

Seed Library: An Exploration of Specialized Transformation and Community Extension in Grassroots Libraries (Postprint)

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Abstract

[Purpose/Significance] This study investigates the origin and development of seed libraries, addressing what inspiration they can offer for service innovation in grassroots libraries and why they can facilitate China's grassroots libraries' transition from document and space services to tool services. [Method/Process] By systematically reviewing the concept, international practices, and target positioning of seed libraries, this paper discusses the primary models for operating and maintaining foreign seed libraries, and proposes actionable references for seed libraries to assist China's grassroots libraries in achieving high-quality development and characteristic transformation. [Results/Conclusion] The study reveals that seed libraries embody the action consciousness of European and American community libraries in responding to community integration, social inclusion, and national needs, offering certain reference value for breaking through the current "breaking out of the circle" predicament of China's grassroots libraries. China should recognize the importance of seed libraries in science education, local culture and ecological conservation, seed security and food traceability, cultural-tourism integration, and community networking, promote the Sinicization of seed libraries, and advance the characteristic transformation and embeddedness in daily life of China's grassroots libraries.

Full Text

Abstract

[Purpose/Significance] This study explores the origins and development of seed libraries, examining what inspiration they can provide for service innovation in grassroots libraries and how they can help China's grassroots libraries transition from document and space services to tool-based services. [Method/Process] By analyzing the concept, foreign practices, and target

positioning of seed libraries, this paper discusses the main operational and maintenance models of foreign seed libraries and proposes feasible references for China's grassroots libraries to achieve high-quality development and characteristic transformation. **[Result/Conclusion]** The study finds that seed libraries reflect the action consciousness of European and American community libraries in responding to community integration, social inclusion, and national needs. They offer valuable insights for breaking the current "out-of-circle" predicament of China's grassroots libraries. China should attach importance to the value of seed libraries in science education, local culture and ecological protection, seed safety and food traceability, cultural-tourism integration and community networks, promote the sinicization of seed libraries, and facilitate the characteristic transformation and life-oriented embedding of grassroots libraries in China.

Keywords: seed library; grassroots libraries; community libraries; characteristic transformation; community extension

Food security concerns national destiny and people's livelihood, representing an important foundation of national security. Safeguarding food security requires placing seed security in a prominent position. In 2020, the Central Economic Work Conference explicitly pointed out that solving seed and arable land problems requires tackling "bottleneck" technologies in seed sources to ensure food security. Seed resources are strategic and fundamental core resources related to national development, essential for promoting long-term stable agricultural development and ensuring national food security. Therefore, it is necessary to strengthen germplasm resource protection and utilization, and enhance seed bank construction. Seed libraries undoubtedly represent a new initiative with significant value in food security and germplasm traceability.

As a movement targeting the functional transformation of community libraries, seed libraries aim to expand community library service functions and provide community members with more opportunities for community participation and local ecological conservation [1]. Since their emergence in the 1980s, they have developed on a small scale and became an important means for American community libraries to enhance community consciousness through seed sharing and preservation in the early 21st century. In recent years, this movement has radiated from the United States to other European and American countries, becoming an organized campaign with broad participation from community libraries across Europe and America. In this process, community libraries, as initiators and primary participants, actively pursue the integration of library services with community needs, social inclusion, and national demands, endowing public libraries with more important missions and functions. This has been accompanied by the extension of community public cultural services, shaping a community 共同体 with social visibility and broad influence. In other words, this spontaneously organized movement by European and American community libraries reflects their action consciousness in responding to community

integration, social inclusion, and national food security needs. It also mirrors their deep reflection on their own value and demonstrates librarians' strategic efforts to transform community libraries into centers for social innovation [2]. These efforts have enabled European and American community libraries to gain greater user recognition in the process of highlighting their mission and value, providing valuable experience for community libraries to achieve “out-of-circle” breakthroughs. This experience may offer references for the high-quality development and characteristic transformation of China's grassroots libraries and provide feasible measures to break their current “out-of-circle” predicament.

