Strategic risk management in public library services: Approaches to prioritization and mitigation

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ABSTRACT

Public libraries face many challenges in maintaining their services, especially in a rapidly evolving technological and economic environment. This study identifies and prioritises the main risks impacting public library services in Iran and proposes strategic solutions to address these challenges. The study is based on a meta-synthesis of scientific literature, the fuzzy Delphi technique for expert evaluation and Chang's Fuzzy Hierarchy Analysis to rank the most important risks. Field observations were conducted in several provinces of Iran to validate the results and develop region-specific strategies. The study identified 75 risks, which were categorised into nine main groups. The greatest risk was the loss of access to digital resources due to economic sanctions and financial restrictions, followed by competition from search engines and alternative digital information platforms. The expert's evaluation emphasised that technological limitations and insufficient funding are the most pressing threats to the sustainability of public libraries. To overcome these challenges, the study recommends improving technological infrastructure, fostering collaboration between libraries, implementing innovative outreach programmes and diversifying financial support strategies. The findings emphasise the urgent need for public libraries to address digital transformation and strategic planning to remain relevant in digital and economically constrained environment. As public libraries worldwide face similar financial, technological and operational risks, this study contributes to the global library policy discussion by offering a scalable risk assessment model that is applicable to different library systems. These findings can guide decision-makers in library governance, digital transformation policies and strategies for sustainable access to knowledge at national and international levels.

Keywords: *Public library; Risk assessment; Service sustainability; Meta-synthesis; Fuzzy Delphi; Chang's fuzzy analysis; Digital transformation.*

INTRODUCTION

Public libraries are important institutions that provide equal access to information, promote lifelong learning and foster social inclusion. However, as the landscape of information services continues to evolve, these institutions face a number of challenges that threaten their sustainability and effectiveness. Rapid technological advances, changing user expectations and economic constraints mean that library services need to constantly adapt (Chen et al., 2018). The importance of this change is widely recognised, as evidenced by discussions at the 2015 American Library Association (ALA) annual conference and subsequent reports from the International Federation of Library Associations and Institutions (IFLA) and the 2016 State Library of America report (Ananthakrishnan et al., 2023). These

discussions emphasise the urgent need for libraries to re-evaluate their service models in order to adapt them to the needs of today's users.

In addition to technological changes, recent global crises, particularly the COVID-19 pandemic, have drastically altered the landscape of public library services (Robinson, Ruthven, & McMenemy, 2022; Khalid, Malik, & Mahmood, 2021; Choi & Joo, 2018). Libraries around the world have had to rapidly transform their service models, moving to interlibrary loan, digital collections and virtual engagement programmes (Syn, Sinn, & Kim, 2023; Dempsey & Constance, 2018). Public libraries in the UK, for example, have had to cease operations and have been forced to innovate with online programmes, e-book extensions and digital outreach initiatives (Robinson, Ruthven, & McMenemy, 2022; Mahmoudi Kohestani, 2014). Similarly, public libraries in South Korea have introduced advanced online reservation systems, expanded e-learning services, and developed targeted services for vulnerable populations (Oh, 2023; Gilpin, Karger, & Nencka, 2024). These global changes highlight the need for public libraries to adopt comprehensive risk management to ensure long-term sustainability and resilience in the face of economic and technological uncertainties.

In Iran, public libraries face a number of challenges that often differ from those in industrialised countries. Economic instability, exacerbated by government budget constraints and international sanctions, has severely impacted access to important digital resources (Reimers & Waldfogel, 2022; Rahmani & Fahimnia, 2019). In contrast to many industrialised countries where libraries benefit from stable funding and robust digital infrastructures, public libraries in Iran face high subscription costs for electronic publications, restrictive licencing agreements and inconsistent budget allocations (Syn, Sinn, & Kim, 2023). The first-sale doctrine, which allows libraries in many countries to purchase physical books at affordable prices, does not apply to digital content, further exacerbating the financial burdens (Reimers & Waldfogel, 2022; Albergaria, 2024).

Apart from financial constraints, public libraries in Iran also face technological shortcomings, including an outdated digital infrastructure and limited integration with global academic databases. They face growing competition from commercial information providers such as Google Scholar and Amazon, which offer freely accessible digital content and challenge the traditional role of libraries as primary information hubs (Reimers & Waldfogel, 2022). These financial and technological barriers hinder equal access to information, disproportionately affecting underserved and rural communities (Syn, Sinn, & Kim, 2023).

Public libraries also face complex social, administrative and political challenges. Libraries play an important role as community hubs that provide educational and cultural programmes and promote digital literacy and social innovation (Zbiejczuk Suchá et al., 2021; Xie & Waldfogel, 2022). However, their ability to fulfil these roles is often undermined by factors such as limited professional development opportunities for librarians, bureaucratic constraints and the lack of structured risk management strategies (Bamgbose, Ibrahim, & Adamu, 2023). Addressing these challenges requires a comprehensive, multi-layered risk assessment framework that prioritises financial sustainability, technological adaptability and community engagement.

Despite the significant investments that public libraries make in infrastructure, collection development and digital services, the lack of a structured risk management strategy poses a risk to these investments. Effective risk management in libraries comprises three core components: risk identification, risk assessment and risk mitigation (Bamgbose, Ibrahim, &

Adamu, 2023). However, previous studies have typically analysed these risks in isolation, focusing on financial constraints, technological inadequacies or user engagement without integrating these aspects into a holistic risk assessment framework (Syn, Sinn, & Kim, 2023). This study attempts to fill this gap by proposing an integrated approach to risk assessment in public libraries. This study aims to provide evidence-based insights for policy makers and library administrators to ensure the long-term resilience and adaptability of public libraries in the face of economic, technological and social disruptions.

LITERATURE REVIEW

Numerous studies have looked at the challenges facing public libraries, risk management strategies, service innovation and the impact of digital technologies on library operations. A review of the existing literature shows that although no comprehensive study on risk assessment in public library services has been conducted in Iran, several studies have examined the service quality and the future of libraries in the country (Salari, 2006; Zavarghi, 2006; Dilmaqani, Naghshineh, & Moeini, 2010; Hosseini & Mirhosseini, 2014; Asadi & Mahdigholi, 2016). Extensive research has been conducted in this area at the international level, focusing on various aspects such as economic and technological challenges, human resources, digital transformation and service innovation. Public libraries around the world are facing numerous challenges, including budget cuts, infrastructural constraints, changing user behaviour and the need for technological adaptations. Studies such as that by Reimers and Waldfogel (2022) show that the rising cost of e-books and problems with digital rights management (DRM) have significantly impacted libraries' ability to provide adequate digital resources, exacerbating problems with access to information and challenging the traditional role of libraries.

Competition from search engines and digital information platforms such as Google and academic databases has caused user preferences to shift to alternative sources, resulting in a decline in library patronage (Matthews, Smith, & Knowles, 2007; Waller & McShane, 2008; Umar, 2013; Morris, 2014). Some researchers argue that in order to maintain patron engagement and operational efficiency, libraries need to improve staff services and adapt their services to meet the new demands of patrons (Umar, 2013; Waller & McShane, 2008; Morris, 2014; Matthews, Smith, & Knowles, 2007). Other studies highlight the importance of staff development and library management and emphasise that continuous professional development can help libraries to adapt quickly to new trends and mitigate risks (Michalko, Malpas, & Arcolio, 2010; Mierke, 2014; Horava, 2014).

The COVID-19 pandemic has had a profound impact on public library services and required the rapid introduction of alternative service models. Research shows that libraries worldwide are expanding their digital programmes, implementing online lending systems and introducing home delivery services to meet the needs of users (Oh, 2023). Syn, Sinn and Kim (2023) found that digital transformation in libraries has not only improved the quality of services but also strengthened risk management strategies by increasing online accessibility, developing digital platforms and encouraging virtual user engagement. The need for interdisciplinary skills among library staff was also emphasised by Bamgbose, Ibrahim and Adamu (2023) who argued that library staff need to acquire inter-professional skills to keep up with the rapid development of digital environments and new technologies**.** Workplace stress and mental health problems among librarians have been identified as factors that can significantly affect the quality of service. Therefore, there is a need for an improved work environment and institutional support systems (Igbinovia, Edobor, & Ejiroghene, 2023).

In terms of service innovation, Zbiejczuk Suchá et al. (2021) suggest that public libraries can use social innovation to improve their services, particularly through digital literacy initiatives, collaborative social platforms and targeted services for vulnerable communities. Other studies emphasise the importance of collaboration between libraries, the implementation of innovative outreach programmes and financial diversification to ensure the sustainability of services (Oh, 2023). Overall, the literature suggests that public libraries need to drive digital transformation, improve the skills of their staff and adopt innovative strategies to remain resilient in the face of future challenges.

