Material and Immaterial Archival Heritage : The Shift From Analog to Digital

التراث الأرشيفي المادي واللامادي: التحول من التناظرية نحو الرقمية

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Article abstract :

This study examines the issues surrounding the digitization of archival heritage and the reasons for its transition from analog to digital formats. It defines the concept, its relationship to other forms of cultural heritage, and aims to reclassify archival heritage to reflect technological advancements and the requirements of digital transformation. Employing a documentary-analytical approach, the research is divided into methodological and theoretical sections ; the latter comprises three chapters addressing issues related to heritage, archives, and digital transformation. The study concludes that digital transformation is crucial for preserving and enhancing access to archival heritage, but identifies challenges such as technological limitations and data security. It recommends investment in infrastructure, training, and knowledge sharing, emphasizing the need for strategic planning.

Key words : Archival heritage ; Digital transformation ; Analog ; Digital.

ملخص المقال:

تتناول هذه الدراسة إشكالية التحول الرقمي للتراث الأرشيفي ودوافع انتقاله من الطبيعة المادية التناظرية نحو اللامادية الرقمية، محددة بذلك مفهومه وعلاقته بغيره من أنواع التراث الثقافي، كما تهدف الدراسة إلى إعادة تصنيف هذا التراث الأرشيفي بما يتناسب مع التطورات التكنولوجية وفهم متطلبات هذا التحول. ولذلك تم تقسيم هذا البحث إلى قسمين رئيسيين هما جانب منهجي يهدف الى ضبط وتوضيح مسار معالجة حيثيات موضوع الدراسة من خلال المنهج الوثائقي التحليلي وجانب نظري في ثلاث مباحث تدور حول اشكاليات التراث والأرشيف والتحول الرقمي، لتتوصل الدراسة بعدها لعدة نتائج حول أهمية التحول الرقمي في حماية التراث الأرشيفي وتعزيز فرص تثمينه واتاحته للوصول اليه، مع ابراز العديد من التحديات التي تقف في طريق هذا التحول كالجانب التكنولوجي وأمن البيانات، وفي الأخير تؤكد الدراسة على عدة توصيات أهمها محاولة الاستثمار في البني التحتية وتدريب الكوادر وتبادل الخبرات وذلك من خلال استراتيجيات معينة.

كلمات مفتاحية: التراث الأرشيفي، التحول الرقمي، التناظرية، الرقمية.

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Introduction

Cultural heritage, in all its tangible and intangible forms, constitutes a cornerstone of national identity and a vital link between generations and peoples. Archives are an integral part of this heritage, serving as a vital record of the history of nations and civilizations, recording their advancements and challenges, and defining their identity across time. However, the digital transformation wave that swept the globe during the 20th century profoundly impacted the nature of this heritage, converting its analog contents into digitally processed data.

This transformation, despite offering advantages related to easy access and flexible availability of information, has simultaneously sparked widespread debate about the very essence and existence of archival heritage, as well as methods for its preservation and transmission to future generations. Fundamental questions have arisen concerning the possibility of preserving the core of the original heritage after its conversion to a digital environment, and how to ensure the integrity and protection of this digital data from loss or damage. New challenges have also emerged regarding methods for preservation, maintenance, and updating, and ensuring efficient user access.

These issues can be further elucidated by framing them within the following central question :

How can the digitization of archival heritage best balance the preservation of its authenticity and integrity with the enhanced accessibility and usability afforded by digital technologies, while addressing the associated challenges of technological limitations, data security, and long-term preservation ?

I.   Methodological framework

1. Study Questions:

Based on the foregoing, this study aims to resolve the aforementioned discrepancies and answer several key questions, including :

- What is the relationship between archives and heritage ? Can archival materials be separated from their inherent heritage characteristics ?
- What is meant by the digital transformation of archival heritage, and what are the most important factors driving archival institutions toward this transformation ?
- What is the current state of the digital transformation of archival heritage, and what role has this transformation played in its preservation ?

2. Study Objectives :

This study aims to achieve several key objectives :

- This research investigates the historical evolution of the recognition of the heritage value of archives.
- To propose new classification schemes for archival heritage that account for recent technological advancements demanding sustainable adaptation.
- To investigate the digitization of archival heritage, exploring the key drivers behind this process and the requirements for its successful implementation.

3. Study Importance :

This study's significance lies in its novel approach to archives, offering a contemporary perspective. It highlights an aspect frequently overlooked in previous research : the often-underestimated cultural and historical value of archives—a value some even deny. Prior studies have largely focused on administrative and managerial aspects, neglecting this crucial dimension.

