福建省中电海峡智能装备研究院
Fujian Zhongdian Straits Institute of Intelligent Equipment
Asia Pacific Science Press
Advances in Management and Intelligent Technologies
ISSN(O):3079-5869
ISSN(P):3079-5850
Vol. 2 No.5 (2026)

From Campus Carbon Points to Carbon Inclusion for All: Insights into Incentive Mechanisms for Second-Hand Trading in Promoting the Circular Economy—A Survey of AP High School Students

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Abstract: Establishing a waste recycling system is an important component of China's dual-carbon goals, and second-hand trading is one of the links closest to daily life. Teenagers are both a major source of idle items and a key group for cultivating green consumption habits; however, empirical research on incentive mechanisms for campus second-hand trading remains limited. A questionnaire survey was conducted among students at an AP international high school, yielding 48 valid responses (items 8–10 were based on 46 responses collected at an earlier stage). The results show that: (1) the average annual spending on school supplies was about CNY 1,536 per capita and the original value of idle items was about CNY 784 per capita, yet 87.5% of the respondents left idle items "gathering dust at home" and only 12.5% had ever sold items through off-campus platforms, indicating a low-circulation path of "idling–discarding" that causes significant waste; (2) the mean willingness to sell was 3.63, with 47.9% of respondents showing strong willingness (a score of 4 or above), whereas the mean willingness to buy was only 2.96, revealing a marked supply–demand asymmetry; (3) the main barriers on the selling side were transaction costs ("too troublesome" 68.75%, "unsure how to price" 39.58%), while those on the buying side concerned quality and trust ("worry about outdated editions or broken calculators" 52.17%, "dislike of items used by others" 45.65%); and (4) regarding incentive preferences, "quick cash-out" (65.22%) and "unified platform collection and resale" (63.04%) were the most attractive options, whereas "campus carbon points/service hours" was less attractive on its own (21.74%) but showed considerable potential once linked to institutional resources. Accordingly, a "campus carbon points–service-hours accreditation" incentive mechanism is designed, and a three-level pathway of "campus–region–society" for promoting carbon inclusion is proposed, providing a reference for extending the circular economy from campus to society.

Keywords: Campus Idle Items; Second-Hand Trading; Carbon Inclusion; Carbon Points; Incentive Mechanism; Circular Economy; AP School
Published: Oct 14, 2026
DOI: https://doi.org/https://doi.org/10.62177/aper.v2i5.1743

1. Introduction

Against the backdrop of China's dual-carbon goals, developing the circular economy has become a national priority. In 2024, the General Office of the State Council issued the Opinions on Accelerating the Establishment of a Waste Recycling System,

explicitly calling for the standardized development of second-hand commodity markets and for diversifying second-hand trading channels [1]. In the same year, the State Council issued the Action Plan for Energy Conservation and Carbon Reduction (2024–2025), and fourteen departments led by the Ministry of Commerce launched the trade-in programme for consumer goods [2, 3]; as an important form of green consumption, second-hand trading has received sustained policy support [7]. Second-hand trading carries the dual value of resource recycling and carbon emission reduction—it is estimated that trading one idle mobile phone can achieve a carbon emission reduction of about 50.6 kg [6]—making it one of the links in the circular economy that is closest to everyday life. However, compared with policy momentum, actual participation by micro-level actors remains limited, and the phenomenon of "unwilling to sell, afraid to buy" is widespread.

Campus provides a unique window on this problem. International high school students use large quantities of cyclically replaced items—standardized examination textbooks (AP/IB/A-Level/SAT/TOEFL), graphing calculators, performance costumes for activities—and concentrated idle stocks are generated at grade-promotion and graduation nodes. The school surveyed in this study offers AP courses and, in line with the common practice of international schools following US curricula, requires students to complete a prescribed number of accredited volunteer-service hours, which provides a natural "interface" for incentive-system design. The habits of item disposal formed during adolescence directly affect consumption patterns and low-carbon lifestyles in adulthood; campus therefore serves as a "test field" for cultivating circular-economy awareness among the whole population.

Existing research and practice of carbon inclusion have focused mainly on urban residents. On the one hand, platforms such as Ant Forest and Xianyu's personal carbon points have accumulated mature experience; in fiscal year 2024 alone, Xianyu users collectively reduced carbon emissions by 6.594 million tonnes [5]. On the other hand, Shenzhen has released a carbon inclusion methodology for second-hand electronic products (mobile phones), providing an institutional template for the quantification and verification of emission reductions from second-hand trading [4]. Nevertheless, first-hand data on second-hand trading behaviour among teenagers on campus remain scarce, and there is little empirical evidence on how incentive mechanisms should be designed or how symbolic incentives (e.g., carbon points) should be combined with practical incentives (e.g., quick cash-out).

