Preliminary Study on Reverse Logistics Model in College Students' Idle Goods Trading

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Abstract: This study explores the construction and optimization pathways for reverse logistics models in college students' idle goods trading. Through theoretical analysis, it clarifies model types, key processes, and stakeholder roles, while identifying multiple practical constraints in implementation-including technical management deficiencies, cost-benefit imbalances, and insufficient student participation motivation. The research proposes a three-pronged approach to address these challenges: innovating multi-stakeholder collaborative governance mechanisms on campuses, integrating digital platforms to streamline logistics information chains, and designing policy frameworks that combine incentives with regulatory constraints. Ultimately, establishing a reverse logistics system that balances economic viability with operational efficiency can significantly enhance campus resource recycling rates and provide practical references for advancing green campus initiatives.

Keywords: Reverse Logistics; Idle Goods Trading; Campus Collaboration; Digital Platform; Incentive Policies

1. Introduction

With the deepening concept of circular economy and the rise of shared consumption models, the trading of idle items by college students has become an integral part of campus life. However, reverse logistics challenges arising during transactions-including returns, recycling, and re-distribution processes-have yet to establish systematic and efficient operational frameworks, hindering the sustainable development of this market. This study aims to explore the construction of reverse logistics models for student-owned item trading, analyze existing operational mechanisms, key obstacles, and feasible solutions. The findings are intended to provide theoretical references and practical insights for improving campus green consumption systems, thereby promoting resource recycling and low-carbon campus development.

2. Theoretical Framework of Reverse Logistics Model

2.1 Pattern Types and Feature Analysis

Currently, blockchain-based media content source authentication models can be broadly categorized into three fundamental types. The first is the public anchoring model, characterized by periodically uploading digital fingerprints (e.g., hash values) of media content to public blockchains. Leveraging blockchain's immutability, this model generates public timestamp proofs to establish content existence and temporal relationships. While featuring relatively simple technical architecture and lower costs, it provides limited authentication information and typically does not directly store complex identity data. The second model employs consortium chain collaboration, where media organizations, authentication platforms, and technology providers form a permissioned consortium network to jointly maintain a distributed evidence storage and identity directory. This approach strikes a balance between transparency and controllability, supporting richer metadata evidence storage and rapid member verification, though its decentralization remains relatively weak. The third model utilizes embedded protocols, embedding authentication rules and identity verification through smart contracts directly into content creation or publishing toolchains. This enables automatic blockchain anchoring of source information and identity credentials during content generation. While achieving high process automation and mandatory authentication, this model requires significant modifications to existing production tools and poses challenges in deployment. Different models exhibit distinct characteristics in decentralization levels, authentication information dimensions, implementation costs, and applicable scenarios, necessitating strategic selection and integration based on specific authentication objectives and industry contexts [1].

2.2 Key Nodes in Process Design

The design of a comprehensive blockchain-based media content source authentication process must revolve around several critical technical nodes. First, the creation and anchoring of digital identities require content creators or institutions to generate and manage their blockchain-based digital identities through trusted means. These identities establish verifiable mappings with real-world attributes and serve as the foundation for all content authentication processes. Second, content fingerprinting and blockchain registration involve extracting irreversible digital fingerprints using standardized algorithms during content creation or initial publication. These fingerprints are then linked to key metadata such as the creator's digital identity and timestamp, and submitted to selected blockchain networks through transactional protocols to create unique on-chain credentials. Third, credential verification enables any auditor to retrieve corresponding records using these credentials. By comparing the current content fingerprint with the original blockchain record, auditors can verify whether content has been tampered with since authentication and confirm the authenticity of claimed sources. The entire process design must ensure secure, efficient operations across these nodes while maintaining smooth user experience, thereby forming a credible and functional authentication closed loop [2].

