Analysis of the Operational Mechanism of the ETH Zurich Library Lab and Its Implications: Postprint

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Abstract

[Purpose / Significance] First-class university libraries abroad are gradually embedding themselves into the core of the research lifecycle. Under this new trend, numerous novel practical achievements have emerged. This paper explores innovative directions and possibilities in library transformation by focusing on exemplary cases. [Method / Process] Employing web-based investigation and literature research methods for case study, this paper introduces the ETH Library Lab innovation project at ETH Zurich, conducts an in-depth analysis of its top-level design, operational mechanisms, and project outcomes, and comprehensively demonstrates the innovative aspects of this project in the transformation of library research services. [Results / Conclusion] The phased achievements of the ETH Library Lab provide two major references for domestic university libraries: first, libraries can proceed from a strategic perspective to identify their value contribution points within the research lifecycle, focusing on empowerment; second, in selecting paths for library transformation and innovation, they can actively seek external cooperation and conduct interdisciplinary innovation through relatively independent project teams.

Full Text

Operation Mechanism Analysis and Insights of ETH Library Lab

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Abstract

[Purpose/Significance] First-class university libraries abroad are gradually embedding themselves in the core of the research lifecycle. This new trend

has generated numerous innovative practices. This paper explores the direction and possibilities of library transformation by focusing on a highlighted case. [**Method/Process**] Using web-based and literature research methods, this case study introduces the ETH Library Lab innovation project at ETH Zurich, analyzing its top-level design, operational mechanisms, and project outcomes to fully demonstrate its forward-thinking innovations in library research service transformation. [**Result/Conclusion**] The phased achievements of the ETH Library Lab offer two key insights for domestic university libraries: First, libraries should strategically identify their value contribution points within the research lifecycle and focus on empowerment. Second, in choosing paths for library transformation and innovation, libraries can actively seek external cooperation and conduct interdisciplinary innovation through relatively independent project teams.

Keywords: ETH Zurich; library; research services; academic lifecycle

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As libraries enter a transformative period, the resources, services, and collaboration models they provide have undergone profound changes. Embedding library research support services throughout the entire research lifecycle [1-2] and continuously clarifying and expanding the scope and boundaries of library research support has become a consensus and trend among libraries both domestically and internationally to address this transformation.

ETH Zurich (Swiss Federal Institute of Technology), founded in 1855 and known as "Europe' s top institute," has produced 21 Nobel laureates or nominees including Albert Einstein. Its performance over the past five years has been particularly outstanding, consistently ranking in the top 10 across the world' s three major university rankings (QS [3], THE [4], and USNews [5]). This remarkable achievement is inseparable from its progressively comprehensive research support system developed during the same period.

Research support services at world-class university libraries have been a hot topic among scholars in recent years. As early as 2013, S. Corrall et al. surveyed bibliometrics and research support services at 140 libraries globally, including Australia, New Zealand, and the UK based on North American data, summarizing emerging trends in library support for research data storage and management, relevant policies, and career development [7]. Subsequently, A. Keller conducted an in-depth comparison of research support transformations at Australian university libraries with developments in Europe (particularly the UK, Switzerland, and Germany), identifying and discussing five types of research support services: institutional repositories, open access, bibliometrics and enhanced research impact, support for research students, and research data management [8]. Since then, innovations in research support services have been closely integrated with the open access movement.

Domestic research on this concept can be traced back to 2001 when Wang Li proposed that university libraries in the new century "must simultaneously

support teaching and research" [9]. However, systematic practical research only emerged after 2016. Xiao Long [2], E Lijun et al. [10], and Xue Jingjing et al. [11] took Peking University Library, domestic "211" university libraries, and six foreign research university libraries as examples respectively, revealing how the research lifecycle framework reshapes library research support services. In 2018, Si Li et al. conducted a comprehensive survey of research support services at 100 top-ranked university libraries worldwide, systematically summarizing service items, content, and forms, and outlining progress in research data management, open access, academic publishing, and impact assessment [12]. This series of studies established and guided subsequent domestic research directions: (1) In terms of content, the three most prominent themes—research data management [13-16], research evaluation services [17], and disciplinary support models [18]—became focal points; (2) Geographically, research expanded beyond American university libraries [19] to include the UK [20], Canada [21], Australia [22], New Zealand [23], the Netherlands [24], Sweden, Finland, Denmark, Norway [25], Singapore [26], and more.

