
AI translation · View original & related papers at
chinaxiv.org/items/chinaxiv-202308.00430

Exploration of Multi-party Co-construction Models for Library Maker Spaces (Post-print)

Authors: Hu Yongqiang

Date: 2023-08-26T00:00:00+00:00

Abstract

[目的/意义] To address the space, funding, and talent bottlenecks encountered by university libraries in the process of makerspace construction, this study proposes a multi-party collaborative construction model to facilitate the rapid development of library makerspaces.

[方法/过程] Through comparative analysis of makerspace construction cases across various domains, this paper summarizes multiple makerspace construction models suitable for university libraries in China, and examines the support that different collaborative models can provide for university library makerspace construction based on their distinctive features, thereby enabling university libraries to forge a successful path aligned with their actual conditions.

[结果/结论] Based on comparative analysis of various makerspace construction models, libraries should, in accordance with their actual circumstances, break free from the constraints of existing models, boldly innovate by synthesizing the advantages of each model, and seek superior solutions.

Full Text

Preamble

Volume 62, Issue 2 January 2018 ChinaXiv Cooperative Journal

Exploration of Multi-Co-construction Models for Library Makerspaces

Hu Yongqiang

Shenyang Normal University Library, Shenyang 110034

Abstract

[Purpose/Significance] Aiming at the space bottleneck, funding bottleneck, and talent bottleneck encountered by university libraries in the process of building makerspaces, this paper proposes a multi-co-construction model to promote the rapid development of library makerspace construction.

[Method/Process] Through a comparison of makerspace construction examples from various fields, this paper summarizes multiple makerspace construction models suitable for university libraries in China, and analyzes the support that various collaborative models can provide for university library makerspace construction, in order to help university libraries forge a successful path that aligns with their actual circumstances.

[Result/Conclusion] Through comparative analysis of various makerspace construction models, libraries should base their decisions on actual circumstances, not be constrained by existing models, and boldly innovate by integrating the advantages of different models to seek better solutions.

Keywords: university libraries makerspace construction model

Classification Number: G250

DOI: 10.13266/j.issn.0252-3116.2018.02.002

In recent years, makerspaces, with their advantages of “experimentation, innovation, and learning,” have not only provided opportunities for individuals and small enterprises to rise, but have also offered universities a new path for talent cultivation that better aligns with social development and practical needs. The construction of makerspaces has rapidly emerged worldwide, demonstrating vigorous development momentum. However, the high construction costs and operational difficulties have made it challenging for many university libraries to bear the burden independently, prompting them to seek cooperative co-construction models and methods.

1. Research on Makerspace Construction in University Libraries

Research on makerspace construction in university libraries began relatively late. A search in CNKI using “library + makerspace” as keywords yields 343 relevant documents, of which 103 are related to university libraries. In terms of research trends, domestic research on library makerspace construction has shown a continuous upward trajectory. The earliest article on library makerspace construction in CNKI was published in 2013, focusing primarily on learning from foreign makerspace construction experiences. Between 2014 and 2016, papers on university library makerspace construction accounted for 60% of all library makerspace research publications in those years, indicating that an increasing number of university libraries began building their own makerspaces

during this period. By June 2017, although attention to shared space construction had somewhat declined, it still maintained a relatively high publication volume, representing about 50% of all research output, demonstrating that university library makerspace construction remains a relatively hot topic.

From the perspective of research on university library makerspace construction models, the focus has primarily concentrated on funding acquisition, space renovation, equipment procurement, and personnel recruitment. Currently, domestic university library makerspace construction mainly draws on advanced models from abroad, particularly from the United States and Germany. Summarizing and analyzing existing construction models can help address the difficulties and problems encountered by university libraries during makerspace renovation and new space construction, thereby advancing the construction process.

2. Challenges Facing University Library Makerspace Construction

The development of university library makerspaces has been slow. Among those that have been completed, few have truly fulfilled their intended functions. Many university libraries interested in establishing makerspaces have been unable to implement their plans due to various factors such as funding, space, and human resources, limiting the development of makerspaces.

