

A Cambrian Moment for Libraries: Shaping Futures through Evolution and Leadership

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abstract: Academic and research libraries are undergoing a profound transformation, shaped by technological advancements, shifting societal dynamics, and evolving institutional priorities. This essay examines how these forces are driving libraries to evolve into specialized and distinct models, shaping their future and drawing parallels to the Cambrian Explosion—a period of rapid diversification in natural history. Using the frameworks of evolutionary theory, ecosystem models, and systems thinking, it explores the interplay between external pressures and internal strategies. By fostering adaptability and embracing leadership attuned to complexity, libraries can redefine their roles to meet the unique and emergent needs of their communities, ensuring they remain vital forces of knowledge, culture, and well-being in an ever-changing world.

Introduction

Libraries have always adapted to the evolving needs of the societies they serve. Today, they face increasingly complex challenges, driven by technological advancements, economic constraints, and shifting societal expectations. These pressures are pushing libraries toward highly specialized futures, shaped by both local needs and global forces. Similarly, higher education is undergoing its own transformation, responding to political agendas, technological disruption, and the need for new models and curricula. Both libraries and universities operate as dynamic systems, continuously evolving to remain relevant and resilient.¹

Evolutionary theory provides a valuable lens to understand this moment. The Cambrian Explosion—a period of rapid diversification in evolutionary history—offers a compelling metaphor for this moment of transformation.² Around 540 million years ago, changes in ocean chemistry, tectonic activity, and ecological niches spurred an extraordinary burst of biodiversity, with life forms developing innovations like hard shells and complex body structures to adapt and thrive.³ Just as species adapt to their



ecosystems, libraries are not only responding to external pressures but actively shaping their futures.⁴ The concept of punctuated equilibrium suggests that libraries, like species, may experience long periods of stability punctuated by sudden, transformative shifts triggered by technological breakthroughs, economic crises, or societal changes.⁵ Organizational theory similarly shows that institutions balance stability with exploration, maintaining core strengths while experimenting with new opportunities.⁶ This framework highlights how libraries can not only survive but thrive by embracing specialization and differentiation.

Ecosystem models and systems thinking further illuminate this shift. Libraries are part of interconnected networks that include universities, research communities, publishers, and broader societal systems. These connections shape the tools, platforms, and strategies libraries adopt, directly influencing their services and evolution. By applying systems thinking, we can understand how libraries co-evolve with their environments, shaping and being shaped by the systems around them.⁷

The Cambrian Explosion metaphor underscores the potential for libraries to diversify into distinct forms, each uniquely adapted to its specific environment. This invites us to imagine futures shaped by trends like technological innovation, social progress, cultural preservation, and sustainability.⁸ Libraries that thrive will be those that tailor their collections, spaces, and services to meet the unique needs of their communities, demonstrating flexibility and responsiveness to shifting demographic, cultural, and educational trends.⁹

Proactive leadership will be key in guiding libraries through this transformation. Effective leaders must balance immediate demands with long-term vision, fostering innovation and inclusivity while ensuring sustainable growth.¹⁰ Reflective leadership, which continuously assesses and refines strategies, and Compassionate Systems Leadership, which integrates empathy and systemic thinking, will be critical for libraries to remain central to their communities.¹¹

As libraries navigate this era of transformation, their success will depend on synthesizing tradition with innovation. By drawing from their rich history while embracing new possibilities, libraries can remain dynamic forces of knowledge, service, and leadership in an increasingly complex world.

Historical Context: Libraries as Adaptive Institutions

For centuries, libraries have demonstrated resilience, evolving in response to cultural, technological, and intellectual shifts.¹² From the ancient scrolls of Alexandria to today's digital resources, libraries have continually adapted their formats and service models while maintaining a central mission: preserving knowledge and providing access to information.¹³

This evolution has also been deeply social. Once elite repositories, libraries have become public institutions that serve diverse populations, bridging economic, social, and digital divides. Through literacy programs and public internet access, libraries have played a critical role in promoting digital equity and democratizing knowledge.¹⁴ Whether safeguarding collections or fostering civic engagement, libraries have consistently adapted to meet societal needs across eras.



Historically, libraries followed a relatively unified trajectory with similar structures and missions. However, technological disruptions, financial pressures, shifting cultural priorities, and localized governance mandates are pushing libraries toward more differentiated roles. Rather than evolving in parallel, libraries may now branch into distinct identities tailored to their communities or local context. This poses a challenge: how do librarians embrace specialization while upholding inclusivity and their democratic mission? Partnerships, alliances, and a commitment to open access and intellectual freedom will be essential to ensure that these evolving missions enhance, rather than restrict, equity and accessibility.

This transformation mirrors the Cambrian Explosion, when unique environmental conditions spurred the emergence of diverse biological lifeforms. Similarly, libraries may evolve into varied models. Some might emphasize innovation hubs, prioritizing technology, makerspaces, and digital scholarship, while others could focus on social engagement, instructional initiatives, or cultural preservation. Still others may lean heavily into sustainability, driving climate action, or champion openness by advancing research transparency and engaging deeply across the research lifecycle.

