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# Modeling the reuse intention and practices of secondhand clothing: evidence from a developing nation

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This study explored the effect of perceived values on sustainability, problem awareness, the ascription of responsibility, sense of community, and anticipated guilt on reuse (sell and/or swap) intention of secondhand clothing through partial least squares structural equation modeling. This study adopted a cross-sectional design and collected quantitative data from 524 conveniently selected respondents in China through an online survey. The findings revealed that perceived values on sustainability, ascription of responsibility, sense of community, and anticipated guilt are the most important factors influencing reuse intention, whereas problem awareness is not a significant predictor. It has also been demonstrated that reuse intention promotes the development of reuse practices. Despite its large population, China is facing significant environmental challenges. The findings of this study may provide a viable option for the sustainable development of reusing secondhand clothing and also contribute to new knowledge on the factors that influence the reuse practices of secondhand clothing in China and even around the world.

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## Introduction

With the frequent occurrence of extreme weather events caused by global climate issues in recent years, society, academia, and governments have become concerned about the environmental impacts on production and consumption. This model has been considered not sustainable owing to the resulting environmental and social effects (Ostermann et al., 2021). Therefore, sustainable development, low carbon economy, and circular economy have become hot topics in both social and academic fields. With the continuous enrichment of the global commodity market, the acceleration in the update and iteration of various products, and the continuous deepening of the idea of environmentally friendly secondhand consumption, the global e-commerce market for secondhand items is developing rapidly. In 2019, the scale of the global secondhand goods e-commerce transaction market reached \$822.8 billion; in 2020, the global secondhand goods e-commerce transaction market scale increased to \$895.6 billion (Institute of Energy, Environment, and Economy, 2021). In China, with the concept of green, low-carbon consumption and the circular economy gaining popularity, people's recognition of secondhand consumption has further increased, while industrial policies encouraging the development of a circular economy continue to yield dividends. According to China's e-commerce database, China's secondhand e-commerce transactions reached \$56.2 billion in 2021, and it is expected to reach a market size of nearly \$420 billion by 2025 (Economic and Social Network E-Commerce Research Center, 2021). With the continuous development of the global commodity market, the acceleration in the update and iteration of various products, and the continuous deepening of the idea of environmentally friendly secondhand consumption, the global e-commerce market for secondhand items is developing rapidly.

The secondhand goods industry refers to traders or sharers who buy, sell, rent, and exchange their goods—that they no longer need—in the secondhand market to improve the utilization rate of goods and extend the use value of secondhand goods in their limited use cycle (Wang et al., 2022). Currently, China's recycling of used clothing is still in its infancy, and the recycling rate of waste clothing is far lower than the comprehensive utilization rate of textiles. Until now, used clothes have mainly been recycled by various secondhand clothing recycling companies, and recycling bins have been set up in many cities by recycling companies. However, most recycling bins have a low utilization rate and are facing many problems, and people have doubts about whether this approach really reduces the burden on the environment. In the past few years, online secondhand clothing trading platforms have been developed, and the recycling rate of secondhand clothing has increased; nevertheless, it is still lagging compared to the total amount of used clothing. According to a survey of Chinese consumers, more than half of the users who have no experience in trading idle items will consider trading secondhand items online or offline in the following year (Lang and Zhang, 2019). Simultaneously, the convenience and richness offered by the Internet make online transactions the first choice of users, and 44.2% of users will consider conducting secondhand transactions through online channels. From the perspective of the sub-categories of secondhand market transactions, the secondhand items that users tend to consume mainly include large-scale commodities (household appliances, two-wheeled vehicles), 3C electronic products, clothing, and books. Among the above-mentioned goods, energy consumption by the clothing industry accounts for 40.6%, followed by bulky goods at 52.6% (Institute of Energy, Environment, and Economy, 2021).

In terms of resources and the environment, the textile and garment industry has overtaken the oil industry as the world's second-most polluting industry, and the Chinese textile-printing

and dyeing industry has also become a closely monitored industry owing to its high energy and water consumption, and the resulting pollution. Simultaneously, China's clothing and other products have ranked first in the world in terms of volume, and they have been exported in large quantities, implying that China has incurred significant environmental and resource costs because of textile production and manufacturing. From the cultivation of raw materials to textile production and printing and dyeing, the production process of clothing results in large amounts of carbon emissions consumes a lot of water and produces a large amount of sewage, thus pressurizing the ecological carrying capacity (Wang et al., 2022). According to a survey, approximately 26 million tons of used clothes are discarded in China every year, of which less than 1% is reused; this leads to a waste of resources (Zhai et al., 2021). If used clothes are recycled to the greatest extent possible, their life cycle can be extended, and resource waste and environmental pollution can be greatly reduced.

In the last century, second-hand clothing occupied a significant portion of the market due to reasons such as economic scarcity. However, it gradually declined with the development of the economy. Currently, due to environmental issues caused by resource waste, second-hand clothing enters the public eye again, even though the products are now more affordable than before. This shift has attracted extensive research from scholars (Lang and Zhang, 2019; Silva et al., 2021; Koay et al., 2022). Kim et al. (2021) investigated the factors influencing the attitudes and willingness of American consumers toward second-hand clothing, focusing on the theme of the circular economy. However, Empirical research on factors affecting reuse intention (RUI) and secondhand clothing practices has received lesser attention in developing contexts such as China. Most studies on the reuse of secondhand clothing have been undertaken in developed European and Asian countries (Kim et al., 2020; Kim et al., 2021). Moreover, most research has only focused on buying or using secondhand clothing rather than selling or swapping used clothing (Abbes et al., 2020). Besides, earlier studies relied heavily on the theory of planned behavior (TPB) to explain secondhand clothing consumption intention or behavior (Khan et al., 2019; Zhang et al., 2020; Ostermann et al., 2021). The TPB proposed by Ajzen (1991) contends that intention is a predictor of behavior, and it is further influenced by attitude, perceived behavioral control, and subjective norm, which does not consider the connection between emotions and specific conduct. Many behaviors are increasingly thought to be influenced by affective processes (Nguyen et al., 2022). For instance, positive or negative emotions have been identified as important influencing factors in behavior within certain pro-environmental contexts (Kim et al., 2021; Wang et al., 2022; Attiq et al., 2021a). The study by Wang et al. (2022) indicates that some consumers are not influenced by low prices but are attracted to the pleasurable emotions associated with the shopping process, leading them to engage in second-hand clothing consumption. Thus, the theory of interpersonal behavior (TIB) provides ideas and theoretical support for this study, which emphasizes on emotional factors. However, it should be noted that while some studies use TIB as the foundation for studying consumers' pro-environmental behavior, for example, Nguyen et al. (2022) used TIB to investigate the intention to use their own shopping bags instead of plastic bags. Therefore, thorough discussion is required to make this model more suitable and comprehensive for the study of consumer behavior in the context of environmental protection.