MATERIALS AND METHODS

This study systematically identifies, prioritises and mitigates the risks affecting public library services in Iran. The methodology integrates qualitative and quantitative techniques to ensure a robust risk assessment framework. The research follows five main phases as shown in Figure 1. Each phase is designed to increase the reliability of the results and ensure their applicability for policy and decision making. The aim of this study is to identify and categorise the main risk factors affecting public library services in Iran. The following research questions guided the study:

i. What are the main risk factors affecting public library services in Iran?
ii. How can these risks be systematically prioritised?
iii. What is the status of risk factors affecting the provision of public library services in Iran?
iv. What strategies can be implemented to mitigate the impact of these risks?

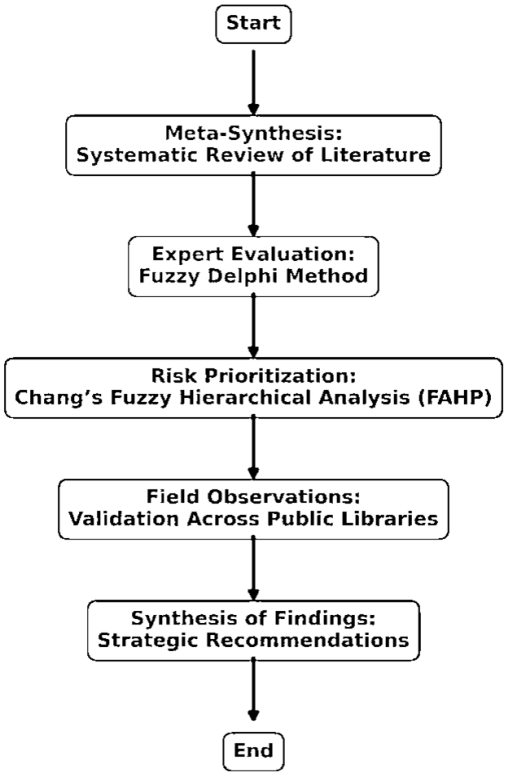

Figure 1. Research flowchart

Risk identification through meta-synthesis

In the first phase of the study, a meta-synthesis of existing research was conducted to identify and categorise the main risks to public library services. This process involved a systematic review of articles from academic journals, government reports and policy documents published between 2013 and 2023. The inclusion criteria focussed on studies that addressed the risk assessment of libraries, the challenges of digital transformation, financial sustainability and accessibility of services. A total of 112 relevant sources were initially identified. These sources were screened and filtered, resulting in a final selection of 45 core studies that were directly included in this review. The results of the meta-synthesis led to a comprehensive risk taxonomy, which was then refined through expert judgement.

A qualitative meta-synthesis approach was used to analyse the selected studies. The 45 core studies were initially screened using predefined inclusion and exclusion criteria. After reviewing the full texts, the studies were imported into the MAXQDA software for qualitative coding. Inductive thematic analysis was used to identify recurring risk-related patterns, which were then summarised into nine overarching categories. This process was carried out iteratively and validated by two independent reviewers to ensure the reliability of the coding and thematic coherence. These risk categories served as the basis for the expert assessment using the fuzzy Delphi method.

Expert evaluation using the fuzzy Delphi technique

The Fuzzy Delphi method, a structured consensus-building technique, was used to refine and validate the identified risks. A panel of 24 experts, including professionals from the fields of library science, public administration and information technology, was selected through purposive sampling. The experts were selected based on specific inclusion criteria, such as at least 10 years of experience in public library management, academic contributions in the fields of information science and digital transformation, or an active role in the development of strategies related to public library services. Invitations were sent by email and those who confirmed their participation were included.

The Delphi process consisted of three iterative rounds. In the first round, the experts reviewed a preliminary list of 75 risks derived from the meta-synthesis and provided qualitative feedback. In the second round, the risks were rated quantitatively on a five-point Likert scale based on two dimensions: severity and likelihood. These ratings were then converted into triangular fuzzy numbers to account for uncertainty and subjectivity. The fuzzy values were aggregated using the average fuzzy number method and consensus was assessed by comparing the distance between expert opinions. In the final round, a consensus threshold of 80% agreement was applied; items that did not fulfil this criterion were discussed further or excluded. This led to the final categorisation into nine primary risk categories. The Delphi checklist can be found in Appendix 2.

Risk prioritisation using Chang's Fuzzy Analytical Hierarchy Process (FAHP)

A multi-criteria decision-making method (MCDM), known as Chang's Fuzzy Analytic Hierarchy Process (FAHP), was used to prioritise risks hierarchically. A panel of 18 experts, selected through purposive sampling from academic information scientists, library practitioners and public service administrators, participated in this phase. The experts were selected on the basis of at least 8 years of relevant professional experience and published research in the field of risk assessment or library services. Invitations were sent by email and participation was confirmed by informed consent.

The experts compared the nine risk categories in pairs using a fuzzy scale from 1 to 9. The scale represented the degree of importance of one risk category compared to another: 1 = Equal importance 3 = Moderate importance 5 = Strong importance 7 = Very strong importance 9 = Extreme importance 2, 4, 6 and 8 = Intermediate values between neighbouring judgements. A fuzzy pairwise comparison matrix was created on the basis of these comparisons. Chang's fuzzy synthetic extension method was then applied to calculate the fuzzy weights of each category. These values were defuzzied to determine the final risk prioritisation. See Appendix 3 for the pairwise comparison tool and scoring instructions.

Field observations to validate the results

To ensure that the results determined by the experts reflect the real conditions, extensive field observations were carried out in nine Iranian provinces in the fourth phase between October and December 2023: Tehran, Isfahan, Khorasan, Hormozgan, Kurdistan, Fars, Gilan, Bushehr and East Azerbaijan. These provinces were deliberately chosen to represent different socio-economic, cultural and technological conditions. The fieldwork was conducted by the lead researcher and two trained assistants with experience in library science and public administration. The team used a structured field observation checklist developed specifically for this study. The checklist ensured consistency and comparability across all field sites. The observation instrument can be found in Appendix 4.

RESULTS

i. The main risk factors for public library services in Iran

Public libraries face a variety of risks that threaten their sustainability, accessibility and service quality. In order to develop a structured framework for risk assessment, 75 different risks were identified in this study and categorised into nine main groups as shown in Table 1. These categories were created based on a meta-synthesis of the scientific literature. The categorisation aimed to distinguish between major and minor risks to ensure that policy recommendations and mitigation strategies can be effectively tailored to the most important issues.

Table 1: Risks to public library services

No	Risk	References (Refer to Appendix 1)
1	Sustainability in the digital age	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Borreli (2015); Crawford Barniskis (2022); Dewe (2006); Dilmaqani, Naghshineh, & Moeini (2010); Han et al. (2016); Hildreth & Sullivan (2015); Igbinovia, Edobor, & Ejiroghene (2023); Jaeger et al. (2014); Khalid, Malik, & Mahmood (2021); Kumaran & Templeton (2020); Matthews (2019); Rahmani & Fahimnia (2019); Reimers & Waldfogel (2022); Rosa & Henke (2017); Serholt et al. (2018); Syn, Sinn, & Kim (2023)

No	Risk	References (Refer to Appendix 1)
2	Collection development risk	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Borreli (2015); Crawford Barniskis (2022); Dempsey & Constance (2018); Dewe (2006); Dilmaqani, Naghshineh, & Moeini (2010); Han et al. (2016); Hildreth & Sullivan (2015); Igbinovia, Edobor, & Ejiroghene (2023); Jaeger et al. (2014); Jana (2023); Kumaran & Templeton (2020); Matthews (2019); Michalko, Malpas, & Arcolio (2010); Rahmani & Fahimnia (2019); Reimers & Waldfogel (2022); Serholt et al. (2018); Syn, Sinn, & Kim (2023); Xie & Waldfogel (2022)
3	Technological disruption	Adle et al. (2023); Borreli (2015); Crawford Barniskis (2022); Funk & Kennedy (2020, August 27); Gibson & Mandernach (2013); Gregersen (2013); Hildreth & Sullivan (2015); Horava (2014); Igbinovia, Edobor, & Ejiroghene (2023); Jaeger et al. (2014); Jana (2023); Kumaran & Templeton (2020); Mathiasson & Jochumsen (2022); Michalko, Malpas, & Arcolio (2010); Oh (2023); Rahmani & Fahimnia (2019); Reimers & Waldfogel (2022): Robinson, Ruthven, & McMenemy (2023); Rosa & Henke (2017); Salari (2006); Smith (2019); Syn, Sinn, & Kim (2023); Veil et al. (2014)
4	Staff competencies	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Borreli (2015); Casselden et al. (2015); Choi& Joo (2018); Dempsey & Constance (2018); Funk & Kennedy (2020, August 27); Gibson & Mandernach (2013); Gregersen (2013); Han et al. (2016); Horava (2014); Jaeger et al. (2014); Kumaran & Templeton (2020); Mathiasson & Jochumsen (2022); Michalko, Malpas, & Arcolio (2010); Mierke (2014); Oh (2023); Robinson, Ruthven, & McMenemy (2023); Rosa & Henke (2017); Smith (2019); Syn, Sinn, & Kim (2023); Umar (2013); Veil et al. (2014); Zbiejczuk Suchá et al. (2021)
5	Regulatory and ethical constraints	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Casselden et al. (2015); Choi & Joo (2018); Horava (2014); Hosseini & Mirhosseini (2014); Igbinovia, Edobor, & Ejiroghene (2023); Kumaran & Templeton (2020); Mahmoudi Kouhestani (2015); Michalko, Malpas, & Arcolio (2010); Mierke (2014); Reimers & Waldfogel (2022); Robinson, Ruthven, & McMenemy (2023); Umar (2013); Zbiejczuk Suchá et al. (2021)
6	Governance and risk management	Chen et al. (2018); Choi & Joo (2018); Crawford Barniskis (2022); Dempsey & Constance (2018); Hosseini & Mirhosseini (2014); Igbinovia, Edobor, & Ejiroghene (2023); Kumaran & Templeton (2020); Madu, Onyeneke, & Azubogu (2018, August 23); Mahmoudi Kouhestani (2015); Mierke (2014); Morris (2014); Rosa & Henke (2017)