This study also bridges two fields traditionally seen as distinct : heritage studies and digital transformation. It demonstrates not only the potential for their intersection but also the necessity of their convergence in the modern era.

This is achieved by tracing the lifecycle of archival heritage in the post-digital age, from its original physical form to its current digital, immaterial state. The study underscores how binary code ("0,1") has become essential for accessing and understanding this digital archival heritage.

4. Study Methodology :

To achieve the objectives of this study and arrive at logical results, the documentary method was adopted using analytical approaches. This method is based on gathering various information and sources related to the research topic for the purpose of analyzing, scrutinizing, and critiquing them, and then re-utilizing them in the study in a different format to reach results that help understand and attempt to develop the reality. **(Al-Asaf, Saleh Bin Hamad, 2006, p. 203)**This study relied entirely on reading, analyzing, and critiquing Arabic and foreign sources and references related to the problematic issues of archival heritage and the possibility of its digital transformation. The aim was to understand and reorganize ideas within a systematic framework that facilitates the reader's comprehension of this topic and clarifies its perspectives.

5. Study Concepts :

- **Archival heritage:** comprises a collection of documents and materials containing enduring and significant informational content for individuals or groups, whether this content is analog or digital. This content can be stored on a physical medium suitable for preservation and transfer, or digitized and converted into a digital format.
- **Digital transformation:** converts information from its original analog formats (books, images, audio recordings, etc.) into a computer-readable digital format using tools like scanners and digital cameras. This involves translating data into a binary sequence of zeros and ones, with the bit as the basic unit of measurement.
- **Analog :** An analog signal represents a natural phenomenon, such as sound or an image, as a continuous waveform. The values within an analog signal are measured on a typically logarithmic scale and displayed using indicators like volume meters or signal strength gauges.
- **Digital :** A digital signal represents a natural phenomenon as a discrete sequence of binary digits (0.1) that are computer-readable. Technologies such as LCD displays facilitate the accurate transmission of this data.

Figure 1 : A diagram comparing digital and analog information encoding
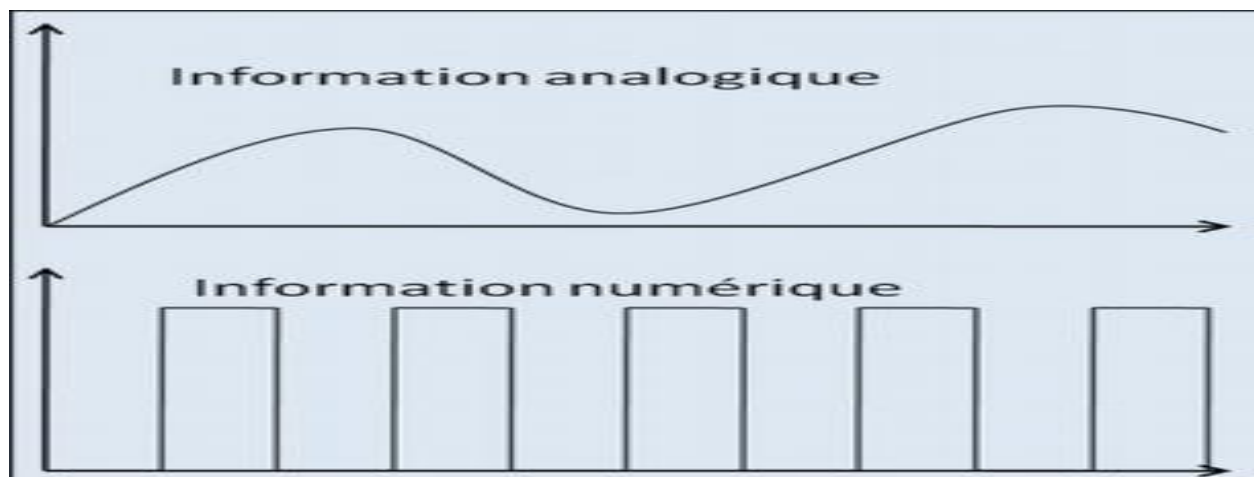
Source : PIAF, the Global Portal for Francophone Archives,2024, https://www.piaf-archives.org

II.   Theoretical Framework

1. Cultural Heritage :
1.1 Defining Cultural Heritage:
- **Heritage :**

The concept of heritage is deeply intertwined with several other concepts, stemming from the core idea of inheritance. The word "heritage" (Arabic : تراث) is derived from "inheritance" (إرث) (**Ibn Manẓūr, 1999, p. 3083**), signifying that which is passed down from one person to another—be it material wealth, lineage, or cultural practices. The term also implies the transfer of ownership from the past to the present ; one might say "X inherited from Y," referring to something old left behind. Therefore, heritage encompasses everything inherited from ancestors, whether material, such as artifacts and books, or immaterial, such as customs, traditions, and values. Consequently, heritage constitutes an inherited wealth and a historical archive documenting past civilizations and highlighting their achievements.

