

## Article

# Categorizing Chinese Consumers' Behavior to Identify Factors Related to Sustainable Clothing Consumption

Wenjun Guo <sup>1,2,\*</sup>  and Eunyoung Kim <sup>1</sup> 
<sup>1</sup> School of Knowledge Science, Japan Advanced Institute of Science and Technology, Nomi 9231292, Japan; kim@jaist.ac.jp

<sup>2</sup> Southampton International College, Dalian Polytechnic University, Dalian 116034, China

\* Correspondence: wenjun100@163.com

**Abstract:** Consumers' current clothing consumption behavior patterns have become the primary challenge to environmental sustainability within the clothing industry. In order to ensure any behavioral change intervention is successful, a thorough understanding of consumers' current consumption behavior is required. Accordingly, we aimed to identify factors related to sustainable clothing consumption by categorizing the actual clothing consumption behaviors of Chinese consumers. Specifically, the study aims to answer two sub-questions: (1) how can we categorize clothing consumption behaviors? and (2) what factors influence different types of clothing consumption behaviors? Data were collected through a two-phase survey that included observations and a questionnaire. The consumer behavior was divided into three categories based on the actual total number of clothing items and clothing usage frequency during a designated period. Among these categories, demographics and clothing consumption behavior variables were examined in the purchase, use, and disposal phases, using Chi-square analysis, Fisher's exact test, and variance analysis. The findings show that gender, age, brand preference, annual expenditure, number of new items, purchase priorities, reason for disposal, disposal channels, disposal quantity, repair experience, duration of use, price, and clothing type were the main factors related to sustainable clothing consumption. Finally, we discuss the implications of our findings and define the issues to be addressed in order to move towards sustainable clothing consumption behavior changes.

**Keywords:** sustainable clothing consumption; categorization of behavior; factors for sustainable clothing consumption; total number of clothing items; usage frequency



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## 1. Introduction

The clothing industry has become one of the most polluting industries worldwide, with clothing products causing environmental pollution and energy consumption throughout their production, distribution, and consumption (phases of purchase, use, maintenance, and disposal) [1]. This increased environmental impact is promoted by both suppliers and consumers [2,3]. While considerable efforts have been devoted to improving the production stage, little attention has been paid to improving consumption behavior, especially in the use phase [4]. With the growing number of purchased, used, and discarded clothes, the current clothing consumption pattern negatively affects the clothing lifespan, becoming a primary environmental challenge [5–11]. A particular concern is the rapid development of fast fashion in the last decade, which advocates for high-volume, low-cost consumption, and has hence continuously accelerated environmental impact through consumption [6,9,12,13]. However, consumer awareness and knowledge of sustainable consumption behavior is limited, resulting in a large number of clothing items being purchased with inefficient use, and irrational disposal [5,9,10,14,15]. Such a consumption pattern urgently needs to be transformed through behavioral change interventions; in turn, this first requires a comprehensive understanding of consumer behavior [16].

As the middle phase of consumption, clothing use not only influences purchase behavior, but also directly affects disposal behavior [17,18]. With a large number of clothing items owned and a low wearing frequency, decisions made during the use phase result in a large volume of items that are worn out or no longer desired, and a large quantity of new purchases, leading to environmental impact through waste, production, and transport [3,4,9,15,18]. However, few studies have focused on the use phase of consumption, as its details cannot be determined as easily as in the purchase phase. Studies that focus on the use and maintenance phases tend to investigate maintenance practices, such as washing and drying [19–22]. Aside from Gwozdz et al. [3], few studies on the purchase, use, and disposal phases identify consumer categories based on clothing consumption, and propose intervention directions by characterizing each category. To address this gap, our study aims to categorize the behavior of Chinese consumers based on total number of clothing items and usage frequency during a certain period, and identify issues affecting the environment that need to be addressed in each category regarding the consumption phases of purchase, use, and disposal. The specific research questions addressed in this study are as follows:

- (1) How can we categorize sustainable clothing consumption behaviors in terms of total number of clothing items and usage frequency?
- (2) What factors influence different types of consumption behaviors?

This study contributes to the literature in three ways. First, to our knowledge, this is the only study to collect data on the actual number of clothing items (used and unused) owned and the usage frequency during a certain period through observation with daily photograph logs. Second, we categorize sustainable clothing consumption behaviors in terms of the number of clothing items and usage frequency, and extend the categories to explore the factors related to sustainable consumption behavior during the phases of purchase, use, and disposal for each category, which extends the clothing consumption behavior categorization of the previous literature. Third, we identify the environmental issues that need to be addressed for each category of clothing consumption, which provides a rational and explicit basis for developing systematic clothing consumption behavior interventions [23].

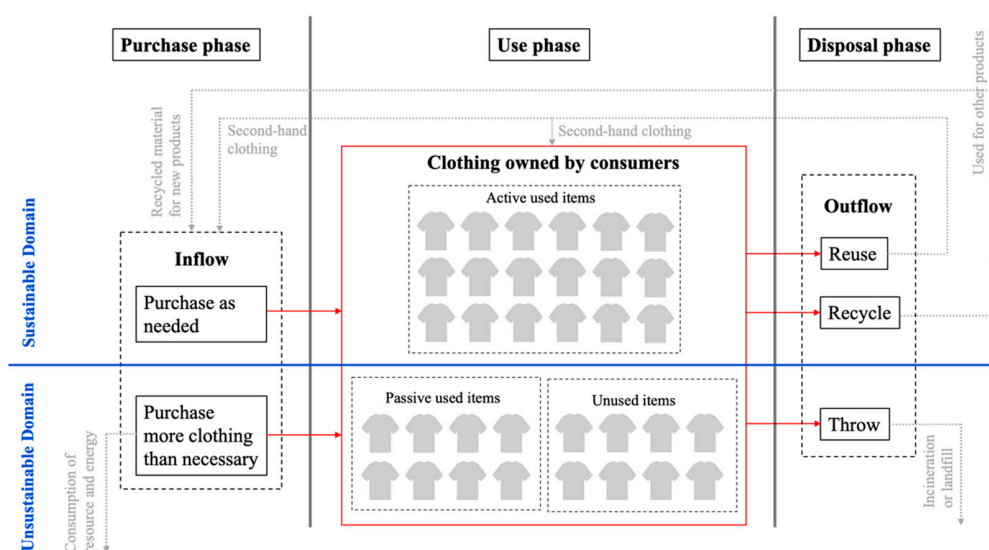
## 2. Literature Review

### 2.1. Sustainable Clothing Consumption

Sustainable consumption and production have been defined by the Oslo symposium as “the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of further generations” [24]. Applied to sustainable clothing consumption behaviors toward the environment, this definition suggests that consumers should (1) purchase high-quality garments that are produced in an environmentally friendly manner, (2) limit their total number of clothing items, (3) improve their usage frequency, (4) prolong the clothing use period, and (5) dispose of clothing items in a manner that limits the amount of waste entering landfill, including reuse, recycling, and repurposing [25]. Among these, (1) is associated with the purchase phase, (2) with all three phases, (3–4) with the use phase, and (5) with the disposal phase.

