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Managing low-cost digitization projects in Least Developed Countries and Small Island Developing States

A Manual

Digitization is a key ingredient in preserving and accessing documentary heritage

The COVID-19 pandemic caused library, archival, museum and similar services to close because of the lockdown policies enforced by governments across the globe in response to the public health crisis. For many such organizations, online services became the lifeline through which they could meet their audiences' information needs.

The pandemic threw into sharp relief the need for digitization as a strategy for ensuring not only the preservation but also the online accessibility of documentary heritage as a knowledge asset.

A key issue is the inability – often associated with budgetary constraints – to undertake large-scale digitization projects which can enable their libraries, archives, museums and other holding places to continue providing services in health emergencies that require little or no physical movement by the provider and the user.

This publication fills this gap by i) providing such memory institutions with state-of-the-art technical information on how to manage low-cost digitization projects; and ii) highlighting existing resource opportunities and partnerships for such digitization projects.

The interactive multimedia archive system (AIME) is now used in

21 African countries

A good example is the interactive multimedia archive system (AIME) which, is now used in 21 African countries to digitize and archive several thousand hours of audiovisual documents.

Furthermore, this publication looks beyond the technical aspects of digitization and links the concept to its implementation across the entire management chain of memory institutions.

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'Since wars begin in the minds of men and women it is in the minds of men and women that the defences of peace must be constructed'

Managing low-cost digitization projects in Least Developed Countries and Small Island Developing States

A Manual

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1. Introduction

Why this manual

UNESCO launched the Memory of the World (MoW) Programme in 1992 to protect against collective amnesia and to call for the preservation of the valuable archive holdings and library collections all over the world, with a view to ensuring their wide dissemination.

Digitization of documentary heritage is an essential pillar of achieving the aim of the MoW Programme. In particular, the demand for the digitization of documentary heritage is on the rise in the wake of coronavirus disease (COVID-19), which has resulted in suspended and more limited access to documentary heritage across the globe.

However, the digitization of documentary heritage requires a large budget, digitization policy and trained personnel. These requirements are a burden for the Least Developed Countries (LDCs) and Small Island Developing States (SIDS), even though these countries agree on the need for digitization.

Against this backdrop, the MoW Programme has decided to publish 'Managing low-cost digitization projects in Least Developed Countries and Small Island Developing States: a Manual', to contribute towards the digitization of documentary heritage within poorer memory institutions.

In particular, the Manual seeks to:

1. Provide LDCs and SIDS with state-of-the-art information on how to manage low-cost digitization projects by sharing practice-oriented guidelines along with international context for digitization and framing the process within their own unique contexts.

2. Highlight technical resources for managing low-cost digitization projects such as examples of low-cost digitization projects, affordable technologies and so forth.

3. Give advice on available funding opportunities for digitization projects and encourage LDCs and SIDS to build a network with other memory institutions that have digitized their documentary heritage.

UNESCO hopes that the Manual will not only improve the accessibility of documentary heritage through the MoW Programme, but that it will also help achieve the United Nations Sustainable Development Goals, particularly in the field of quality education; sustainable cities and communities; and peace, justice and strong institutions

The need for digitization of documentary heritage

Digitization of documentary heritage is closely linked with objectives of the Memory of the World (MoW) Programme, particularly in terms of preservation of the world's documentary heritage and universal access to documentary heritage:

Preservation of the world's documentary heritage

A recent survey conducted by the MoW Programme on disaster risk reduction for documentary heritage found that documentary heritage in LDCs and SIDS is exposed to risks such as natural disasters, poor and inadequate storage, civil disturbance, looting, armed conflict, illicit trafficking and so on. Also, over 60 per cent of institutions surveyed do not have a management plan in preparation for emergency or disaster.

Digitization in line with international standards will sustain the evidential value of records in case of emergency or disaster, as well as protecting documentary heritage by minimizing physical access to original documentary heritage.

Universal access to documentary heritage

Documentary heritage is an asset of humanity that should be shared with the global community without discrimination, thereby contributing to mature democratic societies.

Digitization enables people not only to access to documentary heritage, but also to use it in various ways. This is advocated in the UNESCO Recommendation concerning the Preservation of, and Access to, Documentary Heritage Including in Digital Form (2015).

How the manual can be used

Digitization is an avenue that must be explored for the preservation and protection of documentary heritage, especially in the twenty-first century when more digital records and documentary heritage are created and utilized than ever before.

Needless to say, the benefits of digitization should be shared out equally throughout the global community. This is the reason for UNESCO publishing this Manual.

How the Manual can be used:

Getting to grips with digitization

◆ Users can learn why digitization is necessary and gain insight into the international context in terms of digitization.

◆ Also, the Manual can be used for persuading policy-makers and decision makers to set aside a budget for digitization.

Digitization planning

◆ Ahead of a digitization project, users can plan how to begin digitization within their agency or institution in a cost-effective and step-by-step way by reading the sections on digitization in the context of LDCs and SIDS and managing low-cost digitization projects.

◆ Prior to the digitization of documentary heritage, users might consider which technologies to use.

◆ Also, users could use digitization support networks and initiatives in LDCs and SIDS.

Funding opportunities

◆ Users could find funding by using digitization support networks and UNESCO networks.

◆ Updated news

◆ Since the Manual is updated on a regular basis, users are kept informed of state-of-the-art technologies and best practices for successfully digitizing documentary heritage on a low budget.

2. Preservation of digital heritage

UNESCO PERSIST Project (Platform to Enhance the sustainability of the Information Society Transglobally)

Jungho SEO[1]

Introduction

Records are by-products of humans' individual, institutional or business activities, and are composed of contents, context and structure. Records are mainly divided into two categories, based on storage medium: analogue records and digital or electronic records (including born-digital works). Digital heritage is made up of digital records or electronic records of enduring value that should be permanently kept for future generations.

According to the UNESCO Charter[2] for the Preservation of Digital Heritage, resources of human knowledge or expression (cultural, educational, scientific, administrative, technical, legal, medical or other) are increasingly created digitally or converted into digital form from existing analogue records. Digital records largely use software and hardware, which are becoming obsolete as time passes. This is unlike analogue records, whose contents and medium are not separate.

Against this backdrop, UNESCO established PERSIST (Platform to Enhance the sustainability of the Information Society Transglobally), which is based on the UNESCO/UBC Vancouver Declaration[3] from the Hague International Conference held in May 2013. The Declaration called for a road map for solutions, agreements and policies to ensure long-term access and reliable preservation of digital information. This was intended to support a dialogue and joint actions of key stakeholders around barriers and opportunities for achieving long-term preservation and access to digital heritage.

Overview of PERSIST

The PERSIST[4] project is based on cooperation among memory institutions (International Council on Archives (ICA), International Federation of Library Associations and Institutions (IFLA), International Council on Museums (ICOM) and so on.), government agencies in each country and the ICT industry. The aim is to make a contribution to the Sustainable Information Society.

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1   Loaned Expert (2018-2021), UNESCO.
2   UNESCO Charter on the Preservation of Digital Heritage.
3   UNESCO/UBC Vancouver Declaration, 2012. unesco_ubc_vancouver_declaration_en.pdf.
4   See more from UNESCO PEERSIT Programme: About PERSIST – UNESCO PERSIST Programme.

Figure 1. PERSIST operational model
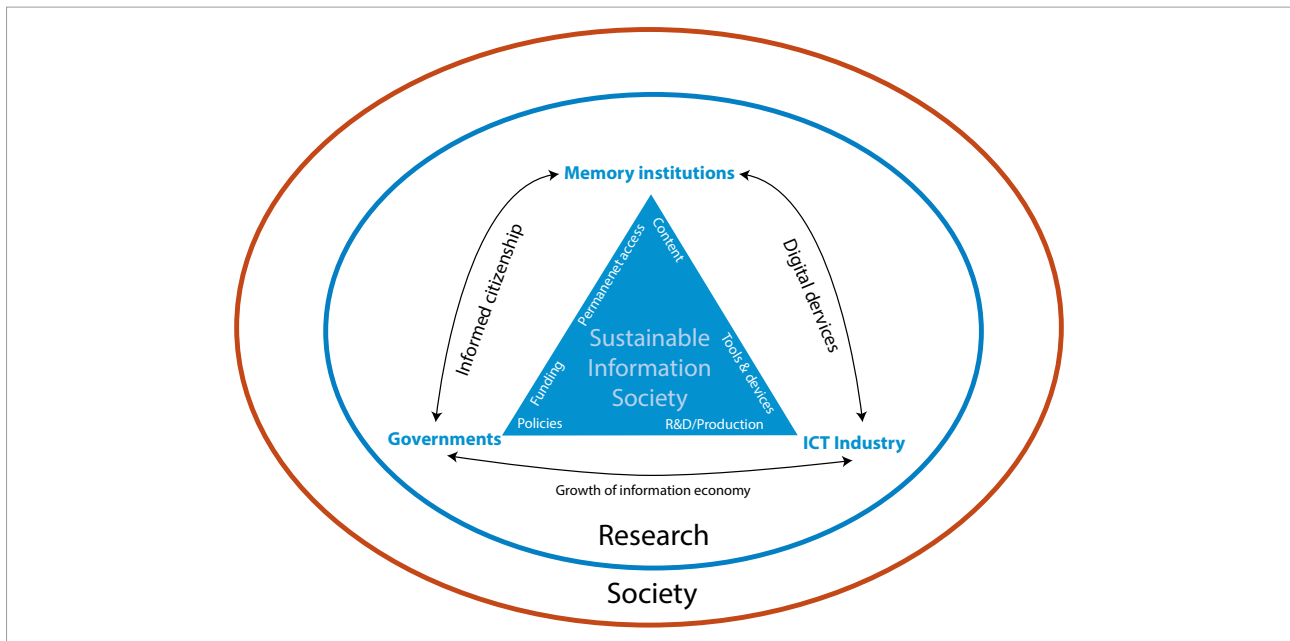
Within PERSIST, there is a Programme Committee and three working groups (Policy; Technology and Research; and Content and Best Practices). The Programme Committee mainly formulates policies and direction for digital heritage preservation and follow-up actions, while the roles of the three working are outlined below:[5]

◆ Digital Preservation Policy: to help governments and memory institutions research and analyse strategies and policies in relation to digital preservation and results within the international community.

◆ Technology and Research: to bring together memory institutions and the ICT industry, so that they may join forces on initiatives such as documentary heritage software archiving.

◆ Content and Best Practices: to improve best practices for the preservation of digital contents.

The Memory of the World Secretariat provides administrative supports for PERSIST and plays an advisory role in terms of its worldwide networks.

Main achievements and activities of PERSIST

Software platform for the long-term preservation of digital heritage

The aim of PERSIST is not only to ensure continued access to and use of digital heritage irrespective of software and hardware (which are becoming obsolete in the midst of technological development), but also to preserve digital heritage for the next generation.

All efforts come down to the software platform, which organizes the eco-system based on open-source software and preserves obsolete software and hardware to ensure permanent access to digital heritage for memory institutions.

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5   See more from UNESCO PERSIST Activities – UNESCO PERSIST Programme.

To translate the software platform into action, PERSIST envisages a stand-alone foundation supported by the Memory of the World Programme. However, this concept is based on the understanding that all documentary heritage stakeholders would join forces for its implementation.

The software itself would come from the open-source community, ICT industry, government agencies and non-profit organizations in the form of donations based on prior agreements. PERSIST would award UNESCO Digital Heritage Alliance to software donors. In addition, costly hardware infrastructure and management would likely also be financed through external funding, while the workforce for this software platform would be sourced through cooperation between UNESCO and government agencies worldwide. In addition to these factors, PERSIST is also considering a levy or charge for the use of this platform, as well as funding securement measures and so forth.

Recommendation and selection guidelines for the long-term preservation of digital documentary heritage

In addition to the software platform, PERSIST launched the UNESCO/PERSIST Guidelines for the selection of digital heritage for long-term preservation6 in March 2016 to enable memory institutions to establish coherent policies that ensure continuing access to digital documentary heritage. The Guidelines are now available in English, French, Dutch, Arabic, Lithuanian, Spanish, Serbian, Chinese and other languages, and provide a starting point for heritage institutions drafting their own policies on the selection of digital heritage for long-term sustainable digital preservation.

First of all, the Guidelines urge national institutions and networks to establish proper policies and adapt existing legislation to cover digital material, as well as recommending national selection strategies based on cooperation with all relevant stakeholders.

The Guidelines also highlight the impact of the legal environment on selection. In particular, they underline that a restrictive legal environment (such as copyright restrictions) will negatively impact the long-term survival of important digital heritage. The Guidelines recommend continued cooperation to address legal impediments. The Guidelines also hint at the adoption of international and domestic legislation to overcome barriers to the selection and preservation of digital heritage for public access.

Moreover, the Guidelines recommend a rethink of how heritage institutions identify and assess value of documentary heritage, and advocate the introduction of measures for the long-term preservation of digital documentary heritage. This is because existing authorities and selection policies may not be suited to new forms of documentary heritage (as opposed to traditional forms such as books, periodicals, government records, private correspondence, personal diaries, maps, photographs, film, sound recordings, artefacts and works of art).

Last but not least, the Guidelines suggest strategies for digital heritage collection such as comprehensive collection, representative sampling and selection based on internal selection criteria. The Guidelines also recommend that institutions develop selection criteria through the use of decision trees, as well as emphasizing that selection criteria should be adapted to embrace new forms of digital expression.

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6   See UNESCO/PERSIST Guidelines for the selection of digital heritage for long-term preservation, 2016, persist-content-guidelines_ en.pdf (wordpress.com).

Table 1. Decision tree for Selection within an individual Institution

Step 1. Identification	To identify the material to be acquired or evaluated
Step 2. Legal framework	To review whether an institution has a legal obligation to preserve the material
Step 3. Application of selection criteria	To assess the material using three selection criteria: significance, sustainability and availability to identify if it should be preserved
Step 4. Decision	To review all the records made during the process and make a decision based on the results from steps 1 to 3

Expansion of networks and cooperation across borders

Since it was created, PERSIST has continuously provided useful information on digital heritage preservation to the memory community through workshops, seminars, conferences and so on across the globe.

Against the backdrop of COVID-19, PERSIST project experts were involved in the UNESCO Virtual Policy Dialogue[7] held on 27 October 2020, which aimed to build an international policy agenda for the digital preservation of documentary heritage. Experts covered preservation topics under four themes: cultural identity, sustainability, technology and legal frameworks. They focused on the policy gaps in digital preservation and put forward some possible digitization measures for countries with a low level of resources.

Conclusion

Other than the achievements and activities listed here, PERSIST has been actively involved in many other projects. To keep abreast of developments in the field of digital heritage preservation, stakeholders should stay informed about the UNESCO PERSIST platform and its activities. Digital preservation matters as time goes by and technologies advance, and the issues will only be tackled when all stakeholders join forces together. The UNESCO PERSIST project will use its convening power to bring together all stakeholders to assess ways of preserving electronic records.

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7   See UNESCO Virtual Policy Dialogue on Digital Preservation, 27 October 2020 – UNESCO PERSIST Programme.

3. Framing digitization in the context of LDCs and SIDS

Digitization of documentary heritage and management of born-digital documents in Africa: issues, challenges and experiences

By Papa Momar Diop[8]

Introduction

Africa is, for the most part, a continent made up of Least Developed Countries (LDCs).

The least developed countries (LDCs) is a list of developing countries that, according to the United Nations, exhibit the lowest indicators of socioeconomic development, with the lowest Human Development Index ratings of all countries in the world…. the first group of LDCs was listed by the UN in … 1971. … As of December 2020, 46 countries are classified as LDC.[9]

Most of them are in Africa. Not counting the Maghreb, Djibouti, Mauritania and Sudan,[10] Africa, or UNESCO's Electoral Group V(a), numbers 46 states, 30 of which, or 65.21 per cent, are in the LDC category.

In these States more than elsewhere, both documentary heritage and born-digital heritage are subject to all kinds of threats and dangers, and deserve to be better protected and managed. However, perhaps because of their LDC status, governments do not give priority to investing in better preservation and management of their documentary heritage, including digital heritage, preferring to earmark those funds for other sectors.

For this reason, institutions responsible for documentary heritage are turning to national or international private sponsors, and to funding through bilateral and multilateral cooperation to finance their projects, which are generally low cost.

Before citing some examples of implementation of such low-cost projects, what follows is an overview of the issues involved in the digitization of documentary heritage and also the management of born-digital documents.

Issues relating to the digitization of documentary heritage in Africa

In terms of the UNESCO Recommendation, documentary heritage includes digital heritage, analogue heritage, digitized heritage and born-digital heritage. In terms of historical research, good governance and citizens'

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9   Wikipedia: https://en.wikipedia.org/wiki/Least_developed_countries.
10   The Maghreb states, Djibouti, Mauritania and Sudan belong to UNESCO's Arab Group, Group V(b).

rights, documentary heritage raises significant issues. To satisfy sustainability standards, documentary heritage (including digital) requires proper digitization and management.

Of all the continents, Africa appears to be the one with the most substantial issues in terms of digitization and the management of born-digital heritage. These relate to Africa's specific historical and sociocultural characteristics, and also to the identification, preservation and accessibility of its documentary heritage.

Issues relating to the specific historical nature of African documentary heritage

The archive depositories and library collections in Africa mainly contain written documents deriving from British, French, Dutch, Belgian, Portuguese or Spanish colonization, as well as the penetration of Arab culture and religion.

Taking the example of West Africa and Senegal, first the Arabs began to arrive in the eighth century, mainly to trade in gum arabic and slaves as part of the eastern trading system between Africa and the Orient, and from the tenth century onwards to spread Islam,[11] which required the inhabitants to be literate in Arabic so they could be taught the Qur'an. Thus, Arabic characters were used by native converts to Islam for the purposes of transcribing indigenous idioms in all kinds of documents. The documents generated from these transcriptions are known as 'ajanis'.

