# A Library for All: A Vision for Inclusive and Engaging Library Spaces

How can the redesign of the KB's physical and digital accessibility foster social inclusion and community engagement for people with physical disabilities?

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## Abstract

This research looks at how the *Koninklijke Bibliotheek* (KB) – the national library of the Netherlands – can be redesigned to better support people with physical disabilities. By improving both its physical spaces and digital services, the goal is to make the KB a more inclusive and welcoming place where everyone can participate fully in library life. As libraries increasingly become community hubs rather than just places to store books, designing for inclusion has never been more important, especially in historic buildings like the KB, where accessibility and preservation often clash.

Through a mix of case studies, site visits, and literature review, this research explores how architecture and technology can work together to remove barriers and improve the experience for users with disabilities. It draws inspiration from inclusive libraries like Oodi in Helsinki and Seattle Central Library, and focuses on strategies such as clear navigation, flexible spaces, and built-in assistive technologies. It also highlights the importance of embedding digital tools – like self-checkout stations and library catalogues – directly into the library's layout so they're easy to find and use independently.

Rather than treating accessibility as a box to check, this thesis argues for a more human-centered approach – one that listens to users, responds to real needs, and sees inclusion not as a limitation, but as an opportunity to rethink what a library can be. In doing so, it aims to show how national libraries like the KB, which safeguard important heritage, can become truly inclusive spaces that bring people together and support a sense of belonging for all.

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## 1. Introduction

Libraries have long served as vital cultural and educational institutions that promote knowledge access, social inclusion, and community interaction. As society continues to evolve, libraries are being challenged to adapt their physical and digital spaces to serve increasingly diverse user groups. Among these, people with physical disabilities often face barriers ranging from inaccessible layouts to limited digital usability that hinder full participation in library spaces and services.

According to the World Health Organization (2023), approximately 1.3 billion people globally, around 16% of the world population live with a significant disability. Of these, physical and mobility impairments represent one of the largest groups, affecting up to 40% of disabled individuals. Despite this, many public institutions, including libraries, still fall short in offering spaces that are fully inclusive and equitable (Goldsmith, 1997).

The *Koninklijke Bibliotheek* (KB), the national library of the Netherlands, has expressed a commitment to accessibility and inclusion (KB, n.d.). However, both its physical infrastructure and digital platforms present clear challenges for people with physical disabilities. For example, the main entrance is difficult to find, signage within the building lacks clarity and tactile elements. Digital services also pose issues, such as interfaces not being compatible with screen readers and limited staff support for assistive technology (De Jager-Loftus & Fox, 2022).

Since the KB is undergoing a redesign rather than a completely new build, this presents a unique opportunity to investigate how existing library spaces can be transformed to become more inclusive. Redesigning an existing structure poses different challenges than new construction – it requires negotiating between preserving heritage[1] elements and implementing modern, accessible design solutions (Moss, 1981).

This research explores how architectural redesign, spatial strategies, and digital tools can be integrated to enhance accessibility, community engagement, and the overall user experience. Public libraries, as Kranich (2001) argues, are more than repositories of books – they are institutions that support democracy by fostering inclusion, access to knowledge, and community conversation. By focusing on the KB as a case study, the goal is to contribute to broader discussions on how national and public libraries can redesign existing structures to create spaces that not only meet legal accessibility standards, but to transform them into inclusive, welcoming libraries.

The study also responds to a notable knowledge gap: much of the existing literature solely focuses on accessibility, universal design, or community engagement separately (Fournier & Ostman, 2021). There is limited research on how these can be combined in the context of

[1] This thesis starts from the idea that while the *Koninklijke Bibliotheek* building is not officially listed as heritage, it possesses significant architectural and cultural qualities that warrant a heritage-sensitive approach. In this context, particular emphasis is placed on the building's spatial character, public role, and symbolic function. Importantly, the library's collections – rather than the building itself – are recognized as national heritage, reinforcing the need to design with both preservation and accessibility in mind.

redesigning an existing library, especially one with national significance. Furthermore, existing guidelines often prioritize compliance over user experience, overlooking the everyday struggles people with physical disabilities face in navigating library spaces and services (Pionke, 2017).

Common barriers in library design include inaccessible entrances and restrooms, poor wayfinding and signage, furniture not suited for wheelchair users, and limited integration of assistive technologies (Goldsmith, 1997; Moss, 1981). Beyond the physical environment, transportation difficulties, digital inaccessibility, and social exclusion also hinder engagement. These layers of barriers not only reduce access but also discourage independent use and participation in library life.

By identifying these barriers and proposing integrative solutions through architectural and digital redesign, this research will inform both practical design strategies and theoretical frameworks for inclusive library development. The findings will also directly influence the accompanying spatial design proposal, which will test ways of transforming the KB into a library that is more inclusive.

Although accessibility is increasingly deemed essential in public institutions, the practical implementation of inclusive design in existing library buildings remains inconsistent and frequently inadequate. Redesign efforts often prioritize meeting regulatory standards rather than creating environments that actively support the independence, dignity, and participation of individuals with physical disabilities (Pionke, 2017; Hudson-Peralta, 2025). Consequently, library environments – both physical and digital – may remain inaccessible in practice, even when they formally comply with regulations (Goldsmith, 1997; Moss, 1981).

