Documenting Institutional Knowledge Through TRAC Self-Audit: A Case Study

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The University of North Texas (UNT) Libraries' Digital Collections preserve and host more than 27 million files that have accumulated over more than ten years through the activities of the Digital Libraries Division. In 2015, the Division undertook a self-audit according to the Trusted Repositories Audit & Certification: Criteria and Checklist as a way to codify practices and document the stability of the program as it continues to grow. This paper explores the self-audit process within the knowledge management (KM) framework of contextual dimensions outlined by Bouthillier and Shearer (2002), providing background and examples for each of the dimensions: discover of existing knowledge; acquisition of existing knowledge; creation of new institutional knowledge; storage of existing knowledge; organization of knowledge, new and old; and sharing, use, and application of knowledge. Additionally, we analyze the motivations, challenges, and successes of the process based on Jafari, et. al., (2008), particularly the challenge that the self-audit would have been easier if we had used an existing KM framework at the time since we did not have a peer institution's audit to emulate, and the success that we have released documentation publicly that has assisted UNT staff and would be useful to other institutions that wish to complete a similar self-audit.

Keywords: digital preservation, institutional repositories, sustainability, digital curation.

1. Introduction

In 2015, the University of North Texas (UNT) Libraries' Digital Libraries Division completed a self-audit of its digital library infrastructure, based on the Trusted Repositories Audit and Certification (TRAC) Criteria and Checklist. As a result of this self-audit, the UNT Libraries documented workflows, procedures, policies, and document-evaluation schedule that previously had not been codified within a single, unified location. The digital preservation endeavor at UNT Libraries has thus far resulted in over 27 million files preserved and accessible via three different digital library interfaces: The Portal to Texas History, the UNT

Digital Library, and the Gateway to Oklahoma History. The TRAC self-audit served as an important next step as this massive digital preservation initiative matures. While the tangible product of this effort has been documentation, the overarching goal this process achieved is codified and preserved knowledge of the entire process of how UNT Libraries manages digital preservation. This paper explores the concept of knowledge management (KM) and the important role it served in the TRAC self-audit that UNT Libraries performed in 2015. This exploration consists of a retrospective examination of the knowledge this process helped codify with the first goal of making tacit the interconnections between digital preservation policies and practices, and the second goal of supporting the work of other institutions considering implementation of a TRAC self-audit.

2. Review of Literature

As practices in KM become increasingly entrenched in institutional culture, exploring how knowledge management (KM) supports a growing organization in the short-term offers useful insight into long-term institutional strategy. In 2015, when UNT Libraries undertook to perform a self-audit of the trustworthiness of its digital library and digital preservation infrastructure, it quickly became evident that knowledge would have to be identified and managed in a few different and significant ways.

The collection, organization, and distribution of knowledge play a vital role in ensuring standards for future and current work in digital preservation (Hammer & Davenport, 2004). The steps inherent in KM as laid out by Bouthillier and Shearer (2002)--discovery of existing knowledge, acquisition, creation, storage, organization, sharing, use and application of knowledge--shape the actions necessary for KM. The information captured by this system, can then be described as the contextual and structural dimensions of an organization (Jafari, Fathian, Jahani, Akhavin, 2008). Contextual dimensions "characterize the whole organization, describe the organizational setting and influences, and shapes the structural dimensions" and can be used to identify critical success factors, motivations, and obstacles (Jafari et. al, 2008). According to Jafari et. al, (2008) these dimensions can be best captured by codifying the size, technology, environment, goals and strategies, and culture of an organization. Structural dimensions then "provide labels to describe the internal characteristics of an organization...the basis for measuring and comparing organizations" (Jafari et. al, 2008). To support the ability of an organization to collect, organize, and distribute both dimensions of knowledge, a standard set of evaluative measures can be used

to guide the KM process. These measures should map connections documented by KM, including contextual and structural dimensions of the organization.

