Research on the Design of Community Personal Durable Goods Rental Platform Based on P2P Model

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Abstract: The continuous popularization of "Internet +" has led to the rapid development of the "sharing economy." In this context, based on the research of "sharing economy" theory, this paper designs a community personal durable goods rental system based on the P2P model. This paper analyzes the feasibility of project implementation, the main content of the rental platform design, and the innovation of the project. The research concludes that the community personal durable goods rental platform based on the P2P model is convenient for users, reduces the costs for durable goods owners and renters, and increases the benefits for both parties. Additionally, the rental platform is stable and highly scalable, making it suitable for promotion and use in different communities.

Keywords: P2P Model; Community; Personal Durable Goods; Rental Platform

1. Project Background and Significance

With the continuous popularization of "Internet +", the sharing economy has become a globally influential business model. Its core idea is to fully utilize available resources and effectively apply idle resources to practice, achieving rapid and stable wealth transfer. With the intensification of global warming and climate change, the sharing economy has become a viable solution. It not only meets the current society's demand for a green economy but also receives recognition from various government departments. The " Plan and 2035 Vision Goals Outline" proposes developing strategic emerging industries and promoting the healthy development of platform economy and sharing economy, pointing out the direction for the sharing economy. The sharing economy is expected to have a broader space in the future market, presenting more opportunities and challenges for the entire society. As a main form of the sharing economy, P2P has better development prospects.

In the sharing economy, three key roles are product owners, renters, and sharing platforms. The community personal durable goods rental platform based on the P2P model, as a key element, connects product owners and renters, establishing a complex interactive system. Online, this rental platform temporarily transfers resources from suppliers within a given community range, making them shared resources. It also effectively improves the utilization of idle resources, promoting the orderly circulation of resources, reducing waste, and improving overall resource utilization efficiency. Ultimately, it promotes both owners and renters to gain more benefits, fostering social mutual aid, trust, and long-term healthy socio-economic development.

2. Project Feasibility

2.1 Theoretical Support Analysis

In 1984, American sociologist Paul Ryan first used the term "sharing economy" to convey a new concept of life consumption to the public [1]. The concepts and theories about the sharing market economy were pointed out by Marcus Felson and Joel Spaeth in 1980. The sharing economy refers to a market model jointly established by a third party based on information technology. The third party includes commercial institutions, companies, and government departments, as well as individuals who use online platforms to achieve data sharing of idle materials, including demand-side, supply-side, and platform market economy models [2]. Belk pointed out that the sharing economy is the action and process of distributing our property to others for their use and accepting or obtaining certain items from others for our use [3]. Yu et al. believed that the sharing

economy refers to organizations and individuals with idle resources transferring their temporary usage rights through the resource trading market for compensation, or buying and selling the ownership of idle fixed assets through online sharing platforms to gain economic benefits [4].

British researchers Rachel Botsman and Roo Rogers proposed in 2010 that the development model of the sharing economy has many unique features. The most important point is to achieve the goals of saving energy, reducing costs, and maintaining nature through participating in various organized, decentralized, tradable, and rentable collective activities, which is the so-called collaborative consumption [5]. Schor divided the sharing economy into four categories based on "market orientation" and "market structure": (P2P, non-profit), (P2P, for-profit), (B2P, non-profit), and (B2P, for-profit) [6]. According to the subject of the sharing economy, the sharing economy can be divided into B2C, P2P, and G2C forms [7]. From the above literature, it is evident that the true subject of the sharing economy is ordinary consumers; thus, P2P is the main form of the sharing economy [8].

Benjaafar et al. believed that sometimes durable goods owners use their assets for personal consumption, while other times they rent them out. Such a market is called a peer-to-peer or P2P market [9]. The P2P rental market is also called the C2C market [10].

The P2P leasing market is also known as the C2C market. The participation behavior of consumers in this market depends on the size of their own benefits obtained [11], aiming to seek the maximization of utility and cost savings [12]. Apostolos Filippas et al. demonstrated that compared to the absence of consumer surplus in P2P rental markets, the presence of P2P rental markets leads to a significant increase in consumer surplus, with long-term consumer surplus being higher than short-term consumer surplus.