Taking students of an AP international high school as the survey object, this study systematically analyses the current status of campus idle items, willingness and barriers regarding second-hand trading, and incentive preferences based on 48 valid questionnaires. On this basis, a "campus carbon points–service-hours accreditation" incentive mechanism is proposed, and the promotion pathway from campus carbon points to carbon inclusion for all is explored, with the aim of providing a reference for implementing the circular economy in youth scenarios.

2. Survey Design and Sample Characteristics

2.1 Questionnaire Design

The questionnaire consists of 10 items with the following structure: Item 1 collects demographic information (grade); Items 2–4 examine spending, the types of idle items and the scale of idle stocks; Item 5 examines previous disposal methods (multiple choice); Items 6 and 8 use a five-point Likert scale to measure, respectively, the willingness to sell and to buy second-hand items on an on-campus platform; Items 7 and 9 examine the barrier factors on the selling and buying sides (multiple choice); and Item 10 examines incentive preferences (multiple choice). In Item 10, the expression "CAS hours" denotes hours of accredited volunteer service, following the wording of the questionnaire.

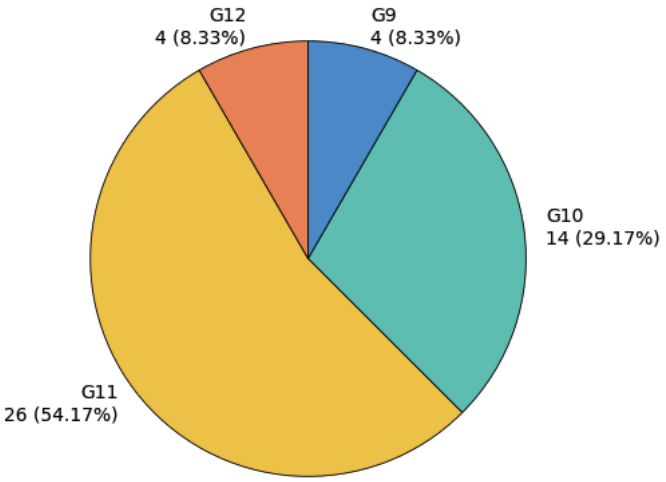
2.2 Implementation and Sample Characteristics

The survey was administered to all enrolled students of an AP international high school, and 48 valid questionnaires were collected, of which Items 8–10 were based on 46 responses from an earlier collection stage. The grade composition of the sample is shown in Table 1 and Figure 1: Grade 11 accounts for the largest share (54.17%), followed by Grade 10 (29.17%), while Grades 9 and 12 each account for 8.33%; Grades 10 and 11 together account for 83.33%. The over-representation of higher grades is related to the time constraints on respondents under academic pressure in graduation years, which has been taken into account in the analysis.

Table 1. Composition of the sample by grade (n = 48)

Grade	Number of respondents	Percentage
G9	4	8.33%
G10	14	29.17%
G11	26	54.17%
G12	4	8.33%
Total	48	100%

Figure 1. Composition of the sample by grade (n = 48).



