Enhancing Catalog Records of Electronic Theses and Dissertations (ETDs) with ORCID Identifiers: A Case Study at the University of Tennessee Libraries

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Abstract

Tennessee Research and Creative Exchange is The University of Tennessee's (UTK) open-access archive for research and creative work by UTK scholars and researchers; including electronic theses and dissertations (ETDs) (University of Tennessee Libraries, 2023a). UTK began to offer the submission of theses and dissertations in electronic format online as open-access content in the academic year 2002-2003 (University of Tennessee, 2002, p. 20). Catalogers at the University of Tennessee (UT) Libraries have been cataloging ETDs in Ex Libris Alma local catalog and OCLC WorldCat database. Between December 2019 to June 2020, UT Libraries participated in the PCC URIs in MARC Pilot (LC PCC, 2019, October 24). In this pilot, four catalogers and one practicum student added ETD authors' and their advisors' ORCID iDs (ORCID, 2023) to the catalog and name authority records following the pilot's guideline and later adopted this practice into the current workflow. For the pilot, the participants added 371 ETD catalog records to OCLC WorldCat database and the Libraries' Ex Libris Alma catalog. During the pilot we observed that a small percentage of ETD authors' and major professors' ORCID iDs do not display their information to the public. The article concludes with the impact of ORCID iDs in the global linked data platforms such as WorldCat Entities and Wikidata and its potential for further data analyses on scholarly communication in Scholia, a tool to create scholarly profiles based on Wikidata.

Keywords: ETD Metadata, Linked data, Open Access, ORCID, Researcher Identifiers, Scholarly Communication

1. Enhancing Catalog Records of Electronic Theses and Dissertations (ETDs) with ORCID Identifiers: A Case Study at the University of Tennessee Libraries

As an academic library at an R1, land-grant and research-based institution, The University of Tennessee (UT) Libraries has committed to provide barrier-free, equitable access to research, scholarship, and creative work. This tenet is at the core of UT Libraries' role as a steward of learning, scholarship, and community (UT Libraries, 2022, June 29). This commitment of open access to the libraries collections also applies to our metadata and their interoperability with other bibliographic and repository databases. It is also in alignment with the larger scholarly communities' FAIR data sharing principles (a set of guiding principles to make data

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Findable, Accessible, Interoperable, and Reusable) (FORCE11, 2016). Academic, research, national libraries and major bibliographic utilities, publishers and library vendors and other information providers have been exploring the linked open data model to make a shift from the outdated relational-database metadata model to a linked open metadata model, such as BIBFRAME (Library of Congress, 2023), Resource Description Access (Joint Steering Committee for Development of RDA and others, 2017) and LD4 linked data implementation projects (LD4 Steering Group, 2023).

To prepare for this shift to the linked open data and metadata models, Cataloging Department at UT Libraries submitted a proposal to participate in the Library of Congress Program for Cooperative Cataloging's (LC PCC) PCC URIs in MARC Pilot in 2019 (LC PCC, 2019, October 24). In this pilot we proposed to add Open Researcher and Contributor IDs (ORCID iDs) of authors and major advisors of the electronic theses and dissertations (ETDs) to our catalog records in WorldCat database and in our Ex Libris Alma library catalog. Our goal was to assess the availability and quality of ORCID iDs supplied by the ETD authors at The University of Tennessee, Knoxville (UTK), the flagship campus of the University of Tennessee System. We also wanted to assess the availability and quality of their advisors' ORCID iDs, i.e. if they are readily available on their faculty websites and if their ORCID iDs have substantial information to support our local practice. We would identify ORCID iDs from these ETDs supplied by the authors and from their advisors' faculty websites, if available. This article will give an overview of the pilot, its outcome, the impact on our local practices and its implication for the linked open data and scholarly communication.