The current redesign of the KB provides a critical opportunity to address these issues. However, without a comprehensive, user-focused approach, there is a risk that persistent barriers will be maintained. Existing scholarship tends to treat accessibility, universal design, and community engagement as separate domains, offering limited guidance on how these elements might be meaningfully integrated into the redesign of historically significant public institutions (Fournier & Ostman, 2021). Moreover, few studies explore the often competing demands of heritage preservation and accessibility.

Hence, this research aims to fill a critical gap in both theoretical and practical knowledge by examining how architectural and digital redesign strategies can be combined to transform library spaces into genuinely inclusive environments. By using the KB as a case study, the study seeks to develop evidence-based, actionable insights that go beyond compliance and actively foster a sense of belonging, empowerment, and usability for all users.

***Keywords***

Accessibility: Ensures that all individuals, including those with physical disabilities, can fully participate in the library's offerings without barriers.

Universal design: Promotes inclusive architectural strategies that create adaptable, user-friendly spaces for everyone.

Community Engagement: Strengthens the library's role as a dynamic space for interaction, learning, and collaboration, fostering a sense of belonging in both physical and digital environments.

## 1.2 Hypothesis

Integrating universal design principles and digital accessibility tools into redesigning the *Koninklijke Bibliotheek (KB)* will significantly enhance access for people with physical disabilities and support more inclusive social interaction within the library. By addressing both spatial and digital barriers – such as unclear layouts, limited mobility access, and inaccessible digital interfaces – the redesigned KB has the potential to create an environment where diverse user groups can participate equally.

This research hypothesizes that thoughtful integration of inclusive architectural strategies and digital technologies will not only improve user experience for people with physical disabilities but also strengthen the KB's role as a welcoming and engaging public space for the broader community.

## 1.3 Research questions

This research was initiated following multiple visits to the *Koninklijke Bibliotheek* (KB), the National Library of the Netherlands. Despite its prominent public role, the building presented noticeable challenges in terms of visibility, navigation, and physical accessibility, particularly for individuals with physical disabilities. This observation prompted a broader inquiry into how national libraries can evolve not only to comply with accessibility standards but to actively foster inclusive, welcoming environments through both physical design and digital innovation.

Using the KB as a case study, this research investigates how spatial and digital redesigns can be strategically integrated to improve accessibility and strengthen the library's function as a hub of community engagement and social inclusion. In doing so, the study aims to bridge the gap between architectural design, technological solutions, and user-centered inclusivity in public knowledge institutions.

This study focuses specifically on individuals with physical disabilities and does not comprehensively address all forms of disability, such as sensory or cognitive impairments. Additionally, while the research examines both physical and digital spaces, it is limited to user experience within the context of public libraries.

***Main Research Question:***
How can the redesign of the KB's physical and digital accessibility foster social inclusion and community engagement for people with physical disabilities?

***Sub-questions:***

- What are the challenges for the physical and digital accessibility in redesigning library projects?
- What spatial strategies can the KB implement to ensure accessibility while promoting community engagement?
- What digital tools and technologies can be integrated into the redesign of library spaces to support accessibility and enhance the user experience for people with physical disabilities?

## 1.4 Methodology

This research adopts different methods to explore how the *Koninklijke Bibliotheek* (KB) can be redesigned to improve accessibility for individuals with physical disabilities while enhancing community engagement. The research is structured in three key phases: literature and case study analysis, site observations, and data collection through interviews and focus groups.

The project begins with a literature review to build a strong theoretical foundation on accessibility, universal design, and inclusive public space design. This includes reading key texts such as:

1. Selwyn Goldsmith – *Designing for the Disabled (1997)*
This book introduces the concept of inclusive architectural design and is among the first to prioritize accessibility as a design consideration rather than merely a legal obligation. It offers vital guidance on eliminating physical barriers in public spaces, making it highly pertinent for rethinking the layout of the KB.

2. Mary Davis Fournier & Sarah Ostman – *Grounding Your Library Work in Community Engagement (2021)*
This book examines how libraries can transition from mere information centers to genuine community spaces. It highlights participatory methods and inclusive programming, establishing it as a valuable resource for linking spatial accessibility with significant social engagement.

3. Charles A. Moss Jr. – *Planning Barrier-Free Libraries: A Guide for Renovation and Construction of Libraries Serving Blind and Physically Handicapped Readers (1981)*
This article, chosen for its focus on library architecture, offers recommendations for enhancing the accessibility of both new and renovated libraries. It addresses specific design features that support the research focus on the challenges of redesigning existing library spaces, such as the KB.

4. Danielle De Jager-Loftus & E. Fox – *Universal Design, the Library, and Assistive Adaptive Technologies (2012)*
This article discusses how libraries can integrate assistive technologies within a universal

design framework. It was selected for its emphasis on digital inclusion and adaptive tools, helping to inform the digital aspects of the KB's redesign and its impact on users with physical disabilities.

Moreover, this research will look at case studies of innovative library projects, including Oodi Library in Helsinki, Halifax Central Library in Canada, Seattle Public Library in the United States, and Amsterdam Public Library (OBA) in the Netherlands. These libraries serve as examples of how inclusive design can be successfully implemented in different contexts.

Based on the knowledge gained, the next phase involves on-site analysis at the KB to observe how current spaces are used and to identify barriers to access and inclusion. This includes assessing physical elements such as entrances, pathways, restrooms, and reading areas, and how digital tools and services are experienced within the space. To gain a deeper, first-hand understanding of the challenges faced by users with physical disabilities, I will also navigate the library in a wheelchair, allowing me to test the space from an accessibility perspective. These observations aim to uncover how well the current layout supports or limits mobility**,** independence, and social interaction for users with physical disabilities.