2.1 Funding Shortages Constraining Makerspace Construction

2.1.1 Lack of Makerspace Construction Funding

First, the initial construction of a makerspace requires substantial one-time investment, including space renovation, decoration, and equipment procurement. While space renovation and decoration are mandatory expenses, equipment procurement—encompassing items such as 3D printers, laser cutters, CNC machines, small machine tools, sewing machines, and woodworking tools—can be selected based on the library's financial capacity. However, even the most basic equipment purchases require significant funding, and the functionality of makerspaces largely depends on these devices. Second, space operation and maintenance require continuous and stable funding, primarily for consumables procurement and equipment maintenance and updates. Unlike commercially operated makerspaces, university library makerspaces mainly function to cultivate students' innovative consciousness and creative abilities, encouraging hands-on experience and practice. Consequently, most university makerspaces are open to students free of charge, necessitating long-term stable funding to ensure normal operation. Third, personnel costs include expenses for space operation and maintenance staff, maker instructors, external experts, and training for staff and volunteers.

2.1.2 Single Source of Library Funding

University library funding primarily comes from special appropriations from their institutions. Except for a few key universities with abundant funding,

most universities allocate insufficient funds to their libraries, creating significant shortfalls that sometimes cannot even support normal literature resource procurement and daily expenses, let alone the establishment of costly makerspaces. Therefore, most university libraries building makerspaces must apply for additional special funds. However, after completion, funding for space operation and maintenance, including various activities and maker education, often has no clear source, forcing libraries to explore alternative fundraising channels. It must be acknowledged that funding and space are the biggest challenges facing library makerspace construction.

2.2 Infrastructure Constraints on Makerspace Construction

2.2.1 High Difficulty of Makerspace Renovation

While the size of a makerspace can be selected based on actual needs and library conditions, creating a well-equipped, fully functional makerspace still requires considerable space. When conditions permit, constructing a new building is ideal, as demonstrated by Florida Polytechnic University, which built a 162,000-square-foot building where the RAD laboratory alone can accommodate 500 3D printers and scanners [1]. However, most libraries lack the conditions for new construction and must repurpose existing space from already planned layouts. This requires not only substantial funding but also consideration of the original building structure and layout to minimize disruption to normal library operations—a challenge that is self-evident. Additionally, makerspaces engage in practical activities such as sample printing and modeling, inevitably generating noise, odors, and dust, all of which must be comprehensively considered during space renovation.

2.2.2 Rapid Equipment Obsolescence in Makerspaces

A primary function of makerspaces is to enable students to experience the latest technological equipment. However, as human technology continues to advance, the iteration cycle of new technologies and products becomes increasingly shorter, making it more difficult and costly to maintain the technological advancement of makerspace equipment. Taking 3D printers as an example, since the technology matured and became widely applied across industries in 2010, it has been updated dozens of times in just over six years, with significant improvements in both printing speed and volume, and new models emerging every month. This illustrates the difficulty and challenges libraries face in maintaining technologically advanced equipment in their makerspaces.

2.3 Scarcity of Human Resources Delaying Space Construction

University library makerspaces primarily require managers, technical staff, maker mentors, and project leaders. Librarians can be trained to fulfill managerial and technical maintenance roles, but maker mentors and project leaders are difficult to cultivate from existing library staff and must be recruited from industry experts and entrepreneurial elites. In universities, maker mentors should be teachers from various disciplines who possess a maker spirit, while

project leaders should be faculty or students who initiate maker projects. The three founders of Tsinghua University's makerspace are all master's or doctoral graduates in science and engineering with solid technical expertise. The University of Michigan Library's makerspace also employs students proficient in human-computer interaction technology, somatosensory game development, and computer graphics programming as space consultants [1]. However, most domestic university libraries, constrained by their financial resources and conditions, have limited appeal to maker talent, making it difficult to recruit sufficient outstanding personnel to support the realization and sustainable development of makerspace functions. Talent scarcity has become another important factor delaying makerspace construction.

3. Multi-Collaboration Models Driving Library Makerspace Construction

Faced with numerous constraints, how to break through bottlenecks and achieve large-scale popularization and development is a common challenge for university libraries. Clearly, relying solely on the efforts of university libraries themselves is insufficient to solve these problems. By studying the successful experiences of university library makerspaces at home and abroad, the author found that most have achieved breakthroughs through cooperation with governments, schools, charitable organizations, industry associations, and enterprises, forming multi-collaboration models to jointly build and expand makerspace functions, realizing the leap from zero to one.