Currently, the basic strategy for developing China's grassroots libraries mainly focuses on “enhancing grassroots library empowerment” [3], particularly relying on the main-branch library system and following unified standardization principles to highlight the professional transformation of grassroots libraries during construction. However, since the construction process is usually government-led and the construction 主体 has been elevated to county-level libraries, the impact on lower-level street and community libraries is limited. This has led to insufficient motivation in resource autonomy and service initiative at the street and community library levels, with empowerment from main libraries to branch libraries often remaining within the scope of basic business guidance. This is prominently manifested in two aspects: First, under the guidance of building a comprehensive and equalized public cultural service system since the “13th Five-Year Plan” period, some grassroots branch libraries have been established by simply incorporating single-function cultural station reading rooms into the system rather than covering communities with professional public library services [4]. Second, the achievement of comprehensive coverage and equalization goals relies more on expanding the number of grassroots branches and enriching collection resources rather than on service accessibility and relevance based on public demand. Consequently, grassroots library services tend to offer whatever resources are available, resulting in serious homogenization of service forms and resource content. For example, some community branches have gradually degenerated into reading rooms of community cultural stations in their development, with their core task being to serve book reading. This has led to slow progress in the professional transformation and social “out-of-circle” breakthroughs of grassroots libraries, and even loss of development incentives due to low overall service efficiency of the main-branch library network, making it difficult to achieve “out-of-circle” breakthroughs within the system while pursuing overall service network improvement. In other words, helping grassroots libraries shift their focus from emphasizing physical collections to addressing user, community, and even social issues, and emphasizing the life-oriented and social embedding of library services will be an important direction for future development of grassroots libraries.

Although seed libraries have become an important choice for foreign community libraries to shift from physical collection to life-oriented embedding for users and communities, research on seed libraries in the profession is relatively scarce and mainly focuses on project promotion. That is, relevant studies mostly start from

seed library project practices, examining specific seed libraries and introducing successful experiences from aspects such as specialized staffing, seed resource selection, and operational models. Few studies have examined seed libraries as an important choice for characteristic transformation and community extension of grassroots library services, identified what inspiration they can provide for grassroots library service innovation, or clearly explained why seed libraries, as an opportunity, can help grassroots libraries transition from document and space services to tool services. Starting from this point, this study clarifies the basic concepts and development history of foreign seed libraries, extends to knowledge about their operation and maintenance, seeks theoretical basis for seed libraries as a means for grassroots libraries to achieve characteristic transformation and community extension innovation, and attempts to answer the following questions: (1) What are seed libraries and what is their relationship with grassroots (community) libraries? (2) What are the key factors driving foreign community libraries to choose seed libraries and form a broad and profound seed library movement? (3) What conditions are needed for the establishment and operation of seed libraries, and what are the current main operation and maintenance models? (4) What inspiration can the successful expansion of service functions of foreign community libraries through seed libraries provide for China's grassroots libraries to achieve "out-of-circle" breakthroughs?

2. Origin and Development of Seed Libraries

2.1 Concept of Seed Libraries

A seed library is a community-based institution that provides free seed lending (usually including fruits, flowers, and vegetables) and integrated information resource services [5]. Unlike seed banks that emphasize effective long-term storage of plant species, seed libraries focus on disaster preparedness for seeds to prevent crop species extinction in case of environmental changes or catastrophic disasters, ensuring the source and diversity of human food. Seed libraries have distinct characteristics of open use, undertaking missions of seed diversity protection, advocacy, and public education. Specifically, seed libraries adopt an open free borrowing and returning model, connecting seeds with community users and using seeds as a medium to adopt Internet crowdsourcing thinking to share the mission of protecting biodiversity among community residents. In this process, seed libraries can create networks for developing seed storage, cultivate crop varieties adapted to local conditions, and actively respond to climate change or loss of genetic integrity caused by genetically modified organisms, representing an important step in preserving genetic diversity. This means that the mission of protecting plant diversity is no longer solely the responsibility of professionals and seed banks but an activity in which all users can participate.

