Library Development Dynamics and Direction in a Changing Environment: An Analysis Based on an Integrated Framework of Organizational Theory and Knowledge Theory Postprint

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Abstract

[Purpose/Significance] To identify and analyze the dynamic mechanisms through which libraries achieve development in the current transformative environment, and to explain the patterns and direction of their changes. [Method/Process] Review existing research and construct an analytical framework by drawing upon organizational theory and knowledge theory. [Results/Conclusion] Changes at the knowledge content level drive cascading changes and adaptations in knowledge management technologies and library governance structures, leading to holistic transformation of library institutions.

Full Text

Preamble

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Driving Forces and Directions of Library Development in a Changing Environment: An Analysis Based on an Integrated Framework of Organization Theory and Knowledge Theory

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Abstract

[Purpose/Significance] This study aims to identify and analyze the dynamic mechanisms driving library development in the current changing environment, and to explain its patterns and directions of change. **[Method/Process]** The study reviews existing literature and constructs an

analytical framework by drawing upon organization theory and knowledge theory. [**Result/Conclusion**] Changes at the knowledge content level trigger cascading changes and adaptations in knowledge management technologies and library governance structures, leading to holistic institutional transformation.

Keywords: library reform; library development driving forces; organization theory; knowledge theory
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1 Research Origin and Objectives

The transformation path of libraries has long been a focal concern in both library science theory and practice. Since 2013, our research team has continuously tracked development strategies and transformation approaches of libraries worldwide, conducting periodic reviews and forward-looking analyses every 1-2 years and publishing related synthesis findings. Through this process, we have developed a series of stage-specific understandings and trend predictions, which can be summarized by three sequential keywords: "transformation," "balance," and "driving force."

First, **transformation**. In our initial understanding, transformation stemmed from the rapidly changing technological, economic, and social factors since the 21st century. We argued that libraries could no longer meet successive challenges by merely "optimizing, adjusting, and upgrading" within traditional frameworks. Instead, they needed to redefine and redesign their value positioning and structural functions according to environmental changes, achieving genuine "transformation, reshaping, and reinvention" [1].

Second, **balance**. In the second stage, based on analysis of national library development strategic plans, we found the term "balance" appearing more frequently than before. Libraries no longer emphasized transformation and disruption alone, but rather sought a "dynamic balance in development" across resources, spaces, services, and roles in the context of continuity between old and new knowledge environments [2]. Shera emphasized that libraries as social institutions are deeply influenced and constrained by their social environment [3], but this does not mean libraries are hetero-organizational systems that evolve solely through external stimuli or directives. In an environment where change has become normalized, relying only on "stress responses" would trap libraries in a perpetual state of being "impacted," "affected," and "disrupted" [2], risking marginalization and loss of foundation.

Third, **driving force**. In the third and current stage, our focus on driving force stems from questioning the mechanisms underlying this "dynamic balance." Libraries represent organic systems combining both "hetero-organization" and "self-organization." The connection among these three keywords can be summarized as: discovering a "balance" state behind "transformation," then exploring the "driving force" mechanisms that maintain this balance. At the current re-

search stage, this paper attempts to address the following questions: What are the endogenous driving forces that ensure libraries maintain "dynamic balance" in a "changing environment," propel them from "disorder" toward "order," promote the preservation of original functions or generation of new ones, and enable continuous self-improvement? How do these endogenous driving forces interact with the external environment? What characteristics and patterns of change exist in these dynamic mechanisms themselves? What are the directions of these forces, and how are they manifested in library practice?

Addressing these questions is significant for two reasons. First, it overcomes the limitations of previous library development strategy and trend studies that mostly described individual cases and surface-level phenomena, attempting to derive regular, theoretical insights from numerous manifestations. Second, based on theoretical analysis, it seeks to find support from real-world contexts [4], then uses the constructed explanatory framework to prospectively predict and interpret library transformation, providing guidance for library practice.

Accordingly, this study is designed as follows: first, review literature on library development "driving forces" and their mechanisms to understand existing research foundations and limitations; second, draw upon organization theory and knowledge theory to integrate relevant theories and construct an explanatory framework for libraries; third, analyze the driving forces of library development in changing environments based on this framework, identifying new driving force growth points and their directions.