3.1 Campus Collaboration Model

3.1.1 Technical Collaboration

Universities possess advanced laboratories and technology platforms across various disciplines. Libraries building makerspaces should fully cooperate with campus technology innovation platforms and professional laboratories, leveraging their advanced technologies to ensure technological leadership in their makerspaces and provide a solid hardware and software foundation for student technological innovation. Simultaneously, makerspaces can serve as practice bases for university discipline construction, providing students with a platform to integrate professional theory and practice, thereby applying what they have learned. MIT's FabLab and Media Lab are representative examples of this type of makerspace.

3.1.2 Personnel Cooperation

Another university advantage lies in its large pool of relatively stable faculty with high research capabilities and its limitless potential among creative young student populations. Attracting the attention of these talents and securing their cooperation is an effective way to overcome the talent shortage in makerspaces. This cooperation has a solid foundation: first, both faculty and students need makerspaces as practice bases to transform their design achievements and sci-

entific ideas into actual products; second, makerspaces need maker mentors to lead their research teams into the space, which not only maximizes space utilization but also alleviates talent pressure to some extent. The University of Michigan Library created a 3D laboratory that utilizes the space to offer six courses, attracting six faculty members and 13 students to work and assist in the laboratory, while simultaneously providing high-end technical services such as 3D printing courses, frontier visualization, rapid prototyping, content scanning, and motion capture to the entire university community [2].

3.1.3 Space Sharing

Due to their established layouts, renovating library space for makerspaces entails not only high costs but also increased difficulty in mitigating environmental impacts such as noise and odors. If selection can be made from across the entire campus, the difficulty naturally decreases and renovation costs are substantially reduced. The University of Mary Washington's Simpson Library transformed an underutilized campus classroom into a makerspace, effectively utilizing idle resources while significantly reducing investment costs.

3.2 Social Donation Model

According to a 2014 survey by Miami University of Ohio Library covering libraries in 30 U.S. states and seven other countries (Australia, Canada, China, Denmark, Japan, Netherlands, and the United Kingdom), 14% of library makerspace funding came from social donations [3]. Current sources of donations for university library makerspaces in China mainly include alumni associations, public welfare funds, non-profit organizations, and individuals. Donations from alumni associations are primarily concentrated in well-known universities, such as Tsinghua x-lab and Peking University Entrepreneurship Incubator, all of which include alumni contributions in their startup funding. Public welfare fund sponsorship for makerspaces is more common abroad, with organizations such as the UK Makerspace Foundation, U.S. National Science Foundation, and SD-Bechtel Jr Foundation having made donations of varying scales to outstanding makerspaces. Non-profit organizations like LEGO Education are increasingly focusing on makerspaces, primarily donating equipment such as 3D printers [4], which can effectively alleviate equipment pressure. Individual donations manifest in two ways: financial and equipment donations, which are currently rare; and volunteering, which is more common among elite professionals from various industries who provide free guidance for maker projects. Currently, volunteers constitute one of the main sources of human resources for university makerspaces.

3.3 Library-Enterprise Co-construction Model

Library-enterprise co-construction is currently the most common model for university makerspace construction and operation. Its foundation lies in mutual benefit and reciprocity, ensuring stability and sustainability. Specific models include:

3.3.1 Library-Led Model

The library-led model positions the library makerspace as the dominant entity, absorbing enterprise funding and technical support to break through its own development bottlenecks and achieve sound operation. Enterprises can obtain transformation rights for innovative products from the makerspace, enabling legal tax avoidance while also discovering and recruiting outstanding maker talent to update their human resource structure. For example, South China Normal University's makerspace invites enterprise leaders to participate in project recommendation meetings for entrepreneurial students, attracting enterprise investment for entrepreneurial teams and providing students with platforms to showcase themselves, creating more opportunities for their future entrepreneurship or employment. Libraries can also provide cooperation platforms for enterprises to strengthen collaboration, as demonstrated by Wenzhou University's makerspace lectures, which attracted participation from local enterprises such as Wenzhou Meishangmei Shoe Network Technology Co. and Haowei 3D Technology Co., providing a platform for inter-enterprise exchange and cooperation [5]. Shanghai Jiao Tong University's "SJTU-JD Makerspace," jointly created by JD Group and the university library, has become a base supporting active innovation among faculty and students, representing a typical benchmark for library-enterprise cooperation in incubating quality brands [6].