There are two reasons for naming such institutions seed libraries: First, the seed lending service model provided by these institutions is similar to library book lending services, i.e., borrowing and returning. Seeds and their corresponding knowledge resources replace books as the objects of lending, achieving resource

integration and sharing through the borrowing and returning process. Users borrow seeds from seed libraries according to procedures and return newly harvested seeds to the library within a certain period, initiating the next cycle of borrowing and returning, thereby realizing seed resource sharing and integration. In this process, information resource services are the added value of seed libraries, meaning that the core business of seed libraries lies not in seed lending but in resource connection and service integration. Therefore, the functions, service populations, and business activities of seed libraries are similar to those of traditional libraries. Second, libraries are usually project operators and implementers. Libraries actively promote community building by providing free access to seeds and information resources needed for seed cultivation, helping to improve and change the lives of local community residents and promoting community integration and cultural sharing. This is closely related to many traditional core values of community libraries, such as promoting equitable information access, lifelong learning, social inclusion, protecting cultural diversity, and community participation. From these two perspectives, the seed library movement embodies the value and mission of European and American community libraries themselves, strengthens the key position of community libraries as 21st-century community access points, and provides a new service mechanism for grassroots libraries. This service mechanism transcends their traditional role as information providers, offering more potential innovative services and resources to help grassroots libraries make greater contributions in addressing challenges surrounding food security, community integration, and the sustainability of “heirloom” seeds.

2.2 Development of Foreign Seed Library Practices

Seed libraries are not only a means of sharing and preserving seeds, playing a role in ensuring national food security and protecting “heirloom” seeds, but also can expand grassroots library service functions and provide members with more opportunities for community building and ecological participation. From the perspective of foreign practices, the development of seed libraries has roughly gone through the following three stages.

2.2.1 Seed Library Services Born Within Community Library Systems Connecting public libraries’ missions of community harmony and social inclusion with seed protection began in the United States at the end of the 20th century. At the end of the 20th century, communitarianism became the governing philosophy in European and American countries, and interpretations of the mission and value of public libraries in library science circles also became more connected with community life and community values [6], emphasizing the role of community libraries in cultivating inclusive, trustworthy, mutually supportive, and understanding community culture and establishing common community consciousness. The birth of seed libraries within community library systems is not unrelated to this background. The first seed library in human history was the Bay Area Seed Interchange Library, established in 1999 at the

Berkeley Ecology Center. Its founder, D. B. Sascha, realized through his early internship experience at Community Support Agriculture (CSA) in Colombia that diversity is key to maintaining community ecology. This project later attracted attention in the library community. In 2004, American Gardiner Library librarian K. Greene created the first seed library within a community library system—the Gardiner Seed Library—but this service did not cause much of a sensation at the time. In 2008, K. Greene left the seed library and, with his partner D. Muller, established another Hudson Valley Seed Library, providing free seed lending services and information on how to grow seeds. However, K. Greene later discovered that what truly attracted users was access to high-quality organically certified seeds, so in 2009 he established a seed company responsible for selling and providing “heirloom” seeds and vegetable, flower, and herb seeds for the western United States [7]. It is worth noting that these seeds were either produced by Hudson Valley’s own small farms, came from local farmers, or were from trusted local seed wholesalers, but were mostly unrelated to genetically modified and non-local seeds provided by any multinational biotechnology companies.

2.2.2 Seed Libraries Permeating the Community Large-scale introduction of seed library services by community libraries began with the “Richmond Grows” seed exchange project launched by the Richmond Public Library in 2010. The success of this project led more and more community libraries to begin offering seed library services. During this period, the focus of many seed libraries was not on seed return but on attracting volunteers, transmitting seed awareness, and popularizing planting skills through this approach. Projects were mostly undertaken independently by libraries without establishing close cooperative relationships with other organizations. However, seed libraries no longer simply existed as a service of community libraries but, with support from some communities, appeared as seed libraries with independent physical venues. In subsequent practices, most community libraries carried out special “seed library” service projects, cooperating with local horticultural associations and agricultural science institutes to obtain high-quality seeds and, with the help of volunteer groups, establishing community communities that maintain the seed sharing system. At the same time, to facilitate project implementation, most community libraries also specially opened online and offline seed catalogs, and detailed information about the founding philosophy, rules, seed selection and preservation assistance, and short-term activities to be carried out was openly available on their websites. Some seed libraries also regularly contacted relevant organizations and professionals to conduct free online and offline video training courses, breeding and cultivation teaching classes, horticultural lectures, and shared labor tools, as well as other meaningful public activities to expand the audience of seed libraries. These activities include not only theoretical courses and training but also hands-on practice opportunities, which both deepen mutual assistance among community neighbors and closely connect seed libraries with the mission of community libraries.

