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Technological trends in Swedish medical libraries

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Abstract

Medical libraries in Sweden are digitised to a large extent, technically advanced and developing rapidly. This paper investigates technological trends among Swedish medical libraries in the near and distant future and their application within different areas of library activities. The authors also present a roadmap to increase technological developments within medical libraries in Sweden. Current technological trends include digital collaboration tools, mobile technologies and visualisation. Artificial intelligence, big data and smart technologies are upcoming trends. Technologies are applied within all areas of library activities, but preconditions for academic and hospital libraries differ. To remain a relevant provider of information services, libraries must be able to monitor, test and adopt new technologies.

KEYWORDS

collaboration; Europe, central; information and communication technologies (ICTs); libraries, medical; surveys

INTRODUCTION

Sweden has been a top performer in digital services and technological developments for years (OECD, 2023). Large-scale national projects in broadband expansion and mobile networks, as well as campaigns to increase digital literacy in the general population, have laid the ground for the early digitisation of services. In 2022, 94% of all Swedish citizens used the Internet daily for various reasons (Internetstiftelsen, 2022). Sweden is adopting

new and advanced technologies, such as artificial intelligence (AI) and quantum computing, at a rapid pace (European Commission, 2022).

Swedish medical libraries have been adopting new technologies for a long time and are largely digitised (Ranemo, 2019; Thomas, 2014). Public administration in Sweden is decentralised, making it possible for libraries to implement their own solutions (European Commission, 2022). It has increased the use of new technologies but created inequalities within the medical library sector.

This paper investigates technological trends in Swedish medical libraries in the near and distant future and their application within different areas of library activity. Furthermore, we aimed to examine facilitators and barriers to produce a roadmap for technological developments within medical libraries.

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THE ORGANISATION OF MEDICAL LIBRARIES IN SWEDEN

Swedish libraries are organised according to governing institutions (Thomas, 2010). Higher education is governed by the state and healthcare by regions or counties. All universities and colleges are to have a library; for the healthcare sector, there is no such requirement (Ranemo, 2019). Therefore, the medical library sector is divided into two groups with very different conditions: academic and hospital libraries.

Currently, there are 26 universities or colleges offering education in health sciences. Libraries within these institutions vary in size: most are medium sized (staff 10–50) and a few are large (staff >50). In recent years, many academic libraries have suffered cutbacks in staffing or physical space (Ranemo, 2023).

Hospital libraries are rather small (staff <10) and generally hosted by a single hospital. A few offer services to all health care providers in a county, some only to the staff of their hospital or health care providers signing agreements for library services. Since 2017, hospital libraries have declined from 65 to 56 (17%) (Ranemo, 2023). In some regions, there are currently no hospital libraries; in three, an academic library is providing library services to the county (Ranemo, 2023).

The conditions of hospital libraries are often constrained. Not only may competing with clinical departments for resources be hard, but political demands on the healthcare sector may also affect libraries unpredictably. Within a healthcare setting, information security is crucial, and IT environments often limit libraries' possibilities to try new tools and resources.

This division also means that access to information resources is negotiated by different consortia: BIBSAM for academic libraries and EIRA for hospital libraries. Spendings on library resources vary, and separate municipalities prevent sharing of electronic information resources among academic and hospital libraries.

METHOD

A survey was developed to investigate current uses and future trends in the use of new technologies within medical libraries in Sweden; an English translation is found in Appendix S1.

To add focus to the survey questions, we asked about the following technologies: AI, big data, biometrics, blockchains, digital collaborative tools, mobile technologies, robotics, smart technologies, virtual reality (VR) and visualisation. Common library activities were included to identify potential uses for selected technologies: library

space, information resources, pedagogical activities, search services and scholarly publication. Respondents were encouraged to suggest other technologies and library activities. Definitions for each technology and library activity are given in the survey.

The survey was sent to 53 medical libraries in Sweden in September 2022, asking for one answer per library. The survey closed on October 30, 2022. Results were analysed according to library size and library type. Technologies were cross-tabulated against library activities, and free-text answers were used to interpret and exemplify the results.

RESULTS

We received 33 answers: 16 from academic and 17 from hospital libraries. The library sizes varied; 2 academic libraries were categorised as large (staff >50), 4 were considered small (staff <10) and the remaining 10 were medium sized (staff 10–49). Only 3 hospital libraries were medium sized and the remaining 14 were small.