2 Literature Review

2.1 Literature Survey Process

The issue of library development driving forces has appeared in Chinese research literature since the 1990s. In existing studies, the term "driving force" is widely used. This study used "driving force" as a title keyword and selected the CSSCI journal database in CNKI as the data source, obtaining 95 documents in the library, information, and digital library fields. After excluding documents with low relevance such as those discussing enterprise development driving forces or network communication driving forces, we obtained 68 documents directly related to library development driving forces. Using a combination of content analysis and bibliometric methods, we extracted and parsed the content elements referred to as "driving forces" in the texts, forming a quantifiable set of driving force elements. These were then clustered according to certain principles to establish a category framework. Following content analysis coding procedures [9], we extracted and merged elements to obtain 48 driving force elements.

For category construction principles, Fu Lihong divided the library driving force mechanism operation process into five stages: driving source development, driving force transformation, driving force cultivation, driving force distribution, and driving force feedback [10]; Guo Haiming divided library operation driving force mechanisms into four elements: driving source, driving force storage, driv-

ing direction, and service driving force [11]; Wang Xuming et al. divided public library development driving forces into administrative promotion and endogenous development [12]; many other studies divided library career development driving forces into three major types: original driving force, internal driving force, and external driving force [13-15]. Drawing on these achievements, this study integrated the 48 original driving force elements extracted from literature into the framework shown in Figure 1 [Figure 1: see original paper].

2.2 Analysis of Driving Force Elements

2.2.1 Directions and Targets of Library Development Driving Forces Figure 1 shows that existing research on library development driving forces covers directions including resources, space, services, users, human resources, and disciplinary theory. Table 1 further presents specific targets of library development driving forces, most of which are historical or current hotspots. For example, in library resource construction, research discusses the development driving forces of institutional repositories and open access [16-18]; in library space renovation, research discusses the development driving forces of information commons and learning commons [19-20]; in library services, research has successively examined knowledge services [21], subject services [22-23], data services [24], and other service models.

2.2.2 Types of Library Development Driving Forces First, existing research primarily treats user demand and knowledge attributes as the original driving forces of library development, reflecting the recognition of user-centered concepts and the important influence of libraries' knowledge attributes.

Second, external driving forces for library development can be summarized as macro social environment, technology, government, and market. For example, urbanization in the macro social environment promotes urban library development. Information technology is the most frequently discussed external driving force for libraries. In recent years, accelerated legislation for public cultural services and the establishment of modern governance structures have also strengthened researchers' attention to government roles. Additionally, market driving forces have been repeatedly mentioned, particularly regarding the impact, influence, and lessons from market competitors such as search engines, database vendors, and consulting companies.

Finally, external factors only work through internal factors. When it comes to internal driving forces for library development, professional ethics, value pursuits, beliefs, and concepts are the most frequently mentioned elements, which can aptly be described as "spiritual driving forces." Next are structural driving forces such as organizational structure and human resource allocation, as well as management methods including knowledge management and performance management, and support from theoretical research.

2.2.3 Quantitative Analysis of Library Development Driving Force Elements This study categorized the 48 original driving force elements into ten major categories, then used these 10 category labels to index each collected document, obtaining mention frequencies of major driving force elements in existing research, as shown in Figure 2 [Figure 2: see original paper]. This expression intensity indicator can reflect the focus of existing research on library development driving forces.

As Figure 2 shows, technological factors are the most frequently mentioned driving force element, followed by demand factors. Content factors include knowledge characteristics and library literature resource characteristics, reflecting libraries' features as knowledge collections. Government factors reflect libraries' reliance on policy, legal, and financial support from government. Value factors include library professional ethics, professional philosophy, and values. If technology, demand, content, and market factors represent common driving forces for different information service institutions, then value factors represent characteristics that distinguish libraries from other information service models. The market factor's explicitness can help libraries better choose development directions and strategies [25], as libraries also exist in market environments and must transform their core capabilities based on productivity and market environment changes [26]. Less frequently mentioned factors include organizational factors, library institutional characteristics, theoretical research, and cultural factors, with organizational factors mainly involving library business organization methods and human resource management. These differences in bibliometric attention do not fully represent the importance or weight of elements in real contexts, but may instead reflect blind spots and weaknesses in research perspectives.

