



Evaluation Report on the Digital Preservation Component of the Preservation Program (2015–2020)

The Evaluation Function
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TABLE of CONTENTS

Executive Summary	3
1. Introduction.....	5
2. Evaluation Scope and Methodology	5
3. Program Component Description	5
4. Findings.....	7
5. Conclusion	24
6. Recommendations	26
Appendix A: Management Response and Action Plan.....	27
Appendix B: Logic Model for the Digital Component of the Preservation Program.....	28
Appendix C: Performance Measurement Strategy (PMS)	29
Appendix D: Digital Preservation Workflow	30
Appendix E: Bibliography	31

Executive Summary

Introduction

This report presents the results of the evaluation of the digital preservation component of the Library and Archives Canada (LAC) Preservation Program.

Evaluation scope

The evaluation covered the period from 2015-2016 to 2019-2020, and addressed the following questions:

- What is the current state of digital collection and its preservation at LAC?
- What progress was made in attaining the short- and medium-term program results to which the component contributes?
- How efficient are LAC's digital preservation operations?
- Does LAC have the capacity (expertise and technology) to preserve and provide enduring access to digital holdings?

Methodology

The evaluation was conducted in accordance with the 2016 Treasury Board Policy on Results and Directive on Results. The evaluation used a mixed-method approach combining qualitative and quantitative lines of evidence, including a literature and internal document review, key informant interviews, an employee survey, and analysis of financial and performance information.

Main findings

The state of preservation of the digital collection over the five-year period from 2015-2016 to 2019-2020 has been stable; however, it has been affected by declining human and financial resources. In addition, there is no common perspective on digital preservation within the Digital Preservation and Migration Division (DPMD) and among stakeholders. Furthermore, the capacity of digital preservation operations is not taken into account by acquiring areas when making acquisition decisions. While the current capacity of the digital preservation function at LAC allows it to cope with the current workload, it would be insufficient to support an increase in digital acquisitions. Moreover, the digital preservation infrastructure is not optimal and requires further investment. The evaluation also noted a clear disconnect among operational areas regarding the extent to which LAC's Digital Asset Management System has been implemented and how this relates to digital preservation.

In terms of efficiency, the DPMD has improved some of its practices related to the verification of the authenticity and integrity of digital holdings and has begun the testing and use of some components of its Digital Asset Management System. However, there is no overarching governance mechanism to ensure proper planning and coordination among the various stakeholders. Furthermore, the chain of authority and accountability for digital preservation is fragmented, i.e., it does not take into account key process points and the impact of various process dependencies. There is also an important policy gap, which contributes to the confusion over roles and responsibilities and the lack of understating of what digital preservation entails. This creates stalemate situations that have serious repercussions for the efficiency of digital preservation operations. Consequently, the program component has made limited progress in attaining its short- and medium-term results. Finally, the resourcing of the digital component does not take into account the long-term sustainability of digital preservation operations.

Recommendations

In the spirit of continuous improvement, the Senior Director General, Digital Services, in collaboration with the Assistant Deputy Minister, Collections, and the Assistant Deputy Minister, User Experience, should:

1. Develop and communicate to staff a comprehensive Digital Preservation Policy suite (framework, policy, directive, guidelines) that clearly defines:
 - a. LAC's Digital Preservation Priorities;
 - b. Roles and responsibilities of all stakeholders involved, notably the Digital Collections Operations Division (DCOD), previously the Digital Preservation and Migration Division (DPMD), the acquiring areas, and the Digital Services Sector;
 - c. Criteria for the acquisition and preservation of digital material that take into account the ability to preserve and make accessible; and
 - d. A horizontal workflow for LAC's Digital Content Lifecycle Management.
2. Ensure that an overarching governance and coordination mechanisms are in place to facilitate consultation and decision making between internal stakeholders;
3. Conduct an annual joint planning exercise with internal stakeholders to prioritize digital preservation activities and to manage interdependencies; and
4. Ensure that LAC has sustainable resources and technology to preserve and provide an enduring access to its digital collection.

Management Response and Action Plan

Management's response to the recommendations and the action plan it has put forward are set out in Appendix A.

1. Introduction

This report presents the results of the evaluation of the digital preservation component of Library and Archives Canada's (LAC) Preservation Program. The evaluation was included in the 2020–2025 Departmental Program Evaluation Plan (DPEP) approved by the Departmental Performance Measurement and Program Evaluation Committee (DPMPEC). It is the first time this component is evaluated.

2. Evaluation Scope and Methodology

2.1 Evaluation Objectives

The evaluation covered the five-year period from 2015-2016 to 2019-2020, and examined the following questions:

- What is the current state of digital collection and its preservation at LAC?
- What progress was made in attaining the short- and medium-term program results to which the component contributes?
- How efficient are LAC's digital preservation operations?
- Does LAC have the capacity (expertise and technology) to preserve and provide enduring access to digital holdings?

2.2 Methodology

The evaluation was conducted in accordance with the 2016 Treasury Board Policy on Results and Directive on Results. The evaluation used a mixed-method approach, combining qualitative and quantitative lines of inquiry, including a document and literature review, key informant interviews, an employee survey, and analysis of financial and performance data.

Limitations in the literature¹ and in the performance metrics² used by the program did not allow for conducting in-depth efficiency analysis and assessment. To compensate for that, the evaluation gathered supplementary data through key informant interviews, an employee survey and a document review.

3. Program Component Description

LAC defines digital preservation as the active management of digital content over time to ensure ongoing access.³ The Digital Operations and Preservation Branch (DOPB) is responsible for all management activities and strategies that serve to ensure the integrity, authenticity, current and long-term preservation and accessibility of digitally acquired or digitized Canadian documentary heritage. The Digital Preservation and Migration Division (DPMD) within the Branch administers the Digital Preservation (DP) component and is responsible for managing the physical control and long-term preservation of LAC's digital collections (including migration and obsolescence prevention of digital material). The DPMD is made up of the following sections:

- Digital Integration,
- Digital Preservation, and
- Audiovisual Migration.

3.1 The digital preservation workflow

The following description of the digital preservation workflow at LAC draws on interview and staff survey data. Digital records in various formats come to LAC from a variety of creators (for example, government departments,

¹ The literature does not present a consistent view on how to measure digital preservation efficiency. Though ISO standards exist regarding what constitutes a digital repository, their interpretation and application are subjective. Practices are determined by the nature of the repository institution (national, municipal or private), its needs and its capacity.

² The logic model of the program component was not up to date, and some performance data was either not collected or found not to be useful for the purposes of the evaluation.

³ [LAC Strategy for a Digital Preservation Program \(2017\)](#)

publishers and private donors). The Digital Integration (DI) unit of the DPMD is responsible for taking in the data, performing virus checks, ensuring that the data complies with LAC format and other policies, and registering it for processing. The data is placed on a staging server and a checksum is conducted to ensure the records were not altered during transfer. The archivists assigned to the specific fonds or portfolio then decide which records have historical significance according to LAC’s Evaluation and Acquisition Policy Framework. They process and arrange the records selected for retention. Once that is complete, the archivists inform the Digital Preservation unit that the records are ready for preservation. The Digital Preservation unit performs the appropriate preservation procedures and writes the data onto two Linear Tapes Open (LTO)⁴ tapes, which are then placed in two separate vaults in LAC’s Gatineau Preservation Centre. When LAC clients or users request access to digital records, LAC’s Reference or ATIP teams direct the request to Digital Preservation. The requested data is restored from the tape and provided to clients via a temporary file stored on a public-facing server or, in some cases, on a CD-ROM.

3.2 Resources

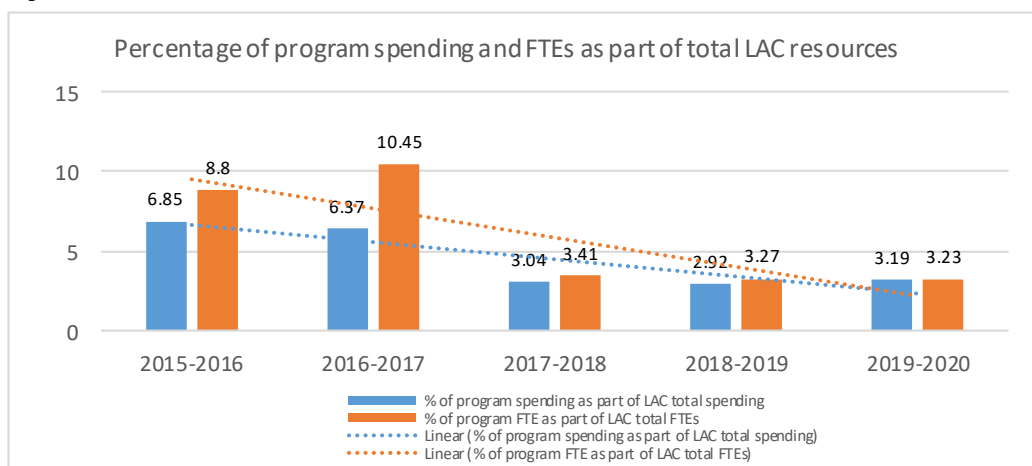
Table 1 presents the resources allocated to DPMD. It can be observed that, both the financial and human resources devoted to digital preservation decreased over the five-year period examined by the evaluation. This negative trend is due in part to the completion of the digitization of the World War I military personnel records project, a limited-term project that had temporary funding and FTEs. Internal restructuring and other internal constraints also contributed to that trend.

Table 1: Resources

Program Component’s Resource Description*	Fiscal Year				
	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Funding (in Canadian dollars)					
Actual spending	6,266,130.83	7,297,634.90	3,879,359.71	3,642,539.52	4,291,231.94
Total LAC spending	91,451,612.40	114,500,637.62	127,416,748.98	124,630,163.87	134,354,194.56
Percentage of program spending as part of total LAC spending	6.85%	6.37%	3.04%	2.92%	3.19%
Human Resources (in full-time equivalents—FTEs)					
Actual FTEs	80.36	94.39	32.05	31.21	33.64
Total LAC FTEs	913.45	902.84	940.81	954.47	1,040.67
Percentage of program FTEs as part of total LAC FTEs	8.80%	10.45%	3.41%	3.27%	3.23%

*Spending includes salaries and other operating costs

Figure 1



⁴ Linear Tapes Open (LTO), also known as the LTO Ultrium format, is a powerful, scalable and adaptable open-tape format that is optimized for high capacity, maximum storage density, and performance. <https://www.lto.org/what-is-lto/>

4. Findings

4.1 Current state of preservation of the digital collection

Finding 1: Digital preservation is not prioritized and is not resourced accordingly.