In digital preservation, the Trusted Repositories Audit and Certification (TRAC) stresses the importance of infrastructure and processes that are defined in support of satisfying digital preservation necessities (Center for Research Libraries, 2007). This certification process evaluates metrics relating to the organizational infrastructure, digital object management, and technology, technical infrastructure, and security within a digital repository to make concrete the measurement of trustworthiness within a repository. The initial TRAC self-audit process gave UNT Libraries the opportunity to apply the TRAC Criteria and Checklist (Center for Research Libraries, 2007) to its institutional knowledge, to codify and quantify the effectiveness of Division processes in digital preservation that were not necessarily documented and accessible in a body of policies or otherwise tangibly expressed. The Hammer and Davenport (2004) definition of knowledge management, as a process for obtaining, distributing, and utilizing knowledge in a useful manner, closely relates to the spirit of the "Trustworthy Repositories Audit & Certification: Criteria and Checklist" (2007). Such processes defined by Hamner and Davenport closely relate to processes included in the digital preservation policy framework, which served as an overarching premise on which the Division functioned, or the digital collection usage and feedback practices which represented the digital library content to external users. In essence, the "TRAC Criteria and Checklist" provided the means by which to codify knowledge:

> In determining trustworthiness, one must look at the entire system in which the digital information is managed, including the organization running the repository: its governance; organizational structure and staffing; policies and procedures; financial fitness and sustainability; the contracts, licenses, and liabilities under which it must operate; and trusted inheritors of data, as applicable. Additionally, the digital object management practices, technological infrastructure, and data security in place must be reasonable and adequate to fulfill the mission and commitments of the repository (Center for Research Libraries, 2007).

TRAC and KM form a natural pairing, as the goal of both is to identify different types of core information necessary to run an organization, albeit in the case of TRAC, a digital library interface. In each criteria, TRAC aggregates what Koenig (2012) identifies as three types of information or knowledge that support a functional institution: Explicit, Implicit, and Tacit. In the case of implicit, or

"information or knowledge that is not set out in tangible form but could be made explicit," TRAC provided UNT Libraries with the opportunity to achieve just this, and it gave staff the opportunity to understand how intangible, or tacit, knowledge serves as the invisible glue that keeps the institution running. Examples of intangible knowledge, according to Koenig's definition, would be unpredictable budget mechanisms that could impact the UNT Digital Libraries Division, for example, and this could not necessarily be codified and explained but which staff could plan for as circumstances require. The final result of these efforts allows us to understand how these dimensions interact through explicit, implicit, and tacit knowledge and their contributions to critical factors for success and failure.

3. Methodology

For the purposes of this paper, we apply the steps identified by Bouthillier and Shearer (2002) as contextual dimensions defined by Jafari, et. al., (2008) and combine them with the TRAC Criteria and Checklist to serve as a method for reflecting upon our TRAC self-audit of the digital preservation infrastructure of the UNT Digital Libraries Division. The self-audit process we undertook in 2015 enables the TRAC team at present to consider our strategy and processes in the light of KM. Through this reflection, we may evaluate how the self-audit process identified and codified explicit, implicit, and intangible knowledge, and we may draw conclusions about how this knowledge contributed to successes, challenges, and motivations as defined by Jafari, et. al. (2008).

When we first performed the TRAC self-audit process at UNT, we established a schedule to revisit the documentation we had originally developed for this process, and KM theory and practice offer useful descriptive avenues for understanding both the current state of knowledge in the UNT Digital Libraries Division as well as future directions for how knowledge will benefit UNT. Building on the practices of KM researchers allows us to explore the TRAC self-audit process and more deeply to explore the UNT Digital Libraries Division in a way we have previously not undertaken. This paper will map the UNT TRAC self-audit process begun in 2014 to contextual dimensions developed by Bouthillier and Shearer (2002). Table 1 represents how we tailored the steps defined by Bouthillier and Shearer to contextual diensions to evaluate knowledge discovery, creation, and sharing in our own TRAC self-audit of the UNT Digital Libraries Division.