First, respondents rated the importance of implementing each technology in their libraries within 5 and 10 years, respectively. The averages, interpreted as the overall perceived importance of implementing technology, are presented in Figure 1. For practical purposes, important is used for “important or very important” in the following sections unless otherwise stated.

Second, respondents rated how likely a technology was to be used for different library activities; for each activity, multiple technologies could be chosen. Activities with a score of 20 or more for a specific technology were considered for further analysis. The cut-off at 20 was selected to ensure that not only hospital libraries or academic libraries had given that answer (Table 1).

Finally, respondents were asked when they planned to develop library activities using new technologies. Results are summarised in Table 2.

Based on these results, enhanced with free-text comments and examples, technologies were categorised as current trends, upcoming trends or non-trending. Important factors were identified through comments and one specific question in the survey.

Current trends

Digital collaboration, mobile technologies and visualisation are important to implement within 5 years (see Figure 1). All responding libraries considered digital collaboration and mobile technologies important. Visualisation was deemed important by 14 academic libraries (87%) and 11 hospital libraries (65%).

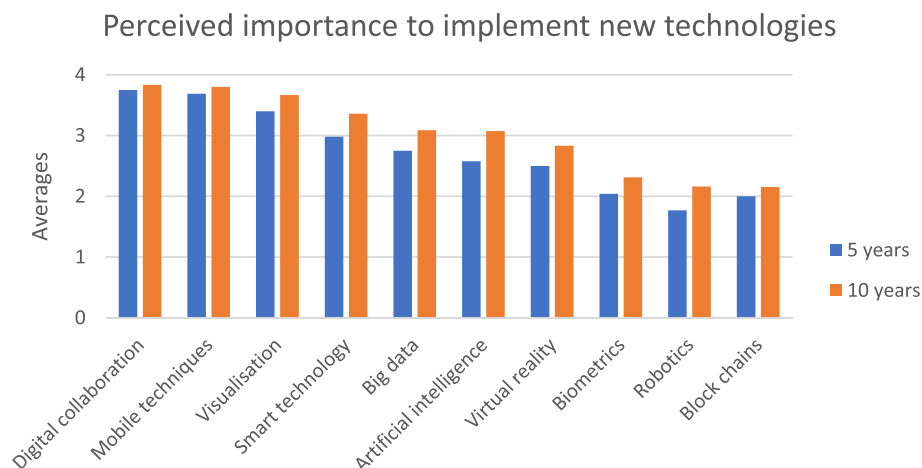


FIGURE 1 Importance of implementing specific technologies. (1 = not important, 4 = highly important).

TABLE 1 Technologies correlated to areas of library work.

	Library space	Information resources	Pedagogical activities	Search services	Scholarly publication	Other areas	Sum
Digital collaboration	21	13	27	20	16	0	97
Visualisation	10	13	22	20	21	0	86
Mobile technologies	25	24	20	9	7	0	85
Smart technologies	19	15	13	11	9	0	67
Artificial intelligence	2	18	7	24	8	0	59
Big data	0	16	2	20	17	2	57
Virtual reality	16	6	21	3	3	0	49
Robotics	19	5	2	5	1	0	32
Biometrics	10	5	1	4	5	2	27
Blockchains	0	9	1	5	3	3	21
Sum	121	124	117	121	91	7	580

TABLE 2 Timeframe to develop areas of library work with new technologies.

	Library space	Information resources	Pedagogical activities	Search services	Scholarly publication
Ongoing	11	11	19	12	7
<5 years	5	8	6	9	6
<10 years	3	3	1	2	2
Not at all	2	0	0	0	1
Unable to determine	10	10	6	9	16
No answer	2	1	1	1	1
Total	33	33	33	33	33

The same technologies were also considered relevant for more than one area of library activity by at least 20 libraries (see Table 1). Many ongoing, planned or already finished projects for these three technologies exist. Examples of digital collaboration include the use of

Teams, Zoom, or a learning management system. Most projects were user-oriented, for example, digital support, guidance and teaching. Several libraries commented that they had already implemented digital technologies in education before or during the COVID pandemic. Mobile

technologies include using QR codes in the physical library to access digital resources, including stories for children. For visualisation, a large-scale project on Power-BI to visualise research data can serve as an example.