Interview data revealed that, while digital preservation is considered an important activity that supports delivery of LAC's mandate, it has not been prioritized. According to interviewees, the level of investment in analog preservation and infrastructure far outmatches that for digital preservation. For example, LAC is building its second preservation facility in Gatineau while the infrastructure for digital preservation remains very basic. Stakeholders pointed out that LAC has not invested consistently in digital preservation and that the institution has too many priorities that appear to be of equal weight and paralyze decision making. Some stakeholders pointed out that LAC is currently developing its Digital Asset Management System (DAMS) but has not secured the resources needed to maintain it.

A review of LAC's Departmental Plans for the 2015-2016 to 2019-2020 period revealed that, while digital preservation elements are reflected in some of LAC's priorities, no specific priority is given to the activity as a whole. Furthermore, the financial resources dedicated to the program activity are determined by the overall budget allocation to the Preservation Sector. Those resources fluctuate from year to year according to institutional pressures. This indicates that no stable funding was provided as would be expected for a priority activity.

Finding 2: While the state of LAC's digital collection is known and monitored, lack of resources and limited technological capacity prevent DPMD from providing adequate level of preservation to all items in the collection.

Program documentation indicated that a comprehensive inventory of the digital collection was conducted over the period from 2015 to 2018. Stakeholders recalled the inventory, but indicated they had not participated in any other such activities since. DPMD management explained that the inventory in question was done in the context of LAC preparing to seek certification as a Trusted Digital Repository (TDR). However, as LAC's senior management subsequently decided not to pursue that certification, there was less interest in continuing the practice.

According to DPMD management, what complicates doing a comprehensive inventory of LAC's digital holdings is that the data is not owned, compiled or managed by a single program authority. The DP unit itself manages only material that has been sent to them for preservation; however, there is vast amount of digital material that has not reached them yet. Those materials reside in other systems managed by the acquiring areas, over which Digital Preservation has no control. The main issue, according to DPMD management, is therefore that the digital preservation process is not managed, end to end, under the authority of DPMD.

DPMD managers acknowledged that the state of preservation of LAC's digital holdings is not optimal. Some of the material is not in fact under the control of LAC and resides outside of its current infrastructure. Furthermore, they stated that a significant amount of digital material is stored on legacy media and is not being prioritized for migration as LAC does not have the technological capacity to process it. Some of the material is on media so old that LAC does not have the hardware to open it. While DPMD is responsible for migrating that material, it does not have the resources and means to do that. The material is kept in the vaults but is not taken into account in preservation planning.

DPMD senior management acknowledged that the digital collections have not received equal treatment as a result of the lack of proper preservation tools at the time the collections were first acquired. They also stated that some collections are not in multiple copies and reside on outdated systems, which is problematic for LAC.

DPMD senior management pointed out that LAC's limited ability to invest in the infrastructure it needs is due in part to the high cost of cloud-based technology, dependencies on the overall Government of Canada IT infrastructure, and a lack of understanding of the nature of digital material and its preservation within LAC. They also indicated that, while DAMS is aiding digital preservation in terms of increasing LAC's capacity to acquire digital material, on its own it does not constitute digital preservation. Consequently, there is a need for proper preservation infrastructure behind the DAMS.

Stakeholders indicated that not all parts of the collection receive the same level of preservation care and attention as a result of DPMD's lack of tools and capacity. Some stakeholders reported that the state of the preservation of the digital collection has not improved and that this is evident in the way the current digital preservation technological solution was deployed. In their view, the solution acquired by LAC has many capabilities. However, as a result of a lack of funding, it is not being used to its full potential.

Only 9% of respondents to the DMPD staff survey rated the current state of LAC's digital holdings as optimal. According to staff, the state of preservation of the digital collection is affected by lack of funding, human resources issues and technological infrastructure. They expressed the view that the true cost of digital preservation is not adequately factored into decision making and that lack of foresight is contributing to the creation and perpetuation of backlogs of acquired but unprocessed material. Staff also stated that insufficient consideration is given to how digital material will be processed and made ready for preservation and access at the time of acquisition.

"In the world of Digital Preservation, 'unprocessed' is the same as 'not preserved.' Data can (and will) rot if left to sit on physical carriers; it will also be completely inaccessible to LAC's clients, leading us to fail our institutional mandate."

DPMD staff also pointed out that the state of the digital collection is monitored through random monthly verification of LTO tapes. The Digital Preservation team conducts random monthly verifications of 30% of newly preserved tapes and there are plans to increase that even further. Survey respondents indicated that migration to new LTO tapes is done when older media reaches the end of its shelf life or when the team observes irregularities during any verification, preservation or restoration activities. In addition, respondents specified that the Digital Preservation Operations team maintains a complete inventory of all active media and their creation date, and conducts regular checks on any bad media flags in the tape library. The team also maintains complete statistics on the state of the collection by project ID, producer, date, file extension and other measures. This enables comparison of intake and outtake.

Finding 3: The rate of growth of the collection and the processing speed at which stakeholders triage incoming digital heritage material have a significant impact on digital preservation operations and capacity.

DPMD management estimates that the overall growth rate of the digital collection is about 1,250 terabyte (TB) per fiscal year. AV material is estimated to be growing at 1,000 TB per year for migrated material and at 12 TB per year for born-digital material given the current rate of acquisition and provided that the material is single copy. The growth of the Web archiving collection is estimated at 13 TB per year.

Program documentation and interview data revealed that only AV migration has a planned and systematic/predictable approach for the migration of AV material. The Digital Preservation and Digital Integration sections, however, face serious challenges stemming from operational and logistical dependencies on the acquiring areas. DPMD management stated that the Digital Preservation section is currently running on a

skeleton crew of six full-time equivalents (FTEs). Those staff split their time between managing the digital archive and managing the incoming material. The Digital Integration section has only three FTEs. They are responsible for the ingest of digital material and its preparation for preservation as well as for providing assistance with digital acquisitions to the whole Archives Branch. Those are minimum resources that allow the sections to cope with the current volume of digital material. According to DPMD management, if acquiring areas were to increase the volume of acquisitions, it would quickly overwhelm the Digital Preservation unit in terms of both staff and systems; however, currently, there is no planning for such eventuality.

In addition, DPMD management stated that unstable financing poses problems for digital preservation operations in terms of procuring LTO tapes, which is essential for preservation, and in terms of securing a data budget for web archiving. DPMD management stressed that the inability of acquiring areas to estimate and prioritize acquisitions, coupled with the inability to process acquisitions in a timely manner, have additional impact on digital preservation operations. More specifically, those factors could impede digital storage capacity and even stall operations altogether.

DPMD senior management expressed concern that acquisition volumes can outpace storage costs in terms of budget allocation. They acknowledged that, while LAC's legislation frames its acquisitions in a way that does not give acquiring areas much room to control the volume of what they acquire, they are not bound by the pressures of the cost of ownership of those acquisitions. In the DPMD senior management's view, LAC needs to change the way it makes acquisition and preservation decisions, adding that such decisions should be more strategic and should be driven by considerations regarding the affordability and growth of the collection. DPMD senior management stressed that unchecked growth is unsustainable when it comes to digital material because its preservation involves more than just storage—it is also about having the ability to read and retrieve such material and about the technology required to ensure that.

Some acquiring areas stated they are expecting to be increasing the volume of their acquisitions considerably thanks to the new functionalities of the DAMS. However, they indicated that they are not aware of whether DPMD would be able to support such an increase. They are mindful that DPMD has limited capacity at present and indicated they are supportive of an approach where preservation is prioritized according to the significance of the material.

Finding 4: Risks to the digital collection are known, and there are measures in place to keep track of the state of the collection.

DPMD management stated that the main risks to the digital collection stem from process inefficiencies, lack of stable funding and processing delays by the Archives Branch. According to them, the digital preservation process is a patchwork of manual and automated processes, which lacks an overall monitoring system and is subject to human error risk. Furthermore, DPMD management is concerned that LAC senior management is under the impression that LAC has a fully operational DAMS. However, the DP team does not yet have the DAMS functionality that would allow it to transfer digital material directly from departments or service providers (web harvesting). The DP team has to use hard drives to transfer data physically from departments and into LAC's systems. Added to that is a lack of understanding of digital preservation as an archival function throughout LAC. For example, stakeholders make some infrastructure and acquisition decisions unaware that selecting certain types of file formats or reducing the size of certain file types can compromise the quality of the content, and that this cannot be rectified after the fact. In addition, material residing on the pre-ingest server is at risk of becoming corrupted. DPMD management pointed out that digital material is placed on the pre-ingest server in order for the Archives Branch to select and process the material. While some back-ups are performed on the material, it is not preserved, and therefore there is a risk of its becoming corrupted. That risk increases with the length of time

the material stays on the pre-ingest server. According to DPMD management, unprocessed material has been accumulating.

The DPMD staff survey revealed several risks that differ from those listed by management. Staff stated that often transfers of digital material proceed without the involvement of DMPD personnel. In addition, there is disagreement between LAC's acquiring areas and DMPD regarding responsibilities for the transfer and description of digital material. As a result, according to staff, acquiring areas run into issues with file formats, as well as with exports from systems and metadata. This affects the ability to access, open or migrate the digital content. Ultimately, material is preserved at the bit level, but the content is not accessible to the public. Staff stressed that this creates a bottleneck where processing practically stops and content is not being preserved. They also pointed out that classified material and "Protected C" level material are at risk because LAC does not have the infrastructure required to adequately address that type of record.

Senior DPMD management added that the main risk to the digital collection is the lack of consistent funding. Without it, DPMD cannot keep up with the pace of technological change. The lack of consistent funding also jeopardizes the ability of the Digital Preservation team to migrate LTO tapes to newer versions and procure new preservation formats for physical copies. In DPMD senior management's view, it is important to continue to preserve at least two physical copies until new preservation practices become available and prove viable.

DPMD management stated that risks to the digital collection are mitigated by applying specific standards to the data before it comes to LAC and it is transferred to the preservation team. The Digital Integration team ensures that those standards are followed and prepares the data for preservation. In addition, DPMD management pointed out that the Digital Preservation team records the file formats that Digital Integration sends to it for preservation and then places the content on LTO tapes. DPMD management also indicated that the Digital Preservation team performs scheduled spot checks on the material to ensure its integrity has not been affected.

DPMD management also pointed out that digital archival material is inventoried annually and that the Digital Preservation team is aware of the extent of material that has not yet reached them yet; however, infrastructure issues preclude the same being done for digital published heritage material. The team does not have access to digital published heritage material the same way it does for digital archival material.