3. Current Status of Campus Idle Items

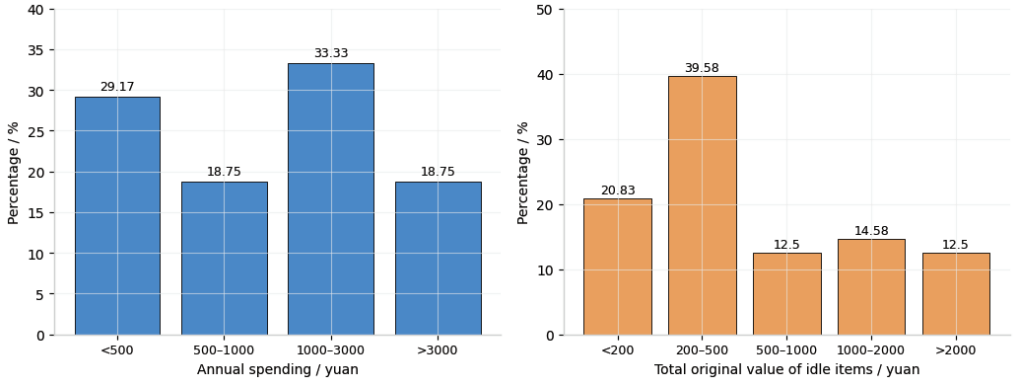
3.1 Spending Levels

The distribution of the sample's spending on textbooks, stationery, calculators, school uniforms and other school supplies over the past year is shown in Table 2 and Figure 2 (left). Estimating with the midpoint of each interval, the average annual spending is about CNY 1,536 per capita, and the combined share of spending above CNY 1,000 is 52.08%, exhibiting a consumption pattern that is high-frequency, rigid-demand and rigidly cyclical: textbooks and examination supplies are replaced with each stage of study and each examination season, providing a continuous source of idle items.

Table 2. Distribution of annual spending on school supplies (n = 48)

Annual spending interval (CNY)	Number of respondents	Percentage
Below 500	14	29.17%
500–1000	9	18.75%
1000–3000	16	33.33%
Above 3000	9	18.75%
Total	48	100%

Figure 2. Annual spending on school supplies (left) and the estimated original value of idle items (right) (n = 48).



3.2 Types and Stock Scale of Idle Items

The distribution of idle item types is shown in Table 3. Standardized/academic textbooks account for the highest proportion (72.92%), far exceeding other categories, which is directly related to the strong cyclical replacement of standardized examination books such as AP/IB/A-Level; stationery and dormitory supplies (41.67%) and school uniforms and performance costumes (33.33%) follow; electronic products (25.00%) have high unit prices but slower replacement cycles.

Table 3. Distribution of idle item types (multiple choice, n = 48)

Type of idle items	Number of respondents	Percentage
Standardized/academic textbooks (AP/IB/A-Level/SAT/TOEFL, etc.)	35	72.92%
Stationery and accessories (notebooks, stationery, dormitory supplies)	20	41.67%
School apparel (uniforms, performance costumes for specific events)	16	33.33%
Electronic products (graphing calculators, tablets, old mobile phones, etc.)	12	25.00%
Others	7	14.58%

Using the interval midpoints for estimation (values above CNY 2,000 are taken as CNY 2,500), the original value of idle items is about CNY 784 per capita, totalling about CNY 38,000 for the 48 respondents; extrapolated to every one thousand students, the idle stock of a single school approaches CNY 780,000. The stock distribution is shown in Table 4 and Figure 2 (right): the CNY 200–500 interval accounts for the largest share (39.58%); individual items are of low value but the aggregate volume is large—this is a typical "low-value, high-frequency" pattern of idle items, whose recycling value depends on platform mechanisms that achieve scale and low transaction costs.

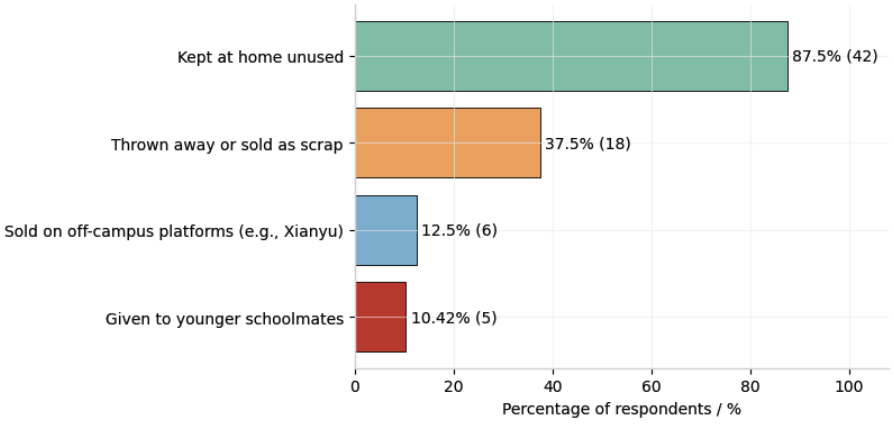
Table 4. Distribution of the estimated total original value of idle items (n = 48)

Total original value interval (CNY)	Number of respondents	Percentage
Below 200	10	20.83%
200–500	19	39.58%
500–1000	6	12.5%
1000–2000	7	14.58%
Above 2000	6	12.5%
Total	48	100%

3.3 Previous Disposal Methods: A Low-Circulation Path

Previous disposal methods are shown in Figure 3. "Kept at home gathering dust" ranks first with an absolute share of 87.5%, "thrown away directly or sold as scrap" accounts for 37.5%, and only 12.5% of respondents had ever sold items through off-campus platforms such as Xianyu. Campus idle items currently follow a low-circulation path of "idling–discarding": on the one hand, a large number of items with remaining use value remain "asleep"; on the other hand, some items enter the waste system directly, causing avoidable environmental burdens. The key to opening an "idling–rebirth" path lies in lowering transaction thresholds and establishing a credible on-campus trading channel.