1.1 Access to ETDs at The University of Tennessee Libraries via TRACE (Institutional Repository) and the Library Catalog

Tennessee Research and Creative Exchange (TRACE) is The University of Tennessee's open-access repository, publicly-accessible archive featuring research and creative work by UTK's scholars and researchers; including electronic theses and dissertations (ETDs) (UT Libraries, 2023a). It is a part of the Digital Commons Network on the bepress platform (Digital Commons, 2023). At UTK, the option to submit the theses and dissertations in electronic format was first available in the academic year 2002-2003 according to the Graduate Catalog/2002-03 (University of Tennessee, 2002):

Electronic copies approved for final submission will be catalogued and placed on the ETD website (http://etd.utk.edu) approximately four weeks after the conferral of the graduate degree. At this time, the electronic copies will be in the public domain via the library catalog and the ETD website. (p. 20)

This change enabled UTK graduate students to share their scholarly works locally and globally as online open-access content. In TRACE to date, there are 7,747 dissertations (including the digitized dissertations as early as 1950 submission year) and 9,264 masters theses (including the digitized masters theses as early as 1902 submission year) (UT Libraries, 2023a). The digitization of dissertations and master theses is an ongoing project under UT Libraries' Digital Initiative. Catalogers at UT Libraries have created original catalog records for all the dissertations and master theses for UTK campus from their legacy print format to

the current electronic format (ETDs) in WorldCat database and in Ex Libris Alma catalog. For the digitized theses and dissertations (DTDs) UTK catalogers have been updating their print versions' catalog records by adding their URLs to their catalog records in WorldCat database and in the local Ex Libris Alma catalog. These records in TRACE and the library catalog are searchable via UT Libraries' One Search discovery platform.

1.2 Open Researcher and Contributor ID (ORCID)

ORCID iD has become a researcher identifier of choice over the past ten years since 2012 (ORCID, 2013). The library communities and universities adopted it as a major researcher identifier for their faculty and graduate students' scholarly and creative works due to its many advantages as a scholarly research profile. ORCID gives individual record holders the right to control what information is displayed publicly, what is shared with trusted partners, and who those trusted partners are. ORCID users can control the access in three different levels: and set the visibility of the information in three visibility settings: everyone, trusted parties, or only me (ORCID, 2023b). ORCID users can control how to interact with the trusted organizations, from giving permission to the trusted parties to gain access to their ORCID iDs, to adding and updating information from the organization to the ORCID profiles (ORCID, 2023a). ORCID's commitment to protect the privacy of its users and its ability to integrate into research workflows; such as 1) data exchange with grant and manuscript submission systems, 2) linked to information on research activities such as publications, grants, patents, and datasets and 3) integration with other identification systems (such as ResearcherID and SCOPUS) and other databases, possibly contributed to its exponential growth. Currently there are over 15 million live ORCID iDs and 1,337 ORCID member organizations worldwide, including ORCID US with 200 member organizations (ORCID, 2023c; ORCID, 2023d, & ORCID, 2023, July 5).

1.3 ORCID's Usage at the University of Tennessee, Knoxville

As one of ORCID member organizations, UTK offers its researchers benefit from ORCID's integration with the grant database, PIVOT (ProQuest, 2016, April 15), and other databases (such as, Web of Science, SSRN, Scopus, RePEc, PubMed, MLA, DBLP, CiNii, or arXiv) (UT Libraries, 2019, July 24). ORCID is also integrated with Symplectic Elements software UTK uses for its Faculty Activity Reporting system (UTK. Office of the Provost, 2021). UTK faculty can update their publications in ORCID and to set their ORCID iDs to send the data automatically to update in their Elements' accounts (UT Libraries, 2019, July 24), and with the option to publish their profiles on the university 'Discover Our Faculty' website (https://faculty.utk.edu). UTK researchers can also access ORCID and other researcher identifiers via the database, Dimensions (UT Libraries, 2023).