Table 1. Bouthilier & Shearer (2002) contextual framework for mapping information knowledge

Dimension	Bouthilier & Shearer Application	UNT Local Definition
Discovery of existing knowledge	• Locating internal knowledge • Helpful when organization is spread out and knowledge is situated in multiple, distinct areas	• Division-level knowledge, easy to identify • Implicit, explicit, and intangible knowledge
Acquisition of existing knowledge	• Obtaining knowledge from sources external to the working department	• External to Division • Implicit, explicit, and intangible knowledge
Creation of new institutional knowledge	• Combining different types of internal knowledge to form new knowledge	• Creating knowledge for identified gaps • Implicit and explicit knowledge
Storage of existing knowledge	• Application of specific storage structure to prepare knowledge for organization and sharing • Intermediate to organization and sharing	• Moving implicit information to written documentation • Explicit knowledge
Organization of knowledge, new and old	• Arrangement process for making knowledge usable	• Final documentation, policies, appendices • Explicit knowledge
Sharing, use, and application of knowledge.	• Transfer of knowledge from one person to another • To be useful, knowledge must be shared with the community.	• Website and formal external documentation • Institutional presentations • Schedule for auditing documentation and division of responsibilities • Explicit knowledge

4. Contextual Dimensions within the UNT TRAC Self-Audit

The UNT Libraries' Digital Collections operates as an umbrella for the wide range of access and preservation activities underway at UNT Libraries. Existing "in support of the UNT Libraries Mission, the UNT Libraries' Digital Collections is dedicated to the long-term collection, production, maintenance, delivery, and preservation of a wide range of high-quality digital resources and services for the UNT Community and users throughout the world." (UNT Libraries, 2015). This high-level goal is directly carried out by the Digital Libraries Division with 19 full time employees and over 35 part-time student assistants. In addition to the Digital Libraries Division there is strong commitment and effort from units across UNT Libraries to ensure long-term sustainability. As the central repository infrastructure for digital content at UNT Libraries, trust in the Digital Collections infrastructure, policies, workflows, and preservation activities is critical to ensure long-term stewardship of digital resources collected, created, and curated by UNT Libraries.

During the self-audit process, we relied primarily on the "Trusted Repositories Audit & Certification: Criteria and Checklist (TRAC)" documented by the Center for Research Libraries (2007). Although we considered using the requirements outlined by ISO 16363 which also governs trusted repositories, the ISO standard was not yet adopted at the time that we started our self-audit, so there was less documentation available and no institutions had documented audits or certifications to use as examples. The TRAC Criteria and Checklist includes a comprehensive list of questions and suggested documents to demonstrate that a repository meets the requirements to be considered "trusted," and which also cover all of the major critical success factors identified by Jafari, et. al. (2008) (see Table 2). While this provided a realistic starting point, we still had to do some extensive work to compile information and determine what we considered sufficient to document each point.

Table 2. Critical Success Factors identified by Jafari, et. al., (2008) as represented within sections of the "UNT Libraries' TRAC Conformance Document," with each section number based on the TRAC Criteria and Checklist.

Critical Success Factors	Sections Represented in TRAC
Collaboration and knowledge workers	A2. Organizational structure & staffing
Technology deployment	B. Digital Object Management
	C. Technologies, Technical Infrastructure, & Security

Learning culture	A2. Organizational structure & staffing
Flat Structures	A3. Procedural accountability & policy framework
Supply chain integration	A5. Contracts, licenses, & liabilities
Comprehensive strategies	A1. Governance & organizational viability

When we initiated this process, we coordinated with University of Florida Smathers Library, who were completing their own TRAC self-audit concurrently. Thus, in addition to our internal work, we had a number of conference calls and one in-person meeting with personnel from the University of Florida (UF). Through this collaboration, we had thorough discussions that helped both organizations plan their work and more clearly address some points. For example, an early concern was how we would define the scope of the "repository" which we wanted to audit.

