UDC 069:[004.738.5:008

ENHANCING VISITOR EXPERIENCE AND WORK EFFICIENCY THROUGH THE DIGITIZATION OF CULTURAL HERITAGE IN MUSEUMS[1]

Dejan Masliković, PhD
Institute of Social Sciences, Belgrade
dmaslikovic@idn.org.rs

Nevena Novaković
(researcher-intern)
Institute of Social Sciences, Belgrade
nnovakovic@idn.org.rs

Abstract: The digitization of cultural heritage in museums has revolutionized the way museums operate, manage collections, and engage with visitors. This article explores the impact of digitization on museum work, focusing on how digital technologies can enhance the efficiency of curatorial processes, improve conservation efforts, and foster collaboration. It also examines how digitization transforms the visitor experience by offering personalized, accessible, and interactive content through virtual tours, augmented reality, and multimedia displays. Furthermore, the article discusses the essential skills required by museum employees, including digital literacy, data management, and technical expertise in areas such as 3D imaging and user experience design. The paper also highlights the types of equipment necessary for successful digitization, such as scanning tools, digital storage solutions, and interactive display systems. By integrating these technologies, museums can improve operational workflows, expand their global reach, and provide engaging, educational experiences for diverse audiences.

Key words: cultural heritage, museums, digitization, visitors, skills

INTRODUCTION

The main activity of museums is the collection, recording, documentation and preservation of movable cultural heritage. In addition to this activity, museums have an obligation to display objects that represent cultural heritage. Objects are exhibited, that is, presented to the public in various ways: in space, in showcases, by creating ambient wholes, digitally, illustratively, in printed form or in some other way.[1]

In Serbia, the process of digitizing cultural heritage in museology, but also in other cultural fields, is set at the national level and directly defined by the Guidelines for the Digitization of Cultural Heritage in the Republic of Serbia adopted by the Government in 2017 and the Regulation on Detailed Conditions for the Digitization of Cultural Heritage adopted in 2019. It is also more closely defined in the Strategy for the Development of Culture, the Law on Museum Activities, the Law on Cultural Heritage and the Law on Culture.[2] These government acts have made digitization a mandatory job for employees and a mandatory activity for museums.

The digitization of cultural heritage is rapidly transforming the museum sector, offering unprecedented opportunities to enhance both internal operations and visitor engagement. As museums seek to preserve, catalog, and share their collections, digital technologies provide an essential toolkit for improving efficiency, safeguarding artifacts, and expanding access to cultural heritage (Ognjanović et al. 2019). The transition from physical to digital records allows for better management

[1] This paper was written as part of the 2025 Research Programme of the Institute of Social Sciences with the support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

[2] All documents are available on https://kultura.gov.rs/tekst/43/zakoni-i-uredbe.php and https://kultura.gov.rs/tekst/4052/pravilnici-direktive-i-resenja.php

of collections, more effective conservation practices, and increased collaboration between institutions worldwide (Ognjanović et al. 2019).

Furthermore, the digitization of museum collections enriches the visitor experience, enabling new forms of interaction and educational opportunities (Siliutina et al. 2024). Through virtual exhibitions, 3D scanning, and augmented reality (AR), museums can create immersive, personalized experiences that extend beyond the traditional boundaries of physical spaces (Shehade et al. 2020). Visitors are not only able to interact with artifacts in innovative ways, but also to access digital content remotely, broadening accessibility for global audiences.

However, the digitization process requires significant investments in both technological infrastructure and human expertise. Employees must develop a diverse skill set encompassing digital literacy, data management, technical proficiency in imaging and scanning technologies, and understanding the nuances of user experience design. Additionally, museums must invest in cutting-edge equipment and software that support high-quality imaging, storage, and interactive displays (Terras 2007).

Also, digital objects can be used to increase the visibility of museum activities and even the visibility of the objects and collections themselves on the internet, especially on social networks, and thus increase interest among potential visitors (Krstić 2019).

This article explores the various facets of digitization within museums, focusing on how it can enhance the work of museum employees, improve operational processes, and create more engaging and inclusive experiences for visitors. It will also offer insights into the necessary skills for museum staff and the technological tools that facilitate successful digitization efforts.

POSITIVE EFFECTS

Digitizing cultural heritage in museums involves converting physical artifacts, documents, and other materials into digital formats (as defined in the Guidelines – creating digital objects), which can be stored, analyzed, and displayed via digital platforms. This transformation has several benefits for museum operations, employee roles, and visitor experiences.

