

# Open Source Digital Ecosystems for Accelerating Global Research, Innovation and Collaboration

(Lightning Talk)

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Texas State University Libraries

Presented for JROST 2020, Joint  
Roadmap for Open Science Tools,  
December 2020



**Identity Management System**



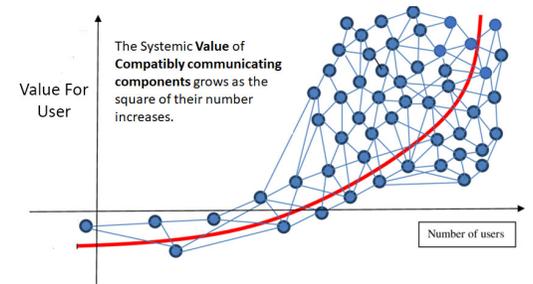
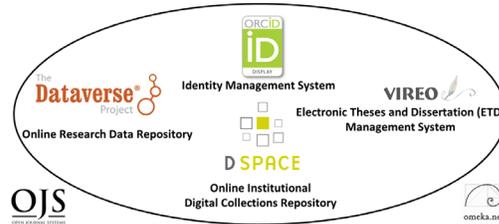
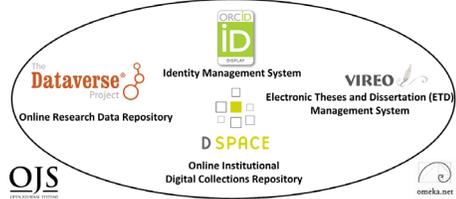
**Repository**



**DSPACE**

**Online Institutional  
Digital Collections Repository**

# Can We 'Better' Enable Scholarly Research Network Ecosystem Possibilities on Global Levels?



Is it Time to Begin Thinking 'Systematically' About Empowering a Global Research University Community ?

# Research University Statistics

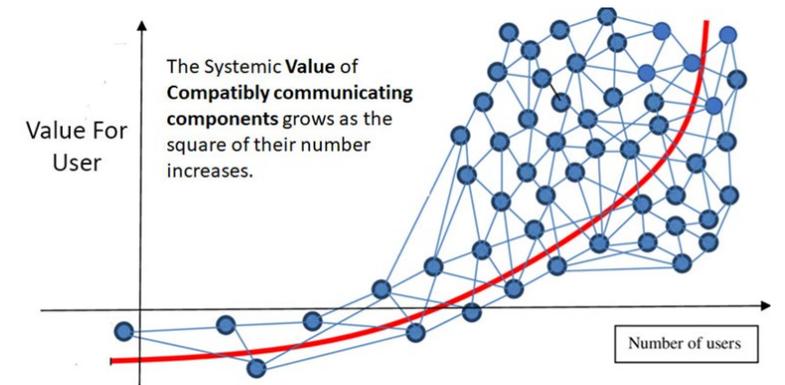
- **~266-300 Research Institutions US & Canada**  
Carnegie R1 & R2, Very High or High Research Activity with associated Research library infrastructures

- **~Estimated 1000-1250 Research Intensive Universities Worldwide**

QS Rankings and Times Higher Education Supplement. (40% Europe, 26.5% Asia Pacific, US/Canada 18%, Latin America 10.8% and Middle East/Africa 7%.)

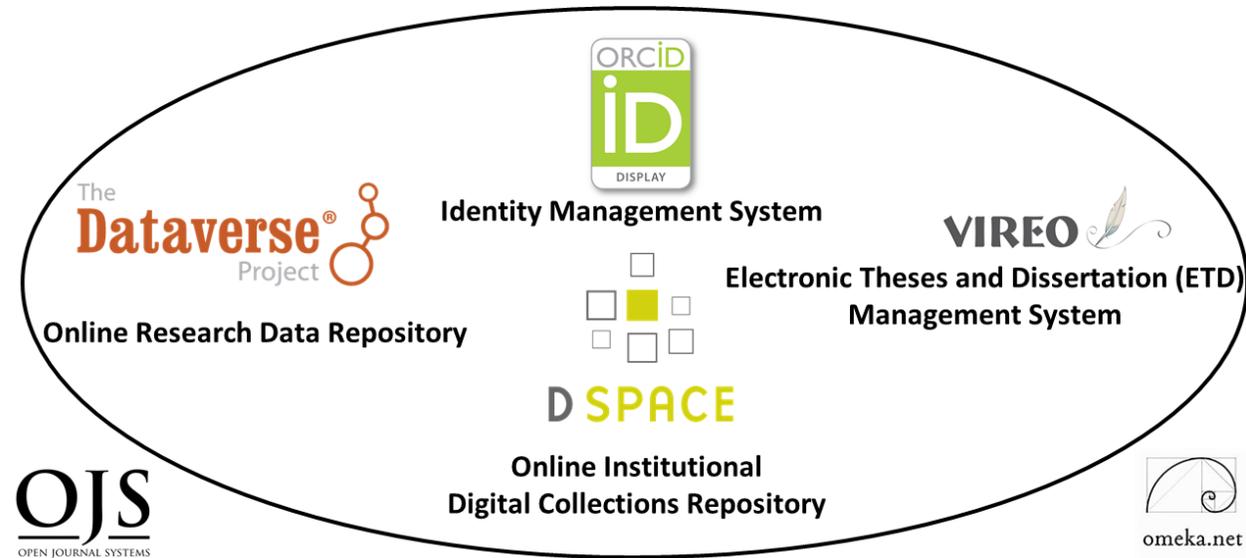
**Is it possible to Enable Top 2-3% Research Institutions Globally, ~ 1000 Institutions with Open Digital Research Ecosystems**

(Institutions beyond the few universities who already possess these)