Looking ahead, libraries' ability to diversify and specialize will define their paths. Much like species adapting to ecological niches, libraries have the opportunity to develop services and collections uniquely suited to the needs of their institutions, stakeholders, and communities. By embracing reinvention and staying responsive to both local demands and global developments, libraries can continue to innovate and remain vital institutions in higher education.

The Forces Shaping Divergence

Libraries are undergoing profound transformations, driven by a complex interplay of external forces that challenge their traditional roles. As higher education faces scrutiny over its value and accessibility, libraries are redefining their place within this evolving landscape.¹⁵ Shifting priorities, such as the rise of non-traditional learners, skills-based education, and lifelong learning, reflect broader changes in higher education. While residency-based education remains central, demographic shifts add further complexity. Declining birthrates have reduced the population of traditional college-aged students.¹⁶ Simultaneously, institutions are serving increasingly diverse learners, including first-generation students, adult learners, and those from underrepresented backgrounds.¹⁷ In response, libraries are expanding their roles to include lifelong learning, equity-focused initiatives, and broader community engagement.¹⁸ These evolving expectations highlight libraries' importance as inclusive spaces that support both traditional educational pathways and a broader array of needs, positioning them to adapt in significant ways.¹⁹ How might libraries evolve their roles and services to effectively balance these diverse and sometimes competing demands?

Economic pressures compel libraries to prioritize resource efficiency and specialization, but overspecialization risks alienating broader user bases. Many libraries form horizontal partnerships to share resources, while others pursue grants and philanthropy, which can influence their focus based on funding priorities. These pressures often drive investments in areas like digital scholarship, open science, data services, and community



initiatives to reinforce their value and relevance.²⁰ How can libraries strategically allocate resources, adapt to funding priorities, and ensure long-term impact?

The digital revolution continues to reshape the role of libraries, presenting both opportunities and challenges. Some libraries lead in technological innovation, adopting tools that enhance scholarship and research. Others focus on traditional roles like collection development and introductory instructional services, which remain integral to their mission. However, as higher education prioritizes digital transformation, libraries emphasizing legacy roles may struggle to maintain institutional support and interest. This can result in budget cuts, staffing reductions, restructuring, or the loss of faculty status, all of which hinder their ability to adapt, strain resources, and prolong necessary transitions.

Generative AI adds another layer of complexity, offering both promise and potential misunderstanding. Misconceptions that AI tools can replace librarians' expertise risk devaluing critical services.²¹ Libraries counter these trends by fostering AI literacy, promoting ethical use of technology, and integrating advanced tools like machine learning to enhance research and teaching. By balancing innovation with tradition, libraries can position themselves as both technologically adept and mission-driven in an ever-changing landscape.

Environmental factors are also reshaping the library landscape. With growing awareness of sustainability, some libraries are emerging as leaders in green initiatives and climate research.²² Whether through sustainable building practices, educational programs, or partnerships with local organizations, libraries are adapting to address environmental concerns and becoming key advocates for climate literacy and action. In addition, libraries are increasingly integrating climate-related resources into their collections, offering access to critical information that supports both academic research and community engagement on environmental issues. How might libraries be forced to evolve their operations and services due to climate change while maintaining their core missions?

Social and political polarization presents additional challenges. Many libraries are advancing diversity, equity, and inclusion efforts while safeguarding intellectual freedom and fostering dialogue. Some serve as hubs for community engagement, offering programs on social justice and civic discourse.²³ Others diversify collections and programming to reflect broad viewpoints in fragmented environments.²⁴ Yet libraries often find themselves navigating debates over censorship, book banning, and academic freedom. Balancing these tensions requires careful strategy and a renewed focus on intellectual freedom and equitable access.²⁵ How can libraries adapt their services and policies to address these pressures while maintaining their role as champions of free thought and open access?

Much like species during the Cambrian explosion, libraries are entering a potential period of rapid divergence and specialization. External forces—ranging from political polarization and government mandates to climate change, economic instability, demographic shifts, and social movements—are compelling libraries to evolve in distinct ways. This dynamic interplay of adaptation and specialization will result in libraries increasingly tailored to their local contexts, reflecting the unique pressures and opportunities they face. Success will depend on libraries' ability to embrace change with strategic



foresight, balancing tradition with innovation. Over time, these adaptations may produce institutions that are not only distinct in their operations but also profoundly divergent in purpose, embodying the ecosystems in which they thrive.

The Evolutionary Paths: Diverging into Distinct Futures

Just as evolutionary paths in nature lead to diverse adaptations, libraries may evolve in multiple directions. Some may focus on cutting-edge technologies, while others prioritize social missions. This multifaceted range of possible evolutions highlights the complexity of modern libraries, which must respond to a broad range of demands and serve as dynamic institutions within an ever-changing information landscape. The following gallery of possible futures showcases speculative evolutionary paths that libraries might follow, each shaped by institutional needs and global shifts. These scenarios illustrate how libraries could transform to meet the unique demands of their environments.