Interviews with DPMD management further revealed that, in order to guarantee the proper safeguarding of the data after it is placed on LTO tapes for preservation, Digital Preservation needs to migrate the tapes to newer versions. The shelf life of an LTO tape is ten years. According to DPMD management, a significant portion of the collection is on LTO tapes that are four generations outdated and the LAC digital collection is on the cusp of serious risk. While they are negotiating with Shared Services Canada to procure newer versions of LTO tapes, lack of secure financing prevents DPMD from moving forward.

In terms of monitoring the state of the collection, interviewees explained that LAC's digital preservation model is not based on hard drives that can be continually assessed. The only way to assess data stored on tape is to restore it to a computer and then run checks on it. Given that LAC's digital collection sits on thousands of LTO tapes, such verifications are neither practical nor feasible. Interviewers further stated that the decision to preserve material on tape was made to mitigate costs, as it is a cheaper and more reliable method than having data on spinning disks or hard drives. DPMD management stressed that, given the size of LAC's digital collection, it is not sustainable to preserve it through other means and it would be financially ruinous to LAC to do so.

The DPMD staff survey identified additional risk mitigation practices used by staff. For example, the Digital Integration team has created "Digital Transfer Assessment Forms" for donors and government departments that are used to assess and address any potential issues prior to transferring data to LAC. The team is also available to

work with acquiring area staff and donors to ensure successful transfers. In addition, the Digital Integration (DI) team informs acquiring areas annually of the quantity of unprocessed material on the pre-ingest server and asks that they prioritize their service requests. Furthermore, in collaboration with IT, DI has put in place a back-up system using a LAC server to ensure that storage for data awaiting processing is available for longer than the 90-day standard used by Shared Services Canada. DI has complete control over the server, and no content is deleted without DI staff's authorization. Staff also pointed out that DPMD has recently acquired several TEMPEST workstations for processing classified and "Protected C" material. Finally, DPMD staff indicated that risks related to bit rot and obsolescence of file formats, software and/or physical carriers are mitigated through migration and checksum⁵ verification.

4.2 Efficiency of LAC's digital preservation operations

Finding 5: The governance structure as well as the roles and responsibilities of stakeholders involved in the digital preservation process are not clear. This affects the efficiency of digital preservation operations.

Interviews with DPMD management revealed that the roles and responsibilities of various stakeholders in the digital preservation process are not clear and indicated that there are some contentious issues, such as the impact of acquisition decisions on the ability of DPMD to ensure effective preservation and the matter of whether DPMD should be involved in acquisition decisions and to what extent. Another contentious issue is the nature and extent of involvement of IT in Digital Preservation operations. Some interviewees stated that IT should not be involved in digital preservation or its architecture beyond providing technical support and liaising with Shared Services Canada. They pointed out that the confusion over the division of roles and responsibilities between the DP team and IT is rooted in the misperception of digital preservation as a technology issue. A contributing factor is the use of the CS classification for both digital preservation and IT staff, while in fact their responsibilities differ in important ways. For that reason, the two divisions/branches put in place a Memorandum of Understanding.

DPMD management emphasized that there are classification issues for other digital preservation professionals, too. For example, AV migration staff are classified as conservators, even though this does not reflect the work performed by staff or their competencies. Digital Integration staff have hybrid technical competencies as well as competencies and expertise in archival science; however, this is not recognized by other archival professionals at LAC.

According to interviewees, DPMD are the subject matter experts for all things related to digital preservation; as such, they should have the ultimate responsibility for the preservation of digital content and the associated infrastructure. Furthermore, in management's view, the acquisition areas should take direction from the subject matter experts in Digital Integration, Digital Preservation and AV Migration. Currently that is not always the case—there are still outstanding issues over roles and responsibilities, and persistent questions about which areas really have responsibility for digital acquisition, processing and description. According to DPMD management, LAC's acquiring areas do not have sufficient competencies to understand the nature of digital content, file requirements and subsequently the implications of the acquisition decisions they make regarding digital material. For example, acquiring areas are not cognizant of the fact that a single hard drive can contain terabytes of data, or that digital preservation involves more than storage. If acquired material is in an obsolete format or requires specialized technology that no longer exists, DPMD staff would not be able to preserve it nor guarantee access to such material. Furthermore, according to DPMD management, acquiring areas still insist on

⁵ "Checksum A unique numerical signature derived from a file. Used to compare copies." Digital Preservation Handbook, <https://www.dpconline.org/handbook/glossary#C>

manual processes, such as metadata extraction, instead of automation. Automated processes would save time and effort and would free staff to focus on more pressing work.

DPMD senior management acknowledged that the roles and responsibilities among stakeholders are not well defined and understood, and that more work is required in that respect. While DPMD senior management maintains that decisions regarding digital acquisitions belong with the acquiring areas and decisions regarding digital preservation belong with Digital Preservation and Migration Division, it also considers that decision making should be more collaborative given the interdependencies at the operational level. In its view, LAC's program areas need to come together in order to have a comprehensive picture of the impacts of the decisions each of them is making; while working in isolation they are getting only a partial picture of the issues involved.

To address this matter, a LAC forum has been created at the director level to discuss issues and needs and to find solutions. In addition, DMPD has developed a tool to communicate to the respective acquisition areas the level of preservation that the digital preservation team can provide for various digital acquisitions. However, according to some DPMD senior managers, that is not enough, and there is a need to find a balancing decision-making mechanism between stakeholders. Their view is that acquisition decisions need to take into account preservation costs and DMPD's ability to preserve and provide access. Not doing so risks LAC building a dark archive.⁶ This could cause embarrassment to the institution, as it would not be able to provide access to some collections as a result of technological issues.

Interviews with stakeholders further confirmed that not all of them are aware of their roles and responsibilities regarding digital preservation. Some of them acknowledged that they have become aware only recently, within the context of work related to DAMS, of the benefits of involving and working more closely with the Digital Preservation team. They also stated that the team is often overlooked because it tends to work behind the scenes and does not have sufficient visibility.

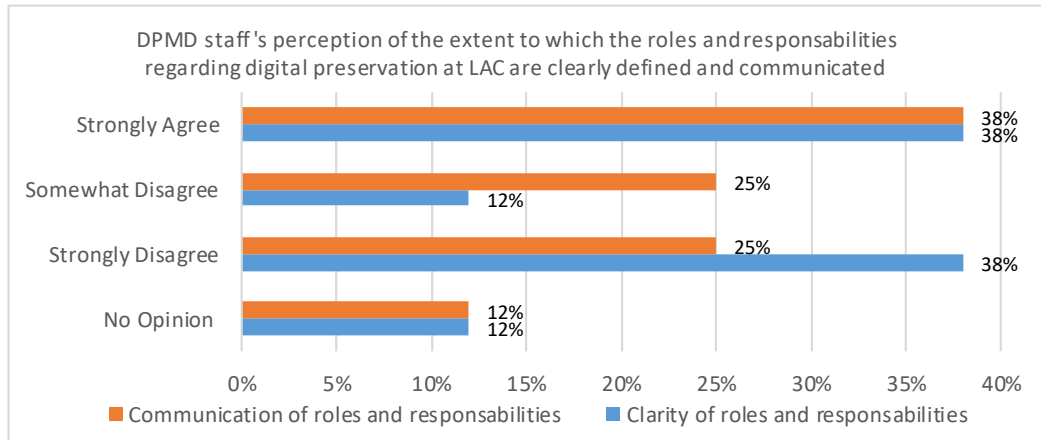
In terms of governance, stakeholders were not aware of any specific structure in place regarding digital preservation. Some identified LAC's Resource Planning and Management Committee or the DAMS steering committee as the main governing body, while others maintained that the existing hierarchical structure is sufficient as a governance mechanism. Certain interviewees also pointed out that there were some informal governance mechanisms, such working groups and director level meetings.

Overall, stakeholders indicated that they would like an explicit, clearly explained digital preservation governance that would leave room for exploration. They stressed the need for more collegiality, collaboration, and sharing of expertise. Some stakeholders, however, made it clear that certain lines of responsibility, such as acquisition decisions, should not be crossed. Others stated that the historical significance of digital material takes precedence and that they would proceed with an acquisition even if the Digital Preservation team cannot guarantee it can be preserved and made accessible. Their argumentation was that a technological solution might become available in the future and unlock previously inaccessible material.

Respondents to the DPMD staff survey are somewhat divided about the extent to which roles and responsibilities regarding digital preservation are clearly defined and well communicated (Fig. 2).

⁶ The [Society of American Archivists](#) defines dark archives as follows: 1. a repository that stores archival resources for future use but is accessible only to its custodian; 2. a collection of materials preserved for future use but with no current access.

Figure 2



Furthermore, while staff are aware of their own roles and responsibilities, they do not consider that LAC operational areas are aware of the roles and responsibilities they have in respect to digital preservation (Fig. 3 and 4).

Figure 3

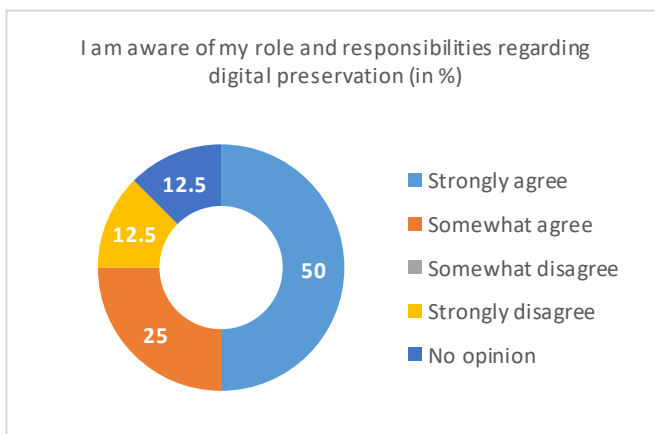
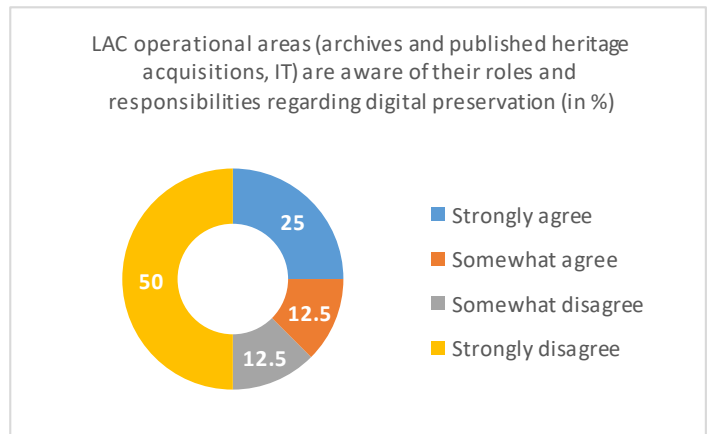


Figure 4



The high-level policy instruments do not contain any sections related to roles and responsibilities; however, internal LAC procedures are very clear on the roles and responsibilities between DMPD and other LAC areas. The evaluation noted several instruments on LAC's Policy and Strategic Research Division portal that outline the procedures for ingesting, preserving and accessing Digital Records. The documentation also shows that, in 2015, there was discussion in the Policy Renewal Coordination Group (PRCG) about developing a Digital Preservation Policy suite, which was to have included a directive, procedures, standards and checklists. It was suggested at the time that, while LAC's Stewardship Policy Framework (2013) and Policy on Holdings Management (2014) set the prerequisites and requirements for the preservation of digital holdings, there was a need for lower-level instruments to address the specific requirements of digital preservation.⁷ Unfortunately, the documentation does not reflect the outcome of the proposal. PRCG held no subsequent discussions on that after 2015. It appears that the procedures were developed and approved by the director of DPMD in 2017. The procedures in question appear to be evergreen documents, with the latest updates dating to May 2020. This indicates that there is an important policy gap between the high-level instruments and the operational instruments.