2.3 Limitations of Existing Research

Reviewing existing research reveals several findings: (1) Attention to driving forces mostly accompanies the emergence of new forms in the library field, with new phenomena containing enormous development power, and exploring this power being indicative for grasping library development trends; (2) Library development driving force elements are in evolutionary flux—for example, knowledge services, as a new phenomenon in early stages, were objects of driving force injection and action, but later transformed into library driving sources acting on emerging fields like data services; (3) Library development driving force elements exist in an open environment, where endogenous driving force elements require continuous interaction with the outside world, manifesting as policy guidance, technology adoption, and interaction with other institutions.

However, existing research also has limitations: (1) The driving force elements presented in existing research are too general, often summarized as demand, technology, policy, and market, which could describe driving forces for most types of institutions, lacking integration with library institutional attributes and knowledge attributes; (2) Most existing research is descriptive and lagging,

often focusing on driving forces only after new forms emerge, lacking predictive, guiding, and forward-looking research that uses driving force patterns to identify and anticipate potential emerging fields and growth points; (3) In existing research, technological factors serve as the main "independent variable" of library change, presenting a one-dimensional linear logic of "technology triggers library transformation." However, this logic has many limitations—for example, it cannot explain why different libraries implementing the same technology show performance differences, or why libraries in the same technological environment develop different management systems and models. Technological factors work in combination with other factors and should not be viewed in isolation, yet existing research often separates technology from other factors, neglecting interactive relationships among different driving force elements.

3 Framework Construction and Analysis

To address these limitations, this study attempts to propose an explanatory framework that should be applicable not only to describing the history and current state of library development, but also to some extent predicting future trends and even planning paths. This requires elevating temporary, partial understandings to long-term, panoramic perspectives, and drawing on relatively mature theoretical tools. This framework should reflect libraries' "institutional attributes," because these attributes distinguish libraries from other concepts and forms, providing libraries with unique missions and positions in social functional division, while reflecting the specific information systems, functional compositions, and organizational forms that libraries represent. The framework should also reflect libraries' "knowledge attributes," because the macro "knowledge" field has been an extremely vibrant and promising expansion direction for libraries since the second half of the 20th century, both conceptually and practically, with the transition to the role of "knowledge manager" being a significant transformation path for libraries in recent decades.

This study introduces relevant tools from organization theory and knowledge theory to analyze the above "institutional attributes" and "knowledge attributes," integrating both dimensions into a unified framework. In this process, a series of examples will be provided to demonstrate and examine the practical significance and application of the theoretical analysis framework.

3.1 Vertical Dimension: The Neglected Institutional Attributes and Knowledge Governance Levels

3.1.1 The Neglected Institutional Attributes Although discussions about library profession "de-institutionalization" and "non-institutionalization" have been endless since the information society emerged, we cannot deny that historically the concept of "library" as an independent entity appeared in an "institutionalized" form. Two English definitions of "institution" help understand "library as an institution": library is an organization, originating from social functional division formed in knowledge communication processes;

library is an institution, originating from rule design formed in social knowledge resource allocation processes.

The organization and institution within library institutional connotations have close relationships. North, a representative of new institutional economics, proposed that organizations are "agents" of institutional change [27]. Although North's theory was proposed in the socio-economic field, he himself pointed out its potential value in broader contexts [28]. For example, Professor Jiang Yongfu's institutional library science uses the institutional meaning of new institutional economics as its theoretical foundation [29]. We can consider that changes in library organizational forms are closely related to institutions, and institutional evolution is mostly a continuous and gradual process with a series of institutional generation dynamic mechanisms [30]. Based on this understanding, we can obtain a new perspective for understanding library development driving forces from the angle of organizational and institutional evolution.