Figure 3. Previous disposal methods for idle items (multiple choice, n = 48).



4. Willingness for Second-Hand Trading and Its Barriers

4.1 Willingness to Sell: Considerable Supply Potential

The distribution of willingness to sell on an on-campus second-hand platform is shown in Table 5 and Figure 4. The mean willingness score is 3.63; no respondent chose "1 (definitely not)", and 47.9% chose a score of 4 or above. Considering that 87.5% of households hold idle stocks, it can be judged that the supply side does not lack either goods or selling motivation; the main reason for "wanting to sell but not having sold" should be sought in the transaction process itself.

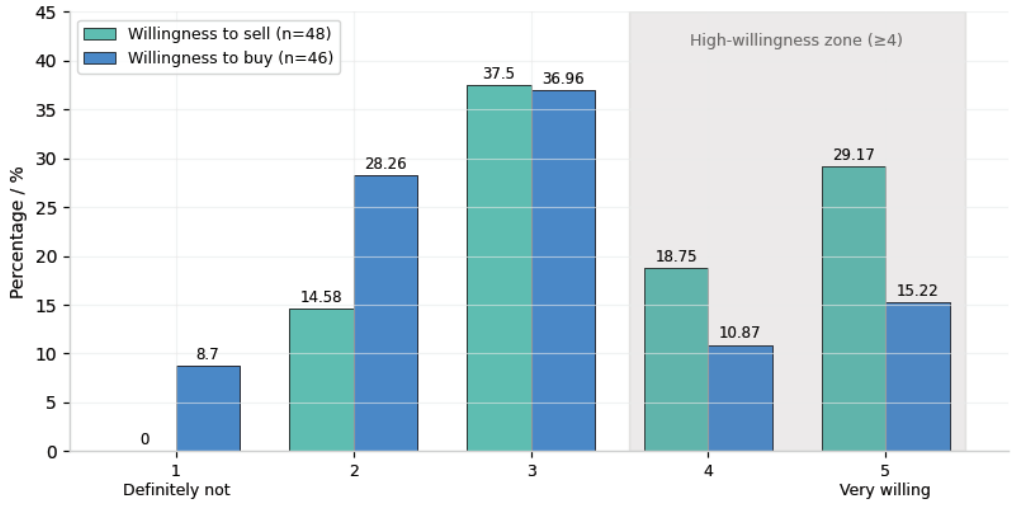
4.2 Willingness to Buy: A Noticeably Weak Demand Side

The mean willingness to buy is 2.96, 0.67 points lower than that to sell; only 26.1% chose a score of 4 or above, while 36.96% chose scores of 1–2. The gap in high willingness between the two sides is about 22 percentage points (47.9% vs 26.1%), presenting a clear asymmetric structure of "strong selling willingness and weak buying willingness". If a platform solves only the "selling" problem while neglecting trust building on the "buying" side, the market will fail to close the loop owing to insufficient demand.

Table 5. Distribution of willingness to sell and to buy on an on-campus second-hand platform

Willingness level	Willingness to sell (n = 48)	Willingness to buy (n = 46)
1 (definitely not)	0%	8.7%
2	14.58%	28.26%
3	37.5%	36.96%
4	18.75%	10.87%
5 (very willing)	29.17%	15.22%
Mean value	3.63	2.96
Share with a score ≥ 4	47.9%	26.1%

Figure 4. Comparison of the distributions of willingness to sell and to buy.



