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Knowledge Sharing and Smart Library in Smart City: A Conceptual Framework and Research Agenda

Merryam Agustine[1], Diah Sri Rejeki[2], Haria Saputry Wahyuni[3]

[1,2,3]Library and Information Science, Universitas Widyatama

ABSTRACT: The convergence of smart city initiatives and digital library transformation has generated a new imperative for rethinking how knowledge is created, shared, and accessed in urban information ecosystems. This conceptual paper examines the intersection of knowledge sharing, smart library systems, and smart city frameworks, arguing that libraries are uniquely positioned as knowledge hubs within emerging intelligent urban environments. Drawing on existing literature in Library and Information Science, knowledge management, and urban informatics, this study proposes a conceptual framework integrating four dimensions: technological infrastructure (IoT, AI, and data analytics), user-centric knowledge services, interoperability and open data standards, and community-driven knowledge networks. The paper further identifies critical research gaps, including the underexplored roles of librarians as knowledge brokers, the digital equity challenges inherent in smart city deployments, and the absence of governance models for public knowledge sharing in connected urban spaces. By synthesizing cross-disciplinary perspectives, this study contributes a structured agenda for advancing research and practice at the nexus of smart libraries and smart cities, with implications for policy, technology design, and professional librarianship.

KEYWORDS: Knowledge sharing; Smart library; Smart city; Knowledge management

I. INTRODUCTION

The concept of the smart city has rapidly evolved from a largely technological vision into a complex socio-technical paradigm that encompasses data-driven governance, sustainable urban development, and the intelligent integration of physical and digital infrastructures (Albino, Berardi, & Dangelico, 2015). At the heart of this transformation lies the management and sharing of knowledge, a resource that underpins civic participation, economic innovation, and social cohesion. Yet, within the extensive body of smart city literature, the role of libraries as institutions dedicated to organizing, preserving, and democratizing access to knowledge remains conspicuously underexplored.

Libraries are foundational to the knowledge infrastructure of cities. Historically, they have served as repositories of recorded human knowledge, spaces of learning, and sites of community engagement. As cities become smarter, libraries are undergoing their own transformation into smart library systems that integrate Internet of Things (IoT) devices, artificial intelligence (AI)-driven services, real-time data analytics, and seamless digital-physical interfaces (Cao, Liang, and Lie, 2018). These smart libraries are not merely technologically upgraded buildings; they represent a fundamental reimagining of how knowledge services can be delivered in response to the dynamic, hyperconnected needs of smart city residents.

Knowledge sharing, defined as the purposeful exchange of information, expertise, and insights between individuals, organizations, and communities, is a cornerstone of both library practice and smart city theory (Shujahat et al., 2019). In library contexts, knowledge sharing encompasses the circulation of curated resources, reference services, collaborative programming, and increasingly, the facilitation of user-generated content and community knowledge. In smart cities, knowledge sharing is amplified by digital platforms, open data ecosystems, and participatory sensing networks that generate and distribute vast quantities of urban knowledge in real time.

Despite the conceptual alignment between knowledge sharing, smart libraries, and smart cities, the academic literature has not yet produced an integrated framework that articulates how these three domains interact, reinforce one another, or create tensions. Studies on smart city libraries have primarily focused on technological implementations, such as RFID-based book management, automated cataloguing, or smart building energy systems (Zhou, 2024). Meanwhile, knowledge management

literature has explored organizational knowledge sharing but rarely extends to the unique institutional and public service contexts of libraries operating within smart urban environments.

This paper addresses this gap by proposing a conceptual framework that situates the smart library as a strategic knowledge-sharing institution within the smart city. The framework integrates four key dimensions: (1) technological infrastructure enabling intelligent library services, (2) user-centric knowledge services tailored to smart city residents, (3) interoperability and open data standards that connect library systems to broader urban data ecosystems, and (4) community-driven knowledge networks that leverage the library as a civic knowledge hub. The paper further identifies critical research gaps and proposes a forward-looking research agenda for scholars and practitioners working at the intersection of Library and Information Science, urban studies, and knowledge management.