In the technical sense, heritage encompasses everything bequeathed by humankind or nature to future generations. This includes all artifacts, sites, buildings, manuscripts, records, values, and ideas that constitute a wealth spanning the past, present, and future. As it belongs to all, we must acknowledge its value, protect it, and ensure its continuity. (**Jokilehto, J, 2005, p. 41**)

- **Culture :**

Linguistically, the word "ثقف" (to be cultured) implies skill and intelligence. The phrase " ثقف الرجل ثقافة" (the man became cultured) signifies that he became skillful and insightful, adept at understanding matters and expertly handling them. Similarly, "ثقف الشاي" (to grasp something) means to quickly understand it. (**Ibn Manẓūr, 2014, p. 492**).

Culture encompasses the complex whole that includes knowledge, law, art, morals, beliefs, and other customs acquired by an individual as a member of society **(Imād, Abd al-Ghani, 2006, p. 31)**. It comprises elements intrinsically linked to ways of thinking, feeling, and acting—ways codified into relatively explicit rules, learned, acquired, and shared among a group of people. These are employed both objectively and symbolically to unite individuals within a specific group that aligns with these shared ideas.

- **Cultural Heritage :**

In light of the foregoing analysis, archival heritage is understood to comprise all assets identified by states for protection and preservation, irrespective of the specific rationale. Such assets encompass : archaeological materials, including fossils ; archaeological sites exceeding one century in age ; objects of artistic merit, such as sculptures ; original artistic creations, including hand-painted images and paintings ; and historically and scientifically significant manuscripts and printed books **(UNESCO Convention, 1972, p. 3)**.

1.2 Types Cultural Heritage:

Cultural heritage can be Bradly categorized into two main types : tangible and intangible. Both are intrinsically linked to the cultural and social identity of a specific region or civilization, thus possessing unique and distinctive characteristics that warrant recognition by international organizations dedicated to heritage preservation. Therefore :

- **Tangible Cultural Heritage :** This encompasses all tangible, material, and fixed cultural assets and possessions subject to constant change **(Mohamed Suwailem, 2018, p. 243).** Their protection and preservation are crucial to ensuring their transmission to future generations. Examples include : ancient buildings and cities, mosques, zawiyas (Sufi lodges), churches, archaeological artifacts, jewelry, and literary creations such as books, manuscripts, and archives.
- **Intangible Cultural Heritage :** This refers to the inherited, non-material, and immaterial skills and practices that engage the intellect and mind **(Ismail, Ben Melouka, 2021, p. 212)**. This includes oral traditions, traditional crafts, singing, music, dance, myths, and various intellectual products directly related to human experience and the lives of peoples. These expressions of creativity in diverse fields are passed down through generations and can be preserved through material mediums, such as digital or audio-visual archives.

1.3 Reasons for Preserving Cultural Heritage:

Cultural heritage constitutes a precious treasure, preserved as a legacy for future generations. It represents an invaluable social asset, being a collection of tangible and intangible items whose worth stems from their role in enriching social life and their unique, irreplaceable nature.

The 1972 UNESCO General Conference adopted the Convention Concerning the Protection of the World Cultural and Natural Heritage (United Nations Educational, Scientific and Cultural Organization **(UNESCO UNESCO Recommendation, 2015, p. 4)** for the benefit of humanity and to ensure its transmission to future generations. Algeria plays a significant role in this endeavor, having been elected a member of the World Heritage Committee for a four-year term beginning in November 2011.

This heritage is preserved for several key reasons :

- **Social Value :** Cultural heritage is a shared asset among communities, contributing to the preservation and transmission of cultural identity to future generations.
- **Unique Nature :** These artifacts are unique and represent a non-renewable heritage. Damage to them represents an irreplaceable loss.
- **Enigmatic Nature :** Some artifacts may be difficult to understand due to their origins in forgotten social contexts. This highlights the importance of interpreting and disseminating them through educational methods suitable for the public, particularly younger generations.
- **Age :** While cultural heritage often signifies items created in the distant past, this characteristic is not absolute. Many contemporary creations will constitute heritage for future generations, without necessarily originating from a previous era.

These reasons make cultural heritage worthy of preservation, dissemination, accessibility, and enjoyment by the public. This is where its value and importance lie. What good is it to store and hoard this heritage without conveying it to its intended beneficiaries ?