Second came the Europeans, among them the Portuguese, starting in the early fifteenth century, driven by scientific curiosity and the determination to spread the Christian religion, and later by the trade in slaves in the west or across the Atlantic between Africa, Europe and America. In this they were followed by the Dutch, the French and the English. Thus began the European adventure of the colonization of Africa, consolidated by the Berlin Conference. That Conference, held from 15 November 1884 to 26 February 1885, was organized by Otto von Bismarck, the first chancellor of Germany. Germany, Austria-Hungary, Belgium, Denmark, the Ottoman Empire, Spain, France, the United Kingdom, Italy, the Netherlands, Portugal, Russia, Sweden-Norway and the United States took part.[12] With the Berlin Conference, Africa was carved up with arbitrary frontiers defining the new European colonies on the Continent.

Many of the archives came from the colonial administrations. However, as in the case of the French colony of Senegal, documents can be found from European explorers that predate the Berlin Conference. The oldest document conserved in the National Archives dates from 1672.[13]

Essentially, these depositories of written documents were the work of the former colonizers and invaders. That is the case with national archives, libraries and museums and the depositories of ancient manuscripts (in Timbuktu, Chinguetti, Oualata and so forth).

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11 Papa Momar Diop, The Appropriation of the UNESCO Memory of the World Programme in the Socio-cultural Context of West Africa: The Contribution of the Department 'Heritage Professions' of the University Gaston Berger of Saint-Louis of Senegal to a Better Management of Oral Archives, in *The UNESCO Memory of the World Programme. Keys Aspects and Recent Developments*, Springer, Berlin, 2018, p. 130.

12 Wikipedia: https://en.wikipedia.org/wiki/Berlin_Conference.

13   *Observation du Sr. Destival sur la Côte de Guinée.*

Issues relating to the sociocultural specificities of African documentary heritage

Apart from a few territories like Egypt[14] or Ethiopia,[15] writing was not known in Africa until the arrival of those peoples from Europe and Arabia, who remained for many years. Because documents can go back no further than the tenth century, the written history of the Continent and its population cannot be told from written sources alone. Africa, being mainly a civilization of oral traditions, institutionalized a medium for the transmission of its oral sources from generation to generation through veritable living memories, in particular the griots.[16] Any history of Africa written without including these fundamental oral sources could only ever be a truncated version.

The oral sources also include the oral literature made up of stories, legends, epics, riddles, hagiographies and myths.

The major challenge with oral sources is gathering the oral information or archives they contain before they are lost forever. This can only be done by using audiovisual and/or digital recording techniques.

With the emergence of new information and communication technologies and the dramatic upsurge in the use of hard and soft computer technology, Africa has also experienced an exponential growth in born-digital documents. So strong is this trend that documents on paper or other types of analogue media are becoming increasingly rare in modern African administrations and are giving way to born-digital documents.

All of this documentary heritage, in analogue, oral or born-digital form, faces a multitude of risk factors and the danger of deterioration or even destruction. At the present time, the most appropriate way of safeguarding it in the long term is through proper digitization and management.

Issues relating to the identification, preservation, access to and promotion of documentary heritage including born-digital heritage

It is not possible to preserve documentary heritage and make it accessible without first having correctly identified it. The 2015 UNESCO Recommendation concerning the preservation of, and access to, documentary heritage including in digital form distinguishes between two types of identification: identification of documentary heritage having potential national importance or 'the survival of which is at potential or imminent risk', and identification of those elements of documentary heritage to be nominated for inclusion in the Memory of the World Registers.[17]

Identification presupposes a nationwide survey of existing heritage, which can then be catalogued, inventoried and sorted. In the majority of African States, documentary heritage suffers from lack of identification.

Databases can be extremely useful for recording survey findings and inventories of documentary heritage. From this standpoint, a relational database seems the best suited as it can set up systematic dynamic relationships between its own different tables and those of a number of other databases.[18]

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14 The hieroglyphics of Ancient Egypt.
15 The Ge'ez script appeared in the seventh century before Christ.
16 Papa Momar Diop, The Appropriation of the UNESCO Memory of the World Programme in the Socio-cultural Context of West Africa: The Contribution of the Department "Heritage Professions" of the University Gaston Berger of Saint-Louis of Senegal to a Better Management of Oral Archives, in *The UNESCO Memory of the World Programme. Keys Aspects and Recent Developments*. Op. cit. pp. 129-142.
17 Paragraphs 1.3 and 1.4 of the 2015 Recommendation.
18 A non-SQL database uses a variety of formats, such as documents, graphics, wide columns and so on.

In practice, it can locate all heritage items within the national territory that relate to a similar subject or theme.

On the preservation side, the challenge is to give documentary heritage (digitized and born digital alike) as long a life as possible to preserve the memory and make it available to future generations. In this regard, the 2015 Recommendation states:

The world's documentary heritage is of global importance and the responsibility of all, and should be fully preserved and protected for all, with due respect to and recognition of cultural mores and practicalities.

UNESCO and non-governmental organizations, such as the International Council on Archives (ICA), the International Federation of Library Associations and Institutions (IFLA) and the International Council of Museums (ICOM), urge States to give particular importance to the preservation of the digitized and/or born-digital documentary heritage. The 1993 Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples is relevant here, as are the 1999 IFLA Statement on Libraries and Intellectual Freedom, the Moscow Declaration on Digital Information Preservation, adopted at the international conference on 'Preservation of Digital Information in the Information Society', and the 2012 UNESCO/UBC Vancouver Declaration on 'The Memory of the World in the Digital Age: Digitization and Preservation'. Like other States, African countries, as Members of UNESCO and stakeholders in those NGOs, are bound to respect the 2015 Recommendation and the Declarations mentioned above.

Common sense suggests that preservation is pointless unless heritage is accessible and accorded its due value. From this standpoint as well, Africa has much ground to make up considering its documentary potential.

The Continent's libraries and most of its archives are heavily consulted by researchers from African countries and elsewhere. Africanist universities and American library associations have been known to invest in Africa to make its documentation more accessible. One example is the Cooperative Africana Materials Project (CAMP), which has done considerable work with institutions responsible for documentary heritage to improve the cataloguing and inventorying of documentary resources that were not easily accessible. Another is the African e-Journals (AEJP) project based at Michigan State University that, from the early 2000s, has sought to improve the accessibility, visibility and viability of African journals by helping them to develop digital versions of their editions currently available in print.19

On the promotion of African documentary heritage, too, much remains to be done. Looking at the presence of African assets in the International Memory of the World Register, it becomes clear that, despite its relatively high potential, Africa's documentary heritage is very poorly represented. At present, of the 424 assets in the International Register, only 22 are from African States. Taking Africa minus the African countries that belong to the Arab Group (46 states),20 the ratio of number of inscriptions to number of countries is very low (10.12 per cent). Therefore, more nominations for inclusion are needed to achieve a representative critical mass.

Below are some examples of the issues to be addressed by the national institutions responsible for documentary heritage, with the help of their governments and potential international donors. Today, though, the true situation on the ground shows that the process of addressing these issues is often fraught with challenges and obstacles that simply must be overcome.

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19   Antonin Benoît Diouf, Enjeux théoriques et pratiques de la numérisation en contexte africain de périphérie, in https://scienceetbiencommun.pressbooks.pub/classiques25ans/chapter/enjeux-theoriques-et-pratiques-de-la-numerisation-en-contexte-africain-de-peripherie/.
20   See footnote 2.

Challenges and obstacles to digitization and good management of digital heritage

The second Inter-regional Conference of the Memory of the World Programme was held from 5 to 8 November 2019 in the Republic of Korea, on the theme of 'Preserving and Providing Access to Digital Heritage'. The Memory of the World Regional Committee for Africa (ARCMOW) was asked to contribute an update on current progress and challenges in digital heritage preservation in Africa.[21]

ARCMOW is one of the three Memory of the World Regional Committees. In comparison to the other two committees, the African one is dormant, probably owing to organizational and management problems, but also lack of financial means.

It was difficult, therefore, to gather data about the challenges and opportunities in digital heritage preservation. To stay as close as possible to the actual situation on the ground, it was decided to use the results of a survey comprising three questions sent to all ARCMOW members who took part in the Abuja African Consultation for implementation of the 2015 Recommendation. Unfortunately only six responses were received, and these were used. The resulting data were fragmented, and every attempt was made to optimize it. The three questions were:

◆ Does your country or organization have a written national strategy for the long-term preservation of digital heritage?

◆ What training/tools/information would you like to support your work or project for preserving digital heritage?

◆ What are the main challenges you face in the preservation of digital heritage in your country/ organization?

The six responses came from the following countries: Benin, Eritrea, Gabon, Mauritius, Nigeria and Seychelles.

The challenging lack of written national strategies for the long-term preservation of digital heritage

Of the six countries that replied to the questionnaire, two have a national strategy for the long-term preservation of digital heritage. These are Nigeria and Mauritius. Officials in the former country have problems implementing the strategies, while colleagues in the latter know where they are going and have the Government's support.

However, they face some difficulties arising from the lack of good practices and of models for funding and technical expertise. The four remaining countries do not yet have a strategy. By country, the main challenges they face are:

Nigeria:

◆ Implementing the existing strategy

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21   Contribution presented by Mr Papa Momar Diop, Vice-Chairperson of ARCMOW. See: http://www.mowcapunesco.org/wp-content/uploads/CONFERENCE_PROCEEDINGS_13112019-merged.pdf.

Seychelles:

◆ Lack of good practices/models

◆ Lack of funds

◆ Lack of technical expertise

Eritrea:

◆ Lack of administrative support

Gabon:

◆ Lack of good practices/models

◆ Lack of funds

◆ Lack of technical expertise

◆ Lack of administrative support

Benin:

◆ Lack of administrative support

Mauritius is the only one with a national strategy that is being implemented, despite some difficulties.

The challenging lack of training to support the preservation of African digital heritage

None of these countries has a school or tools for training people in heritage preservation. However, Gabon plans to implement a system of electronic document management (EDM) called 'Gabon Digital 2025'.

Countries are therefore asking for:

◆ Administrative support from governments

◆ Regional cooperation for digital sustainability

◆ Good practices/models

◆ Funding

◆ Technical expertise

◆ Sharing of information and solutions

◆ Defined standards for content and metadata

◆ Shared tools/references and so forth.

In addition to these challenges identified by the survey, there are also constraints relating to electronic document management (EDM) in Africa.

The challenges of electronic document management (EDM) in Africa

EDM is a set of processes using electronic computer-based instruments such as software programmes and packages for the fast and optimal management of documents (both physical and digital). EDM allows documents to be made swiftly accessible and usable by generating metadata to enable more sophisticated indexing.

Africa, like all continents, is witnessing a dramatic increase in the use of EDM. This system was welcomed at the outset in Africa, where documentary heritage suffers particularly from problems of conservation and access. This is because the continent faces geographical, climatic, economic and political factors that are not generally conducive to the proper management of its documentary heritage. Examples include problems relating to unsuitable conservation spaces, the lack of appropriate material and technological means of management and insufficient trained human resources.

The majority of EDM systems in Africa in the structures used for documents are funded by bilateral or multilateral donors or by open-source system providers.

The challenges of budgetary contingencies and the risk of regime changes leading to abandonment of digitization projects

African governments do not seemingly make conservation a priority, and as a result the budgets allocated to archives and libraries fall well short of needs or aims in terms of the preservation, digitization and management of documentary heritage.

There are also examples of digitization projects being abandoned following a change of government or ministerial reshuffle. This was the case in Senegal. President Abdoulaye Wade had resolved in 2010 to proceed with the digitization f the archives of French West Africa (AOF),[22] which is the common heritage of nine West African States. Unfortunately for the project, the President left power in 2012 and the new regime has not taken up the mantle.

This prompted Benjamin Polle to write:

> *While the former Senegalese Head of State, Abdoulaye Wade, committed to having a building constructed in Dakar for the archives, which will in effect be African archives, and at the same time have them digitized, as he told Afrique Magazine in 2010, no work has been done on it since.[23]*

That said, there have been some examples digitization and management of born-digital documents, though in general these were low-cost and funded by foreign or multilateral donors.

Examples of low-cost digitization in Africa

As regional documentation stands, most digitization projects are relatively low cost. If one considers the cost of digitization of an archive deposit like that of the National Archives of Senegal, which is 17,000 linear metres, a volume of roughly 17 million pages, an average estimate would be €14,110,000. That calculation is based on

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22   The federation of French West Africa (AOF) existed from 1895 to 1960, with Dakar as its capital.
23   Benjamin Polle. Numériser le patrimoine: les ambitions africaines d'Arkhênum: https://www.jeuneafrique.com/423960/economie/numeriser-patrimoine-ambitions-africaines-darkhenum/.

€0.83 per page. The estimate, which covers all the work of digitization including optical character recognition (OCR) processing,[24] is from Thierry Uske.[25]

However, the documentation available on digitization costs in Africa shows that the highest amount of investment identified is €685,000.

To illustrate this, below are some examples of projects for the management and digitization of documentary structures.

The first is the Digital Capital project, which brings together seven African and European actors to boost African audiovisual heritage. This project, aimed at renewing African cultural heritage, relies mainly on dematerialization and archive systems supported by the Organisation internationale de la francophonie (OIF). It has received €685,000 in funding over three years from the ACP Cultures+ Programme from the African, Caribbean and Pacific Group of States together with the European Union. This example was discussed by Lassané Tapsoba[26] and Marc Bidan,[27] who have produced an informative paper[28] on the constraints involved in EDM on the Continent.[29]

The second is the scalable interactive multimedia archive system (AIME), made available by the International Council of French-speaking Radio and Television Organizations (CIRTEF). This is a software programme for the archiving and documentary processing of the audiovisual data and archives of radio and television channels. AIME is becoming an indispensable tool in French-speaking Africa for archiving audiovisual documents. AIME is used in 21 African countries: Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Gabon, Guinea, Madagascar, Mali, Morocco, Mauritania, Mauritius, Niger, Senegal, Seychelles, Togo and Tunisia.

Thanks to AIME, an interface available in three languages (English, French and Arabic), it has been possible to digitize and archive several thousand hours of audiovisual documents. It makes it possible to index, segment export and locate data; as well as managing the administration of users by profile.

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24 According to the French graduate school of information and library sciences, ENSSIB, Optical Character Recognition is the processing of an image (the text is scanned, as by a photocopier) using a software programme that recognizes characters: the software decrypts the forms and translates them into letters. See: https://www.enssib.fr/services-et-ressources/questions-reponses/bonjour-quest-ce-que-locerisation-merci-beaucoup-pour.

25 Bachelor HES, Swiss Federal Institute of Technology, Lausanne (EFPL), *Etude préliminaire en vue de la numérisation de la documentation scientifique de l'EPFL*, in file:///C:/Users/momar%20diop/Downloads/Uske_T_Memoire_travail_diplome_bachelor_2011_EPFL_Bibliotheque.pdf.

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27 Professor of management sciences specializing in information systems management at the University of Nantes.

28 Les défis de la gestion électronique des documents en Afrique, (theconversation.com).

29 Lassané Tapsoba and Marc Bidan. *Les défis de la gestion électronique des documents (GED) en Afrique*, in https://theconversation.com/les-defis-de-la-gestion-electronique-des-documents-en-afrique-102826.

According to Hamet Bâ,[30] AIME was 'developed as part of the Digital Capital project implemented by the Organisation internationale de la francophonie (OIF) in the period 2014-2016 and jointly funded by the Secretariat of the ACP States (Africa, the Caribbean and the Pacific)'.[31] Mr Bâ adds:

> *In March 2014 INA was given the task of developing a new version of the AIME software (V4), and designing the Archibald website. The aim of this platform is to link the AIME stations of twenty African countries to a centralized archive platform. In this way, each body of archives put together via local means of storage, digitization and indexing, will be permanently stored in a single place with the prospect of exchanging programmes in the future. The proposed system is based on simple solutions, with the option for user countries of evolving towards more sophisticated solutions with the improvement in infrastructure, especially network speed.[32]*

However, there are some efficient EDM systems developed in Africa to meet the needs of document management, especially for administrative documents. The third example is GAINDE-ORBUS 2000 in Senegal. This system was designed as a real 'one-stop shop' by the various stakeholders in foreign trade (import and export), including banks, insurance companies, verification and standards bodies, transit and customs services and the Ministry of Trade. The procedures and operations involved in foreign trade are made easier by electronic exchanges between the various actors, by eliminating what sellers used to describe as an 'obstacle course'. ORBUS has meant a significant reduction in the time taken for pre-customs clearance formalities and a reduction in the cost of these processes and improved quality of service to the customer, as well as paperless processing.

The fourth example is that of the collections of the Institut Fondamental d'Afrique Noire Cheikh Anta Diop (IFAN) of the University of Dakar, entirely funded by €410,482[33] from French cooperation: 'African cultural property. Safeguarding and promoting the documentary, audiovisual, iconographic, sound and text-based heritage of IFAN Cheikh Anta Diop'. The aim of the project, launched in 2007, was to use digitization to better safeguard the collections, the oldest of which were 70 years old. These collections comprise 5,784 manuscripts, 62,640 monographs, the 750 William Ponty Papers (inscribed in the International Memory of the World Register in 2017), 6,200 maps and a substantial body of reports, press cuttings and audiovisual and photographic documents. The effort was crowned with success when this rich and varied documentary heritage was put online from 2009.

The fifth experience is that of the digital library of scientific and technical information of Burkina Faso, financed with around €3 million from the Institute for Research and Development (IRD). The project, carried out in 2004, created a digital library of 120,000 pages of scientific documents from 13 institutions in Burkina Faso. The library's resources can be accessed via the website developed using the free software Greenstone.[34]

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30 Specialist in African audiovisual archives and the legal deposit, promotion and digitization of heritage. Consultant, independent researcher, part-time teacher at the Universities of Dakar and Saint Louis, Senegal, former Head of the Audiovisual Archives Unit at Senegal Radio and Television.

31 Hamet Bâ**,** *Valoriser son patrimoine audiovisuel, enjeu africain à l'ère de la TNT*. In   https://larevuedesmedias.ina.fr/valoriser-son-patrimoine-audiovisuel-enjeu-africain-lere-de-la-tnt.

32 Ibid.

33 Mody Sow, *Les bibliothèques et archives électroniques au Sénégal* /Digital libraries and archives in Senegal, http://wiredspace.wits.ac.za/jspui/bitstream/10539/8946/1/31%20Sow%20Biblioth%C3%A8que.pdf.