The remainder of this paper is organized as follows. Section II reviews the relevant literature on smart cities, smart libraries, and knowledge sharing. Section III presents the proposed conceptual framework. Section IV discusses implications and identifies research gaps. Section V concludes with recommendations for future research and practice.

II. LITERATURE REVIEW

A. Smart City: Definitions and Knowledge Dimensions

The smart city concept lacks a single universally accepted definition, but a synthesis of the literature identifies several recurrent characteristics: the pervasive use of information and communication technologies (ICT), the integration of multiple urban systems, the prioritization of sustainability and liveability, and the centrality of data as a governance resource (Yigitcanlar et al., 2018). Scholars such as Hollands (2015) have cautioned against technologically deterministic interpretations, emphasizing that a truly smart city must also be a participatory, equitable, and knowledge-rich city. This broader understanding positions knowledge not merely as a byproduct of urban digital systems but as a fundamental input and output of smart city operations.

Yigitcanlar and Kamruzzaman (2018) identify three foundational components of the smart city: technology, people, and institutions. The knowledge dimension cuts across all three: technological systems generate and process knowledge; people create, share, and apply knowledge; and institutions govern and facilitate knowledge flows. Libraries, as institutions that explicitly exist to organize and share knowledge, therefore occupy a structurally significant position within this framework. Yet, as Angelidou (2017) observes, knowledge management has not been sufficiently theorized within smart city research, leaving a substantial gap that this paper seeks to address.

B. Smart Library: From Automation to Intelligence

The evolution of library systems from manual cataloguing to automated and now intelligent services reflects a broader trajectory of technological adoption in the information sector. The smart library concept has advanced considerably since the proliferation of RFID technology enabled contactless item management and self-service borrowing systems. Subsequent waves of technological adoption have introduced a range of capabilities: digital resource management systems, recommendation algorithms, smart building management, conversational AI for reference services, and data analytics for collection development (Cao, Liang, and Lie, 2018).

Recent empirical studies have examined specific dimensions of smart library development. Zhou (2024) analysed IoT-based smart library systems in South Korea, documenting improvements in user experience and operational efficiency. Cox and Wang (2025) explored AI-powered reference services, finding that while user satisfaction improved, significant concerns remained around equity of access for less digitally literate users. Nazim and Mukherjee (2016) further highlighted the role of knowledge management systems in academic library transformation, emphasizing that successful implementation requires both technological readiness and organizational change management.

These findings point to a recurring tension in smart library development between technological optimization and social inclusion, a tension that must be explicitly addressed in any framework seeking to align smart libraries with the broader values of smart city governance. Hassan and colleagues (2020) reinforce this view, arguing that human-centred design principles must underpin smart library service development to ensure equitable knowledge access across diverse urban populations.

C. Knowledge Sharing: Theoretical Foundations

Knowledge sharing has been extensively theorized in the organizational learning and knowledge management literature. Shujahat et al. (2019) provide a comprehensive review of knowledge sharing in digital and hybrid organizational environments, identifying trust, reciprocity, and platform design as critical enablers of effective knowledge exchange. Their framework is particularly relevant to the library context, where institutional trust and platform accessibility are central determinants of knowledge sharing behaviour.

Social capital theory provides another theoretical anchor for understanding knowledge sharing in library and urban contexts. Libraries function as bonding and bridging institutions: they strengthen ties within communities (bonding) and connect diverse social groups through shared access to information and programming (bridging). In smart city environments, where social fragmentation and digital inequality are documented risks (Yigitcanlar et al., 2019), the library's role as a bridging institution takes on heightened significance.

More recently, knowledge sharing has been examined through the lens of open innovation and digital commons (Enkel, Bogers, & Chesbrough, 2020). Libraries, with their historical commitment to open access and their institutional authority in organizing and verifying knowledge, are well-positioned to serve as trusted intermediaries in emerging digital knowledge commons. Sung & Siraj-Blatchford (2013) extend this argument to public libraries specifically, demonstrating that community-oriented knowledge sharing programmes can meaningfully increase civic participation and digital inclusion in urban settings.