Despite the emergence of the P2P rental market, it has increased the income of both renters and owners. However, like other markets, both lessors and owners will bear certain costs, and the level of costs affects the willingness of both parties to participate in the P2P leasing market. Firstly, the owner must bear a fixed cost of ownership, which includes not only purchase costs but also other ownership related costs such as storage related costs and insurance premiums. Secondly, promoting trust between unfamiliar partners is a key issue in all markets. In the P2P leasing market, this issue is particularly prominent because whenever a product is leased, the lessee causes additional wear and damage to the product (due to the lessee's negligence and improper use of the product), and the owner bears additional costs. The owner faces moral hazard, which generates moral hazard costs [9]. The final owner shall bear the BTM cost. BTM cost refers to the cost incurred when a product (durable goods) enters the P2P leasing market, with a portion of the cost being direct costs, including labor costs required for the product or service to enter the market, complementary consumables, and depreciation of assets during use. For tenants, inconvenience costs are incurred due to using someone else's product instead of their own, and inconvenience costs do not include rent [9].

Based on the P2P model refers to designing a sharing rental platform within a given community (residential community or university student community, etc.) using WeChat Mini Programs. This platform effectively integrates the highly dispersed community personal durable goods resources, building a communication bridge between owners with idle durable goods and renters. Moreover, it provides both online and offline customer services. At the same time, the design of the rental platform focuses more on reducing costs for both parties, thereby improving their profits.

2.2 Technical Feasibility Analysis

(1) The maturity and widespread use of the internet, coupled with the surge in the use of smartphones with high-definition photo-taking functions allow individuals to complete various information processing operations through smartphones. This also facilitates information query and maintenance.

(2) WeChat mini program is an application that can be used without downloading. It represents an innovation and has built a new mini program development environment and rich developer ecosystem after years of development. WeChat Developer Tools is an integrated development environment (IDE) designed specifically for the development and debugging of WeChat mini programs. It

provides a range of powerful features and tools, making it easy for developers to write, debug, preview, and publish code. In addition, the use of development tools such as IntelliJ IDEA and Tomcat has brought great convenience to development work.

3. Main Content of the Rental Platform Design

The community personal durable goods rental platform based on the P2P model is divided into two parts: the front-end user side and the back-end service side. Users can access the front-end user side via WeChat, register and log in, rent and return durable goods, view their orders, and browse news information. Administrators can log into the back-end service side via computer to manage users, products, orders, news, and website announcements. The detailed content is as follows:

(1) User Side

1) Registration and Login: Non-member users can register online to become official members. Member users can log in directly to use the rental service platform.

2) News Information: Users can access news information on the platform.

3) Durable Goods Information: Users can view all durable goods information and support viewing details, commenting, bookmarking, and liking. The types of durable goods depend on the needs of different community residents. Before using the rental platform, the project team conducts a survey on rarely used durable goods in the community, organizing the popular and rentable durable goods.

4) Durable Goods Rental: Users can view all durable goods rental information and support viewing details and payment.

5) Durable Goods Return: Users can view all durable goods return information and support viewing details and payment.

6) Durable Goods Loss: Users can view all durable goods loss information and support viewing details and payment.

7) Order Reminders: Users can view all order reminder information and support viewing details.

(2) Back-End Service Side

1) Administrator and User Management: Administrators can create and manage administrators who can operate the web back-end management; they can also manage users registered on the Mini Program.

2) Durable Goods Management: Administrators maintain and manage durable goods type information in the system, inputting and maintaining durable goods information under different categories to the web back-end management, and making it visible to Mini Program users by listing.

3) Durable Goods Rental, Return, and Loss Management: Administrators manage the rental, return, and loss information submitted by users.

4) Order Reminder Management: Administrators can add, delete, modify, and query order reminder information.

5) Website Announcement Management: Administrators upload and manage website announcements on the Mini Program.

6) News Management: Administrators can categorize, upload, and manage news information on the Mini Program.

(3) This rental platform uses MySQL database to store data such as product rental, registered users, order reminders, announcements, etc. Firstly, it is necessary to define the entities involved in the system based on its functions, and draw an E-R diagram based on the relationships between the entities. Next, construct a physical model based on the E-R diagram and ensure that the model meets the requirements of the first to third normal forms. Finally, define the database tables based on the model. The database includes commodity rental tables, announcement tables, commodity type tables, sports equipment tables, user account tables, etc. These tables are associated through foreign keys to ensure data consistency and integrity.

(4) Key Issues the Rental Platform Aims to Solve:

1) Ease of Use: The community personal durable goods rental platform based on the P2P model is user-friendly, does not require installation, and can be used by scanning a QR code on WeChat.

2) Increases Income: The platform matches dispersed durable goods owners and renters within a given community, allowing idle resources to flow, meeting renters' needs, increasing resource utilization rates, and boosting income for both owners and renters.

3) Tenants may abuse or damage the owner's assets, causing the owner to bear the cost of moral hazard and resulting in an increase in

rental prices. In most markets, the "type" of the buyer is irrelevant to the seller, but in the P2P leasing market, the "type" of the lessee is crucial for the owner. A feasible solution is to establish a bilateral reputation system, which essentially reduces moral hazard by disseminating word-of-mouth information about the "seller" and "buyer"

Reputation Mechanism: Within the community, the platform and offline activities encourage users to spread reputation information about renters and product owners, establishing a credibility mechanism, and rental platforms collect deposits from tenants that reduces the moral risk for durable goods owners.