The paper will highlight several positive effects of digitization that affect the work of museums. There are many scientific and professional papers on this topic in domestic and international journals and books. These effects are roughly grouped and adapted to the situation in museums in Serbia and are based on personal experience.

IMPROVEMENT OF MUSEUM WORK AND EMPLOYEE ROLES

- Efficiency in archiving and cataloging:

Digitization allows for faster and more accurate cataloging and archiving. Museums can use digital systems to manage their collections, making it easier to track items, retrieve information, and monitor the condition of objects. Employees need skills in data management, including databases, metadata standards, and cataloging systems (Zlodi 2004).

Museums in Serbia are a good example of this kind of work. The Unified Information System (JIS) has been implemented in over 80 museums and galleries and enables fast, precise and efficient work of curators (Bojković 2016).

- Enhanced conservation efforts:

Digital records help conservators monitor the state of artifacts over time, as detailed digital images or scans can detect minor changes in artifacts that may not be visible to the naked eye. For this, employees must be trained in conservation techniques and the use of digital imaging tools (e.g., 3D scanning, high-resolution photography) (Peters et al. 2017).

Enhanced conservation efforts in museums have been significantly bolstered by digitization, providing new methods for preserving and protecting cultural artifacts. High-resolution 3D scanning, digital imaging, and artificial intelligence-powered restoration techniques allow for detailed documentation of artifacts, reducing the need for physical handling and minimizing wear and tear (Karagiannis 2024). Data on cultural heritage in digital form facilitates precise monitoring of the condition, monitoring external factors: temperature, humidity, pathogenic elements and light exposure. In addition, digitization ensures that if a cultural asset is damaged, lost, or destroyed, its digital object remains, ensuring further opportunities for research and public engagement. Digital modeling and design tools also help in the restoration of cultural heritage by reconstructing missing elements with great precision. Through digitization, museums can extend the lifespan of cultural assets by using digital instead of physical objects and make them more accessible to

researchers and the public, ensuring the preservation of cultural heritage for future generations (Karagiannis 2024).

- Collaboration and sharing:

Digitization can facilitate collaboration with other institutions and researchers by sharing information and data in digital form quickly, accurately, and clearly. Employees must be skilled in managing digital rights, copyright laws, and establishing protocols for secure data sharing (Paul et al. 2024).

IMPROVEMENT OF VISITOR EXPERIENCE

- Use of digital objects:

Museums can enhance the visitor experience by integrating multimedia elements such as virtual tours, interactive displays, and augmented reality (AR) into standard settings. Digital objects can be displayed in more immersive ways that provide a visitor experience beyond that expected with traditional methods. Visitors can explore exhibits remotely, creating an opportunity for wider accessibility.

In the 21st century, it is unthinkable that visitors of any age would enjoy classic, monotonous and static displays. Today's audience, accustomed to faster changes in content, bright colors, lots of information, photos, and video material—while engaging as little personally as possible—needs to experience museum objects in interactive formats. This can only be achieved through the use of digital objects, augmented reality, virtualization, three-dimensional representation of objects and the ability to select and linger on content that interests them, and even store them on mobile devices. As Terras stated in her article, it is essential that these tools are used and that employees have the skills to implement them in their work. Especially skills in multimedia design, AR development, and interactive exhibit programming (Terras 2007).

- Educational, interactive tools and accessibility:

Digitized content can be used to create educational tools such as interactive quizzes, learning apps, and even games. These tools can be used in educational workshops, making the museum experience more engaging and educational for different audiences, especially children.

The Museum of Vojvodina is an example of a museum where digital tools in education have been applied to a large extent.[3] There are good examples in other museums as well. Especially when it comes to the use of digital guides, applications that are downloaded to mobile phones and used instead of human guides. Digital platforms can provide personalized experiences by allowing visitors to access content based on their interests or needs (e.g., language preferences, accessibility options like text-to-speech). This improves inclusivity and broadens audience reach (Eghbal-Azar et al. 2016).

Digital guides in museums, including QR codes, barcodes, and mobile apps, have created a new dimension in museum visits by providing interactive and personalized experiences. QR codes and barcodes placed near exhibits allow visitors to access additional information, high-resolution images, audio guides, and even augmented reality (AR) features simply by scanning with their smartphones. These digital tools enhance accessibility, offering multilingual content.