However, as shown in the literature review above, this perspective has not received sufficient attention in the past. Especially under the influence of library "information paradigm" and "de-institutionalization" trends, people have focused more on libraries' technological environments and means of handling knowledge content itself, while library institutional attributes and connotations have not received timely updated understanding. This 淡化 (dilution) of library institutions, neglect of library systems, and isolated understanding of information technology may weaken libraries' competitiveness and even legitimacy in knowledge environments. "Institution" is by no means just a physical place or spatial facility. If current "institutional attributes" are considered to limit library development, this precisely indicates that these attributes should be further revealed, optimized, and developed, rather than directly abandoned or ignored. Introducing technology without an organizational framework may be blind for libraries; proclaiming values without institutional support may be weak.

Both technological and institutional environments must be faced simultaneously in decision-making processes [31]. For libraries, technological means oriented toward knowledge content forms and governance means oriented toward institutional organizational forms can be integrated into a unified architecture. In this regard, developing organization theory can provide important references for libraries.

3.1.2 Brief Review of Organization Theory Early organization theory held that organizations emerged to eliminate risk and uncertainty [32]; subsequently, the "transaction cost theory" proposed by Coase and developed by Williamson argued that the fundamental reason for economic organizations' emergence and existence is to save transaction costs [33]. However, in the knowledge economy era, transaction cost theory cannot effectively explain increasingly complex organizational knowledge activities and knowledge organizational forms. For instance, an important assumption of transaction cost theory

is that knowledge exchange has no or minimal transaction costs, but in reality, high information search and negotiation costs made taccent knowledge transactions nearly impossible for long historical periods. Thus, knowledge's complex characteristics have still not received effective attention in transaction cost theory.

In this context, to better reflect organizations' knowledge characteristics, organization theory began to integrate with knowledge theory, producing important results such as the "enterprise knowledge theory" that matured in the 1980s and the "knowledge management trend" it led. This theory identifies organizations as "knowledge collections," with organizational development being essentially processes of knowledge accumulation and integration [34], and organizational knowledge capabilities (such as knowledge acquisition and utilization) affecting organizational horizontal and vertical boundaries (governance structures) [35-37].

The above "transaction cost theory" and "enterprise knowledge theory" have long served as main theories explaining organizational issues, each with limitations while also reconciling and complementing each other [38]. As shown in Figure 3 [Figure 3: see original paper], "enterprise knowledge theory" attempts to directly connect knowledge content characteristics with organizational governance structures (the relationship between levels and), directly examining the relationship between "knowledge" and "organization" [39-40]. However, there is no direct causal relationship between organizational governance structures and knowledge characteristics; meso-level knowledge management business activities (level) are needed for bridging and transmission [39]. In other words, governance behavior is not actually oriented toward knowledge content itself, but toward knowledge management activities. Meanwhile, "transaction cost theory" attempts to directly analyze the relationship between knowledge management practice and governance (the relationship between levels and), without focusing on the connection between knowledge content level and knowledge management level [39], because this theory neglects the complexity of knowledge attributes, assuming that knowledge management activity costs are low and easy to implement.

This may also explain why during the period when transaction cost theory dominated, no advanced and specialized knowledge management business settings emerged in economic organizations.

3.1.3 Library Governance Levels At this point, shifting focus back to libraries as institutions, we can see that libraries as a type of organization and institution can fill the missing link in the levels shown in Figure 3 (the relationship between levels and), because libraries have long specialized in management activities oriented toward specific knowledge content objects, forming substantial work experience and contributions. Here, rather than saying libraries draw lessons from organization theory, it is more accurate to say that library institutions have been integrated into the framework of organization theory.

Although existing frameworks mainly originate from economic organizations (such as enterprises), this integration and incorporation has certain adaptability and possibility: first, knowledge content characteristics (tacitness, ubiquity, distribution, contextuality, difference, etc.) must be faced by all organizations; second, knowledge management activities oriented toward knowledge content belong to the grassroots and micro levels, which all organizations in knowledge society need to carry out; third, the entire hierarchy is generated from bottom to top, meaning that knowledge management activities form under the premise of knowledge content generation, and then corresponding governance models form for knowledge management activities [41-42]. The different governance structures at the upper level should not reject the fundamental existence of specific knowledge management activities.