# How do We Define an Open Digital Scholarship Research Ecosystem?

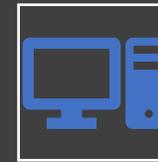
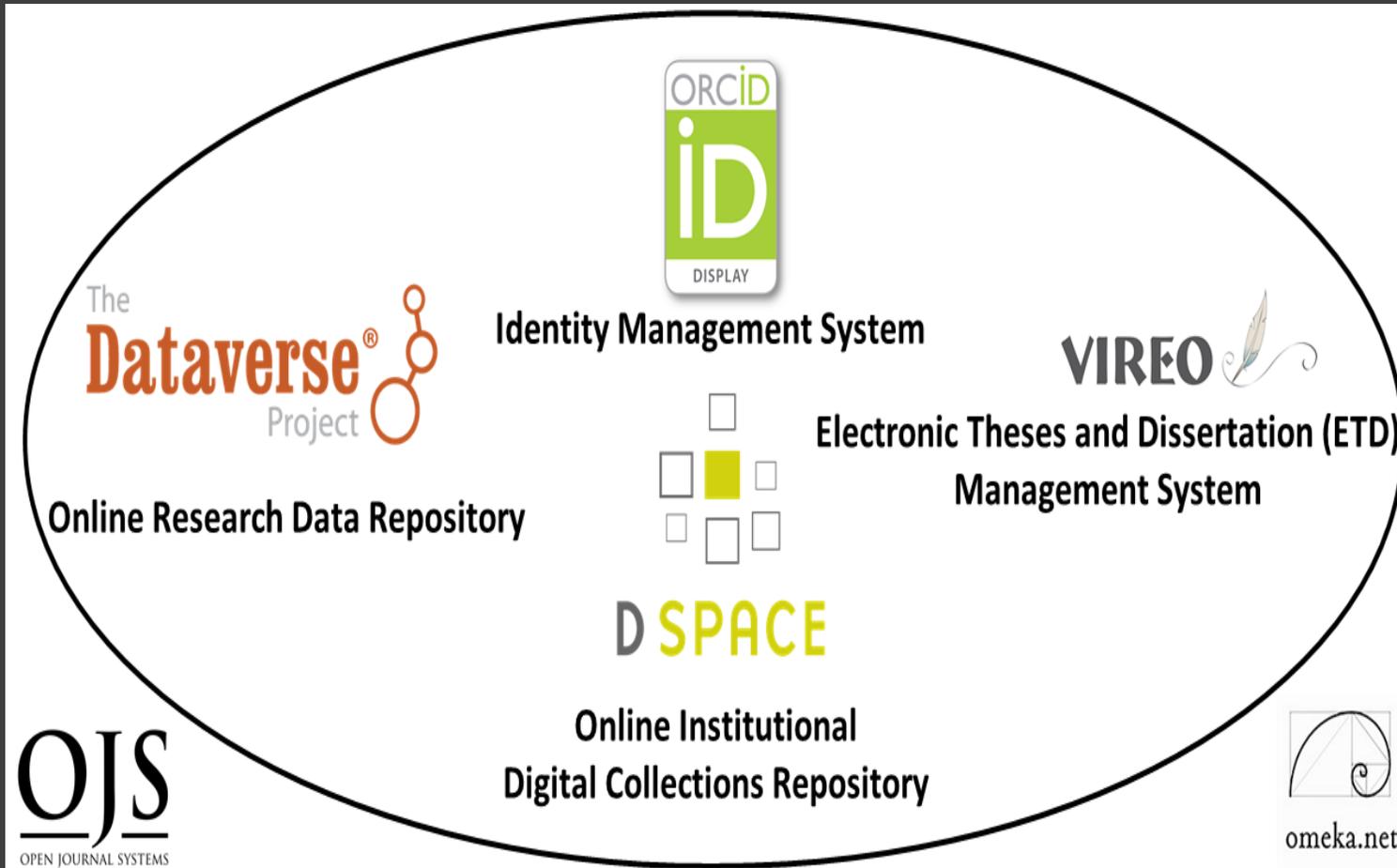
Network of Several Software Components to Enable Research Faculty and Graduate Students to Accelerate Research, Innovation and Global Collaboration



[Texas State University Digital Research Ecosystem](#)



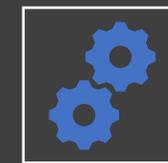
# General Software Characteristics of an Open Digital Scholarship Ecosystem



Open Source Software

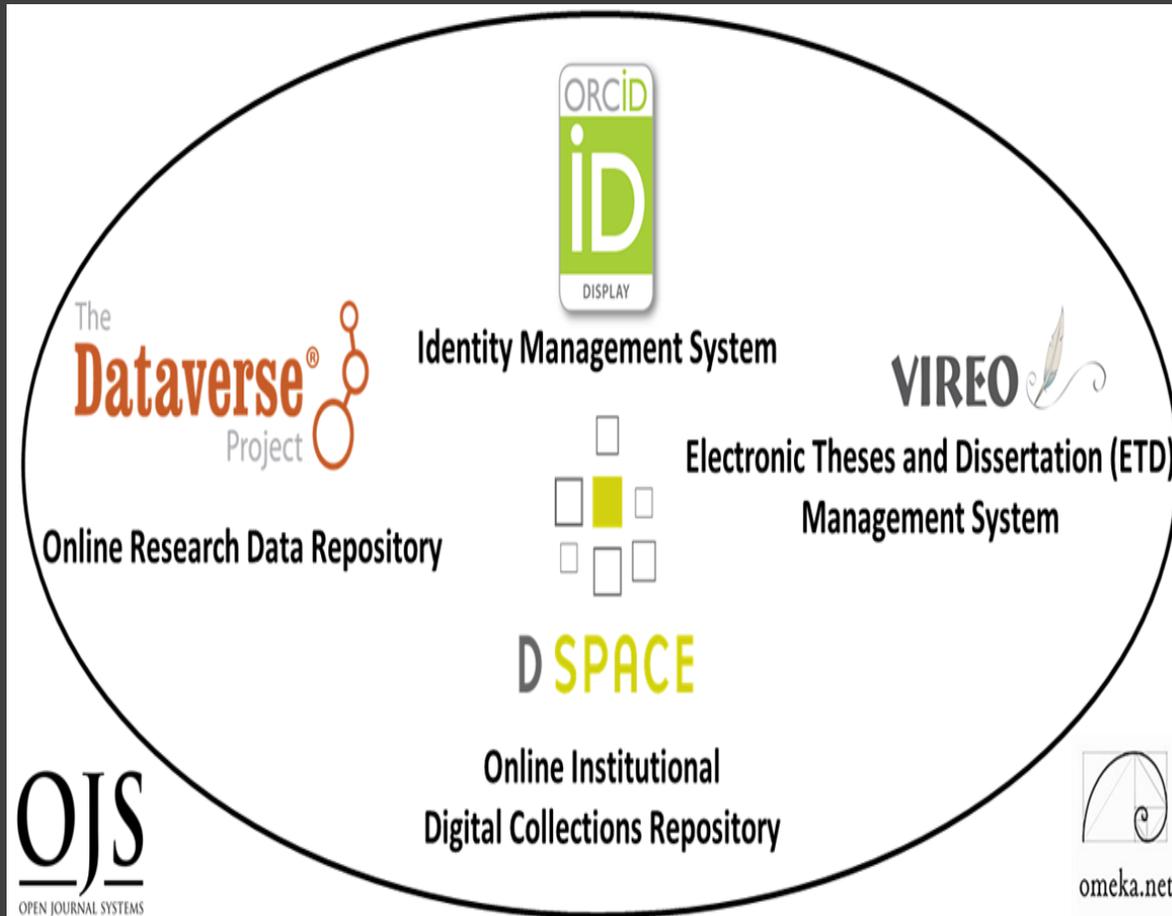


Active Developer  
Communities



Customizable Components  
(Easy Configurability,  
Connectivity)

# What Classes of Open Source Software Components are needed to create a digital scholarship ecosystem?



## TWO PRIMARY

- RESEARCH DATA REPOSITORY (Dataverse)
- DIGITAL COLLECTIONS REPOSITORY (Dspace)