As the middle phase of clothing consumption, clothing use behavior plays an important role and connects with other phases of consumption [3,17,18]. Since consumers’ number of clothing items is determined by the number of items they own, their inflow through purchases, and outflow through disposal [11], the lifespan of owned clothing is determined by the number of times a garment has been worn (usage frequency), resulting in a division into active, passive, and unused items [5,9,11,26] (see Figure 1). Positive use behavior is associated with frequent wear (active use) and owning clothing items in numbers that correspond to the demand, which improves the clothing lifespan [5,9,26]. In contrast, negative use behavior is associated with infrequent wear (passive use/unuse) and

owning more clothing than is necessary, which can shorten the clothing lifespan [9,11,27]. Despite the claim by Klepp et al. [28] that clothing lifespan can be measured by its length of use apart from its frequency of wearing, since longer use times are associated with sustainable use behavior, the fact remains that having a large number of clothing items may lead to some clothing being rarely worn; for example, some items may only be used for one season, only once during a designated time period, or never [9,25], which would constitute unsustainable use behavior [6]. In other words, it is insufficient to measure the use behavior of rarely used clothing items only by the number of years that consumers have owned them; passive use or disuse, even in long-term ownership, is unsustainable. It is more efficient to measure usage frequency in such a context. Therefore, the total number of clothing items and usage frequency are the two crucial aspects of sustainable clothing consumption behavior in this study. A comprehensive understanding of clothing consumption can be obtained by combining the factors of clothing inflow and outflow based on each category.



**Figure 1.** The relationship between phases of purchase use and disposal.

## 2.2. Issues to Be Addressed

Behavioral change is crucial for improving the implementation of evidence-based practice [29]. De Wagenaar et al. [11] and Zhang and Hale [16] explored the use of behavior change theory to promote clothing sustainability by reusing, repairing, and repurposing clothing. According to Michie [30]’s framework for behavior change interventions, which is known as the behavior change wheel, understanding behaviors includes four steps: (1) defining behavior issues, (2) choosing the target behavior, (3) specifying the target behavior, and (4) identifying what needs to change, which is the first stage toward changing behavior [30]. Among these steps, (1) can be obtained through observing those who perform the behaviors, (2) and (3) can be defined using literature such as the symposium document discussed in Section 2.1, which can help determine who should perform what, where, and when, and (4) refers to why the target behavior is not currently being carried out, which can be examined qualitatively or quantitatively [31,32]. In these definitions, behavior change is applied to clothing consumption to determine “what type of consumer needs to change what differently” [23]. To provide interventions in sustainable clothing consumption behavior, it is therefore necessary to understand clothing consumption behavior by categorizing behavior types and observing the variations between them.

## 2.3. Factors for Sustainable Clothing Consumption

Consumers’ sustainable clothing consumption behavior can be affected by several factors, including the categories of demographics, garment attributes, and clothing practice [3,4,21,33].

First, consumer demographic information significantly affects clothing consumption behavior, and contributes to the measurement of lifespan relatively more than other factor categories [4]. Gender has a notable effect on total clothing ownership [34]. According to Rahman et al. [35]’s study of young Chinese consumers, women are more concerned with aesthetics (color and style), which relate to visual and sensory attributes, whereas men are more concerned with functional benefits, which correspond to attributes of performance and utilitarianism [35]. People with low incomes keep their clothing longer than others before disposal [36,37]. According to Langley et al. [33], the personal attributes of user groups including men, older people, individuals with a lower income, and those who intentionally choose longer-lasting clothing, affect the active use of clothing.

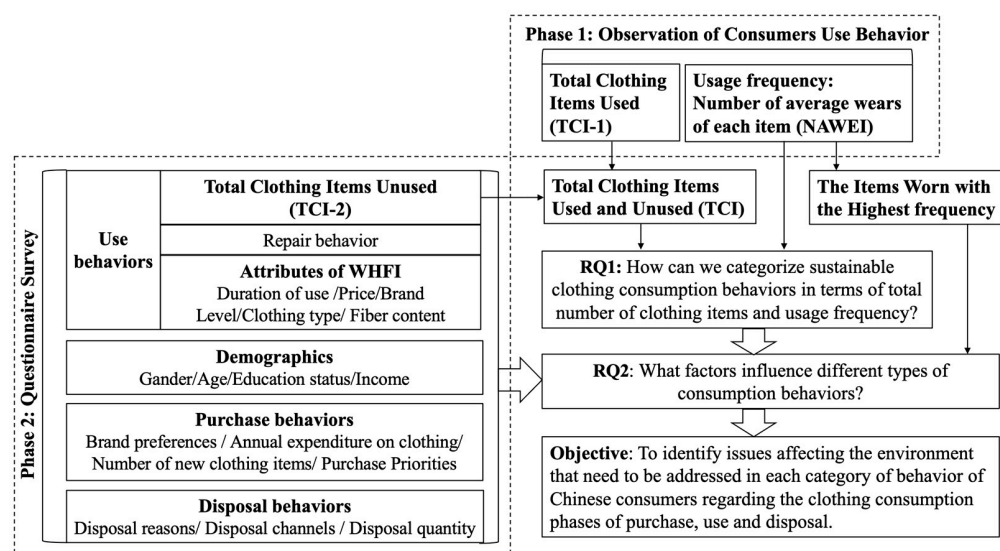
Second, the impact of garment attributes and practices throughout the purchase, use, and disposal phases is noteworthy. Gwozdz et al. [3] claimed that purchase volume and brand choice significantly impact clothing consumption behavior. As clothing item ownership time is a relatively significant factor [4], the average length of ownership of types of clothing is reported as follows: coats are owned for 7 years, jackets/blazers are owned for 6.8 years, blouses/shirts are owned for 4.8 years, T-shirts are owned for 4.6 years, and jeans are owned for 3.5 years [38], which shows that the clothing type affects consumers’ ownership time. According to Laitala and Klepp [4], passive use of clothing is strongly associated with consumers who emphasize brands and fashion, whereas active use of clothing is associated with purchasers of high-quality and value-for-money clothing. Clothing that is damaged or cheap fast fashion is unlikely to be reused by consumers, while clothing that is slightly damaged is likely to be repaired [39]. Clothing type influences the disposal channel, such as reuse, downcycling, or trashing [3]. According to Zhang et al. [37], the online clothing recycling platform (OCRCP), a new clothing disposal channel emerging in China in recent years, is affected by consumer perceptions of usefulness and attitude. Laitala and Klepp [4] identified the factors affecting the clothing lifespan by analyzing four block variables: garment (price, type, and fiber content), user (gender, nationality, age, etc.), garment use (usage frequency, disposal reason, disposal method, etc.), and clothing practices (estimated monthly spending on clothing, number of new items, repair experience, etc.). Additionally, Gwozdz et al. [3] identified five consumer segments based on their clothing purchase behavior. They found that different factors existed among the five segments, which included demographics (nationality, gender, and income), clothing attributes (brand level, such as budget, casual/medium, and premium brands; mode of acquisition; raw material), users’ attitudes (toward sustainability), and users’ behavior (quantity of clothing items, usage frequency, maintenance, and disposal). However, the data collection was based on respondents’ estimations and assumptions, which generated uncertainty about the actual use of clothing in a manner that diminished the expected benefits [14]. In other words, there is a research gap in terms of observing the actual situation among consumers during a designated time period.