This study aimed to evaluate the intention to reuse secondhand clothing by modifying TIB and combining the environmental factors into the model, which could enhance the explanation of TIB and extend the existing studies. Five factors—perceived

values on sustainability (PVS), problem awareness (PRA), the ascription of responsibility (ASR), sense of community (SOC), and anticipated guilt (ATG)—were proposed as the modified factors within the TIB model; were considered the important factors that predict the intention to sell or swap secondhand clothing and determine its further effect on reuse practices in a country with a developing economy, such as China. It also has several implications for both government agencies and individuals in promoting Chinese consumers' intentions and behaviors toward reusing secondhand clothing. The remainder of this paper is structured as follows: The Section "Literature review" provides the theoretical context and hypotheses, the methodology is explained in the Section "Research methodology", Section "Result" discusses the analysis and results, and Section "Discussion" discusses the results and concludes the study.

## Literature review

**Theoretical foundation.** Triandis (1977b) investigated TIB as a theoretical alternative to TPB. TPB contends that intention is a predictor of conduct and that attitude, perceived behavioral control, and subjective norms, all have impacts on it (Ajzen, 1991). TPB is a static model that explains behavior through purpose, is based on self-interest motives, and is incapable of explaining the emotional aspects of consumer behavior (Attiq et al., 2021a). However, Triandis (1977b) noted the important role of both social factors and emotions, which are considered more comprehensive in the process of generating intentions. TIB holds that individual intention can be affected by three aspects: cognitive/attitude, social factors, and affect. The cognitive/attitude aspect is usually divided into outcome evaluation, which refers to assessments of the value of the effects, and outcome of belief, which refers to the belief about the consequences of the behavior (Dang Vu and Nielsen, 2022). Social factors include roles, norms, and self-concepts. Roles are a series of behaviors that are considered appropriate for specific individuals within a group. Norms are the expectation or duty of others regarding what to do or not do, while self-concept is the personal belief about one's responsibility or goals (Triandis, 1977a). Affect is an emotional variable that is distinct from rational thinking and may affect intentions (Triandis, 1980). TIB extends a broader understanding of the key factors that may explain and contribute to the intention and behavior toward the sustainable disposal of secondhand clothing. The previous studies have also proven the validity of TIB in predicting pro-environmental intention and behavior (Issock Issock et al., 2020; Attiq et al., 2021a; Dang Vu and Nielsen, 2022; Nguyen et al., 2022). Therefore, this study modified TIB from the perspective of the environment, and environment-related variables were introduced to make it more suitable for a pro-environmental research context, and to examine the association between the aspects of cognition (PVS, PRA), social factors (ASR, SOC), affects (ATG), and RUI.

## Hypotheses development

**Perceived values on sustainability (PVS) and reuse intention (RUI).** Despite growing interest in the concept of perceived value, scholars' definitions and measures of the concept vary (Inieta-Bonillo et al., 2016). Zeithaml (1988) describes perceived value as the consumers' overall perceptions of the usability of a product or service based on perceptions of what is delivered and received. The notion of sustainable perceived value used in this study incorporated the consumers' environmental aspirations and sustainable consumption and was closely related to the concepts of green perceived value and ecological perceived value proposed by previous researchers (Chen, 2013; Wang and Hsu, 2019). Hence, PVS in this study not only represents the value related to

sustainable consumption but also a cognition or attitude toward sustainable behaviors (Kim et al., 2020). Understanding fundamental and intrinsic elements that may deter SHC purchases may help explain SHC buying intentions. The critical influence of cognition or attitude on intention has also been mentioned in numerous theories, such as TPB and TIB (Ajzen, 1991; Triandis, 1977b). The more perceived sustainable utility acquired by the customer, the more intended they will be to practice sensible consumerism and give used clothing a second chance (Silva et al., 2021). Some researchers have also found that individuals with higher levels of PVS or the environment are more likely to engage in behaviors that protect the environment (Kim et al., 2020; Koay et al., 2022). Therefore, we propose the following hypothesis:

*H<sub>1</sub>: PVS has a positive influence on RUI.*

**Problem awareness (PRA) and reuse intention (RUI).** PRA refers to a person's knowledge that failing to act in a certain way could affect others negatively (Saman Attiq et al., 2021b). PRA indicates individuals' concern about the outcomes which influence the decision to perform a behavior. Triandis (1977b) emphasized the significance of cognition in TIB and highlighted the crucial role of outcome evaluation as a dimension of cognition, and when this is applied to a pro-environmental context, it is shown that when people have a higher awareness of environmental issues, their perceptions increase their concern about environmental issues and their awareness of possible negative outcomes (Esfandiar et al., 2019). In addition, based on the human instinct of seeking advantages and avoiding disadvantages, they are more likely to engage in behaviors that are conducive to the environment. Esfandiar et al. (2019) found that the PRA of tourists affects their intention to adopt pro-environmental behavior during their trip. PRA has been proven to have a positive effect on customers' intention to reuse or recycle waste resources (Wang et al., 2018; Khan et al., 2019; Saman Attiq et al., 2021b). Therefore, this study proposes the following hypothesis:

*H<sub>2</sub>: PRA has a positive influence on RUI.*

**Ascription of responsibility (ASR) and reuse intention (RUI).** ASR can be described as the responsibility that people feel about the problems caused by improper behavior (Wahid et al., 2022). Within the framework of the present study, which draws on the TIB, the concept of ASR refers to the attribution of responsibility at both the individual and societal levels, which pertains to the amalgamation of norm and self-concept within a given environmental context. Many studies have proven that individuals with a strong ASR are more engaged in behaviors that can protect the environment (Stern, 2000; Han and Hwang, 2015; Han et al., 2020; Govaerts and Olsen, 2022). According to Govaerts and Olsen's (2022) research, individuals who exhibit environmentally responsible are inclined to consume food that is both sustainable and healthful. ASR gives people a moral level of behavioral goals, making them know and do what needs to be done (López-Mosquera and Sánchez, 2012). When people take responsibility for the unfavorable effects of their actions, they create a sense of moral obligation and intend to protect the environment or personal conventions from acting in an ecologically friendly way. Many studies have proven that individuals with a strong ASR are more engaged in behaviors that can protect the environment (Stern, 2000; Han and Hwang, 2015; Han et al., 2020). Thus, the following hypothesis is developed:

*H<sub>3</sub>: ASR has a positive influence on RUI.*

**Sense of community (SOC) and reuse intention (RUI).** SOC is people's irrational feelings and attachment toward society or a group and emotional bonds with their community (Li et al., 2022). It also refers to the extent to which people share their

professional expertise or insights with other members of the community as a result of their emotions or sense of belonging (Chen and Lin, 2019). Triandis (1977b) believes that a person's behavioral intention is influenced by the group he or she is in and that people are more inclined to do what is approved by society. A person defined as having SOC would share the interests, values, and conventions of the collective (Schmitt et al., 2019). This means that individuals who feel they belong to a particular group will be motivated to protect the environment in the same way as the people in that community. Hiltz and Wellman (1997) find that people who build frequent community attachment usually become more reliant on their communities and often develop the desired behavioral intentions of the community. This result has also been proven by Attiq et al. (2021a) when exploring the sustainability of household food waste reduction. Thus, the fourth hypothesis is developed:

*H<sub>4</sub>: SOC has a positive influence on RUI.*

**Anticipated Guilt (ATG) and Reuse Intention (RUI).** ATG represents emotions related to behaviors that contradict internalized norms (Narjes Haj-Salem and Al-Hawari, 2021). In other words, negative feelings arise when a person thinks an action might break the rules they follow (Attiq et al., 2021a). Triandis (1977b) proposes that emotion is also an important dimension that affects behavioral intention. Emotions more or less produce unconscious input into an individual's thoughts and decisions. The ATG generated from concern about the environment may have implications for subsequent sustainable behavioral intention or real action. Many previous studies have found that ATG has a positive effect on sustainable behavioral intention (Attiq et al., 2021a). Ravis et al. (2009) confirm in their research that anticipatory emotions have a strong impact on behavioral intention. Kaiser (2006) also discovers that ATG makes a unique and significant contribution to predicting the intention to act cautiously. Hence, the following hypothesis is proposed:

*H<sub>5</sub>: ATG has a positive influence on RUI.*

**Reuse intention (RUI) and reuse practices (RUB).** Intention refers to the possibility that an individual will engage in the said action in the future (Ajzen, 1991). RUI is defined as an inclination to reuse or not reuse a product, whereby an individual's intention to execute a behavior leads his/her reuse behavior to alter positively and drastically (Al Mamun et al., 2018; Mumtaz et al., 2022). This indicates that if a person is willing to sell or swap secondhand clothing, he/she is more likely to take actual action to participate in the RUB. Khan et al. (2019) have proven that behavioral intention highly predicts RUB, indicating that people are more likely to reuse things after only using them once rather than discarding them. Mumtaz et al. (2022) find that waste reduction intention has a significant impact on waste reduction behavior among young consumers. Therefore, the following hypothesis is proposed:

*H<sub>6</sub>: RUI has a positive influence on RUB.*

## Research methodology

**Sample selection and data collection.** The target population of this study includes Chinese adults (18 years old and above). Since a complete sampling framework cannot be obtained from a large population, this study used convenience sampling, which is a non-probability sampling method. The present research utilized G\* Power 3.1 to ascertain the minimum sample size, a commonly employed approach in prior investigations (Faul et al., 2009). This study has established that a minimum sample size of 146 is required based on six predictors, a power of 0.95, and an effect size parameter of 0.15. Besides, some previous studies

recommend that the sample size should not be less than 200 when adopting partial least squares structural equation modeling (PLS-SEM) to analyze the data (Chin, 2010; Hair et al., 2017); these recommendations have been adhered to. This study collected quantitative data through an online survey, the data were collected using WJX (<https://www.wjx.cn/>), and the structured questionnaire was randomly distributed to potential respondents through social networking software such as WeChat or QQ, between 14th June and 29th July 2022. All the respondents participated in the survey voluntarily, and before starting to fill in the questionnaire, the respondents could enter the questionnaire filling interface only after they voluntarily signed the informed consent form. A total of 888 questionnaires were collected. Through data screening, this study deleted the questionnaires of respondents who had no experience in selling or exchanging second-hand clothes, and the questionnaires with too short filling time and too uniform answers were also deleted. In the end, 514 valid questionnaires were retained.

**Survey instrument.** The structured questionnaire used in this study consisted of two sections. The first section dealt with the demographic information of all respondents, including gender, age, education level, marital status, location, occupation, income, and other basic information. The second section dealt with the measurement of the variables in this study. The measurement items utilized in this study were derived from pre-existing literature, thereby ensuring that their reliability and validity had been thoroughly established in prior research. The items for PVS were adapted from Kim et al. (2020) and Han et al. (2019). The items for PRA, ATG, and RUB were obtained from Attiq et al. (2021a). For ASR, the items were adapted from Kim et al. (2021). The items for SOC were taken from Li-Chun (2018) and Huang et al. (2020). The items for RUI were adapted from Borusiak et al. (2020a) and Kim et al. (2021). All items in this study were measured using a seven-point Likert scale. The survey instrument is originally composed in the English language. To align with the research context, this study enlisted the services of two proficient translation specialists to accurately translate and meticulously review the questionnaire. This was done to mitigate any potential biases and comprehension challenges that may arise from language translation. Prior to the commencement of data collection, a pilot study was conducted with a sample size of 25 individuals (not exceeding 30). The opinions of the respondents of the pilot test were carefully analyzed and summarized to enhance the questionnaire. The final data collection results did not incorporate the questionnaire utilized in the pilot test. A complete questionnaire was provided as Supplementary Material S1. Survey Instrument.

**Common method bias (CMB).** When both the independent and dependent variables are captured by the same response mechanism, common method bias (CMB) may occur (Kock et al., 2021). In other words, CMB will exist when the common method variance influences the association between the constructs, and this can have a considerable impact on empirical results and the inferred conclusions of research (Jakobsen and Jensen, 2015). According to Kock (2015), the full collinearity assessment approach can be used to test the CMB, and once the variance inflation factor (VIF) is less than threshold 5, no CMB issue can be observed in the study. Based on the results in Table 1, the VIF values of PVS (1.774), PRA (2.373), ASR (2.11), SOC (2.243), ATG (1.927), RUI (1.792), and RUB (2.851) were all lower than 5, which indicates that the CMB issue in this study is at an acceptable level.



**Table 1 Full collinearity assessment.**

Variables	PVS	PRA	ASR	SOC	ATG	RUI	RUB
VIF	1.774	2.373	2.11	2.243	1.927	1.792	2.851

Note: PVS perceived values on sustainability, PRA problem awareness, ASR ascription of responsibility, SOC sense of community, ATG anticipated guilt, RUI reuse intention, RUB reuse practices.  
Source: Author's data analysis.

**Multivariate normality.** This study also tested multivariate normality before using the data analysis approach. The Web Power online tool was selected to measure the multivariate normality of the data (source: <https://webpower.psychstat.org/wiki/tools/index>). The *p*-value of Mardia's multivariate skewness and kurtosis of all the variables were all below 0.05, which indicates that the data of this study were not normally distributed. Therefore, the PLS-SEM method is appropriate because it is less limited by distributional assumptions (Necmi and Christian, 2018).