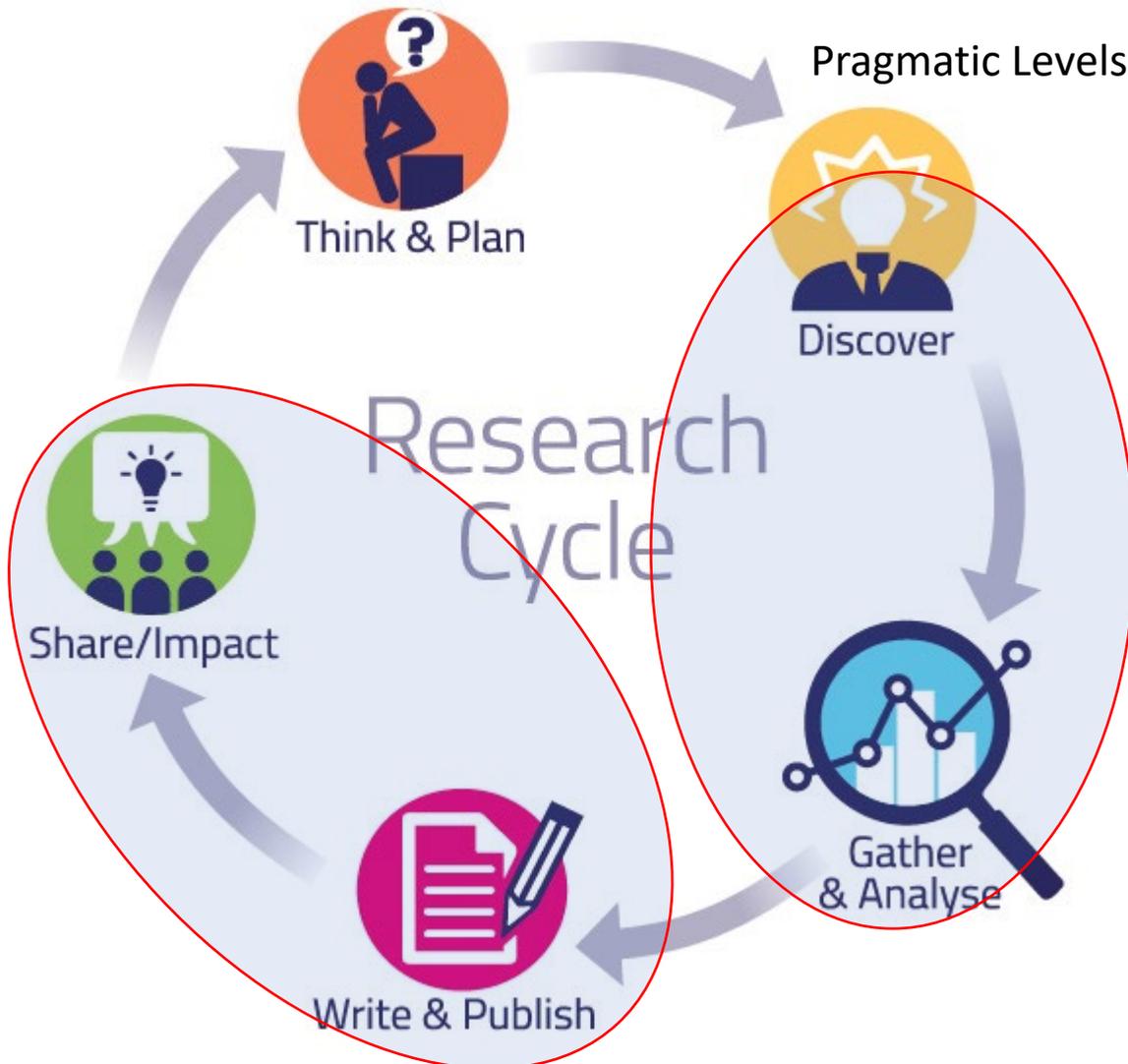


## FOUR TERTIARY

- Electronic Thesis and Dissertation Management System (VIREO)
- Identity Management System (ORCID)
- Academic Journal Software (OJS3)
- User Interface/Content Management Software (OMEKA)