III. CONCEPTUAL FRAMEWORK

Building on the literature reviewed above, this section presents a conceptual framework for understanding the relationship between knowledge sharing, smart libraries, and smart cities. The framework is organized around four interconnected dimensions, each representing a critical domain of analysis and action (see Figure 1). The dimensions are not hierarchical; rather, they are mutually reinforcing and should be understood as components of an integrated system anchored within the overarching Smart City context.

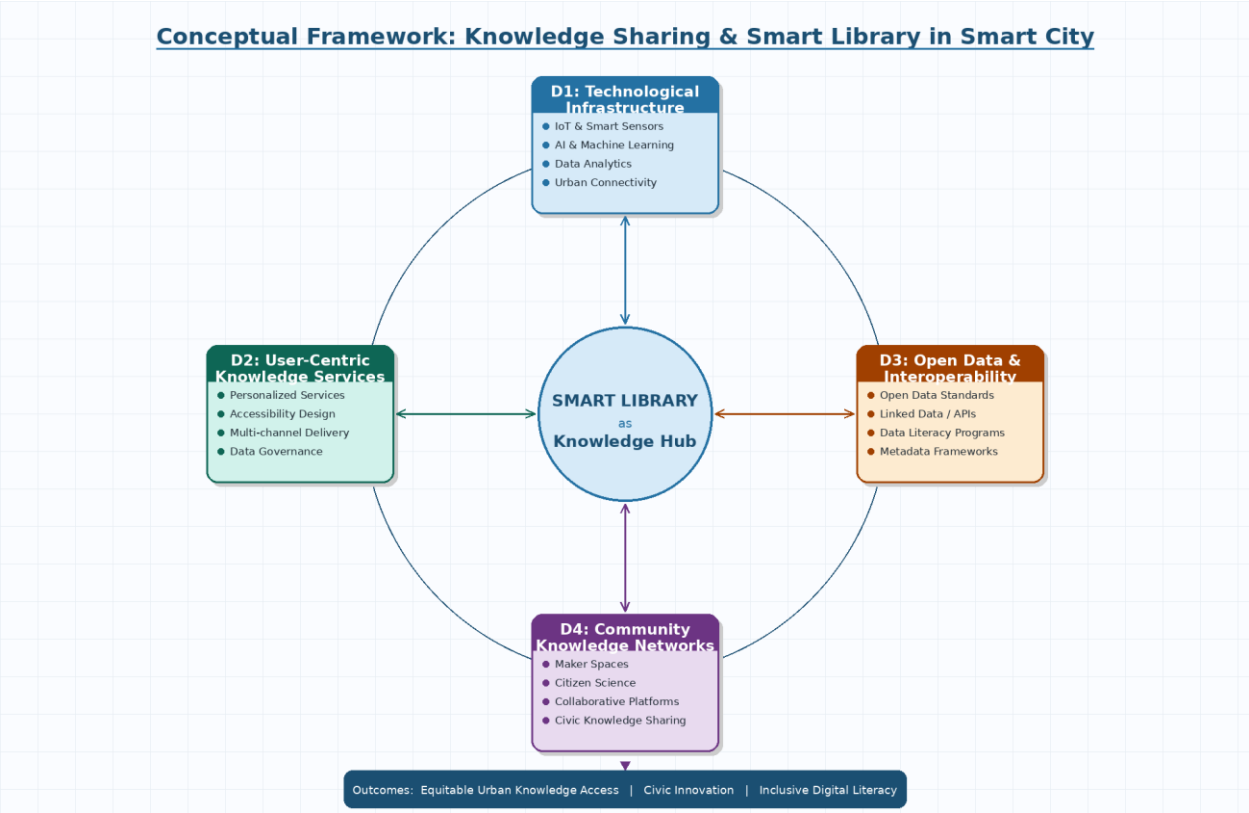


Figure 1. Conceptual Framework: Knowledge Sharing and Smart Library in Smart City