**Data analysis method.** PLS-SEM was used as the data analysis method for this study, which was conducted using Smart PLS software. PLS-SEM and covariance-based structural equation modeling (CB-SEM) are two common and similar methods used in empirical research (Hair et al., 2017). The PLS-SEM analysis consists primarily of a measurement model and a structural model (Hair et al., 2011). The measurement model assesses the internal consistency, discriminant validity, and convergent validity of the constructs at the measurement level using measures such as Cronbach's alpha, composite reliability (rho\_a), composite reliability, average variance extracted, variance inflation factor, heterotrait–monotrait ratio, loading and cross-loading, and the Fornell–Larcker criterion (Hair et al., 2011). The structural model is tested using bootstrapping with one-tailed analysis (with 5000 iterations) to examine the hypotheses. In addition, this study also conducted a multigroup analysis (MGA) to measure the multiple relationships among the different demographic groups, and the measurement invariance of composite models (MICOM) was also included in this procedure.

**Result**

**Demographic characteristics.** Table 2 shows the demographic profile of 514 respondents, which included 10 questions about demographic characteristics. Among them, 225 (43.5%) were male, and 289 (56.2%) were female. Regarding age group, 71(13.8%) were below 20, 130 (25.3%) were 20–30, 128 (24.9) were 31–40, 129 (25.1%) were 41–50, and 56 (10.9%) were above 50 years old. Regarding education level, 121 (23.5%) had a Diploma/Advanced Diploma, 178 (34.6%) had a bachelor's degree, 100 (19.5%) had a postgraduate degree, and 115 (22.4%) had others. Regarding marital status, 148 (28.8%) participants were single, 287 (55.8%) were married, 57 (11.1%) were divorced, and 22 (4.3%) were widowed. Most respondents were from East China (97, 18.9%), Central China (94, 18.3%), and South China (84, 16.3%). Regarding employment of the respondents, privately employed (149, 29%), self-employed (123, 23.9%), and student (101, 19.6%) accounted for more than 70%. Most respondents' monthly income was focused on RMB3001-RMB4500 (106, 20.6%) and RM4501-RMB6000 (103, 20%), followed by RMB6001-RMB7500 (96, 17.7%) and more than RMB 7500 (91, 17.7%). Almost half the participants buy clothing once or twice (242, 47.1%) every month. Regarding monthly clothing spending, the largest group lies in the range of –RMB200-RMB400 (173,

**Table 2 Profile of the respondents.**

	N	%		N	%
<i>Gender</i>			<i>Occupation</i>		
Male	225	43.8	Unemployed	20	3.9
Female	289	56.2	Self-employed	123	23.9
Total	514	100	Student	101	19.6
			Housewife	48	9.3
<i>Age</i>			Privately employed	149	29
Below 20	71	13.8	Public servant	73	14.2
20–30	130	25.3	Total	514	100
31–40	128	24.9			
41–50	129	25.1	<i>Monthly Income</i>		
Above 50	56	10.9	Less than RMB1500	59	11.5
Total	514	100	RMB1500-RMB3000	59	11.5
			RMB3001-RMB4500	106	20.6
<i>Education</i>			RM4501-RMB6000	103	20
Diploma/Advanced	121	23.5	RMB6001-RMB7500	96	18.7
Diploma			More than RMB		
Bachelor Degree	178	34.6	7500	91	17.7
Postgraduate Degree	100	19.5	Total	514	100
Others	115	22.4			
Total	514	100	<i>Fashion Purchase Frequency</i>		
			Less than 1 time	122	23.7
<i>Marital Status</i>			1–2 times	242	47.1
Single	148	28.8	3–4 times	100	19.5
Married	287	55.8	More than four times	50	9.7
Divorced	57	11.1	Total	514	100
Widow	22	4.3			
Total	514	100	<i>Monthly Spending of Clothing</i>		
			Less than RMB200	98	19.1
<i>Location</i>			RMB200-RMB400	173	33.7
Northeast China	54	10.5	RMB401-RMB600	80	15.6
North China	56	10.9	RM601-RMB800	81	15.8
East China	97	18.9	RMB801-RMB1000	48	9.3
Central China	94	18.3	More than RMB		
			1000	34	6.6
South China	84	16.3	Total	514	100
Northwest China	56	10.9			
Southwest China	54	10.5	<i>Social Media Usage</i>		
Others	19	3.7	Yes	477	92.8
Total	514	100	No	37	7.2
			Total	514	100

Note: 1USD = 7.05 RMB.

33.7%). Finally, almost all the respondents had experience using social media (477, 92.8%). The details of the demographic information are provided in Table 2.

**Validity and reliability.** Measuring the outer model when conducting a PLS-SEM analysis is important to ensure the validity and reliability of the constructs. The internal consistency of variables is usually measured by Cronbach's alpha, composite reliability, and rho\_A, which have also been recommended by many previous studies (Hair et al., 2021). According to Table 3, all values of Cronbach's alpha, composite reliability, and rho\_A were larger than the acceptable level of 0.7, indicating the reliability of the internal consistency of the questionnaire. For convergent validity, the average variance derived (AVE) should exceed 0.5 to prove the appropriate level of agreement between various indicators of the same construct. As presented in Table 3, the AVE value of all variables is larger than 0.5, which indicates the convergent validity of this research.

Discriminant validity, which aims to empirically measure how much the constructs truly differ from one another, is also tested in this research. The valuation of discriminate validity is examined

**Table 3 Reliability and Validity.**

Variables	Items	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability	Average variance extracted	Variance Inflation Factor
PVS	5	0.951	0.951	0.962	0.835	1.757
PRA	5	0.958	0.959	0.968	0.857	1.995
ASR	5	0.960	0.961	0.969	0.863	2.037
SOC	5	0.956	0.957	0.966	0.851	2.038
ATG	5	0.960	0.960	0.969	0.862	1.801
RUI	5	0.959	0.960	0.969	0.861	1.000
RUB	5	0.958	0.958	0.968	0.856	-

*Note:* PVS perceived values on sustainability, PRA problem awareness, ASR ascription of responsibility, SOC sense of community, ATG anticipated guilt, RUI reuse intention, RUB reuse practices.  
*Source:* Author's data analysis.