### 3. Materials and Methods

The literature provides a theoretical basis for the data collection. As a means of investigating actual clothing consumption behaviors and categorizing them, the data of total clothing items (TCI) (including tops, outerwear, and bottoms) and usage frequency: number of average wears of each item (NAWEI) as two major use behaviors were collected through observation. A matrix was then used to categorize consumption behavior based on the TCI and NAWEI that have been used and unused for 30 days. For clarity, the total number of clothing items used is referred to in this study as TCI-1, whereas the total number of unused clothing items is referred to as TCI-2. In TCI-1, the clothing items worn with the highest frequency were designated as representative objectives to explore garment attributes (purchase time, price, brand level, garment type, and fiber content). Furthermore, to identify the factors that influence different types of consumption behavior, the variables of the purchase, use, and disposal behavior phases were measured between the behavior categories.

### 3.1. Data Collection

As shown in Figure 2, a two-phase survey was conducted to collect data, which included observation and a questionnaire. The observation phase addressed the records of the 30-day TCI and NAWEI for the participants through daily photograph logs. The questionnaire phase focused on demographic information, purchase behavior, disposal behavior, and use behavior with designated clothing items, the items worn with the highest frequency (HFWI), generated from the observation phase.



**Figure 2.** Structure of the method.

#### 3.1.1. Phase 1: Observation

An observational study was conducted to obtain data on consumers' actual usage behaviors. A total of 60 participants were recruited through a snowball sample for this study, making use of friends, colleagues, and family connections for initial contacts. As a non-probability sampling method, snowball sampling can access hard-to-reach and diverse populations and increases the possibility of selection diversity in terms of age and background among participants [40]. In this study, the sample size ( $N = 60$ ) is suitable according to Saunders et al. [41], who recommended a minimum sample size of 30 samples for non-probability sampling in populations with multiple characteristics. The sample selection criteria included age (between 18 and 70 years) and urban settlement in Liaoning province, China. Individuals who mainly wore uniforms were excluded from the study because their clothing use behaviors were less varied and less relevant to the study's focus. The observational study was conducted between October 2021 and November 2021, which was a typical autumn in Liaoning province (the temperature ranged from about 5 to 20 degrees Celsius). Thus, clothing items for the season were more clearly defined and included tops (T-shirt, shirt, hoodie, etc.; dresses were classified as tops to reduce the complexity of information collection), outerwear (jacket, suit, coat, etc.), and bottoms (trousers or skirts). We recorded what participants wore to go out for 30 consecutive days during the study period, and the days they spent at home were ignored, as home clothes were excluded from study. Participants were instructed to dress naturally according to their personal habits, and record their daily three-item wear (accessories and underwear were excluded) through photograph logs or by filling out and coding the forms that we provided. Photographs (see Figure 3) were collected online daily during the study period, and items that were not clear were immediately confirmed with the participants. The forms that we provided for the participants who were not able to take photos were collected after recording. Therefore, the data of the TCI-1 (the total quantity of tops, the total quantity of outerwear, and the total quantity of bottoms), NAWEI, and wears of the highest-frequency items (WHFI), which include the wears of the highest-frequency tops, highest-frequency



outerwear, and highest-frequency bottoms, were collected by counting manually. For instance, when a participant wears a jacket seven times in 30 days, and this jacket is worn more frequently than any other outerwear he/she wears in this time period, the jacket is counted as 1 in TCI-1, and 7 in the outerwear of WHFI. Participants were also informed that their responses would be used in the research, and that they could withdraw their individual data from the study at any time.



**Figure 3.** Daily photograph log samples collected from participants.

### 3.1.2. Phase 2: Questionnaire Survey

Questionnaires were administered to participants after observation, with general and designated questions regarding potential factors that influence use behavior category differences. General questions included demographics (Table 1), TCI-2 (including tops, outerwear, and bottoms) for 30 days, repair experience, purchase behavior (brand preference, annual expenditure on clothing, number of new items, and purchase priorities), and disposal behavior (disposal reasons, disposal channels, and yearly disposal quantity). According to their TCI-1 results, participants were asked to count the number of unused clothing items (TCI-2), including tops, outerwear, and bottoms, for this season. Designated questions for each participant focused on the attributes of the HFWI, which included duration of use, price, brand level, clothing type, and fiber content for the three items (top, outerwear, and bottom) worn most frequently. After being informed of their HFWI derived from the observation reports, participants were asked to answer questions related to the garment attributes of the three HFWI items during the past 30 days.

As shown in Table 1, among the 60 participants, 67% were female and 33% were male; 33% were 38–47 years, 23% were 28–37 years old, 17% were 18–27 years, 15% were older than 58 years, and 12% were 48–57 years. In terms of education level, most of the participants had a bachelor's degree (42%), 31% had a master's degree or above, and the remaining 27% had a college education level or lower. In terms of income, 58% had medium-level incomes, 23% had low-level incomes, and 19% had high-level incomes.

**Table 1.** Demographics of participants.

		Count	Percent
Number of participants	N	60	100%
Gender distribution	Men	20	33%
	Women	40	67%
Age group	18–27 years	10	17%
	28–37 years	14	23%
	38–47 years	20	33%
	48–57 years	7	12%
	58 years and over	9	15%
Education status	College and below	16	27%
	Undergraduate	25	42%
	Master and above	19	31%
Income level	Low level	14	23%
	Medium level	35	58%
	High level	11	19%

### 3.2. Measurement

We developed survey items based on a literature review. The question items describing garment attributes and consumption behavior across the phases of purchase, use, and disposal were adapted from the items in the questionnaires used by Gwozdz et al. [3] and Laitala and Klepp [4]. To ensure complete understanding, all survey items were tested through a pilot study prior to implementation. As shown in Table 2, among the three consumption phases, purchase behavior was measured based on four variables (variables 1–4): brand preference, annual clothing expenditure, number of new items, and purchase priority. Disposal behavior was measured based on three variables (variables 5–7): disposal reasons, channels, and annual disposal quantity. Apart from TCI and usage frequency, use behavior focused on seven variables (variables 8–14): repair experience, TCI-2, and garment attributes of the designated clothing items (top, outerwear, and bottom of the HFWI), including duration of use, price, brand level, garment type and fiber content. We chose the HFWI to determine the relationship between high-frequency usage and garment attributes for each category. In Table 2, all the predicted variables related to clothing consumption across the three phases are listed along with their corresponding answer categories.