For libraries, adopting and integrating into the governance levels shown in Figure 3 provides possible explanations and guidance for a series of questions. This hierarchy can help libraries view technological and institutional environments more comprehensively, achieving unity without bias. It can help understand library development transformation and its internal driving forces, as every level in Figure 3 is evolving for any institution. Libraries face changes not only at knowledge content and knowledge management technology levels (such as the emergence of big data and related management technologies), but also at governance structure levels (such as the establishment of big data governance mechanisms). Meanwhile, any institutional development should achieve mutual coordination, matching, and unity among the three levels of "knowledge content—knowledge management—governance structure." The self-adaptation process among the three levels can explain the endogenous driving forces of institutional transformation, including libraries. This hierarchy can also help libraries establish foundations for theoretical dialogue and reference. The internal logic of the three levels in Figure 3 is: specific knowledge content and its attributes require compatible management methods and governance structures, while top-level governance structures and mid-level technical rules can significantly affect knowledge activity performance and knowledge value realization [40]. This logic has guiding significance for all types of organizations. Since the 21st century, knowledge governance theory in organization theory has attempted to better coordinate relationships among different levels of "knowledge content—knowledge management—governance structure" through institutional design at the governance structure level. Drawing on this theory can also help libraries address institutional shortcomings in institutional environment construction.

3.1.4 Examples from Libraries To more vividly explain the connotation and application prospects of the levels in Figure 3, the following briefly presents a series of examples derived from typical problems faced by libraries in recent real-world development contexts. These problems will be interpreted and analyzed using the unified framework derived from Figure 3.

(1) Example 1: Library "Institutional Isomorphism" Mechanism. "In-

stitutional isomorphism" refers to the process where organizations, when facing environmental uncertainty, select and implement external advanced experiences and solutions to maintain consistency between internal and external institutional environments, imitating structures of organizations that have been successful or similar in institutional evolution to reduce risks and costs [27, 43-45]. This process has also been described in library fields as "horizontal transplanting institutional allocation methods" [46]. In domestic library science research, numerous studies on "cases," "implications," and "lessons" from overseas library practices may also reflect the influence of this "institutional isomorphism" mechanism. However, the framework in Figure 4 [Figure 4: see original paper] shows that the "institutional isomorphism" process occurs not only between different institutions, but also needs to be coordinated across different levels. We cannot isolatedly evaluate the merits of a content resource, a technology application, or a management model, but must comprehensively examine the fit among knowledge content, management models, and governance structures when acquiring content, selecting technology, or migrating models. This can also explain why maladaptation occurs when libraries borrow external experiences.

(2) Example 2: Library Subject Librarian System. Subject librarians represent a future trend in library services and a continuously evolving conceptual service field. The current core transformation shifts from "library and document-centered" to "user-centered" [47]. This transformation can also be explained through the framework in Figure 5 [Figure 5: see original paper]. Professor Chu Jingli, when analyzing the background of new-generation subject librarians, concisely summarized it as: "Because users' information environment has changed and users' information needs have changed (level in Figure 5), users' information behaviors have changed (level), therefore the models and mechanisms for directly providing subject services to users also need to change (level)" [48]. This typical description precisely confirms the matching and transmission among the three levels.

At level , traditional document information services and even early subject librarian services still took document units as management objects and service carriers. However, in recent years, the knowledge content users face has changed dramatically. Trends such as mobile internet, big data, and open access have strengthened knowledge attributes of ubiquity, complexity, scale, and openness. Users facing complex information environments require higher-value knowledge [49]. In response to changes at the knowledge content level, libraries need to adjust means and methods at level of knowledge management, developing from traditional document unit-based services toward knowledge services. This has also driven changes at level in service organization methods, position settings, and institutional design.