No	Risk	References (Refer to Appendix 1)
7	Financial constraints	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Casselden, et al (2015); Chen et al. (2018); Choi & Joo (2018); Crawford Barniskis (2022); Dempsey & Constance (2018); Hosseini & Mirhosseini (2014); Igbinovia, Edobor, & Ejiroghene (2023); Jaeger et al. (2014); Kumaran & Templeton (2020); Madu, Onyeneke, & Azubogu (2018, August 23); Mahmoudi Kouhestani (2015); Morris (2014); Reimers & Waldfogel (2022); Robinson, Ruthven, & McMenemy (2023); Rosa & Henke (2017); Umar (2013)
8	Service delivery	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Choi & Joo (2018); Crawford Barniskis (2022); Hosseini & Mirhosseini (2014); Igbinovia, Edobor, & Ejiroghene (2023); Kumaran & Templeton (2020); Madu, Onyeneke, & Azubogu (2018, August 23); Mahmoudi Kouhestani (2015); Msauki (2021); Reimers & Waldfogel (2022); Robinson, Ruthven, & McMenemy (2023)
9	Physical environment	Adle et al. (2023); Asadi & Mahdigholi (2016); Bamgbose, Ibrahim, & Adamu (2023); Chen et al. (2018); Choi & Joo (2018); Dempsey & Constance (2018); Gibson & Mandernach (2013); Hosseini & Mirhosseini (2014); Igbinovia, Edobor, & Ejiroghene (2023); Jaeger et al. (2014); Kumaran & Templeton (2020); Madu, Onyeneke, & Azubogu (2018, August 23); Mahmoudi Kouhestani (2015); Msauki (2021); Reimers & Waldfogel (2022); Robinson, Ruthven, & McMenemy (2023); Rosa & Henke (2017)

ii. The prioritisation of risks

To refine and validate this categorisation, the fuzzy Delphi technique was used, involving 24 experts from the fields of public libraries, information management and strategic planning. These experts rated each risk factor according to severity, likelihood and impact on library operations (only severity is shown in the table). The iterative Delphi process led to the consolidation of overlapping risks, the removal of lower impact risks and the refinement of prioritised risk categories. The final classification, shown in Table 2, provides an overview of how the risks were categorised according to the experts' assessments.

The fuzzy Delphi analysis revealed that the greatest risk for public libraries is the loss of access to digital resources due to the expiry of subscriptions, sanctions or financial restrictions (M=4.54). The experts emphasised that such restrictions undermine the role of the library as a reliable information hub. Two other high priority risks were identified: Competition from digital platforms (M=4.50) and insufficient government advocacy (M=4.50), both of which are external threats to library visibility and user engagement. Internal challenges such as lack of staff digital skills and inadequate selection/training of managers were also significant (M=4.29), indicating systemic gaps in human resources. Finally, outdated collections and underdeveloped infrastructure (M=4.21) were cited as barriers to user satisfaction and continued relevance. These findings formed the basis for the next phase of the study, namely quantitative prioritisation using Chang’s FAHP.

Table 2: Fuzzy Delphi ranking of major risks in public library services

Risk Category	Risk Description	Mean Severity Score (1-5)	Rank
Access to Information	Loss of library content due to expired subscriptions, sanctions, or resource removal.	4.54	1
Existential Value of Library	Increased competition from search engines, databases, and online information platforms.	4.50	2
Access to Information	Lack of government or institutional promotion of public libraries.	4.50	2
Existential Value of Library	Failure to provide diverse content formats reduces user engagement and library social standing.	4.38	3
Human Resource Issues	Librarians' inability to adapt to evolving user needs.	4.29	4
Management	Poor selection and training of library management staff.	4.29	4
Collection Development	Failure to maintain up-to-date and diverse collections.	4.21	5
Infrastructure & Space Issues	Lack of investment in improving library facilities.	4.21	5
Technology Risks	Weak adaptation to smart devices and digital platforms.	4.17	6
Human Resource Issues	Staff lacking the necessary training and skills to manage modern library services.	4.17	6

These results provide a clear, expert-based perspective on the key risk factors for public libraries and form the basis for further quantitative prioritisation using Chang's FAHP. Chang's FAHP was applied in the study to create a hierarchical ranking of risk categories. The experts conducted pairwise comparisons between the nine risk areas, and fuzzy synthetic magnitude analysis was performed to derive normalised composite weights.

The results show that financial issues are the most critical risk factor with a normalised weighting of 29%, highlighting the far-reaching impact of budget constraints on digital infrastructure, staff development and resourcing. In second place are problems with IT infrastructure (25%), highlighting the urgent need for technology upgrades in public libraries. In second place (21%) were problems with human resources, indicating deficits in staff training, digital literacy and leadership capacity. Other high priority risks were existential threats to the social value of the library (18%) and access restrictions (14%), while collection issues (12%) and location/space issues (7%) were seen as secondary. Risks related to pandemics (4%) and regulatory issues (3%) received the lowest scores, indicating a relatively low level of urgency in the current environment. These rankings provide a structured basis for strategic planning and resource allocation to mitigate risk in public library systems.

Table 3. Chang's Fuzzy analytic hierarchy process

Rank	Risk Category	Final Weight (%)
1	Financial Issues (F)	29%
2	IT Infrastructure (C)	25%
3	Human Resource Issues (D)	21%
4	Existential Value (A)	18%
5	Access Issues (G)	14%
6	Collection Problems (B)	12%
7	Location/Space Issues (H)	7%
8	Pandemic-Related Issues (I)	4%
9	Regulatory Issues (E)	3%

Each risk category was defined based on its impact on library sustainability, operational efficiency and user engagement. The categorisation process helped structure the subsequent pairwise comparison matrix and hierarchical prioritisation analysis. Table 4 shows the final definitions and risk codes used in the study.

Table 4: Risk category, codes and definitions

Category	Code	Definition	Findings remark
Existential value of the library	A	Threats related to competition from digital platforms, public mistrust, censorship and insufficient resources.	Public libraries are facing increasing competition from digital services such as Google Scholar, online learning platforms and commercial e-book providers. Experts emphasised that users are increasingly favouring online alternatives, making it crucial for libraries to redefine their role in the digital age. The lack of different content formats and strategies to engage users further threatens the sustainability of libraries.
Problems in collection development	B	Problems in obtaining and providing different resources in different languages and scientific fields.	Acquiring academically diverse and multilingual resources has become increasingly difficult, especially due to rising publication costs and budget constraints. Experts have noted that public libraries are unable to keep pace with the rapid increase in research output, leading to a mismatch between user demands and available collections.
Issues on IT	C	Challenges resulting from an inadequate technological infrastructure and digital adaptation difficulties	Many libraries lack the necessary digital infrastructure to support modern services. Challenges include outdated IT systems, slow adoption of digital lending models and limited integration with global databases. Without technological modernisation, libraries run the risk of becoming obsolete in the information landscape.