4) Reducing Costs for Durable Goods Owners and Renters. The reduction of moral hazards directly leads to lower rental prices, and the maintenance costs for owners will also decrease. The use of the rental platform is limited to the community area, where renters and owners are close in distance, making transportation costs nearly zero and facilitating transactions between the two parties.

5) System Stability and Scalability. The developed system is stable and scalable. From April to June 2025, the system is planned to be promoted and used among students at the City Institute of Dalian University of Technology to test the platform's operational stability. Based on student feedback, the system will be continuously improved to better meet the needs of renters and owners in terms of both stability and functionality. Subsequently, contact will be made with nearby streets for the system to be promoted in surrounding communities, with project team students providing back-end maintenance.

4. Innovation of the Project

This project transforms theoretical research into practical applications, deepening industry-university cooperation and providing employment and entrepreneurial opportunities for college students. Existing P2P models are mainly used in lending, homestay, car rental, and other industries, and there is a lack of P2P models for community personal idle durable goods rental platforms. This project enriches the types of specific rental platforms and provides a reference for the construction of similar rental platforms. The rental platform reduces moral hazards for durable goods owners through deposits and word-of-mouth

communication while increasing the benefits for both parties. Given the close distance between the transaction parties within a defined community, transactions are less likely to fail due to high transportation or postage costs, facilitating transactions. The P2P model-based durable goods rental platform is easy to operate, increasing the willingness of more durable goods owners and renters to participate in the platform, thus promoting and applying the rental platform.

5. Conclusion

The community personal durable goods rental platform based on the P2P model allows users to use it by scanning a QR code via WeChat without needing to install or download anything. The system integrates functions such as registration and login, durable goods information browsing, rental, return and loss handling, and order reminders, allowing community residents within a defined geographical area to rent and return durable goods without worrying about lacking infrequently used durable goods. Additionally, the system includes news information and announcement functions, enabling users to view relevant news and system notifications and announcements anytime, anywhere. Through preliminary research, the types of durable goods needed by different resident communities are understood, and durable goods information is adjusted on the rental platform to make it suitable for promotion and use in various communities. Therefore, the system is stable and highly scalable. The use of this rental platform reduces resource waste, improves the overall utilization efficiency of social resources, promotes social mutual assistance and trust, and fosters the long-term healthy development of the social economy.

Acknowledgments

References
[1] Guo Shuna. Research on the Business Model of B Car Rental Company from the Perspective of Sharing Economy. Jiangxi University of Finance and Economics, 2023, p1-8.

[2] M. Felson, J.L. Spaeth. Community Structure and Collaborative Consumption: A Routine Activity Approach. American Behavioral Scientist, 1978.

[3] Belk, Russell. Why Not Share Rather Than Own? The ANNALS of the American Academy of Political and Social Science, 2007, 611(1), 126-140.

[4] Yu H, Tian L, Jiang GL, et al. Sharing Economy: Theoretical Construction and Research Progress Nankai Management Review, 2018, 21(06), p37-52

[5] R Botsman, R Rogers. What`s Mine Is Yours: The Rise of Collaborative Consumption. Rise of Collaborative Consumption, 2010

[6] Schor J. Debating the Sharing Economy. A Great Transition Initiative, 2014

[7] Zhao Tiancheng. Research on the Influencing Factors of Consumers' Participation in Collaborative Consumption. Beijing: Beijing University of Posts and Telecommunications, 2014

[8] Liang Xiaobei, He Minghua. A Review and Prospect of Collaborative Consumption Behavior Research under the Sharing Economy Model. Exploration of Economic Issues, 2018(2): 175-185.

[9] Saif Benjaafar, Guangwen Kong, and Xiang Li. Peer-to-Peer Product Sharing: Implications for Ownership, Usage, and Social Welfare in the Sharing Economy. SSRN Electronic Journal, 2015.

[10] Steffen Zimmermann, Peter Angerer, Daniel Provin, Barrie R. Nault. Pricing in C2C Sharing Platforms. Journal of the Association for Information Systems, 2018.

[11] M Mohlmann, Collaborative Consumption: Reasons for Choosing a Sharing Economy Option. Academy of Management Proceedings, 2015.

[12] Apostolos Filippas, John J. Horton and Richard J. Zeckhauser, Owning, Using and Renting: Some Simple Economics of the "Sharing Economy". Management Science, 2019.