After the initial drafting of the "UNT Libraries' TRAC Conformance Document" we made arrangements to have our documents reviewed by several readers -- two external and one internal to the Libraries (though outside of the UNT Digital Libraries Division) -- for the purpose of identifying things that we might have overlooked, misinterpreted from the TRAC guidelines, or for items that were unclear outside of the institutional context. These readers proved to be invaluable during the process and provided much-needed feedback on changes and improvements that the project team could make. However, this step did not take the place of a comprehensive review of the final documentation. We still believe a peer review process has benefits for the digital preservation and digital library communities but will need to be tested at a later date.

The contextual dimensions (listed in Table 1) are clarified in the following sections. Items named in the following sections, including both consulted resources and documents created by UNT Digital Libraries Division, have been listed in the Appendix.

4.1. *Discovery of existing knowledge*

The first step in the process was to determine information that was already known by members of the division; we consider "discovery of existing knowledge" to refer to knowledge already held by our own staff. For information in this category, we simply needed to identify which information was known and by whom, such as:

Workflows and standards. Over the course of more than ten years, we have established and refined various workflows governing digitization and metadata as well as content packaging and storage. Some of these practices were informally documented in a departmental wiki, in coded scripts, or on webpages. We needed to pool all known documents and other knowledge as a starting point.

Common practice. We also had combined experience about common practice and known issues that had never been formalized into library policies, such as scope and collection development for the digital collections, and procedures related to personal information concerns or redaction requests.

4.2. *Acquisition of existing knowledge*

Some information that we needed was outside the purview of our own staff and we consider this piece to be "acquisition of existing knowledge" since it required us to collect existing information from disparate external sources.

Financial documentation. As part of a state university system, any financial planning and documentation needed to align with university and Libraries funding and to comply with local and state requirements. We were able to work with administrators in the Libraries to compile relevant financial information.

Technical systems. We also collaborated with Lib-TACO (Technology and Computing Operations), the department in UNT Libraries responsible for managing technology and maintaining servers. They helped to provide information about hardware and software related to our systems.

4.3. *Creation of new institutional knowledge*

Once we had identified information known by our staff and appropriate persons external to our department, we worked on highlighting the gaps in the information and determining how to "create new institutional knowledge" to address these holes in our documentation. This new institutional knowledge included two particular types of documentation:

Risk assessment and data loss. A particular area that required work was in creating a risk assessment analysis document to outline potential threats to our system and ways to avoid or mitigate them. Additionally, we worked out procedures for dealing with data loss. Although we had

not previously addressed many of these issues, we worked to outline them explicitly and to work with other appropriate stakeholders (including Lib-TACO) to ensure that the plans were realistic.

Policy development. During the discovery of existing knowledge, we realized that we had several practices that we wanted to document in formal library policies. While much of this information was generally known in our division, there were also a number of related topics that we needed to develop so that we could ensure that our drafted policies were complete.

4.4. *Storage of existing knowledge*

At this point in the process, one of our concerns was to move the implicit information we had identified into more explicit documentation. The tasks involved in making implicit information explicit proved beneficial to our internal understanding of Division preservation processes, as well as to representing those processes to external audiences, as outlined below.

METS profile. Some of our standard practices were not documented or publicly available, such as our METS (Metadata Encoding and Transmission Standard) implementation. In this case, established code was used for all of our processing and packaging, so it was implicitly standardized. We decided, as part of this process, to publicly register our usage as a METS Profile with the Library of Congress and the METS Editorial Board.

File formats. We also created a webpage more clearly documenting our "preferred" file formats -- i.e., formats for which we take responsibility to maintain versus those that we simply store -- and our file derivative processes. While all of these were common practice, none had been previously stated in a public or explicit way.

UNTL metadata schema. For the past decade we have made use of an internal metadata format called UNTL for modelling and serializing descriptive metadata created at UNT Libraries. This format has well-documented input and usage guidelines but did not have a format XML Schema. This TRAC process gave us the opportunity to create this documentation.