### 3.3. Data Analysis

The analysis was conducted using IBM SPSS Statistics, version 28, Release 28.0.0.0, 64-bit edition (Nomi, Japan). Chi-square tests, Fisher's exact tests, and variance analyses were performed. All tests of statistical significance were two-sided, and statistical significance was accepted at  $p \leq 0.05$ . Frequencies and percentages were calculated and compared using Pearson's chi-square and Fisher's exact tests for count data. The chi-square partitioning method was applied to determine the pairwise comparison of groups. One-way ANOVA with a Bonferroni correction for pairwise group comparison was used to determine the differences among categories for numerical data.

**Table 2.** Consumption phases measurements.

Phase	Variables	Answer Categories
Purchase Behavior	1. Brand preferences category	Budget brands, casual/middle brands, premium brands.
	2. Annual clothing expenditure (RMB)	2000 and below, 2001–5000, 5001–10,000, 10,001–20,000, 20,001 and above.
	3. Number of new items	5 items or fewer, 6–20 items, 21–40 items, 41 items or more.
	4. Purchase priorities	Fashionable/trendy, price, fabric quality, aesthetics (e.g., design or style), sustainable/environmentally production and brand.
Disposal Behavior	5. Disposal reasons	Wear and tear, fashion issues, poor fit, wardrobe space, others.
	6. Disposal channels	Conventional reuse and recycle channels, OCRP, throw away.
	7. Disposal quantity this year	Fewer than 10 items, 11–20 items, 21–30 items, 31 items or more.
Use Behavior with Garment Attributes of HFWI	8. Repair experience	Has repair clothing experience last 12 months (0 = no, 1 = yes).
	9. TCI-2	Varied from 4 to 62.
	10. Duration of use	Less than 1 year, 1–2 years, 2–3 years, more than 3 years.
	11. Price (RMB)	200 and below, 201–500, 501–1000, 1001–2000, 2001 and above.
	12. Brand Level	Budget brands (e.g., H&M or Uniqlo); Casual/middle brands (e.g., Levi's, MLB, or FILA); Premium brands (e.g., Louis Vuitton, Prada, or Moschino).
	13. Garment type	Top: T-shirts/polos/singlets, shirts/blouses, blazers/hoodies, others; outerwear: jackets, suits, overcoats, parkas, others; bottoms: jeans, sports/knitted trousers, formal trousers, skirt, others.
	14. Fiber content	Cotton and cotton blends, wool and wool blends, synthetics, others.

## 4. Results

### 4.1. Categorization of Clothing Consumption Behavior of Chinese Consumers

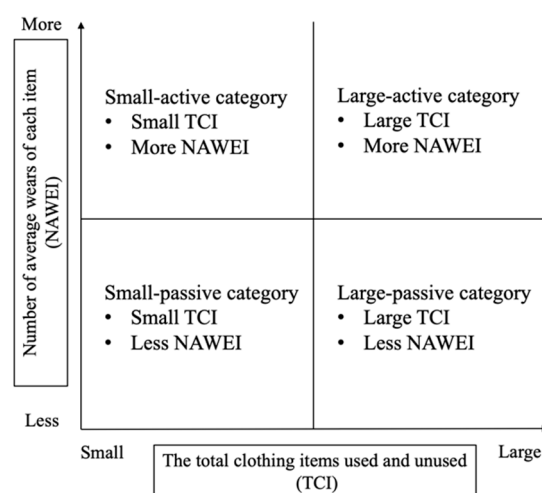
We categorized the clothing consumption behavior of Chinese consumers using a matrix based on TCI and NAWEL. Behaviors were divided into four categories: large-active, small-active, small-passive, and large-passive (see Figure 4). Participants had an average of 51.4 clothing items each (varying from 19 to 111) for the designated season, and wore items an average of 3.97 times (ranging from 1.61 to 10) in 30 days. A matrix was used to categorize sustainable clothing consumption behaviors, based on averages of two factors: TCI on the x-axes and NAWEL on the y-axes. Participants with fewer than 51.4 clothing items (varying from 19 to 50) and wearing items on average more than 3.97 times (ranging from 4.29 to 10) were categorized as small-active. Those who had fewer than 51.4 clothing items (varying from 31 to 49) and wore items on average fewer than 3.97 times (ranging from 2.5 to 3.91) were categorized as small-passive. Finally, those who had more than 51.4 clothing items (varying from 55 to 111) and wore items an average of fewer than 3.97 times (ranging from 1.61 to 3.8) were categorized as large-passive. Therefore, the behaviors of the 60 participants were categorized as small-active ( $N = 21$ ), small-passive ( $N = 15$ ), and large-passive ( $N = 24$ ); no behavior was categorized as large-active. A comparison was then made between the categories of small-active, small-passive, and large-passive based on sustainable clothing consumption behaviors across the purchase, use, and disposal phases. For instance, a comparison could be made between small-active and large-passive behaviors regarding disposal reasons and channels.

### 4.2. Factors That Influence Different Types of Consumption Behaviors

To determine whether significant relationships existed between the behavioral categories of small-active, small-passive, and large-passive, Pearson's chi-squared and Fisher's exact tests were used for count data. As shown in Table 3, the results of a Chi-square test indicated that there are significant differences between the three categories with regards to gender ( $\text{Chi}^2 = 25.714$ ;  $p < 0.001$ ), preference for budget brands ( $\text{Chi}^2 = 11.418$ ;



$p = 0.003$ ), preference for casual/middle brands ( $\text{Chi}^2 = 8.350$ ;  $p = 0.015$ ), purchasing priority for fashionable/trendy items ( $\text{Chi}^2 = 11.331$ ;  $p = 0.003$ ), psychological reasons for disposal ( $\text{Chi}^2 = 20.371$ ;  $p < 0.001$ ), conventional reuse and recycling disposal channels ( $\text{Chi}^2 = 12.702$ ;  $p = 0.002$ ), disposal channel of throwing away ( $\text{Chi}^2 = 6.724$ ;  $p = 0.035$ ), and repair experience ( $\text{Chi}^2 = 8.449$ ;  $p = 0.015$ ). The results of a Fisher's exact test indicated that there are significant differences between the three categories with regards to age ( $p = 0.012$ ), annual expenditure on clothing ( $p < 0.001$ ), volume of new clothing this year ( $p < 0.001$ ), purchase priorities for environment ( $p < 0.001$ ), disposal quantity ( $p = 0.01$ ), use duration for designated tops ( $p = 0.021$ ), use duration for designated bottoms ( $p = 0.034$ ), price for designated bottoms ( $p = 0.04$ ), and clothing type for designated bottoms ( $p = 0.008$ ). To determine the specific significant relationship between behavioral categories, a pairwise comparison of groups was performed using the chi-square partition method.