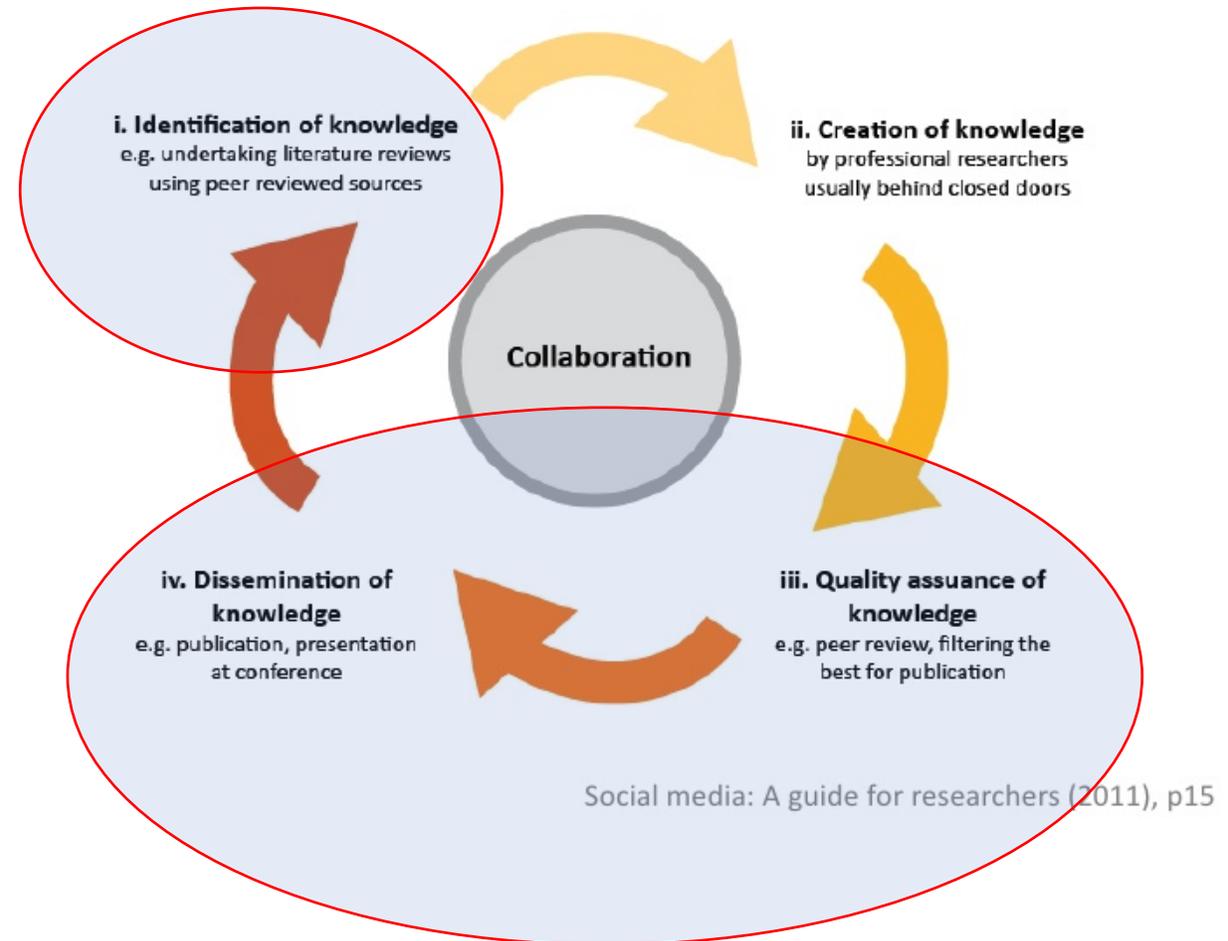


# Together, these Digital Ecosystem Components Enable the Academic Research Cycle



## The academic research cycle

## Abstract Levels





The Dataverse<sup>®</sup> Project  
Online Research Data Repository

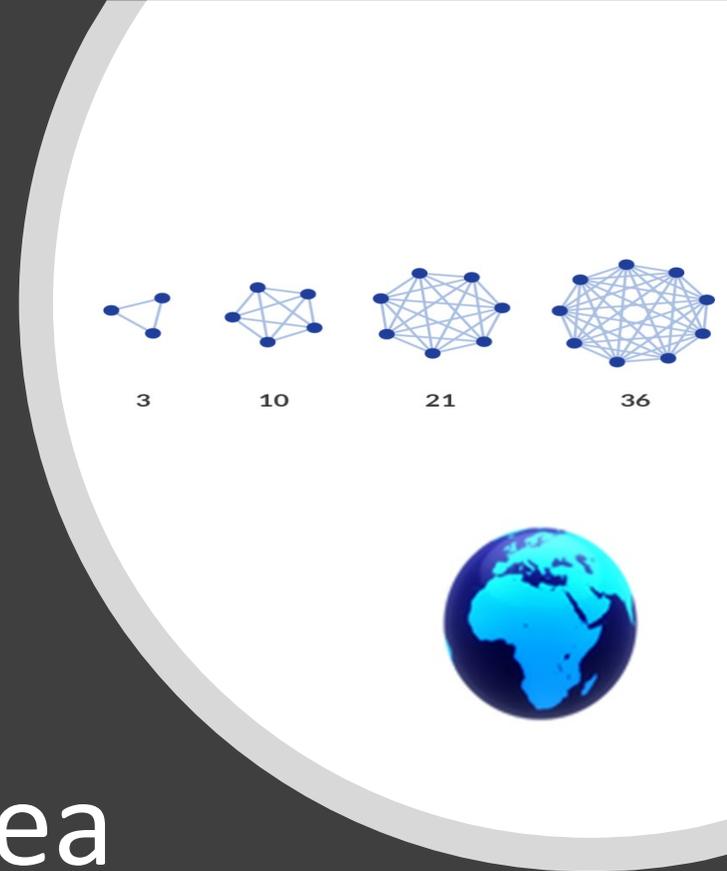
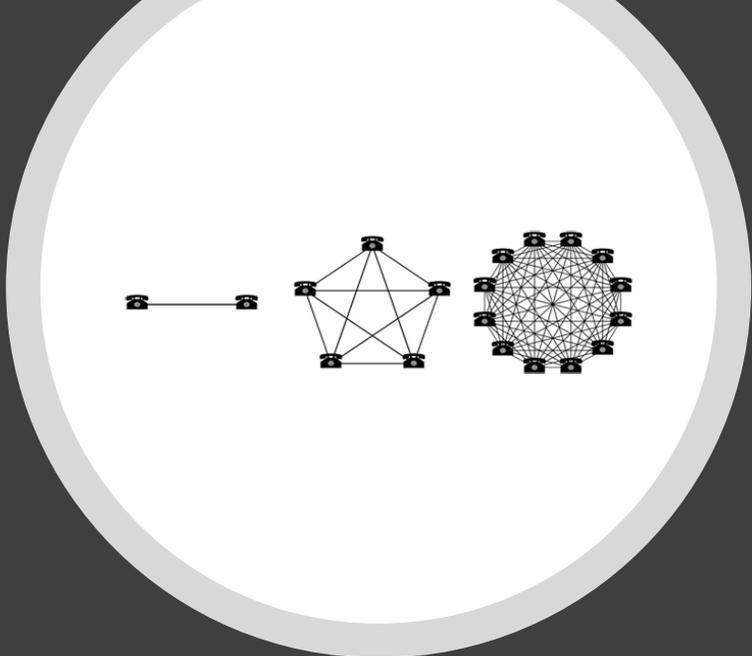
ORCID iD  
Identity Management System

VIREO  
Electronic Theses and Dissertation (ETD) Management System

DSPACE  
Online Institutional Digital Collections Repository

OJS  
OPEN JOURNAL SYSTEMS

omeka.net



# Simple Larger Idea

Collocating Open-Source Digital Components in a Networked Research Environment Enables Larger Connections and/or Network Effects, Accelerating Research, Collaboration and Innovation  
 ([Further Contextualization](#))

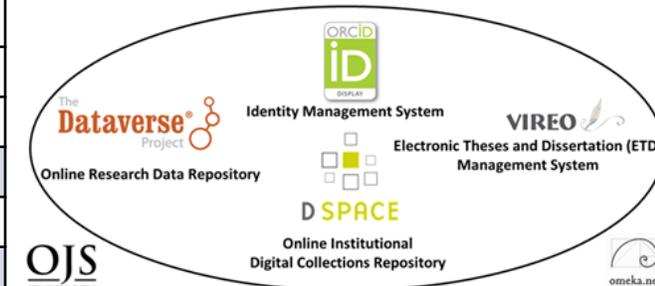
# Quantitative and Qualitative Assessment, 2014-2020

This Digital Research Ecosystem Shows Very Strong and Continued Potential for Growth

Research Ecosystem Implemented at Texas State University, 2014-2019

System	2014	2015	2016	2017	2018	2019
<b>Downloads</b>						
DSpace	326,762	318,742	385,163	341,224	972,359	1,010,349
ETDs	136,985	158,240	200,373	328,420	470,437	505,658
Dataverse	n/a	n/a	n/a	455	3,451	2,043
<b>Number of Items</b>						
DSpace	1,340	1,437	1,546	1,660	2,135	2,720
ETDs	967	1,174	1,326	1,581	1,789	2,218
Dataverse	n/a	n/a	n/a	28	33	53
<b>ORCID IDs</b>						
ORCID	101	190	316	438	545	669
<b>Hosted Journals</b>						
OJS	1	1	2	2	3	4

Annual Usage, Downloads, Number of Items, ORCID ID's and Online Academic Journals Added

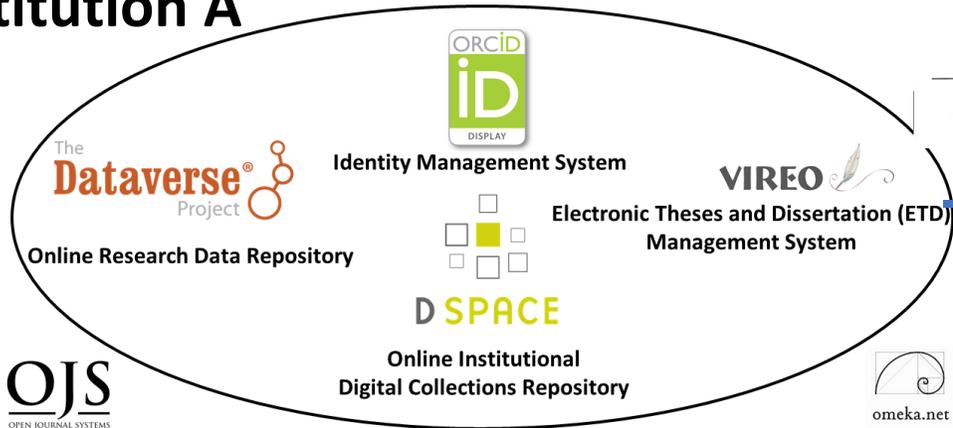


LibQual Biannual Survey 2013-2019, Faculty and Student System Perceptions, Comments

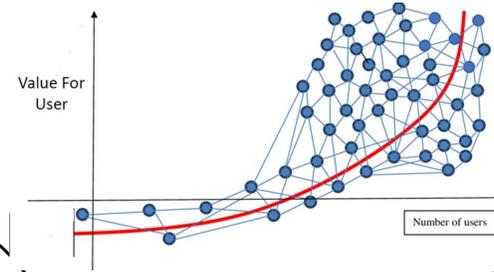
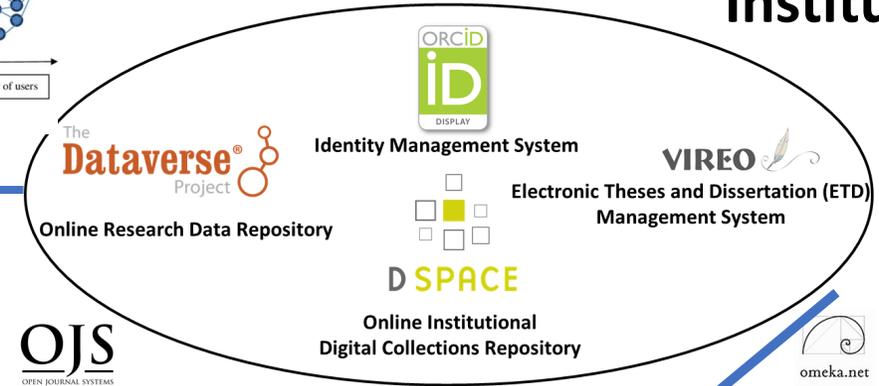