2. Archival Cultural Heritage :

2.1 Stages in the Recognition of Archives as Heritage :

The recognition of archives as heritage has been a long and arduous process, unfolding in several stages. The concept of archival heritage itself is not easily defined, particularly given the extensive critiques leveled against it and its inherent designation as "heritage." Are archives, in fact, heritage ? This very question is posed by archival expert Fouad Soufi in his book, *Les archives une problématique patrimonialisation* (**Fouad Soufi, 2012, p. 12**), highlighting the ambiguous status of archives within cultural heritage. While global and regional legislation affirms their importance as an integral part of this heritage, Soufi emphasizes a significant gap between the Algerian national archive and the national cultural movement. Despite limited efforts—workshops and conferences—decision-makers in the cultural sector largely remain unaware of the crucial role archives play in a society's culture and heritage.

This recognition began with a collaborative research project in the Pays de la Loire region of France (2007-2013, CPER 10-LLSHS), aimed at exploring new scientific disciplines and facilitating multidisciplinary projects. The network comprised approximately 50 researchers from various universities nationwide. In 2009, a three-year research program, "Néopat" (2009-2012), was launched, including courses and exchanges between researchers and external experts from various humanities and law disciplines (historians, geographers, sociologists, librarians, heritage preservation specialists).

The project concluded that archives constitute a unique form of heritage, a finding confirmed by its experts and reinforced by the UN's declaration on archives (adopted by the International Council on Archives in 2010 and UNESCO in 2011). This declaration affirmed archives as an irreplaceable heritage transmitted across generations. (**Bénédicte GRAILLES, 2013, pp. 2-6**)

2.2 The Difference Between Archives and Heritage :

The similarities and differences between archives and heritage can be summarized as follows :

- **Inherent Genesis :** Neither heritage nor archives are created with the sole intention of preservation. Both are the result of human activities and practices, whether material or intangible.

- **Chronicling the Past, Testifying to the Present, and Informing the Future :** Both document past events, contribute to the strengthening of current national or global cultural and historical identity, and provide frameworks for understanding future trajectories and addressing challenges based on past experiences.

- **Unique and Irreplaceable Assets :** Both heritage and archives are original and unique treasures. Their loss or damage cannot be compensated for by recreation or replication.

- **Research and Scholarly Utility :** Both can be utilized and their components analyzed to reconstruct their context and document evidence for historical events. Therefore, both heritage (history) and archives are primary resources for researchers, investigators, and historians.

- **Inalienability :** Both are considered public property, inalienable through sale or purchase, and not subject to lapse of time ; they are instead inherited from one generation to the next, a gift from past generations to future ones.

- **Necessity of Sharing, Accessibility, and Dissemination :** Both are of paramount importance as public assets belonging to all peoples. Therefore, their accessibility and dissemination, ensuring access for all researchers, are essential.

In conclusion, the relationship between heritage and archives is deeply intertwined. Heritage, without archival documentation, lacks credibility and scholarly rigor and cannot be fully understood without reference to them. Similarly, archives lose their historical and heritage significance when separated from the broader context of heritage.

2.3 Defining and Categorizing Archival Heritage:

Archival heritage: encompasses a collection of documents, both physical and digital, containing significant information about the past and present. This includes a diverse range of materials such as maps, photographs, films, audio and digital recordings, and written documents, reflecting important aspects of individual, institutional, and societal life, and expressing their history, culture, and achievements.

This archival heritage possesses significant historical and cultural value. It constitutes the collective memory of society, contributing to an understanding of human history as a whole and defining the identity of individual communities. Crucially, this heritage must be accessible to all without restriction to realize its historical and cultural value and fulfill its role in fostering good governance and sustainable development **(Concepts and Components, under the Cultural Heritage Act., 2024, p. 03)**.

Types of Archival Heritage : Considering the types of cultural heritage and the pervasive influence of digital technology, archival heritage can be broadly divided into two main categories :

A. Tangible Archival Heritage : This can be further subdivided into :

- **Archives on Traditional Media :** This includes various analog materials used for recording in the past, such as clay tablets, wood, stone, leather, papyrus, and metals. The designation of these materials as archival heritage is determined by factors such as the value and significance of their content, their function as documentation of a specific period, and other criteria.

- **Paper-Based Archival Heritage :** This encompasses all materials written or printed on paper, including letters, registers, manuscripts, maps, photographs, correspondence, and contracts.