Mobile applications can also be used with additional features, including GPS navigation. This tool allows visitors to follow pre-created thematic routes. This is particularly suitable for large archaeological sites. Some museums integrate chatbots with artificial intelligence (AI) to answer visitors' questions in real time (Gaia et al. 2019). Additionally, digital guides reduce the need for printed materials, contributing to sustainability efforts. By leveraging these technologies, museums not only provide deeper educational content but also create a more immersive and engaging experience for diverse audiences, making cultural heritage more accessible and interactive.

NEEDS TO BE MET

When considering digitization in museums, we should also mention ICT experts who should be engaged, or permanently employed.

Unfortunately, the Catalogue of Public Service Jobs[4] did not foresee the employment of ICT specialists in museums. From a market perspective, ICT specialists have high salaries and the cultural sector, i.e. public services, do not have the ability to pay them.

[3] https://www.muzejvojvodine.org.rs/e-muzej/ (accessed 15.01. 2025. At 11.03)

[4] https://mduls.gov.rs/wp-content/uploads/Nezvanicno-preciscen-tekst-Uredbe-katalogu-radnih-mesta-maj.pdf?script=lat (accessed 15.01.2025. At 12.15)

Their services are outsourced, which leads to many problems. Therefore, museums are obliged to conduct public procurement to provide these services, which leads to a limited duration of cooperation with application and software authors and to the unsustainability of projects.

By further analyzing the needs of museums that they need to meet in the process of digitization and the use of digital tools, we can distinguish: employee skills, equipment, and the use of artificial intelligence.

SKILLS EMPLOYEES SHOULD HAVE

The basic skills that are necessary and taken for granted today are:

- Digital Literacy

Employees should have basic digital literacy, including knowledge of digital tools for scanning, archiving and managing digital content. They should also be familiar with collaboration platforms and virtual meeting tools.

Basic digital literacy is required in museums in Serbia. When applying for employment in cultural institutions financed by public funds, it is mandatory to provide evidence of the level of computer literacy, i.e. basic digital literacy. All of this is also required when taking the professional exam for museum employees to obtain the title of curator, documentarian, etc.

- Project Management

The process of digitization, as a new process, often involves the conception of these processes as separate projects. Museum employees today must be up-to-date in writing projects, managing projects, reporting and creating budgets (Kharitonova & Hook 2017). Money for the implementation of projects, the materialization of ideas and the progress of museums does not necessarily have to be provided from the state budget (Kharitonova & Hook 2017). Most often, funds are obtained through competitions of the Ministry of Culture, local governments or from international funds. It should be noted that in Serbia, employees must also have a certain level of knowledge about public procurement because culture is not exempt from purchasing goods and services without a tender.

According to Silvaggi and Pesce, authors of the Job Profiles for Museums in the Digital Era additional abilities, knowledge and skills that employees should have are:

- Data Management (knowledge of database software, metadata standards, and content management systems is crucial for organizing digital assets),
- Technical Skills (depending on their roles, staff might need skills in 3D modeling, digital photography, video production, or AR/VR development (Maslikoviċ 2023).
- Cybersecurity and Data Protection (protection of digital collections, ensuring the security and integrity of the data is critical. Staff should be knowledgeable about cybersecurity practices).

These new roles in museums require expertise in digital curation, audience interaction, and technology-driven storytelling. The Silvaggi and Pesce also emphasize the necessity of continuous training to bridge skill gaps and enhance digital literacy.

By equipping museum professionals with digital skills, will foster innovative visitor experiences and ensures the sustainability of cultural heritage institutions. The authors underline the critical role of digital transformation in redefining museums as dynamic, interactive, and accessible spaces in the 21st century.

Employees in charge of visitor services need skills in accessibility and user experience design.

EQUIPMENT MUSEUMS SHOULD HAVE

Last but not least, the equipment that museums should have. Of course, the equipment, or rather the purchase of equipment, depends on the financial capabilities of the institution itself. In Serbia, museums at the national level, which are financed from the budget of the Ministry of Culture, have more funds than museums at the local level which are financed from the funds of local governments. Therefore we cannot talk about equal conditions and opportunities for the development of digitization and the purchase of equipment.

We will list several important segments of equipment that museums should have or strive to acquire, which are not expensive, complicated to use and maintain.