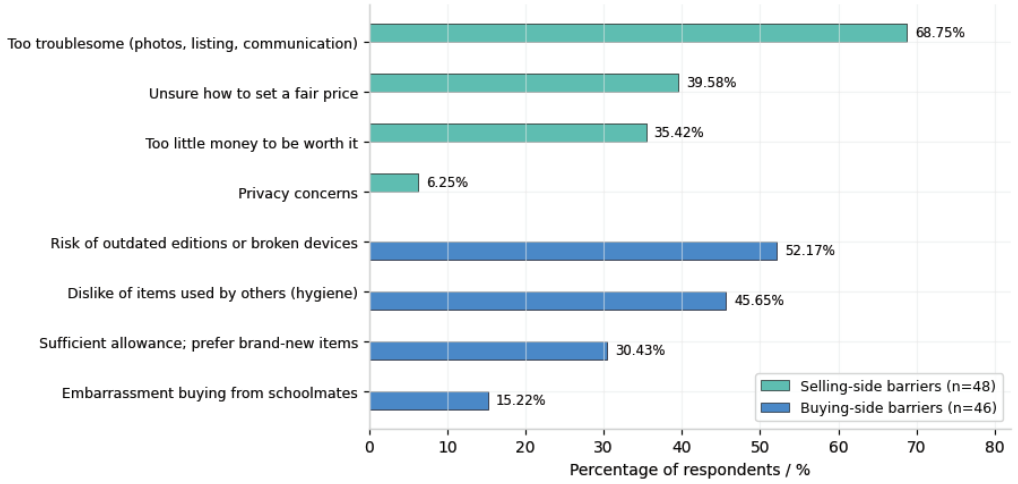
4.3 Barrier Factors: A Structural Divergence between Transaction Costs and Trust Deficits

A comparison of barrier factors on the selling and buying sides is shown in Figure 5. The top three barriers on the selling side are "too troublesome—unwilling to take photos, list items and communicate" (68.75%), "unsure how to set a fair price" (39.58%), and "the items would fetch too little to be worth it" (35.42%), while privacy concerns account for only 6.25%. This indicates that selling resistance arises mainly from transaction costs and pricing uncertainty rather than from attitude or "face" concerns. The top three barriers on the buying side are "worry about buying outdated textbook editions or broken calculators" (52.17%), "a dislike of items used by others (hygiene concerns)" (45.65%), and "sufficient allowance; prefer brand-new items" (30.43%), indicating that buying resistance arises mainly from quality uncertainty and hygiene concerns, i.e., a trust problem. This finding is consistent with research on community-based dispute-resolution mechanisms for second-

hand e-commerce transactions, such as Xianyu's "small court" [8].

The structural divergence of barriers on the two sides has direct implications for platform design: lowering transaction costs (unified collection, no self-listing, automatic pricing) can activate supply, whereas quality guarantees (edition verification, function testing, disinfection treatment and anonymous options) are needed to cultivate demand; neither can be neglected.

Figure 5. Comparison of barrier factors on the selling and buying sides (multiple choice).



5. Design of A "Campus Carbon Points–Service-Hours" Incentive Mechanism Based on The Survey Findings

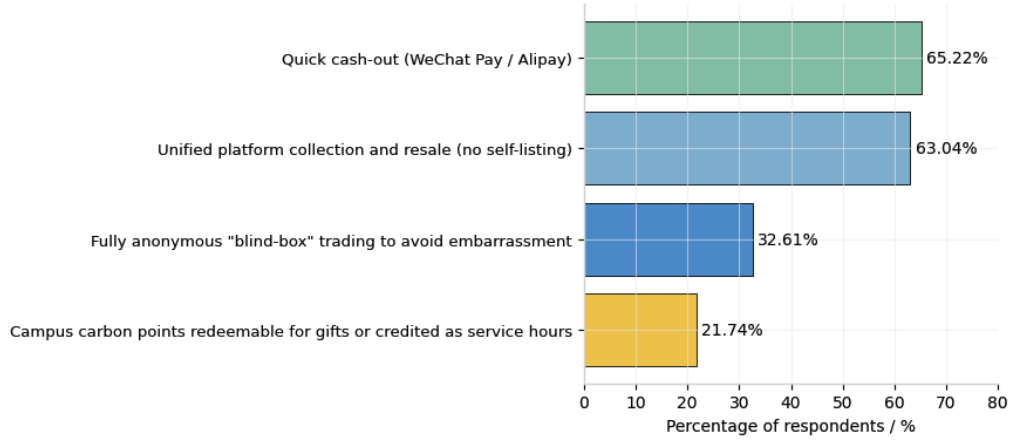
5.1 Incentive Preferences: Convenience First; Symbolic Incentives Require Institutional Embedding

Preferences for the four candidate incentive options are shown in Table 6 and Figure 6. "Quick cash-out via WeChat Pay or Alipay" (65.22%) and "unified platform collection and resale without self-listing" (63.04%) are far ahead, and correspond exactly to the two transaction-cost barriers identified in Section 4.3; "fully anonymous blind-box trading" accounts for 32.61%, echoing the social concerns of some students; and "campus carbon points redeemable for gifts or credited as volunteer-service hours" ranks last with an independent selection rate of 21.74%.