Category	Code	Definition	Findings remark
Human resource challenges	D	Shortcomings in staff skills, training and performance affect the quality of services.	Staff training deficits are a major obstacle to improving services and digital adaptation. Experts emphasised that library staff often lack specialist skills in digital resource management, user engagement and modern methods of service delivery. This skills gap hinders libraries' ability to compete with online information providers.
Regulatory and policy barriers	E	Conflicting or inadequate laws governing public library services.	Public libraries operate within restrictive legal frameworks, limiting their ability to expand digital services and participate in global knowledge-sharing initiatives. Regulations related to copyright, licensing agreements, and bureaucratic policies create additional barriers to innovation.
Financial constraints	F	Budget shortages affecting library operations, resource acquisition, and service expansion.	Libraries consistently face funding shortages, affecting their ability to acquire digital resources, upgrade infrastructure, and train staff. Experts noted that public library budgets are often deprioritized, leading to long-term operational inefficiencies.
Access to information issues	G	Barriers limiting users' ability to access physical or digital resources due to infrastructural or policy constraints.	Users in rural areas or marginalized communities often face significant barriers to accessing library materials due to internet limitations, restrictive lending policies, and insufficient digital outreach programs. This inequality worsens the knowledge gap, particularly for students and researchers.
Location and space limitations	H	Problems caused by poorly located libraries or insufficient space for collections and patrons.	Poorly planned library locations, lack of expansion space, and inadequate physical facilities contribute to low visitor engagement and accessibility challenges. Experts recommended redesigning public library spaces to better align with community needs.
Pandemic-related disruptions	I	Risks from public health crises leading to service interruptions and reduced physical access.	COVID-19 exposed critical weaknesses in library service models. Many libraries lacked digital alternatives during lockdowns, leading to disruptions in access to educational resources. Experts stressed that libraries must develop resilient remote service models to mitigate future public health crises.

In order to systematically determine the relative importance of the risk categories, a pairwise fuzzy comparison analysis was carried out using Chang's FAHP. This method provides a structured, data-driven approach to prioritising risks based on expert judgement. The experts were asked to compare the risk categories with each other and assign values on a fuzzy scale from 1 to 9, with higher values indicating the greater importance of one category

over another. The pairwise comparison matrix was then created to quantify the relative weighting of each risk category. These weights were used in the subsequent fuzzy synthesis calculations to determine the final ranking of risk factors in public library services. Table 5 shows the pairwise fuzzy comparison matrix reflecting the experts' ratings for all nine risk categories.

Table 5: Pairwise fuzzy comparison matrix with FAHP

Risk Category	A	B	C	D	E	F	G	H	I
A (Existential Value)	1/1/1	0.25/0.33/0.50	0.16/0.20/0.25	0.33/0.55/1	1/1/1	4/5/6	1/1/1	0.25/0.33/0.50	1/2/3
B (Collection Development)	3/4/5	1/1/1	1/2/3	0.33/1/1.5	4/5/6	1/1/1	0.25/0.50/1	0.25/0.50/1	2/3/4
C (IT Issues)	5/6/7	2/3/4	1/1/1	3/4/5	1/1/1	1/1.5/2	0.33/1/1.5	1/1/1	0.25/0.45/1
D (Human Resources)	4/5/6	2/3/4	1/2/3	1/1/1	1/1/1	0.33/1/1.5	1/1/1	1/1/1	0.5/1/1.5
E (Regulatory Issues)	0.5/1/2	0.33/0.50/1	0.33/1/1.5	1/2/4	1/1/1	0.25/0.50/1	0.25/0.50/1	1/1/1	0.15/1/2
F (Financial Issues)	2/3/4	1/2/3	4/5/6	0.33/1/1.5	1/1/1	1/1/1	0.25/0.50/1	0.33/0.50/1	2/3/4
G (Access Issues)	1/1/1	0.25/0.50/1	0.33/1/1.5	2/3/4	0.50/1/1.5	3/4/5	1/1/1	0.25/0.50/1	0.33/1/1.5
H (Location & Space)	0.25/0.50/1	0.33/0.50/1	1/1/1	1/2/4	0.25/0.50/1	0.50/1/1.5	0.25/0.50/1	1/1/1	0.33/1/1.5
I (Pandemic Disruptions)	1/2/3	1/1/1	0.33/1/1.5	0.33/1/1.5	2/3/4	1/2/3	1/1/1	0.33/1/1.5	1/1/1

The pairwise comparison matrix provides a quantitative insight into how the experts categorise the various risk factors. The following main trends were identified:

i. Financial constraints dominate as the most important risk: the highest weighted risk category in the pairwise comparison matrix was financial problems (F), which was consistently rated higher than all other categories. The experts overwhelmingly agreed that budget constraints impact almost every aspect of library service provision, from investment in IT infrastructure to staff development and the acquisition of digital resources.
ii. IT and digital transformation issues are the second highest priority: the second most important risk according to the experts is IT issues (C). Libraries are struggling with outdated digital systems, poor integration of online services and slow adoption of smart library technologies. Given that modern library use is increasingly dependent on digital accessibility, this result emphasises the urgency of IT infrastructure improvements.
iii. Human resource challenges are a key operational weakness: the experts also rated human resource constraints (D) highly, citing a lack of qualified staff, training opportunities and digital skills as key issues. Without adequately trained staff, even well-funded libraries face operational inefficiencies.

iv. Existential threat to libraries from competition from digital services: The existential value (A) of libraries ranks after financial, IT and staffing issues, but is still a major issue. Experts have noted that search engines, online learning platforms and digital bookshops are luring users away from traditional libraries and necessitating a reinvention of library service models.
v. Regulatory and locational issues are seen as less urgent: Compared to financial and technological risks, regulatory and locational challenges (E and H) rank lower in the pairwise matrix. Although these issues have an impact on the long-term provision of services, they were categorised as less urgent compared to funding constraints, IT deficiencies and staff shortages.

After creating the pairwise comparison matrix, fuzzy summation and composite expansion calculations were performed to derive the relative weight of each risk category. This approach makes it possible to identify the most influential risks on the basis of expert judgements and aggregated fuzzy values. In the summation process, the fuzzy values from pairwise comparisons are added together and then normalised to calculate the relative importance of each category. The results of this analysis are summarised in Table 6.

Table 6: Fuzzy addition and composite expansion of risk categories

Category	Fuzzy summation (L/M/U)	Composite expansion values	Relative weight (%)	Rank
Financial Issues (F)	19.83 / 26.33 / 32.94	0.10 / 0.17 / 0.29	29%	1
IT Issues (C)	16.00 / 21.50 / 28.00	0.08 / 0.14 / 0.25	25%	2
Human Resource Issues (D)	13.25 / 18.43 / 24.27	0.06 / 0.12 / 0.21	21%	3
Existential Value (A)	7.95 / 10.75 / 14.45	0.04 / 0.07 / 0.13	18%	4
Access Issues (G)	12.52 / 16.22 / 20.41	0.06 / 0.10 / 0.18	14%	5
Collection Problems (B)	12.91 / 18.33 / 24.50	0.06 / 0.12 / 0.22	12%	6
Location/Space Issues (H)	5.19 / 7.63 / 11.49	0.02 / 0.05 / 0.10	7%	7
Pandemic-Related Issues (I)	8.83 / 14.16 / 20.00	0.04 / 0.09 / 0.17	4%	8
Regulatory Issues (E)	5.99 / 6.74 / 8.02	0.03 / 0.04 / 0.07	3%	9

The results of the fuzzy summation and the composite extension calculations confirm that financial issues (F) are the most critical risks for public library services with a relative weight of 29%. The experts agreed that libraries suffer from chronic underfunding, which limits their ability to acquire new resources, maintain infrastructure and invest in digital transformation. Given that financial constraints affect almost every other risk category, addressing funding issues should be a top priority for library leadership and policy makers. Closely followed by financial concerns are IT issues (C) with a relative weight of 25%. Many public libraries lack the technological infrastructure needed to support modern digital services, including online catalogues, e-books and distance learning platforms. Experts emphasised that the inability to adapt to technological advances puts libraries at a competitive disadvantage against commercial providers of digital information such as Google Scholar and Amazon. Human resources (HR) challenges ranked third with 21% of the total risk impact. Experts emphasised that library staff often lack the necessary digital skills and training opportunities to meet evolving user needs. Without adequate investment in staff development, it will continue to be difficult for public libraries to provide high-quality services and integrate new technologies into their operations.

The existential value of libraries (A) was ranked fourth (18%), highlighting the concern that users are increasingly relying on digital platforms rather than traditional library services. If libraries do not modernise their services, they risk becoming obsolete in an age dominated

by instant digital access to information. Other categories such as access issues (14%) and collection issues (12%), while still important, are secondary to financial, IT and staffing issues. Location and space issues (7%) and pandemic-related disruption (4%) were mentioned but seen as less immediate challenges compared to structural financial and technological gaps. Interestingly, regulatory issues (E) ranked last (3%), suggesting that bureaucratic hurdles are not perceived as a major obstacle compared to more operational challenges. However, experts acknowledged that policy reforms are needed to streamline digital lending regulations and improve resource sharing initiatives.

