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Advances in Theory and Application of Science and Technology Information Policy Foresight

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Abstract

Based on a comprehensive understanding of trends in the evolving environment of scientific and technical information exchange and related policy foresight research, this study uses the inaugural China Open Access Promotion Week as a case study to illustrate the practical experience of applying policy foresight in the domain of scientific and technical information policy. The research demonstrates that policy foresight can establish structural elements for policy communication and shape the direction of future scientific and technical information exchange.

Full Text

Theory and Practical Progress of Policy Foresight for Science and Technology Information

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Abstract: Based on a comprehensive investigation of trends in the science and technology (S&T) information exchange environment and relevant policy foresight research, this paper uses the first China Open Access Week as a case study to illustrate practical experience in applying policy foresight to S&T information policy. The study demonstrates that policy foresight can establish structural elements for policy communication and shape the future direction of S&T information exchange.

Keywords: Policy research methodology; Selective future; S&T information nudge; Open access

Changes in the S&T Information Exchange System and Strategic Needs

The structure of current S&T information exchange is undergoing significant transformations. First, the development of data-driven research has made scientific activities inseparable from data management [?]. Second, the emergence of born-digital resources has raised the bar for information management technologies [?]. Third, the appearance of native open access behaviors is driving changes in the knowledge industry supply chain [?]. Fourth, controversies over scientific data management are forcing major adjustments to policies affecting researchers and project management [?, ?].

These changes, summarized in , share three overarching characteristics: they all exert major impacts on the technology, policy, and behavior of S&T information exchange systems; they represent complex phenomena that evolve through continuous interaction; and new changes continue to emerge with expanding influence. Consequently, the library community must adjust its strategies to adapt to these shifts.

Building upon dynamic tracking of international developments, referencing and adapting them to China' s library and information science realities—encompassing institutional systems, organizational capacities, and operational frameworks—cannot yield concrete and feasible policy recommendations through a few research reports alone. This is because actual conditions and implementation intentions exist across various levels and sectors of the industry. Therefore, it is more practical to enable broad participation in community-based collaborative discovery, equal consultation, consensus building, and collective action. In the face of rapidly changing and complex environments, a new strategic model that fills gaps and accelerates operations is better suited to address the disruptive changes in S&T information exchange structures.

This paper introduces foresight policy research methods to explore pathways for implementing S&T information policy research and consulting work in China. Foresight thinking encompasses three approaches with interconnected methods but distinct methodologies: technology foresight, strategic foresight, and policy foresight. Technology foresight (distinct from technology forecasting) focuses on how to generate future technologies. Strategic foresight (including both Strategic Foresight and *la prospective*) concerns not only what technologies should emerge but also how to shape them. Policy foresight (similar to *la prospective*) addresses the necessary and sufficient conditions for developing these technologies and how to prepare for the future before it arrives. In policy science, policy foresight includes organizational activities such as joint exploration, collaborative innovation, consensus building, and creating conditions for future development. Based on the experience of the first China Open Access Week, this paper examines how foresight thinking can advance S&T information policy research and practice in China, hoping to inspire broader peer participation.

Research Progress and Theory of S&T Information Policy Foresight

Current S&T information policy demands feature timely reflection, advance deployment, and rapid execution, requiring mechanisms that can quickly concentrate resources, solve problems immediately, and disband instantly—differing from traditional cross-organizational collaboration models that establish new permanent structures. Foresight governance, with its systematic thinking and continuous feedback, can appropriately meet these needs. Foresight governance draws from: (1) the engineering modeling of Technology Foresight (TF) and its public policy applications; (2) the humanistic 思辨 of Strategy Foresight (SF) and its social movement practices; and (3) Policy Foresight (PF), an emerging policy research model in the Asia-Pacific region that integrates both approaches and forms the focus of this study.

Technology Foresight originated from U.S. military-industrial operations research, while Strategy Foresight emerged from French critical thinking in policy formulation. Germany’s Federal Ministry of Education and Research (BMBF) recently launched a National Foresight Process that combines both approaches, forming a “Policy Foresight Methodology” for S&T information, decision intelligence, and organizational transformation. This methodology employs quantitative bibliometrics, qualitative workshops, expert interviews, and internet/literature research as core methods, creating a policy formation mechanism of “anticipatory intelligence shaping the future.”

