Smart Laboratories in Slovak Libraries – Innovation for the Future

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Public libraries worldwide are undergoing a significant transformation, evolving from traditional repositories of books into creative, educational, and community-oriented hubs. This shift reflects broader technological, social, and cultural changes that require new forms of learning, collaboration, and public engagement. In Slovakia, these developments have led to the establishment of SmartLabs – creative and educational laboratories integrated into public libraries and coordinated by the Slovak Centre of Scientific and Technical Information (CVTI SR). SmartLabs combine digital fabrication tools, robotics, and experiential learning with community engagement and digital inclusion. This article outlines the global trends influencing library transformation, explains the Slovak context and the role of CVTI SR, describes the SmartLab concept and its implementation, and discusses its potential to shape the future of libraries in Slovakia and beyond.

SmartLab, public libraries, STEAM education, makerspaces, digital fabrication technologies

1. Global Trends and Context: Libraries as Creative, Community and Learning Hubs

In his influential book The Great Good Place, the American sociologist Ray Oldenburg (1989), introduced the concept of third places – informal public spaces such as cafés, clubs, or tea rooms where communities meet, converse, and build social capital. Although libraries are not explicitly mentioned in Oldenburg's original work, subsequent developments in library practice and theory have increasingly recognised public libraries as ideal third places. They are open, accessible, and non-commercial spaces that can function as a "public living room" for the community.

Today, the idea of the library as a third place is closely linked to its role as a creative, learning, and community hub. Libraries are expected not only to provide access to information, but also to host events, support collaboration, and offer spaces where people of different ages and backgrounds can meet and learn from one another.

Major professional organisations confirm this shift in the mission and practice of libraries. The American Library Association (ALA), through its Center for the

Future of Libraries, identifies a wide range of trends that reframe libraries as open and collaborative community spaces, including co-working/co-living and the sharing economy (ALA, 2014; 2018). These trends highlight how shared spaces and shared resources are increasingly important in contemporary society, and how libraries can play a central role in such "co-everything" environments.

The International Federation of Library Associations and Institutions (IFLA) has also emphasised the changing role of libraries. The IFLA Trend Report 2024: Facing the Future of Information with Confidence describes seven key forces shaping the future of libraries, including changing knowledge practices, the uneven distribution of digital technologies, the rise of artificial intelligence, and the renegotiation of trust in information systems (IFLA, 2024). One of the future scenarios in the report, Libraries as LifeHub (Fung, 2024), imagines that by 2035 libraries will be dynamic centres integrating digital innovation, community engagement, and lifelong learning. In this scenario, libraries support the development of micro, small and medium enterprises, foster literacy, and enhance cultural understanding by using technologies adapted to local needs and contexts. Libraries are no longer only repositories of books and knowledge; they become vibrant spaces where technology and human interaction converge to address global and local challenges.

These professional visions reflect wider societal developments that increasingly shape the expectations placed on libraries. The growth of the sharing economy strengthens the demand for shared public resources, while open and citizen science require accessible spaces for experimentation and engagement. Everyday life is becoming deeply digitalised, raising the need for support in navigating technologies and information. At the same time, societies face rising concerns about misinformation, democratic resilience and sustainability. The rapid spread of artificial intelligence further transforms how information is created and trusted. Combined with the recognised need to strengthen digital, scientific and critical-thinking skills, these factors position libraries as essential, future-oriented learning and community hubs.

In this context, both theory and practice – as well as leading organisations such as ALA and IFLA – confirm that libraries are in transition from traditional information-holding institutions to active centres of learning, creativity, and community development. Public libraries are increasingly seen as essential elements of civic infrastructure and as third places that provide a shared "public living room" for citizens.

2. The Slovak Context

2.1 Slovak Centre of Scientific and Technical Information

The Slovak Centre of Scientific and Technical Information (CVTI SR) is a public body under the Ministry of Education, Science, Research and Sport of the Slovak Republic. Established in 1938 as the Slovak Technical Library, it has long been a pioneer in introducing new library and information services. Today, CVTI SR serves as the national information centre for science, technology, innovation and education, as well as a specialised scientific library at the national level.