To further refine the prioritisation of risks to public library services, a normalisation of preferences and relative impact calculations were performed. In this process, the rankings derived from the fuzzy analysis were adjusted to standardise the degree of importance of each risk category and determine their proportional impact on library sustainability. Normalising the expert assessments created a clearer, more actionable framework for decision makers to focus on the most pressing challenges. Table 7 shows the final normalised preference scores and illustrates the relative importance and impact of each risk category based on the expert scores.

Table 7: Normalisation of preferences and risk impact analysis

Risk Category	Preference Normalization	Degree of Importance	Relative Impact (%)	Rank
Financial Issues (F)	1.00	1.00	29%	1
IT Issues (C)	0.89	0.82	25%	2
Human Resource Issues (D)	0.87	0.69	21%	3
Existential Value (A)	0.66	0.49	18%	4
Access Issues (G)	0.72	0.55	14%	5
Collection Problems (B)	0.74	0.55	12%	6
Location/Space Issues (H)	0.69	0.41	7%	7
Pandemic-Related Issues (I)	0.57	0.33	4%	8
Regulatory Issues (E)	0.35	0.25	3%	9

The normalisation process confirms that financial problems are the biggest risk, with a relative impact of 29%. Public libraries are highly dependent on stable funding, and experts emphasised that budget constraints directly hinder the expansion of services, digital transformation and the development of human resources. Without financial stability, other risk categories such as IT investment, staff training and collection development remain limited. IT issues were the second most important concern (25% relative impact). The rapid digitisation of library services has created a growing divide between well-equipped libraries and those struggling with outdated technology. Experts pointed out that public libraries need to prioritise improving their IT infrastructure in order to remain competitive with online information providers such as Google Scholar and commercial e-book platforms.

The third most important risk (21%) is inadequate staffing, which emphasises the urgent need for library training and further education. Without qualified staff, even well-funded libraries are unable to optimise their services, resulting in low user engagement and ineffective integration of digital services. The experts recommended investing more in staff training programmes that focus on digital literacy, database management and user-centric service models. The existential value of libraries was ranked fourth (18% impact), adding to concerns about declining user engagement. Public libraries are competing with alternative digital sources. If they fail to innovate and diversify their service offering, they risk becoming redundant in the information economy.

Other categories such as access (14%) and collection (12%) issues, while still important, were ranked as secondary to financial, technical and staffing issues. Location and space issues (7%), pandemic-related risks (4%) and regulatory issues (3%) were ranked lower, suggesting that while these factors are relevant, they are not as immediate a threat as financial and digital challenges. To further refine the risk prioritisation, fuzzy summation and composite expansion techniques were applied to the data collected by the experts. These calculations helped to determine the relative importance of each risk category and ensure that decision making was based on systematically quantified risk factors. Fuzzy summation aggregated the pairwise comparative values derived by the experts to determine the cumulative influence of each category. Table 8 shows the results of the fuzzy addition and composite expansion of the risk criteria with the fuzzy summed values, composite weights and final risk rankings.

Table 8: Fuzzy addition and composite expansion of the risk criteria

Category	Fuzzy Summation of Each Row	Composite Expansion Values	Relative Weight (%)	Rank
Financial Issues (F)	19.83 / 26.33 / 32.94	0.10 / 0.17 / 0.29	29%	1
IT Issues (C)	16.00 / 21.50 / 28.00	0.08 / 0.14 / 0.25	25%	2
Human Resource Issues (D)	13.25 / 18.43 / 24.27	0.06 / 0.12 / 0.21	21%	3
Existential Value (A)	7.95 / 10.75 / 14.45	0.04 / 0.07 / 0.13	18%	4
Access Issues (G)	12.52 / 16.22 / 20.41	0.06 / 0.10 / 0.18	14%	5
Collection Problems (B)	12.91 / 18.33 / 24.50	0.06 / 0.12 / 0.22	12%	6
Location/Space Issues (H)	5.19 / 7.63 / 11.49	0.02 / 0.05 / 0.10	7%	7
Pandemic-Related Issues (I)	8.83 / 14.16 / 20.00	0.04 / 0.09 / 0.17	4%	8
Regulatory Issues (E)	5.99 / 6.74 / 8.02	0.03 / 0.04 / 0.07	3%	9

The results of the fuzzy addition and the composite expansion confirmed the dominance of the financial aspects (F), which represented the highest rated risk at 29%. The experts strongly emphasised that budget constraints impact almost every operational aspect of public libraries, from collection development to hiring staff to technology upgrades. Without adequate financial support, all other challenges become secondary issues. After financial risks, IT issues (C) ranked second (25%), emphasising the urgent need for digital transformation in public libraries. Experts pointed out that outdated IT infrastructure and the inability to integrate digital lending services are among the biggest constraints to libraries' modernisation efforts. Bridging the digital divide through increased technology investment is critical to maintaining the relevance of libraries.

Staff shortages (D), in third place (21%), remain a major challenge. Experts found that many librarians lack the technical skills needed to deliver modern services, particularly in areas such as managing digital collections, cyber security and engaging online users. Professional development programmes and ongoing training opportunities are needed to ensure that staff can adapt to evolving technological requirements. The existential value of libraries (A), ranked fourth (18%), remains a growing concern. As digital platforms such as Google Scholar, Amazon Kindle and academic databases provide faster and more convenient access to information, public libraries need to differentiate themselves through specialised services and community engagement initiatives.

Other categories such as access issues (G, 14%) and collection issues (B, 12%) were considered important but less immediate compared to financial, IT and HR challenges. The lower ranked risks, including location issues (7%), pandemic-related disruption (4%) and regulatory restrictions (3%), were seen as less urgent but still relevant to long-term planning. After the process of fuzzy summation and composite expansion, the next step was to measure the degree of preference of each risk component to determine the relative

importance of the different risk factors. This step ensures that decision makers and library managers can focus their efforts on the risks with the greatest impact. The degree of preference was calculated using a fuzzy hierarchical analysis in which the relative preference of each risk component was compared to the others using a normalised scale.

The results of the degree of preference calculations are shown in Table 9, which contains normalised values indicating which risks have the highest priority in terms of expert preference.

Table 9: Measurement of the degree of preference of risk components

Risk Category	Degree of Preference for Si Over Sk	Degree of Preference	Preference Normalization
Existential Value (A)	0.56 / 0.40 / 0.55	1.00	0.21
Collection Development (B)	1.00 / 0.86 / 0.99	1.00	0.15
IT Issues (C)	1.00 / 1.00 / 1.00	1.00	0.17
Human Resources (D)	1.00 / 1.00 / 0.87	1.00	0.15
Regulatory Issues (E)	0.54 / 0.07 / 0.00	0.54	0.00
Financial Issues (F)	1.00 / 1.00 / 1.00	1.00	0.21
Access Issues (G)	0.95 / 0.46 / 0.29	1.00	0.02
Location/Space Issues (H)	1.00 / 0.89 / 0.74	1.00	0.12
Pandemic-Related Issues (I)	0.75 / 0.34 / 0.19	1.00	0.004

The analysis of the degree of preference confirms that financial problems (F) and IT problems (C) remain the risks with the highest priority, with both achieving a degree of preference of 1.00. This result is consistent with previous fuzzy summation and composite expansion calculations and emphasises the critical role of financial stability and technological advancement in public libraries. Financial issues (F) received the highest preference normalisation score (0.21), highlighting the dominance of budget constraints in limiting library operations, expanding infrastructure and developing services. The experts overwhelmingly agreed that funding constraints are the cause of many other risk factors, making financial investment the top priority for maintaining library services. Similarly, IT issues (C) was ranked as the second most important risk category (0.17 preference normalisation score). Public libraries are struggling with outdated digital systems, slow adoption of online services and insufficient investment in smart library technology. Experts pointed out that libraries need to prioritise IT improvements to remain competitive with commercial digital platforms such as Google Scholar and subscription-based academic databases.

Human resource challenges (D) followed closely behind (0.15 normalisation value), reinforcing concerns about staffing and professional development. Experts emphasised that library staff often lack the necessary training to manage digital platforms and communicate effectively with users in an evolving technological landscape. Targeted staff development programmes and ongoing digital literacy training for librarians are needed to address this challenge. The existential value of libraries (A) was also rated highly (0.21 preference normalisation score), reflecting concerns about declining public engagement. The experts emphasised that libraries need to reinvent their role in modern communities by providing more interactive and user-centred services. Without strategic reinvention, libraries risk becoming obsolete due to competition from digital information providers.

Lower categories, including location and space issues (H), pandemic-related disruption (I) and regulatory challenges (E), were considered less urgent. The value for the normalisation of preference for regulatory issues (0.00) indicates that the experts do not consider bureaucratic hurdles to be a major limiting factor compared to financial, IT and personnel challenges. In the final stage of risk prioritisation, fuzzy summation and composite weight calculations were used to derive the final normalised weights for each risk category. This analysis provides a comprehensive ranking of the most important risks and ensures that decision makers can allocate their resources effectively. The results of this analysis are presented in Table 10, which shows the final composite weights and prioritisation ranking for the risk categories.