These methods together will help build a clearer picture of the challenges people with physical disabilities face at the KB, while also uncovering new opportunities to make the national library a more welcoming, inclusive, and engaging place for everyone.

## 2. Research Q 1

*What are the challenges for the physical and digital accessibility in redesigning library projects?*

### *2.1 Literature*

Redesigning current libraries to enhance accessibility for individuals with physical disabilities poses considerable architectural and technological challenges. These difficulties are frequently tied to the structural limitations of older library buildings, which were not initially constructed with inclusivity or universal design principles in mind. Consequently, these spaces might feature steep staircases, narrow corridors, or entrances that are hard to find or navigate independently. When these libraries are designated as historically or culturally significant, like the Koninklijke Bibliotheek (KB), architects encounter the additional challenge of preserving heritage elements while integrating accessibility features. This dual responsibility often leads to compromises that adhere to regulatory codes yet do not fully address the experiential needs of users with physical disabilities. As Borowczyk (2017, pp. 1-6) points out, adapting heritage buildings to meet accessibility goals requires complex, often reversible interventions that involve negotiation between design integrity and inclusive access.

The demands of digital accessibility have grown more complex as libraries expand their online services. These digital extensions, ranging from websites and catalogs to interactive

kiosks and mobile apps, must also be inclusive and usable by individuals with a range of physical impairments. Digital inclusion today encompasses requirements such as screen reader compatibility, clear interface design, and device-agnostic functionality. As Chung and Park (2021, pp. 6-12) point out, poor physical placement and design of digital access points, such as kiosks and self-service machines, often create barriers that limit usability, especially for users with mobility issues or those who rely on assistive technologies. However, accessibility challenges are not confined to the digital sphere. For instance, at the KB, users are required to ring a bell for entrance at one side of the building, and the path includes uneven paving, which creates unnecessary barriers for wheelchair users. Additionally, signage inside the building is difficult to read, limiting independence.

**Physical Accessibility Challenges in Redesign**

According to Goldsmith (1997), many public buildings were constructed without regard to accessibility, resulting in narrow doorways, multi-level layouts without elevators, and poorly placed entrances. These limitations are often rooted in the original architectural plans of older institutions, libraries like the Koninklijke Bibliotheek (KB) being a prime example. When these buildings are historically significant, the imperative to preserve features further complicates efforts to improve accessibility. Sáez-Pérez and Marín-Nicolás (2023) reinforce this argument, noting that renovation efforts in heritage libraries are often limited by conservation standards, which can conflict with installing practical accessibility features such as ramps, lifts, automatic doors, or reconfigured entryways. Both authors emphasize that accessibility should not be an afterthought or add-on; it must be integrated into the redesign process from the very beginning.

This need for fundamental integration is made more urgent by the evolving understanding of what it means to create accessible public spaces. As accessibility is increasingly tied to user dignity and independence, retrofitting older structures presents not only physical but ethical challenges. [2] According to Pionke (2017), renovations must go beyond structural compliance and aim to foster welcoming, inclusive experiences for a wide range of users, which often means redesigning key routes of circulation, improving surface materials for mobility aid compatibility, and reevaluating sightlines and spatial hierarchy within the building.

Wayfinding poses another persistent barrier to independent use of library spaces. De Jager-Loftus and Fox (2022) observed that signage in public buildings often lack tactile or visual clarity, making navigation difficult for users with mobility or visual impairments. Goldsmith (1997, pp. 44–46) supports this by asserting that intuitive navigation is a cornerstone of accessible environments. He suggests that consistent visual cues, tactile elements, and spatial coherence are critical in enabling users to move freely and with confidence. Moss (1981) highlights that poor spatial legibility, such as vague signage, irregular floor plans, or hard-to-reach restrooms, can greatly hinder users' ability to navigate, compromising their independence even in spaces that meet technical standards. This issue is also evident at the

[2] This thesis starts from the idea that inclusive architectural design is a moral necessity – especially when it comes to accessibility for people with physical disabilities. This view is supported by Nussbaum's capability approach (Sen, 1999; Nussbaum, 2006), which argues that justice means making sure everyone has the real opportunity to do and be what they value – like moving around freely, learning, and taking part in public life – by ensuring fair access to shared spaces.

KB, where unclear signage and disjointed internal layout present similar challenges for visitors with disabilities.

Poor wayfinding systems may lead to dependence on staff or signage that assumes a level of physical ability not possessed by all users. Consequently, some users may avoid certain areas altogether, which impacts how equitably the library is experienced. Addressing these concerns requires attention to layout planning, signage design, and the thoughtful incorporation of universal symbols and auditory or tactile aids (Goldsmith, 1997).

**Digital Accessibility Challenges in Redesign**

Access to digital interfaces in libraries is also fraught with accessibility issues, particularly when platforms fail to meet the varied needs of users with physical disabilities. De Jager-Loftus and Fox (2022) argue that digital platforms are not fully compatible with assistive technologies like screen readers, limiting access to essential services such as catalog searches, event registration, or digital borrowing. In many cases, even seemingly minor design flaws – such as unlabeled buttons, inaccessible drop-down menus, or non-adjustable font sizes – can render a platform unusable for individuals dependent on assistive devices. Similarly, Clarkson and Coleman (2015, p. 235) explain that "disability arises from interactions with the surrounding environment that are amenable to design … not inherently from capability levels," highlighting that accessibility must be addressed through continuous design adaptation rather than static solutions.