**Figure 4.** Matrix of TCI and NAWEI.

**Table 3.** Comparison of clothing consumption behavior categories for count data.

Items	Answer Categories	Categorization						Value	Sig. (2-Sided)
		Small-Active		Small-Passive		Large-Passive			
		N	%	N	%	N	%		
Gender	Female	6 <sub>a</sub>	28.6%	10 <sub>a</sub>	66.7%	24 <sub>b</sub>	100.00%	25.714	<0.001 <sup>***a</sup>
	Male	15 <sub>a</sub>	71.4%	5 <sub>a</sub>	33.3%	0 <sub>b</sub>	0.00%		
Age	18–27 years	2 <sub>a</sub>	9.5%	7 <sub>b</sub>	46.7%	1 <sub>a</sub>	4.2%	–	0.012 <sup>*b</sup>
	28–37 years	4 <sub>a</sub>	19.0%	3 <sub>a</sub>	20.0%	7 <sub>a</sub>	29.2%		
	38–47 years	5 <sub>a</sub>	23.8%	4 <sub>a</sub>	26.7%	11 <sub>a</sub>	45.8%		
	48–57 years	3 <sub>a</sub>	14.3%	1 <sub>a</sub>	6.7%	3 <sub>a</sub>	12.5%		
	58 years or over	7 <sub>a</sub>	33.4%	0 <sub>b</sub>	0.00%	2 <sub>a,b</sub>	8.3%		
Brand preference: budget brand	No	6 <sub>a,b</sub>	28.6%	1 <sub>b</sub>	6.7%	14 <sub>a</sub>	58.37%	11.418	0.003 <sup>***a</sup>
	Yes	15 <sub>a,b</sub>	71.4%	14 <sub>b</sub>	93.3%	10 <sub>a</sub>	41.7%		
Brand preference: casual/middle brand	No	12 <sub>a</sub>	57.1%	7 <sub>a,b</sub>	46.7%	4 <sub>b</sub>	16.7%	8.350	0.015 <sup>*a</sup>
	Yes	9 <sub>a</sub>	42.9%	8 <sub>a,b</sub>	53.3%	20 <sub>b</sub>	83.3%		
Annual expenditure on clothing (RMB)	2000 or below	8 <sub>a</sub>	38.1%%	0 <sub>b</sub>	0.00%	0 <sub>b</sub>	0.00%	–	<0.001 <sup>b</sup>
	2001–5000	8 <sub>a</sub>	38.1%	3 <sub>a</sub>	20.0%	3 <sub>a</sub>	12.5%		
	5001–10,000	3 <sub>a</sub>	14.3%	3 <sub>a</sub>	20.0%	5 <sub>a</sub>	20.8%		
	10,001–20,000	1 <sub>a</sub>	4.8%	9 <sub>b</sub>	60.0%	6 <sub>b</sub>	25.0%		
	20,001 or above	1 <sub>a</sub>	4.8%	0 <sub>a</sub>	0.00%	10 <sub>b</sub>	41.7%		

Table 3. Cont.

Items	Answer Categories	Categorization						Value	Sig. (2-Sided)
		Small-Active		Small-Passive		Large-Passive			
		N	%	N	%	N	%		
Number of new clothing items this year	5 items or fewer	13 <sub>a</sub>	61.9%	2 <sub>b</sub>	13.3%	1 <sub>b</sub>	4.2%	–	<0.001 <sup>b</sup>
	6–20 items	8 <sub>a,b</sub>	38.1%	9 <sub>a</sub>	60.0%	5 <sub>b</sub>	20.8%		
	21–40 items	0 <sub>a</sub>	0.00%	4 <sub>b</sub>	26.7%	12 <sub>b</sub>	50.0%		
	41 items or more	0 <sub>a</sub>	0.00%	0 <sub>a</sub>	0.00%	6 <sub>b</sub>	25.0%		
Purchase priorities: fashionable/trendy	No	17 <sub>a</sub>	81.0%	4 <sub>b</sub>	26.7%	16 <sub>a</sub>	66.7%	11.331	0.003 <sup>***a</sup>
	Yes	4 <sub>a</sub>	19.0%	11 <sub>b</sub>	73.3%	8 <sub>a</sub>	33.3%		
Disposal reasons: psychological	No	16 <sub>a</sub>	76.2%	4 <sub>b</sub>	26.7%	3 <sub>b</sub>	12.5%	20.371	<0.001 <sup>****a</sup>
	Yes	5 <sub>a</sub>	23.8%	11 <sub>b</sub>	73.3%	21 <sub>b</sub>	87.5%		
Disposal channel: conventional	No	13 <sub>a</sub>	61.9%	4 <sub>a,b</sub>	26.7%	3 <sub>b</sub>	12.5%	12.702	0.002 <sup>***a</sup>
	Yes	8 <sub>a</sub>	38.1%	11 <sub>a,b</sub>	73.3%	21 <sub>b</sub>	87.5%		
Disposal channel: throw away	No	8 <sub>a</sub>	38.1%	7 <sub>a,b</sub>	46.7%	18 <sub>b</sub>	75.0%	6.724	0.035 <sup>*a</sup>
	Yes	13 <sub>a</sub>	61.9%	8 <sub>a,b</sub>	53.3%	6 <sub>b</sub>	25.0%		
Disposal quantity	10 items or fewer	14 <sub>a</sub>	66.7%	6 <sub>a,b</sub>	40.0%	6 <sub>b</sub>	25.0%	–	0.01 <sup>b</sup>
	11–20 items	6 <sub>a</sub>	28.6%	6 <sub>a</sub>	40.0%	5 <sub>a</sub>	20.8%		
	21–30 items	1 <sub>a</sub>	4.8%	2 <sub>a</sub>	13.3%	6 <sub>a</sub>	25.0%		
	31 items or more	0 <sub>a</sub>	0.00%	1 <sub>a,b</sub>	6.7%	7 <sub>b</sub>	29.2%		
Repair experience this year	No	4 <sub>a</sub>	19.0%	10 <sub>b</sub>	66.7%	11 <sub>a,b</sub>	45.8%	8.449	0.015 <sup>*a</sup>
	Yes	17 <sub>a</sub>	81.0%	5 <sub>b</sub>	33.3%	13 <sub>a,b</sub>	54.2%		
Attributes of WHFI (tops): duration of use	Less than 1 year	2 <sub>a</sub>	9.5%	9 <sub>b</sub>	60.0%	8 <sub>a,b</sub>	33.3%	–	0.021 <sup>*b</sup>
	1–3 years	13 <sub>a</sub>	61.9%	4 <sub>a</sub>	26.7%	13 <sub>a</sub>	54.2%		
	More than 3 years	6 <sub>a</sub>	28.6%	2 <sub>a</sub>	13.3%	3 <sub>a</sub>	12.5%		
Attributes of WHFI (bottoms): duration of use	Less than 1 year	4 <sub>a</sub>	19.0%	8 <sub>a</sub>	53.3%	7 <sub>a</sub>	29.2%	–	0.034 <sup>*b</sup>
	1–3 years	6 <sub>a</sub>	28.6%	4 <sub>a</sub>	26.7%	13 <sub>a</sub>	54.2%		
	More than 3 years	11 <sub>a</sub>	52.4%	3 <sub>a,b</sub>	20.0%	4 <sub>b</sub>	16.7%		
Attributes of WHFI (bottoms): price (RMB)	200 and below	8 <sub>a</sub>	38.1%	5 <sub>a</sub>	33.3%	1 <sub>b</sub>	4.1%	–	0.04 <sup>*b</sup>
	201–500	10 <sub>a</sub>	47.6%	6 <sub>a</sub>	40.0%	18 <sub>a</sub>	75.0%		
	501–1000	1 <sub>a</sub>	4.8%	3 <sub>a</sub>	20.0%	3 <sub>a</sub>	12.5%		
	1001–2000	1 <sub>a</sub>	4.8%	0 <sub>a</sub>	0.00%	0 <sub>a</sub>	0.00%		
	2001 and above	1 <sub>a</sub>	4.8%	1 <sub>a</sub>	6.7%	2 <sub>a</sub>	8.3%		
Attributes of WHFI (bottoms): clothing type	Jeans	4 <sub>a</sub>	19.0%	6 <sub>a,b</sub>	40.0%	15 <sub>b</sub>	62.5%	–	0.008 <sup>**b</sup>
	Sports/knitted trousers	11 <sub>a</sub>	52.3%	6 <sub>a,b</sub>	40.0%	3 <sub>b</sub>	12.5%		
	Skirt	0 <sub>a</sub>	0.00%	0 <sub>a</sub>	0.00%	3 <sub>a</sub>	12.5%		
	Other trousers	6 <sub>a</sub>	28.6%	3 <sub>a</sub>	20.0%	3 <sub>a</sub>	12.5%		