OAIS Information Packages. We had made use of the Submission, Archival and Dissemination Information Packages (SIP/AIP/DIP) of

OAIS within our process but did not have formal documentation. We developed the *UNT Libraries OAIS Information Package Specification* to document how we were using these packages within the UNT Libraries' Digital Collections and to define what constitutes a well-formed and complete package.

4.5. *Organization of knowledge, new and old, identified through this process*

As we started to document various information -- both the identified knowledge that we were moving into more explicit formats and created knowledge to fill various gaps (see Table 3) -- we had to consider the format we wanted to use as our final, comprehensive documentation to complete the TRAC process. This documentation took the shape of three primary formats:

TRAC Conformance Document. Our primary method for organization was to apply the TRAC Criteria and Checklist as a template to outline all of our information and associated documentation in a single, unified document. Although the end result was lengthy, we felt that it was important to have a single report as our primary deliverable.

Webpages. In addition to the conformance report, we also had a number of webpages that documented of information in more segmented ways. For example, our formalized policies are saved with other library policies. Some other information we outlined in departmental webpages, such as the preferred file formats.

Appendices. While all of our documentation was compiled within the conformance document, we also provided each of the supplementary appendices as individual PDFs to make them easier to find and share. These included workflow diagrams and the documents created to address knowledge gaps.

The self-audit process resulted in two types of knowledge organization: A single, overarching document, "UNT Libraries' TRAC Conformance Document," which makes tangible the implicit knowledge we identified during the investigation; and a collection of webpages for sharing appendices in document format, within their application context, such as library policy pages or metadata standards pages. Table 3 represents each document and its intended purpose.

Table 3. Documents developed through the TRAC self-audit, explanations, and respective library policy section to which each applies (Krahmer & Phillips, p. 11, 2016).

Document Title	Description	Overarching Library Policy & Section
"Formal Statement of Conformance to ISO 14721:2012"	Statement of UNT Libraries' Digital Collections conformance to the OAIS Reference Model	Digital Preservation Policy Framework • Levels of Preservation, Implementation • Collection Development Policy • Guiding Principles
"UNT Libraries' OAIS Information Package Specification"	Documents the Submission, Archival, and Dissemination Information Packages used within the UNT Libraries Digital Collections.	Digital Preservation Policy Framework • Levels of Preservation • Collection Development Policy • Guiding Principles
"UNT Libraries SIP-to-AIP Conversion Workflow"	Documents UNT Libraries' process for converting Submission Information Packages (SIPs) to Archival Information Packages (AIPs).	Digital Preservation Policy Framework • Levels of Preservation • Implementation
"UNT Libraries AIP-to-DIP/ACP Conversion Workflow"	Documents UNT Libraries' process for conversion from AIPs to Dissemination Information Packages (DIPs)/Access Content Packages (ACPs).	Digital Preservation Policy Framework • Levels of Preservation • Implementation
"UNT Digital Libraries: Risk Analysis and Management Strategy Plan"	Outlines some known risks to UNT Libraries' Digital Collections in relation to the technical infrastructure, environmental concerns, and risks related to staffing and personnel.	Digital Preservation Policy Framework • Levels of Preservation • Roles and Responsibilities • Collection Development Policy for the UNT Libraries' Digital Collections • Audience • Retention and Evaluation

"Data Loss Escalation Procedures"	Explains the escalation procedures related to potential data loss; created to clarify what steps should be followed and what sort of information should be relayed during a potential or actual data loss event.	Digital Preservation Policy Framework • Levels of Preservation • Roles and Responsibilities • Collection Development Policy for the UNT Libraries' Digital Collections • Audience • Retention and Evaluation

4.6. *Sharing, use, and application of knowledge now, within the institution*

From the start of the self-audit, we realized that a significant part of completing our process would be to use and share our documentation within the UNT Libraries, and to publicize what we had done externally. This sharing evinced itself in multiple ways.

Trusted Digital Repository page. We created a basic webpage in our departmental suite to explain our process and provide a place where interested persons could download our conformance document or specific components of our documentation.