2.2.3 The Rapidly Developing Seed Library Movement Currently, seed library projects have become an organized movement with broad participation from European and American community libraries. Network platforms for multiple seed library communities have been established, and physical organizations have also developed rapidly with strong support from individual donations and foundation grants. As of July 2018, there were more than 450 seed libraries across 46 states in the United States [8]. Most of these seed libraries are non-profit seed libraries hosted by public libraries, offering free community seed lending and return services. They not only provide users with services on how to borrow and return seeds but also provide corresponding information and resource support. For example, the Richmond Seed Library combines library information resources on planting techniques with seed lending services, producing video materials on how to use and preserve seeds. Some seed libraries also provide model replication and customization services for other organizations to build seed libraries, and even some have established online platforms for seed procurement and sales, as well as land services needed for seed cultivation. For instance, the Northern Onondaga Seed Library has opened a half-acre library farm outside the library, where users can “borrow” a small plot of land to cultivate seeds and share and learn food production skills and horticultural techniques during cultivation. Some seed libraries have also produced a series of peripheral cultural and creative products. For example, the Hudson Valley Seed Library has established close cooperative relationships with local artists to create a series of exquisite and unique seed art packaging products.

2.3 Goals and Positioning of Seed Libraries

From the above review of seed library development, the determination of seed library goals is inseparable from the vision of their founders and the actions of community libraries, mainly including education, seed access, local plant diversity protection, and community building.

First, founders’ general interest in seed libraries is the main reason for their initial emergence. For example, in a 2016 National Public Radio (NPR) program about seed library stories, K. Greene made similar statements, such as “protecting seeds is an important way to solve community environmental, health, historical, cultural and other problems” and “being passionate about the food movement and protecting species diversity are the main reasons I created a seed library.” Similar sentiments appear in the brand story of Native Seeds Seed Library: “What we really want are the seeds our grandparents used to grow.” In other words, from the founders’ perspective, the goal of early seed libraries was established on the basis of protecting food security and seed diversity. Therefore, the mission of seed libraries is to protect and promote crop diversity and ensure common access to and control of seeds, thereby supporting sustainable agriculture and food security. Seed libraries created around this concept are similar to seed banks in their core business, focusing on collecting and protecting regional characteristic seeds and endangered seeds. For example, Native

Seeds Seed Library provides lending services for nearly 2,000 crop seeds, mostly collected from crops in southern Colorado to central Mexico, many of which are rare or endangered. The accompanying collection resources are also the unique cultural heritage and agricultural knowledge of more than 50 communities in this region [9].

Second, as the birthplace of the seed library movement, community libraries undoubtedly hope to improve community members' participation through the introduction of seed libraries, thereby gaining recognition from library funders and highlighting the value of library services to the community. Seed libraries shaped by this concept are expected to be an effective outreach tool that can provide more opportunities for community members' participation and library service promotion. They are typically interpreted as promoting community building and shaping community consciousness by providing free access to plant seeds and the knowledge and information resources needed to grow them. Therefore, in specific practices, the operation of seed libraries emphasizes establishing close communication among individual members and local groups, strengthening community cooperation consciousness through collective actions in horticulture, food, and seeds. Goals can be specifically refined as: (1) Promoting the development of social education practices. Community libraries hope to improve community members' seed literacy through seed lending, providing a hands-on learning (planting) approach. (2) Promoting the development and prosperity of participatory and collaborative public resources. Community libraries hope to establish a new bond by making seeds part of public resources, thereby strengthening cooperative bonds among community members and groups based on reading activities. (3) Promoting social inclusion and harmonious community development. Seed libraries create a basic space for preserving and sharing planting knowledge, where people of various professions such as gardeners, farmers, and students can connect through seed libraries.

3. Creation and Operation of Seed Libraries

3.1 Creation of Seed Libraries

3.1.1 Conditions for Creating Seed Libraries First, site selection is the first step in establishing a seed library. In actual practice, public demand and seed storage needs do not match. Seeds are generally stored in refrigerators or freezers, but in seed libraries, seeds can only be preserved at room temperature, which reduces their lifespan and viability. Therefore, most foreign seed libraries set opening hours according to solar terms and convenience to quickly lend out seeds and guide users to plant them in the short term.

Second, stable staffing is an important factor in ensuring the operation of seed libraries, including employees, volunteers, or both. In foreign countries, almost every seed library has a dedicated seed librarian who usually possesses certain agricultural knowledge or library science knowledge and can complete tasks such as seed cataloging, inventory, organization, volunteer coordination, and

seed packaging and transportation. At the same time, since personnel needs for operating seed libraries have obvious seasonal characteristics, volunteers are also an important supplement.