According to the email communication from the Libraries' former Scholarly Communication and Publishing Librarian in 2021, UTK asked bepress to add a field for ORCID iDs only recently, therefore that field to add ORCID iDs remains empty for many years (UT Libraries' former Scholarly Communication and Publishing Librarian, personal communication, April 20, 2021). Based on TRACE, UTK graduate students started adding

their ORCID iDs to their metadata, when submitting their dissertations in TRACE since 2017, as shown in this dissertation title, Drivers of stormwater runoff characteristics from non-point source urban pollution (Wyckoff, 2017) and the master thesis title, Taking back the Internet: Defeating DDoS and adverse network conditions via reactive BGP routing (Smith, 2017).

1.4 ORCID iDs in Catalog Records and PCC URIs in MARC Pilot

ORCID is also an identifier used as one of the major identifier systems adopted by the Library of Congress Program for Cooperative Cataloging (LC PCC) to apply to their bibliographic and authority records since 2019 (LC PCC, 2019, October 24); with the guideline to add ORCID iDs as URIs (LC PCC Task Group on URIs in MARC, 2020, p. 59). In November 2020, LC PCC Name Authority Cooperative Program (NACO) allowed the addition of ORCID iDs to personal name authority records (LC NACO, 2020). Catalogers at UT Libraries have been cataloging ETDs in Ex Libris Alma local catalog and OCLC WorldCat Database. Between December 2019 to June 2020, UT Libraries participated in the PCC URIs in MARC Pilot as a PCC NACO member and eventually adopted this practice into their ETDs' cataloging workflow since January 2021 (LC PCC, 2019, October 24).

2. Rationale

As ETDs are available as open-access scholarship on the web, incorporating them into the linked data model or knowledge graph would provide better access to these ETDs in connection with other scholarships. One of the methods to add ETDs to the linked data environment is to build the linked data capability into their metadata. The author's study to compare eight researcher identifier systems (ORCID, ResearchGate, Google Scholar, SCOPUS, ResearcherID, Library of Congress Name Authority File (LCNAF), Virtual International Authority File (VIAF) and International Standard Name Identifier (ISNI)) concluded that ORCID's and LCNAF's combined services are the best combination to use to better serve the library and research communities (Panigabutra-Roberts, 2019). Other library-related applications also include ORCID iDs in their metadata, such as Virtual International Authority File (in MARC 024) and Wikidata (Wikidata property: ORCID iD - P496) as used in the author's Wikidata (Q62393357). ORCID's linked data capability is also a major benefit, since we are in transition from the MARC format to the linked data model, BIBFRAME, in the foreseeable future (Library of Congress, 2023). Therefore, for the PCC URIs in MARC Pilot, we have chosen to add ORCID iDs to enhance access via our library catalog to UTK scholarly and creative works due to its open and persistent identifiers' status and its growth as a researcher identifier of choice over the years since its conception in 2012 (ORCID, 2013).

3. The Pilot's Implementation

Cataloging Department at UT Libraries implemented the pilot from December 18, 2019 to July 30, 2021 and subsequently adopted the pilot into our regular workflow for cataloging ETDs. The pilot participants were four catalogers and a practicum student from the School of Information Science, under the author's supervision. The pilot participants added the ETD authors' and their advisors' ORCID iDs, when available,

to the catalog and name authority records following the pilot's guideline (LC PCC, 2019, October 24). Based on the PCC pilot's and PCC Name Authority Cooperative Program's (NACO) guidelines on adding other identifiers, an ORCID iD can be added to a catalog record in MARC21 format, as both a number string and a URI to WorldCat catalog records, as shown in this pattern (OCLC, 2019):

100 0# ǂa [first name last name], ǂe author ǂ4 http://id.loc.gov/vocabulary/relators/aut

ǂ0 (orcid)[ORCID number] ǂ1 https://orcid.org/[ORCID number].