Upcoming trends

AI, big data and smart technologies were rated important to implement within 10 years (Figure 1) and were commented on by several libraries. All large or medium-sized libraries considered AI and big data important, while small libraries rated them moderately important or stated they could not judge their importance. The responses for smart technologies were evenly distributed among library types and sizes.

Together with VR, they constitute a group of technologies moderately relevant for library activities, with only one area of library activity considered relevant by at least 20 libraries (Table 1). No library activity was deemed relevant by 20 libraries for smart technologies, but the total score still places it in the second-most relevant category. There were no significant differences between library sizes or types.

AI, big data and smart technologies depend on large amounts of data, demanding technical capacity and competence in the library. Large libraries and a few medium-sized libraries have the means to develop technical solutions, such as AI-automated indexing of resources. Small and medium-sized libraries report monitoring and evaluating automated tools for systematic searching or screening from suppliers such as Keenious or Rayyan.

These technologies had fewer ongoing projects, but many libraries commented that they monitored developments, for example, chatbots, avatars, robotics and drones. Respondents also commented on the need for keeping up-to-date and training staff. Journal clubs and study circles were the most common methods.

Non-trending technologies

None of the remaining technologies was rated important to implement within 5 or 10 years. For blockchains, 58% stated that they could not judge the importance of this technology. Robotics and biometrics were considered important only by a few libraries, with no significant differences between library sizes or types. Biometrics were considered useful only for accessing resources, but several respondents commented on the potential ethical issues in collecting personal data.

Library activities versus technologies

There are currently several ongoing and planned projects within all areas of library activity (Table 2). The following are examples of answers for each area of work:

- **Library space:** Interactive library maps and search stations, 3D printing, active learning classrooms and robots at the information desk.
- **Information resources:** QR codes to increase access to digital sources.
- **Pedagogical activities:** Hybrid teaching or active learning classrooms.
- **Search services:** AI-based tools for searching and screening. Collaborative tools to meet clients as well as enable sharing of documents online.
- **Publication:** Analysing and visualising bibliometric network analyses.

Academic libraries gave most examples. The two large libraries had the means to develop digital tools. For medium-sized libraries, projects involved adapting existing solutions. Small libraries, mainly hospital libraries, generally stated that they lack ongoing projects and found it hard to judge when developments would be possible. However, they were open to using existing tools in continuous improvement work.

Several projects using one technology involved more than one library activity. For example, web-based print services were the most frequent example of mobile technology involving both physical library space and information resources. Projects in visualisation describe working with research data for scholarly publication and the use of anatomic resources.

Scholarly publication is a more common activity in academic libraries than hospital libraries, thus the lower score for this activity (see Table 1).

Factors affecting the implementation of new technologies

Economic, administrative and IT environments are external factors frequently said to affect the implementation of new technologies.

- **Economy:** Access to licensed information resources put a heavy toll on all types of libraries; one academic library stated that increased expenses for e-media left no resources for projects involving the implementation of new technology.
- **Administration:** Academic libraries reported on barriers to sharing research data or licensed data

(e.g. bibliometrics). Hospital libraries said that the needs of clinical departments make it hard to find resources for library projects.

- **Legislation:** GDPR and other legal issues affect the possibility of exchanging or exploring tools or testing new technical solutions.
- **IT environment:** All hospital libraries commented on the effects of their restrictive IT environments: not being allowed to instal programs, having the same security levels as personnel handling patient data and so on.

Staffing, time and technological competence were the most frequently mentioned internal factors; comments often address a combination.

- **Staffing:** A small staff means less time for training in new tools. Regardless of staff size, all libraries have to prioritise core activities.
- **Technological competence:** Without the right knowledge, it is hard to identify how internal processes could be sped up using new technologies.

DISCUSSION

This survey aimed to identify technological trends within medical libraries in Sweden. However, predicting trends in technological developments and the speed thereof is difficult. Two factors, in particular, affect our results. First, the survey closed before the launch of ChatGPT, which sparked a huge interest in implementing AI tools and how to handle their consequences (Cox & Tzoc, 2023). Second, social restrictions during the COVID pandemic increased demand for devices supporting distance and hybrid learning, distance meetings and file-sharing (Pelletier et al., 2022). Unsurprisingly, digital collaboration is the most important current trend. The necessity of digital collaboration also increased the acceptance of technology overall among library staff and users, reflected in the answers.