- **Audiovisual Archival Heritage :** Audiovisual recordings provide a living record of lived experience, documenting the activities of individuals and various entities. Documentary films, in particular, play a vital role in preserving archival heritage by depicting historically and scientifically significant events. This category includes microfilm, microfiche, podcasts, and videotapes.

- **Electronic Archival Heritage :** Digital archival heritage represents a collection of symbols recorded on various electronic storage media, such as hard drives and optical discs. This type of heritage is particularly vulnerable to preservation challenges due to factors such as media obsolescence and the obsolescence of reading devices. **(FILIAUX, Véronique, 2002, p. 15)**.

B. Intangible Archival Heritage : The classification of intangible archival heritage varies depending on storage location :

- **Archival Heritage Stored in Databases :** Databases provide a method for organizing and linking files to create a cohesive data set that is easily preserved. This type relies on electronic devices and yields abundant and diverse outputs depending on the type of data stored.

- **Archival Heritage Stored in Digital Repositories :** Digital repositories serve as shared spaces for archiving, preserving, and ensuring easy online access to digital files. They offer technical services for data management and processing, while also enabling users to connect with data from traditional printed sources.

- **Archival Heritage Stored in Databases :** Databases organize data into sets of interconnected tables via various fields, facilitating preservation and the production and extraction of new data.

- **Archival Heritage Stored in Data Containers :** Data containers are essential for long-term data storage and preservation, offering advanced archiving solutions with large storage capacities for the development of digital data archiving.

- **Archival Heritage Stored in Portals and Directories :** Portals and directories are linked to databases and networks, allowing for the collection and long-term storage of metadata via digital portals.

- **Archival Heritage Stored in Cyberinfrastructures :** These infrastructures enable the secure and reliable preservation of digital heritage, but require adherence to technical standards and coordination between archivists and artificial intelligence specialists. They also facilitate data exchange and resource sharing through sensor networks, analytical tools, and common policies.

- **Archival Heritage Stored in Cloud Computing :** Cloud computing offers various storage options, both public and private, facilitating efficient and easy online data storage.

- **Archival Heritage Stored in Information Centers :** Information centers are major centers for collecting and preserving data using numerous devices in non-structured databases, regardless of whether the data is raw or derived. These centers contribute to providing storage.

- **Archival Heritage Stored in Automated Institutional Programs :** A wide range of programs are used to manage and preserve data over the long term, whether ready-made, downloaded online, custom-designed, or open-source, providing diverse solutions for data archiving and organization **(Cheikhi, Fatima Zahra, 2024, pp. 147-150)**.

3. Digital Transformation Of Archival Heritage :

Archival heritage is no longer merely a repository of the past ; it has become a dynamic force interacting with contemporary cultural evolution and digital transformation. It has transformed into a complex network of meanings and symbols connecting the past, present, and future, fostering a continuous bridge between them. Its role has expanded beyond the mere preservation of historical documents to encompass the integration of these past records with contemporary culture and the ongoing digital transformations experienced by humanity in the context of modern media and communication technologies.

3.1 Defining the Digital Transformation of Archival Heritage :

The terms "digital transformation" and "digitization" are often conflated in academic research and studies, largely due to the use of the English term "digitalization" to describe both. However, a crucial distinction exists : adding the word "strategy" or "policy" clarifies the difference.

- **Digitization :** This is the process of converting data or information from its traditional format into a digital format. For example, converting paper documents into MP3 files or a cassette tape into a PDF. This process aims to facilitate the preservation, access, management, availability, and sharing of information more quickly and efficiently **(Al-Jamal, Ahmad Qasim, 2013, p. 16)**.
- **Digital Transformation Strategy :** This is a broader and more comprehensive process than digitization. Digital transformation involves strategies for converting data from its original sources—such as books, images, and audio recordings—into a digital form processable by computers using the binary digital system. This relies on various tools, most importantly scanners and digital cameras **(Abdel Hamid, Bashi, 2023, p. 6)**.

Therefore, digital transformation is more than simply converting data into a digital format ; it represents a fundamental shift in systems and policies

3.2 The Significance Of Digital Transformation for Archival Heritage :

The importance of the digital transformation of archival heritage can be demonstrated by comparing the advantages of analog archival heritage with its digital counterpart. The following table highlights these differences :