Finally, since seed libraries have certain operating costs, financial support is an essential condition. These expenditures are usually used for storage containers, educational materials, seed sorting/threshing equipment purchases, and farm tool rental fees. Funding sources are raised through donations and membership fees. Membership fees generally include the cost of using all seeds and services, usually ranging from \$10 to \$200 [11].

3.1.2 Business Processes of Seed Libraries Once a library decides to operate a seed library, librarians face various choices, but the main task of seed librarians is how to store seeds and guide users in their use. Around this, a general business process for seed libraries has been formed. The business process of seed libraries mainly includes three aspects: seed and related information organization, seed lending and inspection, and user education [12].

- (1) **Seed and Related Information Organization.** First, seed and related information organization is a typical composite resource organization model. In seed determination and selection, not only local environmental conditions and necessary conditions for seed preservation must be considered, but also the seed cultivation technical level of the target audience. Second, seed classification and organization also need to be considered. For example, seed classification and organization should be based on either the category they belong to or the difficulty level of preserving and cultivating seeds. Classification systems based on the difficulty of preserving and cultivating seeds are widely used in many seed libraries, requiring classification administrators to have or acquire extensive knowledge about seed preservation and cultivation. Finally, to display seeds in a way that is convenient for user identification, seed resources must be revealed, which involves cataloging and organization of seeds. Catalogers need to create special bibliographic records for each type of seed included in the seed library system, with each record representing a different seed. In this process, seed metadata is crucial.
- (2) **Seed Lending and Inspection.** In some seed libraries that do not require library cards, users usually rely on paper forms similar to library borrowing cards to borrow and return seeds. These are also user records of seeds, used to record seeds borrowed from and returned to the seed library (see Figure 1 [Figure 1: see original paper]). In seed library systems that implement a membership system, seed libraries attach barcodes to seed packets for borrowing using the library's electronic system. In practice, each barcode is an individual item number for each seed packet to help achieve seed inventory control. By scanning the barcode on the seed packet membrane at checkout, seed librarians can more conveniently and quickly determine which seeds have been borrowed, whether their offspring have

been returned, when they were returned, and which seed types are most frequently borrowed and returned.

- (3) **User Education.** Another task of seed libraries is to provide educational opportunities for readers to acquire the necessary knowledge and skills for seed planting and to inform users of their obligation to preserve and return borrowed seeds. For example, Native Seeds Seed Library provides public workshop services ranging from one-hour basic knowledge lectures to intensive training lasting several days, aiming to provide more targeted services for seed users with higher-level needs. This kind of education helps community members interested in planting and cultivation establish deeper social connections and utilizes seed education opportunities to develop the library's collection resources. For example, Native Seeds Seed Library explicitly states that if seeds are successfully grown, 1/3 of the seeds should be returned to the seed library, growers can keep 1/3 for themselves, and the remaining 1/3 can be shared with other interested community members. In this process, seeds lent out by the seed library are replenished, and a community social network is built based on seed sharing, strengthening community consciousness [13].

3.2 Data Standards and Open Data of Seed Libraries

In seed libraries, whether it is the organization of seed resources or seed lending and inspection, both rely on seed metadata. In foreign seed library projects, most libraries use the MARC format to describe basic seed information. Taking the Pima County Public Library's lending seed library as an example [14], seeds in this seed library system are uniformly placed under the "3-D Object" category and distinguished from literature resources. Specific record information mainly includes the scientific name of the seed, alias, category, difficulty coefficient, donor, and call number. The difficulty coefficient can usually be divided into three categories: low, medium, and high. In addition, in the library system, seed librarians can retrieve the number of seed collection copies, number of lendable copies, number of user collections, and seed collection address through the database. Users can search seed information and others' evaluations online and can add information about seeds and share comments based on their own experiences. For example, the Los Angeles Seed Library has established a specialized platform with functional areas such as user posting areas, seed library systems, seed library meeting archives, seed preservation techniques, and seed stories. It not only describes and reveals seed characteristics of the seed library and provides information on all seed library networks in the Los Angeles area but also provides a dedicated communication and sharing section to facilitate user exchange and sharing [15]. Cataloged seeds are placed in archive cabinets or card catalog cabinets in seed libraries, sorted alphabetically, and indicating the cultivation difficulty coefficient. Corresponding data is also simultaneously published on the platform. For example, in the Venice Seed Library's 2020 Warm Season Catalog, 184 seed information entries were provided, involving

seed number, seed name, seed attributes, and seed type [16].