During the pilot, an ORCID identifier was searchable only in the advanced search as a number string in UT Libraries' Ex Libris Alma catalog, as shown in figure 1 (Ex Libris, 2019 update).
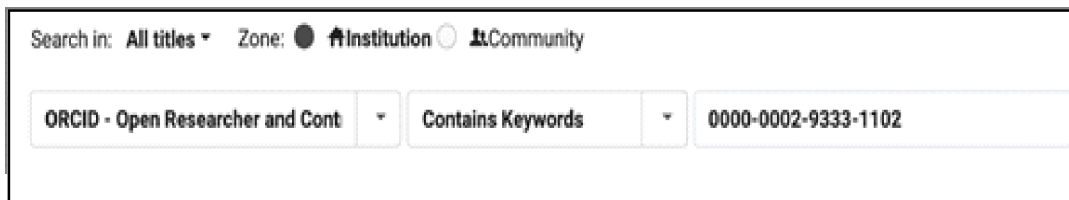
Figure 1: Ex Libris Alma Advanced Search Key for ORCID iDs (2019)

Therefore, in Ex Libris Alma catalog, we added ORCID iDs to the catalog records as number strings in MARC 100 and 700 subfield $0 for personal names, as shown in this example of MARC100 as displayed in Ex Libris Alma's metadata editor (Ex Libris, 2019a update).

100 0_ $$a[first name last name].
$$eauthor $$4http://id.loc.gov/vocabulary/relators/aut $$0(orcid)[ORCID number]