**Table 4 Discriminant validity.**

	PVS	PRA	ASR	SOC	ATG	RUI	RUB
<i>Fornell-Larcker criterion</i>							
PVS	0.914						
PRA	0.540	0.926					
ASR	0.560	0.613	0.929				
SOC	0.557	0.593	0.601	0.922			
ATG	0.513	0.558	0.548	0.578	0.929		
RUI	0.468	0.485	0.501	0.538	0.541	0.928	
RUB	0.518	0.708	0.623	0.661	0.592	0.604	0.925
<i>Heterotrait-monotrait ratio (HTMT)</i>							
PVS							
PRA	0.565						
ASR	0.586	0.638					
SOC	0.584	0.618	0.627				
ATG	0.537	0.582	0.571	0.603			
RUI	0.489	0.505	0.521	0.560	0.564		
RUB	0.542	0.739	0.649	0.690	0.617	0.630	

*Note:* PVS perceived values on sustainability, PRA problem awareness, ASR ascription of responsibility, SOC sense of community, ATG anticipated guilt, RUI reuse intention, RUB reuse practices.  
*Source:* Author's data analysis.

based on indicators such as the Fornell–Larcker criterion, heterotrait–monotrait (HTMT) ratio, and cross-loading. Based on the Fornell–Larcker criterion results in Table 4, the square root of all latent variables’ AVE is the highest among the correlations with other constructs (Fornell and Larcker, 1981). According to Henseler et al. (2015), the HTMT values should be less than the threshold value of 0.9; the results in Table 4 show that all HTMT ratios are below 0.9. Table 5 shows the loading and cross-loadings; all the loading values were higher than the cross-loading values, which were also higher than 0.5. All the discussions prove the discriminant validity of this research (Hair et al., 2017).

**Hypothesis testing.** In addition to the analysis of the measurement model, multicollinearity requirements were also tested. This study used the VIF as an indicator to detect multicollinearity. Hair et al. (2021) recommended 5 as the threshold to consider the multicollinearity problem. The range of the VIF value in this research is from 1 to 2.038, which is within the safe range suggested. Therefore, multicollinearity was not considered in this study.

The measurement model explained 40.1% of RUI and 36.5% of RUB (Fig. 1). Since the coefficient of determination ( $R^2$ ) percentages were all greater than 25%, the measurement model had substantial and satisfactory predictive power (Eom et al., 2006; Avkiran and Ringle, 2018). The effect size ( $f^2$ ) was evaluated

**Table 5 Loading and cross-loadings.**

	PVS	PRA	ASR	SOC	ATG	RUI	RUB
<i>PVS</i>							
PVS1	0.898	0.462	0.488	0.501	0.418	0.404	0.432
PVS2	0.918	0.487	0.507	0.487	0.485	0.432	0.466
PVS3	0.919	0.508	0.531	0.515	0.483	0.414	0.490
PVS4	0.918	0.503	0.530	0.526	0.470	0.442	0.492
PVS5	0.914	0.504	0.504	0.517	0.486	0.442	0.485
<i>PRA</i>							
PRA1	0.522	0.913	0.557	0.572	0.500	0.463	0.675
PRA2	0.495	0.930	0.565	0.536	0.512	0.442	0.647
PRA3	0.507	0.931	0.577	0.553	0.541	0.465	0.653
PRA4	0.482	0.926	0.551	0.540	0.511	0.432	0.648
PRA5	0.491	0.928	0.585	0.541	0.518	0.440	0.656
<i>ASR</i>							
ASR1	0.555	0.577	0.920	0.566	0.498	0.466	0.593
ASR2	0.510	0.569	0.934	0.563	0.502	0.466	0.566
ASR3	0.521	0.572	0.939	0.583	0.523	0.484	0.585
ASR4	0.501	0.556	0.922	0.534	0.510	0.463	0.570
ASR5	0.516	0.572	0.932	0.547	0.514	0.445	0.579
<i>SOC</i>							
SOC1	0.569	0.571	0.586	0.922	0.528	0.515	0.638
SOC2	0.513	0.559	0.581	0.932	0.536	0.513	0.632
SOC3	0.499	0.531	0.521	0.921	0.541	0.496	0.582
SOC4	0.506	0.539	0.558	0.924	0.527	0.468	0.601
SOC5	0.480	0.531	0.525	0.913	0.534	0.483	0.595
<i>ATG</i>							
ATG1	0.486	0.518	0.533	0.550	0.923	0.510	0.573
ATG2	0.467	0.514	0.505	0.538	0.924	0.523	0.554
ATG3	0.474	0.522	0.512	0.560	0.934	0.498	0.541
ATG4	0.487	0.522	0.488	0.529	0.931	0.488	0.537
ATG5	0.470	0.514	0.507	0.505	0.930	0.492	0.540
<i>RUI</i>							
RUI1	0.437	0.426	0.451	0.508	0.504	0.901	0.552
RUI2	0.465	0.476	0.507	0.505	0.506	0.937	0.578
RUI3	0.436	0.469	0.460	0.499	0.501	0.934	0.545
RUI4	0.401	0.438	0.446	0.476	0.505	0.933	0.556
RUI5	0.429	0.438	0.457	0.506	0.494	0.934	0.569
<i>RUB</i>							
RUB1	0.508	0.664	0.590	0.637	0.552	0.566	0.908
RUB2	0.471	0.643	0.552	0.608	0.554	0.565	0.927
RUB3	0.480	0.655	0.578	0.614	0.537	0.570	0.934
RUB4	0.468	0.644	0.565	0.586	0.534	0.545	0.923
RUB5	0.468	0.671	0.596	0.612	0.562	0.549	0.935

*Note:* PVS perceived values on sustainability, PRA problem awareness, ASR ascription of responsibility, SOC sense of community, ATG anticipated guilt, RUI reuse intention, RUB reuse practices.  
*Source:* Author's data analysis.

using the threshold value proposed by Cohen (2013). Table 6 shows that PVS (0.011), PRA (0.007), and ASR (0.013) have a small effect on RUI; SOC (0.035) and ATG (0.057) have a moderate effect on RUI; RUI (0.575) has a substantial effect on RUB. Table 6 presents the hypotheses testing results for this