34 Pier Luigi Rossi, *Numérisation et bibliothèques électroniques : bilan de 15 années de formations réalisées par l'IRD au bénéfice des professionnels de pays de l'Afrique francophone*. Paper given to the Fifty-Year Colloquium of EDAB, Dakar, 14-16/11/2017, in https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers17-12/010071833.pdf.

The project began with workshops to train a five-person team in digitization. The Greenstone software was configured to extract and manage metadata allowing searches by field, and also the generation of presentation and browsing lists (classifiers) according to different criteria (browsing lists by title, author or publication date).[35]

Apart from these projects that have received external funding, there has been one national project financed using extremely limited resources by amateur digitizers using whatever funds were to hand. This was the project for digitization of the slave trade archives in Senegal's National Archives, stored as Series K1 and K2 on old postcards and inscribed in the International Memory of the World Register in 2017. It goes without saying that the quality of this digital archive is not especially good. It is hoped that the process will be reworked as part of a more ambitious overall digitization by the Archives Department of Senegal, in keeping with the importance of conserving these archives (inscribed in the International Memory of the World Register in 1997) for Senegal, France and the nine former colonies in French West Africa.

Conclusion

Since the Industrial Revolution, the world has become an information society in which the frantic race for knowledge is part of daily life. At the same time, peoples, civil society, civic organizations and multilateral institutions working through United Nations conventions have evolved new standards in terms of human rights, good governance, transparency in all areas and human dignity. These new requirements can only be met if the materials in which information is contained are properly preserved and accessible to all without hindrance. This is the fundamental interest underlying good management of documentary heritage, including digital heritage: it must be identified and safeguarded in appropriate conditions to make it available to all and usable for research. Unfortunately, this aspect seems to be ignored by African States, which relegate their documentary heritage to the status of unimportant items, and tend to leave it up to sponsors, international or supranational organizations and foreign countries to step in and fulfil one of their basic duties: guaranteeing national sovereignty over the control and long-term preservation of their national sources of information, both analogue and digital. In 2009, for example, when Senegal began preparations to host the Third World Festival of Black Arts, the country had to contact the Archives of the French National Audiovisual Institute (INA) in Paris to purchase items that should have been available in the national audiovisual archives (particularly those of Senegal Radio and Television). The same happened when it was time pay tribute to the country's first President, Léopold Sédar Senghor. The unfortunate example of Senegal is regrettably all too common in Africa.

All this to say that the time has finally come for the information society to become a reality in Africa.

Some countries in Africa are, however, making remarkable efforts that should be welcomed and encouraged. Thus, the contribution to the Second Inter-regional Conference of the Memory of the World Programme held in the Republic of Korea from 5 to 8 November 2019 on 'Preserving and Providing Access to Digital Heritage' concluded that Mauritius stood out as the most advanced country in terms of preservation and management of digital heritage, and as a good example to share in the African context. From that perspective, the country deserves to be a benchmark for training at the continental level.

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35   Ibid.

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4. Initiating and managing effective digitization projects: essential guidelines

Eng Sengsavang[36]

Introduction

This chapter endeavours to bring together a selection of best practices and lessons learned from the Digitizing Our Shared UNESCO History[37] project and from standards and best practices published by different sources around the world. The guidelines are not meant to be definitive or exhaustive; instead, they distil a selection of practical information from shared experience and knowledge within a community of practice,[38] which can be used, developed and customized by memory institutions[39] when considering and planning for digitization projects. The chapter focuses on formal digitization projects involving the conversion of non-digital records[40] into digital form. Informal or routine digitization processes that occur during the course of business – what the International Organization for Standardization (ISO) refers to as 'business-process digitization'[41] – are not covered here. These processes deserve their own treatment and are covered in other resources.[42]

The chapter also considers challenges that are specific to Least Developed Countries (LDCs) and Small Island Developing States (SIDS), gathered from existing literature. Regardless of national or local contexts, digitization is a resource-intensive process requiring the existence of digital infrastructures, organizational capacity, institutional and governmental support, and financial and human resources to ensure continued access to and long-term sustainability of digitized materials. However, on a global level, LDCs and SIDS find themselves on an uneven playing field when compared to richer nations. While they are a heterogeneous group and do not uniformly share the same challenges, LDCs and SIDS face heightened barriers to digitization including, but not limited to, access

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37 The Digitizing Our Shared UNESCO Project was generously funded by the People of Japan and ran from November 2017 to June 2020. It was led and managed by the UNESCO Archives, Library and Records Management Unit. The project digitized 672,118 pages of documents of the International Institute for Intellectual Cooperation (IICI); 560,000 pages of bound volumes of the UNESCO governing bodies; 108 films on 16 mm (45 hours); 98 Umatic videos (35 hours); 7,000 hours of sound recordings on magnetic tape; and 5,000 photographic prints.

38 A community of practice is defined as 'groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly'. From Etienne and Beverly Wenger-Trayner, 'Introduction to communities of practice - A brief overview of the concept and its uses', viewed 16 April 2021, https://wenger-trayner.com/introduction-to-communities-of-practice/.

39 'Memory institution is a collective term which includes, but is not limited to, archives, libraries, museums and other educational, cultural and research organizations'. From UNESCO, 2015, *Implementation Guidelines on the Recommendation Concerning the Preservation Of, and Access To, Documentary Heritage Including In Digital Form* prepared by Raymond Edmondson, viewed 5 April 2021, https://en.unesco.org/sites/default/files/2015_mow_recommendation_implementation_guidelines_en.pdf, p. 4.

40 In this chapter the term 'record' is used interchangeably with 'document', 'material' and so forth to refer to any type of document in any format that is digitized as part of a digitization project. The term 'record' is taken from the field of archival science. One definition of a record is 'A document made or received in the course of the conduct of affairs and preserved'. Bureau of Canadian Archivists, Planning Committee on Descriptive Standards, 2008, 'Appendix D: Glossary', Rules for Archival Description rev. ed., viewed 16 April 2021, http://www.ciscra.org/mat/mat/term/60.

41 International Organization for Standardization (ISO), 2010, *ISO/TR 13028:2010 - Information and documentation - Implementation guidelines for digitization of records*, p. v.

42 See ISO/TR 13028:2010.

to resources and training, availability of basic and technical infrastructures, political or economic instability and challenging physical environments. For this and other reasons, digitization is neither a utopia nor a universal answer to archival access and preservation. Nevertheless, if managed appropriately, digitization can bring immense benefits. The summary of best practices presented in this chapter is designed to offer accessible advice to support digitization efforts undertaken by organizations in LDCs and SIDS, and any other organizations seeking digitization guidance. While it is neither possible nor advisable to skimp or take shortcuts in many areas of digitization, accessible digitization approaches and solutions will be considered wherever possible, in recognition of the fact that LDCs and SIDS have particular challenges and needs.

What is digitization?

Digitization is the process of creating a digital image of a physical record, whether that is in the form of a manuscript, paper document, photographic item, map or even a 3D object.[43] The digital image is produced by scanning or photographing the original artefact. Digitization is sometimes referred to as 'digital imaging' or 'digital conversion'. The resulting digital images are called 'bit-mapped' or 'raster' images, as opposed to other types of digital files such as vector files, which represent graphic images using mathematical formulas.[44] Analogue films and audio recordings are digitized not by imaging, but by converting analogue signals on a physical medium to digital signals or code.[45] Digitization is different from an early form of imaging known as microforms, which reproduce images of documents either on microfilm – strips of 16 mm or 35 mm film – or on microfiche ('a flat sheet of images').[46] Digitization is different because it produces a digital file made up of machine-readable binary code that is then viewed or played via a computerized system.[47]

Assessing the sustainability of digitization projects

While digitization projects may have specific beginnings and endings, digitization is really a long-term commitment in terms of human, financial and technical resources that extend beyond the life of a digitization project. The digital objects and descriptive information generated during a digitization project will require ongoing care and resources for storage, maintenance and management. These will be achieved through strategies and systems to ensure continued access to, and long-term preservation of, digital records. It is essential to consider key questions regarding the viability and need for digitization, in order to make an informed decision before committing to a complex and resource-intensive process. Undergoing a conscious assessment of the sustainability of digitization for any organization encourages a 'bird's-eye view' or broad perspective of the labour and resources needed to manage the outputs of a project beyond its completion.[48]

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43   ISO 3.
44   IFLA 17.
45   Ibid. https://www.researchgate.net/publication/334960700_Digitization_of_Library_Resources_in_University_Libraries_A_ Practical_Approach_Challenges_and_Prospects.
46   Yale University Library. 2019. 'What is the difference between microfilm and microfiche?' Viewed 5 April 2021, https://ask.library.yale. edu/faq/175029. TNA – imaging since 1960s via microfilm until 2015, then producing digital images; UNESCO – since 1960s.
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Considerations related to possible collections for digitization

◆ Do the materials considered for digitization have permanent value (for instance, are they vital records or records of historical value with permanent retention, or will they eventually be weeded or destroyed?)?

◆ Are there copyright, confidentiality or cultural sensitivity issues related to the materials and, if so, how will the organization deal with these issues?

◆ Do digital copies exist outside the organization, within other collections? If so, teams may reconsider the need to digitize the collection.

◆ Are the materials considered original items or are they copies of original items held in other institutions? If so, is there a possibility to partner with those institutions to digitize original materials?

◆ Can project team members ensure that staff or other individuals with the best knowledge of the collections are engaged in the project?

Technical infrastructure considerations

◆ Does the organization have the digital storage space necessary to house the digital files and backup copies in separate locations over the long term? Have storage needs been discussed with IT staff?

◆ Does the organization have a functional database environment[49] for storing and making the digitized collections and descriptions of the collections accessible? If not, does the organization have the ability to acquire and manage a database environment?

◆ Can project team members ensure that IT staff and staff who are managing relevant database environments are engaged in the project?

◆ Is the organization able to take on digital preservation practices and strategies, such as adherence to metadata and file format standards, file format migration and documentation?

Organizational, financial and human resource considerations

◆ Does digitization align with and support the mission of the organization?

◆ Are the potential benefits of the project worth the potential costs?

◆ Is there a source of funding for the project and for managing ongoing costs after the project?

◆ Is there institutional support for the project?

◆ Do staff have the necessary project management, cataloguing and technical skills required to proceed with a digitization project? If not, is there support for the necessary training or external outsourcing of certain activities (including perhaps the digitization itself)?

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49 For the sake of simplicity, the term 'database environment' is used in the singular, but it can be assumed to mean any and all relevant information systems within the organization, including repositories, catalogues, content/asset management systems or record-keeping systems. The term 'database environment' is seen as distinct from a 'trustworthy digital repository,' which is a specific type of digital system with a certification process. See Center for Research Libraries, "TRAC Metrics," https://www.crl.edu/archiving-preservation/digital-archives/metrics.

Digitization benefits

Understanding the potential benefits of digitization is also helpful when assessing the strategic viability of committing to a digitization project. It is useful to look to other organizations to gain a sense of why they have undertaken digitization projects and what could be gained from such projects. The benefits below have been grouped into themes and have been gathered from various sources.[50] It should be noted that the benefits of digitization are not automatic: it takes active planning, labour and the existence of certain conditions and infrastructure (such as staff, budget, IT and so forth) to realize the benefits. Some benefits will not be applicable in all situations.

Access

Access refers to the ability of wider audiences to discover, find, consult and contextualize digitized materials in expanded ways. The potential benefits related to access include:

◆ Increased possibility for multiple users to access digitized collections from any networked location. Users no longer have to physically travel to access the materials.

◆ Ability to access content on previously inaccessible or challenging formats, such as 16 mm films, magnetic tape, large-format maps or microfilmed documents.

◆ Improved knowledge about the collections: enhanced indexing, cataloguing and metadata creation (this refers to information about the information resources). Collections that were previously not inventoried or minimally indexed may be discovered or re-discovered during digitization.

◆ Increased visibility and findability of collections published online.

◆ Enhanced searchability of records through more consistent classification and indexing and, if relevant, through optical character recognition (OCR) applied during digitization, enabling full text searching of documents. It is also possible to create automated transcripts of audio and film recordings using artificial intelligence-based technologies.[51]

◆ Possibility of hyperlinking, integration or 'reunification'[52] of related sources from different institutions in online catalogues, enhancing the possible connections, contexts, findability and information value of collections.

Strategic and operational benefits

Strategic and operational benefits refer to how digitization might support an organization's day-to-day functioning and strategic goals, including the following potential advantages:

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50   Balogun & Adjei, 2019, 'Challenges of digitization of the National Archives of Nigeria', *Information Development*, 35(4); Jagboro, Omotayo, Aboyade, 2012, 'Digitization of Library Collection in Developing Countries: The Hezekiah Oluwasanmi Library Experience', *Library Philosophy and Practice*; Namande, 'Digitization of Archival Records: The Kenya National Archives And Documentation Service Experience' https://core.ac.uk/download/pdf/39670332.pdf; Okeke, Udem & Onwurah, 2015, 'Digitization of Library Resources in University Libraries: A Practical Approach', *Challenges and Prospects* (3); Rafiq, Ameen, and Jabeen, 2018, 'Barriers to digitization in university libraries of Pakistan: a developing country's perspective', *The Electronic Library*, 36(3); *Digitizing Our Shared UNESCO History;* The National Archives, n.d., 'Benefits of digitisation', viewed 5 April 2021, https://www.nationalarchives.gov.uk/about/commercial-opportunities/digitisation-services/benefits-of-digitisation/.

51   For example, the World Intellectual Property Organization (WIPO) has developed 'WIPO Speech to Text', a transcription tool based on artificial intelligence (AI). See https://www.wipo.int/about-ip/en/artificial_intelligence/speech_to_text.html.

52   Michelle Caswell, 2014, *Archiving the Unspeakable: Silence, Memory and the Photographic Records in Cambodia*, p. 84.

◆ Greater ability to support the current work of the organization through integration in business systems and workflows.

◆ Reduction of hybrid systems (paper/analogue versus digital), thereby facilitating access to more complete records on a topic or matter.

◆ Reduction of delays and increased accuracy when searching for and retrieving records.

◆ Increased access to and knowledge of digitized historical records and information may significantly enhance current programme creation and implementation.

◆ Development of staff skills and organizational capacity (such as staff knowledge and experience, IT infrastructure and so forth).

◆ Greater institutional awareness of the value of archives and heritage collections, as well as the need for more digitization.

◆ Creation of opportunities to attract potential funders for further digitization or by enhancing the commercial value or interest of certain documents.

◆ Possibility for increased physical storage space through off-site storage of digitized physical records or, in some cases, through destruction of records after digitization.[53]

◆ Depending on national legislation and compliance with legal standards, certified digital copies may facilitate legal and judicial processes.

Preservation

Preservation refers to the state of physical and long-term conservation of digitized materials. This includes the following potential benefits:

◆ Creation of backup copies of unique materials. This is especially valuable in locations that are prone to flooding, infestation or other high-risk environmental conditions, or where no disaster recovery policies are in place. Digitized records should form part of the organization's long-term digital preservation and disaster recovery plans if they exist.

◆ Reduction of physical handling and exposure to light and other elements for physical records being digitized.

◆ Ability to copy and share materials as many times as permitted without damaging source materials.

◆ Increased opportunities to rehouse and improve the physical condition of records if budget allows (including shelving, archival-quality containers, folders and envelopes).

◆ Increased security of records and reduced opportunities for theft through storage of physical collections in secure areas and by limiting physical access to the originals.

Outreach, communication and partnerships

Outreach, communication and partnerships refer to sharing and networking activities for digitized collections. These include the following potential benefits:

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53   Destruction is not recommended for the digitization of physical records that have permanent value. However, some organizations have a defined policy regarding destruction of certain records after digitization, if a number of strict criteria are met.

◆ Creation of opportunities for promoting and communicating collections via social media, crowdsourcing, online articles/blogging, events, exhibitions and other initiatives.

◆ Ability to reach wider audiences or targeted audiences through promotional campaigns.

◆ New opportunities for partnerships and projects with other organizations and enterprises.

◆ Potential to develop and increase the 'brand' value of the organization.

Digitization as a social good

This topic considers the potential social, cultural, political and economic benefits of digitization on a broad social level,[54] including:

◆ Contributing to the safeguarding of world documentary heritage by digitizing and making records of permanent historical value accessible.

◆ Supporting the transparency and accountability function of archives by making public records more accessible and by helping citizens to exercise their rights.

◆ Contributing to national or local development by enhancing digital capabilities and infrastructure.

◆ Meeting user expectations for increased access to information in the digital age.

◆ In terms of records related to a source community that are held outside of that community, ensuring that said records become more accessible to the originating or subject community. Opportunities for consultation and participatory description with the source community should be considered, as well as digital repatriation where appropriate. Issues of cultural sensitivity, privacy, ownership, contextualization and representation of the communities involved must be respected in all digitization projects.

Challenges for LDCs and SIDS

Along with the potential benefits, digitization projects present a number of challenges. The inherent demands of digitization projects are more pronounced in the context of LDCs and SIDS, which face barriers unlike those of their peers in the developed world. Below are just a few examples of challenges specific to LDCs and SIDS gathered from existing literature.[55]

◆ Staff training and levels of expertise - Since digitization projects are initiated, managed, led and implemented by humans, the challenge of staff training and the need for project management, technical and fundraising skills is a major barrier to initiating digitization projects in the developing world. Lack of training on both theoretical and technical or practical aspects of digitization (such as best practices) has also been noted as a challenge.[56]

◆ Funding and fundraising - Digitization projects are costly and require specialized equipment or outsourcing, human resources and infrastructure provisions such as Internet connectivity, a stable power supply,

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54 These benefits may also be linked to the United Nations 2030 Sustainable Development Goals.

55 Balogun & Adjei, 2019; Jagboro, Omotayo, Aboyade, 2012; Namande, 2011; Okeke, Udem & Onwurah, 2015; Rafiq, Ameen, and Jabeen, 2018; Sepania Walla Kaiku & Puipui, 2013, 'Political, Cultural and Professional Challenges for Digitization and Preservation of Government Information in Papua New Guinea', in UNESCO, *The Memory of the World in the digital age* (proceedings), viewed 28 March 2021, https://unesdoc.unesco.org/ark:/48223/pf0000373728.locale=en; UNESCO and UNESCO Field office for the Gulf States and Yemen, 2021, *Documentary heritage in the Arab Region: a regional survey; understanding needs, challenges and opportunities*, viewed 28 March 2021, https://unesdoc.unesco.org/ark:/48223/pf0000375817.locale=fr.