The lack of integration of assistive technologies remains a persistent barrier to digital accessibility in libraries. While many institutions provide tools such as screen magnifiers, speech-to-text software, or alternative input devices, these resources are frequently underused. According to Sherman et al. (2022), this underutilization is often due to poor promotion, limited staff training, and a lack of awareness about the specific needs of users with disabilities. In some cases, assistive technologies are locked away or unavailable during peak usage times, further limiting their impact. Addressing these issues requires not only better training and visibility but also an institutional commitment to making accessibility tools an integrated part of everyday library services. Fournier and Ostman (2021) support this view, arguing that inclusive digital service depends not only on the availability of hardware or software, but also on the institution's capacity to facilitate their use. They stress the importance of informed, proactive staff who can offer hands-on guidance and can tailor their support to a user's specific needs. Both sources agree that the human element – namely, training, empathy, and awareness – is essential to bridging the gap between available technology and its actual usefulness for people with disabilities.

Moreover, staff support and digital literacy play a critical role in ensuring true accessibility. Fournier and Ostman (2021, pp. 21–24) caution that libraries often underestimate the learning curve involved in navigating digital systems, particularly for users with physical impairments who may also face challenges related to screen sensitivity, touchpad accuracy, or multi-step authentication processes. They emphasize that staff must be trained not only in the technical operation of these systems but also in the social and emotional aspects of accessibility, such as promoting user dignity, demonstrating patience, and empowering users to become confident navigators of the digital space. This perspective aligns with De Jager-Loftus and Fox (2022), who found that without personalized and ongoing support, even well-

designed systems can fall short of their intended impact. Together, these studies underline the idea that digital accessibility is not solely a technical/architectural matter.

A common problem in library redesign projects is the separation between digital and architectural planning. Goldsmith (1997) and De Jager-Loftus and Fox (2022) point out that when these areas are designed separately, it can lead to disjointed user experiences. For example, a building might meet basic accessibility standards, but the digital services, such as websites or self-checkout machines, could still be hard to use for people with physical disabilities. Or the reverse might happen: the digital side is accessible, but the building itself isn't easy to navigate. This kind of mismatch makes the library harder to use and can discourage people from returning.

To avoid this, both sources argue for a more integrated approach – one that brings physical and digital planning together under a shared philosophy: universal design. This means designing spaces, tools, and services to be usable by as many people as possible from the beginning, regardless of age, ability, or background. Instead of adding accessibility features as an afterthought, universal design focuses on creating environments that are welcoming and practical for everyone.

In practice, this could look like automatic sliding doors that open without needing to push a button, or signage that includes visual symbols, Braille, and audio cues. On the digital side, it might include a library website that's easy to navigate with a keyboard, works with screen readers, and uses clear language and good contrast. When done well, this kind of design creates a smooth experience from start to finish. A person with limited mobility could check the library map online, enter the building without help, find their way using tactile floor markers, and use an accessible touchscreen or voice-activated catalogue inside.

### *2.2 Site visit (KB)*

During a visit to the KB using a wheelchair (see Appendix A), many of the accessibility challenges described in the literature became immediately apparent. While some features, like a slower revolving door, attempt to accommodate different needs, actual independence remains limited. To enter the building, someone still has to manually open a side gate, which isn't practical or dignified. Inside, the elevator in the reading room is so small it can only fit one person, making it difficult to use comfortably. An accessible toilet was available, but it was locked, requiring visitors to go back to the ground floor to request a key. This adds unnecessary effort and discourages spontaneous use. Wayfinding throughout the building is poor: signage is small and hard to spot, there's no tactile guidance, and the floors are uneven, making it harder to move safely. Some spaces, like the coat-hanging area, are simply unreachable for wheelchair users due to steps. In the reading areas, oversized chairs block the pathways, making it difficult to pass through. These individual barriers might seem minor in isolation, but together they create an environment that is frustrating, unequal, and often disempowering. They highlight the urgent need to rethink accessibility not as a checklist, but as something that should shape the entire design from the start.

In addition to spatial layout and orientation, the internal furnishing of library environments often presents hidden and underacknowledged obstacles (author's observation, Visit to KB,

2025). Moss (1981) notes that tables, chairs, and shelving are rarely designed with wheelchair users in mind, frequently lacking appropriate height clearance or adjustability. This results in environments where people with disabilities are unable to engage with resources or participate in communal areas. Therefore, Goldsmith (1997) advocates for adaptable furniture systems that offer both functionality and inclusivity, allowing flexibility in spatial arrangements that can be reconfigured to suit the needs of individual users or diverse group settings. An example of this could be a mix of seating types (with and without armrests) or adjustable-height tables and workstations. Moreover, the positioning and spacing of furnishings matter – crowded layouts can make it impossible for wheelchair users to move comfortably between aisles or workspaces, effectively restricting access even when entry is technically unobstructed.

In addition to the site visit, a semi-structured interview with the KB's accessibility coordinator (Appendix C) provided further insight into the challenges users with physical and sensory access needs encounter. The interview highlighted recurring issues such as low-contrast signage, unclear entrance sequences, lack of tactile or hand-height pictograms, and the absence of a continuous guided route from public transport to the main entrance. The coordinator also emphasized acoustic overstimulation, glossy materials that create glare, and insufficient availability of sensory-friendly spaces. These findings reinforce many of the barriers identified in the literature and on-site observations, while also introducing additional user-centered considerations—such as preferred colour tints, lighting warmth, and the importance of non-verbal communication tools—that can inform a more inclusive redesign of the KB.