(3) Example 3: Libraries and the "Open Access" Environment. Open access, currently represented by open access to scientific literature, open data, and open educational resources [50], has promoted the formation of an open knowledge environment across society. As reflected in Figure 6 [Figure 6: see

original paper], open access has disrupted libraries' previous commercial publishing subscription models [50]. Faced with open access resources increasingly approaching mainstream resources [51] (level in Figure 6), if libraries still rely on purchased resources to build collections and organize services around collections [52-53], remaining in passive retrieval and acquisition of information objects [54] (level), they will likely face the threat of having "no resources to purchase" and risk marginalization in future open environments. The term "removing the firewood from under the pot" is more vividly presented in Figure 6: the bottom-level resource driving force (level) has already switched, but the upper-level management methods (level) remain in the original model, explaining libraries' "capability deficiency" and "capability misalignment" (see dashed lines in Figure 6). Open access is moving from openness at the content level to openness at management and operation levels [2], and will inevitably affect openness in governance structures.

Professor Zhang Xiaolin pointed out that the essence of open access is building new knowledge communication and exchange mechanisms, inevitably involving complex policy, legal, management, economic, and technical issues that require systematic supporting "mechanisms" [50]. These mechanisms include collaborative and embedded service mechanisms, open innovation support mechanisms, etc. [54-55]. Professor Sun Tan noted that libraries facing open information environments need to reconstruct business layouts, redefine business interaction models, and reposition the roles of resource construction librarians [56]. All these can be understood as manifestations at level of governance, not management of knowledge content itself, but coordination and organization of knowledge management activities.

3.2 Horizontal Dimension: Reshaped Knowledge Attributes and Knowledge Transformation Chain

3.2.1 The Driving Role of Knowledge Attributes The above analysis of institutional attributes reveals that the development of organization theory has been a process of continuously discovering knowledge attributes (continuously breaking original knowledge attribute assumptions) and strengthening understanding of knowledge-organization relationships. This process can be summarized as: knowledge's contextuality and embeddedness broke traditional economics' assumption of knowledge as "natural public goods," thereby creating foundations for knowledge transactions; knowledge's tacitness and implicitness increase knowledge transaction costs, while knowledge's codifiability facilitates knowledge dissemination and sharing, reducing knowledge transaction costs, thereby generating knowledge management activities centered on "making tacit knowledge explicit"; however, this process easily leads to an "information disclosure paradox" (where information buyers can usually obtain information without paying) [57], thereby generating knowledge exchange and service methods based on strict knowledge proprietary systems (represented by commercial copyright) to protect organizational knowledge achievements; in the current

open knowledge environment, knowledge's openness is greatly highlighted [58]. According to this pattern, we can infer that openness, like other knowledge attributes, will affect knowledge management methods and governance structures.

This process provides important insights for re-understanding organizational development driving forces. Past researchers habitually attributed organizational development driving forces, including libraries, to external "technology-driven," "demand-driven," and "market-driven" forces (see section 2.2). Now we can understand organizational development's internal driving forces from "knowledge attribute-driven" perspectives. For libraries, if knowledge management activities neglect matching with knowledge attributes (levels and), relying only on top-down bureaucratic promotion (level) or single-level technology adoption and method migration (level), it may cause "driving force imbalance" in organizational development.

Just as some viewpoints hope to redefine the term "knowledge management," believing that the word "management" is harmful as it implies control over everything [59]. In fact, for knowledge management, the focus should not be on deliberating the rhetoric of "management," but on changes in knowledge attributes. Management methods effective in certain knowledge environments may become ineffective in new knowledge environments—not necessarily because of problems with the management model itself, but because changes have occurred at the knowledge content level.

3.2.2 Brief Review of the DIKW Chain To effectively describe changes at the knowledge content level, we introduce the DIKW model here. This model is introduced not only because of its fame in knowledge management, but more importantly because it is a widely accepted theoretical model for explaining knowledge form transformation. Although the DIKW model is often presented as a "pyramid" shape [60], implying a "bottom-up" dependency relationship among data, information, knowledge, and wisdom, Russell Ackoff, an early organizational theorist who systematically elaborated the DIKW model, defined it as a parallel relationship at the same level [61-62]. This study will also adopt a linear serialized DIKW presentation form to better explain changes occurring in the knowledge chain and facilitate integration with other theoretical models.