In 2014, CVTI SR opened FabLab, an innovative creative laboratory providing public access to advanced digital fabrication technologies. FabLab was designed as an open space where people of all ages – from students and hobby makers to professionals and start-up founders – can meet, share ideas, learn new

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skills, and realise their projects. Its mission is to promote innovation, creativity, and technological development in Slovakia by providing access to equipment, expertise, and a supportive community.

The experience gained in FabLab CVTI SR – both in terms of technology and methodology – became a key inspiration and foundation for the later development of SmartLabs in public libraries.

2.2 Libraries for Slovakia and the need for creative-educational spaces

As a national scientific library, CVTI SR identified two worrying trends in Slovak society:

1. Declining reading habits and library use. There is a noticeable decline in book reading, particularly among younger generations. As a result, library visits are decreasing, and libraries are often perceived as outdated institutions with limited relevance for modern life.
2. Low interest in STEM fields and insufficient digital skills. Interest in STEM (science, technology, engineering and mathematics) among young people remains relatively low, which has negative implications for the future workforce and innovation capacity. At the same time, a significant part of the population still lacks basic digital competences.

In response to these challenges, CVTI SR has, since 2021, supported public libraries through the national programme "Libraries for Slovakia", which helps libraries modernise their services and develop creative-educational spaces. This support includes training, consultations, methodological assistance and the organisation of events aimed at helping libraries establish and operate creative workshops. However, these efforts alone were not sufficient. Many public libraries lack the financial capacity to purchase the advanced equipment required for modern creative and educational spaces. Therefore, CVTI SR actively sought a systematic solution that would allow such workshops to be created simultaneously in multiple libraries across the country. This effort proved successful, and in 2025 a network of 50 SmartLabs was established in Slovak public libraries. But why libraries, and why are they the right environment for such creative laboratories?

"Many public libraries lack the financial capacity to purchase the advanced equipment required for modern creative and educational spaces."

Fig. 1: Training of librarians on the mBot2 robot at the Regional Library in Žilina in 2023

Placing creative labs in libraries is not an arbitrary decision, but a logical and natural step. Creative workshops and libraries share several core characteristics: openness, community orientation, sharing of resources, and support for learning. In many countries, makerspaces, FabLabs and urban workshops have already become a standard part of public and academic libraries, bringing clear benefits for both the public and the institutions themselves.

Creative labs in libraries foster community-based learning and peer-to-peer knowledge exchange, while also increasing interest in library services and collections. They help bridge the gap between traditional reading and modern technologies, and they support local creativity, craftsmanship and the sustainable, shared use of tools and materials.

In this sense, the development of creative labs in libraries - culminating in the SmartLab initiative - can be seen as a natural evolution of the library's role in Slovak society.

3. What is a SmartLab? Concept and Practice

3.1 Concept, origins and objectives of SmartLabs

A SmartLab is an intelligent creative laboratory integrated into a library, designed for experiential learning, creativity and the development of both digital and manual skills, as well as for the popularisation of science, research, innovation and technology. It enables users to explore their creativity, materialise ideas and acquire new competences ranging from 3D modelling and robotics to traditional craft techniques. SmartLabs were established as part of the Action Plan of the National Strategy for Research, Development and Innovation 2030, within the priority area Concentration of Talent, specifically through a measure aimed at strengthening young people's interest in research and innovation.

The main objective of SmartLabs is to increase interest in science, research, innovation and technology through experiential learning for the general public, especially children and young people. By offering playful and practical workshops, SmartLabs aim to increase interest in STEM fields, improve digital literacy across the wider population and enhance public understanding of the role of science and technology in everyday life.