Digital Innovation Hub

In this scenario, libraries fully embrace their roles as digital research centers, incorporating cutting-edge technologies such as AI-powered tools, virtual reality environments, and advanced data science capabilities. These institutions would act not only as technology incubators but also as innovation hubs, driving interdisciplinary research and fostering collaborations that push the boundaries of knowledge creation. By providing faculty, students, and researchers with access to state-of-the-art digital infrastructure and specialized expertise, these libraries would become indispensable partners in advancing scientific discovery, promoting new literacies, and pioneering transformative practices. Additionally, they could facilitate the development of new methodologies, such as machine-assisted research and data-driven experimentation, placing libraries at the forefront of scholarly advancements and ensuring their continued relevance in a rapidly evolving academic landscape.

Cultural Heritage and Preservation Center

Other libraries may evolve into primary roles as cultural heritage and preservation centers, serving as vital stewards, curators, and facilitators of dynamic engagement for both analog and digital historical materials. These institutions would not only confront the challenge of preserving traditional formats—such as manuscripts and artifacts—but also develop innovative methods to safeguard fragile digital content, ensuring that cultural memory is not lost in the transition to the digital age. These libraries and archives could become catalysts of cultural resilience, creating immersive, interactive experiences in which history is not only preserved but actively interpreted, discussed, and connected to present-day issues. By offering services that engage communities in ongoing dialogues around cultural heritage, these institutions would foster a deeper contextual understanding of our shared past. Furthermore, they would help bridge the gap between generations, ensuring that both historical materials and born-digital content inspire future scholars, artists, and citizens in new and significant ways.



Community-Engaged Library

Community-engaged libraries would integrate deeply into the social and civic life of their communities, becoming centers for public involvement, activism, and experiential learning. Alongside offering resources, these libraries would also serve as facilitators, connecting academic expertise to real-world challenges, supporting individuals and groups in tackling complex real-world issues, and promoting applied research that drives community-focused solutions. By fostering partnerships that enable local initiatives and encourage collective action, they would become essential platforms for inclusive dialogue and civic engagement. In particular, these libraries could play a vital role in nurturing productive discussions on critical and contentious topics, helping to reduce divides and support informed, civil discourse. Acting as connectors between universities and the wider public, they would help address pressing social concerns while also contributing to broader goals like economic revitalization, environmental stewardship, and stimulating conversations that can lead to meaningful change.

Open Science Leader

As global demand for transparency and collaboration in research intensifies, some libraries could emerge as pioneering leaders in the open science movement, championing not just open data and software but also setting the standard for ethical research practices on a global scale. These libraries would transcend their traditional roles as providers of open access infrastructure, becoming integral partners in the research process itself. By embedding themselves within research teams, they would actively contribute to critical stages such as grant writing, data management, and ensuring compliance with open access mandates. Furthermore, by fostering a culture of openness, these libraries would not only drive intercollaboration but also ensure the seamless and equitable flow of knowledge across borders. Their leadership would be pivotal in advancing the reproducibility of research, safeguarding ethical standards, and ultimately transforming the very fabric of scientific inquiry on a global scale.²⁶ In doing so, they would position themselves as institutions at the forefront of research.

Research Data and Interdisciplinary Collaboration Hub

In this model, libraries would evolve into central facilitators of complex data management and interdisciplinary research, becoming essential centers of collaboration for global scientific initiatives. Along with curating and overseeing vast datasets, they could also provide tools and support for data visualization, analysis, and integration. Their expertise in data stewardship and knowledge systems would position them as key collaborators in addressing some of the world's most urgent challenges, such as climate change, pandemics, and social inequity. Additionally, these institutions would spearhead the development of new data-driven methodologies and frameworks, ensuring that interdisciplinary innovation thrives in an environment of open collaboration and shared knowledge. In this future, libraries would transcend their traditional roles, becoming partners in scientific discovery.



Lifelong Learning and Skills Development Library

As the demand for continuous education grows, libraries may increasingly become centers for personal enrichment and skills-based professional development. Acting as curriculum builders, they could offer workshops, certification programs, and courses that enhance both traditional and emerging literacies. These might range from digital fluency, coding, and data analysis to financial literacy, communication skills, and entrepreneurship. Libraries could also provide hands-on training in crafting, basic home repair, and sustainability, addressing both practical and professional needs. By partnering with industry, educational institutions, and tech companies, libraries would give individuals access to cutting-edge tools, professional networks, and modernized vocational training. This broad approach would not only help communities thrive in evolving fields like AI and data science but also support workforce development in underserved areas, positioning libraries as key facilitators of lifelong learning and career adaptability.

Sustainability and Environmental Research Library

With heightened attention on climate change, some libraries may evolve into prominent leaders in climate science and sustainability research. These institutions would facilitate interdisciplinary collaboration on environmental issues, offering not only the resources and data necessary for innovative solutions but also actively contributing to the development of climate action strategies. By embracing advanced green technologies and championing climate literacy programs, sustainability-oriented libraries would position themselves as essential hubs and idea labs for advancing environmental research while demonstrating eco-friendly practices. These libraries could also curate real-time environmental data, support citizen science initiatives, and host sustainability-focused hackathons, symposiums, and other events. By forging partnerships to expand initiatives and mobilizing local communities in advocacy and action, these libraries would be instrumental in shaping the future of climate resilience and sustainability. In this role, libraries would not only support research but also drive impactful action, becoming vital players in the global response to environmental crises.