2.3 Role Positioning of Participating Entities

Within this framework, participating entities assume distinct yet synergistic roles. Media content creators and providers serve as the core drivers and primary beneficiaries, functioning as holders of digital identities and initiators of authentication processes. They are responsible for establishing and maintaining their on-chain identities, actively linking original content fingerprints to their identities through blockchain technology to assert and prove ownership rights. Their active participation forms the foundation of system operation. Authentication service providers and technical support teams play pivotal roles as builders and operators, tasked with designing blockchain infrastructure, developing smart contracts, providing user-friendly evidence storage and verification interfaces, and ensuring the security, stability, and compliance of the technical stack. Their technical expertise and credibility directly determine system trustworthiness. Media platforms and distribution channels act as key adopters and validation scenarios, integrating authentication processes into content upload, review, and display workflows. They provide visual identifiers or prioritized recommendations for verified content, leveraging the system to enhance platform credibility and combat misinformation. Finally, regulatory bodies, auditors, and end-users form the supervisory and verification community, conducting independent audits or routine checks based on public blockchain records to jointly maintain a trustworthy network ecosystem through multi-party checks and balances. Only when all stakeholders clearly define their responsibilities and collaborate effectively can this digital identity and authentication system transition from technical concepts into industry-standard infrastructure [3].

3. Practical Challenges in Implementing Reverse Logistics

3.1 Constraints at the Technical and Management Levels

The implementation of reverse logistics for idle items among college students first encounters fundamental constraints at both technological and managerial levels. Technologically, most campus transactions rely on social groups or basic second-hand platforms that generally lack built-in reverse logistics modules, such as intelligent return reservation systems, logistics tracking tools, or digital management systems for offline collection points. The absence of technical tools makes return, exchange, and recycling processes heavily dependent on manual communication and coordination, resulting in low efficiency, information opacity, and frequent disputes during item handover and inspection. Management-wise, the lack of standardized procedures and collaborative mechanisms persists. Clear responsibilities and unified operational standards for reverse logistics have yet to be established among university logistics departments, student organizations, third-party logistics providers, and individual students. For instance, there are no universally accepted guidelines regarding quality inspection criteria for returned goods, depreciation calculations, or refund timelines, leading to arbitrary processing practices and high administrative costs. These dual shortcomings in technology and management hinder the development of scalable and standardized reverse logistics systems, creating fundamental barriers to model implementation [4].

3.2 Cost Control and Benefit Balance Dilemma

The imbalance between costs and benefits remains the core economic challenge hindering the sustainable operation of reverse logistics models. Reverse logistics involves multiple stages including recycling, inspection, warehousing, redistribution, and processing, each generating explicit costs such as transportation labor expenses, storage management fees, and potential maintenance or cleaning costs. However, college students 'idle items typically exhibit low intrinsic value and significant residual value fluctuations, resulting in relatively low average transaction prices. This makes the cost of a single reverse logistics service easily approach or even exceed the item's actual value, leading to severe lack of economic incentives. Neither platform operators, logistics service providers, nor individual students can directly benefit economically from this "high-cost, low-return" activity. From a benefit perspective, the environmental advantages (e.g., resource conservation) and social benefits (e.g., improved convenience) generated by reverse logistics represent positive externalities that participants struggle to internalize and convert into direct financial returns. Designing a cost-sharing and compensation mechanism to transform social benefits into economic incentives-thereby breaking the "who bears the cost, who suffers losses" dilemma-remains a critical challenge in model development.

3.3 Factors Influencing Student Participation Willingness and Behavior

The ultimate success of recycling models largely depends on broad participation from student demographics as core users, with their willingness to engage influenced by multiple complex factors. Convenience remains the primary determinant-lengthy return procedures, distant collection points, or complicated application processes significantly reduce student participation rates. Economic incentives also play a crucial role: even environmentally conscious students may opt out if reverse logistics (e.g., returns) result in additional shipping costs or item depreciation. Trust perception is equally critical-students express concerns about post-recycling disposal methods, personal data security, and platform fairness, leading to low participation rates when trust is lacking. While environmental awareness and social responsibility awareness serve as deeper motivations, these require accessible channels and proper guidance to translate into action. Group norms and social influence cannot be overlooked either; widespread participation among peers that fosters campus-wide trends naturally boosts individual engagement. Therefore, boosting participation requires comprehensive strategies beyond one-way publicity campaigns, including optimized process experiences, well-designed incentives, transparent trust mechanisms, and community-building initiatives to effectively drive behavioral change.