# Many Beneficial Internal and External Effects of Such a System

Research Institution A

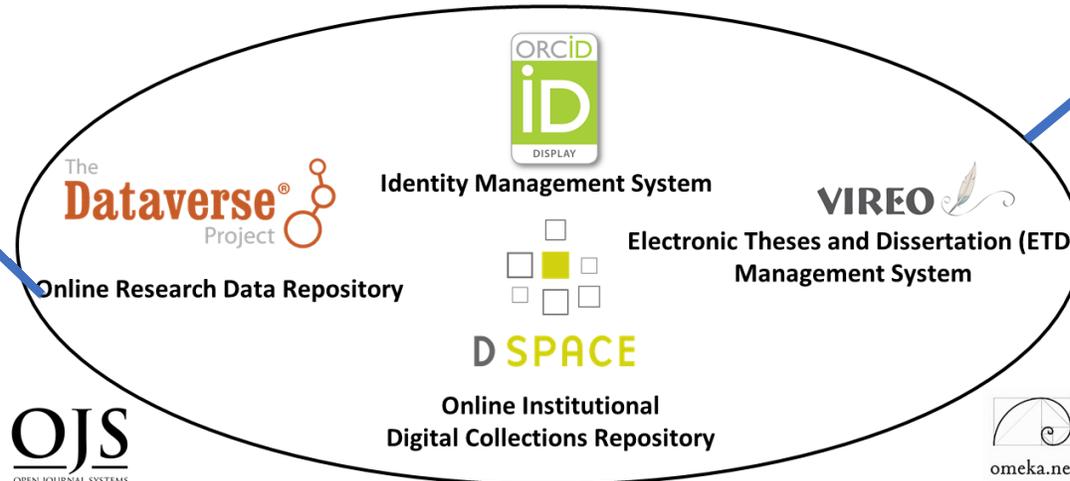


Research Institution B



Internally, these digital components significantly raise and optimize search engine rankings (SEO) for researchers and their research

Externally, this ecosystem enables collaborative opportunities among Researchers and Research Institutions

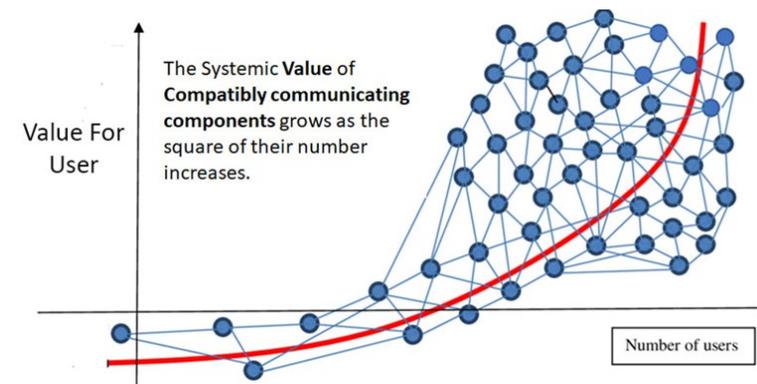


Research Institution C

# Pragmatically, how do you enable a larger set of research institutions globally?

(Top 2-3% Research Institutions, ~1000 Institutions and Research Libraries, ~ 90% of Research Universities Globally)

This is from a Larger Set of 26,000-40,000 Universities Globally. Research Universities 2.7% - 4.2% of all universities worldwide. Highest by Country: US 156, UK 76, Germany 45, Japan 44.



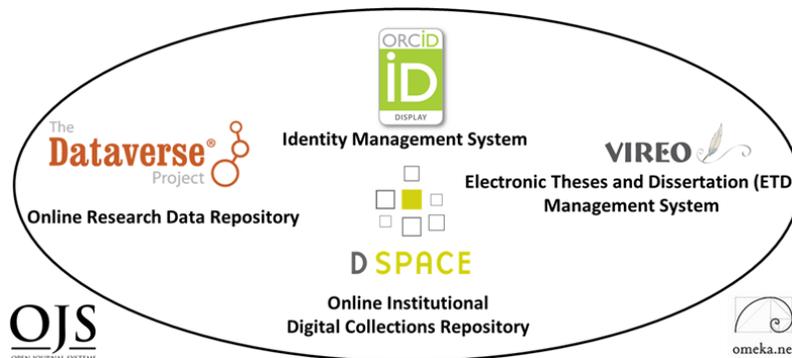
# One Server Per Research University Initiative

## 2021-2025, V 1.0

### Vision

Give ~ 1000 Research Universities/Academic Libraries Globally:

- 1 Configured Research Ecosystem Server with 6 Open-Source Research Ecosystem Software Components < \$1000.00 US/Server or set up Fractional Server Space in the Cloud with Mirror Sites Globally (SAAS)
- Hold Weeklong trainings over 6 continents
- Create a global help network to get the institutions and academic libraries started
- After Five Years, Gage Effects for Global Research!