⁷ LAC Trusted Digital Preservation Policy Suite: Moving towards Trusted Digital Repositories, Proposal of Policy Direction, presented to the Policy Renewal Coordination Group on July 14, 2015.

Finding 6: There is a lack of planning and coordination between DPMD and stake holders regarding digital preservation.

DMPD management acknowledged that there is no planning coordination between the acquiring areas and the Digital Preservation team. This is due in part to the nature of archival work and operations, which does not allow for proactive planning. The other part of the issue is that the acquiring areas are not required to consider the implications of their acquisition decisions for the parts of the collection management process that do not belong to them. In fact, traditionally, acquiring areas have rarely notified DP about material they have decided to acquire ahead of its actual acquisition.

What exacerbates the situation, according to DPMD management, is the lack of horizontal capacity planning and the lack of horizontal management of the lifecycle of digital material. The acquiring areas are concerned solely with the amount of material they acquire, because that is what is required of them in terms of performance. They do not have to worry about data quality or about whether or not the data is readable or can be provided to a client. At present, the capacity of DP—and the overall LAC capacity, for that matter—in terms of infrastructure, financing and scheduling are not included in acquisition decisions.

In addition, DPMD management is concerned that LAC is bringing in digital material at a rate exceeding the capacity of acquiring areas to process it. As a result, that material is placed on a server and stored to await processing. This way of doing things is based on the same type of logic used in the processing of paper and other analog material. The implications for the Digital Preservation team are that data has a life span of three to five years and that therefore there is a high probability unprocessed material can become corrupted while in the custody of LAC. According to DPMD management, this in turn could have serious repercussions for LAC in terms of costs, liability, reputation, and ability to deliver its mandate; however, that is not well understood throughout the institution.

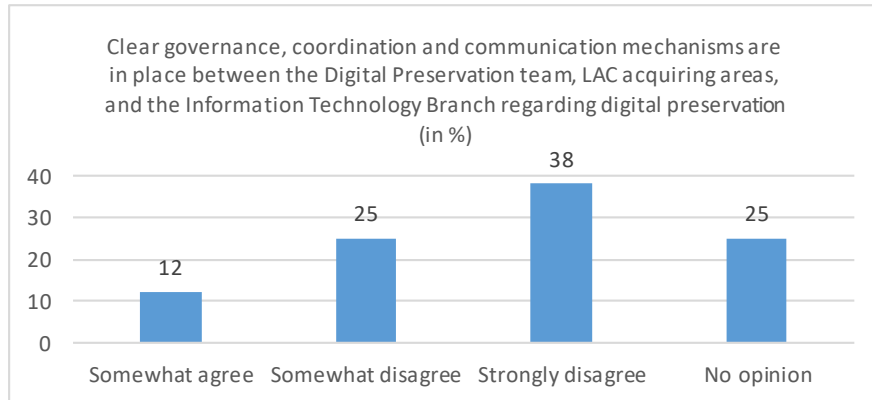
According to DPMD management, an added complexity, comes from the fact that the acquiring areas do not have the competencies to deal with digital material and the fact that the expertise is concentrated in DPMD. The latter, however, does not have the authority to direct other LAC areas on how to manage digital material. Furthermore, given legislative and policy issues across the Government of Canada, while LAC is responsible for preserving digital material for government departments, it does not have the ability to influence the quality of digital material produced by departments prior to its transfer into LAC's custody. Presently, DPMD is forced to negotiate this with departments at the operational level in the absence of any regulatory or policy mechanisms.

Interview data revealed that the coordination and planning practices of stakeholders and DPMD vary. Overall, coordination between DPMD and the acquiring areas occurs in preparation of, and during, the transfer of material into the custody of LAC but does not involve acquisition planning. Acquiring areas tend to seek DPMD's support around specific issues related to digital material, such as volume or file formats, and regard DPMD as a service provider. They indicated they do not involve DPMD in the planning of digital material acquisitions, because they consider that as their exclusive responsibility. Others were unsure as to when they are supposed to involve the DP team. Some, however, recognized the value of involving the DP team from the outset when developing preservation pathways for digital material as it helps ensure that acquisition and preservation occur seamlessly.

Certain stakeholders pointed out that there is a need for more integrated planning and coordination at LAC in general, and that what is missing is a common space for discussion, challenge and debate among operational areas. Having such a space would provide an opportunity to explain the "why" and "how," and would help avoid misunderstanding of the mandates and objectives of others, especially when an understanding of their realities is lacking.

Respondents to the DPMD staff survey, also appear to confirm stakeholders’ perception of a lack of clear digital preservation governance, coordination and communication mechanisms (Fig. 5).

Figure 5



In addition, respondents indicated that acquiring areas do not inform them in a timely manner of planned digital acquisitions and of acquired digital items on unstable media (Fig. 6 and 7).

Figure 6

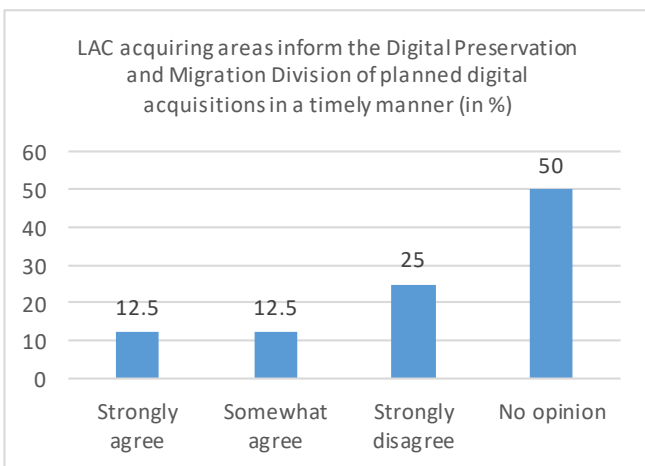
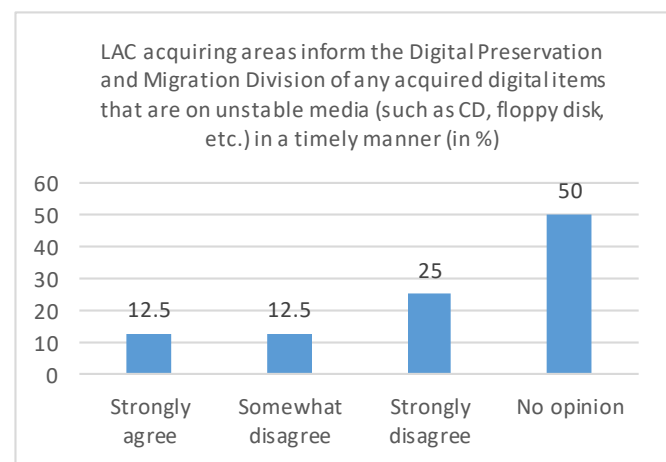


Figure 7



Finding 7: There are monitoring and reporting mechanisms for the Digital Preservation component; however, the division of responsibilities and accountabilities between stakeholders and DPMD is inefficient and disproportionate.

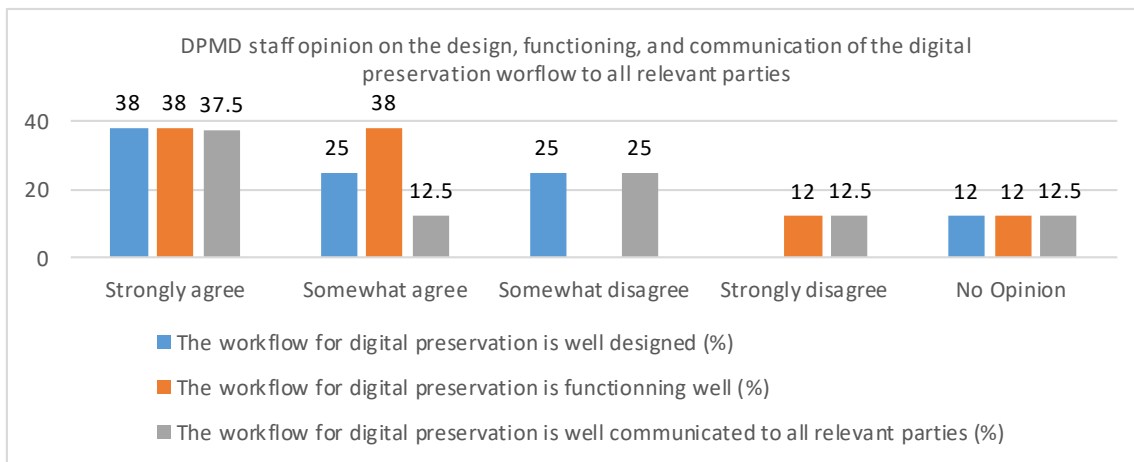
Program documentation and interview data demonstrated that DPMD has appropriate monitoring and reporting mechanisms in place for digital preservation. The evaluation team observed that reporting was done through the Digital Operations and Preservation Branch Briefing Books (annual) and through the Digital Operations and Preservation Branch Dashboards (quarterly), which were shared through LAC’s internal newsletter In Touch.