Library Policies. Now that a number of our practices are publicly documented and adopted as formal library policies, we have pointed users to those pages when they have questions or concerns that are governed by the policies. Additionally, staff members in other parts of the UNT Libraries are now aware of those policies and may appropriately answer or direct patron questions as needed.

Presentations. Staff members have actively publicized the activities of our division and the outcome of the self-audit in a number of venues. After the completion of the self-audit we held a Libraries-wide forum to explain the process, discuss the overall functionality of the system and to answer questions from others around the organization.

5. Conclusion: Motivations, Challenges, and Successes

The TRAC self audit allowed the team to identify and fill important gaps within the existing KM infrastructure, as well as identify factors for success and failure of the UNT Digital Libraries Division. Jafari, et. al., (2008) identified seven critical success factors across their organizational studies, and while they are not directly applicable to digital preservation organizations, the content of each factor proved of great benefit to the Digital Libraries Division Knowledge Management as it evinced itself within the audit, as represented in Table 2.

Identifying where the motivations set forth by Jafari, et. al., (2008) supported the necessary knowledge-building for this process has proven far less difficult than we initially thought. One of the primary motivations for completing this self-audit was to make implicit knowledge explicit through documentation of existing processes, practices, and workflows. This documentation provided, among other benefits, the ability for people in and outside of the division to reference library policies for problem-solving, along with improved training materials for new employees. An additional motivation proved to be the opportunity to work with external consultants to review a beta version of the TRAC conformance document. Feedback from external consultants gave us useful insight for tailoring our document for both intra- and inter-departmental representation of the digital preservation infrastructure.

When we encountered challenges, those challenges took the shape of knowledge gaps that we had to overcome toward fulfillment of the requirements outlined by the TRAC Criteria and Checklist. The primary and perhaps most profound challenge was a lack of available field knowledge: as no peer institution had previously published a full self-audit, we had no formal guidance for the steps required for us to map knowledge. We gleaned the actions to gather and codify this knowledge from sources of institutional memory, working with peer institutions using similar processes, and the existing TRAC documentation as a framework for representing these factors. More minor knowledge gaps between division and university infrastructure, particularly related to budget practices and university IT policies, impacted Digital Libraries Division workflows and processes. The resultant TRAC Conformance Document builds in scheduled reviews of the process, creating a mechanism to extend KM into the future of the UNT Digital Libraries Division through maintenance of this work.

Final successes within this process proved to be a cohesive set of documentation that supports two important outcomes: this documentation can serve as a framework for replication at other institutions seeking to perform a self-audit of

their own digital repository trustworthiness, and second we can leverage this documentation to seek additional repository certifications that acknowledge the important role that digital preservation plays in long-term sustainability. An additional success proved the importance of implicit knowledge, in that we could leverage institutional memory of individuals who have been involved in the digital preservation infrastructure from the beginning to codify their knowledge into actual, tangible documentation. Finally, the importance of collaborators in any large-scale self-evaluation is crucial. Our work with both the Smathers Library at University of Florida and other external consultants, as well as our work with the different library divisions and university departments to obtain and document knowledge that supports long-term preservation proved critical to successfully codifying the trustworthiness of the digital repository infrastructure at UNT Libraries.

This exploration of the TRAC self-audit through the lens of knowledge management provides other institutions with a theoretical framework to structure the activities necessary in conducting a self-audit. In outlining the processes and products of this self-audit, the UNT Digital Libraries Division can serve as a model for other institutions considering an audit of their own digital library infrastructure. Institutions can more clearly organize the activities necessary to undertake a self-audit using these motivations and dimensions to understand how the TRAC Criteria and Checklist also functions as a means of organizing institutional knowledge. This framework is also useful for understanding the TRAC Criteria and Checklist through broader organizational KM concepts that are more easily recognizable to stakeholders who are unfamiliar with digital preservation concepts. These processes also serve to delineate relationships both internal and external to the institution, providing language that can more easily communicate value.

Appendix

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