- Scanning and Imaging Equipment

High-resolution scanners, 3D scanners, and cameras are essential for capturing detailed digital representations of cultural assets.

- Data Storage and Backup Solutions

Robust storage systems, both physical (external hard drives, servers) and cloud-based, are necessary to securely store large digital files. In Serbia, the Ministry

of Culture has secured space in the State Data Center in Kragujevac

- Editing and Modeling Software

Software for image editing (Photoshop), 3D modeling (Blender, AutoCAD), and AR/VR creation (Unity, Unreal Engine) are required for developing digital content.

- Interactive Displays and Kiosks

For enhancing visitor interaction with exhibits, museums need interactive touch screens, VR headsets, and AR devices.

- Networking Infrastructure

A solid internet and network setup ensure seamless access to digital. Museums in Serbia, at the national level, are provided with internet via optical connection through the University of Belgrade and the Ministry of Information and Telecommunications. Others can connect to the same network but through local governments.

ARTIFICIAL INTELLIGENCE

Finally, before drawing a conclusion, it is necessary to mention the application of artificial intelligence in museums, i.e. culture. As a new and insufficiently developed topic, it is currently being addressed through the field to which culture belongs, the social-humanistic one (Milosavljevic et al. 2022).

According to most authors and as shown in practice, AI is most often used in collection management and selection of displays for visitors. AI plays its role in creating collections that meet the needs, desires and habits of visitors, thereby making their experience better and the museum more productive. As a new and not yet available tool for museums, AI is yet to find its adequate application in museology (Sunanda et al. 2023).

CONCLUSION

Digitization of cultural heritage can profoundly enhance museum operations, employee workflows, and visitor engagement. It requires a combination of technology, skill-building, and infrastructure. By equipping museum staff with the right digital tools and expertise, and ensuring the right technology is in place, museums can offer more dynamic, inclusive, and engaging experiences for their visitors.

By introducing these innovative business mechanisms, we can confidently say that the number of visitors, especially young people, is increasing. Museums and spaces for displaying cultural goods are no longer conservative places, but places where audience participation is increased, new experiences are provided and interaction is enabled. Increasing citizen participation in cultural events has a great importance and impact on the development of local communities and raising awareness about the importance of cultural heritage and its preservation.

REFERENCES

Bojković, Slađana. 2016. „Muzejska dokumentacija – digitalizacija i dostupnost – na primeru Istorijskog muzeja Srbije". U: *Otvoreni pristup muzejskoj dokumentaciji u Srbiji, iskustva, izazovi i potencijali*, ur. Milja Stijović: 52–60. Beograd: Centralni institut za konzervaciju. (ćir.)

Eghbal-Azar, Kira, Martin Merkt, Julia Bahnmueller, and Stephan Schwan. 2016. "Use of digital guides in museum galleries: Determinants of information selection". *Computers in Human Behavior*, 57: 133–142.

Gaia, Giuliano, Stefania Boiano, and Ann Borda. 2019. "Engaging Museum Visitors with AI: The Case of Chatbots". In *Museums and Digital Culture*, eds. Tula Giannini i Jonathan P. Bowen: 309–329. https://doi.org/10.1007/978-3-319-97457-6_15.

Karagiannis, Georgios K. 2024. "High Resolution, In Situ, Multispectral, Spectroscopic Mapping Imaging System Applied in Heritage Science." *Optics and Lasers in Engineering* 174: 107971. https://doi.org/10.1016/j.optlaseng.2023.107971.

Kharitonova, Tatiana Yu, Daria Yu Hookk. 2017. "Project Management in a Digitally Transformed Museum." *International Culture & Technology Studies* 2 (1): 70–74. https://cat.ifmo.ru/ru/2017/v2-i1/113.

Krstić, Nataša, Dejan Maslikoviić. 2019. "Pain Points of Cultural Institutions in Search Visibility: The Case of Serbia." *Library Hi Tech* 37 (3): 496–512. https://doi.org/10.1108/LHT-12-2017-0264.

Maslikoviić, Dejan, Tijana Stankoviić-Pešterac, and Natalija Vulikić. 2023. "Digital Tools – A New Era in Archaeology." *Archaeology and Science* 19: 187–198. https://doi.org/10.18485/arhe_apn.2023.19.12.