3.3.2 Enterprise-Led Model

The enterprise-led model makes enterprise needs the dominant factor, giving early-stage university maker creativity clear directionality and fully leveraging enterprises' advantage in rapidly transforming achievements into products, thereby increasing makers' chances of success. The enterprise-led model still maintains the library makerspace's autonomy, enabling win-win outcomes for both enterprises and makerspaces. This model more easily mobilizes enterprise enthusiasm for participation, saves enterprises' R&D expenses, and allows enterprises to dispatch experienced technical personnel as maker mentors to guide students' maker practice, solving the talent shortage in library makerspaces while facilitating students' acquisition of practical knowledge. In 2015, the well-known video provider MakerStudio cooperated with Full Sail University to establish a makerspace, providing students with a platform to learn video production techniques and digital storytelling, reserving excellent talent for the enterprise's development while adding new perspectives and momentum for new product launches through university students' creativity. The "Changrong Jianhao Cultural Makerspace" established in 2015 at Tianjin University's Beiyang Park Campus Library, jointly created by Tianjin University and Tianjin Changrong Jianhao Cloud Printing Technology Company, represents the crystallization of industry-academia-research integration, achieving a win-win outcome for both enterprise and makerspace [7].

3.4 Crowdfunding Model

Crowdfunding is a recently emerged fundraising method that has been rapidly adopted across industries since the U.S. government legalized it in 2011. Makerspace construction can similarly employ crowdfunding to raise initial construction costs and develop creative products. The world-renowned crowdfunding platform Kickstarter successfully funded 12,000 maker projects in 2011 alone, raising \$100 million [8]. University libraries can use crowdfunding to raise funds for various stages of makerspace construction, procure various equipment, and even recruit managers and volunteers.

3.4.1 Selecting Appropriate Crowdfunding Methods

The biggest challenge in university library makerspace construction is the enormous initial investment. When using crowdfunding to raise these funds, several characteristics of crowdfunding must be considered to select suitable methods: first, crowdfunding harnesses collective power to jointly complete a project within strict time limits, with smaller amounts having higher success rates. Therefore, when raising makerspace construction funds, it is advisable to break the project into smaller components, such as dividing it into three parts—infrastructure renovation, space decoration, and furniture and equipment—with each piece of equipment being crowdfunded separately. Second, appropriate return methods must be selected. Since university library makerspaces lack independent autonomy, they are unsuitable for overly commercial crowdfunding methods and lean more toward public welfare crowdfunding, with returns primarily consisting of naming rights, honors, participation rights, and souvenirs. The crowdfunding model of Yunlei Garage Workshop offers valuable lessons, dividing the entire project into different levels and treating each workbench, tool, and wall as crowdfunding objects with corresponding returns—for example, decorating a wall allows the investor's name to be displayed on an honor plaque, while adding a workbench grants permanent free usage rights.

3.4.2 Selecting Suitable Crowdfunding Platforms

Currently, there are many crowdfunding platforms in China. Selection should primarily consider two factors: first, the platform's scale. Based on successful cases and fundraising amounts, the leading platforms include JD Crowdfunding, Taobao Crowdfunding, Zhongchou Network, and Qingju Crowdfunding. Larger scale means higher attention and greater project success rates. Second, platform preferences must be considered—for instance, JD Crowdfunding favors product development, Taobao Crowdfunding leans toward technology and entertainment, and Zhongchou Network focuses on public welfare projects. For library space renovation, Zhongchou Network may yield higher success rates, while JD Crowdfunding may be better for equipment procurement. Selecting an appropriate crowdfunding platform is crucial for project success.

3.4.3 Issues Requiring Attention in Implementing Crowdfunding Models

There are currently no real-world successful cases combining crowdfunding

models with library makerspace construction for reference. Therefore, implementation requires attention to several issues: first, maintain an attitude of bold vision with cautious implementation, preparing contingency plans and thoroughly considering potential problems; second, when designing crowdfunding projects, strictly adhere to the public welfare nature of libraries and avoid any form of commercial behavior; third, consider the possibility of crowdfunding failure and adopt multiple parallel approaches in space construction planning to minimize impact on overall progress if crowdfunding projects fail. In summary, during the initial construction phase of university library makerspaces, crowdfunding should serve as a supplementary method rather than being completely relied upon.