Table 10: Final composite weightings and prioritisation of risk categories

Risk category	Fuzzy summation	Composite expansion values	Relative weight (%)	Rank
Financial Issues (F)	19.83 / 26.33 / 32.94	0.10 / 0.17 / 0.29	29%	1
IT Issues (C)	16.00 / 21.50 / 28.00	0.08 / 0.14 / 0.25	25%	2
Human Resource Issues (D)	13.25 / 18.43 / 24.27	0.06 / 0.12 / 0.21	21%	3
Existential Value (A)	7.95 / 10.75 / 14.45	0.04 / 0.07 / 0.13	18%	4
Access Issues (G)	12.52 / 16.22 / 20.41	0.06 / 0.10 / 0.18	14%	5
Collection Problems (B)	12.91 / 18.33 / 24.50	0.06 / 0.12 / 0.22	12%	6
Location/Space Issues (H)	5.19 / 7.63 / 11.49	0.02 / 0.05 / 0.10	7%	7
Pandemic-Related Issues (I)	8.83 / 14.16 / 20.00	0.04 / 0.09 / 0.17	4%	8
Regulatory Issues (E)	5.99 / 6.74 / 8.02	0.03 / 0.04 / 0.07	3%	9

The final composite weighting confirms that financial issues (F) are the highest rated risk (29%), emphasising the crucial role of funding in sustaining public library services. The experts emphasised that budget constraints limit investment in digital infrastructure, collection development and staff development, ultimately hampering libraries' modernisation efforts. IT issues (C) ranked second (25%), reflecting the urgent need for technological upgrades and the integration of digital services. Experts emphasised the increasing dependence of public libraries on digital tools and stressed that without an adequate IT infrastructure, libraries will continue to lose ground in the digital knowledge economy. The challenges in the area of human resources (D), which ranked third (21%), were also seen as critical. Many library staff lack specialised training in managing digital services and new technologies, limiting their ability to effectively support modern library operations. Investment in training programmes for librarians and staff development initiatives are essential to alleviate this problem.

The existential value of libraries (A) ranks fourth (18%) and illustrates the concern about declining customer loyalty. The increasing preference for online search engines and digital resources over traditional library services suggests that libraries need to redefine their role in an evolving digital landscape. 14 of the lower ranked risks are access issues (14%), collection issues (12%) and location constraints (7%). Pandemic-related issues (4%) and regulatory challenges (3%) were ranked lowest, suggesting that while these factors impact library services, they are less immediate concerns compared to financial, technological and staff-related risks.

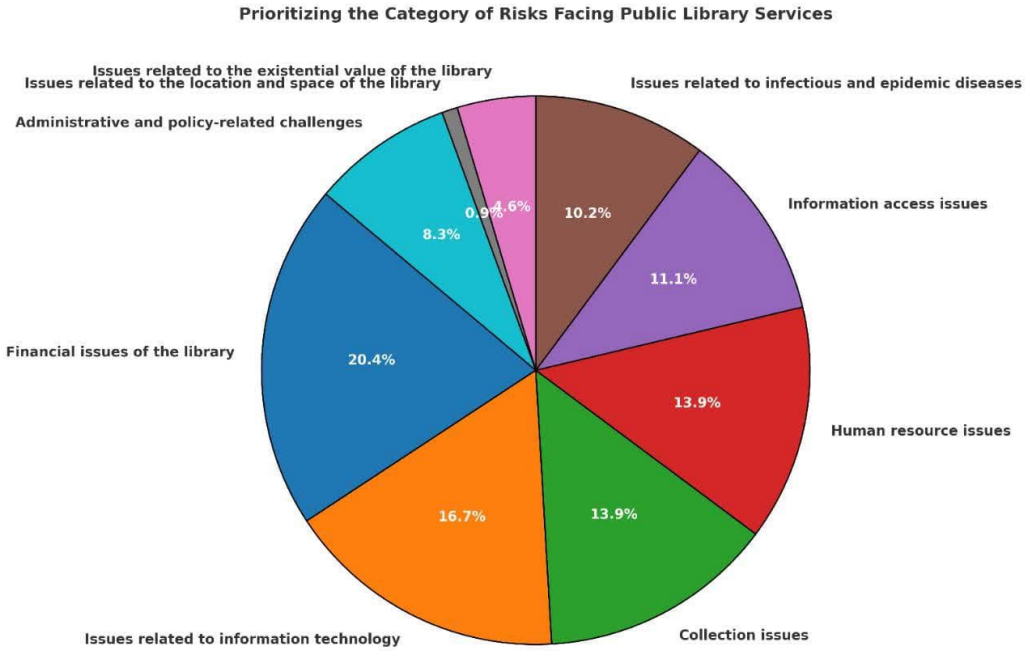

Figure 2: Prioritisation of risk categories for public library services

The prioritisation of risk categories impacting public library services was assessed using expert judgement and analysed using the FAHP method. As can be seen in Figure 2, financial issues emerged as the most critical risk, accounting for 20.4% of the total risk impact. This is followed by challenges related to information technology (16.7%), inventory management (13.9%) and human resource constraints (13.9%). Other risk factors, such as information access issues, political challenges and spatial constraints, contribute to risk exposure to varying degrees. The results suggest that financial sustainability and digital transformation are the most pressing issues, emphasising the need for targeted strategies to effectively mitigate these risks.

iii. Current status of risk factors affecting the provision of public library services in Iran

Field observations conducted in nine provinces (Tehran, Isfahan, Khorasan, Hormozgan, Kurdistan, Fars, Gilan, Bushehr and East Azerbaijan) have revealed several critical patterns in the current state of risks to public libraries in Iran. Among the most pressing problems are:

i. Severe financial constraints, especially in rural and low-income areas, have led to outdated collections and deteriorating infrastructure
ii. The technical infrastructure is very uneven. While libraries in urban centres benefit from better connectivity and equipment, many in remote areas do not even have basic internet access
iii. There are significant gaps in human resources. Many librarians lack digital skills and have limited access to professional development
iv. Existential risks such as low public engagement and competition from digital platforms are increasing, making it difficult for libraries to attract and retain users
v. Physical barriers to access (poor location of buildings, insufficient space) and policy bottlenecks (licence and copyright restrictions) remain unresolved
vi. Pandemic-related disruptions have highlighted the lack of digital contingency models and continuity plans

These observations confirm the risk taxonomy established by the experts and emphasise the urgency of tackling these challenges at both national and local political level.

iv. Strategies to mitigate the impact of these risks

Based on the hierarchical risk assessment and prioritisation analysis, this section presents strategic recommendations to mitigate the most critical risks to public library services. The proposed strategies aim to increase financial stability, strengthen technological capabilities and improve the staffing capacity of public libraries. Table 11 summarises the recommended risk management measures, together with the respective impact and feasibility of the measures.

Table 11: Risk management recommendations and future strategies

Risk Category	Proposed mitigation strategies	Expected impact	Implementation feasibility
Financial issues (F)	1. Create alternative sources of funding (e.g. sponsorships, membership models).	High	Moderate
	2. Use political lobbying to advocate for higher municipal/state funding.	High	Difficult
	3. Introduce cost-sharing agreements between public and university libraries.	Medium	Moderate
IT issues (C)	1. Development of nationwide digital library networks for shared online resources.	High	Difficult
	2. Modernise IT infrastructure with government grants and technical partnerships.	High	Moderate
	3. Staff training in digital resource management and cyber security.	Medium	Easy
Human resource issues (D)	1. Create standardised training programmes for library staff.	High	Easy
	2. Introduce digital literacy courses for librarians.	Medium	Moderate
	3. Develop incentives for career advancement to retain qualified professionals.	Medium	Difficult
Existential value (A)	1. Launch marketing campaigns to reposition libraries as centres of the community.	High	Moderate
	2. Strengthen co-operation with educational institutions for integration into the curriculum.	Medium	Easy
Risk Category	**Proposed mitigation strategies**	**Expected impact**	**Implementation feasibility**

Access issues (G)	1. Expand the possibilities of distance selling (e.g. digital lending, home delivery).	High	Difficult
	2. Improve accessibility features for disabled users.	Medium	Moderate
Collection problems (B)	1. Implement user-driven collection acquisition strategies.	Medium	Easy
	2. Expand interlibrary loan services.	Medium	Easy
Location/space issues (H)	1. Remodelling public libraries for versatile use by the community.	Medium	Difficult
	2. Develop mobile library services in underserved regions.	Medium	Moderate
Pandemic-related issues (I)	1. Create long-term plans for the continuity of digital services.	High	Difficult
	2. Create reserves for emergency funding in the event of future disruptions.	Medium	Difficult
Regulatory issues (E)	1. Campaign for modernised copyright law to support digital distribution.	Medium	Difficult
	2. Introduction of a national policy framework for the sustainable funding of libraries.	High	Difficult