Stakeholders demonstrated a general understanding of the digital preservation workflow and dependencies between their respective areas and DPMD. Some, however, stated that they were not aware of the digital preservation procedures and the formats that DP cannot preserve. Both DPMD management and stakeholders acknowledged that acquiring areas are dependent on the expertise of the DI and DP teams regarding the transfer and preservation of digital material, and that DPMD is dependent on IT regarding infrastructure, tools, technical support and liaison with Shared Services Canada. Certain stakeholders expressed concern about the decision-making process currently in place regarding digital material. In their view, it puts acquiring areas and DPMD at

odds, as it is not clear who has authority to decide the course of action in cases where digital material is deemed to have archival and heritage significance, but it is not possible to preserve it given technical issues and/or the cost. Having shared responsibility does not work in reality, according to those stakeholders, and there is a need for a tie-breaking mechanism such as a cross-representational committee and/or a policy instrument.

While respondents to the DPMD staff survey consider that the workflow for digital preservation is well defined, functions well and is well communicated to all stakeholders (Fig. 8), DPMD senior management acknowledges that the digital preservation function is not yet stable and that further work is needed.

Figure 8



Finding 8: Mechanisms for verifying the authenticity and integrity of digital holdings are in place, and some improvements have been made. Nevertheless, a significant amount of unprocessed material remains on the staging server for extended periods of time. This is out of the control of DMPD. There are some measures in place to prevent major data loss and ensure data recovery in the event of loss; however, DPMD relies primarily on third-party service providers to ensure those safeguards are in place and are properly managed.

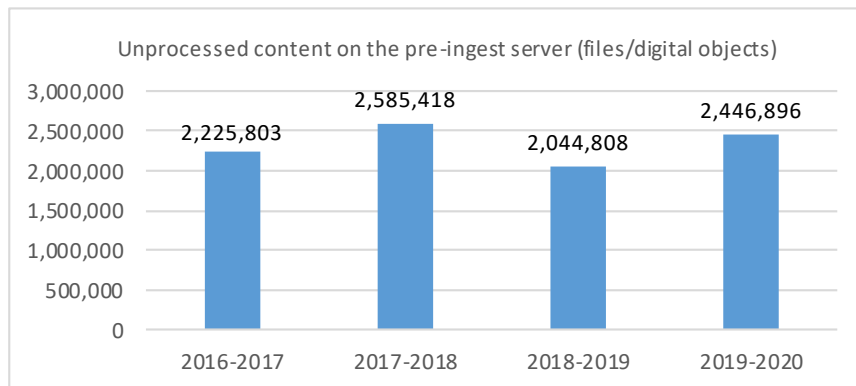
In its assessment report (2015) of LAC against the Trusted Digital Repository Audit Criteria (TRAC), the Centre for Research Libraries (CRL) found that LAC’s practices around data integrity checks were deficient and recommended that LAC introduce a schedule of data integrity measures. According to CRL, “[w]ithout regular integrity checks on digital objects the repository cannot ensure that its content remains useful and authentic. This is particularly important because the content is not backed up to an offsite location, and is therefore irreplaceable if it were somehow lost or corrupted.”

Interview and survey data gathered from DPMD management and staff indicated that the deficiency has been addressed. Integrity checks (checksums) are conducted at various points in the process: at ingest, at time of transfer to DP for preservation, and when restoring material from LTO tapes. The documentation review conducted by the evaluation team further confirmed that procedures for documenting such verifications are in place.

Another issue noted by CRL was in connection with the amount of unprocessed digital material. The report stated that, if the situation were not addressed, digital holdings would become “unable to be read or displayed due to format obsolescence, hidden defects, and/or corruption before they can even be ingested.” CRL deemed that the situation was urgent and needed to be addressed as quickly as possible. In addition, they recommended that the existing backlog of digital content be eliminated and that provision be made for the timely processing and ingest of new material.

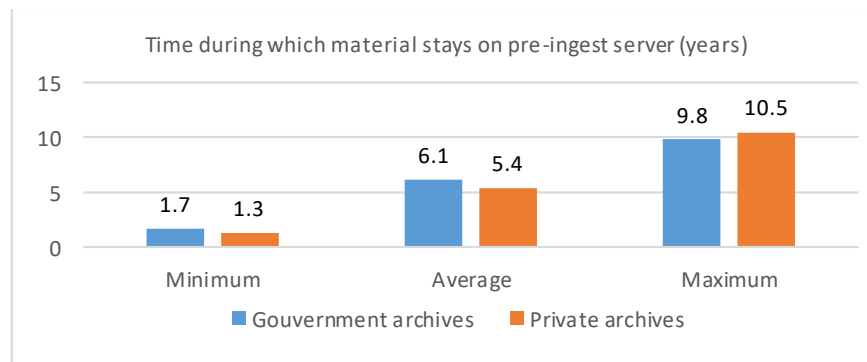
DPMD documentation demonstrated that the situation described by CRL is persistent. There is a considerable amount of unprocessed material on the pre-ingest server (Fig. 9), and material is residing on the server for an average time of around six years.

Figure 9



Furthermore, it appears that some material has remained unprocessed for more than ten years (Fig. 10).

Figure 10



The evaluation team was unable to determine whether DPMD has a business continuity and disaster recovery plan for digital material. Some interviewees pointed out that LAC uses Software as a Service, which includes data protection. In addition, the digital collection is stored in two copies on LTO tapes in two separate vaults of LAC's Gatineau Preservation Centre. Some data is also stored in the cloud. According to interviewees, ideally, LAC should have its data stored at two geographically distinct locations by two different cloud service providers; however, the institution does not have the resources to do that. They acknowledged that the current measures LAC has in place are not foolproof and that data recovery following a major incident would be labour intensive and time consuming.

Finding 9: Digital preservation solutions are performing well so far, but their functionality is still being tested and explored.

LAC's Digital Asset Management System (DAMS) uses a number of different technological solutions from third-party providers. The latter are responsible for monitoring the performance of these solutions and for resolving any issues. An internal steering committee with cross-representation from all areas provides overall oversight of the DAMS development and implementation. Its functionalities are still being tested and eventually will be integrated into LAC's operations. The DAMS functionalities being explored touch on the whole lifecycle of digital material (acquisition, preservation and access).

Stakeholders appear to place great hopes on the DAMS to resolve the issues they are having with the transfer of digital material to LAC. Some who have participated in the pilot tests noted significant improvements and have

had a very positive experience so far. DPMD management, on the other hand, are more cautious in their assessment and stressed that a lot more work would be needed before LAC has a fully functioning DAMS. Senior DPMD management acknowledged that not all of the DAMS functionalities are in place: DAMS is not able to handle material classified as “secret” or above, and the preservation module has not been developed yet. However, DPMD senior management maintains that the work currently under way is adequate and are satisfied with how it is progressing.

Respondents to the DPMD staff survey indicated that their experience with some of the DAMS solutions has been challenging and that certain transfer-related functionality is still not in place. Some noted that LAC DP experts have developed a special code that addressed certain issues with one of the solutions. The code was adopted by the solution provider and made publicly available. Others pointed out that there are remaining issues with the solution and that they are unclear about the intended use of some of its functionalities at LAC. They are also concerned that DPMD staff is not sufficiently consulted and involved in the discussions about these functionalities. Yet others regard DAMS as promising. However, they noted that currently it is used to deal with a very small portion of the digital collection. According to respondents, some of the solutions used in the DAMS show great promise for automation of certain digital preservation processes and have decreased the time and effort spent by staff in the execution of certain tasks. Others stated that staff have been able to make just as many improvements using the tools available to them as with the new solutions, and that LTO tapes continue to be the most efficient and cost-effective preservation method.

Finding 10. While DPMD management has taken some steps to improve the efficiency of digital preservation, there is an absence of cost modelling and cost estimation for the process as a whole.

DPMD senior management stated that the costs of digital preservation are difficult to estimate given the nature of digital material. For example, complex formats cost more to preserve. They noted that there is lack of openness in the cultural heritage community internationally about the cost of digital preservation and the amount institutions are investing. This makes it difficult to gauge and compare costs and investment efforts. However, in comparison to the level of investment in LAC’s analog infrastructure, the digital infrastructure is not up to par. DPMD lacks funding to upgrade existing or procure new servers. DPMD senior management acknowledged they manage costs by ensuring they stay within their allocated budget for the fiscal year.

Another way to keep costs of digital preservation low is DPMD’s use of LTO tapes as the main method of digital preservation. DPMD senior management indicated that the decision to use this method was made because this is the prevalent preservation practice among heritage institutions and the industry at large. This is further confirmed by the literature on digital preservation. According to the literature, LTO tapes have become the *de facto* industry standard because of their longevity, capacity to store very large quantities of data, low cost, and rapid data restore.⁸ LTO tapes can accommodate long-term to infinite retention of data. This makes them ideal for long-term archival preservation. Furthermore, current estimations in the literature place the cost of LTO tapes at \$4 per TB while other archiving and back-up methods range from \$8 per TB to \$150 per TB. In addition, future storage cost projections estimate that, over the next decades, the costs for disk-based systems will be seven times higher than tape-based systems and that cloud-based systems will cost three times more than tape-based systems.⁹

A major concern related to costs and financing that DPMD senior management raised is staffing. The expertise and skill set required for digital preservation are very specific and are in high demand, coupled with the reality of

⁸ Phil Goodwin, Proactive Defense Strategies Provide the Best Chance to Defeat Ransomware, IDC TECHNOLOGY SPOTLIGHT, International Data Corporation Canada, 2022

⁹ Fred Moore, Horizon Information Strategies: Reinventing Archival Storage, THE STORAGE HIERARCHY, 2021

limited financing it becomes very difficult to attract and retain talent. Given the high turnover in some areas of LAC in recent years, senior DPMD management are worried about their ability to retain the expert staff they currently have as more opportunities are becoming available in other government departments and in the private sector.

Stakeholders noted that the main challenges for DPMD stem from lack of financing and technological infrastructure. Some pointed out that the lack of long-term planning at LAC has had an adverse effect on infrastructure financing. As a result, IT is forced to prioritize financing decisions on the basis of urgency and have to look at LAC's overall infrastructure, not just the infrastructure needed for digital preservation. Stakeholders emphasized that what complicates things further is the fact that much of the funding is project-based and that there is no planning to ensure that LAC has the resources it needs to continue to run the project or to absorb the long-term costs of maintenance and repairs. Stakeholders recognized that, as a function, digital preservation lacks the solid financial resources it needs to be efficient and successful.

For DPMD management, the most important factors that could prevent LAC from delivering on its digital preservation priorities are the following:

- lack of clear roles and responsibilities at various stages of the lifecycle of digital material,
- lack of clear governance and accountabilities between acquiring areas and DPMD,
- unstable funding,
- inadequate infrastructure,
- staff morale, and
- retention of expert staff.