3.5 Government Support Model

3.5.1 Policy Support

Maker space encouragement policies and support measures issued by government departments at all levels have a significant promoting effect on university makerspace construction. In early 2012, the U.S. government planned to introduce makerspaces into 1,000 American schools within four years. On June 18, 2014, the first White House Maker Faire was held. This series of actions by the U.S. government laid the foundation for the rapid development of American makerspaces. The Chinese government has also introduced relevant policies and measures to promote makerspace construction. In early 2015, the term “maker” was first written into the government work report, and the State Council subsequently issued “Several Policy Measures for Promoting Mass Entrepreneurship and Innovation,” proposing “improved inclusive tax policies,” sparking the first wave of makerspace construction across the nation. The Shenzhen municipal government issued “Shenzhen Measures for Promoting Maker Development” and the “Three-Year Action Plan for Promoting Maker Development,” providing a favorable development environment for makers. Beyond policy support, current maker development also requires government departments to formulate relevant legal provisions to protect makerspace operation at the legal level and resolve issues such as intellectual property rights ownership and infringement during product transformation.

3.5.2 Financial Support

University library makerspace construction funding primarily comes from school appropriations, a considerable portion of which consists of national education subsidies. Beyond this indirect investment, governments have begun directly investing in university makerspace construction in recent years. Equipment funding for the makerspace at Kent State University’s Tuscarawas Library included \$24,900 in federal grants. In 2012, the U.S. government planned to fund 1,000 universities to build makerspaces. In June 2016, Obama announced that 11 government departments would invest \$2.5 billion annually to support maker research and practice [9]. Shenzhen, China, plans to invest at least 600 million yuan over three years to cultivate a maker community of 100,000 people,

transforming Shenzhen into an international maker center [10]. Numerous cases demonstrate that government investment has gradually become an important source of funding for makerspace construction.

3.6 Community Partnership Model

Communities are the basic units of society, serving both as venues for using social products and as important bases for generating social product demands. Compared with universities, community members have more complex compositions, and their creativity and needs are more diverse. The rapid development of American makerspaces is precisely based on the internal motivation generated by community makers' demand for new creation methods in terms of technology and social development, as well as the external push from planning and practicing maker actions in various communities across the United States.

3.6.1 Breaking Through the Talent Bottleneck of University Makerspaces

Unlike the single source of maker mentors in university settings, community members come from all sectors of society. Hiring community makers as mentors for university makerspaces can, on one hand, solve the dilemma of insufficient human resources in universities, and on the other hand, broaden students' horizons and inspire their creativity in making, generating more diverse creative directions. Simultaneously, with the participation of community makers, university makerspace outcomes will better align with actual social needs and be more easily transformed into real products. For example, the College of Business at Illinois State University created a makerspace laboratory based on the concept of "learning, making, and sharing" [11], inviting community makers to join through the laboratory and organizing community maker fairs where students display, recommend, and sell their maker outcomes to community residents to test their effectiveness.

3.6.2 Alleviating Funding Pressure on University Makerspaces

Through partnerships between university library makerspaces and communities, on one hand, outcomes produced in the space can be sold to community residents to commercialize maker achievements and raise funds to maintain normal space operation. On the other hand, university libraries can open their makerspaces to community makers for a fee, allowing community residents to participate in technology lectures, technical training, and scientific projects organized by the makerspace, as well as to use experimental equipment for a fee, creating a funding source for makerspace development [12].

3.6.3 Boosting Libraries' Fulfillment of Social Service Functions

The "Regulations on University Libraries" issued by the Ministry of Education in 2015 mentioned twice that university libraries should undertake social service responsibilities. In recent years, an increasing number of university libraries have opened to society to varying degrees, gradually becoming a trend. As an open innovation activity, university library makerspaces have obvious

“bidirectional interactivity”: on one hand, they can meet the needs of university libraries’ socialization of services, increase library value, and solve talent dilemmas; on the other hand, community makers can obtain opportunities and platforms for systematic maker education. Additionally, partnerships between library makerspaces and communities are more likely to obtain special funding investment and support from local governments. For instance, Pittsburgh has specifically invested substantial funds to hold maker action roundtable meetings and establish special funds to promote university-community partnerships [13].