Table 6. Preferences for incentive options of the on-campus second-hand platform (multiple choice, n = 46)

Incentive option	Number of respondents	Percentage
Quick cash-out via WeChat Pay or Alipay	30	65.22%
Unified platform collection and resale without self-listing	29	63.04%
Fully anonymous "blind-box" trading or consignment to avoid social embarrassment	15	32.61%
Campus carbon points for trading, redeemable for gifts or credited as volunteer-service hours (referred to as CAS hours in the questionnaire)	10	21.74%

Figure 6. Preferences for incentive options of the on-campus second-hand platform (multiple choice, n = 46).



This result should not be interpreted simply as "carbon points are ineffective". The 21.74% share means that carbon points already possess a basic level of attractiveness, while the practical demands expressed by more than 65% of respondents indicate that carbon-inclusion incentives, if promoted alone without a convenience-oriented design, can hardly change behaviour. The correct path is to "carry carbon incentives with a convenience-oriented design": students obtain carbon points while completing transactions effortlessly and at low cost, and the points are linked to institutional resources such as accredited service hours, so that symbolic incentives are upgraded into accumulable, redeemable and certifiable "institutional assets".

5.2 Design of the "Campus Carbon Points–Service-Hours" Mechanism

Based on the above findings, five components of the on-campus platform incentive mechanism are proposed (Figure 7):

(1) Unified collection and consignment without self-listing. Collection points are set up in dormitory and teaching areas; students complete a "sale" simply by depositing idle items, with no need for photos, pricing or communication throughout, directly addressing the "too troublesome" barrier (68.75%);

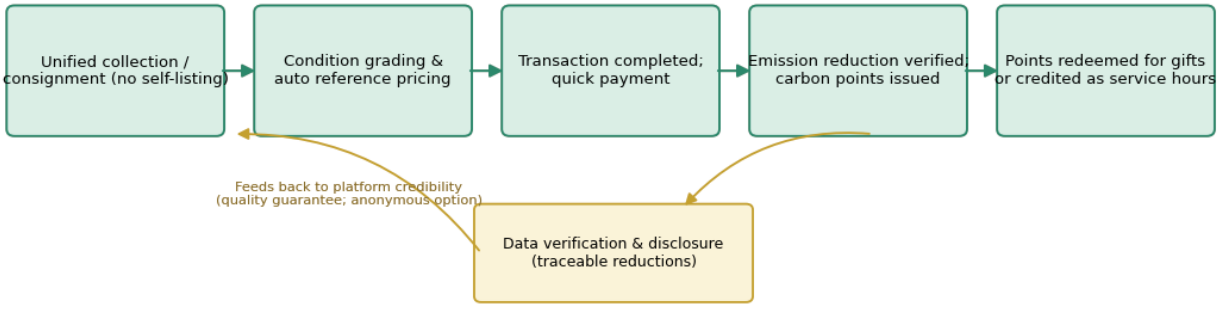
(2) Condition grading and automatic reference pricing. The platform establishes condition standards by category and a historical transaction database, providing transparent reference prices and resolving the "unsure how to price" barrier (39.58%);

(3) Quick settlement. Payments arrive rapidly after a transaction is completed, satisfying the most preferred incentive demand (65.22%) and forming a behavioural reinforcement loop of "low threshold–immediate reward";

(4) Emission-reduction accounting and point issuance. Following the verification approach of Shenzhen's carbon inclusion methodology for second-hand electronic products [4], emission reductions are calculated from item category, weight and reference price, and "campus carbon points" are issued automatically; the points can be redeemed for campus merchandise or, upon school accreditation, converted into volunteer-service hours, so that carbon points acquire a "quasi-credit" attribute through the school's accredited service programme.

(5) Data verification and credibility feedback. Emission reductions and transaction data are archived and disclosed regularly to ensure the authenticity and credibility of carbon points; the platform's accumulated quality-inspection records feed back into its credibility system, and, together with anonymous trading options, gradually resolve quality concerns on the buying side.

Figure 7. Operational flow of the "campus carbon points–service-hours" incentive mechanism.