Fig. 2: Official SmartLab logo

SmartLabs are conceptually close to makerspaces, FabLabs, urban workshops and other creative labs that have become increasingly common in libraries abroad. Libraries provide an ideal environment for such spaces because they are open and inclusive, oriented toward education and lifelong learning, deeply rooted in their local communities, and based on the shared use of resources rather than private ownership.

By integrating a SmartLab into a library, the institution not only supports community education but also increases interest in its traditional services and collections, connecting reading with making, theory with practice, and knowledge with creativity.

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SmartLabs are designed for a broad spectrum of users. Their primary audience is children and young people, for whom they offer opportunities to explore science, technology and creativity through hands-on, project-based learning. They also serve students, designers, artists, enthusiasts and start-up entrepreneurs who use the available technologies to prototype ideas and develop projects. At the same time, SmartLabs are open to the general public, including adults and seniors, who wish to develop their creativity, acquire new skills or explore modern technologies in an accessible and supportive environment.

3.2 Production zone: digital fabrication technologies

Each SmartLab includes a production zone equipped with a range of digital fabrication technologies that support both creative expression and practical learning in a library environment. These include 3D printers, which build three-dimensional objects layer by layer and are frequently used for workshops on 3D modelling – typically in tools such as Tinkercad or Blender – as well as for producing useful objects and prototypes. A cutting plotter enables precise cutting of shapes and designs from vinyl, paper, cardboard and similar materials, allowing users to create stickers, stencils and heat-transfer graphics (Fig. 3). The combination of a sublimation printer and multifunctional heat press makes it possible to transfer printed designs onto textiles, ceramics and other materials, opening opportunities for personalised items and small creative projects. Pyrography stations support artistic techniques such as woodburning, helping users develop fine motor skills, concentration and creativity (Fig. 5). Finally, notebooks serve both to operate the equipment and to deliver educational activities, including workshops on artificial intelligence, critical thinking and information security.

These technologies offer users the opportunity to realise their own projects, create personalised gifts, promotional items or artworks, and experiment with local production, green and sharing economies, and new forms of craftsmanship.

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Fig. 3: Cutting plotter, sublimation printer and multifunctional heat press

3.3 Educational zone: robotics, coding and digital competences

The educational zone of the SmartLab is equipped with a range of modern learning tools, including BBC Micro:bit, mBot 2, Ozobot and LEGO Education SPIKE Prime, each supporting playful, experiential and inquiry-based learning. BBC Micro:bit is a small programmable microcontroller designed to introduce beginners to coding and electronics through simple, interactive projects. mBot 2 is an educational robot equipped with sensors and motors that allows learners to explore robotics, automation and algorithmic thinking (Fig. 1). Ozobot is a miniature robot that can be programmed through colours or block-based coding, making it ideal for the youngest learners (Fig. 4). LEGO Education SPIKE Prime combines robotics, engineering and programming in a modular system that enables students to build and control a wide range of mechanical structures.

Together, these tools support activities that strengthen critical thinking, problem-solving, creativity, design thinking, teamwork and communication. They also build essential digital and technological literacy, which is increasingly important in both education and everyday life. Through interactive workshops and courses, participants gain practical skills and theoretical knowledge in robotics, programming, artificial intelligence, 3D modelling and digital fabrication.

At the same time, SmartLabs play an important role in inclusion and social cohesion by providing access to modern technologies for people who might otherwise have limited opportunities to engage with them. In the library environment, these tools help create an accessible, motivating and community-oriented space where learners of all ages can explore, experiment and develop confidence in using technology.

Fig. 4: Programming Ozobot robots with coloured markers at the Staromestská Library

3.4 From STEM to STEAM: integrating art and creativity

While the Action Plan of the National Strategy for Research, Development and Innovation 2030 focuses on STEM fields, SmartLabs also embrace the broader concept of STEAM, which adds Art to Science, Technology, Engineering and Mathematics. The integration of art and design underlines the importance of creativity and aesthetic thinking in technological and scientific disciplines.