Each subscript letter denotes a subset of group categories whose column proportions do not differ significantly from each other at the level of 0.05. \*  $p < 0.050$ , \*\*  $p < 0.010$ , \*\*\*  $p < 0.001$ . <sup>a</sup> Pearson chi-square; <sup>b</sup> Fisher exact test.

#### 4.2.1. Demographics

As for gender, the proportion of female participants was significantly higher in the large–passive category (CL-P) (100%) than in small–passive (CS-P) (66.7%) and small–active (CS-A) (28.8%), while the proportion of male participants in CS-A (71.4%) and CS-P (33.3%) was significantly higher than that in CL-P (0%) (Table 3). This indicates that female participants contributed more to large TCI and passive usage frequency, whereas male participants contributed more to small TCI and active usage frequency.

Among the behavioral categories, age is a significant predictor. A significant difference was found in the age range of 18–27 years. A higher proportion of young consumers in CS-P (46.7%) than in CS-A (9.5%) and CL-P (4.2%) indicates that young consumers contributed more to small TCI and passive usage frequency. A significant difference was also found in the age range of 58 years and over, with a higher proportion of older consumers in CS-A

(33.4%) than in CL-P (8.3%) and CS-P (0.00%), indicating that older consumers contributed more to small TCI and active usage frequency.

#### 4.2.2. Purchase Behavior

The difference in budget brand preference among the three categories was significant. The proportion of consumers who preferred budget brands in the CS-P (93.3%) and CS-A (71.4%) was significantly higher than that in CL-P (41.7%) (Table 3). Meanwhile, the difference in the preference for casual/middle brands among the three behavioral categories was significant. The proportion of consumers who preferred casual/middle brands in CL-P (83.3%) was significantly higher than in CS-P (53.3%) and CS-A (42.9%).

When it comes to annual expenditure on clothing, the proportion of participants with a price range of RMB 2000 and below in CS-A (38.1%) was significantly higher than that in CS-P (0.0%) and CL-P (0.0%). The proportion of participants with a price range of RMB 10,001–20,000 in CS-A (4.8%) was significantly lower than that in CS-P (60.0%) and CL-P (25.0%). The proportion of participants with a price range of RMB 20,001 or above in the CL-P group (41.7%) was significantly higher than that in the CSA (4.8%) and CS-P (0.0%) groups. The results indicate that CL-P contributes more to expenditure on clothing, CS-P contributes more to expenditure on clothing, and CS-A contributes less to expenditure on clothing.

New items this year differed significantly between categories. The proportion of participants with fewer than five new items in CS-A (61.9%) was significantly higher than that in CS-P (13.3%) and CL-P (4.2%); the proportion of participants with 6–20 new items in CS-P (60.0%) was significantly higher than that in CS-A (38.1%) and CL-P (20.8%); the proportion of participants with 21–40 new items in CL-P (50.67%) and in CS-P (25%) was significantly higher than that in CS-A (0.00%); and the proportion of participants with 41 or more new items in CL-P (25.0%) was significantly higher than that in CS-P (0.0%) and CS-A (0.0%). The results indicate that CL-P contributes more to a large clothing inflow, CS-P contributes moderately to a large clothing inflow, and CS-A contributes less to a large clothing inflow.

The purchase priorities of fashionable/trendy items differ significantly. The proportion of participants considering fashionable/trendy items when purchasing in CS-P (73.3%) was significantly higher than that in CL-P (33.3%) and CS-A (19.0%), indicating that fashionable/trendy items are more important to CS-P consumers.

#### 4.2.3. Disposal Behavior

As shown in Table 3, there was a significant difference in psychological reasons for disposal between the categories: CL-P (87.5%) and CS-P participants (73.3%) disposed of items for psychological reasons significantly more than CS-A participants (23.8%).

In terms of the conventional channels of reuse and recycling, disposal channels differ significantly between the categories. Participants who disposed of items through the conventional channels of reuse and recycling were significantly higher in CL-P (87.5%) and CS-P (73.4%) compared to CS-A participants (38.1%), indicating that CL-P and CS-P contributed more to conventional sustainable disposal. Meanwhile, CS-A (61.9%) contributed more to the channel of throwing away, followed by CS-P (53.3%) and CL-P (25.0%).

There was a significant difference in the proportion of participants disposing of fewer than 10 items: CS-A had the highest proportion (66.7%), followed by CS-P (40.0%) and CS-A (25.0%). Meanwhile, the proportion of participants disposing of more than 31 items in CL-P (29.2%) was significantly higher than in CS-P (6.7%) and CS-A (0.00%). The results indicate that CL-P contributed more to the disposal quantity, followed by CS-P, and last by CS-A.

#### 4.2.4. Use Behavior

As shown in Table 3, repair experience this year among behavior categories is a significant predictor. CS-A participants (81.0%) had significantly more repair experience

than CL-P (54.2%) and CS-P participants (33.3%), while CL-P participants had significantly more repair experience than CS-P participants. This indicates that participants from CS-A were most likely to extend their clothing's lifespan through repair, followed by those from CL-P, and CS-A were the least likely to extend their clothing lifespan through repair.