56 Rafiq et al. (2018), p. 9, 11.

computers, physical space and archival supplies. To cover the costs of digitization, staff must learn fundraising skills, such as grant-writing and proposal-writing.

◆ Infrastructure - The lack of IT and basic utility infrastructures are cited as barriers to establishing digitization projects in developing countries. Issues include limited bandwidth and low Internet connectivity. Power outages and electric failures are also cited. The lack of these types of infrastructure can prevent stable file uploads and transfers during digitization, as well as creating issues when users attempt to access digitized resources.

◆ IT management - There are also challenges related to content availability via database environments such as content management software, as well as a lack of IT security.

◆ Strategic challenges - Digitization is described as a low priority at the institutional or national levels, and this is reflected in a lack of policies, coordination or governance related to digitization and memory institutions.

◆ Digital divide - The digital divide refers to the gap between users who have access to Internet services and technologies (such as adequate bandwidth, Internet connectivity and computing devices), and those who do not. It can be measured by various demographic and socioeconomic criteria such as 'gender, age, education, income, social groups or geographic location'[57] and can refer to differences across countries or regions, or to inequalities within a country or grouping of people. On a global level, there is a marked imbalance of digital resource access and distribution across geographic regions. Regions with more developed economies show higher rates of Internet access. In 2020, Internet penetration was estimated to be lowest in countries in Africa and Asia, followed by those in Oceania, the Middle East and Latin America and the Caribbean. North American and European countries had the highest rates of Internet use.[58] Barriers to digital access go hand in hand with 'low levels of ICT literacy and e-resource use'.[59] Consequently, it can be even more challenging for LDCs and SIDS to pursue 'digital service delivery environments', including digitization projects.[60]

◆ Access to specialized supplies and equipment - Inputs for conservation and restoration of archives and digitization are limited in certain regions (such as Arabic-speaking countries) and must be acquired abroad (thereby increasing costs.)[61] Equipment purchased for digitization also becomes obsolete or may be difficult to repair if damaged as it may require specific suppliers or parts. This reflects an imbalance in the global distribution of supplies for properly managing heritage collections.

◆ Environmental conditions - Challenging environmental conditions include high levels of humidity, pest/insect infestations and mould issues. LDCs and SIDS are particularly vulnerable to climate change effects and natural disasters[62] including storms, hurricanes, floods and fire. In 2020, the United Nations Conference on Trade and Development (UNCTAD) stated that SIDS suffer more disasters than other countries in the world, sustaining damage amounting to an annual rate of 2.1 per cent of Gross Domestic Product (GDP).[63] Volatile environmental conditions significantly complicate the pre-existing challenges of digitization for LDCs and SIDS.

57 UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training, n.d., TVETipedia Glossary, 'Digital Divide', viewed 6 May 2021, https://unevoc.unesco.org/home/TVETipedia+Glossary/filt=all/id=704.

58 Ibid.

59 Namande, 2011.

60 Ibid.

61 UNESCO and UNESCO Field office for the Gulf States and Yemen, 2021, p. 17.

62 UNESCO, 2019, Mid-term review of the UNESCO SIDS Action Plan 2016-2021, viewed 7 May 2021, https://unesdoc.unesco.org/ark:/48223/pf0000367367.locale=fr.

63 UNCTAD, 2020, 'Multiple disasters and debt sustainability in Small Island Developing States', viewed 7 May 2021, https://unctad.org/webflyer/multiple-disasters-and-debt-sustainability-small-island-developing-states.

Essential digitization guidelines

The guidelines below focus on project planning, project management and the long-term sustainability of digitized resources. Many other important factors related to digitization projects have not been included due to space and time limitations. However, this chapter is just one resource among many that share lessons learned and best practices for digitization projects.

Digitization projects do not happen within a vacuum; they are initiated by all types of organizations, groups or governments - each with their own multi-layered contexts. Those who participate in digitization projects understand that each one is unique, and that a range of practical and technical complexities must be tackled at each step. However, a common characteristic of all digitization projects is their collaborative nature. All digitization projects, no matter their scale or purpose, involve many people applying learned skills and expertise to work together on different aspects of the project towards a common goal. It is perhaps more accurate to describe digitization projects as journeys rather than mere processes, acts or outcomes.

Digitization policy

Before beginning a digitization project, a digitization policy should be created if it does not already exist within the organization. A digitization policy is an essential tool for establishing standards, best practices and roles and responsibilities for digitization. By capturing and formalizing key requirements that can be built upon and referred to on a continual basis, a digitization policy helps ensure consistency and quality control of digitization processes and outcomes. A digitization policy also helps to increase organizational efficiency and effectiveness by supporting informed, transparent and accountable digitization practices and decisions. Digitization policies should be reviewed at regular intervals to adapt to evolving requirements and to learn from trial and error. The following elements should be part of a digitization policy:[64]

◆ Purpose statement - The purpose of the policy and how it is meant to be used.

◆ Policy scope:

  • The types of digitization activities covered, such as formal digitization projects and/or informal, routine or ad-hoc digitization.

  • The types of non-digital records and formats included. This may include all records regardless of format, or only textual and photographic materials, due to the highly specialized nature of analogue audiovisual materials. Standards and practices for audiovisual items may be added subsequently if the opportunity or need to digitize audiovisual items emerges.

  • The persons and entities that must follow the policy should be made clear, for instance all staff, including consultants and contract workers, and any field or satellite offices if relevant.

◆ Roles and responsibilities - The policy should define the authority responsible for creating, overseeing and updating the policy, and who to consult internally when considering a digitization project. It may also include a statement of responsibility for all staff to follow digitization guidelines and standards.

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64   These are taken from the UNESCO Digitization Guidelines; FADGI, 2009, Digitization Activities: Project Planning and Management Outline, viewed 28 March 2021, http://www.digitizationguidelines.gov/guidelines/DigActivities-FADGI-v1-20091104.pdf; Indigitization, 'Indigitization Toolkit', viewed 28 March 2021, https://www.indigitization.ca/toolkit/.

◆ Technical standards - Technical standards must be established after careful consideration of needs and expected outcomes, and should be reviewed and updated as required. The technical standards should outline the following specifications:

  · Digital file formats and file versions.

  · Resolution.

  · Bit depth or colour resolution.

  · Compression.

  · Colour management.

◆ Metadata standards - A minimum set of required metadata for digitized items should be defined.

◆ Standards for physical handling and preparation of non-digital materials - The policy should require proper handling of physical items. Physical handling workflows are likely to vary depending on the nature of the materials to be digitized and the needs of each project. Therefore, the policy should require that clear documentation of the procedures for physical handling and preparation of records for each project be created and validated by appropriate staff.

◆ Quality control practices and standards - The policy should require that quality control criteria and workflows be documented, and appropriate staff thoroughly trained on each quality control procedure.

◆ Digitization project evaluation - The policy should state how digitization projects will be evaluated and should outline processes for documenting 'lessons learned', so that knowledge and experience gained during projects is transferred to other staff and can benefit the organization over the long term.

Digitization stages and activities

Digitization projects may be divided into multiple stages and activities. The activities can be grouped into general phases, modelled on those outlined by the United Nations Archives and Records Management Section (UNARMS) and the United States Federal Agencies Digital Guidelines Initiative (FADGI):[65]

◆ Project planning

◆ Pre-digitization

◆ Digitization / digital conversion

◆ Post-digitization.

Specific activities within each phase will vary in terms of when, how and how often they occur within and across phases; they are not strictly linear or chronological. Certain activities are constant throughout a digitization project, such as project management and documentation, while other activities may occur at different points repeatedly, such as quality control and gathering and creating metadata.[66] Different activities also happen concurrently or at the same time.[67] In this sense, digitization is like a symphony of different activities; some instruments are played together in certain moments, while others come in and out of a composition.

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65   UNARMS, *Standard - Record-keeping Requirements for Digitization*; FADGI, 2009, p. 12.
66   FADGI, 2009, p. 12.
67   FADGI, 2009, http://www.digitizationguidelines.gov/guidelines/DigActivities-FADGI-v1-20091104.pdf, p. 12.

It is worth repeating here that no two digitization projects are exactly alike or will unfold in precisely the same way. As Butterworth states, 'The most important thing we have learnt…is the need to be flexible and resourceful [and] that we cannot adopt a "one size fits all" attitude'.[68]

Project planning

The success of a digitization project largely depends on how well it is planned and managed from the beginning, and how project members are able to adapt and respond to unforeseen circumstances that arise. It is in the project-planning phase when the main components of a project are designed and organized.

Project documentation

In the interests of transparency, accountability and good record-keeping, it is critical to document key decisions, workflows, standards and important project references throughout a digitization project. Such documentation also serves as a record of the context in which digital objects are created during a project. To facilitate the documentation process, it is useful to create a collective centralized workspace such as a shared computer drive or a collaboration tool available to the organization. Team members may agree on a folder structure to organize the different types of documentation, which may evolve and grow with the project. Having a single shared workspace with an organized folder structure will help to ensure that project members systematically save all important documentation for long-term reference.

Project team structure and project management

Each digitization project should have a defined team structure and clearly documented roles and responsibilities for team members. Large-scale digitization projects may have a steering committee to oversee and monitor progress.

One key role within digitization projects is the project manager or coordinator, who is responsible for overall project planning, timelines/scheduling and designing and implementing project activities and logistics. The project manager must be able to motivate team members and create a positive atmosphere, as well as having a flexible and hands-on problem-solving approach. Staff responsible for the care of physical source records and the management of database environments should form part of the project team and must be closely consulted throughout the project to advise on the preparation and cataloguing of source collections, technical specifications and metadata harmonization for publication in the final database environment.

Selection for digitization

Almost every aspect of the project will be shaped by the selection of records to digitize. Selection may begin by identifying collections to prioritize for digitization, followed by a decision on whether to digitize an entire collection or just one part. It may be helpful to draw on existing catalogues and inventories in the selection process. The selection criteria should be documented. Below are examples of common selection criteria:[69]

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68   Jody Butterworth, 2018, Introduction, in Butterworth J., Pearson A., Sutherland P., & Farquhar A. (Eds.), *Remote Capture: Digitising Documentary Heritage in Challenging Locations*, viewed 16 April 2021, http://www.jstor.org/stable/j.ctv8j3vh.8, p. 16.

69   See Indigitization; ISO/TR 13028:2010; Queensland Government, 'Digitise physical records', viewed 16 April 2021, https://www.forgov.qld.gov.au/digitise-records.

◆ Physical condition - At-risk collections that are damaged, deteriorating or in poor condition may be considered a priority for digitization.

◆ Characteristics of the original materials - Collections on rare or obsolete mediums may be prioritized for digitization due to a special interest in the medium (such as glass plate negatives) or the inaccessibility of the content unless digitized (as in the case of 16 mm film reels or reel-to-reel magnetic tapes). Conversely, if the budget or the scanning equipment is limited, records requiring special treatment, equipment and expertise (such as audiovisual collections or large-format documents) may not be chosen for immediate digitization if their condition is stable.[70]

◆ Value - Collections with special historical or informational interest may be prioritized for digitization. Three types of value have been identified by the programme Indigitization.[71] Other sources cite similar value types. A fourth value type is added from the Digitizing Our Shared UNESCO History project:

　• Administrative (records that have functional usefulness to an organization).

　• Informational (records that provide significant information on key people, places, events, objects, periods, activities, processes, projects and so forth).

　• Archival (rare or unique cultural material with intrinsic value to its users).

　• Representativeness (a fourth type of value is the representativeness of the collection in terms of significance to the organization's history, current/past work, type of programme, time period or geographical area).

◆ Use and demand - Collections that are frequently consulted or in demand may be prioritized for digitization.

◆ Copyright - Collections with copyright owned by external parties or with unclear copyright may present barriers to sharing and re-use once digitized. Additional work may be required to manage rights. Therefore, such documents may be ruled out if the project goal is to make digitized collections publicly available or if the organization does not have the capacity to properly manage rights.

◆ Sensitivity of records - This refers to the level of privacy or secrecy of the record contents. If records are considered sensitive, additional measures and metadata will be needed. The collections may not be publishable or may require restrictions.

◆ Availability and completeness of collection description - The completeness of existing information about a collection (metadata and indexes) will affect the time and resources required during different phases. When working with a small budget, a team may decide to prioritize well-inventoried collections initially. On the other hand, digitization may be an opportunity to better document and understand the contents of a collection. Whether this is used as a criterion depends on the goals and available resources of the project.

◆ Whole versus partial digitization - The ability to digitize an entire collection rather than one part may be a factor in deciding what to digitize. It may be more time consuming and complex to digitize part of a collection, because partial digitization requires added steps to select which parts to digitize. For this reason, an organization may wish to digitize an entire collection. On the other hand, if the budget can only cover partial digitization, or the aim is to raise interest in multiple collections, there may be a benefit to cherry picking parts of several collections.

70　Queensland Government, Australia; IFLA, p. 13.
71　The first three value types and their description are quoted directly from Indigitization, "B2: Selection of Materials," viewed 16 April 2021, https://library-indigitization-2020.sites.olt.ubc.ca/files/2020/06/B2.pdf.

◆ Multiple formats versus a single format - If the budget is limited, an organization may consider digitizing a single type of format instead of multiple formats in the same project. Digitizing multiple formats in a single project may be more costly, since it increases the time and labour needed to prepare different formats, as well as multiple scanners or other equipment possibly being required (or calibration of equipment between digitization of different formats). Digitizing only one type of format could lower costs and save time by simplifying the requirements.

Project scope

The project scope outlines the size and ambition of the project, based on the quantity and formats involved and the planned activities. It is crucial to ensure the project scope is based on the actual financial and human resources available. An achievable scope helps to ensure high-quality results and avoid repetition of work. This is highly preferable to creating an over-ambitious project with inadequate resources that risks ending in poor outcomes. If the budget is limited, the project could be considered as a pilot project that may serve as a 'test' or 'preview' of the institution's collections and the value of digitization, with the goal of attracting potential future funders or partners.

Purposes and outcomes

An essential step when planning a digitization project is considering the end of a project before it begins. This is not a whimsical exercise, but a necessary part of identifying and documenting the purposes and expected outcomes of a project. The purpose refers to the broad motivations for a project, such as creating backup copies of at-risk materials, or providing access to high-demand items. An expected outcome is a concrete product or practical result, such as the publication of digitized documents in a public catalogue or the replacement of deteriorating folders or boxes.

Expected outcomes, in particular, are more than theoretical reference points. They need to be thoroughly identified and documented for the project plan to include the necessary steps to achieve them. Purposes and expected outcomes must be translated into real activities in the project plan. As mentioned previously, one way of doing this is by starting backwards from the imagined end of a project. In what database environment(s) should the digitized items and their metadata be stored and preserved? In what ways should the digitized materials be searchable and accessible? What should the final state of conservation of the physical source records be? How will the digitized files be used by the organization and what types of derivative files[72] will be needed for the different types of uses? It is vital to document all expected outcomes and construct the logical steps needed to achieve them. The necessary activities must be incorporated into the project plan and schedule.

Ultimately, this may prevent reaching an advanced stage in a digitization project, only to find that a key step was missed that could have saved days, months or even years of work after the end of a project. In addition, outcomes provide measures for evaluating whether a project has achieved its objectives and are useful when reporting to funders or upper management.

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72   Lower-quality digital copies created from a first 'master' file.

Major project decisions

A set of key decisions must be made before any further planning can be completed.[73]

◆ In-house or outsourced digitization - A decision will be needed about whether digitization will be outsourced to an external company or completed by staff within the organization:

- If completed by in-house staff, there may be fewer risks of unauthorized access to records and more control over processes. Training of staff and purchasing of equipment will be necessary. It may be possible to seek partnerships with educational institutions in order to recruit student interns or volunteers enrolled in professional studies programmes such as archival studies and information management. It is helpful to research the equipment and staff hours needed and create an estimated budget to compare the costs of outsourcing the work to an external company.

- If outsourced to an external company, the project will benefit from the firm's technical expertise. It is advisable to request estimates from several different companies, as well as considering that the cheapest vendor may not be the best choice. Any decision should be based on a combination of pricing and the professionalism and expertise of the company. When outsourcing a project, the recommendation is to meet with several different companies for comparison.

◆ On-site or off-site digitization:

- If all or most collections are located on the premises, on-site digitization is preferable as this minimizes the risk of damage and loss to the collections, and shipping collections off-site becomes unnecessary. However, this may not be possible due to lack of available space, IT infrastructure (computers, Internet connection, servers and a stable power source) or specialized equipment.

- If collections need to be digitized off-site, space and equipment are then outsourced. This entails increased risk of damage to or loss of records during moving and the loss of control over records and processes. Nonetheless, off-site digitization with a trusted vendor is a viable option, as long as clear and regular communications between the project team and vendor, including progress reports, are assured.

◆ Storage and database environment - Systems for storing and managing records and their metadata should be in place before the start of the project.[74] Storage devices such as servers, hard drives and backup systems should be identified or purchased. Once the collections have been selected, an estimate of the required storage space should be calculated. In addition, a database environment for managing and providing access to the digital objects and metadata should ideally be in place. If there is no database environment, a budget and plan for acquiring and implementing one must be incorporated as part of the project. Although there are a number of free open-source software applications available on the market, even 'free' software will require staff to manage and support it.

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73 This section is based on the UNESCO *Digitization Guidelines* and the UNARMS *Standard on Record-keeping Requirements for Digitization*.
74 ISO, 2010, p. 9

Training

Training requirements will depend on a number of factors and should be identified early on in the project planning process. The goal of training is to ensure that all staff involved in tracking and preparing collections, working with metadata, digital conversion, quality control and post-digitization processes comply with established standards and workflows. It is essential to invest the time and energy required to train staff thoroughly. The project manager/coordinator and team members should be in constant communication and share information, questions, problems and progress.

