A Study on the Influencing Factors of Electronic Product Recycling Behavior among College Students: A Case Study of Universities in Nanchang City

Xu Pan

1398513612@qq.com

School of Management, Shanghai University, Shanghai, China

Abstract: With the development of science and technology, the replacement speed of electronic products is accelerated, and the waste electronic products are increasing. It is of great significance to study how to improve the recycling behavior of college students' electronic products. This paper establishes a recycling behavior model based on the relevant theories of planned behavior theory, and analyzes five dimensions, including recycling channels of external factors and four internal factors, self-efficacy, perceived behavior control, subjective norms and behavior attitude, to determine the influence of different factors on their behaviors. The results show that the proportion of factors affecting recycling channels is the largest, followed by self-efficacy. College students' recycling willingness is still relatively high, but they do not know much about channels.

Keywords: Electronic products; Recycling; Recycling behavior model; Behavioral intention.

1 Introduction

With the rapid development of economy and science and technology in our country, and the continuous improvement of people's quality of life and consumption level, electronic products have become necessities in the daily life of college students. The variety and quantity of electronic products are increasing, and the speed of their renewal and replacement is also accelerating, resulting in an increasing number of waste electronic products [1].

China's waste electronic products recycling industry started from the middle and late 1980s, this period, the national laws and regulations and related management systems are in a state of lack, can not fundamentally solve the problem of environmental pollution caused by waste electronic products. In 2009, the state issued relevant regulations on the recycling and utilization of electronic products, including the multi-channel recycling system, centralized processing system, fund subsidies and other related systems. The issuance of this regulation has become a milestone in the research and legislation on the recycling and utilization of electronic products in China [2]. The new coronavirus epidemic has caused the global industrial chain to be more urgent, and in 2021, China has lowered the fund subsidy standard for the recycling of electronic products, which has faced new challenges for the development of the industry. However, the publicity of government departments is weak, and minority groups have never known about recycling. Most groups have theoretical cognition and relevant

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environmental awareness, but have not taken practical actions, resulting in a low utilization rate of recycling [3]. Research on the recycling, treatment and reuse technology of waste electronic products has become one of the topics of common research at home and abroad.

Senawi Nur Hidayah explored the impact on e-waste recycling through five attributes, namely, convenience of e-waste recycling infrastructure and services, e-waste recycling information, e-waste recycling incentives, e-waste recycling reminders and e-waste recycling infrastructure and services [4].

Mohamad Nur Shafeera found that ethical obligations were the most important factor influencing companies' willingness to recycle e-waste, followed by perceived convenience. It was also found that the lower/secondary education group was more likely to be affected by the implementation of e-waste recycling than the higher education group [5].

Yadav Rambalak uses the theoretical perspective of Behavioral reasoning Theory (BRT) to investigate individual attitudes and intentions. Moral and social norms have a certain impact on individual rationality and attitudes towards e-waste recycling. Self-efficacy plays a moderating role among reasoning, attitude and intention [6].

Liu Xinmin constructed a tripartite Itô stochastic evolutionary game model to perform analysis of the complex game interaction between national government, local government and recyclers. The three parties working together can significantly improve the quality of e-waste recycling [7].

Wang Zhen constructed a system dynamics model, studied the Chinese government's intervention measures on e-waste recycling from a holistic perspective, and found that the most effective adjustment strategy is to increase the government's policy support while increasing the punishment for recyclers. Simply increasing subsidy support will not work [8].

Liu Kang discusses the current situation of e-waste recycling from a global perspective. The existence of illicit trade and "informal" recycling has exacerbated the global recycling of e-waste. Advocates for the sustainable recycling of e-waste worldwide through regional cooperation, legislative regulation, technology development and eco-friendly design [9].

To sum up, college students are a major group in the current electronic products and second-hand consumer market. College students have a high demand for electronic products, and their replacement speed is faster. Through questionnaire survey, this paper studied the recycling behavior of electronic products of college students in Nanchang city to understand their attitude and willingness, explored the key factors affecting the recycling behavior of electronic products of college students, and found out targeted behavioral promotion measures through investigation and analysis, so as to provide suggestions for improving waste utilization rate and reducing environmental pollution.

2 Theoretical basis and model

2.1 Theory of reasoned action

The Theory of Reasoned Action (TRA) [10], also known as the "rational action theory", was proposed by American scholars Fishbein and Ajzen in 1975. The theory holds that individuals'

behaviors can be reasonably inferred from their behavioral intentions. However, individual behavioral intention is also affected by behavioral attitudes and subjective criteria. This theory is mainly used to analyze how attitudes consciously affect individual behaviors. People have attitudes according to their own cognition.

2.2 Theory of reasoned action

The theory of planned behavior was proposed by Icek Ajzen based on the theory of rational behavior. In his research, Ajzen found that human behavior is not 100% voluntary, but mostly controlled. He added a new concept of "behavioral control cognition" to the content of TRA, which developed into a new behavioral theory research model -- Planned behavior theory (TPB) [11]. The five elements of Ajzen's planned behavior theory are attitude, subjective norm, perceived behavior control, behavior intention, and behavior.