Specialized Knowledge Centers

Libraries may evolve into highly specialized knowledge centers, shifting from the broad support they currently offer to becoming deeply integrated into specific academic disciplines or research domains. Unlike traditional models that cater to a wide array of subjects, these libraries would narrow their focus, curating specialized collections and providing expertise tailored to the distinctive needs of particular research communities. As universities increasingly prioritize specialized curricula and targeted research, these libraries would collaborate closely with departments and research centers, driving scholarship that addresses complex, discipline-specific challenges. Their role would transcend information provision, functioning as intellectual epicenters that actively influence academic inquiry, offering insights and resources that accelerate breakthroughs in areas such as quantum computing, bioengineering, or environmental policy. By embedding themselves as essential collaborators in these specialized fields, libraries would not only advance academic progress but also play a pivotal role in tackling global issues.



As libraries continue to adapt to an ever-changing world, their evolution reflects a diverse range of responses to external pressures, much like the varied evolutionary paths found in nature. These potential futures suggest libraries may shift from being generalists to specialists, evolving from curators to active collaborators in both research and societal progress. Whether driven by technological advancements or social missions, this spectrum of possibilities underscores the dynamic nature of libraries in today's complex information landscape. By embracing specialization and responding to global shifts, libraries can not only thrive but also reaffirm their value as key drivers of academic advancement and social change. In navigating these transformations, libraries are positioned not just to survive but to lead, evolving into institutions of greater relevance and deeper impact.

Speculative and Hybrid Evolution Paths

As the higher education and research landscapes continue to evolve rapidly, libraries should also explore more novel approaches to navigate emerging challenges. With increasing unpredictability, libraries must look beyond familiar trajectories and envision bold new realities that capitalize on their adaptability, expertise, and creativity. This gallery of possibilities demonstrates how libraries can prepare for diverse futures by developing new skills, insights, and capacities, enabling them to integrate and pivot seamlessly when new opportunities arise.

What follow are several speculative pathways that explore potentially transformative directions.

Biolibrary

The biolibrary pathway envisions libraries as essential partners in the life sciences, managing vast repositories of biological data such as DNA sequences and microbiomes. As biotechnology and life sciences expand, these libraries would support cutting-edge research in personalized medicine, genetics, synthetic biology, and environmental biology. Acting as key data managers and knowledge connectors, biolibraries would ensure that biological data is curated, preserved, analyzed, and made accessible to researchers globally.²⁷ They would also play a pivotal role in supporting advancements like gene editing technologies, bioinformatics algorithms, and biotechnological innovations, helping accelerate breakthroughs across various scientific disciplines. This model would provide essential resources not only for students and researchers but also for public health initiatives, pharmaceutical developments, and sustainability efforts, fostering interdisciplinary collaboration and accelerating discoveries in the life sciences.

To prepare for this pathway, libraries can build expertise in bioinformatics, data curation, data analysis, and interdisciplinary collaboration. By developing capabilities to manage and support complex biological datasets, they can position themselves as indispensable hubs for global research and innovation in the life sciences.

Cognitive Enhancement

The cognitive enhancement library would focus on integrating brain-computer interfaces and neurostimulation technologies to create advanced learning environments. These



libraries could become centers for cognitive experimentation, exploring methods to optimize memory retention and enhance learning outcomes.²⁸ By offering personalized cognitive training programs, these libraries would revolutionize educational delivery and create new opportunities for research into human-computer interaction, benefiting the entire academic community, from first-year students to faculty.²⁹ Just as makerspaces and media labs today provide hands-on experiences with emerging technologies, these libraries would offer critical spaces for exploring cognitive enhancement tools, ensuring that users gain a deep understanding of these powerful innovations. Libraries would become trusted sources for ethical literacy and thoughtful critique, guiding the responsible development and application of cognitive technologies.

To prepare for this pathway, libraries can partner with neuroscience departments, invest in emerging technologies related to cognitive enhancement and human-computer interaction, and explore flexible service delivery models to support these advanced learning environments.

Mobile Pop-Up

The mobile pop-up library pathway envisions modular, adaptable units that can appear in diverse settings—rural areas, urban centers, across campus, or at specific events—to provide essential resources where permanent facilities are unavailable. These libraries would deliver on-demand access to information, technology, and research support, extending the reach of academic resources both within and beyond campus boundaries. By embedding with researchers in the field, mobile pop-up libraries could offer critical support to ongoing projects, ensuring access to necessary materials and data analysis tools in remote or challenging locations. Moreover, these libraries could quickly mobilize to meet urgent needs in unexpected locations or conditions, whether responding to a crisis or addressing gaps in access. By addressing these gaps, mobile pop-up libraries would enhance inclusivity and ensure that students, faculty, and local communities can benefit from library services regardless of location, promoting outreach, academic engagement, and greater connectivity.