In terms of WHFI attributes, there were significant differences between categories regarding use duration for designated tops and bottoms, as well as price and clothing type for designated bottoms. CS-P participants (60%) used designated tops purchased less than one year ago at a rate significantly higher than that of CL-P participants (33.3%) and CS-A participants (9.5%). In CS-A (52.4%), the proportion of participants wearing long-duration bottoms was significantly higher than that in CS-P (20.0%) and CL-P (16.7%), indicating that CS-A was more likely to wear long-duration bottoms frequently. The proportion of participants wearing designated bottoms at prices below 200 RMB in CS-A (38.1%) and CS-P (33.3%) was significantly higher than that in CS-P (4.1%), indicating that participants in CS-A and CS-P were more likely to wear low-cost bottoms. CL-P (62.5%) had a significantly higher proportion of participants wearing the designated bottoms of jeans than CS-P (40.0%) and CS-A (19.0%), and CS-P was also higher than CS-A. Sports and knitted trousers were used by more participants in CS-A (52.3%) than in CS-P (40.0%) or CL-P (12.5%).

We carried out a one-way ANOVA, followed by pairwise comparisons using the Bonferroni test to determine the significant relationship in terms of TCI-2 between behavior categories. As shown in Table 4, significant differences were found between the behavioral categories in terms of TCI-2 ( $F = 19.599$ ,  $p < 0.001$ ). There was a significant contribution of CL-P (Mean = 35.71; SD = 15.71) to TCI-2 compared with CS-A (Mean = 20.24; SD = 10.27) and CS-P (Mean = 12.53; SD = 4.44), respectively. This suggests that CL-P participants owned more TCI-2s.

**Table 4.** Comparison of clothing consumption behavior categories in terms of TCI-2.

Categories	N	TCI-2 Mean $\pm$ SD	p
Small-active	21	20.24 $\pm$ 10.27	<0.001
Small-passive	15	12.53 $\pm$ 4.44	
Large-passive	24	35.71 $\pm$ 15.71 *#	

\* Compared with small-active, the difference was statistically significant; # Compared with small-passive, the difference was statistically significant.

## 5. Discussion

To propose a successful behavioral change intervention for clothing consumption towards environmental sustainability, it is crucial to understand current consumption behavior and the factors influencing them. By categorizing the actual clothing consumption behavior over the phases of purchase, use, and disposal, this study identifies factors affecting sustainable clothing consumption and issues that need to be addressed within each category, as discussed in the following.

### 5.1. Categorization of Clothing Consumption Behavior of Chinese Consumers

Based on the averages of TCI and NAWEL, the behaviors of the 60 participants were categorized as small-active, small-passive, or large-passive. Despite both CS-A and CS-P having a small amount of TCI, their NAWELs differed. This indicates that CS-A wore certain clothing items frequently and kept a few TCI-2. However, frequent and long-term use could result in clothing damage, indicating the need for clothing repair and maintenance for CS-A [42]. Compared to CS-A, CS-P used more of their clothing items and kept fewer TCI-2. As for CL-P, a large number of TCI were owned and clothing items were infrequently worn. CL-P also owned significantly more TCI-2 than CS-A and CS-P based on the results of the one-way ANOVA (Table 4). According to these findings, CL-P own significantly more clothing items than necessary, indicating that a large number of clothes may need

to be disposed of by this category composed of female participants. This is consistent with Zhang et al. [37], who found that women tend to dispose of more clothing items than men. In addition, no behaviors were categorized as large-active, which could be interpreted as the study excluding populations, such as women over 70, who may have accumulated a large number of clothing items but only wear a few items frequently due to less participation in social activities.

### 5.2. Purchase Phase

For the purchase phase, we measured brand preferences, clothing expenditures, number of new clothing items, and purchase priorities to determine whether the behavior categories followed sustainable clothing purchase behaviors, such as buying high-quality clothing and restricting clothing purchases [25].

In CS-A, a behavior category dominated by men and the elderly, budget brands tend to be purchased with lower annual clothing expenditures, and fewer new items purchased this year. The CS-P is mainly composed of young people who typically purchase budget brands and casual/middle brands, with medium clothing expenditure, relatively more new items purchased this year, and priority given to fashionable/trendy purchases. The CL-P is mainly composed of middle-aged females who typically purchase casual/middle brands with higher annual clothing expenditures and more new items purchased this year. This is consistent with the findings of Gupta and Gentry [43], that women were more eager to consume clothing associated with femininity. A possible explanation for this is that women require more items for a variety of clothing combinations, which would inevitably produce waste. These findings also support those of Rahman et al. [35], who noted that men were more concerned with functional benefits, corresponding to the attributes of performance and utilitarianism; thus, highly efficient clothing use behaviors were performed. Possibly, as age affects the difference between behavior categories, this could be explained by the fact that young Chinese consumers tend to spend more on consumer products than previous generations [35]. Rather than being concerned with the visual attributes of clothing, older consumers tend to be concerned with the performance attributes of clothing [36]. Moreover, as they are less likely to participate in social activities, which leads to owning fewer clothing items. In terms of brand preference, the results support those of Gwozdz et al. [3], who found that consumers in a segment with low consumption tended to buy clothing items from budget brands, whereas consumers in a segment with medium and high consumption purchased clothing from casual/middle and premium brands. When it comes to clothing quality, CL-P demonstrates sustainable characteristics in the purchase of better-quality clothing despite its high TCI and passive NAWEL, while CS-A and CS-P demonstrate unsustainable traits in the purchase of lower-quality clothing despite their small TCIs. The annual clothing expenditure and number of new items show that the inflow of clothing items is in line with the TCI of CS-A and CL-P. Fashionable/trendy appears to be a high priority in CS-P, supporting the findings of Litala and Klepp [4] that fashion-conscious consumers are strongly associated with passive clothing use. However, a small TCI appears to contradict the relatively large clothing inflow shown by CS-P. This could be explained by young consumers purchasing large numbers of clothing items and being a primary group consuming fast fashion [35,44], despite having smaller TCIs than previous generations. CS-P's pursuit of fashion and low-frequency wearing also demonstrates the demand for short-term clothing ownership, such as experiential and innovative approaches (renting and swapping) [45]. Therefore, the issues to be addressed regarding categorization toward the purchase phase are improving the quality of clothing purchased for CS-A, improving the quality of clothing purchased and reducing the inflow of clothing items for CS-P, and reducing the inflow of clothing items for CL-P.

### 5.3. Use Phase

For the use phase, we measured TCI-2, repair experience, and WHFI attributes to determine whether the behavior categories followed sustainable clothing use behaviors,



such as limiting the total number of clothing items, improving their usage frequency, and prolonging the clothing use period [25].