2.3 Recycling behavior model

Based on rational behavior theory, planned behavior theory and other theories, a recycling behavior model is built according to the influencing factors of behavior, as shown in Figure 1.

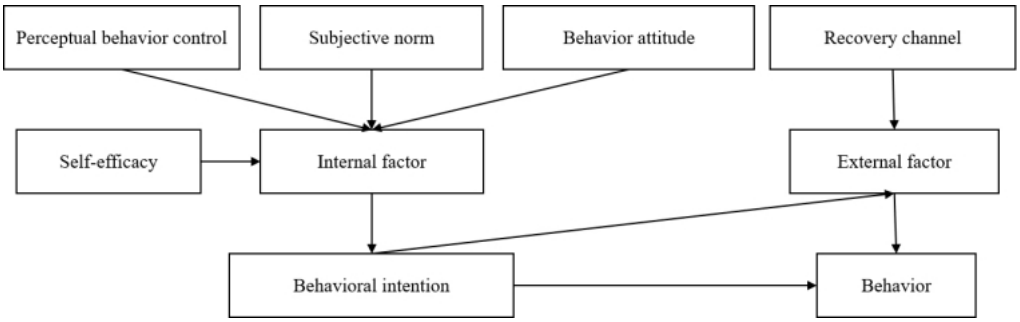

Figure 1. Recycling behavior model.

It can be seen from the recycling behavior model that individuals' behavioral willingness is affected by some internal factors, mainly their own attitudes, subjective norms, perceived behavioral control and some personal factors that affect individuals' behavioral willingness to do certain behaviors [12]. From the internal factors, we can find the attitude and view of college students towards electronic product recycling, which promotes their behavioral willingness to recycle. After the behavior intention is established, the individual is unwilling to become the behavior due to his own inertia or some factors. We need to actively and correctly guide college students to transform this willingness into actual behavior through external factors.

3 Research method

3.1 Questionnaire design

In this paper, a 5-level Likert scale was used to measure variables such as influencing factors, recycling channels, self-efficacy, perceived behavioral control, subjective norms and behavioral attitudes. There are 6 basic control variables in the questionnaire. External factor

recycling channels mainly refer to the measurement scale of the following scholars [13]. Internal factors Self-efficacy, perceived behavioral control, subjective norms and behavioral attitudes refer to the following scholars' measurement scales [14,15].

3.2 Sample selection

The form of the questionnaire is mainly a combination of online and offline, the object of this questionnaire is most of the university students in Nanchang. A total of 314 questionnaires were issued, 303 questionnaires were recovered, and 300 valid questionnaires were recovered except for invalid questionnaires and missing questionnaires.Table 1 lists the distribution of sample characteristics. It can be seen from Table 1 that the structure of gender, grade, major and living expenses of the respondents is reasonable and in line with the actual situation.

Table 1. Sample characteristics.

	Options	scale（%）
sex	male	86.33
	female	13.67
grade	freshman	22
	Sophomore year	32
	junior	22
	senior	19.67
	Graduate student	4.33
profession	Science and engineering	25.33
	Economics and management	26
	Literature and history	22.67
	Foreign language	11.67
	arts	8.67
	sports	5.67
	other	0
Disposable amount	Below 1000	23
	1000-2000	41
	2000-3000	22.67
	More than 3000	13.33
Knowledge of recycling of electronic products	Don't know much about	21.67
	Basic understanding	37
	Better understand	24.67
	Know very well	16.67
Disposal of waste electronic products	Give away	22.67
	Recovery mechanism	34.67
	Storage idle	23.33
	Direct discard	19.33

4 Statistical analysis

4.1 Questionnaire reliability and validity analysis

The reliability of each variable is shown in Table 2. The reliability of the variables reflects the consistency and stability of the questionnaire test results. In this study, Cronbach α coefficient greater than 0.7 was used as the evaluation criterion for questionnaire reliability, and the reliability of the questionnaire met the design requirements.

Table 2. Reliability analysis results of each scale.

variable	Item	Cronbach's α
Recovery channel	5	0.895
self-efficacy	5	0.892
Perceptual behavior control	5	0.913
Subjective norm	4	0.865
Behavior attitude	5	0.906

In this paper, validity analysis is carried out from the aspect of structural validity, and exploratory factor analysis is carried out by SPSS software for validity measurement. If Barth spherical test is used, we need to judge according to the size of the P-value, and if it is less than 0.05, exploratory factor analysis can be used.The KOM value of the output was 0.911 > 0.6, and the significant P-value was 0 < 0.05 according to Bartlett sphericity test. The validity analysis of the questionnaire was good, and exploratory factor analysis could be conducted.The results of validity analysis are shown in Table 3.