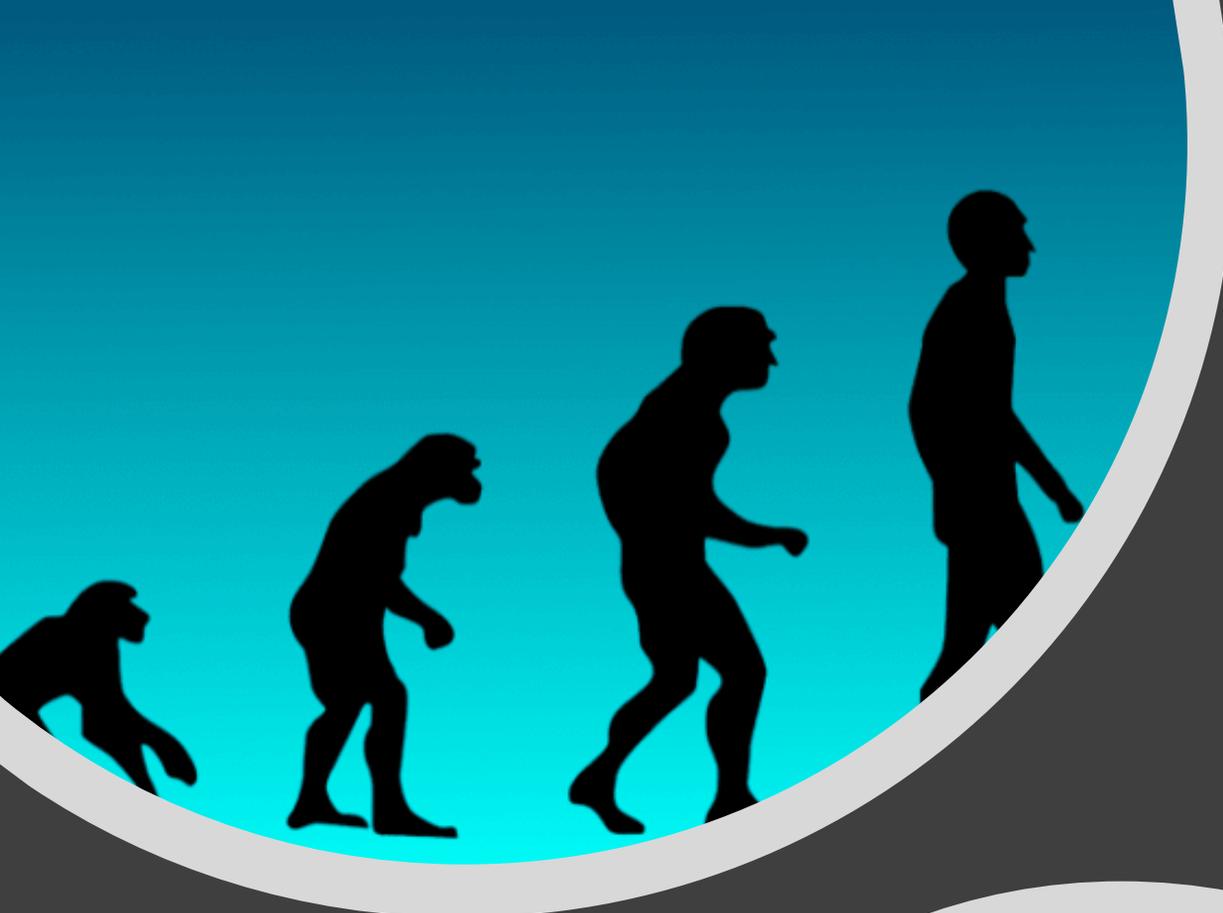


# Summary Statements

Placing Open-Source Research Software Components within a Global Digital Ecosystem:

- 1) Accelerates Global Collaboration, Research Impact and Possibilities for New insights and Innovation
- 2) Opens a New Paradigm For Research Accessibility, Retrieval and Sharing
- 3) Creates Evolutionary Milestones for Research Ecosystems Development
- 4) Enables a New Global Roadmap For the Forward Progress of Knowledge in the 21<sup>st</sup> Century.

Open Source Global Digital Research Ecosystems are needed, innovative and pragmatically possible to implement on global levels today.



# Further References

# Papers Presentations & Working Examples

Uzwysyn, R. 2020 [Developing an Open Source Digital Scholarship Ecosystem \(Preprint\)](#). ICEIT2020. Oxford, UK. February, 2020

[Open Digital Research Ecosystems: How to Build Them and Why](#). *Computers in Libraries*, (40) 8. November 2020.

[Digital Research Ecosystems for Open Science \(Presentation\)](#). AI for Data Discovery, Reuse & Open Science Symposium. Carnegie Mellon University. October 20, 2020.

[Open Source Tools for a Digital Research Ecosystem \(Interview\)](#). *Campus Technology C-Level View*. Feature Interview. May 11, 2020.

[Developing a Digital Scholarship Research Ecosystem. \(PDF\)](#) Association of Southeastern Research Libraries Member's Webinar, April 29, 2020.

## **Working Ecosystem Examples**

[Texas State University Libraries Digital Scholarship Ecosystem.](#)

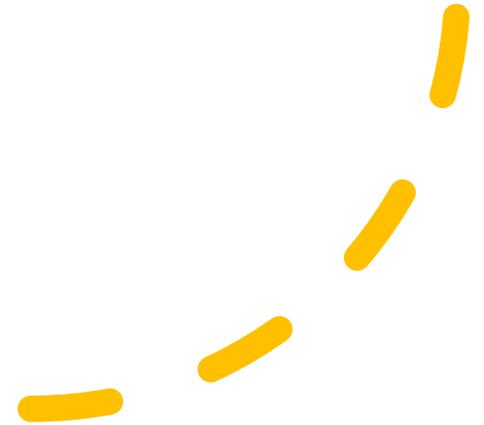
[Texas State Digital Collections Repository](#)

[Texas State Data Research Repository](#)

[Texas State Online Research Identity Management System \(ORCID\)](#)

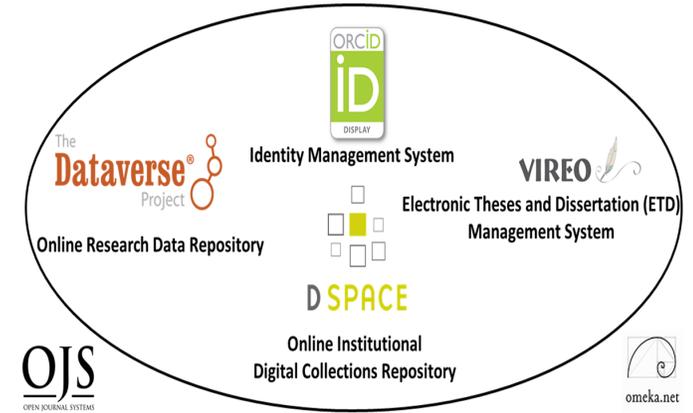
[Texas State Electronic Thesis and Dissertation Management \(VIREO\)](#)

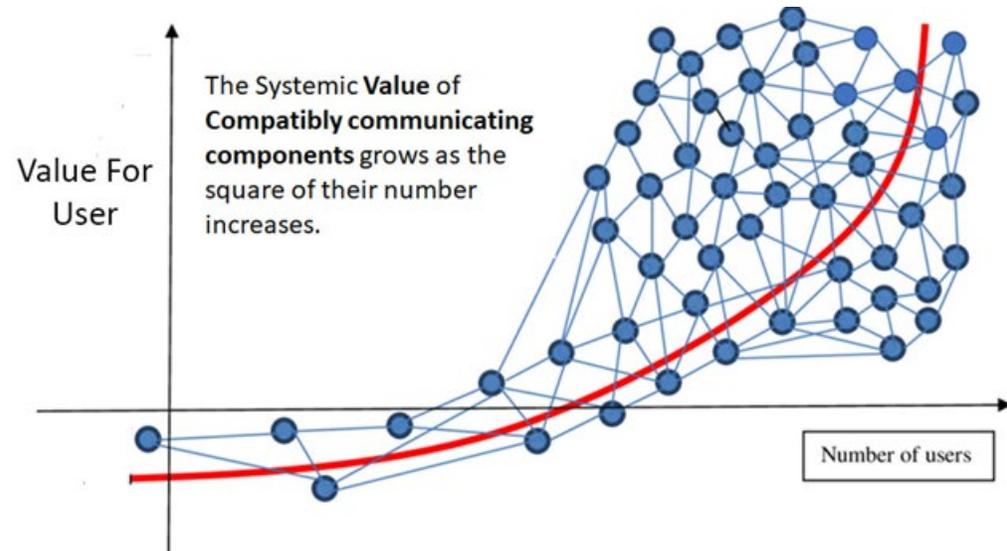
[Open Journal Systems @ Texas State](#)



# Further Links to Open Source Software & Downloads Referenced

- **Digital Collections Repository: Dspace**  
<https://duraspace.org/dspace/>
- **Data Repository: Dataverse**  
<https://dataverse.org/>
- **Content Management System: Omeka**  
<https://omeka.org/>
- **Academic Journal Software: Open Journal Systems 3**  
<https://pkp.sfu.ca/ojs/>
- **Identity Management Software: ORCID**  
<https://orcid.org/>
- **Electronic Thesis and Dissertation Management Software: Vireo**  
<https://www.tdl.org/etds/>