Whether in "pyramid" or "chain" form, the relationships among D-I-K-W in traditional understanding are mostly described as "progressive transformation" relationships, such as "information is the product of data processing," "data is the raw material for forming information, and information is the raw material for forming knowledge" [7], and "knowledge emerges from information, just as information emerges from data" [63]. However, with the overall changes in the current knowledge environment, the progressive relationships among D-I-K-W are being reshaped.

3.2.3 The Reshaped Knowledge Chain Since knowledge itself has long been difficult to define accurately, in management perspectives knowledge is

often incorporated into chains like DIKW, defining knowledge according to its hierarchical relationship with information [64]. This chain is not only a knowledge form transformation chain, but also a processing chain and value chain [7, 65]. Therefore, changes in chain relationships will affect the definition of knowledge content forms. Current changes in the DIKW chain involve at least the aspects shown in Figure 7 [Figure 7: see original paper] (solid arrows represent traditional progressive relationships, dashed arrows represent reshaped relationships):

(1) Reshaping the Chain Between Data and Wisdom. Big data-driven "intelligent decision-making" can directly generate decision bases and even directions from massive data. Under the influence of "data-intensive research" and "data-driven decision-making," insights and intellectual processes that previously required experiential knowledge can to some extent be automatically generated dependent on data.

(2) Reshaping the Chain Between Data and Knowledge. Artificial intelligence breaks through the limitation that only humans can create knowledge. Using data mining (knowledge discovery) can directly discover knowledge from massive data, showing that knowledge sources have transcended the scope of information [62]. In new technological environments, data objects can directly become explicit, basic, and primary knowledge objects through digitization, structuring, semantic parsing, annotation, and linking [66].

(3) Reshaping the Chain Between Data and Information. In the traditional DIKW processing/value chain, information is downstream of data, being the product of data processing. When massive data can be interpreted and calculated with new technologies, their potential value is being dramatically released. "Datafication" is becoming an important way for information to function. Much native information needs to be captured and processed through datafication (such as radio telescopes converting cosmic information into astronomical observation big data [62], wearable devices converting life information into health big data), while existing information forms are undergoing "re-datafication" (such as digitization, structuring, and semantic processing of traditional literature information).

In summary, the important source triggering the above changes is the transformation at the data end of the DIKW chain. Drawing on the vertical framework in Figure 3, changes at the data end mainly include three levels: large-scale release of data content (level), improvement of data computing capabilities and analysis levels (level), and formation of data governance structures (level).

3.2.4 Examples from Libraries In traditional functional division and value distribution, library work mainly focused on the information link in the above chain (primarily literature information, extending to some extent to the knowledge link). Current real-world library situations provide numerous examples

reflecting the above changes in the knowledge chain. For instance, libraries are transitioning comprehensively from information environments to data environments [66], with processing objects rapidly expanding from traditional information resources to data resources, thereby creating more possibilities for connecting knowledge and wisdom. Data management and data services are becoming important service styles for research libraries, data literacy education is becoming a necessary supplement and extension to library information literacy education, and data librarians are becoming new roles in library position sequences. The data environment has also spawned new mechanisms for library knowledge services, with libraries using semantic web, artificial intelligence, and other technical means, employing knowledge organization methods oriented to data granularity in the internet era, to provide knowledge infrastructure embedded in user environments [66-67]. Finally, big data is also the core key technology for achieving "intelligent" transformation in all library links, with smart libraries depending on big data ecosystems requiring guarantees from data sources, data management, and data application aspects.

3.3 Integrated Framework: Library Development's Field of Action and Pathways

Integrating the above vertical and horizontal dimensions forms the framework shown in Figure 8 [Figure 8: see original paper]. The connection point of the two dimensions is knowledge content. This framework can be used to explain libraries' field of action and pathways for development. Specifically, this framework has the following implications and insights for libraries:

(1) The framework in Figure 8 reveals endogenous driving forces from both knowledge attributes and institutional attributes in library development, and their interrelationships. In the new environment, libraries are knowledge service platforms based on knowledge content. When knowledge attributes themselves change (see horizontal dimension at level in Figure 8), libraries' service objectives, methods, and capability foundations will also undergo major transformations (see vertical dimension in Figure 8). Currently, as the knowledge content libraries process moves from traditional literature information toward "datafication," and further toward "knowledgefication" and "intelligentization" forms under "datafication" influence, corresponding adjustments and matching are needed at knowledge management and governance structure levels.