Metadata plan

Work processes related to metadata are essential throughout a digitization project. Metadata are information about the content, characteristics and contexts of records to ensure they are findable, accessible and legible over the long term. Information such as title, date, unique identifier and medium are examples of metadata, or more specifically, metadata elements. Metadata gathered and created during a digitization project should describe the source record and its digital surrogate. Metadata also provide the necessary link between digital objects and their source records. A digital record is not considered to be high quality unless it is accompanied by a minimum set of metadata.[75] The United States Federal Agencies Digitization Guidelines Initiative (FADGI) identifies several types of metadata, including descriptive, administrative (including rights metadata), structural, behavioural and preservation metadata.[76] All these types of metadata are relevant during a digitization project.

At the project-planning stage, decisions will need to be taken on metadata capture in terms of level of detail, timings during the project and the systems for registering the metadata.

◆ Metadata sets - A metadata set is a group of elements for describing records. Metadata elements should be defined and documented as part of project planning. Varying metadata sets may be required for different formats (such as photographs versus textual items), and there may be different levels of description for different collections. Metadata sets should include the minimum metadata required by an organization's digitization policy. Further metadata elements may be added depending on the nature of the source record. If there is a pre-existing database environment in the organization, metadata sets or standards may already be in use. Teams could consult with staff who manage the systems regarding any pre-existing metadata sets in the organization.

◆ Metadata standards - In addition to the above, there are published metadata standards for different types of formats. Project teams should be aware of the existing metadata standards for the format(s) being digitized. If useful for the organization, it is possible to adapt different metadata models to fit specific needs, including 'requirements for particular materials, business processes, and system capabilities'.[77] This strategy reflects the idea that there is 'no single metadata element set or standard… suitable for all projects or all collections' and therefore any organization may adapt metadata best suited to its purposes.[78]

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75 Federal Agencies Digitization Guidelines Initiative (FADGI), 2016, *Technical Guidelines for Digitizing Cultural Heritage Materials Creation of Raster Image Files*, viewed 28 March 2021, http://www.digitizationguidelines.gov/guidelines/FADGI%20Federal%20%20Agencies%20Digital%20Guidelines%20Initiative-2016%20Final_rev1.pdf, p. 74.
76 FADGI, 2016, p. 75-79.
77 FADGI, 2016, p. 74.
78 FADGI, 2016, p. 74.

Digital objects plan

A plan must be established to define how digital files will be uploaded or linked to the intended database environment after digitization, so that they can subsequently be made accessible. Staff managing the database environment must be consulted and involved with creating the plan, and the work of uploading/linking the digital objects must be added to the scheduled post-digitization activities. If this work is left out of the project plan, it will require an enormous amount of time and resources for staff to accomplish it once the project is over, and there is a risk that it may even take years or may never happen at all.

Workflows

Workflows are sequences of actions that guide specific work activities. Several types of workflow should be designed, documented, tested and refined before work begins. Sometimes it will be necessary to adjust and test a workflow several times. Below is a non-exhaustive list of types of workflow. Additional details related to individual workflows are provided in further sections. Workflows are required for:

◆ Metadata preparation/indexing of collections.

◆ Physical preparation of collections.

◆ Digital conversion processes.

◆ Quality control processes.

◆ Metadata capture during digital conversion.

◆ Metadata enhancement and migration post digitization.

Project schedule

A project schedule estimates the duration of a digitization project. Calculations should be based on the quantity of materials to digitize, the different formats affecting the complexity of the project and the availability of staff. It pays to be realistic about the likely duration of each activity and err towards overestimating rather than underestimating the time required. As Pearson wisely advises, 'Remember that the slick, efficient workflow you envisage at the planning stage is unlikely to manifest itself in the real world'.[79]

For example, workflow will be slower at the beginning of any activity, since it will take time for staff to learn and refine workflow.[80] Delays and logistical bumps should also be expected. Special handling requirements for fragile or large-format collections, as well as logistical needs such as moving collections back and forth between the digitization and storage spaces, may take up extra time.[81] The effort required for administrative or project management tasks, such as documenting processes and tracking collections, should also be taken into account.

For these reasons, it is highly recommended to build in extra time beyond the estimated duration for each activity. In particular, the time required for pre-digitization activities - such as preparing metadata and physical collections - should not be underestimated. The time for quality control during the digitization process should also be properly considered. Investing the appropriate amount of time into each activity, rather than rushing

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79 Andrew Pearson, 2018, 'Planning the Project', in Butterworth J., Pearson A., Sutherland P., & Farquhar A. (Eds.), *Remote Capture: Digitising Documentary Heritage in Challenging Locations*, viewed 4 April 2021, http://www.jstor.org/stable/j.ctv8j3vh, viewed 4 April 2021, http://www.jstor.org/stable/j.ctv8j3vh, p. 30.
80   Pearson, p. 30.
81   Pearson, p. 30.

through the work, is more efficient and effective in the long run as it will reduce mistakes, avoid the need to repeat work and increase the quality of outputs.

Pre-digitization

The two main activities in the pre-digitization phase relate to metadata and physical preparation of the collections to be digitized.

Metadata preparation

Metadata workflows and scheduling will vary depending on the needs of each project. It will be necessary to gather and create metadata to ensure that the physical record and its digital surrogate are described to a minimum level as outlined in the organization's digitization policy, and to ensure that they are linked together and identifiable. Gathering and creating metadata is also necessary for the metadata to be made available within a database environment.

As a general principle, staff should design workflows that minimize the handling of documents. For this reason, it would be ideal to implement a single workflow for metadata preparation (indexing/cataloguing) and physical preparation of records at the same time. It is also recommended to gather and prepare descriptive metadata before digitization to facilitate workflow.[82]

Any pre-existing information about source records on paper or in electronic catalogues and inventories may be consulted during the selection phase and metadata creation processes. New technical and descriptive metadata may also be created during and after digitization.[83]

Metadata could be added directly to the database environment before digitization. If pre-cataloguing directly into the database environment is not possible, then a simpler tool such as an Excel spreadsheet could be used for gathering and recording metadata. In all cases, staff may be trained to use the tools at hand. It is worth remembering, however, that if metadata need to be migrated to a database environment afterwards, this may be time consuming and complex. The work of migrating and uploading/registering metadata and digital files must be built into the project plan. Staff who manage the database environment must be consulted during planning of relevant metadata processes and decisions.

Physical preparation

Physical preparation is the process of preparing source records for digitization. Protocols and workflows for safe and sanitary handling of materials must be documented and followed, and staff should be trained on how to properly handle records. Physical preparation involves removing staples, paper clips and other types of binding. If the budget allows, the process may also involve rehousing of physical records in archival-quality containers, folders or sleeves as they are prepared for digitization. Physical preparation of collections could be incorporated into workflows for metadata gathering and creation or in the digital conversion workflow, depending on available space and the logistical capacity of digitization staff to remove bindings and rehouse collections.

The physical preparation process should be tested using a sample from the actual collections to be digitized, not only as part of workflow design but also to better understand the nature of the collections and special cases

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82   FADGI, 2016, p. 81.
83   FADGI, 2016, p. 81; ISO, 2010, p. 11.

that may be encountered. For example, a decision may be needed about how to treat oversized materials or items in different formats, such as bound, graphic, newsprint or audiovisual materials found in loose-leaf paper records.[84] Protocols for handling and digitizing irregular cases (such as multiple copies of the same document, ephemeral materials, handwritten annotations, coloured tags, post-it notes and so forth) may also need to be formulated.[85]

Workspaces should be clean and marked as food- and drink-free zones. Staff should be encouraged not to hurry through the process, as it will lead to damage of materials[86] – yet another reason to ensure that enough time is allotted for preparation in the pre-digitization phase.

Digitization/digital conversion

Digitization, otherwise known as digital conversion, is the moment when a digital surrogate is generated from a source record. The digital conversion process must follow technical standards, which ideally have been defined in an organization's digitization policy. The requirement to use technical standards is both practical and based on record-keeping principles. According to the International Organization for Standardization (ISO):[87]

> *The aim of producing digital images is to reproduce the non-digital source record as faithfully as possible so that the digital image can act in place of the non-digital source record, where it is required to act as evidence of business activities.*

In other words, when digitizing items of permanent historical value, a digital copy should be able to 'stand in' for its source record and becomes itself a 'record' in the archival sense. For this reason, a digital object produced from a physical source should be an 'authentic, complete and accessible' copy of the original source.[88]

Moreover, the principle of digitizing 'at an appropriate level of quality to avoid re-digitizing and re-handling of the originals in the future'[89] should guide digitization projects. This is especially the case if records are fragile – in some cases, there may only be one chance to digitize them.[90] The idea of digitizing only once is also practical given the resources and energy that are invested in a single project.[91] This section therefore focuses on aspects of the digital conversion process that support the creation of authentic, complete and accessible digital copies of source records, aiming for a 'once and for all' approach.

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84   UNESCO Digitization Guidelines, p. 6.
85   UNESCO Digitization Guidelines, p. 6; ISO, 2010, p. 10.
86   Marzo Flavio, 'Collection Care and Document Handling', in Butterworth J., Pearson A., Sutherland P., & Farquhar A. (Eds.), *Remote Capture: Digitising Documentary Heritage in Challenging Locations*, viewed 4 April 2021, http://www.jstor.org/stable/j.ctv8j3vh, p. 113.
87   ISO, 2010, pp. 9-10.
88   'Authentic: The product of routine, documented, authorized copying and registration processes. Complete: Accurate, legible reproduction of the original that contains all intellectual and physical components of the original without alterations to content. Accessible: Available, searchable and readable to all those with a right to access it, for as long as it is required'. From the United Nations Archives and Records Management Section (UNARMS), pp. 6-7.
89   Indigitization, "A5: Digitization Principles," https://library-indigitization-2020.sites.olt.ubc.ca/files/2020/06/A5.pdf; See also ISO/TR 13028:2010, p. 18, 'The highest technical specifications that can be realistically supported should be incorporated into the digitization process'.
90   Elizabeth Hunter, 'Image Standards', in Butterworth J., Pearson A., Sutherland P., & Farquhar A. (Eds.), *Remote Capture: Digitising Documentary Heritage in Challenging Locations*, viewed 4 April 2021, p. 94.
91   FADGI, 2016, p. 9.

Technical specifications

When converting physical records to digital formats, it is necessary to select which digital file formats to use for each physical format being digitized (such as bound volumes, photographs and so forth). In addition to the file format, different technical characteristics that determine the final digital file quality must be selected and documented. These include resolution, bit depth or colour resolution, compression and colour management. Defined specifications should be part of the organization's digitization policy. Deciding on the combination of file formats and technical characteristics can seem daunting due to the complexity of the topic. Although the various risks and benefits of different file formats and discussions on technical specifications are beyond the scope of this chapter, many organizations publish guidelines and policies that are freely available online.[92]

The digital conversion process should result in the creation of a first master file (also known as an archival or preservation master file), which is the highest quality and most faithful digital version of a source record. Master files are intended to be kept for the long term and must capture the 'essential characteristics' of the original.[93] Another type of master file is the 'production master,' which is created from one or more archival masters and results in a file of comparable quality to the first master(s).[94] An example is a digitized map that has been captured in several digital images and then 'stitched' together.[95] By contrast, lower-quality digital copies are created from the first master file and are known as derivative or access files.

It is important to select master file formats that are widely accepted by other memory institutions. However, as FADGI notes, 'There is no one correct master file format for all applications, all format choices involve compromises between quality, access and lifecycle management'.[96] A few principles may help to guide the process. For example, ISO recommends that 'The highest technical specifications that can be realistically supported should be incorporated into the digitization process'.[97] This means weighing quality and long-term sustainability factors, such as whether a format is uncompressed or offers lossless versus lossy compression,[98] against practical factors such as file size, which will impact the amount of storage required and the methods of storage.

The United States Library of Congress has also published seven 'sustainability factors' for evaluating file formats based on their long-term sustainability potential, which can help in analysing the pros and cons of different file formats.[99] In addition to these issues, digitization of textual records should ideally include optical character recognition or OCR (the process of converting a raster image of text into searchable ASCII data). In layman's terms, OCR renders a digital file full-text searchable.[100] It is highly desirable to include OCR capability in the digital conversion process, because enabling users to search within the text will greatly open up new access and research possibilities. Master files and 'screen access' copies (see below) should ideally be OCR-capable.

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92 See, for example, Digital Preservation Coalition, *Digital Preservation Handbook*, https://www.dpconline.org/handbook; Library of Congress, 'Recommended Formats Statement 2020-2021', https://www.loc.gov/preservation/resources/rfs/, 'Formats, Evaluation Factors, and Relationships', https://www.loc.gov/preservation/digital/formats/intro/format_eval_rel.shtml and 'Sustainability of Digital Formats: Planning for Library of Congress Collections', https://www.loc.gov/preservation/digital/formats/sustain/sustain.shtml.

93 FADGI, 2016, p. 13.

94 FADGI, 2016, p. 13.

95 FADGI, 2016, p. 13.

96 FADGI, 2016, p. 12.

97 ISO, 2010, p. 18.

98 For a basic introduction to technical aspects of digitization, see Howard Besser, 2003, *Introduction to Imaging*, https://books.google.fr/books?id=F-hVAgAAQBAJ&printsec=frontcover&redir_esc=y&hl=fr#v=onepage&q&f=false.

99   See Library of Congress, 2017b, 'Sustainability of Digital Formats: Planning for Library of Congress Collections' https://www.loc.gov/preservation/digital/formats/sustain/sustain.shtml.

100 FADGI, 2016, p. 68.

Derivative files

It is best to determine the various types of derivative files and their eventual uses at the beginning of a digitization project. Types of derivative files may include 'print access', 'screen access' and thumbnails.[101] If digitized files need to be uploaded to a catalogue or database, for instance, master files might be too large for the system to handle. Lower-resolution 'screen access' files must be uploaded to the database environment instead.

It is most efficient to create access copies from preservation master files at the point of digital conversion. This will save staff from having to convert a large number of files to a different file format and lower resolution later. It is advisable to consult IT staff on the ideal file size that database environments are able to handle (in other words, the maximum number of bytes per file). Staff who need high-quality 'print access' copies for exhibitions or other communications activities may also be consulted on ideal image resolutions. For textual documents, access copies of multi-page documents should be produced in a single integrated portable document format (PDF) instead of as separate pages per file, in order to avoid having to combine the single pages into a complete file later.

Relationships

Three main types of relationships must be maintained during digital conversion. The first is the relationship between different parts of the same physical record, such as a physical folder (which may contain information on the cover) and the documents inside the folder, or a document with a note attached to it.[102] Each digital file representing a single page or a single part of the physical record must be linked to its other parts, 'so that the digitized image can faithfully represent the non-digital source record'.[103] This is accomplished using file-naming conventions.[104]

The second type of relationship is the correspondence between a digital file and its original source record.[105] The linking is accomplished using a unique identifier, which consists of a series of numbers or an alphanumeric code. The unique identifier must be documented in the metadata of the physical record. The linking process may sometimes be automated if barcoding is possible.[106] It should be noted that records – both digital and physical – will likely have more than one identifier or code, such as the number of the catalogue record and a historical code linked to the original physical record.[107]

A third type of relationship is between the master file and its derivative files. Links between different file versions are also maintained through file-naming, for example, by adding a qualifier or suffix to the master file name to indicate the status of a file as an access copy.[108]

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101 Indigitization, 'C2, Standards', https://library-indigitization-2020.sites.olt.ubc.ca/files/2020/06/C2.pdf, p. 5.
102 ISO, 2010, p. 10.
103 ISO, 2010, p. 10.
104 FADGI, 2016, pp. 83-85.
105 ISO, 2010, p. 10.
106 ISO, 2010, p. 10.
107 FADGI, 2016, p. 75.
108 ISO, 2010, p. 24.

Quality control

Quality control is essential and occurs at multiple points throughout a project, such as when working on metadata, and during and after digital conversion. The purpose of quality control during the digital conversion process is to ensure that the digital record is 'a true and accurate copy' of the source record.[109] It should be understood as an inseparable part of the digitization process. Quality control procedures should check for the following: aspects of file integrity and technical specifications; correctness and completeness in representing the original record; completeness and accuracy of the metadata; and correctness of the image quality.[110] A complete list of each element to check must be documented and followed. Staff must be thoroughly trained on quality control procedures.

At least two levels of quality control must be incorporated during digital conversion.[111] The first level of control should occur immediately after digital conversion by the imaging operator. The second level of control should ideally be performed by a second person, and even a third person if it is a big project. If this is not possible, more time should be given for the imaging operator to complete a more thorough quality check after each conversion.

For the second-level quality check, the sampling rate of digitized files should be a minimum of one per every 10 items scanned.[112] If problems are found frequently, then it may be necessary to increase the sampling rate, for example, to 25 per cent of items scanned. It may also be useful to use a higher sampling rate at the beginning of the digitization process and decrease the sampling rate to 10 per cent once an appropriate level of quality has been achieved (if relatively few issues are found).

Checksums

In addition to quality control procedures, a checksum should be generated for digital records, either per file or per group of files[113] and must be stored with the digital files.[114] A checksum is 'a unique alphanumeric value that represents the bitstream of an individual computer file or set of files'.[115] It can be thought of as a 'digital fingerprint'.[116] Checksums are used to verify the integrity of digital files, that is, whether or not digital files have been corrupted or altered.[117] This verification process is known as a 'fixity check' or 'integrity check'[118] and can be done through a checksum calculator programme that reads the alphanumeric value and returns an error report if any changes have occurred in the file or the folder.[119] Checksums are an important tool for ensuring that digitized files remain uncorrupted and unaltered over time. Other tools for checking file integrity are 'cryptographic hash values' or 'hashes', including secure hash algorithms or message-digest algorithms (MD5, SHA-1 and SHA-256), which use

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109 ISO, 2010, p. 11.
110 For a more detailed checklist, see FADGI, 2016, p. 86-88.
111 FADGI, 2016, p. 85.
112 FADGI, 2016, p. 86.
113 Butterworth et. al, 'A workflow for digitisation', in *Remote Capture: Digitising Documentary Heritage in Challenging Locations,* viewed 16 April 2021, http://www.jstor.org/stable/j.ctv8j3vh.13, p. 130.
114 FADGI, 2016, p. 90.
115 Society of American Archivists (SAA), "Checksum," Dictionary of Archival Terminology, viewed 15 April 2021, https://dictionary.archivists.org/entry/checksum.html.
116 Digital Preservation Coalition, 'Fixity and checksums', in Digital Preservation Handbook, viewed 16 April 2021, https://www.dpconline.org/handbook/technical-solutions-and-tools/fixity-and-checksums.
117 Society of American Archivists (SAA), 'Checksum', viewed 15 April 2021, https://dictionary.archivists.org/entry/checksum.html.
118 Digital Preservation Coalition, 'Fixity and checksums', viewed 16 April 2021, https://www.dpconline.org/handbook/technical-solutions-and-tools/fixity-and-checksums.
119 Butterworth et. al, 2018, p. 130.

an algorithm to generate values for digital files.[120] Checksums should be verified when files are transferred from one system to another, such as when backup files are created or when files are deposited into a trusted digital repository.[121] However, integrity checks should be performed on a regular basis even if the files have not been moved or copied. The Digital Preservation Coalition recommends that files be checked annually if they are on data tapes, and every six months if they are stored on hard drives.[122]

Post-digitization

Post-digitization activities ensure that digitized files and metadata are searchable, findable, accessible and sustainably managed. The post-digitization phase may include communication activities if the purpose of the project is to make digitized files widely available. Finally, it is important to celebrate project successes and to document lessons learned at the conclusion of the project.