To prepare for this pathway, libraries can experiment with flexible service delivery options, develop logistical expertise in mobile operations, and refine resource distribution strategies to meet the diverse needs of campus and community contexts.

Data Ecology

The data ecology library would integrate with environmental monitoring systems to provide real-time data on sustainability, climate change, environmental policy, and weather hazards. These libraries could manage and analyze environmental data, supporting researchers and policymakers in addressing global ecological challenges. By developing partnerships with environmental organizations and using tools like remote sensing and GIS, these libraries could drive sustainability efforts while engaging the public through citizen science initiatives. Embedded in academic institutions, would support interdisciplinary research and connect university expertise with actionable solutions.

To prepare for this pathway, libraries can build expertise in environmental data analysis, weather modeling, and citizen science, while also exploring collaborations with



tech companies and investing in data visualization tools to enhance public engagement and leadership in ecological research.

Health and Wellness

The health and wellness library supports a holistic approach to well-being, integrating physical, mental, and cognitive health programs to optimize the mind-body connection. By partnering with campus health centers, libraries on this pathway could deliver personalized wellness plans and workshops that support both physical fitness and mental resilience, while also providing critical health literacy resources. This model recognizes that colleges and universities are not just spaces for intellectual and social growth but also centers for enhancing overall well-being, mental health, and cognitive performance.³⁰

To prepare for this pathway, libraries can collaborate with health professionals, invest in wellness infrastructure, and explore programs that enhance mental performance and optimize the mind-body connection.

Hybrid Models

Hybrid models represent the repositioning or blending of library functions with the expertise of adjacent university departments to address broader challenges. By combining efforts and resources, libraries and their partners can develop new approaches that have a larger impact. These models emphasize cooperation, where libraries act as both enablers and collaborators, working closely with other units.

Team Science Hub

The Team science hub envisions libraries as facilitators of interdisciplinary research collaborations. These libraries would coordinate complex research projects that span multiple disciplines—such as environmental science, public health, and engineering—offering data management, analytical tools, and collaboration support. By streamlining communication, assisting with grant-writing, and fostering open and reproducible research, libraries would become central players in tackling global challenges that require integrated approaches.³¹ Libraries would also provide training on team science methodologies, positioning themselves as critical infrastructure in supporting interdisciplinary innovation.

To prepare for this pathway, libraries can develop expertise in project management, data stewardship, interdisciplinary research support, and team science frameworks, ensuring they are well-equipped to coordinate complex, multi-disciplinary collaborations.

Implementers Library

The implementers library would focus on translating academic research into practical applications with direct societal impact. These libraries would collaborate with policy-makers, industry leaders, and community organizations to turn academic knowledge into real-world solutions in areas like public health, urban planning, and environmental conservation. By focusing on technology transfer and policy development, the implementers library would play a key role in addressing community needs and driving societal progress.³²



To prepare for this pathway, libraries can cultivate relationships with industry, policymakers, and community leaders, while developing expertise in technology transfer, policy impact, and implementation science to effectively bridge the gap between research and practice.

Library and Entrepreneurship Lab

The library and entrepreneurship lab would foster innovation by supporting startups and new business ventures. These libraries would provide resources for business development, technology commercialization, and entrepreneurial training, while also offering education in financial and business literacies. Hosting incubators, mentorship programs, and pitch competitions, these libraries would connect users with funding and expertise, nurturing entrepreneurial thinking and contributing to economic growth.³³ By fostering ecosystems for innovation, these libraries would become hubs for technological advancement and market-ready ideas.

To prepare for this pathway, libraries can build partnerships with investors, entrepreneurs, and industry leaders while expanding their resources in business development, financial literacy, and commercialization to create thriving innovation ecosystems.

Library and Research and Compliance Center

The library and research & compliance center would integrate deeply into research infrastructure, offering expertise in grant management, research ethics, and compliance. These libraries would aid in navigating institutional review board (IRB) processes, ensuring research and data privacy and security, and supporting open access mandates and intellectual property opportunities. By collaborating on these complex processes, libraries would reduce administrative challenges for researchers, allowing them to devote more time to their scholarly work.³⁴ Additionally, these libraries could provide training programs on regulatory requirements and data stewardship, ensuring that researchers are well-prepared to meet evolving compliance standards.

To prepare for this pathway, libraries can develop specialized knowledge in compliance, data privacy, research ethics, and research administration to effectively support research management and institutional governance.

Student Success Library

The student success library would partner with student affairs units to enhance students' academic achievement, skill development, and personal growth. These libraries would offer tutoring, writing support, academic workshops, and research assistance to help students excel in their studies. In addition to academic skills, the library would support social development, leadership, and team building through programs designed to foster collaboration and communication. By providing resources for study strategies, time management, career planning, and interpersonal skills, these libraries would create a supportive environment that promotes both academic and personal growth. Through peer mentorship and learning communities, students would gain a well-rounded experience that prepares them for future success.³⁵



To prepare for this pathway, libraries can expand partnerships with student affairs units, invest in skill development programs, and offer resources that support both academic and personal growth, ensuring a holistic approach to student success.