A. Dimension 1: Technological Infrastructure for Intelligent Knowledge Services

The first dimension encompasses the technological systems and platforms that enable smart library services within the smart city context. This includes IoT-based physical systems (smart shelving, environmental monitoring, occupancy sensing), AI-driven service applications (recommendation engines, conversational interfaces, automated cataloguing), and data analytics capabilities (usage analytics, collection optimization, predictive demand modelling). Critically, this dimension also includes the connectivity infrastructure that links library systems to broader urban data platforms, enabling bidirectional flows of information between the library and the city (Cao, Liang, and Lie, 2018).

A key concern within this dimension is interoperability: the ability of library systems to communicate and exchange data with other urban systems, such as transportation networks, municipal open data portals, health information platforms, and educational management systems. Achieving interoperability requires the adoption of common data standards, open APIs, and

shared governance frameworks, a challenge that has been documented in both library technology and smart city literature (Bibri & Krogstie, 2017).

B. Dimension 2: User-Centric Knowledge Services

The second dimension focuses on the design and delivery of knowledge services that are responsive to the diverse needs of smart city residents. Drawing on user experience research and service design principles, this dimension emphasizes the importance of personalization, accessibility, and proactive service delivery. Smart libraries can leverage data analytics and user profiling to anticipate information needs, recommend relevant resources, and deliver services across multiple channels, including physical spaces, mobile applications, and voice interfaces (Hassan et al., 2020).

However, user-centricity must be balanced against privacy and equity considerations. The collection and analysis of user data raises significant concerns about surveillance, data governance, and the potential for algorithmic bias to reinforce existing inequalities in access to knowledge. A user-centric framework for smart library services must therefore include robust data governance policies, transparent algorithmic accountability, and proactive outreach to underserved communities (Abubakar & Abubakar, 2022).

C. Dimension 3: Open Data and Interoperability Standards

The third dimension addresses the role of the smart library as a participant in the open data ecosystems of the smart city. Libraries hold substantial data assets, including collections metadata, usage statistics, community programme records, and local heritage materials, that have significant potential value for urban researchers, policymakers, and residents (Sung & Siraj-Blatchford, 2013). By publishing these data as open, machine-readable datasets and linking them to broader urban data infrastructures, libraries can contribute to the knowledge commons of the smart city while enhancing the discoverability and reuse of their own collections.

This dimension also encompasses the library's role as a data literacy educator, equipping smart city residents with the skills to understand, evaluate, and use open urban data. As cities generate increasing volumes of sensor data, administrative records, and citizen-generated content, the ability to critically engage with data becomes a core civic competency. Libraries, with their established expertise in information literacy and their trusted position as neutral community institutions, are ideally placed to provide this education (Enkel, Bogers, & Chesbrough, 2020).

D. Dimension 4: Community-Driven Knowledge Networks

The fourth dimension positions the smart library as a facilitator and convener of community knowledge networks within the smart city. Beyond its traditional role as a custodian of recorded knowledge, the smart library can serve as a platform for collaborative knowledge creation, bringing together residents, experts, researchers, and civic organizations to generate and share locally relevant knowledge. This may include maker spaces and innovation labs, citizen science programmes, community oral history projects, and collaborative policy research initiatives (Yigitcanlar et al., 2019).

This dimension draws on the concept of the library as a third place, a neutral, welcoming space for community interaction that is neither home nor workplace. In the smart city context, the library's third-place function can be extended into digital domains through online community platforms, virtual programming, and hybrid knowledge-sharing events that connect physical and digital participants. The library's unique combination of physical presence, institutional trust, and digital capability positions it as a natural anchor for community knowledge networks in the smart city (Shujahat et al., 2019).