3.3 Operation Models of Seed Libraries

The operation models of seed libraries are diverse but can generally be divided into three types: (1) free acquisition without mandatory return; (2) free acquisition with obligatory return; and (3) paid membership system [17].

3.3.1 Free Acquisition Without Mandatory Return Seed libraries using this model mostly do not have dedicated premises and share premises with community libraries, treating seed lending only as a basic business operation of community libraries. They usually do not have dedicated seed librarians, with librarians working part-time or community volunteers maintaining operations independently. Seed sources are mostly social donations. Users can receive seeds for free, but in small quantities. Users can choose whether to return harvested seeds to the library according to their own wishes. For example, the Richmond Grows Seed Library uses this model, where community users can query seed catalogs through the website, make appointments, and borrow seeds. As long as they complete registration, they can obtain the right to borrow seeds for free, and seed return is not an obligation for users [18].

3.3.2 Free Acquisition With Obligatory Return The seed lending and returning in this model is similar to traditional book lending. Although users can borrow seeds for free, they also have the obligation to return seeds. Users must return seeds as agreed on schedule. If users fail in cultivation, they must purchase seeds of equal quality and quantity to return to the library. The number and types of seeds available for users to borrow are greater than in the “free acquisition without mandatory return” model. During the lending process, users need to truthfully fill out seed lending forms and seed return forms. For example, in the Los Angeles Seed Library’s seed lending and returning process, users need to fill out two forms: lending and returning. The forms include personal name, contact information, seed information, etc., but seeds must be returned before December, otherwise equivalent compensation will be required.

3.3.3 Paid Membership System The paid membership system is currently the mainstream operation model for seed libraries. Users pay a certain amount of membership fees and sign agreements with seed libraries to become qualified to borrow seeds, experiencing seed library services as members. Users under this model have more obligations. They must not only bear membership fees but also provide seed sources for the library. The membership system is based on terms agreed upon between users and seed libraries. Growers participate in cultivation practices as members. This approach places higher demands on growers. While seed libraries provide seed sources for interested members, growers also need to bear part of the expenses. For example, the John Trig Estes Seed Library’s Growing Estes’ Biodiversity program. Part of the program’s funding comes from

community fundraising, mainly used for initial project operations, but funds for long-term development mainly come from user membership fees. Users need to pay annual membership fees ranging from \$5 to \$20, and when returning seeds, they also need to record information such as seed type, planting location, growth environment, and planting stories to facilitate the library's classification and organization of seeds [19].

4. Seed Libraries for the Transformation of China's Grassroots Libraries

For grassroots libraries, "out-of-circle" breakthroughs at the main-branch library service network level focus on the value of grassroots branches within the main-branch library network system, reflecting the unique contributions and wisdom of grassroots branches in pursuing overall quality improvement and efficiency enhancement of the main-branch library service network. "Out-of-circle" breakthroughs at the government and decision-making level demonstrate the rationality and necessity of grassroots libraries as an institutional arrangement, helping them secure more development resources. "Out-of-circle" breakthroughs at the social level in terms of public recognition demonstrate their social responsibility and value, providing justification for the considerable funds spent and numerous jobs occupied by grassroots libraries. All three are indispensable. Achieving "out-of-circle" breakthroughs at these three levels is undoubtedly key to ensuring the sustainable and effective development of grassroots libraries and enhancing their social influence. To some extent, this also aligns with the strategic goal of China's public library development during the "14th Five-Year Plan" period, which aims to pursue overall quality improvement and efficiency enhancement, as well as the current call from the library academic community to "enhance public awareness of the value and impact of libraries" [20].

From the above review of seed library movement practices, seed libraries, as an exploration by European and American community libraries after re-examining their own value, have proven their value in community integration, social inclusion, and biodiversity protection. Seed libraries undoubtedly stand at the convergence point of "out-of-circle" breakthroughs at these three levels and are expected to provide references for China's grassroots libraries to achieve "out-of-circle" breakthroughs. China's grassroots libraries should seize the opportunity of the seed library movement and make greater efforts in local culture and ecological protection, seed safety and food traceability, thematic science education, and deep integration of culture and tourism with social network construction, making due contributions to achieving "out-of-circle" breakthroughs for high-quality development and characteristic transformation of China's grassroots libraries.