To ease the implementation of this pilot and for the ongoing workflow, our catalogers created two constant data records in WorldCat database; one for cataloging electronic dissertations and one for cataloging electronic theses. The example in figure 2 is the constant data in WorldCat used for cataloging dissertations from UTK (OCLC, Cox & Panigabutra-Roberts, 2019) based on Resource Description and Access (Joint Steering Committee for Development of RDA and others, 2017 update):

```
006    m o d
007    c ǂb r ǂd u ǂe n ǂf u
040    TKN ǂb eng ǂe rda ǂc TKN
043    [Geographic code if needed]
099    Thesis ǂa 2019b ǂa .
100 1_ [Verified form of name], ǂe author ǂ4 http://rdaregistry.info/Elements/a/rdaa:P50541
245 10 [Title from title screen]|: ǂb [sub title] / ǂc [Author name as it appears on title page].
264 _1 Knoxville, Tennessee : ǂb The University of Tennessee, Knoxville, ǂc 2019.
264 _4 ǂc ©2019 [If included by author]
300 __  1 online resource ( pages) : ǂb [if applies: illustrations, maps, etc., also adjust Fixed Field
accordingly]
336 __  text ǂb txt ǂ2 rdacontent ǂ0 http://rdaregistry.info/termList/RDAContentType/1020
337 __  computer ǂb c ǂ2 rdamedia ǂ0 http://rdaregistry.info/termList/RDAMediaType/1003
338 __  online resource ǂb cr ǂ2 rdacarrier
       ǂ0 http://rdaregistry.info/termList/RDACarrierType/1018
500 __  Title from title page screen (viewed on [month, day], 2019).
500 __  Thesis advisor: [first name last name]
502 __  ǂb Ph. D. ǂc The University of Tennessee, Knoxville ǂd 2019
500 __  Vita.
504 __  Includes bibliographical references ( pages).
540 __  The author retains ownership of copyright and all other proprietary rights, such as patent
rights, in this thesis or dissertation. The author has granted the University permission to archive, to
reproduce, and to publicly display this dissertation or thesis in all media now known or developed
in the future, including by electronic and digital technologies.
520 3_ [Abstract]
650 _0 [Subject headings]
655 _7 Academic theses ǂ2 lcgft
690 __  UTK Theses ǂx [Major verified]
700 1_ [Major professor -- verified form of name], ǂe degree supervisor ǂ4
http://rdaregistry.info/Elements/a/rdaa:P50091
710 2_ University of Tennessee, Knoxville. ǂb Department of [...], ǂe degree granting institution ǂ4
http://rdaregistry.info/Elements/a/rdaa:P50003
856 40 ǂu [Paste URL here]
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Figure 2: WorldCat's Constant Data For Cataloging Dissertations

The highlights of the pilot's guidelines and workflow were as follows:

❖ The URI enrichment for cataloging ETDs in WorldCat was based on the guideline recommended by PCC Task Group on Linked Data Best Practices to use RDA Registry for role terms, content, carrier and media types (LC PCC, 2018, page 3).

❖ For the relationship terms used in MARC 1XX and 7XX in subfield Âe, add subfield Â4 with the URIs based on the RDA elements for relationship terms in MARC21 guideline for X00 - Personal Names-General Information, subfield Â4 - Relationship (OCLC, 2019a).

❖ Add MARC 588 to both ETDs' constant data:

588_ _ Some URIs added to this record for the PCC URI MARC pilot. Please do not remove these subfields.

❖ Add ORCID iDs, if found in the ETDs' metadata supplied by the authors in TRACE, on the faculty's websites and/or Dimensions database for the major advisors (i.e. to limit the sources and search time to minimize the pilot's impact on the workflow due to the limited staffing level in Spring 2020).

❖ Add ORCID iDs as subfield Â1 URIs in WorldCat catalog records for ETD authors and their major advisors.

❖ Export the record to the Ex Libris Alma catalog.

❖ In Ex Libris Alma catalog, in MARC 100 and 700 fields, add subfield $0 and ORCID iD as number strings to be searchable in Alma.

Recently ORCID iDs are searchable in Ex Libris Alma catalog as both number strings and Real World Object URIs as shown in the advanced search keys in Ex Libris Alma catalog in figure 3 (Ex Libris, 2023 update).
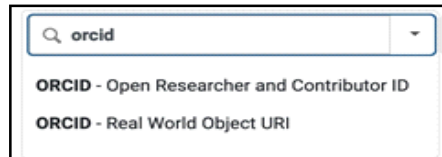
Figure 3: Ex Libris Alma Advanced Search Keys for ORCID iDs and URIs (2023)

With this update in Alma's advanced search capability, catalogers at UT Libraries can add ORCID identifiers as both number strings and Real World Object URIs in our catalog records, as shown in this example in MARC100 as displayed in Ex Libris Alma's metadata editor (Ex Libris, 2023a update):