### *2.3 Case study*

This kind of joined-up thinking helps make the whole library experience more intuitive and inclusive. A great example is Helsinki's Oodi Library, which brings these ideas together, such as motion-activated entrance doors to user-friendly digital kiosks (see Appendix B).

However, this level of integration requires collaboration across different departments – such as architecture, IT, and digital services – which do not always work closely together in practice. As Goldsmith (1997) emphasizes, physical and informational environments should not be treated in isolation. De Jager-Loftus and Fox (2022) build on this, arguing that infrastructure updates should go hand in hand with improvements to digital interfaces to create a truly accessible experience for all users.

Hudson-Peralta (2025) adds a critical perspective, pointing out that meeting minimum accessibility requirements is often not enough. Small gestures – like a single ramp or a few marked "accessible" areas – may check legal boxes but still fail to meet the real needs of people with disabilities. He stresses the importance of involving disabled users early in the design process, so their lived experiences directly shape the final outcome.
This people-centered approach connects with what Moss (1981) called for: barrier-free environments that are not just technically accessible but also comfortable, dignified, and empowering. Moss emphasizes that accessibility should support independence and social interaction, not just physical movement through space.
Taken together, these sources highlight a shared message: that true accessibility is not

simply a technical requirement or regulatory checkbox, but a dynamic and empathetic practice. Redesigning libraries for physical and digital inclusion is a complex process that involves architecture, technology, and institutional culture. As Goldsmith (1997), Moss (1981), and De Jager-Loftus and Fox (2022) all suggest, compliance alone is not enough. Whether through thoughtful layouts, inclusive digital design, or staff training: libraries must go beyond surface-level fixes to create welcoming, inclusive environments where all users, regardless of ability, can engage fully and independently.

## 3. Research Q 2

*What spatial strategies can the KB implement to ensure accessibility while promoting community engagement?*

### *3.1 Literature*

Goldsmith (1997) makes an important distinction between "designing for the disabled" and "universal design." While the former focuses specifically on making spaces usable for people with disabilities, the latter takes a broader view, aiming to create buildings and environments that are safe, comfortable, and convenient for everyone, including those with disabilities. This way of thinking has influenced how many modern libraries now approach accessibility, not just as a legal obligation, but as a proactive design philosophy. Kirker (2024) supports this view, noting that real accessibility goes far beyond things like ramps or elevators. It also includes sensory-friendly design, well-trained staff, and programming that makes people feel welcome. Similarly, De Jager-Loftus and Fox (2024), argue that legal compliance should be seen as the starting point. Libraries must actively look for – and remove – barriers like confusing layouts or poor signage that can unintentionally exclude people. Together, these perspectives show that accessibility is not just about access – it is about making people feel included, empowered, and at ease in the space.

Crucially, community engagement should not stop once a building opens. Fournier and Ostman (2021) stress that long-term success depends on building lasting relationships with local users. They argue that truly inclusive libraries need programming that activates flexible spaces and welcomes participation from all kinds of people. Similarly, Asal et al. (2023) emphasizes that "realignment can't happen in a vacuum: maximizing community partnerships and adjacent assets is critical to enable greater physical utilization, community alignment, and diverse engagement" (para. 4), reinforcing the need for sustained outreach and civic collaboration beyond design and construction

Public libraries today are evolving far beyond their traditional roles as quiet places for books and study. Increasingly, they serve as vibrant community anchors that support a wide range of social, cultural, and educational needs. Aabø and Audunson (2012) emphasize that modern library branches are intentionally designed to include features like meeting rooms and auditoria, which allow them to host public events, performances, and community programming (pp. 138-139). These spaces help libraries function not just as repositories of knowledge, but as dynamic gathering places where people connect, learn, and collaborate.

Similarly, Gray et al. (2022, pp. 131-133) highlight how many public libraries are embracing more interactive environments by incorporating makerspaces, play areas for children, and flexible rooms for workshops and group activities. These additions reflect a growing recognition that libraries are key players in fostering community engagement and lifelong learning for people of all ages.

Of course, successful programming depends on flexible spaces. Fournier and Ostman (2021) note that movable furniture, acoustic curtains, and modular walls all help transform rooms for different uses – from lectures to group discussions or storytime sessions. When libraries combine adaptable design with inclusive programming and active community input, they become welcoming places that reflect and respond to the people they serve. In short, they are not just inclusive in how they look, but in how they function.

Goldsmith (2000) emphasizes that universal design should not be seen as an add-on for accessibility but as a core principle that benefits all users. Applying this to the KB, spatial strategies should prioritize features like step-free entrances, accessible restrooms on each floor, and intuitive wayfinding systems that accommodate both first-time visitors and individuals with disabilities. This aligns with OBA's guiding principle of being "accessible and open in every fiber," where no user feels like an afterthought. Similarly, the Office for Civil Rights (2024), as cited by De Jager-Loftus and Fox, underscores that legal compliance is only the baseline; truly accessible spaces must actively identify and remove structural and perceptual barriers that inhibit participation.