5.3 A Three-Level Pathway from Campus Carbon Points to Carbon Inclusion for All

The greater value of campus carbon points lies in their replicability. Drawing on China's experience of developing carbon inclusion from local pilots towards institutionalization—Shenzhen has issued a carbon inclusion methodology for second-hand mobile phone trading and connected it to the personal carbon account system [4]—this paper proposes a three-level promotion pathway (Figure 8):

(1) Level 1—campus scenarios: relying on a closed community, low trust costs and the service-hours institutional interface, the mechanism completes process verification and accumulates behavioural data;

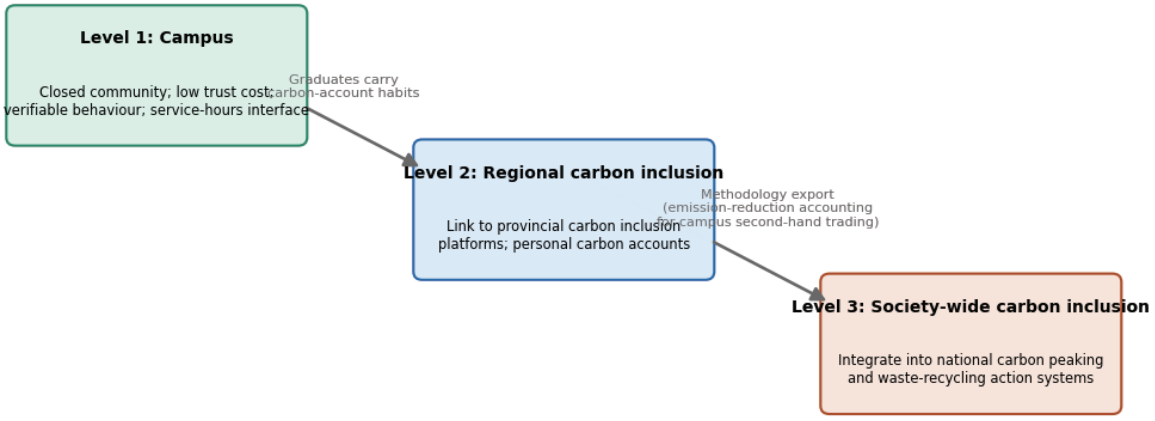
(2) Level 2—regional carbon inclusion: the emission-reduction accounting methodology for idle-item trading accumulated on the campus platform is exported to provincial carbon inclusion platforms [4], and students' personal carbon accounts migrate with them after graduation, achieving "carrying carbon habits out of campus";

(3) Level 3—carbon inclusion for all: once the accounting of emission reductions from second-hand trading becomes

standardized and scaled up, it is incorporated into the national action systems for energy conservation, carbon reduction and waste recycling [1, 2], and idle-item trading becomes an inclusive form of emission-reduction behaviour in which the whole population can participate, which can be verified and from which benefits can be derived.

The logic of this pathway is that the campus provides the two elements most difficult for carbon inclusion to obtain—high-frequency, verifiable behavioural data and a low-cost channel for institutionalizing incentives (service-hours accreditation). Using these as leverage points to activate the regional and societal levels is far more feasible than promoting directly to unfamiliar adults.

Figure 8. The "campus–region–society" pathway for promoting carbon inclusion.



6. Discussion

6.1 Governance Implications of the Supply–Demand Asymmetry

The most important structural feature identified in this survey is the supply–demand asymmetry in willingness (47.9% vs 26.1%). Existing research and platform practice generally assume that "where there are sellers, there are buyers"; this study shows that in the campus context, trust building on the demand side is more urgent than channel building on the supply side. The 47.9% high selling willingness, combined with the 87.5% household idle stock, means that any mechanism that lowers transaction costs can rapidly activate supply; however, if buying willingness remains depressed, the platform will fall into a dilemma of "having goods but no market". Textbooks (72.92% of idle item types) are sensitive to editions and highly testable, making them particularly suitable for opening the demand side through quality commitments such as edition verification, disinfection and refurbishment, and short-term warranties; this category may serve as the breakthrough point for on-campus second-hand trading.