(2) The framework presents the directions and potential pathways of library development driving forces. Vertically, libraries are connecting levels from knowledge content to knowledge management to governance structure, especially the elevation from knowledge management level to governance structure level, which in China's context centrally manifests as establishing modern library governance structures. Horizontally, libraries are rapidly expanding into data, knowledge, and wisdom fields. Overall, libraries' knowledge management capabilities (such as data service capabilities, knowledge service capabilities,

and intelligent service capabilities) are being simultaneously cultivated and enhanced (level), while libraries as knowledge service mechanisms or information resource allocation means (level) are being applied to, covering, and embedded in different knowledge scenarios.

(3) The framework reflects contradictions, conflicts, and driving force bottlenecks in library development. For example, libraries traditionally organized services around fixed collections and processes, forming fixed hierarchical institutions centered on internal departments [53]. This hierarchical architecture was adaptive to collection literature information resources. However, if traditional work methods and business models (or even mindsets) are applied to new knowledge content objects (such as data resources and expert intellectual resources), capability constraints, capability misalignment, and resource misallocation will occur. Moreover, when libraries expand to new knowledge content objects, it is not as simple as adopting corresponding information technology, but often encounters changes in interest patterns and governance structures.

(4) The framework helps understand competitive and cooperative relationships among different institutions. The technological means and governance structures corresponding to specific knowledge content determine the boundaries of different institutions, with different institutional competitors distributed across vertical "tracks" of different knowledge content. For example, in the knowledge track, libraries face competition from database vendors, publishers, and even emerging online knowledge payment service providers; in the data track, library data courses face competition from computer science disciplines. However, different institutions each have their own positions and driving sources. Libraries will not overnight transform into another type of institution, nor can they be easily replaced by other institutions. Libraries cannot always remain in anxiety about being "dissolved" or "replaced," but need to seriously identify their advantages at different levels and tracks. Meanwhile, we should note that on each plate presented in Figure 8, libraries will face more diversified participating subjects in the future. Libraries do not have purely competitive relationships with them, but rather exist in interlaced, interactive, and blended relationships, requiring coexistence, co-growth, and co-prosperity with multiple subjects.

Following the stage-specific understandings of library development regarding "transformation," "balance," and "driving force," this study attempts to understand and explain the dynamic mechanisms that enable libraries to maintain dynamic balance in changing environments. This paper organizes driving force elements mentioned in past literature, confirming existing research's emphasis on information technology means. However, as North pointed out, institutions are to some extent prior to or more important than technology [28]. This study draws on organization theory and knowledge theory to construct an integrated explanatory framework, thereby placing different driving force elements within an overall picture to observe and understand their interrelationships and mechanisms. Synthesizing the full text, this dynamic mechanism can be summarized

as: horizontal "knowledge element-driven" forces driving vertical "institutional element-driven" forces, thereby bringing holistic institutional transformation. The tide of knowledge and the window of technology provide conditions for libraries' ships to sail far, but steady and long voyages also depend on solid hulls and clear adherence to direction.

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The Driving Force and Direction of Library Development in the Changing Environment: Based on the Integration Framework of Organization Theory and Knowledge Theory

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Abstract: [Purpose/Significance] To identify and analyze the dynamic mechanism of library development in the current changing environment, and to explain its patterns and direction. [Method/Process] Existing literature was reviewed, and an analytical framework was constructed by referring to organization theory

and knowledge theory. [Result/Conclusion] Changes in knowledge content lead to chain changes and adaptations in knowledge management technology and library governance structure, bringing overall reform to library institutions.

Keywords: library reform; library development driving force; organization theory; knowledge theory

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