### *3.2 KB context and implications*

Building on this foundation, OMA and LMN Architects (2004) advocate for flexible spatial configurations that support diverse and evolving public uses. Their work on Seattle's Central Library, for example, introduced modular spaces such as the "Living Room" and teen lab, which were designed to be reconfigured based on changing community needs. Inspired by this, the KB could develop a layout that includes a vibrant ground floor for exhibitions, cafés, and civic interaction, balanced by upper floors dedicated to quiet research and study. This tiered zoning mirrors the models seen in Oodi (Yeung, 2022) and Amsterdam's OBA (Coenen, 2014), where activity-based zoning ensures harmony between loud and quiet functions. Inspired by this, the KB could develop a layout that includes a vibrant ground floor for exhibitions, cafés, and civic interaction, balanced by upper floors dedicated to quiet research and study. This spatial zoning could be enhanced by architectural features such as double-height atria, glazed partitions, and soft transitions between noisy and quiet zones, allowing users to navigate through different atmospheres.

Furthermore, Yeung (2022) demonstrates how the participatory design process at Helsinki's Oodi Library fostered deep public ownership and high engagement. More than 3,000 citizens contributed to the planning phase, resulting in a library that truly reflected local needs. Fournier and Ostman (2021) urge institutions to "Ask, Listen, Empower" their communities by involving them directly in shaping library spaces. The KB could put this philosophy into practice not only through workshops and community input, but also by designing the building itself to invite participation. This might include flexible entrance areas that can host events, open community spaces with movable walls, and large windows or glass façades that

show what's happening inside the library from the street. These design choices help make the library feel open and welcoming, symbolically and in how people experience the space.

Finally, spatial infrastructure must be activated by dynamic programming. Cooke (2021) argues that community engagement forms the "foundation" for all library services and offerings. Libraries like Halifax Central and OBA exemplify this, regularly hosting job fairs and art exhibits in multipurpose spaces (Roseen, 2019). These programs depend on adaptable structural systems and open floorplates, where spaces can transition from lectures to workshops, or from exhibitions to informal gatherings. Recent urban design ideas show that libraries can become important community spaces by connecting with nearby homes, shops, and parks. This helps encourage social interaction and makes the library more accessible to everyone. Helsinki's Oodi and Maunula libraries show how libraries can become important public spaces when they are part of a mixed-use urban area. Being close to things like public squares, supermarkets, and cultural centers, they naturally encourage social interaction and make public life more accessible. Mady and Hewidy (2025) note that "libraries form strong connections with their surroundings, incorporating commercial or cultural centers and open public spaces through transparent designs and urban elements, simulating streets and squares" (p. 3). To follow this example, the KB could reconsider its architectural edges and create welcoming outdoor spaces, such as public forecourts, colonnades, and covered terraces, that support informal events and build stronger connections with the surrounding city.

Internally, modular walls, mobile furnishings, and robust service infrastructure allow for adaptive use: "All furniture can be moved and adapted so that the space is there for future uses, which we can probably not even imagine today" (Mady & Hewidy, 2025, p. 6). This physical flexibility is matched by a participatory programming model in which "a lot of the events are organised as people suggest. [People inform us]: we would like to come and organise this" (2025, p. 6). Together, these spatial and organizational choices make the library a platform for co-created events – from workshops to performances – with porous boundaries between civic, educational, and cultural life. The architecture, in this sense, becomes not just a container for inclusion but an active agent in making it possible.

### *3.3 Case study*

OMA and LMN Architects (2004) add that good library design should avoid generic, one-size-fits-all floor plans. These can make it hard for visitors to know where to go or what to expect. Instead, they point to the Seattle Central Library as an example of spatial clarity. The building uses clear zones for different functions and smooth navigation through features like the "Book Spiral" – a gently sloped ramp that allows users to browse the full nonfiction collection without stairs (Mandviwala, 2021). Similarly, Roseen (2019) highlights how Amsterdam's OBA Library feels open and welcoming thanks to its transparent design and straightforward layout. Coenen (2014) adds that the use of natural light and strong sightlines throughout the building makes orientation easier and helps people feel safe. Across these examples, clear signage, logical layouts, and tactile or visual cues are shown to be essential parts of inclusive public design. Kirker (2024) adds that using pictograms and tactile markers can make a big difference for people with visual or cognitive impairments.

Yeung (2022) focuses on how flexible layouts can help libraries support community life. At Helsinki's Oodi Library, for example, around two-thirds of the building is devoted to public amenities like a cinema, creative studios, and makerspaces – not just books. Each floor is zoned according to activity and noise level: the ground floor is social and lively, the middle floor is for creative work, and the top floor – nicknamed "Book Heaven" – offers quiet and calm. A similar idea is seen in Amsterdam's OBA Library, where different levels are set aside for social, cultural, or contemplative activities (Coenen, 2014). This kind of zoning lets a wide range of people use the library without conflict – from kids and families to researchers or people seeking quiet time.

Flexibility was also key in the design of Seattle Central Library. OMA and LMN Architects (2004) explain that spaces like the "Living Room" lounge and the teen lab were designed to be easily reconfigured. Furniture and shelving can be moved to host everything from quiet study to lively events or workshops. These examples show how thoughtful zoning, paired with adaptable layouts, can help libraries become more than just places to read; they become civic hubs, fostering community life. Coenen (2014) adds that the library includes zones with different atmospheres, from quiet, sound-buffered corners to bright and active communal spaces. This variety allows users to choose the sensory experience that works best for them.

Kirker (2024) points out that spaces like Halifax Central Library also use design elements – such as quiet rooms, acoustic treatments, and strategic lighting – to support people who are neurodivergent or sensitive to sensory input. Feinberg and Keller (2010) argue that youth spaces should allow both structured learning and open play, creating chances for interaction between children and adults. They highlight features like foam furniture, interactive displays, and cozy reading corners scaled to children as tools that help families feel truly welcome. All these ideas point to the same conclusion: when libraries pay attention to sensory and ergonomic details, they create environments where everyone – regardless of age, background, or ability – can feel relaxed and included.