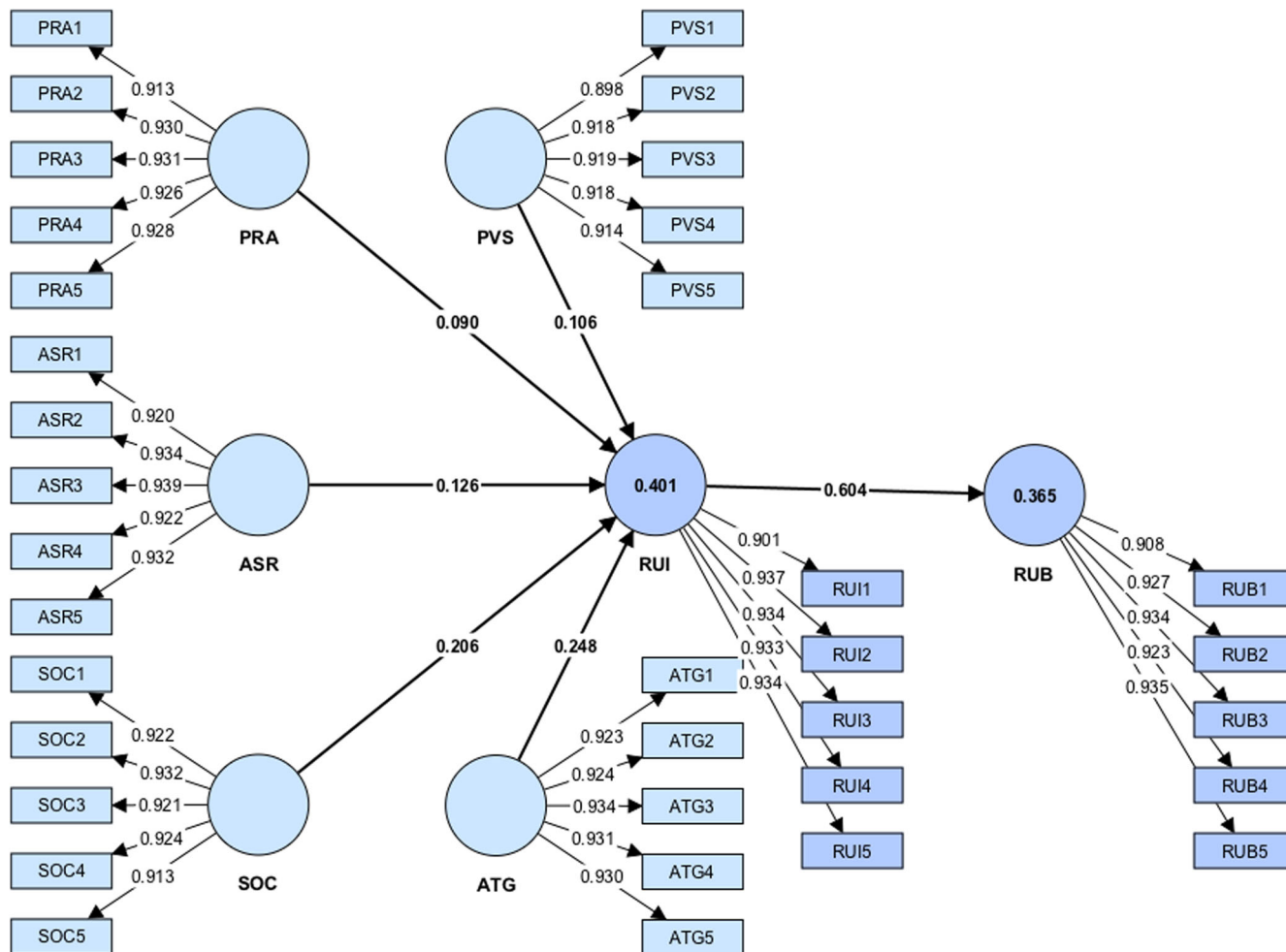


Fig. 1 Framework and Findings.

Table 6 Hypothesis testing.

Hypothesis	Beta	Confidence Intervals	t Value	P value	R <sup>2</sup>	f <sup>2</sup>	Decision
<i>Factors affecting reuse intention of second-hand clothing</i>							
H <sub>1</sub> PVS → RUI	0.106	(0.021, 0.188)	2.081	0.019	0.401	0.011	Accepted
H <sub>2</sub> PRA → RUI	0.090	(-0.001, 0.185)	1.571	0.058		0.007	Rejected
H <sub>3</sub> ASR → RUI	0.126	(0.033, 0.227)	2.132	0.017		0.013	Accepted
H <sub>4</sub> SOC → RUI	0.206	(0.112, 0.315)	3.281	0.001		0.035	Accepted
H <sub>5</sub> ATG → RUI	0.248	(0.160, 0.345)	4.431	0.000		0.057	Accepted
<i>Factors affecting reuse practices of second-hand clothing</i>							
H <sub>6</sub> RUI → RUB	0.604	(0.526, 0.680)	12.802	0.000	0.365	0.575	Accepted

Note: PVS perceived values on sustainability, PRA problem awareness, ASR ascription of responsibility, SOC sense of community, ATG anticipated guilt, RUI reuse intention, RUB reuse practices. Source: Author's data analysis.

research. The results of the path analysis showed that PVS ( $\beta = 0.106, p < 0.05$ ), ASR ( $\beta = 0.126, p < 0.01$ ), SOC ( $\beta = 0.206, p < 0.01$ ), and ATG ( $\beta = 0.248, p < 0.01$ ) had significant positive relationships with RUI, these support H<sub>1</sub>, H<sub>3</sub>, H<sub>4</sub>, H<sub>5</sub>. In addition, RUI has a positive relationship with RUB ( $\beta = 0.604, p < 0.01$ ), which support H<sub>6</sub>. However, the *p*-value of H<sub>2</sub> was larger than 0.05. Thus, indicating no significant association between PRA and RUI; therefore, H<sub>2</sub> was not supported.

**Multi-group analysis.** This study's MGA can be used to investigate the differences between groups, as specified by group

variables. To conduct an MGA, measuring the invariance of composite models is necessary (Hult et al., 2008). Garson (2016) proposes that when MICOM was running in SmartPLS, configural invariance was automatically established. The permutation *p*-values for all variables exceeded 0.05, except for PRA in the income group. Therefore, the compositional invariance requirement was achieved. The MGA was performed in four groups: Group 1. male (*n* = 225) and female (*n* = 289); Group 2. 30 years or less (*n* = 201) and more than 30 years (*n* = 313); Group 3. undergraduate or below (*n* = 299) and master's degree and above (*n* = 215); and Group 4. 4500 RMB or less (*n* = 224) and more than 4500 RMB (*n* = 290). Based on Table 7, for Group 1, which