DPMD management stated that lack of clear authority to lead on issues affecting the preservation of digital material coming to LAC and lack of stable funding have an effect on the division's ability to plan and deliver on digital preservation. For example, general standards need to be followed when negotiating with donors and creators who wish to deposit material at LAC. Those standards allow the Digital Preservation team to receive information about the material that will be coming to LAC (such as file formats, the most recent time files were opened, and security levels). Applying those standards helps to identify issues with the material before it reaches LAC, and the DP team can work with clients to resolve them. However, currently the team cannot assume the lead on this because the acquiring areas perceive it as influencing acquisitions. Furthermore, DPMD managers stated they are not able to anticipate what their budgets will be from year to year and have to adjust to the envelopes they are given. This affects the regularity of procurement, maintenance and replacement of required tools and infrastructure.

DPMD senior management expressed strong concern about the ability to modernize LAC's technological infrastructure, stating that, given LAC's overall financial situation, they have to take a risk-based approach to LAC's digital operations and prioritize what is most at risk. In addition, they have to contend with striking a fine balance between replacing servers that could last another two to three years and using systems that could become inoperable in six months. They are facing a similar situation concerning staffing; that is, they have to consider the impacts and risks of not filling a vacant position versus identifying the most urgent vacancies to fill.

Overall, stakeholders see the lack of financing as the most significant factor that could prevent LAC from delivering on its digital preservation priorities. Others add to that the lack of infrastructure and LAC employees in general lacking digital competencies. Some stated that LAC should equip its employees with the skills necessary to deal with digital material so that there is seamless processing of both analog and digital material. Stakeholders

also acknowledged that LAC's current financial situation is placing a lot of demand and pressure on DMPD staff that they cannot meet and which is affecting their morale.

Respondents to the DPMD staff survey echoed concerns similar to those expressed by DPMD management and stakeholders. Lack of resources and staff's frustration with persistent governance and roles and responsibilities issues were the main concerns. There was also a perception among DPMD staff that their expertise is not valued or given proper consideration by stakeholders. Furthermore, staff appear to feel that they are prevented from doing their jobs efficiently.

The evaluation team noted a growing realization among DPMD management, DPMD senior management, staff and stakeholders about the need for a more collaborative and interdisciplinary way of working to address the issues surrounding digital preservation. The team observed that a number of cross-representational working groups on various aspects of digital preservation and at various levels (operational, manager and director) were created during the period from 2017-2018 to 2020-2021. However, some stakeholders indicated that capacity issues caused DPMD staff to pull out and that this has created a void with respect to exploring solutions and making improvements at the working level.

In terms of improvements, DPMD senior management and stakeholders noted the development of the DAMS as the most significant accomplishment. DPMD senior management stated that DAMS has so far proven to be a good investment for LAC—the cost was lower than expected and the potential of the functionality exceeded their expectations. However, they acknowledged that more investment (financial and FTEs) is needed to test its full capabilities and its limitations across the full spectrum of LAC services. Some stakeholders noted that working in the DAMS project teams has helped them gain a better understanding of what digital preservation is all about and would like to see the synergy created by the DAMS translated into the operational levels. They acknowledged they do not have a detailed understanding of what the DP team does or expects of them, and are uncertain as to when they should be contacting them. Stakeholders suggested that starting a workplace shadowing initiative at LAC would greatly help with understanding the various operations and the issues different areas have. Other improvement suggestions touched on the need for more guidance, better communication and greater sharing of expertise.

4.3 Progress in attaining the expected results

Finding 11: The Strategy for a Digital Preservation Program has not been fully implemented, and there has been no implementation monitoring or reporting.

Program documentation and interview data with DPMD management, DPMD senior management and stakeholders indicated that the Strategy for a Digital Preservation Program has not been implemented as intended and has not been kept up to date. The Evaluation Team did not find any evidence that the implementation of the strategy was monitored and did not find any reports regarding its status. Some of the deliverables, such as the DAMS, have progressed. However, not much progress has been made regarding the financing of the strategy, which was listed as one of the most important prerequisites for successful delivery.

DPMD management explained that the basic premise of the strategy is no longer valid and that it stems from a very early stage of the profession and the field of digital preservation in general. In DPMD management's opinion, the thinking around the strategy has evolved considerably since the document was written, as has the field itself internationally. Moreover, the model on which the strategy is based no longer reflects actual operations. LAC's interpretation of the ISO standard and the Open Archival Information System reference model was faulty, and the way those were operationalized at LAC does not work anymore. DPMD pointed out that, at the time the strategy was written, the thinking about digital preservation internationally was premised on the view that it was a technology issue. It was commonly believed that finding a technological solution would resolve

the issues of digital preservation; however, this is no longer the case. The understanding now is that it is an issue fundamental to archival and library business functions and that digital preservation professionals should have archival and library science backgrounds. In other words, digital preservation infrastructure should be built around business principles instead of the other way around.

DPMD management also noted that the implementation of the DAMS has taken on a different direction than envisioned in the strategy. Some interviewees stated that the functionality of the DAMS is too narrowly focused and operates independently of the infrastructure used by some DPMD areas, which have seen no benefits from its implementation. DPMD senior management added that the strategy was too heavily focused on the digital preservation component and did not take into account the rest of the digital curation lifecycle.

Stakeholders displayed various levels of awareness of the strategy. Furthermore, they indicated they were not aware of any communications, any updates or the state of its implementation. Some who were familiar with the document noted that stakeholders were not involved in the development of the strategy and that DPMD developed it on their own. Others pointed out that the document was too abstract, that it needed to be revised, and that not all deliverables were in place.

Respondents to the DPMD staff survey acknowledged they are aware of the strategy and they consider it relevant to their work (Fig. 11 and 12); however, some staff indicated they were not sufficiently consulted (22%) and involved (22%) in the development of the strategy. In addition, 34% of staff noted that some progress has been made in the implementation of the strategy.

Figure 11

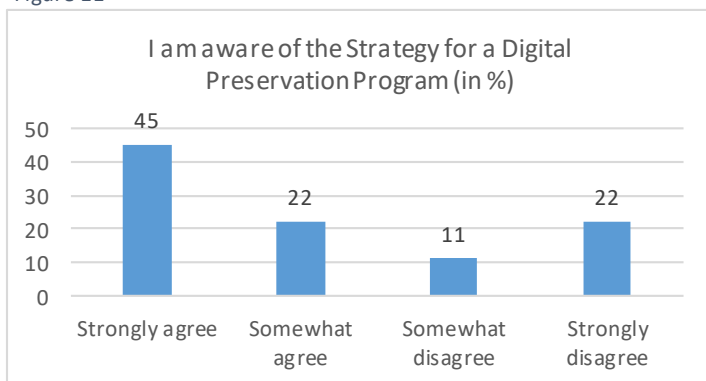
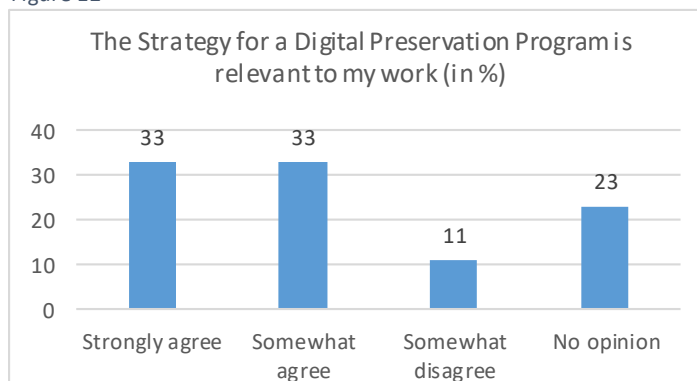


Figure 12



According to respondents, the lack of clarity regarding roles and responsibilities, governance, and shared accountability were the hindering factors to the implementation of the strategy. Staff also acknowledged that the strategy does not take into account the dependencies with other LAC areas. What facilitated the progress, on the other hand, according to respondents, was the hiring of additional staff in some DPMD areas, as well as an increase in knowledge transfer and knowledge distribution across the division.

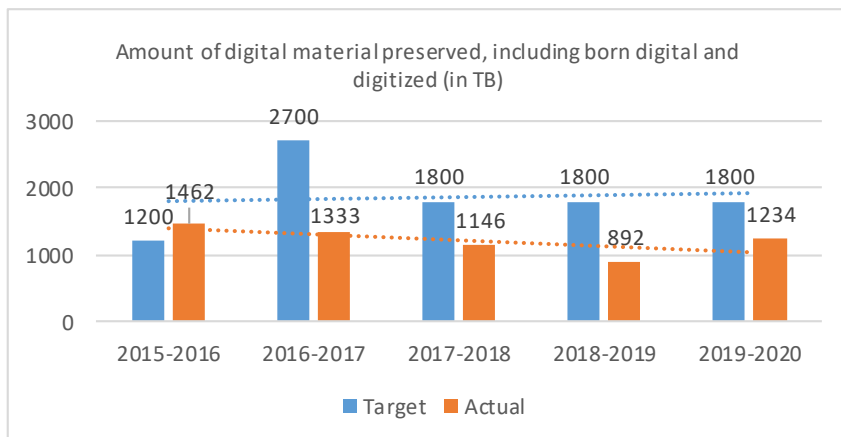
In terms of what elements need to be in place for the strategy to be successful, respondents reiterated the need for stable funding, clear roles and responsibilities, and well-defined governance.

Finding 12: Limited progress has been made to attain the short- and medium-term results related to the digital component of the Preservation Program.

The Program Information Profile of the Preservation Program does not explain what is meant by “increased digital collection.” It is not clear whether the increase is meant to be measured in terms of volume of material or in terms of LAC’S capacity to handle transfers of digital material. Furthermore, the causal links between activities, outputs and results are not captured well. The activities and outputs themselves are poorly articulated and in

fact do not represent actual activities or outputs. The significance of measuring the increase of the digital collection is not well defined and is not explained. Considering that a number of factors that can affect the volume of acquisitions are out of LAC's control, the result does not appropriately demonstrate LAC's capacity or ability to preserve the collection. In addition, the performance indicator chosen does not accurately measure the result, and no performance data associated with it has been collected. The data collected by the program at the output level provides some insight into the overall performance of the digital component. The data shows that, over the four year period from 2016-2017 to 2019-2020, digital preservation was not able to reach its performance targets regarding the amount of digital material preserved (Fig. 13). That is explained by the efficiency issues described in the previous section of this report, chief among them — the lack of financing.