These speculative and hybrid models represent tangible possibilities for ways libraries can evolve in response to a rapidly changing world. While speculative models push the boundaries of what libraries could become, hybrid models strengthen connections with campus partners, creating collaborative frameworks that address both academic and societal challenges. Together, these approaches demonstrate how libraries can remain vital, adaptable institutions that support the diverse and changing needs of their home institutions.

Leadership and Systems Thinking: Shaping the Future

As libraries evolve in a way that evokes the Cambrian explosion—when life rapidly diversified—the crucial question arises: what type of leadership is needed to navigate this transformation? The answer likely lies with leaders who not only anticipate emerging challenges but also embrace the inherent complexity of change. Their roles must extend beyond expanding and stewarding collections or merely adopting new technologies; evolution of libraries requires reimagining relationships with diverse communities, including those who are resistant to change or anchored to the past.

Cultivating Transformation

Leaders must cultivate environments in which transformation is not only managed but fully understood and embraced. Striking a balance among bold experimentation, empathy, and adaptability will help libraries not just adapt in terms of what they do but rethink what they could become. Leaders have an opportunity to foster human-centered innovation, ethical stewardship, and proactive specialization as strategies for reimagining their organizations. By viewing change as an opportunity for growth rather than a threat or loss, leaders can ensure that libraries remain integral to their communities, emerging from slight shifts and strategic maneuvers as vibrant and evolving cultures.³⁶

Visionary Leadership and Agility

Visionary leadership will be essential as libraries adapt to this Cambrian-like landscape. Effective leaders need agility, the ability to respond swiftly to immediate challenges while staying focused on long-term goals.³⁷ This involves anticipating trends, monitoring drivers and signals of change, and investing in staff development, all while upholding the core values that define the library's mission.³⁸ Leaders must also foster a culture of continuous learning and adaptability, ensuring that libraries are resilient in the face of disruption and well-positioned to quickly and thoughtfully seize emerging and potentially unexpected opportunities.

Systems Thinking and Compassionate Leadership

Systems thinking is essential. Leaders must view libraries as part of broader systems encompassing not only research and educational domains but also social, technical, en-



vironmental, economic, and political forces.³⁹ This approach allows leaders to anticipate how external changes can ripple through the institution and to craft more adaptive, forward-thinking strategies.

Compassionate Systems Leadership further deepens this perspective by integrating empathy, relationship-building, and systemic awareness to foster positive organizational outcomes.⁴⁰ Leaders who embody these values are able to build more resilient, agile, and inclusive library environments that adapt to new challenges while remaining true to the institution's mission.

Building on this approach, the Compassionate Systems Leader is uniquely positioned to navigate organizational change while fostering a shared vision with their staff. Recognizing that significant shifts—such as reimagining a library's mission or direction—can create uncertainty or resistance among employees, this leader prioritizes open communication and collaborative decision-making. They engage staff early in the process, ensuring their voices are heard and their concerns addressed, which helps build trust and alignment. Central to their approach is cultivating a mission-driven mindset, uniting the team around a shared “why” that underscores the library's core values and long-term impact. Starting with “the why” inspires action and fosters a sense of purpose within teams and organizations.⁴¹ By framing change as an opportunity—and perhaps a stewardship responsibility—to advance these values, and emphasizing the library's evolving role in meeting community needs, Compassionate Systems leaders inspire a sense of collective purpose. This alignment not only mitigates morale issues but also energizes staff, enabling leaders to guide their team through transformation with cohesion, motivation, and shared commitment. This approach aligns with organizational culture models, which emphasize the importance of shared values and assumptions in driving effective change.⁴²

By fostering collaboration, transparency, and trust, Compassionate Systems Leadership creates a supportive atmosphere in which innovation and progress can thrive. This model emphasizes the importance of nurturing the well-being of individuals and the organization as a whole, ensuring that libraries remain vital contributors to the academic and societal landscape. As libraries navigate the complex intersection of technological advancements, shifting social norms, and evolving user needs, this compassionate and holistic leadership approach becomes the linchpin for driving sustainable success.

Reflection and Inclusion

Additionally, by practicing reflection in action—a continuous process of assessing decisions as they unfold and adapting in real time—leaders can respond more thoughtfully and effectively to emerging challenges.⁴³ Leadership in dramatically changing libraries should aspire to cultivate environments of inclusion and support alongside progress, much like how a healthy ecosystem thrives through balance and interdependence. Just as the vitality of an ecosystem relies on the well-being of all its components, the health of a library organization depends on creating connections in which every member feels valued, supported, and empowered to contribute to the collective mission.⁴⁴



The Leader's Worldview

At the heart of effective leadership lies the leader's worldview—a deeply ingrained set of beliefs, values, and perspectives that shapes how they perceive challenges and opportunities. A leader's worldview influences not only their strategic decisions but also how they engage with stakeholders, navigate ethical dilemmas, and envision the future of their institution. In times of rapid change, such as the current evolution of libraries, a leader's perspective can determine whether they see disruption as a threat or an opportunity for growth. By embracing a worldview that values adaptability, inclusivity, and innovation, leaders can inspire their organizations to evolve in ways that are both sustainable and impactful.