A key feature of Policy Foresight is Anticipatory Intelligence: investing substantial information before decision-support intelligence is generated to establish directionality before the future arrives. Policy foresight initiatives are not merely about “looking into the future” but also about *shaping* and *constructing* the structure of our chosen future. This rich, curated, and verified information—created before intelligence production—enables not only reasonable inferences about the short-term visible future based on past events but also the formulation of alternatives for the long-term unknowable future based on possibilities of events that have never occurred. It allows us to envision, plan, guide, and articulate futures that would not otherwise happen and, to a considerable extent, realize them.

For example, [Figure 1: see original paper] illustrates the flow of Germany’s National Foresight Process, while [Figure 2: see original paper] shows the methods employed. Relevant policy foresight research is summarized in .

Based on preliminary research, we believe that specific practices for S&T information policy research and consulting can include: (1) implementation program design, (2) bibliometrics and literature review, (3) workshops, (4) agenda-setting, (5) stakeholder communication, (6) expert interviews, and (7) forums and promotion.

However, in a dynamically changing environment, promoting policy discussions that align with majority interests and industry development requires evoking en-

thusiasm. A conducive atmosphere for policy discussion must consider: informative outcomes, instrumental outcomes, consensual future perspectives, diverse future perspectives, fixed management, autonomous management, and stakeholder engagement. Therefore, it is not merely expert seminars, exhibitions, project research, or product development, but rather an integrated movement that achieves awareness-raising, consensus building, criticism acceptance, and joint industry advancement. While its thematic scope may be narrow, its forms and methods can be diverse. The China Open Access Week held from October 22-24, 2012, provided such a practical opportunity.

Application Practice of S&T Information Policy Foresight

Purpose and Significance of China Open Access Week Open Access has become a crucial mechanism for promoting international academic exchange and information sharing, transforming how digital scholarly information is organized, disseminated, and utilized. Initially, opening S&T information aimed to address the commercial monopoly of electronic journals and remove barriers to S&T information dissemination. However, as information resources proliferate, application technologies advance rapidly, and the concept of scientific collaboration grows, countries have developed different open access policy practices contributing to their S&T development. These changes require rapid dissemination methods to help disparate institutions reach consensus on appropriate open access pathways for developing nations. At this juncture, applying S&T information policy foresight can assist institutions in formulating and implementing open policies, selecting practical solutions, and maximizing open access to S&T resources.

China's open access movement is not without foundation. As early as 2004, then CAS President Lu Yongxiang and NSFC Director Chen Yiyu signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities on behalf of their respective institutions [?]. In 2010, the Chinese Academy of Sciences and the Max Planck Society co-hosted the 8th Berlin Open Access Conference, notable for being the first held outside Europe [?]. These practices laid important groundwork for China's open access movement. However, as open access concepts, functions, technologies, and methods continue evolving, Open Access Weeks have been held globally each October since 2007 to publicize, promote, exchange, and discuss various open access issues (preliminary planning shown in [Figure 3: see original paper]). To bridge international developments with domestic needs, S&T information policy foresight employs scientific decision-making and democratic processes to structure complex issues.

Drawing on international Open Access Week experience and China's accumulated foundation, the first "China Open Access Week" was held at the National Science Library, Chinese Academy of Sciences, from October 22-24, 2012 [?], inviting renowned open access advocates from home and abroad, with over 360 participants from various sectors.

Process Planning Using Foresight Methods Current open access movements primarily take two forms: Green OA, which requires researchers to deposit final manuscripts of journal articles in institutional repositories after an embargo period; and Golden OA, where researchers publish directly in journals providing open access.

To fully demonstrate these various forms without favoring either, while observing and learning from international experience and showcasing domestic developments, the conference schedule was divided into three themed days: Open Repository Day, China Institutional Repository Day, and Open Publishing Day. The first day introduced the overall development status of international institutional repositories, discussing trends, best practices, and future challenges. The second day shared China's experiences in institutional repository construction, addressing common concerns about strategy, policy, mechanisms, workflow, and interoperability. The final day presented and organized cases, mechanisms, and measures for open publishing, along with relevant policies supporting open publishing domestically and internationally.