Milosavljević, Predrag, Dejan Maslikoviić, and Đorđe Grubišić. 2023. „Aspekti Društvene Implementacije Veštačke Inteligencije: Stavovi i Iskustva". In *Tehnologija, Kultura, Razvoj: Tematski zbornik radova XXIX naučnog skupa međunarodnog značaja „Tehnologija, kultura i razvoj"*, ur. Dušica Semenčenko i Đuro

Kutlača, 153–167. Beograd: Institut „Mihajlo Pupin", Udruženje „Tehnologija i društvo".
Ognjanović, Zlatko, Bojana Marinković, Maja Šegan-Radonjic, and Dejan Masliković. 2019. "Cultural Heritage Digitization in Serbia: Standards, Policies, and Case Studies". *Sustainability* 11 (14): 3788. https://doi.org/10.3390/su11143788.
Longley Arthur, Paul, Lydia Hearn, Isabel Smith, and Nikos Koutras. 2024. "How 'Open' Are Australian Museums? A Review Through the Lens of Copyright Governance". *Internet Histories* 8 (1–2): 136–152.
Peters, Nonja, Marijke Marinova, Van Faassen, and Glen Stasiuk. 2017. "Digital Preservation of Cultural Heritage". In *Digital Preservation of Cultural Heritage*, 3–10. https://doi.org/10.1007/978-3-319-47164-8_7.
Siliutina, Iryna, Olena Tytar, Mykhailo Barbash, Natalia Petrenko, and Larysa Yepyk. 2024. "Cultural Preservation and Digital Heritage: Challenges and Opportunities". *Amazonia Investiga* 13 (75): 262–273. https://doi.org/10.34069/AI/2024.75.03.
Silvaggi, Alessandra, Fabrizio Pesce. 2018. "Job Profiles for Museums in the Digital Era: Research Conducted in Portugal, Italy and Greece within the Mu.SA Project". *ENCATC Journal of Cultural Management and Policy* 8 (1): 56–69.
Shehade, Maria, Theopisti Stylianou-Lambert. 2020. "Virtual Reality in Museums: Exploring the Experiences of Museum Professionals". *Applied Sciences* 10: 4031. https://doi.org/10.3390/app10114031.
Terras, Melissa. 2007. "Digital Heritage: Applying Digital Imaging to Cultural Heritage". In *Literary and Linguistic Computing*, ed. Lindsay MacDonald, 23: 244–246. https://doi.org/10.1093/llc/fqn002.
Zlodi, Goran. 2004. „Muzejska vizualna dokumentacija u digitalnom obliku". *Muzeologija*. https://www.academia.edu/56165665/Muzejska_vizualna_dokumentacija_u_digitalnom_obliku. Accessed January 12, 2025, at 10:23.
Rani, Sunanda, Jining Dong, Dhaneshwar Shah, Siyanda Xaba, and Prabhat Ranjan. 2023. "Exploring the Potential of Artificial Intelligence and Computing Technologies in Art Museums." *ITM Web of Conferences* 53: 01004. https://doi.org/10.1051/itmconf/20235301004.

Др Дејан Масликовић, Невена Новаковић
Институт друштвених наука, Београд

УНАПРЕЂЕЊЕ ИСКУСТВА ПОСЕТИЛАЦА И ЕФИКАСНОСТИ РАДА КРОЗ ДИГИТАЛИЗАЦИЈУ КУЛТУРНОГ НАСЛЕЂА У МУЗЕЈИМА

Резиме

Дигитализација културног наслеђа у музејима је изазвала револуцију у начину на који музеји раде, управљају колекцијама и раде са посетиоцима. Овај чланак истражује утицај дигитализације на музејски рад, фокусирајући се на то како дигиталне технологије могу побољшати ефикасност кустоских процеса, побољшати начин конзервације и подстаћи сарадњу. Такође истражује како дигитализација трансформише искуство посетилаца нудећи персонализован, приступачан и интерактивни садржај кроз виртуелне обиласке, проширену стварност и мултимедијалне дисплеје. Штавише, чланак говори о основним вештинама које су потребне запосленима у музеју, укључујући дигиталну писменост, управљање подацима и техничку експертизу у областима као што су 3Д слике и креирање корисничког искуства. У раду су такође истакнути типови опреме неопходне за успешну дигитализацију, као што су алати за скенирање, решења за дигитално складиштење и интерактивни системи за приказ. Интеграцијом ових технологија, музеји могу побољшати оперативне токове рада, проширити своју глобалну видљивост и пружити занимљива образовна искуства за различиту публику.