4.1 Local Culture and Ecological Protection

The original purpose of seed libraries was to protect and disseminate local species and culture, and many foreign seed libraries have gradually become the main positions for inheriting “heirloom” seeds in their regions. The preservation, inheritance, and exploration of local culture are among the roles played by public libraries in public cultural services. However, grassroots libraries still have certain limitations in their understanding of local culture, having not yet recognized that local natural ecology and species diversity are important components of local culture. In the process of building local characteristic collections, grassroots libraries mostly focus on collecting and organizing local literature resources, paying insufficient attention to the collection, organization, and utilization of local characteristic physical information resources on one hand, and lacking the integration of ecological civilization into local characteristic cultural construction on the other hand, let alone establishing connections between local ecological protection and local characteristic literature. One of the important goals of seed libraries is to protect regional plant diversity, especially “heirloom” seeds. Local characteristic species often lack market competitive advantages and are at a disadvantage in promotion and publicity. In the long-term process of seed improvement and cultivation, some local species face the risk of extinction, leading to serious loss of genetic diversity. Some of the most locally characteristic “heirloom” seeds have gradually been eliminated in market operations and are becoming endangered. According to estimates by the Food and Agriculture Organization of the United Nations, 75% of global plant genetic diversity was lost in the 20th century. At the same time, although increasingly refined social division of labor and frequent population mobility have brought about cultural integration to a certain extent, they have also made it urgent to explore new ways to protect and inherit local culture. Local seeds and ecology are undoubtedly important components of local culture. Therefore, China’s grassroots libraries should learn from the practical experience of foreign seed libraries, adopt the community crowdsourcing thinking of seed library programs, actively undertake the responsibility of disseminating seeds and inheriting diversity, and sink this responsibility into community action, becoming a 抓手 for crowdsourcing services of grassroots libraries. This shift from physical collection to the protection and development of seed resources can not only continue the tradition of local culture preservation and sharing but also provide people with free access to local characteristic seeds, promote seed genetic diversity and local traditional ecological protection, thereby enhancing the resilience of regional ecosystems, strengthening the community service functions of grassroots libraries, and promoting community integration and inclusion.

4.2 Seed Safety and Food Traceability

Currently, the global seed industry market size is about \$50 billion, of which 60% are commercial seeds produced by seed companies, and the remaining 40% are farmers’ self-retained seeds. The commercialization rate of seeds is high in

developed countries, basically provided by private seed companies, while seeds in developing countries are basically self-retained seeds provided by farmers or seeds provided by government public sectors, with a low degree of marketization. Although China is the most populous country in the world, its commercial seed market ranked only 19th globally in 2018, a huge gap from developed countries. Currently, China does not have a world-class seed industry giant. Multinational agricultural enterprises such as Monsanto and DuPont realized more than a decade ago that mastering seed ownership means mastering the lifeline of global food, and they have continuously conducted mergers and acquisitions of seed enterprises. This integration of the seed industry has led to a sharp decline in global seed diversity. At the same time, although seed companies label seed attributes during seed sales, such as whether they are genetically modified, this information is not labeled at the seed output end, i.e., when the final products of seeds flow into the market and are delivered to consumers, causing an information chain “break” in food traceability to a certain extent. Seed library founder K. Greene once pointed out that in the current social context, no one requires large seed companies to uphold transparency and accountability in management, so the only way we have seed sovereignty is to preserve our own seeds and share them. In seed banks or germplasm banks, professional germplasm metadata is not familiar to or mastered by most users, resulting in information asymmetry for the public in understanding seed safety and the initial stages of food production. In seed libraries, seeds exist as a public resource, and the application of metadata gives seeds a unique identifier, which means that information such as where seeds come from, who planted them, how much was produced, and where they ultimately flow can all be revealed, i.e., revealing all aspects of food source and production, opening the door for public participation in seed safety and food traceability. Therefore, if seed libraries can cooperate with agricultural institutes and seed companies, leveraging the absolute advantage of grassroots libraries in information flow control, it would be good news for food traceability and safety issues and would also provide a foundation for information disclosure and data openness of seed safety and food traceability. Similarly, for grassroots libraries, this cooperation is based on long-term resource sharing and project practice, establishing a demand-based community, which undoubtedly helps achieve “out-of-circle” breakthroughs at the government level.