100 0_ $$a[first name last name].
$$eauthor$$4http://id.loc.gov/vocabulary/relators/aut $$0(orcid)[ORCID number]
$$1http://orcid.org/[ORCID number]

With this recent update in Alma, we updated the ETDs' constant data records in WorldCat database accordingly.

3.1 The Pilot's Outcome

The pilot's five participants added 371 ETD catalog records to WorldCat database and UT Libraries' Ex Libris Alma catalog successfully. However, we also observed that, while most ORCIDs had metadata elements

in their profiles sufficient to distinguish these researchers from others (works, employment, education and other identifiers, for example), a small percentage of ORCID iDs belonged to both the ETD authors and the major professors do not have/share public information in their ORCID iDs. This observation prompted the author to pursue a formal research project (in progress) on ORCID users at this institution at a later date.

3.2 Implementing The Authority Toolkit's Macro

In 2020 the author attended the Library of Congress Program for Cooperative Cataloging's virtual meeting in May and learned about the Authority Toolkit's macro created by Gary Strawn, Librarian for Collections Services at Northwestern University, to add URIs to Library of Congress (LC) name authority records (Schiff, 2020 & Strawn, 2020). The author tested the macro in WorldCat Connexion Client to add ORCID iDs and other identifiers to the Library of Congress personal name authority records. After the successful testing, other catalogers also adopted the macro into their name authority workflows to add ORCID iDs and their relevant information to the LC personal name authority records.

4. Discussion

Similar to the finding in Porter (2022), during the pilot we found that some ORCID users did not provide or hide their ORCID information from the public in their ORCID profiles. As a result, it was difficult for our catalogers to disambiguate these ORCID users from others with similar names. This problem prompted us to use other data sources to find the faculty advisors' ORCID iDs, such as from the faculty websites, Dimensions database, and LinkedIn. We added this additional step and data sources to our workflow and documented how to find ORCID iDs for our ETD authors and their major advisors to add to their ETD catalog records.

As for accessing ORCID iDs in the catalogs, locally they are searchable in our Ex Libris Alma catalog as number strings and URIs, but not yet searchable in the system's public interface, Primo VE. Globally, this workflow has provided access to these ORCID iDs in the WorldCat database, Virtual International Authority File, WorldCat Entities, the Library of Congress Linked Data Service (id.loc.gov) and also in Wikidata, in some cases. Some of these ORCID iDs are also linked to other researcher identifiers, such as Scopus Author Profiles and Web of Science ResearcherIDs, and other web services (such as the faculty websites, Google Scholar and LinkedIn).

4.1 Implication for Linked Open Data

Aforementioned, ORCID iDs once integrated into WorldCat bibliographic and name authority databases, they are also integrated into other data and linked data platforms. From the library resource description's perspective, there are currently two major platforms that would have large impact in the current and future linked open data, identity management and scholarly communication, which are WorldCat Entities and Wikidata.

4.2 WorldCat Entities

In May 2022 OCLC announced the debut of a linked data platform for entity management infrastructure called WorldCat Entities (OCLC, 2022, May 24). In this example (figure 4) the author's name entity is created

as a linked data profile, connecting with the author's profiles in ORCID, LC Name Authority File, Virtual International Authority File and Wikidata (OCLC, 2023).
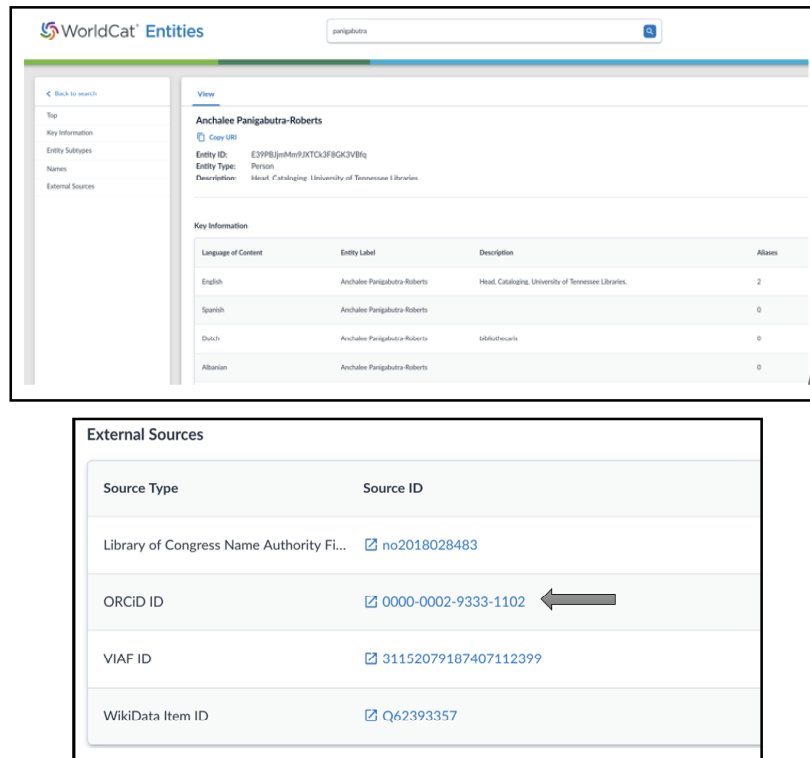
Figure 4: Partial Screenshots of Anchalee Panigabutra-Roberts' Entity ID: E39PBJjmMm9JXTCk3F8GK3VBfq in WorldCat Entities

As shown in this case, ORCID iD links the bibliographic and authority data with other systems of researcher identifiers. And WorldCat Entities acts as a hub for other authority data.

4.3 Wikidata and Scholarly Communication