**Table 7 Multi-group analysis.**

Associations		Difference (Male vs. Female)	Two-tailed <i>p</i> -value	Decision
H1	PVS → RUI	−0.097	0.210	No Difference
H2	PRA → RUI	−0.222	0.044	Difference
H3	ASR → RUI	0.299	0.046	Difference
H4	SOC → RUI	−0.018	0.426	No Difference
H5	ATG → RUI	−0.119	0.163	No Difference
H6	RUI → RUB	−0.072	0.224	No Difference
Associations		Difference (≤30 Years vs >30 Years)	Two-tailed <i>p</i> -value	Decision
H1	PVS → RUI	−0.152	0.077	No Difference
H2	PRA → RUI	−0.078	0.248	No Difference
H3	ASR → RUI	0.048	0.378	No Difference
H4	SOC → RUI	0.038	0.426	No Difference
H5	ATG → RUI	−0.064	0.279	No Difference
H6	RUI → RUB	−0.109	0.118	No Difference
Associations		Difference (Undergraduate or Below vs. Masters and Above)	Two-tailed <i>p</i> -value	Decision
H1	PVS → RUI	−0.272	0.016	Difference
H2	PRA → RUI	0.117	0.167	No Difference
H3	ASR → RUI	0.156	0.113	No Difference
H4	SOC → RUI	−0.044	0.429	No Difference
H5	ATG → RUI	0.005	0.473	No Difference
H6	RUI → RUB	0.002	0.499	No Difference
Associations		Difference (≤RMB4500 vs. >4500RMB)	Two-tailed <i>p</i> -value	Decision
H1	PVS → RUI	0.070	0.262	No Difference
H2	PRA → RUI	0.230	0.033	Difference
H3	ASR → RUI	−0.053	0.348	No Difference
H4	SOC → RUI	−0.068	0.312	No Difference
H5	ATG → RUI	−0.095	0.205	No Difference
H6	RUI → RUB	0.058	0.263	No Difference

*Note:* PVS perceived values on sustainability, PRA problem awareness, ASR ascription of responsibility, SOC sense of community, ATG anticipated guilt, RUI reuse intention, RUB reuse practices.  
*Source:* Author's data analysis.

is on males and females, the *p*-value of PRA on RUI and ASR on RUI is less than 0.05, which indicates a significant difference between the relationship of PRA and RUI, as well as ASR and RUI. For Group 3, which is the educational background with undergraduate and below and master's and above, the *p*-value is less than 0.05; this shows a significant difference between these two groups regarding the effect of PVS on RUI. For Group 4, which is levels of income, the influence of PRA on RUI was significantly different, as its *p*-value was less than 0.05. As for the other variables, the *p*-value is all larger than 0.05, indicating no significant difference between the relationships of this hypothesis.

**Discussions**

This study explores secondhand clothing reuse influence factors through TIB, including the PVS, PRA, ASR, SOC, and ATG. Four significant factors—PVS, ASR, SOC, and ATG—were important when considering the promotion of secondhand clothing reuse. PRA was found to be not a significant predictor for RUI. As expected, RUI was also proven to be a strong predictor of RUB in this study.

First, the findings indicated that PVS was a significant exogenous latent variable in determining the intention to reuse ( $\beta = 0.106, p < 0.05$ ),  $H_1$  was supported. This means that an individual with high PVS will enhance the RUI of secondhand clothing. The PVS is an assessment of the value of an individual's environmental behavior when it is implemented. People are more likely to reuse secondhand clothes if they perceive their contribution to sustainable development in the recycling act. This finding was also confirmed in previous studies (Wang and Hsu,

2019; Silva et al., 2021, Kim et al., 2020; Koay et al., 2022). The study conducted by Wang and Hsu (2019) highlights the significance of sustainable perceived value among Chinese consumers in driving their inclination toward buying smartwatches. In addition, this study highlighted the significant difference in the association between PVS and RUI of the respondents with different education levels; this means that the sensitivity of the RUI of secondhand clothing to the PVS varies with educational backgrounds.

The second finding of this study was the effect of ASR on RUI, and the result showed a significant positive association between them ( $\beta = 0.126, p < 0.05$ ),  $H_3$  was supported. This suggests that responsibility factors play an important role in the process of conducting a practice that protects the environment. Responsibility is a moral obligation that encourages individuals to do things that are beneficial for society. Strong ASR makes people more inclined to choose the environmentally friendly side in the face of environmental problems, further promoting the tendency of norms to translate into environmentally friendly behaviors and making the reuse of used clothing more likely to occur. This study also corroborates previous studies that found a direct influence of ASR on RUI (Han and Hwang, 2015; Han et al., 2020). Gender traits were also shown to influence the relationship between ASR and RUI in this study.

Third, based on hypothesis testing ( $\beta = 0.112, p < 0.01$ ), SOC was also found to be a significant driver of RUI,  $H_4$  was supported. Consumers with a greater SOC are more attracted to reusing secondhand clothing. The social nature of human beings makes people not only influenced by the people around them but also subtly influences others. Therefore, individuals with a high



SOC will have a high tendency toward the reuse of secondhand clothing, as this intention or behavior is socially beneficial and has social attributes. This finding is consistent with the previous studies that indicate that customers with a sense of belonging to society are more likely to consider society and intend to perform pro-environmental practices (Christie and Waller, 2019; Schanes and Stagl, 2019; Attiq et al., 2021a).

This study also considered the influence of emotional factors proposed by Triandis (1977b) in TIB. The fourth finding of this study confirmed the significant positive effect of ATG on RUI ( $\beta = 0.206, p < 0.01$ ) and supported H<sub>5</sub>, ATG was also the most important factor among the constructs in this study. The study results revealed that the anticipated emotion of guilt contributes to the RUI of secondhand clothing, which is similar to previous findings (Kaiser, 2006; Ravis et al., 2009; Attiq et al., 2021a). Cudjoe et al. (2022) discovered that guilt positively influenced the waste sorting intention of residents during conducted their research in China. This finding posits that the experience of guilt as a self-directed psychological affective state may enhance an individual's propensity to partake in conscientious environmental conduct, particularly in China, a nation with a significant cultural heritage. Although most people make rational decisions, irrational emotions appear to drive them to act in an environmentally friendly manner. Although discarding secondhand clothes is the most convenient and quick way for most people to dispose of them, they are willing to give secondhand clothes a second chance owing to environmental guilt.

This study also found that PRA does not directly influence the intention to reuse secondhand clothing, deviating from previous studies that PRA is the driving force for pro-environmental activities (Saman Attiq et al., 2021b; Wahid et al., 2022). Although PRA emphasizes people's familiarity with environmental issues, they appear to have become immune to this phenomenon as a result of the frequent occurrence of various environmental emergencies and the hype of environmental issues in various media and business areas. Farage et al. (2021) also noted in their study on littering that when media messages about the "harmful effects of littering" become common knowledge, increased awareness of the problem does not reduce the intention to litter among the majority of individuals. This aligns with the widely held belief that the dissemination of information alone is insufficient to effectively encourage pro-environmental actions. The veracity of this statement has been confirmed by the finding obtained from the investigation.