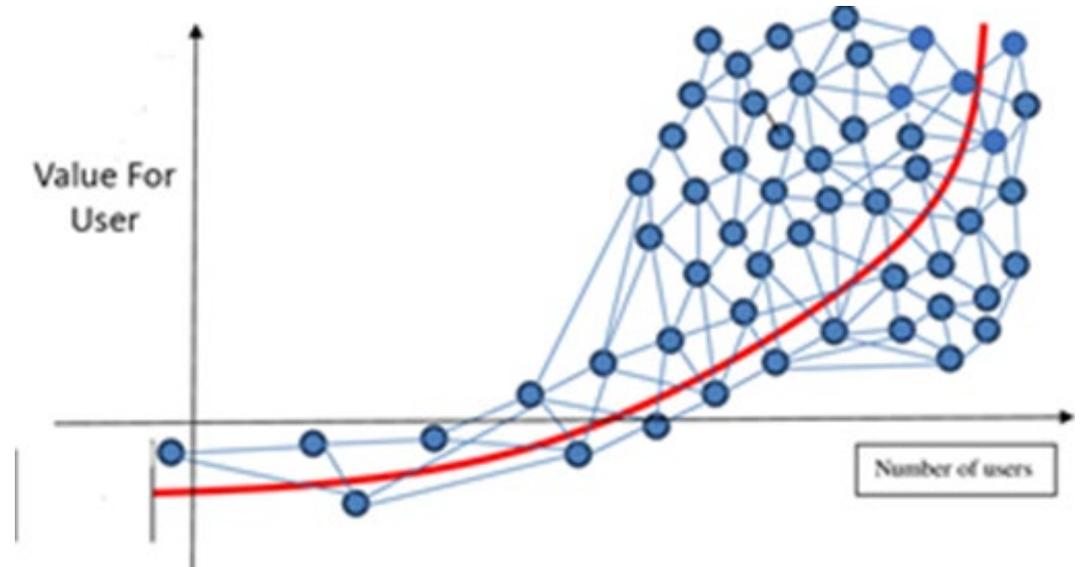
# Questions and Comments



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<http://rayuzwyshyn.net>

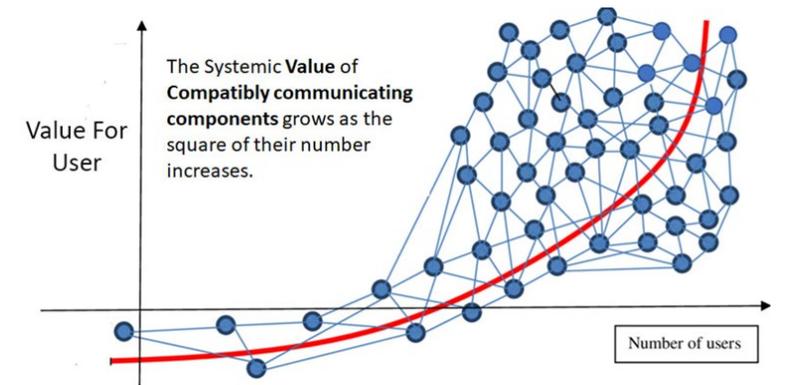


Future  
Pathways  
Networked  
Global  
Scholarly  
Research  
Environment



# Research Universities and Digital Research Ecosystems

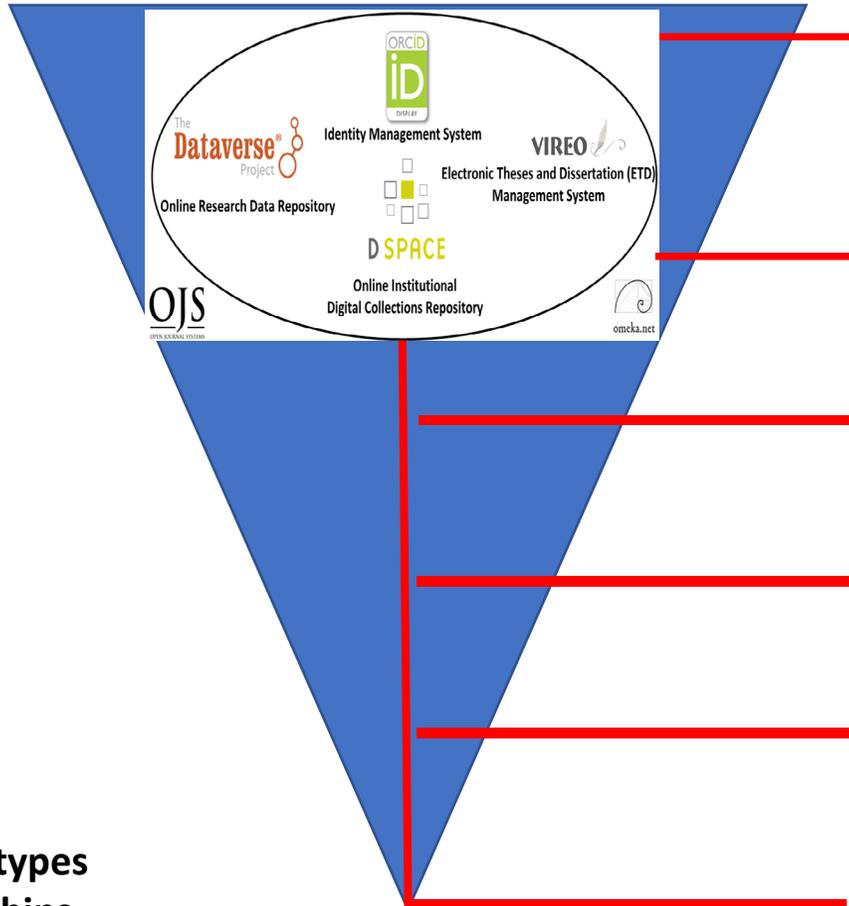
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- **Larger Set of 26,000-40,000** Universities Globally. Research Universities 2.7% - 4.2% of all universities worldwide. Highest by Country: **US 156**, UK 76, Germany 45, Japan 44.
- Enable Top 2-3% Research Institution Academic Libraries Globally, 1500 Institutions including the US and Canada. This represents ~ 90% of Research Libraries Globally



# Together, These Research Ecosystem Components

Open Amazing Possibilities For Digital Scholarship & Collaboration

Complexity



**Complex Multimedia Archives/Cognitive Cartographies**

**Digital Archives/ETD Projects**

**Online Exhibits/ Online Academic Journals**

**Interactive Image Archives/Data Projects**

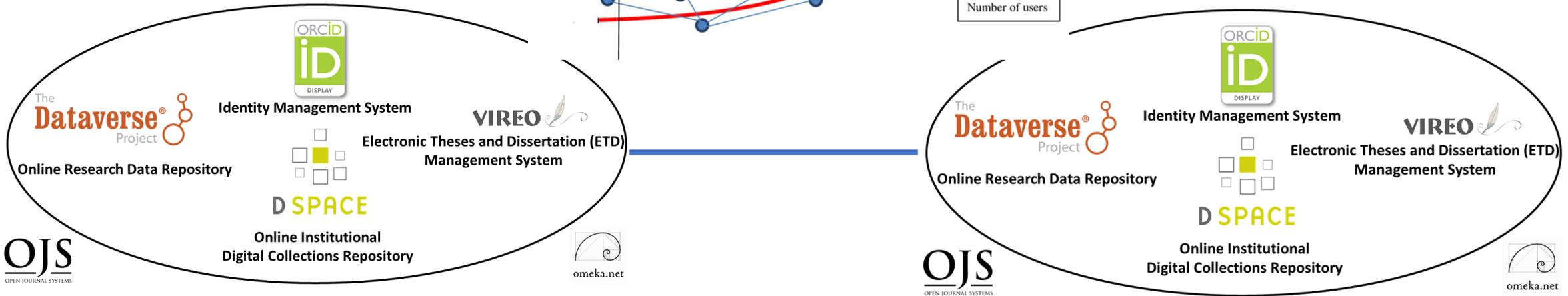
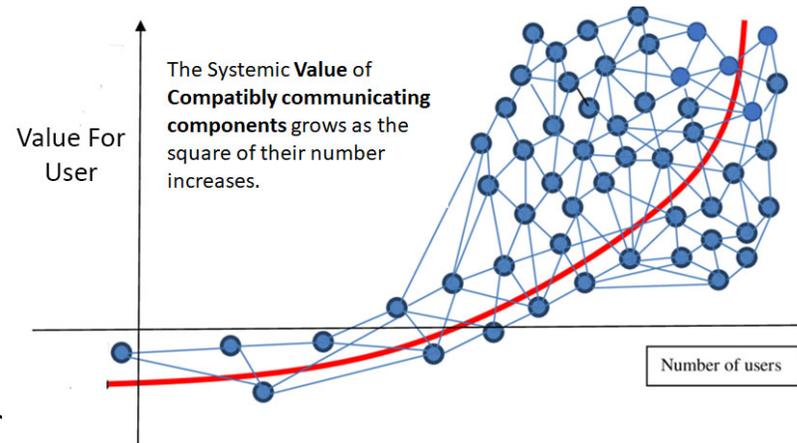
**Digital Libraries, Research Documentation Projects**