The most critical risk factors identified in this study require immediate intervention, particularly in the areas of financial sustainability, IT modernisation and human resource development.

i. Financial stability: Given the dominance of financial constraints in risk assessment, securing sustainable funding must be the first step in strengthening public library services. Strategies such as cost-sharing agreements, public-private sponsorships and targeted lobbying of the government have been proposed to increase financial resilience
ii. Modernising IT infrastructure and digital services: To remain competitive with digital alternatives, public libraries need to accelerate technology upgrades. Investment in statewide digital library networks, cybersecurity training and cloud-based service models are critical to expanding access and improving service efficiency
iii. Training and retention of qualified library staff: The lack of digital literacy skills among librarians was identified as a major barrier to operations. Standardised training programmes, incentives for professional development and collaboration with academic institutions can close the skills gap and improve the delivery of library services
iv. Rebranding libraries as essential public spaces: The declining value of public libraries demonstrates the need for proactive marketing and community engagement strategies. Public libraries should be repositioned as vibrant community centres offering educational workshops, cultural activities and technology-enabled services to appeal to wider user groups
v. Expanding library accessibility and outreach: Limited access to services in rural or marginalised communities can be mitigated by expanding digital lending models, offering mobile library services and improving physical accessibility for users with disabilities

vi. Policy and regulatory reform: While regulatory challenges rank low on the experts' list of priorities, improving copyright law and standardising the funding framework can provide long-term stability for public libraries.

This section summarises the key findings of the study and provides an overview of the most critical risks, their impact on public library services and the recommended policy interventions. Table 12 provides a structured summary of the main risks, their regional relevance, their potential impact and the policy recommendations.

Table 12: Summary of risks, regional relevance and policy recommendations

Risk category	**Risk description**	**Regions most affected**	**Potential impact**	**Suggested policy interventions**
Economic risk	Budget cuts, inflation, and lack of funding	Rural provinces, lower-income areas	Reduced service quality, outdated collections	Introduce alternative financing models, secure sponsorship.
Technological risk	Outdated IT infrastructure, weak digital presence	Urban centres, remote areas	Lagging digital services, decreased patronage	Invest in IT modernisation, develop shared digital databases.
Cultural and social risk	Lack of region-specific programming and engagement	Religious cities, tourist regions	Low user engagement, reduced cultural integration	Develop specialised library programmes for tourists, religious studies.
Human resource risk	Skills mismatch, lack of professional development	Underdeveloped regions	Poor service quality, slow innovation	Start continuous training programmes to improve your digital skills.
Competitive risk	Increasing dependence on search engines, online databases	High-tech urban areas	Diminished relevance of the library	Position libraries as research centres, strengthen your marketing efforts.
Regulatory risk	Legal barriers to digital lending, bureaucratic red tape	Nationwide	Slower adoption of digital services	Advocate for a modern copyright and lending policy.
Infrastructure risk	Poorly located libraries, insufficient space	Remote areas	Accessibility issues, declining library usage.	Expansion of mobile library services, renovation of existing rooms.
Pandemic-related risk	Service interruptions due to public health crises	Nationwide	Long-term disruption of access.	Develop emergency digital service strategies.

The results confirm that financial, technological and personnel challenges are the three biggest risks for public libraries. Financial constraints remain the main problem preventing libraries from expanding their services, updating their collections and implementing digital transformation strategies. Policy measures should focus on finding alternative sources of

funding, promoting cross-sector co-operation and lobbying for more government support. Technology gaps continue to hinder the development of public libraries. Without modern IT infrastructure and digital integration, libraries struggle to compete with commercial digital platforms. Governments and library organisations should invest in IT upgrades, facilitate digital networks between libraries and establish remote access services.

Another major problem is the limited human resources. Public libraries need trained professionals who can adapt to digital tools and new technologies. The study recommends mandatory training programmes, skills development initiatives and recruitment strategies that focus on digital skills to close the talent gap in library services. Regional risks such as cultural engagement, infrastructure constraints and regulatory barriers also need to be addressed. Tailoring library services to regional needs, such as offering religious studies in pilgrimage cities or multilingual resources in diverse communities, can improve public engagement and the relevance of libraries. Similarly, policy reforms should address legal barriers to digital lending and copyright restrictions to ensure that libraries can expand their digital content offerings.

DISCUSSIONS

Public libraries are fundamental institutions in society that ensure equal access to information, promote literacy and support lifelong learning. However, as this study has shown, libraries especially in developing regions such as Iran face a number of challenges that threaten their sustainability and effectiveness. These challenges arise primarily from financial constraints, technological limitations, labour shortages, increasing competition from digital platforms and policy-related obstacles (Mathiasson & Jochumsen, 2022; Reimers & Waldfogel, 2022). The results of this study show that economic, technological and personnel factors have the greatest influence on the operation of public libraries in Iran. At the same time, competition from digital alternatives, the lack of diversification of services based on regional potential and regulatory restrictions continue to hinder the development of libraries. By analysing these risks and comparing them with global best practises, this study provides a structured framework for managing and mitigating risks in the public library sector, with policy implications at national and international levels.

Economic constraints and financial sustainability

One of the most pressing challenges identified in this study is financial instability, which accounts for 29% of the total impact of all identified risks. Limited financial resources prevent libraries from investing in technological upgrades, expanding digital collections and introducing innovative services. This finding is in line with that of Reimers and Waldfogel (2022), who argue that financial constraints are the main barrier to digital transformation in public libraries. Furthermore, Winberry and Potnis (2021) emphasise that budget cuts disproportionately affect libraries in economically disadvantaged areas.

In the Iranian context, economic sanctions and financial instability have exacerbated funding constraints, particularly in rural and underserved areas. As a result, many public libraries are struggling to provide digital services and modernise their infrastructures, limiting their ability to remain relevant in a digitised information landscape (Robinson, Ruthven, & McMenemy, 2022). Recommended strategies for financial sustainability:

i. Build public-private partnerships to secure alternative funding sources
ii. Encourage corporate sponsorship and philanthropic investment in public libraries.

iii. Develop membership-based revenue models and specialised advisory services to generate revenue
iv. Implement cost-sharing agreements between public and academic libraries to optimise resource allocation (Mathiasson & Jochumsen, 2022).

Technological challenges and digital adaptation

Technological shortcomings were the second most important risk in this study, accounting for 25% of the total risk impact. In an era dominated by digital information and virtual services, public libraries need to prioritise investment in IT infrastructure to increase their relevance (Syn, Sinn, & Kim, 2023). Libraries worldwide have addressed this issue by adopting AI-driven cataloguing systems, cloud-based digital repositories and virtual lending platforms (Oh, 2023). Public libraries in South Korea, for example, have successfully introduced real-time digital circulation systems that allow users to access academic and research materials remotely (Oh, 2023). In contrast, Iranian libraries face significant limitations in internet speed, digital infrastructure and cybersecurity. In addition, the lack of trained personnel to manage digital services further hinders technological progress. Recommended strategies for technological progress:

i. Expand digital repositories and interlibrary loan networks
ii. Invest in AI-supported search and recommendation systems to improve user-friendliness
iii. Implement cyber security training programmes to protect digital resources
iv. Collaborate with universities to improve access to academic and research materials through digital resource sharing agreements (Robinson, Ruthven, & McMenemy, 2022).

Staff shortages and professional development

In this study, staff shortages and insufficient digital literacy among librarians were identified as a critical operational risk, contributing to 21% of the overall impact. Without continuous professional development, libraries will struggle to effectively integrate modern digital services (Mathiasson & Jochumsen, 2022). Furthermore, Igbinovia, Edobor and Ejiroghene (2023) highlight that many librarians lack the necessary expertise to manage digital databases and provide remote research assistance. Recommended strategies for workforce development:

i. Introduce mandatory digital literacy workshops for librarians
ii. Introduce certification programmes for library technology management
iii. Incentivise lifelong learning through structured career plans
iv. Partnerships with academic institutions to introduce specialised courses in digital librarianship (Mathiasson & Jochumsen, 2022).

Growing competition from digital information providers

Another major challenge identified in this study is competition from digital alternatives, which has led to a significant decline in library patronage and engagement. The study found that concerns about the existential value of public libraries ranked fourth among all risks, accounting for 18%. Libraries have historically been the primary sources of knowledge, but the emergence of search engines, digital archives and commercial platforms such as Google Scholar and Amazon Kindle has reshaped the information landscape (Mathiasson & Jochumsen, 2022). Recommended strategies to increase the relevance of libraries:

i. Develop interactive community programmes and research workshops to appeal to different user groups
ii. Introduce AI-driven personalised recommendations for books and research materials
iii. Creating hybrid spaces that integrate physical and digital resources
iv. Utilising social media marketing and digital initiatives to increase user engagement.