Table 1 : Comparison of Analog and Digital Archival Heritage

Feature	Analog Archival Heritage	Digital Archival Heritage
Storage Medium	Physical materials (paper, leather, clay, etc.)	Digital data stored on devices and digital spaces, etc.
Accessibility	Requires physical access to the archive	Accessible from anywhere with internet connectivity
Access Speed	Slow, especially for large archives	Very fast, particularly with access permissions
Preservation	Vulnerable to damage and deterioration over time	Challenged by data loss if not properly preserved or due to technological obsolescence
Protection	Vulnerable to theft and natural disasters	Vulnerable to hacking, data breaches, and cybercrime
Cost	High preservation and storage costs	Lower preservation and storage costs
Sustainability	Relies on perishable analog materials	Relies on constantly evolving technology, making preservation more complex
Concurrent Access	Limited to a small number of users	Wide access for many users simultaneously
Search	Slow, manual search ; often inaccurate	Accurate and fast digital search using keywords
Modifiability	Static ; difficult to modify	Flexible ; easily modified and reformatted by creators and authorized personnel
Replication	Requires manual copying to ensure preservation	Easily replicated without loss of quality
Sharing	Requires sharing physical copies or images	Easily shared online
Usage	Limited uses with risk of damaging originals	Multiple uses without restrictions

Source : This work was prepared by the researcher

3.3 Reasons for the Shift Towards Digital Archival Heritage :

Digital transformation strategies in the archival field are crucial for addressing the challenges facing traditional archives, which can be summarized as follows :

- **Massive Increase in Documents :** Institutions routinely generate enormous quantities of documents daily, making their efficient management and preservation in a traditional environment extremely difficult, This reality has compelled various heritage institutions to

adopt digital transformation as an imperative, not an option, to accommodate the massive explosion of documentary materials.

- **Technological Advancements :** Given the digital revolution sweeping through all fields of communication and information, the archival field is no longer immune to these developments that have impacted all sectors. It has become imperative for archives to keep pace with these technological advancements, integrating technology and its tools into their various practices. This is especially crucial given their unique role as the sole link between these sectors and as the enduring bridge between past and present.

- **Limited Resources :** Archival heritage institutions often suffer from a lack of budgets, qualified personnel, and sufficient space for storing paper documents, Traditional documents and materials consumed significant storage space and resources, resulting in substantial financial expenditures for maintenance, preservation, processing, access, and other costs. Furthermore, archivists invested considerable time and effort in these tasks. Digital transformation has significantly reduced or eliminated many of these expenses and burdens.

- **Deterioration and Loss of Documents :** Direct manual handling causes damage to documents and physical materials, exacerbating their physical condition and accelerating deterioration. This threatens their integrity and intellectual value, eliminating any future potential for access and use. Digitization, however, provides protection and security, particularly for traditional materials vulnerable to various natural and human-caused forms of damage. It achieves this by creating exact digital copies that serve the same purpose and retain the same informational value.

- **Inefficiency of Operations :** Traditional archival environments rely on the individual skills of human operators for processing, archiving, preserving, and retrieving information. This makes archival work prone to error and limits the accuracy and efficiency of operations, Human error is an inherent risk in traditional archival environments, while it is virtually eliminated in the digital environment of computers, hardware, and software. This factor is now among the most significant drivers of the shift towards digital transformation.

- **Deterioration and Loss :** Archival documents in traditional environments are susceptible to deterioration, decay, and fragility due to environmental factors such as dust, humidity, and temperature, thus jeopardizing their integrity.

- **Low Security and Confidentiality :** The absence of a robust security system compromises the confidentiality and protection of documents, making them vulnerable to theft and unauthorized access, Furthermore, in addition to lacking security and confidentiality, traditional paper archives are threatened by arson and deliberate destruction ; their loss represents total and irretrievable destruction, as they are stored in a single location. In contrast, digital archives offer high levels of security and confidentiality, thanks to cybersecurity and intrusion prevention programs, and numerous security strategies such as electronic signatures, digital watermarking, facial recognition, and others.

- **Time and Effort Waste :** Another drawback of traditional environments is their high cost in terms of time and effort, which is particularly evident during retrieval and access. Searching traditional paper-based indexes is a time-consuming and laborious process, hindering workflow and impacting the efficiency and transparency of these institutions. In contrast, automated searching, particularly advanced systems, offers ease, speed, and efficiency, providing near-instantaneous access to information.

- **Encouragement of Innovation :** Digital transformation technologies enable new opportunities for providing advanced archival services and developing more efficient workflows, Furthermore, the digital environment encourages employees to strive for excellence and innovation in their work, fostered by a constantly modernizing and evolving setting.