Beyond the library databases and linked data network aforementioned, ORCID is also an author identifier in Wikidata, an open knowledge base that acts as central storage for the structured data of its Wikimedia sister projects including Wikipedia, Wikivoyage, Wiktionary, Wikisource, and others (Wikimedia Foundation, 2022, July 10). In a presentation based on a proof of concept to link bibliographic metadata with Wikidata, the author created a profile for scholarly and creative works as a name entity in Wikidata, including her ORCID identifier (Panigabutra-Roberts, 2019, June 22). Then the author used Scholia, a data visualization tool in Wikidata for scholarly profiles, to visualize the profile based on the author's Wikidata (Wikimedia Foundation, 2019, June 22). As a result, Scholia generated the author's scholarly profile with different types of data visualization and analyses as shown in the table of contents in figure 5.

**Figure 5: The Author's Scholarly Profile in Scholia Based on Wikidata (Q62393357)
Including ORCID iD (as of 2019)**

These examples of data visualization in the figures below are the author's list of publications (figure 6) and the topic scores based on the author's publications (figure 7).

Figure 6:   The Author's List of Publications (as of 2019)

Figure 7: The Topic Scores Based on the Author's Publications (as of 2019)

As demonstrated above, ORCID identifiers can play a major role in the linked open data environment, linking the bibliographic data with other open linked data platforms. Adding ORCID iDs in the library catalogs provides the connection to WorldCat database and other linked data services (id.loc.gov, BIBFRAME, and WorldCat Entities, for example), and to the larger open data platforms such as Wikidata and its sister projects in WikiCommons. Scholia's usage of scholarly data in Wikidata added another powerful tool for data visualization and analytics, thus lending itself to support scientrometric and bibliometric analyses, research questions and methods.

5. Conclusion

Adding ORCID iDs to the ETD catalog and name authority records put these ETDs, their authors and their major advisors into the linked data connectivity locally and globally. This action is also in compliance with the Nelson Memo for access to federally funded research as open-access resources by providing access to

the unique identifiers to accurately link UTK faculty and researchers to their scholarly and creative works on both the local and global scale (United States. Office of Science and Technology Policy, 2022, August 25). The Nelson Memo's mandates for researchers who are funded by the federal government would require them to have ORCID iDs that include information on their employment, education, funding, works or scholarly or creative outputs in their profiles and to keep the information up-to-date. These visible and richer metadata elements would support our work in cataloging and metadata in the libraries to identify these researchers and to be more accurate in creating their name authority profiles in the library databases.

Over all, enhancing catalog records of electronic theses and dissertations (ETDs) with ORCID iDs would support better authority data for libraries and other linked open data platforms and further support scholarly communication and scientrometric and bibliometric research questions. It would also increase the libraries' values and impact on the university's research agenda.

6. Acknowledgments

The author would like to thank the Library of Congress Program for Cooperative Cataloging for accepting our proposal to join the PCC URIs in MARC Pilot in 2019 and UT Libraries' administrators for their approvals of Cataloging Department at UT Libraries to participate in the pilot. Most of all, the author would like to thank UT Libraries' Cataloging Team for volunteering to participate in this pilot. The pilot's participants were Robin L. Cox, Senior Cataloger; Wanda Rosinski, Senior Cataloger; Kim Blaylock, Senior Cataloger; David Scott, Senior Cataloger, and Jordan Lanagan, Cataloger and Database Specialist and former cataloging practicum student, School of Information Science, University of Tennessee, Knoxville. The pilot was on the voluntary basis, thus it would not be possible without the catalogers' buy-in, input of ideas and contribution of the ETD catalog records and the Library of Congress personal name authority records in WorldCat and Ex Libris Alma catalogs.

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