CS-A has fewer TCI-2 and more experience repairing clothing, their clothing is frequently worn, and they prefer long-life, low-priced bottoms, mostly sports/knitted trousers. CS-P has fewer TCI-2 and less experience repairing clothing, their clothing items are infrequently worn, and they prefer short-duration tops, long-duration bottoms, and low-priced bottoms, mostly jeans and sports/knitted trousers. CL-P has large TCI-2 and relatively more experience repairing clothing, wear clothing infrequently, and prefer short-lived tops. As shown in the findings, TCI-2 is in line with the TCI; namely, the participants in the category own a large number of TCI and also a large number of unused items. Surprisingly, TCI-2 ( $N = 1470$ ) accounted for almost half of the TCI ( $N = 3084$ ), and CL-P contributed more to TCI-2 ( $N = 857$ ). This finding supports that of Fletcher [5], who found that a large number of purchases led to increased clothing ownership and storage. In terms of usage frequency, CS-P and CL-P exhibit lower wearing frequency, which also affects the lifespan of the clothing [4]. Regarding the repair experience, CS-A demonstrated sustainable performance, which could prolong the clothing use period, followed by CL-P. This supports the findings by Laitala and Klepp [46] and Gwilt [47] that repairs are more frequent among older consumers with more skills. CL-P participants preferred non-budget brands and spent more on clothing, which is consistent with Degenstein et al. [39], who found that participants' willingness to engage in repair is influenced by the initial cost of the garment. As for the attributes of the WHFI, even though the outerwear attributes do not exhibit significant differences, some attributes of the bottoms and tops can be used to determine the use habits of each category. Participants in CS-A can frequently wear bottoms that last more than three years, followed by those in CS-P, which shows their potential to prolong the life of bottoms and use them frequently. Participants in the CS-P wore tops for a shorter duration (less than one year), which aligns with the category's value for fashionable/trendy use. CS-A and CS-P prefer low-priced bottoms and primarily sports/knitted trousers, which is consistent with their preference for budget brands. In addition, participants in the CL-P group preferred jeans as their most frequently worn bottoms, followed by the CS-P group. However, most jeans have high environmental impacts during the production process of dyeing and washing as well as during the maintenance phase, although some brands adopt sustainable production methods [48]. Therefore, the following issues need to be addressed regarding the categorization toward the use phase: reducing the TCI-2 for CL-P; improving the frequency of usage for CS-P and CL-P; improving clothing repair capability and awareness for CS-P; and optimizing the choice of jeans brands or providing alternatives for CL-P and CS-P.

#### 5.4. Disposal Phase

For the disposal phase, we measured disposal reasons, disposal channels, and disposal quantity to determine whether the behavior categories followed sustainable clothing disposal behaviors, such as disposing of clothing items in a manner that limits the amount of waste entering landfill [25].

Notably, the OCRP has emerged in China in recent years as one of the most promising clothing recycling platforms, providing online booking and free offline pickup services [37]. However, only four participants selected this channel; the Fisher's exact test results were not significant ( $p = 0.056$ ), indicating that it has not been widely accepted by consumers. Interestingly, all four participants were from CL-P, which indicates that CL-P, unlike other categories, has the potential to use OCRP disposal channels in addition to the conventional channels of reuse and recycling.

CS-A disposes of fewer items each year, using conventional and online sustainable disposal channels less, and throws away unwanted clothing items more. CS-P disposes of clothing items for psychological reasons, using conventional disposal channels of reuse/recycling, throwing away unwanted clothing items relatively more, and disposing of medium amounts each year. CL-P disposes of clothing items for psychological

reasons, using conventional disposal channels of reuse/recycling, and disposing of clothing items in large numbers each year. These findings are consistent with those of previous studies [9,37], which found that women are fashion-oriented, making them dispose of clothing items more frequently than men. While CL-P disposal quantities are large, according to the large number of TCI-2s they own, they still have many clothes to dispose of. Psychology is a common reason for discarding clothes, including fashion and boredom concerns [17,49,50]. The CS-P and CL-P selected psychological reasons that were in line with their fashion and variable-style pursuit characteristics. In terms of disposal channels, both CL-P and CS-P indicate better performance when using conventional reuse or recycling channels, which can prolong the lifespan of unwanted clothing with psychological disposal reasons. In contrast, CS-A performs poorly when picking the reuse and recycling channels instead of opting for the throwing away channel, indicating that they may face difficulties in disposing of unwanted clothing owing to physical issues, and given their capacity to use clothing for an extended lifespan. Meanwhile, the fact that CS-P also contributes more to the throw-away channel suggests that they may encounter difficulties in disposing of unwanted fast fashion items. Therefore, the issues to be addressed in the disposal phase include improving the disposal channel of OCRP for all three categories, improving the disposal quantity of TCI-2 (outflow of clothing items) for CL-P, and enhancing the awareness and capability of clothing reuse and recycling for CS-A and CS-P.

## 6. Conclusions

While based on a small sample size of the Chinese population, this study describes consumers' actual clothing consumption behaviors during a designated time period through observation of daily photograph logs. It reveals details about variations in clothing consumption behavior among three behavior types by considering the total number of clothing items (used and unused) and the usage frequency for tops, outerwear, and bottoms. The factors for sustainable clothing consumption behavior across the purchase, use, and disposal phases were examined between behavior categories. The results show that gender, age, brand preference, annual expenditure on clothing, number of new clothing items, purchase priorities, disposal reason, disposal channels, disposal quantity, repair experience this year, duration of use, price, and clothing type are factors that influence the different consumption behaviors of Chinese consumers. As a result of behavior categorization towards environmental sustainability, the following issues need to be addressed: (1) For CS-A, improving the quality of purchased clothing, promoting the usage of the disposal channel OCRP and enhancing clothing reuse and recycling capacity and awareness; (2) For CS-P, improving the quality of purchase clothing, reducing the inflow of clothing items, improving the usage frequency, improving the capability and awareness of clothing repairing, optimizing the choice of jeans brands or providing alternative bottoms, promoting the usage of the OCRP, and enhancing awareness and capability of clothing reuse and recycling; (3) For CL-P, reducing the inflow of clothing items, reducing the quantity of unused clothing items, improving the usage frequency, optimizing the choice of jeans brands or providing alternatives, promoting the usage of the OCRP, and improving the disposal quantity of TCI-2. These insights can benefit designers, educators, and policy makers regarding variations in clothing consumption, as well as provide a basis for developing behavioral change interventions.

Our research also provides recommendations for stakeholders in the clothing industry. Retailers may need to collaborate with manufacturers and recyclers to develop a long-term relationship with consumers, and provide a variety of services tailored to different consumer segments. Repair and maintenance services are suitable for CS-A, rental and swapping services are suitable for CS-P, and take-back services are suitable for CL-P. For manufacturers, producing higher-quality clothing items will facilitate long-term use or reuse patterns. In addition, this study provides consumers with a better understanding of how they can develop sustainable clothing consumption behavior.

Despite its contributions, this study has several limitations. First, the data were collected in China's Liaoning province, and are subject to local cultural values and norms; therefore, they may not be representative of all Chinese consumers. Second, although the observational method allowed us to investigate actual consumption behavior and understand variations in clothing consumption behavior, the small sample size may have limited the statistical power and generalizability of the findings. Large sample sizes are required to accurately identify potential behavioral differences. Further research should propose clothing consumption behavior change interventions for each category, based on issues affecting the environment.

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