Regional inequalities in library services

The results of this study show considerable inequalities in the accessibility of libraries in the different regions of Iran. Urban libraries, especially in Tehran and Isfahan, benefit from better digital infrastructure, while rural and underserved areas lack essential IT resources. This aligns with Smith (2019), who found that urban libraries globally receive higher levels of technological investment than their rural counterparts. Recommended strategies to bridge the urban-rural divide:

i. Expand mobile library services to reach remote communities
ii. Develop government-subsidised digital literacy programmes to support underserved populations
iii. Create shared public access points for digital resources in rural areas.

Political and regulatory obstacles

Although political risks play a smaller role in terms of overall impact (3%), they still pose challenges related to digital lending, copyright regulations and bureaucratic inefficiencies. Winberry and Potnis (2021) emphasise that outdated legal frameworks prevent libraries from adopting open access policies and flexible digital lending models. Recommended policy reforms:

i. Modernise copyright laws to support digital lending and sharing of library resources
ii. Introduce a national funding policy for the sustainable management of public libraries
iii. Introduce standardised acquisition policies for digital collections to ensure consistency and efficiency.

Implications for the future of public libraries

This study shows that financial sustainability, digital transformation and staff development are the three most important factors to ensure the future relevance of public libraries. To remain competitive, Iranian public libraries need to adopt modern technologies, diversify their funding sources and invest in training programmes for librarians. Furthermore, this study contributes to the global library policy discussion by offering a structured risk assessment model applicable to different library systems. Future studies should examine the impact of new technologies such as blockchain and artificial intelligence in improving the security and accessibility of libraries. Longitudinal studies are also needed to evaluate the effectiveness of risk mitigation strategies over time. By implementing these recommendations, public libraries can strengthen their role as important knowledge hubs and ensure equal access to information in the digital age.

CONCLUSIONS

This study provides a comprehensive assessment of the risks affecting public library services. It integrates fuzzy decision-making techniques and expert assessments to systematically prioritise the most important challenges. The findings emphasise that financial constraints, technological deficiencies and staff shortages remain the most critical risks that require immediate policy interventions to ensure that libraries remain relevant, accessible and sustainable. To address these risks, this study proposes evidence-based policy recommendations aimed at mitigating the vulnerabilities and ensuring the sustainable operation of public libraries.

Financial stability as a top priority

Given the dominance of financial constraints in risk assessment, securing sustainable funding must be the first step in strengthening public library services. Strategies include: i) exploring

alternative funding sources such as corporate sponsorship, membership schemes and research collaborations; ii) advocating for increased local/state funding through political lobbying; and iii) implementing cost-sharing agreements between public and university libraries.

Accelerating the digital transformation
To remain competitive, public libraries need to modernise their IT infrastructure and expand digital services. Priority strategies include: i) developing nationwide digital library networks for shared online resources; ii) investing in cloud-based services and AI-driven cataloguing systems; and iii) improving cybersecurity measures to protect library databases and digital collections.

Staff development and library training
Lack of technical knowledge among library staff was identified as a major barrier to operations. Recommended initiatives include: i) standardised digital skills training programmes for all librarians, ii) working with universities to introduce specialist courses in digital library management and iii) career development incentives to retain skilled professionals.

Refocusing libraries as knowledge centres for the community
To counteract declining public engagement, libraries need to adapt their services and expand their role as interactive places. Strategies include: i) marketing campaigns to position libraries as community-focused learning centres; ii) improving collaboration with educational institutions to integrate curricula; and iii) developing hybrid service models that combine physical and digital resources.

Expanding accessibility and digital inclusion
Library services need to become more inclusive, especially for rural and marginalised communities. Proposed actions include: i) expanding remote service options, such as digital lending and home delivery; ii) improving accessibility for disabled users and seniors; and iii) developing mobile library services to reach underserved populations.

Political and regulatory reforms
While regulatory risks were categorised as less immediate, policy updates are essential for long-term sustainability. Recommended reforms include: i) the modernisation of copyright laws to facilitate digital lending and inter-library sharing and ii) the introduction of national strategies to standardise funding models and support library modernisation initiatives.

This study provides a structured model for risk assessment that is applicable to public library systems worldwide. Future research should focus on: i) evaluating the long-term effectiveness of proposed risk mitigation strategies; ii) exploring new technologies such as blockchain and AI to improve library security and accessibility; and iii) conducting cross-national comparative studies to identify best practises in library risk management. Public libraries need to evolve to meet technological, financial and operational challenges. By introducing digital innovations, securing sustainable funding and strengthening public engagement, libraries can continue to serve as important centres of knowledge in an increasingly digitised and information-driven world. The findings of this study serve as a strategic roadmap for policy makers, library administrators and researchers working to ensure the future resilience of public libraries.

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The authors have no relevant competing interests to declare in relation to the content of this article.

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Appendix 2: Selected excerpt of Fuzzy Delphi panel expert's checklist

Category	Code	Clarity of Statement	Relevance to Library Risks	Significance of Risk Impact	Accuracy and Realism	Priority Level
Access to information	The loss of library content or the termination of their subscriptions, such as electronic publications whose subscriptions have ended, collected databases, the removal of some resources due to sanctions, etc., can also be an important challenge for libraries in providing services.					
Existential value of the library	The increase of library competitors (database search engines, Internet cafes, etc.) in providing the information needed by customers (considering that competitors can provide content in a more user-friendly way) leads to creating a risk for public libraries.					
Access to information	The cultural system and the lack of promotion and encouragement of cultural institutions to guide the public-to-public libraries are other challenges that libraries are facing.					
Existential value of the library	Due to the advancement of technology, the failure to provide resources in different formats (especially electronic formats) leads to a decrease in customer satisfaction and the loss of the public library's social status.					
Human resource issues	Due to the librarian's lack of understanding of changing customer needs, customer satisfaction with library services decreases.					
Management	The abundance of information sources in various forms and the inaccuracy of the library in choosing reliable and relevant sources can indicate the inability of librarians and, as a result, the loss of users.					
Collection development	The lack of variety of library resources and lack of attention to the needs of all library users leads to a decrease in the number of visits to libraries.					
Collection development	Failure to invest in improving the physical space leads to a decrease in customer satisfaction with the library as a physical space.					
Collection development	With the growth of electronic resources and especially smart phones, people spend more of their free time with the phone and visit the library and read books less.					
Information Technology	Current human resources do not have the necessary skills for future needs (technological change, etc.).					
Human resource issues	The lack of facilities to provide services in absentia and to send resources by mail leads to the diminution of the position of public libraries at the community level.					
Infectious and epidemic diseases	The low skills of the staff in providing services and in establishing communication is another challenge facing library services in providing services.					
Human resource issues	Dissatisfaction of employees with working conditions and its effect on their performance in providing services to customers can be a serious risk for libraries.					

Appendix 3: Selected excerpt of Fuzzy Delphi technique for pairwise comparison matrix

	The left criterion has higher priority.									The right criterion has higher priority.										
	Absolutely more important	In between	Much more important	In between	Relatively more important	In between	A little more important	In between	To some extent important	In between	A little more important	In between	Relatively more important	In between	Much more important	In between	Absolutely more important			Number کل خبرگان
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Appendix 4: Selected excerpt of field observation instrument

Observer Information

Name : **Province :**
Date : **Library Name/Code :**

1. Financial Issues		
Indicator	**Observation**	**Notes**
Sufficient operational budget for basic services	☐ Yes ☐ No	
Availability of funding for innovation/development	☐ Yes ☐ No	
Diversity of funding sources (government, donors)	☐ High ☐ Moderate ☐ Low	
2. IT Infrastructure Issues		
Indicator	**Observation**	**Notes**
Stable high-speed internet connection	☐ Yes ☐ No	
Sufficient and up-to-date public computers	☐ Adequate ☐ Inadequate	
Availability of digital services (databases, e-books)	☐ Active ☐ Inactive	
3. Human Resource Issues		
Indicator	**Observation**	**Notes**
Staff-to-service ratio is appropriate	☐ Yes ☐ No	
Staff trained in digital tools and services	☐ Yes ☐ No	
Ongoing professional development offered	☐ Available ☐ Not available	
4. Existential Value Risks		
Indicator	**Observation**	**Notes**
Community engagement through programs/events	☐ Strong ☐ Moderate ☐ Weak	
Average daily user attendance	..... users	
Public perception of library's social value (via observation/interviews)	☐ Positive ☐ Neutral ☐ Negative	
5. Access Issues		
Indicator	**Observation**	**Notes**
Operating hours meet community needs	☐ Yes ☐ No	
Services for people with disabilities	☐ Yes ☐ No	
Language/content diversity in resources	☐ Good ☐ Moderate ☐ Poor	