Figure 13

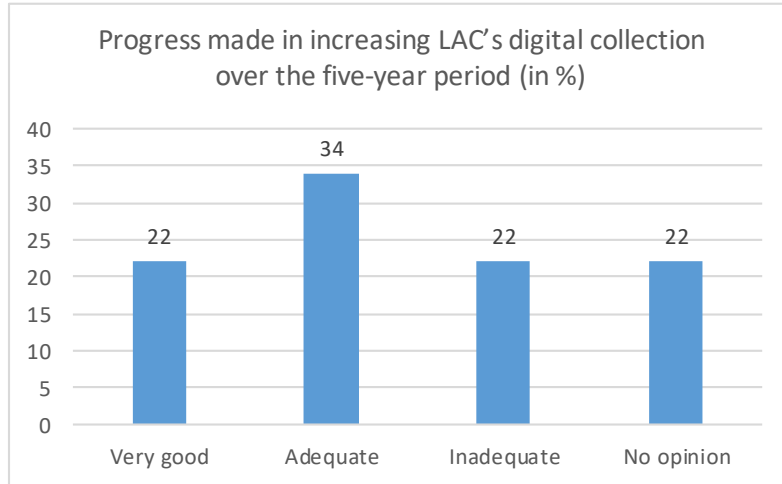


Interview data indicated that DMPD management and DPMD senior management appear to associate the deliverables under the Strategy for a Digital Preservation Program with the short-term result and considered that achieving those deliverables showed that the short-term result was attained.

DPMD management and stakeholders pointed again to the DAMS as a major step forward for LAC in terms of enabling the institution to increase its digital holdings. DPMD management indicated that the focus of the DAMS at present is on building bridges between LAC's systems and the systems of publishers, universities, and other government departments, with the intention of widening those bridges gradually over time in order to accommodate an increased influx of material. Interviewees pointed out that DAMS is the primary means through which LAC would carry out its digital acquisitions. However, they acknowledged that LAC does not yet have the resources and infrastructure to handle large quantities of incoming material.

Respondents to the DPMD staff survey rate the progress towards attaining the short-term result as adequate (Fig. 14). Some pointed out that process inefficiencies, such as lack of clear roles and responsibilities and the absence of well-defined governance between acquiring areas and DPMD, have contributed to the accumulation of unprocessed digital material and have hindered the organization in attaining the short-term result. Others, however, noted that significant progress has been made in terms of automation and that some inefficient and time-consuming processes have been eliminated. Staff emphasized that LAC should make better use of its digital subject-matter experts in order to improve results.

Figure 14



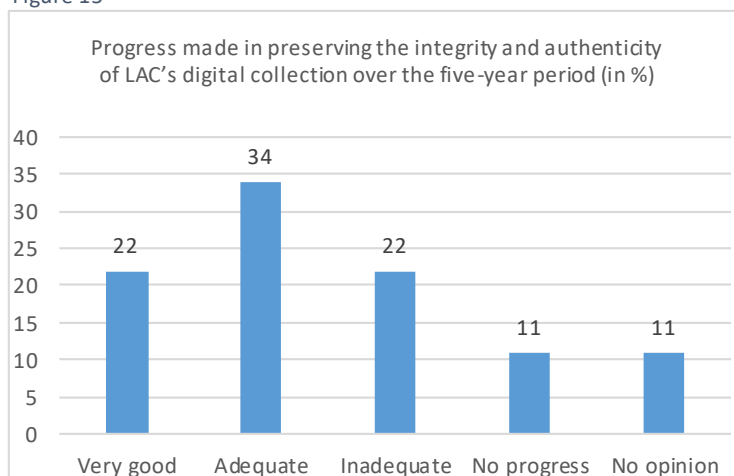
The Preservation Program has chosen a qualitative performance indicator to measure the medium-term result for the Digital Preservation component. However, the indicator chosen does not actually measure the result and is not logically connected to the result chain (see Annex C). The program documentation contained some relevant reporting related to the indicator, which was focused primarily on the planning and implementation of the DAMS component of the strategy.

Interviews with DPMD management and DPMD senior management revealed that the integrity and authenticity of LAC's digital collection is preserved through the conducting of checksums and through maintaining of chain of custody evidence. DPMD senior management stated that DPMD has an up-to-date digital preservation database and that they have recently implemented a system for active auditing of the LTO tapes.

Stakeholders again pointed to the DAMS as an important factor contributing to the realization of the medium-term result. Some stated that collaborating with the DP team has helped them move digital collections from aging and at-risk systems into the DAMS and has ensured the proper preservation of those collections. They also suggested that it would be helpful for them if the DP team developed a reference tool that would help acquiring areas to know whether the file formats they are trying to bring in are acceptable. Some stakeholders pointed out that the DAMS captures all the provenance of the material that enters it, i.e., it captures the time and date the material was received at LAC, and can also provide evidence that material was not changed from its original version while in LAC custody.

DPMD staff rated the progress made towards attaining the medium-term result as adequate (Fig. 15).

Figure 15



According to staff, the factors that facilitated the preservation of the integrity and authenticity of the digital collection are the use of software tools that generate and verify checksums and the tools made available for transfer. Some indicated that the following hinder the preservation of the integrity and authenticity of the digital collection:

- Not receiving checksums with transfers impedes the ability to document integrity from the donor or department;
- Inadequate metadata at the point of acquisition to document/demonstrate authenticity;
- Lack of a system to manage preservation metadata related to integrity and authenticity. Ideally, such a system would be based on, or would follow, the PREMIS¹⁰ metadata standard.

In staff's view, the elimination of redundancies and making the whole process more "digestible, flexible and efficient" would save time in quality assurance. Staff are also concerned about the amount of unprocessed material, which is not preserved and is not monitored for integrity and authenticity. They can guarantee the integrity and authenticity of fully processed content only. Another concern for them is the infrastructure dependency of LAC on Shared Services Canada and its own IT Division, which affects the timely procurement of LTO tapes.

5. Conclusion

The evaluation provides DPMD management with an opportunity to adjust the digital preservation component of the Preservation Program in order to improve its performance and the achievement of expected results.

On the basis of the evaluation findings, the evaluation team concluded that there is no common perspective on digital preservation within the Digital Preservation and Migration Division (DPMD) and among stakeholders. In addition, a number of factors have significantly impacted the efficiency of digital preservation operations and the attainment of program results. The digital preservation process is embedded in the management of the Digital Content Lifecycle, a horizontal process that involves several areas in LAC. However, there is no overarching governance mechanism to ensure proper planning and coordination among the various stakeholders.

Furthermore, the chain of authority and accountability for digital preservation is fragmented, i.e., it does not take into account key process points and the impact of various process dependencies. This creates stalemate

¹⁰ PREMIS - Preservation Metadata Implementation Strategies standard <https://www.dcc.ac.uk/resources/metadata-standards/premis>; <https://www.dcc.ac.uk/resources/metadata-standards/premis>

situations that have serious repercussions for the efficiency of digital preservation operations. An example of this is the existing backlog of unprocessed material resulting from processing delays incurred by the Archives Branch, which prevents DPMD from preserving the material. There is also an important policy gap, which contributes to the confusion over roles and responsibilities and the lack of understanding of what digital preservation entails. Finally, the resourcing of the digital component of the Preservation Program does not take into account the long-term sustainability of digital preservation operations.

Table 2

LAC Digital Preservation	
<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • LAC has digital preservation experts who are recognized internationally. • State of LAC's digital collection is known and monitored. 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Inefficient governance. • Unclear roles and responsibilities of stakeholders and program units administering the program component. • Missing policy instruments. • Digital Preservation is not delivered holistically and horizontally as part of Digital Material Lifecycle Management. • Accountabilities are fragmented and disproportionate. • Digital material is acquired at a rate that outpaces the ability of acquiring areas to process it, which has a direct impact on digital preservation.
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Collaboration between LAC acquiring areas, Digital Preservation team and IT is essential. • LAC's digital collection: <ul style="list-style-type: none"> • increases the relevance of the institution to Canadians • facilitates access nationwide • promotes equity. • There is a need for greater coordination and more integrated planning with regards to the acquisition, preservation and infrastructure for digital material 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Lack of stable and sustainable financing. • Costs of digital preservation and ability to preserve are not taken into account in acquisition decisions, which affects efficiency of digital preservation and LAC's ability to provide access. • Inability to provide access to LAC's digital collection carry serious legal and reputational risks for LAC and its ability to deliver its mandate. • Reliance on third party service providers to ensure the preservation integrity and authenticity of the digital collection.

6. Recommendations

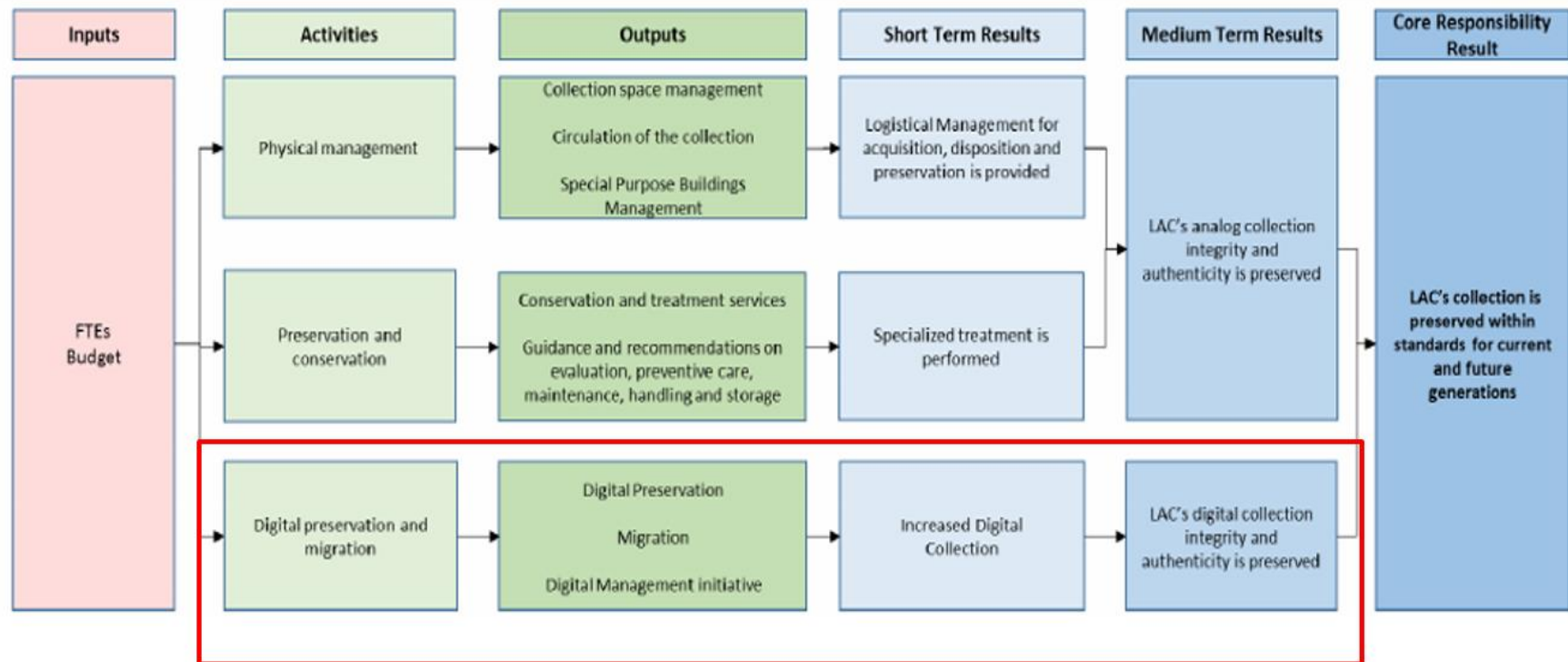
In the spirit of continuous improvement, the Senior Director General, Digital Services, in collaboration with the Assistant Deputy Minister, Collections, and the Assistant Deputy Minister, User Experience, should:

1. Develop and communicate to staff a comprehensive Digital Preservation Policy suite (framework, policy, directive, guidelines) that clearly defines:
 - a. LAC's Digital Preservation Priorities;
 - b. Roles and responsibilities of all stakeholders involved, notably the Digital Collections Operations Division (DCOD), previously the Digital Preservation and Migration Division (DPMD), the acquiring areas, and the Digital Services Sector;
 - c. Criteria for the acquisition and preservation of digital material that take into account the ability to preserve and make accessible; and
 - d. A horizontal workflow for LAC's Digital Content Lifecycle Management.
2. Ensure that an overarching governance and coordination mechanisms are in place to facilitate consultation and decision making between internal stakeholders;
3. Conduct an annual joint planning exercise with internal stakeholders to prioritize digital preservation activities and to manage interdependencies; and
4. Ensure that LAC has sustainable resources and technology to preserve and provide an enduring access to its digital collection.

Appendix A: Management Response and Action Plan

Evaluation Recommendation	Management Response to Recommendations	Action to be Taken	Anticipated Completion Date	Lead
<p>1. Develop and communicate to staff a comprehensive Digital Preservation Policy suite (framework, policy, directive, guidelines) that clearly defines:</p> <p>a. LAC's Digital Preservation Priorities;</p> <p>b. Roles and responsibilities of all stakeholders involved, notably the Digital Collections Operations Division (DCOD), previously the Digital Preservation and Migration Division (DPMD), the acquiring areas, and the Digital Services Sector;</p> <p>c. Criteria for the acquisition and preservation of digital material that take into account the ability to preserve and make accessible; and</p> <p>d. A horizontal workflow for LAC's Digital Content Lifecycle Management.</p>	<p>Management agrees with this recommendation.</p>	<p>Develop and implement a Digital Preservation policy suite (framework, policy, directive, guidelines) that clearly defines:</p> <ul style="list-style-type: none"> – LAC's Digital Preservation Priorities; – Roles and responsibilities of all stakeholders involved, notably Digital Collections Operations (DCO), the acquiring areas, and broadly the Digital Services Sector; – Criteria for the acquisition and preservation of digital material that take into account the ability to preserve and make accessible; and – A horizontal workflow for LAC's Digital Content Lifecycle Management. 	<p>March 2025</p>	<p>Director of Digital Collections Operations (DCO)</p>
<p>2. Ensure that an overarching governance and coordination mechanisms are in place to facilitate consultation and decision making between internal stakeholders;</p>	<p>Management agrees with this recommendation.</p>	<ul style="list-style-type: none"> • Use the Archival Steering Committee on Digital (ASCD) to facilitate consultation and support decision making on matters related to digital preservation and access for acquired materials; 	<p>March 2023 and beyond</p>	<p>Director of Digital Collections Operations (DCO)</p>
<p>3. Conduct an annual joint planning exercise with internal stakeholders to prioritize digital preservation activities and to manage interdependencies;</p>	<p>Management agrees with this recommendation.</p>	<ul style="list-style-type: none"> • Conduct an annual joint planning exercise with director-level members of the Archival Steering Committee on Digital (ASCD) to prioritize digital preservation activities by collection and to manage interdependencies; 	<p>March 2023 and beyond</p>	<p>Director of Digital Collections Operations (DCO)</p>
<p>4. Ensure that LAC has sustainable resources and technology to preserve and provide an enduring access to its digital collection.</p>	<p>Management agrees with this recommendation. We currently have technology for providing access to digital collections, but not all digital collections acquired are accessible as formats or carriers are beyond current technological capabilities.</p>	<ul style="list-style-type: none"> • Perform an annual review, and secure required resources and tools proposed by DCO management, to enable Digital Collections Operations to perform its work and to ensure enduring preservation and access; 	<p>February 2023 and beyond</p>	<p>Chief Information Officer, Chief Data Officer, and Senior Director General of the Digital Services Sector</p>

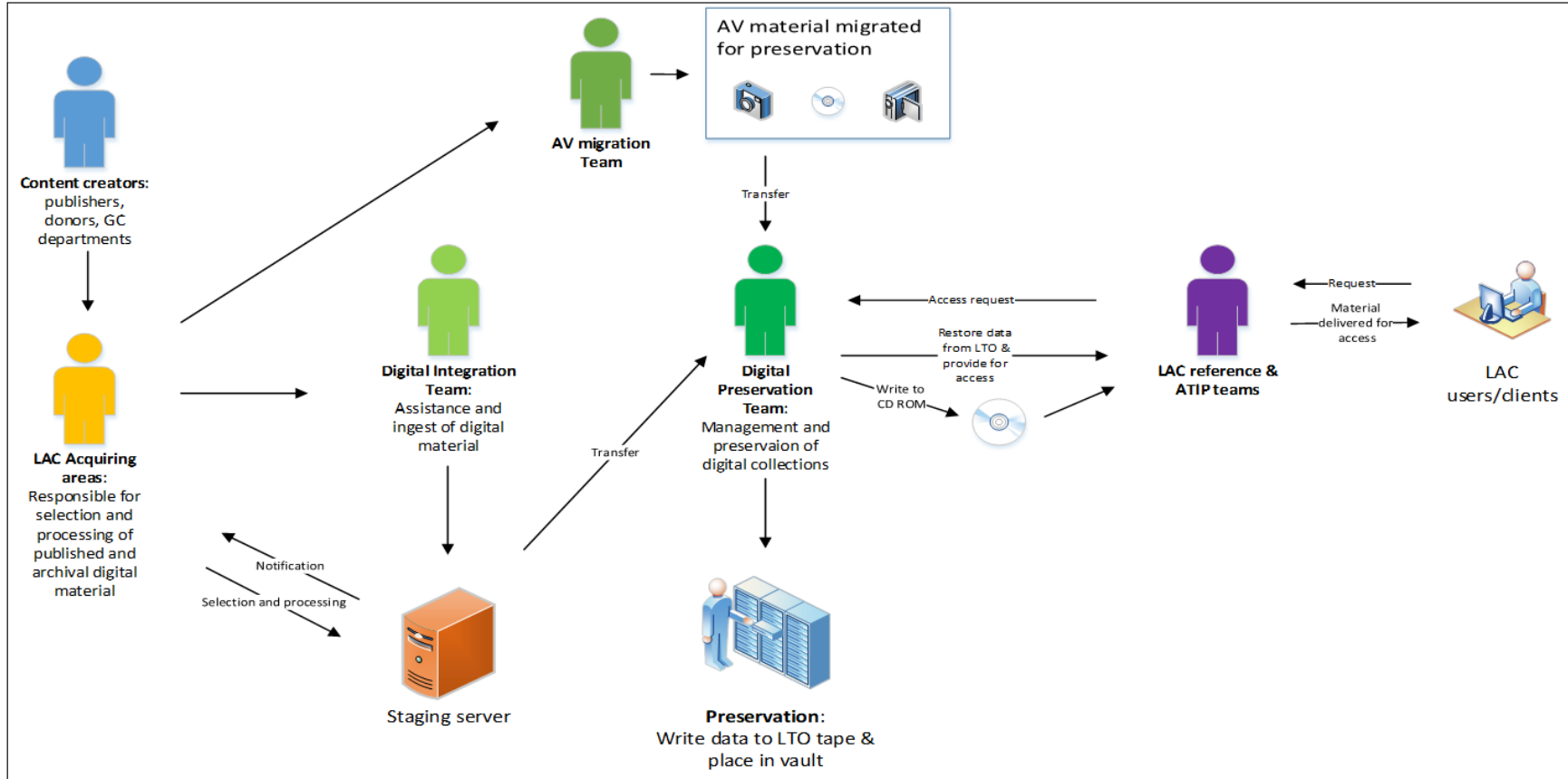
Appendix B: Logic Model for the Digital Component of the Preservation Program



Appendix C: Performance Measurement Strategy (PMS)

Key activities	Logic model element	Indicator	Definition/Source	Data collection frequency	Responsible for data collection
Outputs					
	Digital Preservation	Number of terabytes of digital material preserved including born digital and digitized Documents	CommVault + Local Preservation Database	Quarterly	Digital Preservation Manager
	Migration	Number of hours of at-risk audiovisual content migrated Number of items at-risk digitized (for preservation purposes)	Staff stats	Quarterly	Audiovisual Migration Manager
	Digital Management initiative	Status update on DAMS development	Status update on DAMS development	Status update on DAMS development	Status update on DAMS development
Short-term results					
	Increased Digital Collection	Percentage of reduction of the digital collections backlog	Digital Collections Inventory	Annually	Digital Preservation and Migration Director
Medium-term results					
	LAC's digital collection integrity and authenticity is preserved	Number of components from the digital preservation strategy in place	Digital Preservation Strategy	Annually	Digital Preservation and Migration Director
Core responsibility (ultimate) results					
	LAC's collection is preserved within standards for current and future generations	Year-over-year increase of new digital content preserved within standards	CommVault + Local Preservation Database	Annually	Director General Digital Operations
	LAC collection is safeguarded for current and future generations (former PMS)	Cumulative percentage of at-risk audiovisual material migrated from an obsolete to a current digital file format Annual increase of new digital content preserved (includes both born-digital and digitized documents)	N/A	N/A	N/A

Appendix D: Digital Preservation Workflow



Note: This chart was created by the Evaluation team and is based on information obtained through interviews and the program employee survey.

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