Conference design emphasized not only informative outcomes but also instrumental channels. To facilitate comprehensive exchange on these three themes while enabling sufficient communication and active engagement, daily activities included topic speeches, expert discussions, and working group launches (on the first two days). The expert discussions each afternoon invited speakers and distinguished guests for dialogue, with questions and interaction from industry, academia, publishing, and graduate students. The launch ceremonies for the "China arXiv.org Service Working Group" and "China Institutional Repository Promotion Working Group" both declared and encouraged active participation by China's library and information community in the open access movement and established concrete task organizations post-conference. These activities sought consensual future perspectives among diverse viewpoints and autonomous management solutions within fixed management structures.

Implementing Policy Foresight Tasks Meeting tasks comprised three phases and two tracks. The three phases were pre-conference, during-conference, and post-conference. The two tracks were logistical work and thematic research, which formed an X-shaped cross pattern across the three phases: preliminary research and preparation, full-team assembly during the week (with both thematic research and logistical work conducted on-site), and post-conference research and follow-up. Example work documents are shown in [Figure 4: see original paper], while important task archives are listed in .

Speakers' presentations were deposited in the National Science Library's institutional repository and made open access on November 2, 2012. The China Open Access Week website provided links on the conference schedule to the speakers' PDFs in the institutional repository for open sharing (as shown in [Figure 5: see original paper]).

Implications and Future Development of S&T Information Policy Foresight

Anticipatory Intelligence Activities Based on Intelligence Research

Traditionally, information policy falls within library science. The changes in S&T information exchange systems listed in Table 1, if processed using intelligence analysis methods, can enhance the efficiency of S&T information policy research and consulting. However, while the conventional “data-information-intelligence-knowledge” paradigm effectively refines information and rapidly deduces event trends, it remains relatively conservative in describing visions and changing futures, seldom addressing these aspects.

Conversely, policy foresight as an anticipatory intelligence activity does not focus on describing the visible future of existing facts but rather provides alternative future conditions for facts that do not yet exist (in the past). Fully grasping the dynamics of policy foresight can open new horizons for intelligence activities while transforming the passive role of S&T information policy.

Intelligence Activities and Policy Research Involving Public Affairs

Using China Open Access Week as an example, this approach does not merely satisfy traditional policy research methods such as translation and literature review (desktop work). Instead, it aspires to engage the public in a socially participatory open access movement. While different stakeholder groups—including libraries, publishers, scientists, and graduate students—hold varying positions and perspectives, its significance lies in providing a space for all parties to clarify concepts and propose constructive opinions.

Unlike traditional technology foresight, Policy Foresight (PF) integrates Technology Foresight (TF) and Strategy Foresight (SF). The development of “foresight research” is important, but the “policy work” component is even more crucial. The various “trends” listed in Table 1 could all become subjects for policy foresight exploration at different levels and implementation modes.

Operational Model for S&T Information Policy Research and Consulting

S&T information policy involves not only library and information science but also law, administration, S&T management, public interest, and public policy, encompassing competing and conflicting stakeholder relationships. Therefore, the challenge in S&T information policy research and consulting lies in various positive and negative effects of information transmission, shielding, distortion, and improvement. Policy foresight methods can identify, supplement, and refine relevant information through converging discussions from all parties, providing the public with several achievable directions and concrete implementation plans.

As shown in [Figure 6: see original paper], the model begins with needs assessment, followed by service design. Service models derive from policy choices, which must consider stakeholder interests and policy analysis/comparison. As

a comprehensive activity integrating long-term strategy, medium-term tactics, and short-term operations, policy foresight possesses advantages in detecting, formulating, planning, and shaping various information support mechanisms related to future S&T.

This paper is a brief discussion of policy foresight theory and practice, using China Open Access Week as an illustration. Its purpose is to explain the “foresight mechanism” as a collaborative model for seeking consensus and shared discussion, serving as a modest spur to induce more valuable contributions.

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