Navigating Crisis with Compassion

In times of crisis—whether due to pandemics, political upheavals, or economic downturns—leaders who combine compassion with clarity are better positioned to guide their institutions through uncertainty.⁴⁵ In the higher education landscape, this means reimagining libraries as adaptive hubs that meet both academic and community needs, providing stability and support during times of uncertainty. Agility is critical; leaders must rethink service models, embrace new technologies and platforms, and reallocate resources to address shifting priorities and institutional goals.⁴⁶ Equally vital is strategic vision, enabling leaders to align decisions with long-term goals that not only support academic excellence but also position libraries as essential contributors to the future of higher education.⁴⁷

Stimulating Social Imaginaries

Leaders can play a pivotal role in stimulating shared social imaginaries among library stakeholders by creating spaces for collaborative visioning and dialogue. Social imaginaries, those shared frameworks of meaning that shape how people imagine and experience their social world are not just abstract ideas but collective understandings that influence how society views fundamental institutions such as education, knowledge, and progress.⁴⁸ These imaginaries shape the expectations and roles assigned to libraries and universities. For instance, a social imaginary that prioritizes economic growth and innovation might drive institutional leaders to focus on commercialization and technological advancements, while one centered on social equity might lead to a greater emphasis on community engagement and open access.

Leaders can foster these imaginaries by articulating a compelling narrative about the library's future, one that resonates with stakeholders' values and aspirations while aligning with institutional goals. This involves inviting diverse voices into the conversation, using tools like workshops, town halls, and design thinking sessions to co-create a shared vision. Transition design, with its emphasis on multi-stakeholder collaboration and a long-term perspective, provides a valuable framework for cultivating these imaginaries by addressing complex challenges and envisioning systemic change.⁴⁹ By situating the library's mission within broader societal challenges, leaders can inspire diverse groups to see themselves as active participants in shaping the institution's evo-



lution. As these imaginaries take root, they provide a powerful framework for guiding strategic decisions and aligning collective efforts, ensuring that the library remains a dynamic and responsive institution.

Libraries as Ecotones

Not all libraries will follow the same evolutionary path. The concept of “ecotone”—a transitional zone between two ecosystems—offers a useful metaphor for this evolution.⁵⁰ In nature, ecotones occur where two distinct ecosystems meet, such as the boundary between a forest and a grassland or a riverbank and a marshland. These zones often exhibit greater biodiversity due to the “edge effect,” where species from both ecosystems, along with unique species adapted to the transition zone, coexist. Ecotones are dynamic areas of interaction, adaptation, and heightened diversity.⁵¹ Similarly, libraries may serve as ecotones, spaces where academic, social, technological, and cultural influences converge.

Traditionally, libraries have been described as the “heart of the university,” emphasizing their central role in preserving knowledge and fostering intellectual life. While this metaphor captures their importance, it can suggest a static function. In contrast, the ecotone metaphor positions libraries as dynamic, adaptive spaces where diverse influences intersect. Just as ecotones in nature thrive on interaction and change, libraries as ecotones foster innovation, interdisciplinarity, and specialization, adapting to meet unique institutional and community needs.

For example, a university library in a coastal region may specialize in climate action by partnering with marine biology and environmental science departments. It curates unique collections and datasets, provides advanced tools and support for visualization and GIS, and hosts interdisciplinary symposia that attract scientists, policymakers, and community stakeholders. This library fully embraces its potential as an ecotone, blending academic inquiry with real-world impact and tailoring its services to meet the needs of its diverse ecosystem.

By contrast, a library at a liberal arts college may fail to embrace its ecotone role. As the college expands its focus and mission toward health sciences, the library continues to prioritize traditional humanities collections and services. Over time, students and faculty in nursing and public health programs turn to external resources, diminishing the library’s relevance. Without adapting to the institution’s evolving priorities, the library risks stagnation, reduced funding, and a loss of its connection to the community it serves.

Now let’s consider a regional university in an urban setting, where the library may focus on supporting social work and public service programs. By partnering with local nonprofits, government agencies, and faculty specializing in community engagement, the library curates resources on urban challenges such as housing insecurity, mental health, and community advocacy. It also serves as a bridge between academia and practice by hosting workshops, networking events, and social gatherings that connect students, professionals, and community leaders to opportunities and diverse perspectives rooted in lived experiences. These events may focus on topics such as grant writing, community organizing, policy development, and skills ranging from facilitation to data analytics and visualization for social impact. In this way, the library thrives as an ecotone, fostering dialogue and convergence between academic expertise and practical, on-the-ground solutions to address pressing local needs.