Table 3. Validity analysis results of each scale.

KMO		0.911
Bartlett sphericity test	Approximate chi-square	4437.712
	Degree of freedom	276
	significance	0.000

4.2 Exploratory factor analysis

1) Common factor extraction

Table 4. Analysis of influencing factors of recycling behavior of electronic products.

item	Variance contribution value	Cumulative percentage	Factor loading
Q7	15.566	15.566	0.800
Q8			0.821
Q9			0.757
Q10			0.779
Q11			0.811

item	Variance contribution value	Cumulative percentage	Factor loading
Q12	15.238	30.804	0.788
Q13			0.800
Q14			0.799
Q15			0.792
Q16			0.804
Q17	14.736	45.539	0.850
Q18			0.829
Q19			0.816
Q20			0.816
Q21			0.815
Q22	14.624	60.164	0.839
Q23			0.769
Q24			0.841
Q25			0.802
Q26			0.820
Q27	12.021	72.185	0.821
Q28			0.782
Q29			0.801
Q30			0.843

The data in Table 4 reveals that the cumulative variance of the five influencing factors accounts for a significant explanatory value of 72.185%. These factors provide a reasonable interpretation of the information contained in the original variables. Furthermore, after factor rotation, each factor exhibits a variance explanation rate exceeding 10%, indicating successful exploratory analysis of the questionnaire's five influential factors.

Factor load is the correlation coefficient between variable and common factor. It can be seen from Table 4 that factor loads are all greater than 0.6, indicating a strong correlation.

2) Factor score and weight analysis

To measure the behavioral impact score and total score of five dimensions influencing factors of electronic product recycling behavior of Nanchang University students. The factor score expression is obtained according to the factor score coefficient matrix (1).

$$F1=0.088Q7+0.195Q8+0.228Q9+0.186Q10+0.106Q11+0.108Q12+0.128Q13+0.053Q14+0.167Q15+0.134Q16+0.85Q17+0.829Q18+0.816Q19+0.816Q20+0.815Q21+0.08Q22+0.125Q23+0.053Q24+0.085Q25+0.07Q26+0.099Q27+0.177Q28+0.113Q29+0.141Q30 \quad (1)$$

In the formula, Q7, Q8... Q30 is the average satisfaction of the original scale data. Similarly, the factor expressions of F2, F3, F4 and F5 can be obtained, and the scores of each common factor can be calculated accordingly. The calculation results are as follows: Recycling channel F1=5.221, self-efficacy F2=5.170, perceived behavior control F3=5.070, subjective norm F4=4.950, behavior attitude F5=3.353. The weight of factor scores is shown in Table 5.

According to formula (2):

$$F=\sum_{i=1}^{n} w_i F_i \tag{2}$$

Wi is the proportion of the variance contribution rate of the i-th factor to the cumulative variance contribution rate of the i-th factor, and Fi is the score of the i-th factor, where i=1, 2, 3, 4, 5. From this, it can be concluded that the impact score of electronic product recycling behavior among college students in Nanchang City is F=4.753, indicating a relatively high overall behavioral impact.

Table 5. Factor score and weight.

variable	Factor score		Weight(%)
Recovery channel F1	5.221		21.97
self-efficacy F2	5.170		21.75
Perceptual behavior control F3	5.070	4.753	21.34
Subjective norm F4	4.950		20.83
Behavior attitude F5	3.353		14.11

Through factor score analysis, the proportion of the influence of five dimensions on behavior is calculated, and it can be concluded that the proportion of recycling channels is the highest, which tells us that the selection of recycling channels is very important, and it is necessary to consider whether it is convenient and preferential.

5 Conclusion and discussion

Through questionnaire survey and analysis, the following conclusions are drawn:

Among the five dimensions of electronic products recycling, the recycling channel accounted for 21.97%, followed by self-efficacy, perceived behavioral control, subjective norms and behavioral attitudes.

Among the external factors, the impact of recycling channels is the most significant. College students' choice of resource recycling channel has great influence on their behavior. Students often face uncertainty about the location of transactions and the security and reliability of those transactions. Therefore, national and local governments must implement strict control measures for recyclers while formulating relevant reward and punishment mechanisms.

Among the internal factors, self-efficacy holds the greatest influence, followed by perceived behavioral control, subjective norms, and behavioral attitudes. Self-efficacy is primarily discussed from the perspective of purchasing behavior when considering second-hand electronic products as a college student. Factors such as product functionality, cost-effectiveness, and after-sales services play crucial roles in determining whether consumers are willing to engage in recycling behaviors.

Therefore, we need to improve the behavioral willingness of college students to recycle electronic products. In the process of transforming to behavior, it is necessary to improve the convenience of recycling channels, the government actively guides and encourages recycling behaviors, and strengthens the supervision mechanism of recyclers, so as to better improve the behavioral willingness of recycling, so as to promote the environmental health protection of Nanchang city and reduce the pollution rate of garbage.

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