Against this backdrop of increasingly detailed disciplinary support models and research support content, where lies the innovative boundary of university library research support services? Beyond rapidly advancing research data management, the term "incubator" has appeared more frequently in overseas case studies, representing a frontier area. While not yet forming a separate research theme in terms of output volume, the incubation function has never ceased in library transformation practice and exploration. In 2018, Utrecht University Library in the Netherlands announced a six-year development plan in its OA journal *Uopen Journals*, explicitly proposing to use the journal as a platform for deep cooperation with authors to incubate results [32], actively promoting open access. The following year, Arizona State University Library, through close collaboration with the university's Knowledge Entrepreneurship and Development Office, developed the library into a core component of the university's research achievement incubation system, gradually extending to direct funding of research projects [33].

Among these exploratory projects that emerged since 2018, ETH Zurich's ETH Library Lab project stands out as an exemplary case. Its solid top-level design, operational model, and rich achievements make it an ideal case with clear positioning and distinctive results in current library incubation practice—also the reason for selecting it as the research object. This case selection is based on three considerations: (1) Geographically, it supplements diverse continental European perspectives beyond the dominant US-UK research 视野; (2) Regarding the university, ETH Zurich is a historically established, top-tier research university whose strength rivals well-known Anglo-American elite institutions, with key disciplinary areas highly matching China's "14th Five-Year Plan" emphasis on "basic disciplines" and "science, engineering, agriculture, and medicine" [6], offering strong strategic reference value; (3) From a library transformation perspective, ETH Zurich Library provides rich and complete research materials, from top-level strategic decisions to specific practical outcomes, making it an

ideal research subject. Due to space limitations, this paper focuses on the ETH Library Lab as a highlight project, concentrating on its forward-looking, strategic, and practical nature to expand thinking and provide reference for domestic university libraries.

3. Analysis of Main Characteristics of the ETH Library Lab

As an exploratory project, the Lab did not emerge from a vacuum but was naturally born from the research lifecycle, closely integrated with university-level research strategy and library planning.

From the university strategy perspective, as Switzerland' s most important research "brain," ETH Zurich has established four strategic disciplinary directions: health and medicine, data and information, social responsibility and sustainability, and materials and manufacturing [34]. The university' s entire research support system revolves around these four areas, striving for completeness and detail [Figure 1: see original paper]. In its official website' s chart of support systems for students' academic and research careers, the horizontal axis identifies seven target groups (prospective students, undergraduates, master' s students, doctoral students, postdocs, assistant professors, and professors), while the vertical axis outlines five service modules (personal affairs, study/research career, research projects, technology transfer, and associations/organizations). Each module has specific departments responsible for implementation, forming a three-dimensional research support network that runs through researchers' growth cycles. The university' s cross-group, interdisciplinary, and cross-field collaborative atmosphere is strong, described as a "greenhouse" that attracts international talent and innovation-driven forces [35].

From the library' s perspective, following the university' s service philosophy for the entire research cycle, ETH Zurich Library has since 2018 further integrated the value chain model with the research lifecycle, anchoring its position in the entire research value chain and formulating the 2020-2024 library strategic plan [37]. By breaking down the scientific value creation chain into nine components [Figure 2: see original paper], the library further clarified its position in the core research ecosystem and identified providing comprehensive support for the research value chain as one of its strategic priorities. The library has already established a common platform with the university' s Scientific IT Services for scientific data management alone, covering all mainstream research data storage formats and assuming active data management responsibilities. The strategic plan identifies four major service sectors including research data management [38]. Building on this strategic goal and existing system, the library adopted a "point-to-surface" approach to create a forward-looking project implementation point—the ETH Library Lab.

Founded in 2018, the Lab's timeline aligns with the library's 2020-2024 strategic design. Project leader and Library Director R. Ball articulated a bold hypothesis when explaining the founding concept: "True innovation is not easily born in

the traditional organizational environment of libraries" [39]. Therefore, from the outset, the Lab was established as relatively independent from the existing library structure, with the director personally reorganizing the team to explore the form and functions of the "future library" and enable potential disruptive innovation.

3.2 Lab Operation Mechanism

Through web-based literature research, this paper analyzes the Lab' s operational mechanisms from three aspects—funding, personnel, and project selection criteria—to reveal its distinctive exploratory nature.

3.2.1 Funding Sources Despite relatively sound top-level design and management support, the Lab's sustained operation relies on strong resource guarantees. The core funding is the university-level International Innovator Fellowship, which supports 2-4 selected projects annually. While no specific total funding amount is disclosed, the research grant covers comprehensive and flexible support including space (dedicated offices in the library), salary (approximately 5,000 Swiss francs per month, equivalent to about 35,000 RMB), training and guidance, travel, and infrastructure development. The annual funding duration is flexible based on project completion time, typically ranging from 3-9 months, which greatly facilitates researchers' work [40].