3.7 Makerspace Alliance Model

Makerspace alliances, linked by region or industry, unite makerspaces belonging to the same region or industry to organize activities such as maker competitions, achieving free flow of resources and talent, avoiding redundant construction and investment, and effectively promoting university library makerspace construction. Chinese university makerspaces have spontaneously formed three major maker circles in Beijing, Shanghai, and Shenzhen, using these circles as foundations to hold renowned maker competitions such as the “Global Maker Marathon” and “China Maker,” effectively promoting university makerspace construction [14]. For example, the Shenzhen Makerspace Alliance, initiated by founders of Shenzhen maker bases and internet banking platforms, has become a gathering place for like-minded makers. The “Maker Education Base Alliance” established by Tsinghua University has members from over 60 university engineering training centers and more than 10 maker institutions and enterprises, sharing maker resources and exchanging ideas through the alliance [5]. The Shanxi University of Finance and Economics Makerspace Alliance has practiced its core values of sharing and joint responsibility since its establishment, serving as the campus agent for Dell computer brand marketing.

Conclusion

Makerspace construction for university libraries is both a new phenomenon—having emerged in China only two or three years ago—and relatively mature, with numerous successful domestic and international experiences available for reference and learning. In particular, the seven co-construction models summarized in this paper, except for the crowdfunding model, have all been verified through practice with specific case support, offering strong reference value. However, each library’s situation is different. When constructing their own makerspaces, libraries must avoid rigidly copying models and should instead select appropriate construction models based on their own institutions’ specific conditions. Moreover, these models are not isolated but rather complementary and can be combined as needed, or innovated upon based on existing models to seek better solutions. As society gradually attaches greater importance to makerspaces and related technologies mature, the difficulty of makerspace construction will substantially decrease, enabling more university libraries to gradually overcome their difficulties and build their own makerspaces, allowing

more student makers to benefit and thereby promoting the steady development of the national policy of “mass entrepreneurship and innovation.”

References

- [1] Chen Jing. Research on the Construction of University Library Makerspaces: Taking American Academic Libraries as Examples [J]. *Library and Information Service*, 2016(3): 47-55.
- [2] Wang Youmei, Chen Zan'an. From Innovation to Entrepreneurship: Construction Models and Enlightenment of American University Makerspaces [J]. *China Educational Technology*, 2016(8): 1-6.
- [3] You Yue, Jia Ping. Research and Suggestions on the Development Practice of Library Makerspaces [J]. *Library Journal*, 2015(5): 95-101.
- [4] Britton L. The Making of Makerspaces [J]. *Library Journal*, 2012, 137(16): 20-23.
- [5] Diao Zhenqiang. Research on the Construction of University Makerspaces in the Era of Mass Innovation [J]. *Research in Higher Education of Engineering*, 2016(2): 69-73.
- [6] Shanghai Jiao Tong University. “SJTU-JD Makerspace” Officially Completed [EB/OL]. [2017-03-08]. <http://www.sjtu.edu.cn/info/1489/65539>.
- [7] Culture and Education Research Network. “Changrong Jianhao Cultural Makerspace” Completed in Tianjin University Beiyang Park Campus Library [EB/OL]. [2017-03-08]. <http://edu.chinairn.com/news/20151029/171821763.shtml>.
- [8] Wang Wei. Visual Analysis of Research Hotspots on China’s Makerspaces [J]. *Modern Information*, 2015(12): 92-98.
- [9] Lin Yande, Lu Yunru, Huo Jianbin. Shenzhen to Invest at Least 600 Million in Three Years to Cultivate 100,000-Person Maker Community [N]. *Southern Metropolis Daily*, 2015-07-02(1).
- [10] Ding Yongjian. Practical Characteristics and Construction Experience of American Library Makerspaces [J]. *Library Work and Study*, 2016(6): 104-107.
- [11] From Innovation to Entrepreneurship: Construction Models and Enlightenment of American University Makerspaces [J]. *China Educational Technology*, 2016(8): 1-5.
- [12] Houston Community College (HCC) (2015). HCC Officials Break Ground for Workforce Training Center on Stafford Campus [EB/OL]. [2017-03-08]. <http://www.hccs.edu/district/news/articles/hcc-officials-break-ground-for-workforce-training-center-on-stafford-campus.html>.
- [13] Li Luyi, Zheng Yanlin. American Community Maker Education Carriers—Community Makerspaces: Development Motivation, Functions, and Applications [J]. *Open Education Research*, 2015(5): 41-49.
- [14] Zhang Yajun, Tang Peng, Li Jianqiang. Research on the Practice of American University Library Makerspaces [J]. *Library Work and Study*, 2015(4): 88-91.

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

Source: ChinaXiv — Machine translation. Verify with original.