Activities such as woodburning, textile printing and other creative projects support manual skills, patience and perseverance, while also enriching the tech-

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nological focus of SmartLabs with artistic dimensions. In this way, SmartLabs promote a holistic approach to learning that combines technical competences with creativity and cultural expression.

Fig. 5: Pyrography workshop at the Zemplín Library in Trebišov

4. Implementation and First Results

While 2024 was devoted mainly to preparation, including agreements with participating libraries, procurement processes and the distribution of equipment, the year 2025 shifted the focus to implementation (Fig. 6). During the first half of the year, librarians completed two rounds of intensive training that equipped them with the essential skills to operate SmartLab technologies and to deliver introductory workshops in 3D modelling and 3D printing, sublimation printing, working with a cutting plotter, pyrography and programming with Micro:bit, Ozobot and LEGO Education SPIKE Prime.

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Fig. 6: Grand opening of the SmartLabs at the Ľudovít Štúr Regional Library in April 2025

One of the most important aspects of the project is the development of digital competences among librarians themselves. Despite their already demanding workload, many librarians have actively engaged in learning new skills, from programming and robotics to working with digital fabrication tools. A noteworthy feature is the strong element of self-directed learning and peer support: many librarians act as self-taught innovators, bringing their own ideas and original events into the SmartLab environment.

How do SmartLabs look and function in practice? With fifty libraries involved, there are fifty different stories. Each institution in the SmartLab network operates under distinct spatial, staffing and community conditions, which naturally results in a wide variety of implementations. In some libraries, the SmartLab takes the form of a compact, flexible corner integrated into existing spaces, while in others it occupies a fully equipped, dedicated room. The conditions for visits, workshops and individual use are adapted to local possibilities, and users typically arrange activities directly with their library.

This diversity reflects both the strength and the challenge of the project: SmartLabs are not uniform installations but living spaces shaped by the needs, capacities and the creativity of each community. The principle that "each library is different" is therefore not only a practical reality, but also a defining value of the entire initiative.

The SmartLab initiative positions Slovak public libraries on a trajectory that closely aligns with the Libraries as LifeHub vision articulated in the IFLA Trend Report 2024. By integrating digital technologies, creativity, and community engagement, SmartLabs contribute to making libraries dynamic centres of learning and innovation. They help libraries respond to contemporary societal challenges – by supporting digital inclusion, strengthening local communities and encouraging interest in science, technology and creativity.

5. Next steps and planned developments

The development of SmartLabs in Slovakia is still in its first year of implementation, and libraries are only beginning to explore the full potential of these new spaces. In 2025, the first educational activities and workshops were launched, gradually introducing users of all ages to digital fabrication, robotics and creative technologies. As libraries gain confidence and experience, the scope and diversity of their programmes will continue to grow. At the beginning of 2026, the project will produce the first consolidated statistics, providing an overview of how many events and activities were carried out during the initial year and offering valuable insight into the impact of SmartLabs on their communities.

Looking ahead, several directions are already clear. Continued training for librarians will be essential to further strengthen both pedagogical and technical competences. Plans also include expanding the equipment available in SmartLabs, for example by introducing virtual reality and other emerging technologies. Another important step will be establishing SmartLabs in university libraries, particularly at faculties of education, where they can serve as centres for developing new teaching materials and methods with direct relevance to school practice. At the same time, partnerships with external organisations will play an increasingly important role in co-creating programmes, resources and events that enrich the SmartLab ecosystem.

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As SmartLabs continue to take root across Slovakia, they are gradually becoming spaces where curiosity, creativity and community meet. Although the initiative is still in its early stages, the first experiences already show how strongly libraries can inspire learning and innovation when equipped with the right tools and support. The coming years will bring new skills, new collaborations and many new stories from libraries and their visitors.

Up-to-date information, news and examples from practice can be followed on the project website: smartlab.cvtisr.sk.

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