3.2.2 Personnel Structure The Lab's management team adopts a flat structure consisting of a Scientific Committee and a project management team. The former comprises international experts in the Lab' s key areas who provide recommendations for future research development and select fellowship applicants; the latter is responsible for specific Lab construction. Notably, the team composition fully utilizes external resources rather than merely drawing from existing university and library staff. The project' s advisory committee has four core founding members [41]: Dr. R. Ball, Director of ETH Zurich Library; S. J. Groeneveld, Founder and Managing Partner of Inspire 925 Consulting and Deputy Director of the Digital Leadership Institute at the Zurich University of Applied Sciences in Business Administration; Frank Scholze, Director of the German National Library (former Director of Library Services at Karlsruhe Institute of Technology); and Prof. M. Meboldt, Head of the Product Development and Engineering Design Department at ETH Zurich. These founding members are all senior experts with rich practical and management experience, representing academic, industry, and public sector perspectives.

After the initial startup phase, the Lab also introduced a "professional manager" model. Through external recruitment, daily operations were transferred from the director to Project Managing Director M. Okonnek. Unlike traditional academic or library science backgrounds, Ms. Okonnek studied and worked in Germany and Japan, specializing in digital media management with strong expertise in project development, digital product building, and coordinating in-

novation and cooperation projects [42]. Her more open working style actively adopts many practices from angel investors, even collaborating with the Swiss Chamber of Commerce for overseas roadshows [43] and recruiting qualified applicants in China.

The personnel recruitment, management, and operational model further demonstrate that the Lab aims to create a truly "cross-border, cross-disciplinary, cross-field" open innovation model from its human resources approach.

3.2.3 Lab Goals and Project Selection Criteria The Lab originated from an interdisciplinary horizontal collaboration project between the library and the Karlsruhe Institute of Technology Library in Germany. Unlike other "horizontal" projects where the library only provides funding and conducts mid-term and final assessments, the ETH Library Lab serves as a full-fledged science and technology incubator providing comprehensive support in funding, human resources, and resources. Through this project, the library can directly help young talents from interdisciplinary backgrounds conduct experiments, validate hypotheses, and incubate prototypes for their innovative concepts.

Positioned as an "incubator for open knowledge ecosystems," the Lab's overall goal is to achieve "the free flow of scientific data, information, and knowledge," aiming to open pathways in the research value chain and encourage young talents' forward-looking innovations in open science. To analyze how these goals are implemented, this paper focuses on the Lab's published project selection criteria [44] (functionally equivalent to the familiar "topic guidelines" for domestic scholars). The criteria include: (1) Four major evaluation standards: innovation potential, clear thematic positioning, relatively clear research plan, and applicant's interpersonal and communication skills; (2) The first two standards are not limited by discipline or theme and are relatively broad, yet all funded projects focus on deepening library involvement in information science and interdisciplinary fields (detailed annual projects are shown in Table 1), demonstrating strong forward-looking vision; (3) The latter two standards show that the project does not evaluate whether the research plan is "mature," nor does it require common metrics like papers, reports, or monographs. Instead, it explicitly encourages early-stage innovative ideas and particularly emphasizes communication skills, which differs significantly from typical research project application criteria.

From the overall concept, goals, and distribution of selection criteria, the Lab is fundamentally different from daily library operations—it is more forward-looking, more inclusive, and even allows for certain ambiguities, serving as a "testing ground" for future library functions.

3.3 Lab Achievements

Since its launch in 2018, the Lab has incubated 10 projects and "graduated" 19 innovators. The project outcomes are almost all interdisciplinary, which again

distinguishes them from ordinary research funding or support projects and fully demonstrates the library' s capacity for research empowerment and excellent interdisciplinary innovation vision.

Among the incubated projects, the most representative achievement is the 3D-printed artificial coral reef project [46], which spans humanities, art, marine biology, and materials science. Due to climate change, coral reefs face severe extinction risks. Artist M. Griesmar learned about the Lab through its San Francisco roadshow and immediately applied. With the Lab' s strong multidisciplinary and cross-regional research network support, Griesmar found marine biologist U. Pfreundt and programmer J. W. Van den Bulcke to collaborate on using 3D printing to rebuild coral reefs. They eventually developed 3D-printed bricks that can be assembled underwater to form artificial reefs, with samples currently being tested in the Indian Ocean.

This incubated project well demonstrates what the library aims to achieve: project leadership, innovation frontier, clear themes, and ultimately full embodiment of research and social value. Most importantly, without the library' s inclusive fundamental attitude, the applicant' s artistic background alone could have become an obstacle to project implementation, making such creativity unlikely to emerge from traditional marine science, art institutions, or 3D modeling technology fields.