4.3 Cultural-Tourism Integration and Community Networks

From foreign practices, seed libraries are more suitable to be rooted in community-level public libraries, becoming cultural symbols of the community and boosting local deep integration of culture and tourism. In the cultural-tourism integration of seed libraries, there is not only the “library + scenic spot” model but also the expansion of library service space to parks, farms, and households, endowing these spaces outside public libraries with additional functions such as information dissemination, exchange, and sharing. Seed libraries also have the magic of strengthening community consciousness and

experiencing hands-on learning. For both community residents and out-of-town tourists, seed libraries help solve the problems of community indifference and insufficient immersive experience in urban development. For community residents, seed libraries create a shared space combining agricultural resources and information resources, which can not only output various resources and services to community residents but also need to 汲取 different knowledge from community members, achieving two-way interaction. At the same time, the success of seed library projects also requires the joint efforts of all members of the entire community, and it can provide more communication topics and interaction themes for the community and the public. In this process, the social capital of community libraries is cultivated, community social networks based on seed sharing are established, and overall community consciousness is strengthened. For out-of-town tourists, “heirloom” seeds with local characteristics in seed libraries also have certain appeal, and seed libraries can become an important component of local characteristic culture. For example, the seed library of the Basalt Public Library in a small town in Colorado has become an important part of local tourism in its long-term development.

4.4 Thematic Science Education

Grassroots libraries are legal entities for conducting science popularization work. In the post-epidemic era, public libraries undoubtedly pay more attention to the functions and services of libraries in science education, mainly undertaking science education responsibilities through collection resource recommendations, science reading promotion, relevant exhibitions, lectures, science salons, knowledge competitions, essay competitions, and science games. In this process, most grassroots libraries need to clarify the focus of science education. Seed libraries can generate diverse and rich science themes, which can not only upgrade reading promotion but also boldly innovate in the creation of scientific scenarios [21]. With their diverse seed cultivation scenario creation capabilities, seed libraries can connect hands-on experiential education with knowledge acquisition, having obvious advantages in explaining scientific methods, designing scientific inquiry practices, capability expansion training, stimulating scientific research interest, and improving basic cognition of scientific phenomena and related skills. For example, users can take seeds home, obtain relevant knowledge and experience about seed cultivation by consulting relevant materials and learning from community members, apply this knowledge to seed cultivation practice, and finally obtain new seeds. In this process, on the one hand, successful scenario design enables science activities related to seeds to be completed through both learning and practice, which can stimulate users’ enthusiasm and stickiness for reading and learning. On the other hand, collection resources related to seeds are aggregated, community biodiversity and food safety consciousness can be further cultivated, and the supporting role of library collection resources in informal learning environments can be leveraged.

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Author Contributions

Li Zhuozhuo: Proposed research ideas and paper framework, revised the paper; Zhang Kang: Wrote and revised the paper; Jin Lei: Collected materials and revised the paper.

Seed Library: Exploration of Characteristic Transformation and Community Extension of Grassroots Libraries

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Abstract: [Purpose/significance] This paper aims to explore the origin and development of seed libraries, and answer what inspiration they can provide for service innovation in grassroots libraries, and why they can help China's grassroots libraries realize the transformation from literature service and space service to tool service. [Method/process] This paper combs through the concept, foreign practice and target positioning of seed libraries, discusses the main modes of operation and maintenance of foreign seed libraries, and puts forward feasible references for the realization of high-quality development and characteristic transformation of grassroots libraries in China. [Result/conclusion] The study finds that seed libraries reflect the action consciousness of European and American community libraries in response to community integration, social tolerance and national needs, which has certain reference significance for breaking the current predicament of "out of the circle" of grassroots libraries in China. China should attach importance to the value of seed libraries in science popularization education, local culture and ecological protection, seed safety and food traceability, cultural and tourism integration and community network, promote the sinicization of seed libraries, and promote the characteristic transformation and life embedding of grassroots libraries in China.

Keywords: seed library; grassroots libraries; community libraries; characteristic transformation; community extension

Note: Figure translations are in progress. See original paper for figures.

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