Results confirm that medical libraries in Sweden have a high technical standard, take an interest in new technologies and monitor new developments. Regardless of size, most responding libraries were adopting new technological solutions. However, libraries are at different levels of technological development. Large and a few medium-sized libraries can be early adopters and develop in-house solutions – the majority progress slower, working with vendor-provided or openly available tools within improvement work. Here, easy solutions are preferred, for example, using digital tools at the online information desk, interactive maps showing physical library space, or removing physical library cards.

The differences in technological standards will impact the development of technological trends and how they will be implemented in daily activities.

In this study, it became evident that identifying technologies as important does not necessarily mean that a library will implement them in the foreseeable future. All libraries struggled with external factors slowing down the pace of implementation or even preventing the use of new technologies. Still, skills training, staff development and monitoring new solutions are central activities among several responding libraries and may counterweight these barriers. Noting that the same technologies were used for different activities and tasks, we suggest that sharing ideas would be useful for all libraries. There are three further reasons why technologies are not implemented in the library.

First, technology may be interesting for the parent organisation but not the library. For example, one hospital library noted that VR is increasingly used in healthcare but that the library may not mediate this technology. Another commented that the parent organisation provided technical solutions and did not have to pursue developments themselves. Overall, the speed of digital transformation in the parent organisation was crucial for all types of libraries.

Second, discussing technology does not suffice. AI has become one of the most discussed topics in information technology today. However, there are still limited levels of adopting AI in libraries (Harisanty et al., 2023). None of the respondents mentioned creating or evaluating text or images using AI. Testing and evaluating are imperatives but may be hard for small libraries.

Third, there are ethical and legal issues that individual libraries will find hard to address. For example, smart technologies could be considered a subset of mobile technologies, extended with the collection and use of personal data. What data libraries are allowed to collect and what will be regarded as proper use is too complex for a single library to determine. Legal concerns regarding privacy issues and regulation of personal data will play an increasingly important role.

Results further suggest that implementing technology within one area of work will make it easier for it to be implemented within other areas. Visualisation is important for scholarly publication and may be taught to doctoral students. Once perceived as a pedagogical method, visualisation could show students the consequences of different search strategies. Similarly, visualisation could be introduced as a tool for presenting publication patterns and user behaviour in the physical library.

Furthermore, if an area of work is developed using new technologies, results suggest that this area may be fertile ground for other technologies. For example,

pedagogical activities had the most ongoing projects. Much involved digital collaboration but also reported an interest in VR, mobile and smart technologies.

Identifying new areas of use of relevance to medical libraries must be considered imperative for a surge in implementing novel technologies. Knowledge of technical aspects is not enough to identify new areas of use. Understanding a library's activities and conditions, the parent organisation's and the patrons' needs and wants is crucial.

Finally, we would like to stress that technologies not identified as trending may be important for individual libraries. For example, robotics is identified as relevant to library space by 19 libraries and one states that there is ongoing work implementing robotics in the information desk. If this is successful, robotics may evolve into an upcoming trend.

Roadmap

The speed and impact of technology will continue to impact medical libraries in the future. Looking ahead, we would like to mention some points to consider if Swedish medical libraries are to increase their use of new technologies.

- Encourage continued monitoring of new technologies to stay up to date. Time and resources to develop skills must be allocated.
- Identify areas of work or even tasks in need of development proactively. Focus on what we as libraries consider important to change rather than on technologies.
- Share knowledge, experiences and solutions. Medical libraries must increase collaboration and sharing of ideas and experiences, regardless of library type.
- Encourage trying existing tools to provide a sense of what specific technologies are or could be capable of.
- Create economic incentives for technological development. Make it easier for all types of libraries to test new tools.
- Put pressure on vendors to facilitate access to new tools. It would be preferable if the two consortia could handle this.

To remain a relevant provider of information services, libraries must be able to monitor, test and adopt new technologies. We are confident that if the suggestions

above are implemented, new technologies will continue to develop medical library services in Sweden.

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