Database environment

Following digitization, digital files should be uploaded to a database environment for documentation purposes, accessibility and usability by the organization, the public or both - depending on the project's objectives.[123] Metadata gathered and created in earlier phases may already be registered in the system, or should be mapped to the system's metadata elements for submission along with the digital objects. It may be necessary to enhance the existing metadata with any technical and descriptive metadata created during the digitization process. This process should be considered an integral part of the project and should not be left out of the project plan.

Digital preservation

Digital preservation refers to a set of standards and practices that help to ensure the continued accessibility of digital files over the long term. The digitized files will need to be maintained and monitored by applying digital preservation strategies and practices to support their continued readability over time. Strategies for the long-term management of digital files may include migration to new file formats or file versions; migration to new electronic systems; regular fixity/integrity checks; creation and maintenance of preservation metadata about the digital file; management of existing metadata about the digital file and the original record; creation of multiple backups stored in different locations; and, if possible, management of digital files within a trusted digital repository.[124]

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120 SAA, 'Checksum'.
121 Butterworth et. al, 2018, p. 130; SAA, 'Checksum'.
122 Digital Preservation Coalition, 'Fixity and checksums'.
123 ISO, 2010, 12.
124 See the website of the Center for Research Libraries, 'Digital Preservation Metrics' page, https://www.crl.edu/archiving-preservation/digital-archives/metrics; and the Consultative Committee for Space Data Systems (CCSDS), *Reference Model for an Open Archival Information System*, https://public.ccsds.org/pubs/650x0m2.pdf, which has been turned into ISO 14721:2012. However, the ISO standard must be purchased, while the original standard developed by the CCSDS is freely available online.

Storage and backups

Storage is only part of a strategy for managing digital files for long-term accessibility. The following issues should also be considered:

◆ Secure storage environment - Digital files should be saved in secure storage environments, accountably documented and managed, with security measures for identifying attempts at unauthorized access.[125]

◆ Different storage devices - FADGI recommends using a combination of different types of storage devices, including hard disks that use RAID technology (Redundant Array of Inexpensive Disks), as well as Linear Tape-Open (LTO) data tapes.[126]

◆ Backups - At least two backups should be made.[127] Backups must be checked for file integrity using checksums or hashtags.

◆ Multiple locations - At least one backup should be stored in a separate, secure location.[128] It is key to identify who is responsible for safeguarding the backup(s).

◆ 'Primary dataset' - Butterworth et al. suggest keeping a 'primary dataset from which all backups are generated'.[129] This is an excellent principle for tracking and ensuring that there is a central, authoritative set of files.

◆ Restore plan - Prepare for the possibility that files and backups could become unavailable, compromised or even deleted. Define the different types of situations when data would need to be restored, how and who has the ability to restore data, and the expected 'restore downtime'.[130] It is a good idea to establish and test a restore plan as part of a disaster recovery plan.

Outreach, communication and partnerships

Digitization projects have the potential to generate enormous amounts of interest amongst different user groups, the general public and potential donors or partners. If the digitized materials are meant to be shared publicly, the organization must make some effort to communicate the availability of the collections to user communities. Notices on the organization's public website and announcements through professional, university and educational networks are good places to start. Although communication activities require staff time and effort, incorporating a few achievable and defined communication activities as part of post-digitization activities is one step towards increasing the visibility of digitized collections. It is important to reach out to audiences who may not otherwise be aware that the digitized collections exist. Other potential ways to raise interest include contacting local radio or media. Digitization projects provide a wealth of storytelling opportunities from multiple angles that can appeal to both the public and to specialized audiences (for instance, about the collections; about the processes and technological aspects of digitization).

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125 ISO, 2010, p. 8, 12.
126 FADGI, 2016, p. 90.
127 FADGI, 2016, p. 90.
128 FADGI, 2016, p. 90.
129 Butterworth et. al, 2018, p. 131-32.
130 Peter Bubestinger-Steidl, 2019, presentation on the topic of 'Backup' for 2019 Winter School of Audiovisual Archiving, the Netherlands Institute for Sound and Vision, Hilversum, the Netherlands.

Project evaluation

At the end of a digitization project, it is important to celebrate the achievements of the project, to evaluate and to reflect with the project team on 'lessons learned'. There should be a systematic approach to evaluate the processes and results of the project based on the defined project purposes and expected outcomes. The organization may already have a project evaluation policy or procedures in place that must be followed. Specific evaluation criteria should be documented and should outline the measures used to determine whether project objectives have been achieved. A final evaluation report outlining the achievements of the project and recommendations for future projects should be documented and saved along with the rest of your project documentation, for reporting and accountability and for future reference.

Lessons learned should be incorporated into the evaluation report. Lessons learned are hard-earned knowledge and information gained through lived experience and processes of trial and error. For all their obvious technological aspects, digitization projects are deeply human endeavours and each one entails a collective process of learning and discovery that is often both surprising and rewarding. The end of the project is an opportunity to take stock and to record what worked and what could be improved for next time. Lessons learned offer invaluable insights. As part of project documentation, it may be helpful to create a shared document early in the project called 'Lessons Learned' that can be added to throughout the project. It is preferable to keep adding to the document as the project unfolds, instead of trying to remember everything at the end. A final team meeting should be scheduled to debrief about lessons learned and to add any important final points.

When you have reached the 'end' of the digitization project, it is important to bear in mind that the result is a resource that requires continual care and maintenance, because it is meant to survive for as long as possible. Time should be spent on recognizing and celebrating with team members the substantial efforts involved.

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5. Affordable and robust digitization solutions - examples and analysis of technological and educational needs

Günther Cyranek[131], Felix Gross[132], Galina Skowronek[133]

Summary

This KAdKa (Competence Centre Archive Digitisation Karlsruhe) approach facilitates the process of affordable archive digitization to avoid cost-intensive outsourcing solutions. Digitization with cameras provides all professional standards for various originals such as photographs, slides, posters, negatives on glass, books, posters and so forth.

Inclusive accessibility and visibility of the past will be enhanced by building capacity in memory institutions for the digitization process and support for designing the public (online) presence of digitized collections in collaboration with relevant university history departments.

Introduction

According to the UNESCO Recommendation concerning the Preservation of, and access to, documentary heritage including in digital form (Paris, 2016),134 such preservation and long-term access to documentary heritage underpins fundamental freedoms of opinion, expression and information as human rights. The recommendation also recognizes that, over time, considerable parts of documentary heritage have disappeared due to natural or human disasters or are becoming inaccessible through rapid technological change.

Lack of legislation makes it difficult for memory institutions to counter irreversible loss and impoverishment of that heritage. Finally, there is need for States, communities and individuals to take appropriate measures for the protection, preservation, accessibility and enhancement of the value of documentary heritage. Supportive regional action plans were elaborated for this recommendation, including the Abuja Action Plan for implementation (Abuja, 2018)135 by the Regional MoW Committee for Africa (ARCMOW) and the Pacific Member States Action Plan (Suva, 2017)136 of MOWCAP (Memory of the World Committee for Asia and the Pacific) in co-operation with PARBICA (Pacific Regional Branch of the International Council of Archives).

This contribution relates to affordable, powerful but do-it-yourself digitizing workstations,[137] which are especially appropriate for memory institutions working with a variety of templates (originals).

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134 Cf. https://unesdoc.unesco.org/ark:/48223/pf0000244675, accessed 30 March 2021.
135 Cf. https://en.unesco.org/sites/default/files/afr_regional_consultation_2015_recommendation_concept_note_eng.pdf, accessed 30.03.2021.
136 Cf. http://www.mowcapunesco.org/wp-content/uploads/Pacific-Recommendation-Action-Plan-April-18-.pdf, accessed 30 March 2021.
137 Cf. https://www.unescopersist.org, accessed 30 March 2021.

Figure 1. Assembled and disassembled KAdKa Prototype (unfinished)

Prototype 001, assembled

disassembled for transport

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The KAdKa project group

KAdKa stands for Competence Centre Archive Digitisation in Karlsruhe, Germany. The project is based on 60 years of experience in professional photography, and 20 years with a photography digitizing technique of the highest quality that is suitable for academic research.

Versatile and efficient archive digitization is based on digital photography. Any type of scanner is a photographic device with strongly limited working opportunities.

Fast, cheap, user-friendly and universal digitization can be processed with digital cameras. The physical fundamentals are identical to those of general and object photography. All common peripheral systems (lighting systems, camera stands, computers, software and so on) can be used in the same way for digitization work. Likewise, the various functions of the cameras (autofocus, gradation, exposure control, colour settings, contrast and so forth) can also be used for digitization.

Most standard computers meet the demands in computer hardware. The camera programmes are compatible with all operating systems. The image can be checked on the fly within a second on screen. At the same time, Tagged Image File Format (TIFF) or Joint Photographic Experts Group (JPG) data in different compression rates for thumbnails, as well as RAW data, can be stored with a single shot, providing maximum quality and processing possibilities as master data for postproduction (such as with open source software).

At the beginning of this non-profit project, the project management intends to set up seminars combined with a workshop in Karlsruhe to develop archive digitization prototypes and workstations, and to produce video and text instruction material (tutorials) for do-it yourself production and free use for all interested parties worldwide.

For the moment, KAdKa is concentrating on requests from Africa. In the future, the project will be open to all other regions, depending on financial resources. As part of the second phase of the project, evaluations in African memory institutions will be used to prepare two-week workshops using workstations in Karlsruhe. In addition, trainees can visit memory institutions in the region and discuss technical and administrative experiences.

After the workshops, support is planned for creating archive digitization workstations for the archives in the African countries involved. Contacts with African archives will be made through the City of Karlsruhe and their city network of cooperation, and supported by the German Commission for UNESCO and the UNESCO programmes Information for All (IFAP) and World Documentary Heritage/ Memory of the World (MoW).

Grassroots

Except for the sophisticated parts (cameras, lenses and computers), all components of the construction of the workstations are technically simple and can be made by the users themselves, with some do-it-yourself experience and tools (especially with the help of local craftspeople such as carpenters). As part of KAdKa, a workshop is planned so that participants can implement their own projects based on their needs.

Individual design sketches (not blueprints) can be developed during the workshops, after identifying the specific needs of each participating facility. The KAdKa workstations are based on an open-multimodular system, which is easy to assemble and disassemble built of widely available materials, lightweight, transportable by car and portable enough to be used at multiple locations.

An important premise is that future digitization specialists have to be prepared to learn how to produce their own workstations (see further construction details for a KAdKa Prototype in Figure 6) and how to work with them. As a result, they learn the basics of professional photography along the way.

Sustainability

The project comes under Sustainable Development Goal (SDG) 16/Target 10: [138] 'Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements', and SDG 17/Target 9:

Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation. Strengthen the means of implementation and revitalize the global partnership for sustainable development with technology, science and capacity building. And further: affordable technological solutions have to be developed and disseminated widely.

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138 Cf. https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals, accessed 30 March 2021.

Figure 2. KAdKa workshop in Karlsruhe, Mr Gross, Ms Massimo and Ms Richard

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The competence centre in Karlsruhe is expected to help those interested in producing high-quality digitization workstations by themselves, supported by video and text instructions in the future and face-to-face seminars available now in Karlsruhe. The sophisticated parts (cameras, computer and appropriate software) are available worldwide for moderate prices.

The local production of the workstation(s) makes local maintenance possible. As the disassembled workstations can be transported in cars, they can be used in different locations (shared use). It is easy to take the camera out of the workstation and use it for other purposes (dual use). The cost of the universal KAdKa workstation is much lower than industrial products, as well as being much more flexible and easier to transport. In the event of obsolescence or damage of the camera, a new camera can easily be incorporated instead.

Pilot project in South Sudan

For South Sudan, which has been independent since 2011, documentary heritage is part of nation building. After the civil war, digitization contributes to the recovery of history.

With the support of the Secretariat of IFAP Programme in Paris and the UNESCO Juba Office, a one-week training workshop (1 to 7 December 2019) was organized as part of a pilot project in Karlsruhe with two archivists from

the South Sudan National Archive (SSNA), Juba. SSNA is co-funded by the Government of Norway. The KAdKa workstation, pictured in Figures 1 and 6, was shipped to Juba in February 2021 (following delays because of the COVID-19 pandemic). The virtual online training for Juba is planned for spring/summer 2021.

Technical features

The development of technology in digital cameras is rapid. Currently, devices up to 150 million pixels are available on the market. Second-hand cameras using Advanced Photo System in classic format (APS-C) with sufficient quality for art prints (300 dots per inch (dpi)) for output formats over 30x40 cm are available from about 100 €, while new ones for up to 50 million pixels cost about 1000-3000 €. Compatible macro lenses with autofocus cost around 300-600 € (new). The usual camera control programmes offer practical precise preview and live-view modes for work. With such cameras, templates of all kinds can be digitized.

The stitching technique, which can be used with all cameras, produces quality results from large originals. The originals are moved from shot to shot on the baseboard, so that partial images are taken in one or more rows with some overlapping. These images are automatically stitched together by relevant computer programmes (Photoshop and similar). This method enables extreme file sizes, without the limits of all types of large format scanners.

Using the stitching technique, unique historical maps, oversized tapestries and works of art can be captured. With proper experience and a little practice, it is also possible to archive exceptional objects at low cost.

Further innovative concept details are: the adjustable distance of the optical axis to the column for oversized and small originals; variable independent light sources; cameras that can be rotated continuously around the optical axis for portrait and landscape format and to adapt to oblique positions (as is often useful for daguerreotypes); adaptability to all kinds of recording systems and for all brands of scan backs of with very high pixel numbers (up to 380 megapixels); mechanically operable peripheral modules to avoid safety-related problems with electro-mechanics; and the ability to work with relatively inexpensive accumulator-supported power supply in the field.

Figure 3. Stitching technique

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Figure 4. Workshop visit (Dr. Nippert at the Archive of the Karlsruhe Institute of Technology (KIT))

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Quality references on digitization

By means of KAdKa workstations, cost efficiency does not necessarily go hand in hand with a loss of quality. A reference for the quality of the workstations is the University Archive of the Karlsruhe Institute of Technology (KIT).[139] In recent years, tens of thousands of documents and photographs from different research institutes, departments and faculties have been digitized. After a broad evaluation of the market, the KIT archive decided to work with three KAdKa workstations and students as operators.

For the County Archive Rastatt, a workstation was created that went on to digitize about 160,000 pages of historic newspaper pages within three years.

Depending on the type of camera, and in combination with special lighting methods developed and taught at KAdKa, there are almost no limits on quality.

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139 Cf. https://www.archiv.kit.edu, accessed 30 March 2021.

For the exhibition on the History of photography in Karlsruhe 1840-1990 at the Prince Max Palais museum in Karlsruhe, a postcard-sized daguerreotype from 1840 (a unique image on a silver copper plate) was digitized and enlarged to 2.4 m as a central light poster for the exhibition (see middle of the reference photo, Figure 5). The other elements of the reference photo show digital copies of particularly difficult templates.

Speaking of different templates, KAdKa plans to become part of the company AV-Lab (audiovisual laboratory), so that this institute can offer workshops on capturing audiovisual material from magnetic tapes or film such as 16mm or 35mm. Future work will focus on how the digitization of moving images can be made available on site with the help of a mobile workstation.