4. Optimization Strategies for Reverse Logistics Models

4.1 Innovation in Campus Collaborative Mechanisms

To optimize reverse logistics models for college students' idle items, the primary focus lies in establishing an efficient campus collaboration mechanism. This requires moving beyond fragmented, spontaneous transaction patterns by integrating logistics management departments, student organizations, third-party professional service providers, and student users into an organic network. Specifically, logistics departments can provide standardized storage facilities, unified recycling stations, and basic logistics support while setting macro-level environmental protection and resource management objectives. Active student organizations can undertake roles such as publicity campaigns, community operations, on-site coordination, and personalized services, leveraging their proximity to students to reduce communication costs. Professional third-party service providers can implement standardized logistics solutions, digital management systems, and quality assessment services to enhance operational professionalism. The core innovation of this collaborative mechanism involves designing joint operation rules with clear responsibilities, transparent information flow, and shared benefits. For instance, establishing a campus logistics coordination committee composed of multi-party representatives to regularly discuss process optimization, cost allocation, and dispute resolution. Through such institutional innovations, dispersed resources and capabilities can be systematically organized into a cohesive force covering the entire "recycling-sorting-processing-redistribution" chain, thereby overcoming efficiency bottlenecks caused by fragmented management practices.

4.2 Integration of Digital Platform Functions

To address constraints caused by insufficient technical tools, optimization strategies should focus on functional integration and upgrades for existing or newly established digital platforms. These platforms must evolve beyond being mere platforms for product information dissemination to become comprehensive management tools supporting integrated forward and reverse logistics systems. Key integration priorities include: embedding complete reverse logistics service modules such as online return/recovery request submission, intelligent matching of nearby offline collection points or door-to-door pickup services, real-time tracking of item return flow status, and online refund processing or points settlement. Platforms should also leverage data accumulation to optimize workflows-predicting high-return-category items based on historical data, optimizing collection point layouts, and recommending cost-effective disposal options (repair, resale, or donation) for different items. Furthermore, platforms should actively integrate with campus one-card systems, credit evaluation frameworks, or course credit systems to incorporate reverse logistics participation into broader digital campus ecosystems and assessment frameworks. This deep functional integration aims to transform reverse logistics from cumbersome offline operations into streamlined, visualized standardized services within platforms, fundamentally enhancing operational convenience and transparency while lowering student participation barriers.

4.3 Incentive and Constraint Policy Design

To address cost-benefit challenges and guide student behavior, a comprehensive incentive and constraint policy framework must be designed. The incentive policies should adopt multi-level and diversified approaches: For student users, an engagement points system can be established where accumulated points can be redeemed for platform service discounts, campus facility access rights, or small gifts, converting environmental actions into immediate positive feedback. Sellers who successfully complete product recycling processes should receive commission rebates or credit rating upgrades to compensate their time investment and management costs. Social organizations and volunteers actively involved in coordination efforts should have their contributions recognized through social practice evaluations or honorary awards. Constraint policies aim to establish fundamental order and trust boundaries: Clear return/exchange conditions and depreciation calculation standards must be defined to prevent disputes. A credit blacklist system linked to campus integrity mechanisms should be implemented for malicious damage incidents and fraudulent claims. Service providers must sign standardized service agreements with performance evaluations. Policy design should align closely with campus management realities, coordinating with departments like Academic Affairs, Student Services, and Logistics. For instance, exemplary sustainable consumption practices could be documented in students' comprehensive competency profiles. This "carrot-and-stick" policy toolkit effectively fosters positive participation while respecting market dynamics and individual choices, transforming reverse logistics models from optional practices into standard campus norms.

5. Conclusion

In conclusion, the development of reverse logistics models for college students 'idle goods trading requires balancing theoretical frameworks with practical realities. By clarifying operational processes, identifying implementation challenges, and designing collaborative mechanisms, a sustainable operational system can be progressively established. Future efforts should integrate campus management characteristics, strengthen multi-stakeholder collaboration, leverage technological solutions to enhance logistics efficiency, and prioritize cultivating students' circular economy awareness. This study provides an initial framework for campus idle resource management. Subsequent research could explore customized approaches tailored to different university contexts, fostering deeper integration between green campus practices and circular consumption culture.

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