Yeung (2022) describes Oodi Library as a strong example of participatory design. More than 3,000 local residents took part in shaping the library's design, by voting on ideas, suggesting features, and even deciding how part of the budget should be used. This approach helped build public trust and led to a library that is not only well-used but deeply appreciated by its community. Fournier and Ostman (2021) support this model with their "Ask, Listen, Empower" approach, which calls for ongoing community input throughout the planning, design, and programming stages. They argue that tools like surveys, workshops, and pilot projects can help libraries respond to a wider range of voices, especially those that are often left out of the conversation.

## 4. Research Q 3

*What digital tools and technologies can be integrated into the redesign of library spaces to support accessibility and enhance the user experience for people with physical disabilities?*

### *4.1 Literature*

In modern libraries, digital services are a core part of the user experience. However, for people with physical disabilities, access to these tools is often limited, not because the technology itself is unavailable, but because it is physically hard to reach or operate. Gates, check-in kiosks, catalog computers, and self-service stations are often placed too high, poorly lit, or positioned in ways that create barriers (Lee et al., 2023). This highlights the need to focus not just on what digital tools are offered, but how they are physically integrated into the architectural space.

Chung and Park (2021, pp. 6-12) point out, many libraries face challenges with the placement and usability of assistive technology. Tools like screen readers or large-print keyboards may be technically available, but are often hidden away, not well-marked, or difficult to access without staff assistance. This reduces independence and discourages use. Acquire Digital (2025) argues that accessibility should go beyond basic compliance and must be designed in a way that promotes user comfort, visibility, and dignity. As they state, “If we design better for those who need more help, we end up designing better for everyone.” Poor placement of kiosks, touchscreens, or audio outputs can make even well-intended tools inaccessible in practice.

### *4.2 KB context and implications*

In the KB’s redesign, digital terminals and catalog computers should be in open, spacious zones that allow for easy navigation and turning, especially for wheelchair users. These stations should be equipped with height-adjustable desks and clear under-desk knee space, enabling comfortable use from both seated and standing positions. Digital zones should never be placed on raised platforms or behind steps; instead, level flooring and tactile surface transitions can be used to gently guide users toward interactive areas. Assistive technologies, such as large screens or speech-to-text tools, should not be hidden in isolated rooms but incorporated into central public areas, where they feel like a standard part of the environment rather than an exception. Additionally, entrance gates and self-checkout stations must offer enough space for mobility devices to pass through comfortably.

Beyond accessibility in layout, digital tools should also be placed in settings that support clarity and comfort. Positioning catalog stations and touchscreen kiosks in well-lit areas with natural sightlines helps users locate them without confusion. These spaces can be enhanced by intuitive wayfinding – such as contrasting floor materials or tactile markers – that lead users from the entrance to key digital functions.

Goldsmith (1997, p. 12) and Moss (1981, pp. 30-47) both argue that environments should not just allow access but encourage confidence and autonomy. In line with this, elevator lobbies and circulation nodes in the KB could include interactive screens that provide navigation support through audio prompts, visual maps, and touchless operation – embedded architecturally into walls at user-friendly heights. These elements, when designed as part of the building’s spatial identity, reduce reliance on staff while making technology an active part of how people move through the library.

In the redesign of the KB, these ideas could take shape through open digital hubs, well-lit, clearly visible spaces where computers, catalogs, and assistive technologies are accessible to all. These hubs would be supported by clear circulation paths, wide passageways, and welcoming zones that feel easy to approach. In this way, the architecture itself plays a central role in ensuring digital inclusion, not just through the technology provided, but in how that technology is encountered and experienced.

By focusing not only on the tools themselves but also on the spatial context in which they are used, the KB can ensure that digital inclusion becomes an integral part of the overall library experience.

### *4.3 Case study*

A strong example can again be seen in the Oodi Library in Helsinki, where technology is naturally woven into everyday user flow. Digital services – like self-checkout machines, public-use tablets, and informational displays – are integrated throughout the open plan, rather than confined to hidden corners. This avoids bottlenecks and helps digital interaction feel inclusive rather than exclusive (Yeung, 2022).

## 5. Discussion

This research explored how the redesign of the *Koninklijke Bibliotheek* (KB) can support accessibility and community engagement for people with physical disabilities. The findings show that many challenges still exist, such as unclear signage, uneven surfaces, and poorly integrated digital tools. These barriers make it harder for some people to use the library independently and comfortably.

One key point is that meeting basic legal standards is not enough. True accessibility needs to be built into the design from the beginning, not added later as an afterthought. As authors like Goldsmith (1997) and Pionke (2017) have noted, design should support independence, comfort, and dignity. It should make people feel welcome, not just allow them to enter a building.

Case studies like Oodi Library in Helsinki and Seattle's Central Library show that inclusive design can go hand-in-hand with flexible, creative spaces that work for everyone. Features like movable furniture, wide paths, and quiet areas are useful not only for people with disabilities but also for families, students, and older adults.

However, the KB is not officially a heritage-listed building, but it has significant heritage potential, which still makes redesign decisions more complex. As Sáez-Pérez and Marín-Nicolás (2023) point out, it's not always easy to change old buildings without losing their historical value. There is often a real tension between preserving architectural identity and adapting spaces for new functions. In many cases, improving accessibility can be seen as a threat to the building's original character.