Figure 5. Reference photograph on the results of digitization
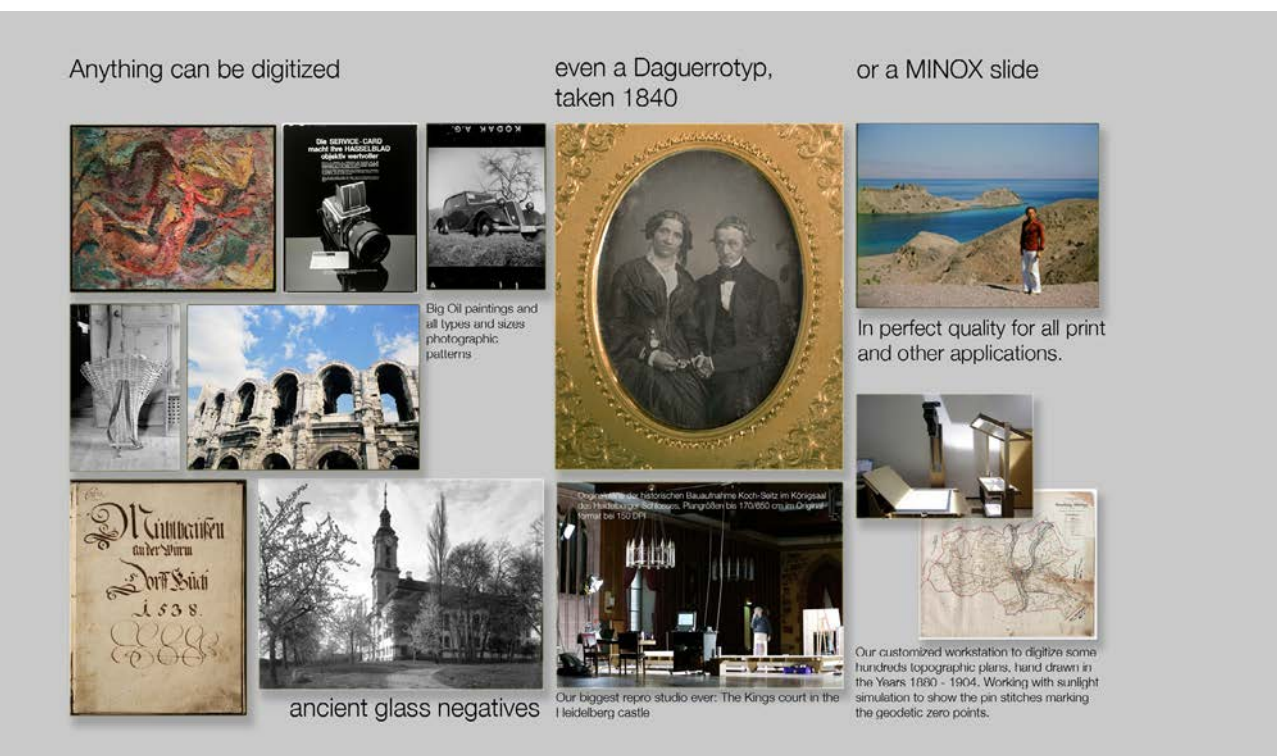
© Felix Gross

Policy statements

Archives are important parts of the memory of nations, of the world. If archives are public and accessible online, they can provide information, resources and knowledge for all people worldwide (but only the documents they have in digital format). Two good examples of archive digitization are the Digital Archive of the Beethoven-Haus,[140] Bonn, and the Austrian Mediathek,[141] formerly Austrian Phonothek, which not only preserve and digitize their inventories but also make them available to the general public.

Public archives in the Federal Republic of Germany have on average approximately 3 to 4 per cent of their archival stock digitized. Most archivists agree on that relatively low figure, although they would like to have much higher rates. There are limited budgets for external service providers, internal personnel, space and budget for technical equipment. Where equipment is available, there may not be the trained staff capable of using it. Finally, most of the available workstations on the market are not universal enough for all types and sizes of originals.

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140 Cf. https://www.beethoven.de/en/archive/list, accessed 30 March 2021.
141 Cf. https://www.mediathek.at/ueber-uns/information-in-english/, accessed 30 March 2021.

The KAdKa concepts facilitate affordable archive digitizing that avoids high-cost outsourcing solutions. Digitizing with digital cameras covers all professional standards, types, objects and templates, including photographs, slides, posters, negative on glass and film, books, posters, maps, tapestry, paintings, documents, manuscripts and objects of any kind. Establishing in-house capacities for memory institutions is the recommendation, while the responsibility for achieving the qualification must be part of the job description of present and future archivists.

Empowering archivists to become activists on behalf of the materials in their care is the vision of KAdKa. One goal is to enable the building of virtual, digital collections and online catalogues for a broad audience and for professional use in education and research. Following future tutorials and workshops, an experienced user with a self-built workstation can fulfil all tasks in archive digitizing. In addition, the user has the perfect equipment for professional photography.

Understood as a broader recommendation, accessibility and visibility will be improved by in-house capacity building in memory institutions for digitization processes and the design of online presence of the digitized collections in cooperation with relevant university history departments. For these purposes, an appropriate audiovisual MOOC (Massive Open Online Course)[142] could support staff in memory institutions in the future.

The concept and curriculum of such a course should be based on the publications of the Open Field Guides Series vol. 1 (2018), [143] Tate Gallery's publications,[144] Gueguen and Hanlon[145] and others. If the course is produced by an audiovisual media company that can run the workshops and produce a series of audiovisual tutorials, this may help to optimize the efforts for face-to-face education and a subsequent move to online education via video lessons and tutorials via conferencing platforms.

Each episode of the audiovisual MOOC tutorials could be published for free through online public video platforms. The combined effect of the workshops, the do-it-yourself workstation and audiovisual MOOCs would make it possible to spread the knowledge and help to secure and preserve the world's cultural heritage.

Outlook

Wherever electric power is available, the hope of a stable and fast Internet connection opens up the possibility of uploading digitized data for cloud storage. This will not only improve the security and sustainability of a collection of digitized materials by storing copies on remote servers, but will also provide access for researchers and the public from anywhere in the world.

Riedel (2012)[146] described some of the legal aspects that archives have to consider in Germany. She provides a rough checklist for project implementation. This can certainly be adapted to the legal frameworks of archival digitization outside Germany.

For virtual collections and online catalogues to grow, a managed digital archive is critical and many institutions are aware of this.[147] While a wide variety of solutions can be chosen for managed data repositories stored locally and on remote servers,[148] a newly developed, open-source IT solution would represent a major leap for the use of content collected around the globe for online. By using a cross-platform relational database application

142 Cf. https://en.wikipedia.org/wiki/Massive_open_online_course, accessed 30 March 2021.
143 Cf. Butterworth, Jody et al (Remote Capture, 2018).
144 Cf. https://www.tate.org.uk/art/archive/archives-access-toolkit, accessed 30 March 2021.
145 Cf. Gueguen, G. and Hanlon, A.M. (Digitising Workflow, 2009).
146 Cf. Riedel, J. A. (Legal Aspects, 2012).
147 Cf. Weiss, K. B. (Public Access, 2009).
148 Cf. https://www.babs-muenchen.de/index.html?c=workflows_dig&l=en, accessed 30 March 2021.

(which integrates a database engine with a graphical user interface (GUI) and security features), there is a realistic opportunity to standardize the data storage and publishing process.

Now is the time to engage the global community of software developers who could bring together the needs of memory organizations into a dedicated online community such as Wikipedia.org or YouTube.com and of course the Europeana.[149]

Figure 6. Construction details of the KAdKa workstation prototype in Figure 1
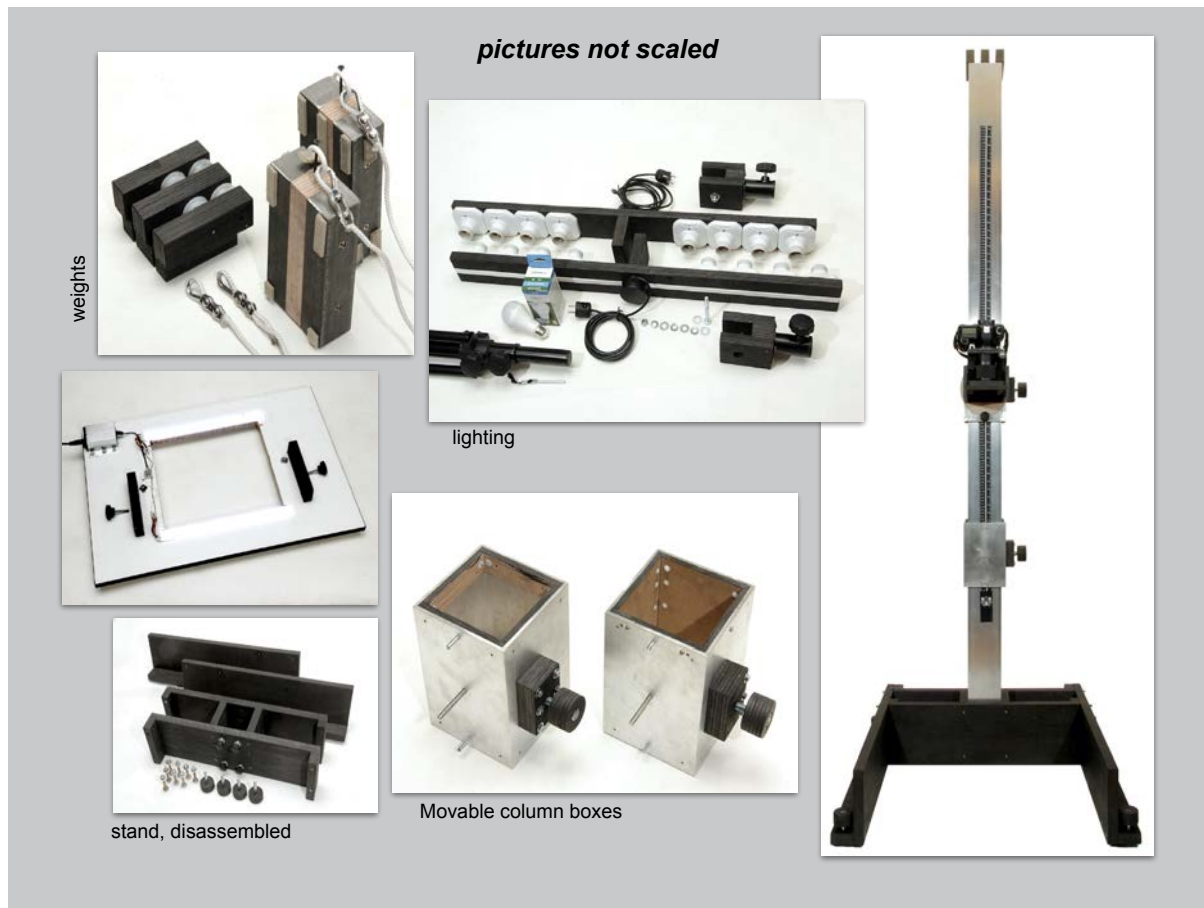
© Felix Gross

Contact and further information

Upon request, a 14-page PDF-brochure is available in German and English: For the KAdKa presentation, please contact Felix Groß gross-fotografie@t-online.de.

For further technical requests regarding digitization workflow, post production and storage concepts, please e-mail Gregor Skowronek, office@av-lab.de.

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149 Cf. https://www.europeana.eu/en, accessed 30 March 2021.

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6. Digitization for preservation

A practical approach to effective, low-cost digitization for long-term protection and future access

Katrine Loen[150]

Archives and institutions around the world have significant analogue collections that are slowly deteriorating, with access becoming more and more challenging. Digitization offers many benefits, allowing content to be accessed and remonetized, while aiding searchability, cataloguing and management.

However, digitized and born-digital information faces new risks that need to be mitigated. Maintaining access to digital information can be challenging after just a few years. Documents can also become corrupt, manipulated or even lost due to poor cataloguing.

Digital preservation - an essential process to mitigate these risks

The process of digital preservation ensures that content is stored in appropriate preservation formats with metadata extracted to ensure future access while maintaining the authenticity of the files.

These two essential processes together ensure the authenticity, survivability and accessibility of the material for the long term. Combining both the digitization and the preservation process into a single workflow promotes efficiency and cost effectiveness. Digitizing a large collection but failing to preserve access can become an expensive challenge just a few years into the future.

Digitization for preservation refers to the act of digitizing archival material, capturing all the original information contained within it and creating a digital copy of the material.

This chapter describes how to plan such a project, design a cost-effective workflow and ensure data is appropriately preserved as part of a unique long-term digital preservation initiative.

Planning and preparation

It is important to develop a comprehensive plan that ensures the desired outcomes can be achieved, as a project can be challenging and expensive when mismanaged. Good planning ensures the project team has a thorough understanding of the necessary processes, the risks and mitigation measures in advance. It also ensures informed decisions can be made about equipment, technology, timeframe and expenditure to help minimize cost elements - thereby reducing the overall resources needed to succeed with the digitization.

When developing a plan to digitize and preserve analogue content, there are three key components to consider: selection, standards and required metadata.

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150 Katrine.loen@piql.com.

Selection/analysis of the collection

Analysis of the collection seeks to understand what the collection contains (file types, content themes, physical media and so on) to support decisions about what should be selected for digitization. When selecting content, teams should consider content value, demand, condition of the material and any copyright issues.

Selection helps to ensure that resources are invested wisely in digitizing the most significant and useful content, while ensuring that only appropriate material is selected in the light of technical feasibility and legality.

Standards for digital imaging

Digitization plans should relate to recognized international standards to ensure that digital imaging is appropriate and will retain value over the long term.

Creating 'archival masters' with optimum quality is also worthwhile as they can then be used to create derivatives to meet various current and future users' needs. The quality and usefulness of multiple derivatives (for publication or image display and so forth) will be directly affected by the initial scan quality. Decisions on standards should be based on plans for future use, as the overall cost increases in direct proportion to the standard of quality. There could be an opportunity here to achieve costs savings based on prioritization of documents and the intended future use by opting for lower quality for low future value documents and high quality for documents that can be monetized in the future.

The choice of preservation method can play an important role in making the right decisions around quality. For example, larger file types can involve higher costs with some mediums and services, especially if preserved data will remain online. Higher quality scans may also prove a better investment and save costs down the line.

There are many best practice recommendations for digitizing materials. These guidelines may need adapting to specific projects, depending on source document characteristics such as font size, photographic detail and physical size.

Table 1. General recommendations for file formats

Material type	Minimum resolution	Minimum bit depth	Minimum colour space
Books and textual documents without images	300 dpi	8	Greyscale
Books and textual documents with images	400 dpi	8	Greyscale
Manuscripts	400 dpi	24	Colour
Maps	300 dpi	8/24	Greyscale/Colour
Photographic prints (<8" x 10">)	400 dpi	8/24	Greyscale/Colour
Posters	300 dpi	24	Colour
Negatives or films	1200 dpi	8/24	Greyscale/Colour

Metadata

Metadata are crucial for ensuring that digital resources continue to be accessible in the future. Metadata take the form of structured information that describes, explains, locates or otherwise makes it easier to retrieve, use or manage a digital file.[151]

Digital information is fragile; it can be easily corrupted or altered. Over time, it may become unusable as storage media, hardware and software technologies change and evolve. This is often managed either through format migration (both software and physical media) or emulation of the historical format.

For effective archival and preservation, unique elements are required to track the provenance of a digital file (where it came from and how it has changed over time), to detail its physical characteristics and to document its behaviour to emulate it on future technologies.

This information can be captured using internationally recognized metadata schemes such as Preservation Metadata: Implementation Strategies (PREMIS) or Dublin Core. These schemes are based on a set of core elements and strategies for the encoding, storage and management of preservation metadata within a digital preservation system. Many of these initiatives are compatible with the ISO Reference Model for an Open Archival Information System (OAIS). The benefits of using recognized schemes are that all aspects of preservation metadata are collected, the data are findable and future users have the necessary contextual and reference information.

Designing an effective workflow

Having an effective and efficient workflow for digitization projects will prove invaluable. The workflow should consider all aspects of the process from selection, physical relocation, reception of objects and files and preparation, through to digitization, digital management and preservation of the digitized content.

Before designing a workflow, it is important to select an appropriate collection management system. This system will manage all digitized records and determine a number of requirements. Standards ISO15489-1:2016 Records Management – Concepts and principles and ISO30301:2019 Management systems for records provide scope and best practice guidelines for effective collection management.

According to these standards, the workflow should systematically control the creation, appraisal, maintenance, use and disposal of the information objects.

Figure 1. Workflow for digitization projects

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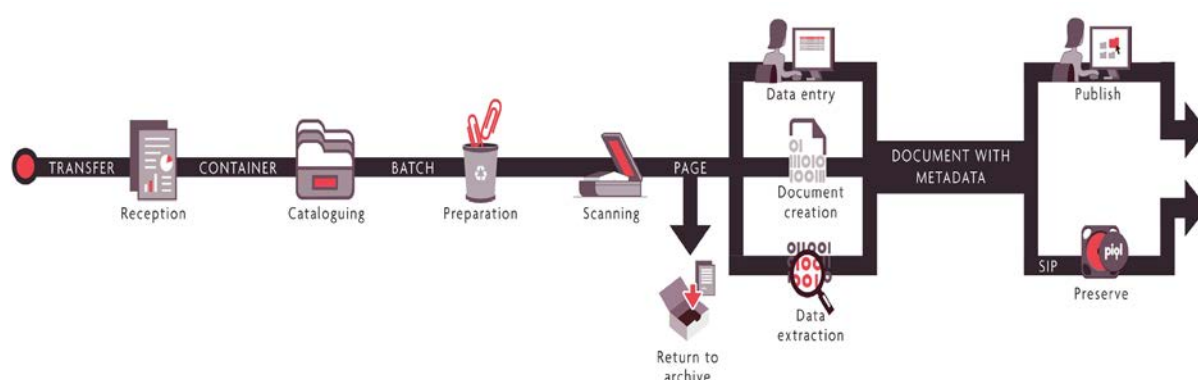
151 https://www.lter.uaf.edu/metadata_files/UnderstandingMetadata.pdf, NISO – National Information Standards Organization, United States, 2004.

Selecting equipment

An analogue collection will need to undergo some preparation prior to scanning, such as the removal of staples or binders, necessary cleaning or physical preparation of older or damaged items and possibly barcoding (as part of the collection management system). It is likely that a collection will require different digitization equipment and scanners. Most service providers will offer a range of equipment to ensure a high-quality result.

Metadata extraction

Indexing is the process of capturing relevant metadata associated with the files. Some metadata are used to index the files to aid retrieval, and other metadata are used to manage those files over time. Depending on the content, metadata can be entered manually or through automatic data extraction. Following a metadata scheme, as mentioned above, is highly recommended.

To ensure text is readable and searchable, Optical Character Recognition (OCR) is essential. There are several tools that can provide this, including:

◆ Tesseract: an open-source OCR engine for various operating systems released under the Apache License. It supports English, German, Italian, French, Portuguese, Japanese, Chinese and Russian languages.

◆ Abbyy FineReader: a commercial tool that has been on the market for a long time. It achieves accurate results in different languages and provides polished final products, like PDF files with text embedded.

◆ Lumex: Norwegian company specialized in high-performance industrial OCR extraction.

All files should be saved in a sustainable preservation format such as eXtensible Mark-up Language (XML), Portable Document Format Archive (PDF/A), Tagged Image File Format (TIFF), Joint Photographic Experts Group (JPEG2000), Waveform Audio File Format (WAV), Motion Pictures Expert Group (MPEG-2) and so forth.[152] This ensures that it can continue into the preservation stage of the workflow.

Quality assurance

It is important to monitor quality throughout the digitization process. Operators should perform calibration tests at the start of every shift, verifying that lenses are focused and cameras have the correct settings to create the most accurate representation of the materials.