## Implications

**Theoretical implications.** Most previous studies have concentrated on the purchase and use of secondhand clothing, and a few studies have investigated the sustainable development of secondhand clothes from the standpoint of the sale and exchange of secondhand clothes; this ignored area is the focus of the current study. Simultaneously, most previous studies have used the widely utilized conceptual model of TPB (Heidari et al., 2018; Khan et al., 2019; Ostermann et al., 2021), but from a rational standpoint, the TPB model has difficulty explaining the behaviors of people, in an irrational scenario. Consequently, this study uses TIB as its theoretical foundation, which adds emotional factors during the decision of the pro-environmental behavior process. A theoretical model was developed to investigate the factors influencing pro-environmental behavior, such as the reuse of secondhand clothing, which could address some of the weaknesses and limitations of TPB, such as the failure to integrate the individual's irrational emotional influence and describe and predict secondhand clothing sales or swap practices more comprehensively. This study diverges from prior research that has utilized

TIB variables, such as cognition, social factors and affects, as direct measures (Moody and Siponen, 2013; Nguyen et al., 2022). This study builds upon prior research by delving deeper into the three primary variables by introducing additional environment-related variables and providing a more comprehensive analysis of the impact of cognition (perceived values on sustainability, problem awareness), social factors (ascription of responsibility, sense of community), and affects (anticipated guilt) on reuse behavior. This has led to a theoretical advancement in the analysis of clothing reuse practices. This study has also obtained some valuable insight into secondhand clothing sales or swap practices, in which PVS, ASR, SOC, and ATG were all proven to play an essential role in shaping intention toward the reusing practices of used clothing, thus confirming the validity of adapted TIB in the context of environmental protection. Finally, through the combination of TIB and environmental factors, this study conceptually adds to the existing body of literature.

**Practical implications.** As the fashion industry is under increased scrutiny by the policymakers who advocate for the implementation of extended responsibility for clothing producers and customers who are more concerned about clothing pollution and the greenhouse effect, the integrated understanding of secondhand selling or swapping intention and behavior could help contribute to the timely issue related to sustainability in the apparel industry. It has far-reaching implications for practitioners and policymakers to increase the secondhand reuse rate for each type of circular fashion. Switching from a throw-away to reusing consumer habits will further favor the development of high-quality clothing with safer and renewable materials and bring environmental value to society.

The enhancement of PVS has been proven to help improve the intention to reuse secondhand clothing. This demonstrates the importance of environmental protection. The key to increasing PVS is to widen the benefit-cost gap. Society and relevant institutions should implement policies to encourage RUB. The users of secondhand clothing, selling, or swap platforms may receive certain benefits such as background checks, tracking users' transactions, and giving electronic certificates to people who have been recycling secondhand clothes for a long time. Simultaneously, it is necessary to reduce the cost of trading or swapping used clothes; this necessitates the platform to simplify the exchange processes, improve the subdivision of used clothes, assist users in quickly matching the appropriate objects for sale or exchange, and provide users with appropriate freight subsidies.

The present study also highlights that the responsibility toward the sustainable consumption of secondhand clothing requires reusing secondhand clothing and aligning with further practices. ASR should be utilized as an argument in effective communication efforts to encourage consumers to embrace secondhand shopping and promote RUB. These campaigns could include presentations on the repercussions of corporate practices, such as online secondhand clothing recycling platforms, as efforts to increase consumer responsibility toward the environment.

Furthermore, this study encourages people to reuse secondhand clothing by increasing their SOC. Online virtual communities represent a new alternative approach. With the rise of the meta-universe, an increasing number of people are beginning to communicate in virtual space via virtual reality technology, which also serves as a platform for the sale and exchange of secondhand clothing. The public's acceptance and recognition of the reuse of secondhand clothing can be improved through online mutual influence and communication.

It should be noted that people's guilt over environmental issues may be translated into their motivation to sell or swap

secondhand clothing. Therefore, this study suggests programs, commercials, and social media that emphasize societal responsibility for a better understanding of inspiring customers to do their bit in preventing secondhand clothing waste in the field of sustainability, which must also focus on anticipating emotions of guilt in advance. These objectives can be accomplished from the secondhand clothing waste produced by monetary losses, environmental harm, and societal issues.

## Conclusions

The development of the clothing industry has resulted in a significant volume of garment waste, raising concerns regarding China's society and ecology. Secondhand clothing sales or swapping allows customers to always have something "fresh" to wear by trading with others while lowering the consumption of new products and contributing to the sustainability of the world. This study considers the new trend of selling or swapping secondhand clothing in China and proposes the following five valuable constructs that may predict RUI based on the TIB model: perceived values on sustainability, problem awareness, ascription of responsibility, sense of community, and anticipated guilt. The results revealed that perceived values on sustainability, ascription of responsibility, sense of community, and anticipated guilt have varying degrees of influence on reuse intention. The study employed multivariate analysis to assess the differences between two groups of samples divided based on factors such as gender, age, education, and income. The results of the multivariate analysis indicate that there are differences in the grouping based on gender, education, and income when studying the relationship between certain independent variables and reuse intention. The study suggests that when conducting promotional activities for the use of second-hand clothing or related apps, it is necessary to consider demographic differences and implement targeted marketing strategies. This will significantly reduce the costs associated with promotion.

**Limitations.** Even though some implications were proposed in this study, the limitations should also be discussed for the further improvement of the sustainability of secondhand clothing research. The first is the inherent limitations of the research methodology. As it is a cross-sectional study, it is difficult to capture the change in trends in the real world, especially for developing nations. In addition, the non-probability sampling method cannot guarantee the full representation of the entire target population. Second, although this study primarily discusses the factors influencing the reuse of secondhand clothing, it also focuses on the two currently popular aspects of selling and swapping, which may lack comprehensiveness. As clothing rentals and redesigns gain popularity, some apparel brands are beginning to investigate the market. Future researchers may consider adding concepts such as renting or redesigning disposal methods to enrich the concept of sustainable disposal. Finally, although the MGA is used to confirm that some demographic characteristics influence the hypothesis, such as gender differences in the relationship between ASR and RUI, the specific direction of influence has not been confirmed. Therefore, these demographic characteristics can be used as moderating variables for more in-depth exploration research in the future.

## Data availability

The original contributions presented in the study are included in the article/Supplementary Material (S2. Dataset); further inquiries can be directed to the corresponding author/s.

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### Author contributions

Conceptualization: MW, AAM, QY, and MMM; Methodology: MW and MMM; Formal analysis and investigation: AAM and QY; Writing—original draft preparation: MW and MMM; Writing—review and editing: AAM and QY; Supervision: AAM. All authors have

revised the paper for important intellectual content and have read and agreed to the present version of the paper.

### Ethics approval

The human research ethics committee of Changzhi University approved this study (Ref. CZ-2022-080). This study has been performed in accordance with the Declaration of Helsinki.

### Informed consent

Written informed consent for participation was obtained from respondents who participated in the survey. No data were collected from anyone under 18 years old.

### Competing interests

The authors declare no competing interests.

### Additional information

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