Table 1. Summary of the Proposed Conceptual Framework

Dimension	Key Components	Research Questions
1. Technological Infrastructure	IoT systems, AI services, data analytics, urban connectivity	How can smart library systems achieve interoperability with urban data platforms?
2. User-Centric Services	Personalization, accessibility, multi-channel delivery, data governance	How can smart libraries balance personalization with privacy and equity?
3. Open Data and Interoperability	Open datasets, linked data, data literacy programs, metadata standards	What governance models support open library data in smart city ecosystems?
4. Community Knowledge Networks	Collaborative knowledge creation, maker spaces, citizen science, hybrid platforms	How do smart libraries foster inclusive community knowledge sharing?

IV. DISCUSSION: RESEARCH GAPS AND AGENDA

A. The Underexplored Role of Librarians as Knowledge Brokers

A significant gap in the existing literature is the limited attention paid to the changing professional role of librarians within smart library and smart city contexts. Much of the smart library research focuses on technological systems and user experiences, with less consideration of the human expertise and professional judgement that underpins effective knowledge services. Librarians, as knowledge brokers, play a critical role in curating, contextualizing, and mediating access to knowledge, functions that are not easily automated and that become more, not less, important as the volume and complexity of available information increases (Nazim & Mukherjee, 2016).

Future research should examine how smart city deployments are reshaping librarian competencies, professional identities, and institutional roles. This includes the emergence of new specializations such as data librarianship, digital humanities librarianship, and community informatics, as well as the evolving relationship between professional library expertise and automated information systems. Ethnographic and interview-based studies of librarians working in smart library environments would be particularly valuable in this regard.

B. Digital Equity and Inclusion in Smart Library Services

The promise of smart city and smart library technologies is frequently articulated in terms of enhanced efficiency, personalization, and connectivity. However, the literature consistently documents that the benefits of digital transformation are not equally distributed, with older adults, people with disabilities, low-income residents, and non-native speakers often experiencing reduced access to or engagement with smart services (Yigitcanlar et al., 2019). In the context of smart libraries, this raises urgent questions about whether technological enhancement may inadvertently deepen existing inequalities in access to knowledge.

Research is needed that examines the differential impacts of smart library services on diverse user populations, drawing on both quantitative usage data and qualitative studies of user experiences and perceptions. Particularly important is research that documents not only patterns of access and non-access, but the structural, cultural, and cognitive barriers that may prevent certain groups from benefiting from smart library services. Such research should inform the design of inclusive smart library systems and the development of targeted outreach and digital literacy programmes (Sung & Siraj-Blatchford, 2013).

C. Governance of Knowledge Sharing in Smart City Libraries

A third critical gap concerns the governance of knowledge sharing in smart library and smart city contexts. The integration of library systems into urban data ecosystems raises complex questions about data ownership, privacy, intellectual property, and the public interest in open access to knowledge. Current governance frameworks for both smart city data and library services have developed largely independently, resulting in potential conflicts and inconsistencies that may impede the realization of integrated smart library systems (Bibri & Krogstie, 2017).

Future research should examine the governance architectures that can effectively balance the competing interests of individual privacy, institutional efficiency, commercial innovation, and the public right to knowledge. Comparative studies of smart city governance models in different national and municipal contexts would be particularly valuable, as would policy analyses examining the alignment between library legislation, open data regulation, and smart city governance frameworks.

V. CONCLUSION

This paper has argued that smart libraries represent a strategically significant but underexplored dimension of smart city development. By proposing a four-dimensional conceptual framework illustrated in Figure 1, integrating technological infrastructure, user-centric services, open data and interoperability, and community knowledge networks, this study provides a structured basis for advancing both research and practice at the intersection of knowledge sharing, smart libraries, and smart cities.

The framework highlights that realizing the full potential of smart libraries as knowledge-sharing institutions in smart cities requires more than technological investment. It demands sustained attention to issues of equity, governance, professional expertise, and community engagement. Libraries that successfully navigate these dimensions will be positioned not merely as service providers within smart cities but as active co-producers of the knowledge infrastructures upon which equitable, innovative, and democratic smart cities depend.