These examples illustrate how libraries, as ecotones, are not merely adapting but actively forging new pathways to address institutional and community needs. This vision complements the Cambrian explosion framework, which highlights how environmental pressures and emerging opportunities drive diversification and specialization. Just as life forms in the Cambrian period evolved new capabilities to thrive within specific ecological niches, libraries are positioned to redefine their roles to fit and shape the systems they inhabit, serving as vibrant catalysts of transformation in a rapidly shifting world.

Adapting to External Pressures

This convergence allows libraries to blend traditional roles with emerging needs, creating unique combinations of functions and services tailored to their specific environments. Just as ecotones adapt to external pressures while maintaining internal diversity, libraries operating in this transitional space can be more flexible, responsive, and innovative. This concept parallels the idea of convergence in transdisciplinary integration, where life sciences, physical sciences, and engineering blend to solve complex problems.⁵² By inhabiting this metaphorical ecotone, libraries can address both local needs and global changes simultaneously, ensuring their relevance in a rapidly shifting world.⁵³

Local adaptation will be a driving force during this period of rapid change. Each library may evolve in ways that reflect its specific context, whether by supporting local research, forging partnerships with community organizations, or customizing services to meet unique needs.⁵⁴ Successful leaders will strike a balance between responding to local demands and maintaining a wider perspective, staying attuned to their communities while drawing on best practices from many disciplines.

Leadership for the Future

The Cambrian explosion serves as a fitting metaphor for the challenges and opportunities facing libraries today. Just as life diversified and specialized in response to unique environmental pressures, libraries are evolving along diverse paths, shaped by technological, social, and institutional forces. This Cambrian-like moment calls for a new type of leader—one who can navigate complexity, foster innovation, and guide institutions toward thriving within their distinct ecosystems.

From the interplay of compassionate systems thinking, the ecotone metaphor, and the cultivation of social imaginaries emerges a distinct leadership model: Adaptive Convergence Leadership. This approach envisions leaders as integrators and catalysts for evolution, thriving at the intersections where disciplines, ideas, and stakeholder communities meet. Like ecotones in nature, these leaders create spaces where diversity fuels innovation, enabling libraries to adapt, specialize, and transform in response to their unique environments.

Adaptive Convergence leaders embrace the inherent complexity of change, viewing disruption not as a threat but as an opportunity for growth and diversification. They align institutional missions with broader societal challenges while fostering a shared sense of purpose among their teams. Through co-creating social imaginaries and embedding a culture of continuous learning, they inspire resilience and commitment, ensuring that libraries remain vital and vibrant hubs of knowledge and collaboration.



This leadership style is uniquely suited to the current era of specialization and diversification. Libraries are no longer monolithic institutions but dynamic ecosystems, each one adapting to its local and global context. Adaptive Convergence leaders bridge the foundational roles of libraries—preserving knowledge and fostering access—with emerging opportunities for interdisciplinary problem-solving, equity advancement, and environmental stewardship. They champion systems thinking and long-term vision, balancing innovation with tradition to ensure their institutions remain indispensable in an ever-changing world.⁵⁵

In this Cambrian-like moment, Adaptive Convergence Leadership embodies the principles of evolution itself: adaptability, creativity, and collaboration. These leaders cultivate organizations that not only respond to the challenges of today but also shape the possibilities of tomorrow, forging new and specialized roles for libraries in the academic and societal ecosystems they serve.

Conclusion: Libraries as Dynamic Ecosystems

Just as the Cambrian explosion brought extraordinary diversification to lifeforms, libraries today stand on the cusp of their own transformative moment. Shaped by societal shifts, technological advancements, and changing institutional priorities, libraries are evolving into diverse forms uniquely suited to their local environments. This is not merely a response to external pressures—it is an opportunity to reimagine and actively shape their roles for the future.

The success of this evolutionary journey depends on visionary leadership that embraces bold experimentation and deliberate stewardship. By fostering innovation, inclusivity, and collaboration, leaders can ensure libraries remain vital centers for knowledge, equity, service, and community engagement.

Tomorrow's libraries will not only adapt to the immediate demands of their environments but will also help shape the broader social imaginaries that define how society values knowledge, education, and progress. By engaging with these collective belief systems, libraries can influence the directions they take—whether toward technological innovation, social equity, or the preservation of cultural heritage. In doing so, they remain not just repositories of knowledge but are active participants in crafting the societal narratives that guide future generations.

As libraries continue to evolve, they remind us that higher education itself must also adapt to global challenges, embracing new models and innovative approaches. Libraries, as essential partners in academia, must similarly evolve. Whether as cultural hubs, digital innovators, social activists, or champions of sustainability, libraries have the potential to redefine themselves while remaining indispensable.

The path forward is one of change and promise. Libraries, like ecotones, are dynamic ecosystems, organically and continuously shaped by the interplay of diverse forces. By embracing this next evolutionary step, they can emerge as impactful and indispensable forces for knowledge, culture, and empathy. In doing so, they will not merely adapt to change—they will lead it, serving as critical interfaces where innovation, collaboration, and transformation converge, continually redefining their purpose for a world that needs them more than ever.



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