, 138*, 262–273.

Yang, J., Long, R., Chen, H., & Sun, Q. (2021a). A comparative analysis of express packaging waste recycling models based on the differential game theory. *Resources, Conservation and Recycling, 168*, 105449. https://doi.org/10.1016/j.resconrec.2021.105449

Yang, Z., Lü, F., Zhang, H., Wang, W., Shao, L., Ye, J., & He, P. (2021b). Is incineration the terminator of plastics and microplastics? *Journal of Hazardous Materials, 401*, 123429.

Yue, P., Wu, Y., Zhang, Y., Chen, Y., Li, J., Xu, Y., & Liu, Y. (2021). Contemplation-action-maintenance model of behaviour change for persons with coronary heart disease: A qualitative study. *Journal of Clinical Nursing, 30*(9–10), 1464–1478. https://doi.org/10.1111/jocn.15699

Zhan, Y., Sun, Y., & Xu, J. (2023). A study on the recycling classification behavior of express packaging based on UTAUT under "Dual Carbon" targets. *Sustainability, 15*(15), 11622.

Zhang, L., Hu, Q., Zhang, S., & Zhang, W. (2020). Understanding Chinese residents' waste classification from a perspective of intention–behavior gap. *Sustainability, 12*(10), 4135. https://doi.org/10.3390/su12104135