Future research should build on this framework through empirical studies that examine smart library implementations in diverse urban contexts, with particular attention to the perspectives of underserved communities, frontline library professionals, and the governance actors who shape the regulatory environment for knowledge sharing in smart cities. Interdisciplinary

collaboration between Library and Information Science, urban studies, knowledge management, and computer science will be essential to advancing this agenda.

REFERENCES

1) Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. Journal of Urban Technology, 22(1), 3–21. https://doi.org/10.1080/10630732.2014.942092
2) Angelidou, M. (2017). The role of smart city characteristics in the plans of fifteen cities. Journal of Urban Technology, 24(4), 3–28. https://doi.org/10.1080/10630732.2017.1348880
3) Bibri, S. E., & Krogstie, J. (2017). Smart sustainable cities of the future: An extensive interdisciplinary literature review. Sustainable Cities and Society, 31, 183–212. https://doi.org/10.1016/j.scs.2017.02.016
4) Cao, G., Liang, M., & Li, X. (2018). How to make the library smart? The conceptualization of the smart library. The Electronic Library, 36(5), 811–825. https://doi.org/10.1108/EL-11-2017-0248
5) Cox, A. M., & Wang, X. (2025). Artificial intelligence in libraries: The emerging research agenda. IFLA Journal, 51(3), 567–569. https://doi.org/10.1177/03400352251365278
6) Enkel, E., Bogers, M., & Chesbrough, H. (2020). Exploring open innovation in the digital age: A maturity model and future research directions. R&D Management, 50(1), 161–168. https://doi.org/10.1111/radm.12397
7) Hassan, H., Mohd Nawi, M. N., & Basaruddin, S. (2020). Library 4.0: Services challenges for smart library practitioners. International Journal of Advanced Science and Technology, 29(4), 9001–9011.
8) Hollands, R. G. (2015). Critical interventions into the corporate smart city. Cambridge Journal of Regions, Economy and Society, 8(1), 61–77. https://doi.org/10.1093/cjres/rsu011
9) Nazim, M., & Mukherjee, B. (2016). Knowledge management in libraries: Concepts, tools and approaches. Chandos Publishing.
10) Shujahat, M., Sousa, M. J., Hussain, S., Nawaz, F., Wang, M., & Umer, M. (2019). Translating the impact of knowledge management processes into knowledge-based innovation: The neglected and mediating role of knowledge-worker productivity. Journal of Business Research, 94, 442–450. https://doi.org/10.1016/j.jbusres.2017.11.001
11) Sung, H.-Y., & Siraj-Blatchford, J. (2013). Exploring the role of public libraries in supporting intergenerational literacies through ICT (pp. 1–12). IFLA WLIC 2013. https://creativecommons.org/licenses/by/3.0/
12) Yigitcanlar, T., Kamruzzaman, M., Foth, M., Sabatini-Marques, J., da Costa, E., & Ioppolo, G. (2019). Can cities become smart without being sustainable? A systematic review of the literature. Sustainable Cities and Society, 45, 348–365. https://doi.org/10.1016/j.scs.2018.11.033
13) Yigitcanlar, T., & Kamruzzaman, M. (2018). Does smart city policy lead to sustainability of cities? Land Use Policy, 73, 49–58. https://doi.org/10.1016/j.landusepol.2018.01.034
14) Yigitcanlar, T., Kankanamge, N., & Vella, K. (2021). How are smart city concepts and technologies perceived and utilized? A systematic geo-Twitter analysis of smart cities in Australia. Journal of Urban Technology, 28(1–2), 135–154. https://doi.org/10.1080/10630732.2020.1753483
15) Yigitcanlar, T., Wilson, M., & Kamruzzaman, M. (2019). Disruptive impacts of automated driving systems on the built environment and land use: An urban planner's perspective. Journal of Open Innovation: Technology, Market, and Complexity, 5(2), 24. https://doi.org/10.3390/joitmc5020024
16) Zhou, Q. (2024). Smart library architecture based on internet of things (IoT) and software defined networking (SDN). Heliyon, 10(3), e25375. https://doi.org/10.1016/j.heliyon.2024.e25375

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