Another important issue is the gap between physical and digital design. Right now, these two areas are often treated separately. That can lead to a mismatch, for example, a building might be easy to get into, but the digital services inside (like kiosks or websites) might not be usable for someone with limited mobility. Better integration is needed to make sure the full experience is smooth and inclusive.

This research focused on people with physical disabilities, but it's important to remember that there are many kinds of access needs, including sensory or cognitive ones. Future work could look more closely at how different users experience the space together.

## 6. Conclusion

This research explored how the redesign of the *Koninklijke Bibliotheek* (KB) can enhance physical and digital accessibility for people with physical disabilities, while also fostering community engagement. Through literature, case studies, site visits and user-centered analysis, the project identified both barriers and design strategies. Below, the findings are organized per research question.

*RQ1: What are the challenges for the physical and digital accessibility in redesigning library projects?*

Many libraries, including the KB, were built before inclusive design became standard practice. As a result, accessibility retrofits must navigate physical constraints and, in the case of (heritage) buildings, preservation regulations. These can conflict with the need for essential features like lifts, ramps, and automatic doors. To address this, accessibility must be embedded from the site level onward. Pathways to the building should be broad, continuous, and tactile, aligning with transit routes and pedestrian flows rather than functioning as secondary service access. Entrances should be sheltered, prominent, and intuitive, designed with automatic doors to support ease of use.

Design should go beyond compliance and aim for dignified, independent access. For example, placing accessible entrances as primary entry points reinforces symbolic inclusion and visibility. The use of graded slopes instead of steep ramps and landscape-integrated guidance cues can create smoother, more intuitive access routes without compromising usability.

Inside, spatial legibility is critical. Many challenges stem from poor circulation and ambiguous layouts. Eliminating unnecessary level changes and embedding sloped transitions into floorplates can improve navigability. Circulation cores – elevators, stairs, ramps – should be easy to find, with elevators that are spacious and near activity hubs, not hidden in corners. These strategies reduce reliance on signage and support autonomous use.

*RQ2: What spatial strategies can the KB implement to ensure accessibility while promoting community engagement?*

Inclusion is about more than entry; it's about how people feel once they're inside. This research highlights the importance of zoning, materiality, and atmosphere in creating environments that welcome everyone.

The KB can draw from successful examples like Oodi or the Seattle Central Library, where flexible program zoning organizes noisy, communal functions on lower levels and quieter areas above. Incorporating material changes, lighting transitions, and ceiling variations – rather than just furniture – to distinguish zones helps all users intuitively find spaces suited to their needs. Architectural transitions, such as acoustic buffers, tactile flooring, and light modulation, support neurodiverse and mobility-impaired users by providing clarity without overstimulation.

To make these possible, open structural grids and accessible mezzanines can allow future adaptability while maintaining inclusivity. For example, bridges and terraces can offer layered experiences, as long as they're accessible by sloped surfaces or elevators. These features respect the historic structure while unlocking spatial diversity for a broader user base.

The use of transparent façades and public-facing programs near the entrance, such as cafés or exhibitions, supports the library's civic role. Architectural features like outdoor courtyards and terraces can serve as extensions of the interior, offering places for informal gathering and supporting spontaneous community interaction, including for those who might not enter the building.

*RQ3: What digital tools and technologies can be integrated into the redesign of library spaces to support accessibility and enhance the user experience for people with physical disabilities?*

Digital inclusion is deeply linked to spatial accessibility. Even the best technology fails if users can't comfortably access it. Catalog terminals, kiosks, and digital signage must be placed at accessible heights and within clear circulation paths. Incorporating sufficient turning space and tactile floor transitions can support these installations architecturally.

Assistive technologies such as hearing loops, charging stations, and touchless entry systems should be carefully integrated into the building's architecture from the outset. Rather than being treated as secondary add-ons, these features should be embedded into walls, ceilings, and surfaces in a way that is both discreet and functional. Digital kiosks and information displays should be positioned in central circulation areas, ideally recessed into niches or integrated into structural elements to maintain open pathways and avoid visual clutter. Designing with future adaptability in mind – through raised flooring systems, accessible wall cavities, or modular infrastructure – allows these systems to be updated or expanded over time without major disruption.

Wayfinding should also be considered as a multi-sensory experience. Combining visual signage with tactile markers, floor texture changes, and auditory cues can significantly improve orientation and independence for users with diverse needs. When these elements are coordinated and supported by well-placed digital interfaces in key circulation nodes, they

create an environment that is easier to navigate for all users, particularly those with mobility, visual, or cognitive impairments.

*Final Thoughts*

The KB's redesign offers a unique opportunity to demonstrate that true accessibility is not simply about meeting code, it's about creating a library culture that values all users. Architectural design must embrace this ethos by using space, material, light, and technology to promote confidence, independence, and belonging.

Designing for symbolic inclusion means expressing openness in the architecture itself. Transparent façades, visible public spaces, and a strong civic presence at street level signal that the library belongs to everyone. Locating cafés, exhibitions, and community rooms near entrances, and creating outdoor forecourts or terraces for informal gathering.

By placing public programs near thresholds, designing for sensory diversity, and embedding accessibility into the spatial and digital fabric of the building, the KB can become more than just compliant: it can become truly inclusive, welcoming, and future-ready. These design choices do not undermine the value of the historic structure. Instead, they show how heritage can evolve: not by preserving form alone, but by preserving relevance and equity in how space is experienced.

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## 8. Appendix