All images should be reviewed visually to ensure the files have the correct technical specifications and images are not cut off, obstructed or out of focus. Any images with errors should be rescanned to ensure the best capture possible. Poor quality can lead to exponential costs, both internally and externally. In addition to the defective product's direct cost, it is essential to consider the internal processes that directly or indirectly led to those errors (unqualified personnel, inappropriate equipment, wrong digitization settings and so forth).

Poor quality can increase the handling and transportation risks when digitizing delicate collections. Finally, if the unchecked content is published for access, the end-user experience is affected.

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152 https://www.loc.gov/preservation/resources/rfs/.

Preservation of digitized content

Digital preservation is the act of preserving and maintaining the digital information created from the initial digitization process and preserving access to the content.

Digital files have a short lifespan unless activities to preserve access to them are undertaken. Keeping a backup of your files is important to guard against loss. However, this does not protect them from the risks over time. If steps are not taken to preserve the files properly, access may be compromised for various reasons, including:

- ◆ obsolescence of equipment, operating systems, software or file formats
- ◆ loss of metadata
- ◆ damage to physical carriers
- ◆ human-made or natural disasters
- ◆ loss of information during migration to new formats
- ◆ inadvertent edits or deletions of files
- ◆ confusion over copyright or usage policies.

Digital preservation is focused on preserving access to information. This relates to software, formats, codecs and hardware, all of which eventually become obsolete, rendering content unreadable. A popular strategy is to migrate data to new media and formats over time. This does not come without risks to the content, and requires designated resources and planning. Some service providers offer 'active' preservation, where data is automatically migrated as required.

Another approach is emulation of the historical format, where software is preserved so older formats can be opened and accessed.

Some providers offer preservation of the software, format specifications and hardware descriptions with the preserved material on an offline, sustainable and long-lasting medium. This approach ensures that data can remain on the offline media for as long as possible, can be accessed whenever required and has a low environmental impact. Using a WORM (write once read many) medium provides assurances with regards to data integrity, authenticity and security. This form of digital preservation is ideal in the longer-term perspective.

For this approach to be effective, however, accessibility must be built in to the medium, so data can always be retrieved. Ideally, this would mean storing all the information required to access the information (access instructions, reference information, software or technology required) alongside the preserved data in a way that future users can easily understand and obtain access.

Long-term global preservation initiative

One initiative using such an approach is the Arctic World Archive (AWA), located on the remote island of Svalbard.

Since this arctic vault was launched in 2017, institutions such as the National Museum of Norway, the Vatican Library, the National Archives of Mexico and Brazil, the European Space Agency, United Nations Children's Fund (UNICEF), GitHub and many others from around the world have chosen to store valuable data there.

The archive's ambition is to ensure that valuable information and cultural heritage are never lost but are kept forever, without risk of data corruption, loss or technological obsolescence. Stored data is offline and secure on a resilient, purpose-built medium designed to last for centuries with guaranteed future access.

The technology used is the world's first digital film, developed by Norwegian innovators, Piql. The 35mm photosensitive film features very high-resolution Quick Response (QR) codes capable of holding digital information.

To ensure distant future accessibility, all the information required to access the data is also stored on the film in human readable text, including descriptions of the hardware, all code for software programmes and format specifications. Piql also offers bespoke readers for access in the meantime.

The physical medium, piqlFilm, has been tested to survive over 1000 years in the natural conditions of the vault, located 300 metres down in a decommissioned mine.

This growing collection of world memories, culture and heritage collections, contemporary media, open source code repositories, business histories and personal memories is becoming a popular repository for valuable digital objects. All deposits can be accessed online on request through Piql's digital preservation platform, piqlConnect.

The archive is focused on preserving cultural heritage such as UNESCO's Memory of the World collection and invites private deposits to sponsor or contribute towards this.

For more information, see www.piql.com and www.arcticworldarchive.org.

7. Practical guide and recommendations on managing low-cost digitization projects in Least Developed Countries and Small Island Developing States

Danny Krkic[153], Sophie Dazé[154]

At the request of the International Council on Archives (ICA), and in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO), a practical guide and recommendations for Managing Low-Cost Digitization Projects in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) has been produced. While the digitization operations of Library and Archives Canada (LAC) are not reflective of the low-budget reality faced by many institutions, common, experience-based issues faced by many are listed below. This is intended to serve as a baseline concept to help in managing digitization for those in LDCs and SIDS. Digitization is an activity that requires great cost and effort to create and maintain. In the end, it does provide many advantages over an analogue-only collection. It serves an important function to help disseminate knowledge to ever-growing communities. It brings firsthand sources to a wider audience that would otherwise never have been able to access them. Digitization permits greater security of the knowledge contained in our collections by making it possible to create many copies and disseminate them in different geographic locations. This ensures their availability for the long-term benefit of future generations. Digitization of archival holdings favours preservation, and greatly enhances collection discoverability and accessibility at large, across the world.

Where to start

Start small. As for every project, teams have to start somewhere. As digitization projects can quickly become overwhelming, it is best to start small and with achievable goals. Within LAC, these services began as a minor offshoot of the traditional photography team that used to make copy negatives of important artwork and was responsible for microfilming documents. The initial team consisted of a handful of individuals with flatbed scanners with the capabilities of digitizing textual records of up to legal size (11"x14," 216 mm x 356 mm) and various formats of photographic prints and negatives. Fortunately, that investment was leveraged by slowly adding equipment and personnel. Digitization capacities increased slowly over time, by purchasing new equipment from funded projects, repurposing them and adding them to our base-level capacity. Whenever a new project request required new capabilities, any associated costs (such as the purchase of equipment, tools and software) were incorporated into the proposal. Twenty years later, a core team of forty individuals and many highly specialized pieces of digitization equipment had been built up. The ideal is to use digitization as a means to enhance collections while not taking anything away from any core business needs.

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154 Acting Director, Digitization Services Division of Library and Archives Canada.

What to digitize

There is no need to digitize everything. Organizations do not have unlimited resources. As such, it is important to realize that it will probably not be possible to digitize the whole of a collection.

◆ How to decide what to do first

The recommendation is to survey what part of the collection is in high demand, what the clients are requesting most and try to determine the target audience. In some cases, public service colleagues may be able to provide that information. They are in closest contact with external clients and they know which parts of a collection are in demand. This is critical in determining where to begin. There is little point in devoting resources to making collections accessible if there is no demand for them.

◆ How else to decide what to do first

Another approach is to assess risk to items. Priorities can be assessed by consulting conservation staff. They may have their own priorities and maintain lists of items and objects that they would like to have digitized. By digitizing these at-risk items, it ensures there is a digital master "backup" should the originals be lost or damaged.

◆ How to deal with others within an organization (expectations and commitments)

It is crucial to the success of any digitization platform to set realistic expectations early and follow them up with updates. It is vital to avoid committing to too many projects at once. A continued push for demand may create an opportunity to get funding in place for those "new" capabilities mentioned previously.

◆ Where collections are stored versus where digitization will take place

Inherent costs such as shipping and circulation play a large factor in the cost of digitization. Minimize or eliminate the cost if possible by arranging for the digitization team to operate in close proximity to where collections are stored.

Human resources

◆ How to deal with staffing requirements

From the outset, Library and Archives Canada (LAC) has closely collaborated with students and academics from local colleges and universities to help with various digitization projects. This has involved recruiting students or taking them on as volunteers to allow them to gain experience in the field and to keep human resources costs at a minimum. Many candidates have been successfully hired from the local college photography and graphical design programmes. Their skill sets align very closely with our technical needs (knowledge of the software we use like Adobe Photoshop, theoretical concepts such as colour spaces, image resolution and so forth).

Funding and partnerships

This is probably one of the greatest challenges of all. It applies to all institutions, no matter their size. If internal funding is not able to cover operating costs for all the priorities, then the best option is to seek external funding.

Are there potential funding opportunities with local government or universities? Perhaps even private funding opportunities? Private funding opportunities in particular can be tricky and should to be revised meticulously before signature. The greatest resource is the knowledge we hold within our institutions. In this new information age, that is a very valuable resource. Any agreements with private individuals or corporations must ultimately allow a team to retain control of the rights to and ownership of the digitized material. It should be borne in mind that that they will probably profit from holdings, and plans should therefore be made for the eventual repatriation of your collections.

It is worth investigating the potential of collaborating with academic institutions or associations for projects in which there may be mutual benefits.

Infrastructure

All digitization activities are inherently more expensive than analogue operations. Whereas you can put a box of material on a shelf and maintain it there for a fixed cost year after year, digital operations require much more care and attention as technologies evolve (both on the hardware and software side) and they all require indefinite ongoing investment. The great advantage, of course, is providing users with ease of access and greater opportunities to explore material that may have otherwise never been accessed by anyone but a small number of scholars.

Related to the point above, the location of your digitization operation must be determined to ensure a steady electrical supply. If that is not possible, there should be a backup source of power available or a copy made offline to maximize the safety of any collection.

Internet access and bandwidth issues are also common hindrances. In recent years, digital collections have grown exponentially, from the creation of digitized contents in addition to the large amount of born-digital material being acquired. It is not possible to make all of that content available online, as the bandwidth required would be cost prohibitive. While working on solutions to make more collections available, there is no definitive answer on how to handle this growing concern.

Equipment and software

While there are no suggestions for specific low-cost equipment, it could include basic equipment such as: Basic flatbed scanner (recommended 300ppi+ optical resolution)Basic digital camera (recommended 20MP+) with a tripod Essential equipment required for digitization: A computer with a computer monitor or a laptop, a flatbed scanner and/or camera setup, imaging software (could be proprietary to the equipment), a storage device as well as a descriptive database to attach digital images to archival descriptions to ensure traceability and searchability.

Digital preservation

Digital preservation is the solution to maintaining both born-digital and digitized analogue collections. This topic requires its own report but the focus here is to summarize the issues around long-term maintenance of digital collections.

The digital preservation team is responsible for organizing and maintaining the digital collections, migration of the data from one form to another as technologies change and ensuring that preservation of the digital data occurs and is in readable form for generations to come.

The act of digitizing collections is but the first step in a long process. The subsequent maintenance and migration of digital assets are crucial to the success of digital collections. It is pointless for digital assets to remain unorganized on a storage device. If digitized items cannot easily be searched and found, that knowledge may as well be considered lost.

In summary, along with publicizing the good news about collections available in electronic form, it is key to consider the wider long-term implications of digital preservation. Along with the advantages of having collections digitized, some significant and recurring costs are associated with preservation of a digital archive that must be accounted for in any long-term planning process.

Please refer to the website for further information on LAC's Digital Preservation Program and Strategy. *Also available in French* (en français).

Digital storage recommendations

Best practices recommend keeping at least three (3) copies of your data, and storing two (2) backup copies on different storage media, with one (1) of them located in a different geographical region. The 3-2-1 backup rule is an easy-to-remember acronym for a common approach to keeping your data safe in almost any failure scenario. Recommended (low risk): Linear Tape-Open (LTO) or related technology (at least two (2) copies stored in different geographical locations), Cloud service, local storage on a particular medium.

Recommended (medium risk): External Hard Drive (at least two (2) copies stored in different geographical locations), local storage of choice.

Least recommended (high risk): Computer hard drive (at least two (2) copies stored in different locations if possible), Flash drives (USB or memory cards).

Appendix: Digitization equipment (excluding audio-visual) of Library and Archives of Canada

The following is a short list of various equipment utilized by LAC's Digitization Services Division (DSD) as of April 2021.

Computers

- PC HP Z440 recommended 24 GB RAM

- Mac Pro minimum configuration with extra RAM (24 GB minimum)

- 30" monitors from various suppliers (minimum 2560x1140 resolution) to allow for accurate colour reproduction and to lessen eye strain for workers who operate the digitization equipment.

Scanners

- Epson 10000 XL Photo flatbed scanners (new equivalent is the 12000 XL Photo) for reflective and transparency scans

- Fujitsu fi-6770 (new equivalent fi-7700) document scanner with a straight path to allow digitization of delicate archival material.

Camera system

- Phase One medium format cameras and Digital backs in various configurations but note that the backs are 100 megapixel and allow studio copy work of art, digitization of negatives and transparencies as well as other delicate material that cannot be digitized with other pieces of equipment.

Large format

- Contex feed through scanners, HD5450, IQ2490, IQ3690 to allow mass digitization of large maps and other oversized collections that are in relatively good condition

- CRUSE Synchron Table Scanner ST185 overhead scanner for large (up to A0) sized originals

- SMA Scan Master 0 large A0 sized flatbed scanner.

High speed / high volume document feeder scanner

- BancTec Intelliscan XDS high-speed high volume document scanner. Conveyor belt-driven document scanner that can handle extremely large projects (that number in the millions of pages).

Film scanners

- Nextscan Eclipse 600 microfilm scanners, high-speed microfilm scanners

- DRS Digitizer microfiche scanner, large volume microfiche scanner

- e-Image Data ScanPro 3000, microfilm, microfiche scanner (for lower volume work).

Book scanner

- Kirtas APT 1200 book scanner, with automatic page turner.

8. ICDH and digitization of documentary heritage in less resourced countries

ICDH

Overview of the UNESCO ICDH

The International Centre for Documentary Heritage (ICDH) is a Category-2 Centre under the auspices of UNESCO. The Republic of Korea and the UNESCO Secretariat agreed to establish ICDH in 2017, and the Centre launched its operations in July 2020. UNESCO ICDH is an international organization covering the global range of programmes, and it focuses on the UNESCO mission and priorities.

Main programmes of ICDH

Under its vision, 'to support universal access to documentary heritage and to provide capacity building for effective preservation of documentary heritage', ICDH strives to create the future value and diversity of sustainable documentary heritage. ICDH has four main strategic tasks:

1. Documentary heritage monitoring
2. Capacity building
3. Information hub and network
4. Raising awareness and public information.

In particular, this chapter seeks to outline capacity building and information hub and network.

Capacity building for documentary heritage

One of the strategic tasks of ICDH is to operate capacity-building programmes for enlistment and management of documentary heritage through educational content and training. In 2020, ICDH created some videos in response to the global pandemic, specifically ones about the digitization of documentaries. The goal of digitization is to have a platform to utilize and cherish documentary heritage beyond mere scanning and imaging of the original text. An example of an educational video content created by ICDH in 2020 was '*Digitization of diaries of the royal secretariat, Seungjeongwon ilgi*', which showcases three different institutions' collaborative effort to digitize the original text of Seungjeongwon ilgi written in the ancient Korean language, translate the digitized text and establish a platform to search the results with Artificial Intelligence (AI) technology. This offers an exemplary case of the digitization process for Member States to benchmark.

ICDH strives to guarantee accessibility and equal learning opportunities for all to preserve and utilize the Memory of the World. All MoW Member States can freely access ICDH's quality resources. ICDH prioritized developing countries in organizing and developing this content to mitigate any potential capability or skill gaps among MoW Member States. ICDH will continue to introduce best practices of preserving and restoring documentary heritage in the future for the international community, and has so far produced the following videos:

- Restoration of paper documentary heritage: National Archives of Korea,

- *Digitization of diaries of the royal secretariat, Seungjeongwon ilgi* (Utilization of documentary heritage): Kyujanggak Institute for Korean Studies (KIKS), National Institute of Korean History (NIKH), Institute for the Translation of Korean Classics (ITKC),
- Preservation and management of Audiovisual documentary heritage: National Archives of Australia,
- Preservation of documentary heritage at risk from natural disasters (flood and landslide): National Archives of Malaysia.

Information hub and network

The lack of infrastructure, such as an integrated platform for a documentary heritage database, makes it impossible to efficiently share and utilize information and knowledge related to the Memory of the World. ICDH is currently in the process of establishing an integrated information platform with user-friendly contents encompassing a diverse range of topics related to the preservation, digitization and utilization of documentary heritage. ICDH aims to close the digital divide by promoting standardization of documentary heritage digitization. ICDH also plans to host multiple international fora that will function as catalysts for cross-border cooperation by sharing the latest documentary heritage protection and preservation trends with experts and policy-makers.

The ICDH participatory platform will allow people worldwide to communicate and share information on preservation and management of Memory of the World. Potentially in conjunction with ICDH's other main programmes to develop a monitoring system and to protect endangered documentary heritage, this platform can provide up-to-date information on the post-management status of the Memory of the World. This platform can also function as a universally accessible model for digitization standards. It is hoped that this platform can close the global digital gap and produce value-added contents. Here are the specific details of the project:

1. Establishment of the database for the Memory of the World: The platform will serve as a global information network hub for Memory of the World by offering information on the MoW listing as well as major unlisted heritage by continent.

2. Establishment of the archive of MoW database: ICDH will receive, preserve and restore sample data of Memory institutions by continent, and upload them onto the platform to establish a universally accessible archive.

3. Development of information sharing platform: Geographic Information Service (GIS, digital map) will enable sharing of Memory of the World data by categorizing and displaying the Memory of the world heritage by continent, country and form. Information and news of memory institutions and other related organizations will also be offered.

4. Development of the Memory of the World Education Platform: Expert lectures to train professionals and general lectures to enhance awareness and interest among the non-experts will be provided.

5. Development and linkage of video conferencing systems.

6. Online exhibitions, curatorial services and so forth.

This platform is expected to have the following impacts. It will enhance awareness and preservation of the MoW. It will establish an information-sharing mechanism and specialized network among memory institutions, museums, galleries and so on. It will also be a foundation to create value-added content such as movies, novels and animation. It will provide an interactive communication system that allows users to search, share data and use them with convenience, therefore being responsive to the changing digital environment and needs. By utilizing mobile applications, location-based services, and multilingual support, it will help resolve inequality among those who could previously not enjoy the Memory of the World and documentary heritage due to a lack of information and convenient access.

Managing low-cost digitization projects in Least Developed Countries and Small Island Developing States

A Manual

UNESCO launched the Memory of the World (MoW) Programme in 1992 to identify, preserve and make documentary heritage accessible for all. Digitization is key to preservation, however, it often requires a large budget, specific policies and trained personnel. The MoW Programme has published this manual specifically for the Least Developed Countries (LDCs) and Small Island Developing States (SIDS) to respond to the pressing needs for preservation and accessibility of documentary heritage in these regions.

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