- **Expansion of Services :** Digital transformation can expand the reach of archival services to a wider range of beneficiaries, facilitating access to information and stimulating institutional development. **(Aqab, Zineddine; Kharabsha, Salem, 2022, p. 567)**

3.4 Requirements for the Digital Transformation of Archival Heritage

The digital transformation of archival heritage represents a crucial step in preserving this heritage for future generations and ensuring broad access and utilization. This process necessitates several key requirements, which can be categorized into three main sections :

A. Administrative Requirements :

- **Management Approval and Authorization :** Obtaining full approval and authorization from upper management is essential to secure the necessary resources for a successful transformation, Such a significant undertaking cannot be commenced without the prior authorization of senior management, particularly given their responsibility for budgeting, planning, and other crucial aspects.

- **Planning :** This step involves assessing the institution's readiness for digital transformation. The institution must evaluate its existing infrastructure and determine whether its current software, tools, and systems adequately meet present and future needs. This assessment will inform decisions regarding which services to upgrade, and which processes to automate or improve. Consequently, the institution can optimally allocate resources, efforts, and investments toward its digital transformation strategy. A comprehensive plan will then be developed, outlining project objectives, implementation phases, timelines, budgets, and resource allocation to ensure successful transformation.

- **Feasibility Study :** A feasibility study should be conducted to assess the economic and technical viability of the project, determine the return on investment (ROI), and estimate the total project cost. The institution must also consider its ultimate goals and desired outcomes, setting long-term objectives and focusing on the desired employee experience. Therefore, it needs to develop a strategic vision based on current resources and objectives to achieve a global vision in the future.

- **Budgeting :** A comprehensive budget must be prepared, detailing all anticipated expenses, including equipment and software costs, labor costs, maintenance costs, training costs, consulting and hosting costs, and scanning and digitization costs.

- **Leveraging Past Experiences :** Lessons learned from other institutions' experiences with the digital transformation of their archival heritage should be utilized, studying best practices and choices, and learning from both successes and failures. **(Sayed Mohammed, Manal, 2017, p. 338)**

B. Functional Requirements :

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- **Data Protection :** Digital data must be protected from cybercrimes such as damage or theft using appropriate security technologies, Platforms and applications must be developed to protect against cyberattacks and ensure confidentiality and privacy in both the technical and administrative aspects of digitization and information management. Greater information security directly correlates with increased organizational and user willingness to adopt digital environments.

- **Ease of Access :** Easy access to digitized and made-available archival heritage must be ensured through the development of a user-friendly interface and provision of effective search tools, Robust internet connectivity and modern hardware are also essential.

- **Secure Data Access :** Secure access to digital data must be provided by defining access levels and user rights, and implementing access control technologies.

- **Ease of Search and Retrieval :** Easy searching and retrieval of information from digital archives must be ensured using advanced search techniques and developing specialized search tools.

- **Interoperability :** Digital data must be compatible with global storage and access standards, using storage standards compliant with the International Organization for Standardization (ISO) and conversion technologies compliant with digital exchange standards.

- **Management of the Digital Archival Heritage Lifecycle :** The entire lifecycle of the digital archival document must be managed, including creation, modification, approval, storage, access, and preservation. **(Westerman,G, Bonnet, D., & McAfee, 2014, p. 138)**

C. Implementation Requirements :

- **Equipment Selection :** A comprehensive digital infrastructure must be implemented, encompassing hardware components such as scanners, software, operating systems, databases, platforms, and other necessary elements to support the digital transformation strategy. This infrastructure must be modern and robust to ensure the efficiency and success of the transformation process.

- **Software Selection :** Suitable software for the transformation process must be chosen, including document conversion software, DMS, backup software, and security software.

- **Digital Training :** This can be achieved through institutional training programs designed to equip archivists with the skills to utilize modern equipment, technologies, and software. This enhances work efficiency and optimizes the management of digital archival heritage.

- **Implementation :** The transformation process should be implemented gradually, starting with the digitization of documents into digital formats. Appropriate scanning resolution should be selected using scanners, and the transformation should be monitored with any challenges addressed during and after the transition.

- **Monitoring :** The digitally transformed archival heritage must be monitored periodically by checking data integrity, ensuring compliance with standards, and identifying any potential problems. **(Bouafia, Said, 2019, p. 243)**

   4. **Analysis and Discussion of Results:**

- Archival heritage constitutes the memory and identity of a society, encompassing all materials—analog or digital—containing significant information about the past or present.
- Recognizing the heritage status of archives is crucial, as they form an integral part of the world's cultural heritage.
- The conversion of archival heritage to a digital environment is a more extensive process than mere data transfer ; it represents a fundamental shift in institutional systems and policies.
- Digital transformation strategies for archival heritage are adopted to achieve numerous benefits, most importantly addressing the challenges inherent in traditional archival environments, such as : the sheer volume of holdings, inefficient workflows, the need to expand service reach, and information security concerns.
- Archival institutions undertaking the digital transformation of their holdings must adhere to several key recommendations :
  - Investing in the necessary technological infrastructure for digital transformation.
  - Establishing clear policies for the protection of digital data.
  - Training and developing human resources to effectively manage and administer digital archival heritage.
  - Fostering collaboration among archival heritage institutions to share expertise and resources.