6.2 Comparison with Existing Carbon Inclusion Practices

The practice of platforms such as Xianyu, whose users collectively reduced emissions by 6.594 million tonnes in fiscal year 2024 [5], shows that "low-threshold behaviour plus visualized incentives" can drive large-scale participation; however, their users are predominantly adults, and the incentives are weakly linked to real rights and interests. Shenzhen's second-hand mobile phone carbon inclusion methodology demonstrates that emission reductions from second-hand trading can be quantified, verified and integrated into the carbon inclusion trading system [4]. The "campus carbon points–service-hours" mechanism proposed in this paper differs in three respects: first, it starts earlier in behaviour formation, seizing the habit-formation period of teenagers; second, the incentives are linked to the school's accredited service-hours system rather than to purely commercial rights, giving stronger sustainability; and third, the closed scenario with verifiable data precisely fills the gap of "scattered data sources and difficult verification" in current personal carbon accounts. Meanwhile, the independent selection rate of 21.74% also reminds us that carbon inclusion incentives should not overestimate their own driving force: "convenience first, carbon incentives alongside" should be the basic principle.

6.3 Limitations

This study has the following limitations. First, the sample comes from a single school with only 48 valid responses, and the grade distribution is skewed towards Grades 10 and 11, so caution is needed when generalizing the conclusions. Second, the data are based on self-reports, and both idle stocks and spending are estimated values, which may be subject to recall bias and

social desirability bias. Third, measured willingness does not equal actual behaviour, and the gap between "high willingness and low action" needs to be tested through platform pilots. Fourth, the accounting of emission reductions relies on the carbon inclusion methodology for second-hand trading [4], and no on-site measurement and verification was conducted in this study. Future research may expand the sample across multiple schools, carry out longitudinal tracking after the platform goes online, and conduct life-cycle measurements of emission reductions for typical items.

7. Conclusions

(1) Campus idle items exhibit a "low-value, high-frequency, textbook-dominated" pattern: the original value of idle items is about CNY 784 per capita, 87.5% of respondents leave idle items "gathering dust at home", and the idling–discarding low-circulation path causes substantial waste; the stock scale at the level of a single school already possesses considerable recycling value.

(2) Willingness for second-hand trading shows a marked supply–demand asymmetry (47.9% vs 26.1% with a score of 4 or above): selling-side resistance concentrates on transaction costs ("too troublesome" 68.75%, "unsure how to price" 39.58%), while buying-side resistance concentrates on quality and trust ("worry about quality" 52.17%, "hygiene concerns" 45.65%); platform design must drive both "cost reduction" and "trust building".

(3) Incentive preferences display a "practicality first" pattern: quick cash-out (65.22%) and unified platform collection and resale (63.04%) are the most attractive, and carbon points have limited attraction on their own (21.74%) but considerable potential once linked to institutional resources such as accredited service hours; "carrying carbon incentives with a convenience-oriented design" is the basic principle.

(4) The "campus carbon points–service-hours" mechanism and the "campus–region–society" three-level promotion pathway designed accordingly transform the verifiable behavioural data and institutional interfaces of the campus scenario into leverage points for promoting carbon inclusion, providing a feasible and replicable solution for extending the circular economy from campus to the whole of society. Platform pilots and longitudinal tracking will follow to examine the actual conversion of behaviour and to advance the on-site measurement and verification of emission reductions.

Funding

No

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

Reference

[1] General Office of the State Council of the People's Republic of China. (2024). Opinions on accelerating the establishment of a waste recycling system (Guobanfa [2024]No. 7). (Original work in Chinese).

[2] State Council of the People's Republic of China. (2024). Action plan for energy conservation and carbon reduction (2024–2025). (Original work in Chinese).

[3] Ministry of Commerce of the People's Republic of China, et al. (2024). Action plan for promoting tradeins of consumer goods. (Original work in Chinese).

[4] Shenzhen Municipal Bureau of Ecology and Environment. (2023). Carbon inclusion methodology for secondhand electronic products (mobile phones) [Standard] (Original work in Chinese).

[5] Alibaba Group. (2024). Environmental, social and governance (ESG) report 2024 [Report]. Alibaba Group.

[6] The Cover News. (2026, August 15). Xianyu releases its green and lowcarbon development achievements report for fiscal year 2026 [Webpage]. https://m.thecover.cn/news_details.html?eid=7lmcQjhm5uSH90qSdq8Jkw== (Original work in Chinese).

[7] Xinhua Net. (2024, April 10). Secondhand trading continues to thrive with lowcarbon circular "green" [Webpage]. http://www.news.cn/fashion/20240410/12f769340eaf44f284079d4aeac8673b/c.html (Original work in Chinese).

[8] Liu, Z. T. (2025). Research on dispute mediation mechanisms of secondhand ecommerce under frame theory—A case study of Xianyu's small court. ECommerce Letters, 14(5), 937944. (Original work in Chinese).