Tracking the project reveals the Lab' s indispensable role, as it "helped find the right people and provided the necessary methodological framework for interdisciplinary approaches." This is a sincere evaluation from project participants based on their experience, clearly showing the value and role of the ETH Library Lab.

Insights and Recommendations

Re-examining Library Value and Empowerment from the Research Value Chain Reviewing the Lab' s background reveals that this innovation was not a management whim. First, ETH Zurich itself has a complete research support system that has already achieved deep embedding of internal services within the research lifecycle. Second, as an "intermediary" for academic knowledge flow, the library adopted relatively advanced analytical models from academia and industry to identify its contribution points to research value, strategically integrating research support resources and services from a high-level perspective. Finally, at the implementation level, the library proposed a "user-centered" service strategy internally (ETH Zurich Library is one of the few university libraries that refers to "users" as "customers" in planning documents, annual reports, and news reports, and has established a "Customer Care Team" in its organizational structure [47]), while simultaneously establishing the ETH Library Lab as an independent operation to actively lead research. ETH Zurich Library' s approach is coherent and methodical, with clear continuity from university strategy to Lab goals, fully demonstrating the library' s

unique value for research innovation.

Similar to ETH Zurich Library, domestic university libraries also have an urgent need to establish their irreplaceable value to the university, faculty, students, and various partners. This demand has generated one path for library transformation: serving the university' s core users—the research community. By embedding itself in the research ecosystem, the library enables researchers to continuously develop trust and dependence on library services, thereby becoming the university' s "academic intermediary and change agent" [48] and continuously enhancing the core competitiveness of university libraries. This ecosystem' s corresponding research lifecycle includes not only pre-project research, implementation, and output, but also the cultivation of research teams, accumulation and maintenance of knowledge achievements, and collection, retrospective compilation, donation, and subsequent research of materials by disciplinary leaders. The Shanghai Research Field (Humanities and Social Sciences) Big Data Joint Innovation Laboratory, established in 2020, represents a beneficial attempt under similar philosophy. The laboratory not only integrates characteristic resource databases through organizing university open data competitions but also substantively participates in projects through data services, such as undertaking the "Study on the Distribution and Development of the Floating Population in the Yangtze River Delta" commissioned by the National Health Commission' s Floating Population Service Center, providing suggestions for relevant think tanks [49]. By establishing long-term supportive relationships with key research users both on and off campus, libraries can serve as the university' s "heart" while further institutionalizing decision-making consulting services as a normalized function [50], thereby gaining more discourse power and influence.

Library Transformation Path: Actively Seeking External Experience and Interdisciplinary Attempts In exploring library transformation, the ETH Library Lab project not only focuses on research value but also boldly innovates in its transformation path selection, extensively collaborating with academia, enterprises, and government departments for deep incubation cooperation. Despite being established for only three years and facing the COVID-19 pandemic, the project has achieved tangible results, which is remarkable. This is inseparable from the Lab' s model of sharing risks through independent project establishment and external cooperation. Similarly benefiting from extensive and close cooperation, the project can freely recruit talent and focus on interdisciplinary fields of greatest concern to libraries in the short-to-medium term (future libraries, collection visualization, machine learning for resources, etc.), using project outcomes to feed back into library transformation and development.

Among domestic universities, the Fudan-Alpha Library Science Research Center, established in 2020, adopts a university-library-enterprise joint model, leveraging complementary advantages to promote smart library research and applications [51], and in 2022 began recruiting autonomous research groups within the

library to deeply study cutting-edge topics related to smart libraries and incubate more applied innovations beyond the boundaries of library and information science.

The ETH Library Lab represents a beneficial attempt in library research service innovation and transformation. The foundation for this forward-looking project' s smooth and sustained development lies primarily in the library' s existing deep embedding of business throughout the research lifecycle. More importantly, as the main entity, the library can break free from traditional positioning, embrace innovation with strategic awareness, and find a relatively small entry point for transformation pilot projects. With guaranteed funding and human resources, it boldly adopts industry venture capital operation mechanisms and models to collaborate with stakeholders sharing common goals, thereby elevating the library from a former "support department" to a core "incubator" for research innovation. This adds a new possibility for future library development and provides useful insights and references for the transformation path of university libraries both domestically and internationally.

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Author Contributions

Chen Xiaoyuan: Participated in framework development, collected and organized materials, wrote and revised the paper; Yuan Yuhong: Proposed the research topic and framework, guided paper writing.

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