Conclusion :

In conclusion, this study finds that the digital transformation of both tangible and intangible archival heritage is of paramount importance, particularly in ensuring its protection and preservation from damage and loss, and in facilitating access and availability. However, this process faces numerous challenges that hinder the achievement of these goals, most notably : rapid technological updates, the protection of digital data, and a lack of skilled personnel.

Therefore, we recommend investing in infrastructure and technology, training personnel, and exchanging expertise with institutions working in the same field.

Sources and références

Abdel Hamid, Bashi. (2023). *r The Impact of Digital Transformation on Human Resource Management Practices: In Business Organizations—A Case Study of Algérie Télécom.* Tebessa, Algeria: University of Shahid Sheikh Larbi Tebessi.

Al-Asaf, Saleh Bin Hamad. (2006). *The Gateway to Research in Behavioral Sciences.* Riyadh: Al-Ubikan Library.

Al-Jamal, Ahmad Qasim. (2013). *Digital Transformation in Arab Higher Education Institutions: Realities, Challenges, and Future Approaches.* Benghazi, Libya: National Library Press.

Aqab, Zineddine; Kharabsha, Salem. (2022). The Transformation Between Traditional and Electronic File Archiving. *Arab Journal of Scientific Publishing*, 567.

Bénédicte GRAILLES. (2013). Les archives sont-elles des objets patrimoniaux ? *La Gazette des archive*, 2-6.

Bouafia, Said. (2019). Challenges of the Transition to Digital Archives in Algerian Public Administrations: A Field Study in the Executive Directorates of Biskra Province. *Bibliophilia Journal of Library and Information Studies*, 243.

Cheikhi, Fatima Zahra. (2024). The Challenges of Digital Data Archiving Techniques in Maintaining the Storage Capacity of Archives: A Study of the Nafta-Batna Archive. *Al-Muqaddima Journal of Humanities and Social Studies*, 147-150.

Concepts and Components, under the Cultural Heritage Act. (2024, 07 27). *Archival Heritage Definition*. Récupéré sur Montreal City: https://ville.montreal.qc.ca/siteofficieldumontroyal/file/3800

FILIAUX, Véronique. (2002). *Les archives : diversité,* nouveauté*, besoin.* Tanzanie :: archives de l'université catholique de Louvain.

Fouad Soufi. (2012). Les archives:Une problématique patrimonialisation. *Insaniyat*, 12.

Ibn Manẓūr. (1999). *Lisān al-ʿArab*. Récupéré sur Dār Iḥyāʾ al-Turāth al-ʿArabī:: https://ketabpedia.com

Ibn Manẓūr. (2014). *Lisān al-ʿArab.* Cairo: Dār al-Maʿārif.

Imād, Abd al-Ghani. (2006). *Sociology of Culture: Concepts and Issues from Modernity to Globalization.* Lebanon: Arab Unity Studies Center.

Ismail, Ben Melouka. (2021). Cultural Heritage and its Role in Reviving Desert Tourism. *Haqoul Ma'rifiyya Journal*, 212.

Jokilehto, J. (2005). *DEFINITION OF CULTURAL HERITAGE.* ICCROM: Heritage and Society'.

Mohamed Suwailem. (2018). The Legal Protection of Tangible Cultural Heritage: And Its Impact on the Development of Tourist Investment in Algeria. *Al-Ijtihad Journal of Legal and Economic Studies*, 243.

Sayed Mohammed, Manal. (2017). Digital Conversion and Remote Access to Archival Documents - Requirements and Stages - An Applied Study on the Al-Azhar Memory Project. *Egyptian Journal of Information Science*, 338.

UNESCO Convention. (1972). *Measures to be Taken to Prohibit and Prevent the Illicit Import, Export and Transfer of Ownership of Cultural Property.* Paris.

United Nations Educational, Scientific and Cultural Organization (UNESCO UNESCO Recommendation. (2015). *UNESCO Recommendation concerning the Preservation of, and Access to, Documentary Heritage, including Digital Heritage.* Paris: General Conference, 38th session.

Westerman,G, Bonnet, D., & McAfee. (2014). *Turning technology Into Business Transformation.* Boston Massachusetts: Harvard business review press.