[Faculty Digitization Proposals/Partnerships](#)

**Projects, Prototypes  
Grant Partnerships**

# Network Effects

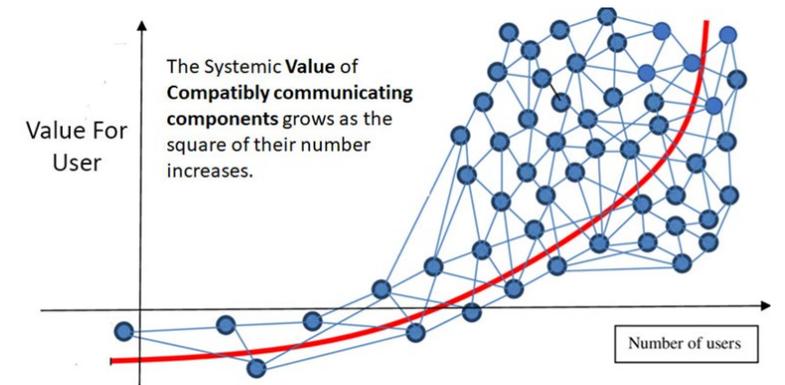
Both In and Between Individual Components  
and In and Among Component Networks



- 1) ORCID Aggregates from Several Sources and Networks and Connects to Other Networks, Internal and External
- 2) OMEKA can act as a middleware front end connecting several components and component networks internally.
- 3) Digitization Lab's IIF Framework can create internal or globally distributed Image Libraries.
- 4) Dataverse can be configured as a single Instance or as a Consortial Model (Texas 22 Individual Instances, TDL)

# Research Universities and Digital Research Ecosystems

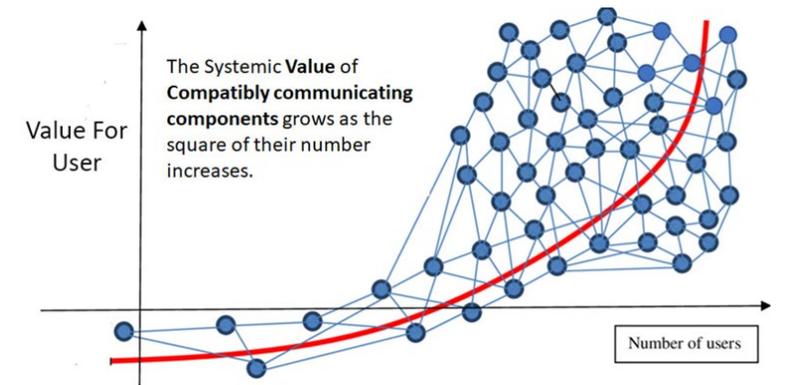
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- **26,000-40,000** Universities Globally. Research Universities 2.7% - 4.2% of all universities worldwide. Highest by Country: **US 156**, UK 76, Germany 45, Japan 44.
- Other Top 2-3% Research Institution Academic Libraries Globally, 1000 Institutions beyond the US and Canada. This represents the other 90% of Research Libraries Globally

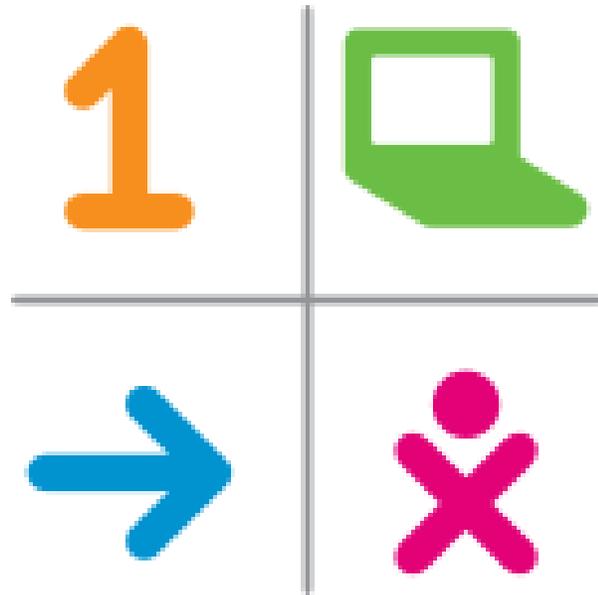


# Research Universities and Digital Research Ecosystems

- **124** ARL Research Libraries (US and Canada)
- **131** US Research Universities (Carnegie R1, Very High Research Activity)
- **135** Doctoral Universities (Carnegie R2, High Research Activity, US), ~266-300 Research Institutions US & Canada
- **1011** Research Universities Worldwide (40% Europe, 26.5% Asia Pacific, US/Canada 18%, Latin America 9% and Middle East/Africa.  
**QS Rankings**
- **1250** Research Universities Worldwide, **Times Higher Education Supplement** (2.7% - 4.2% of all universities worldwide)
- By Country: **US 156**, UK 76, Germany 45, Japan 44
- Global Estimates of General University #'s **26,000-40,000**

**Empower Other Top 2-3% Research Institution Libraries Globally, 1000 Institutions, the other 90% of Research Libraries Globally**





one laptop per child



# One Laptop Per Child Initiative

Dreamed up mid-late 90's, Launched 2005

Antecedent 'Big Idea' Model

MIT Media Lab Director Nicholas Negroponte

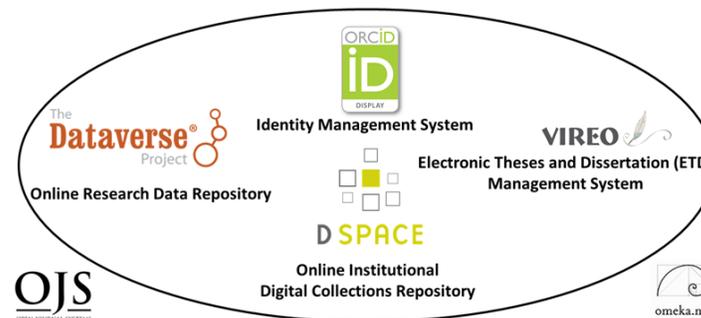
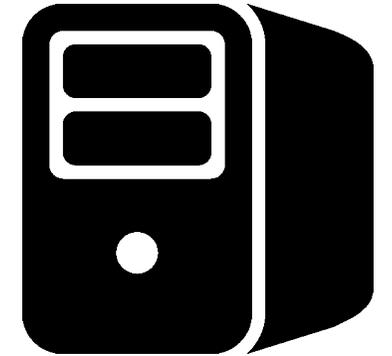
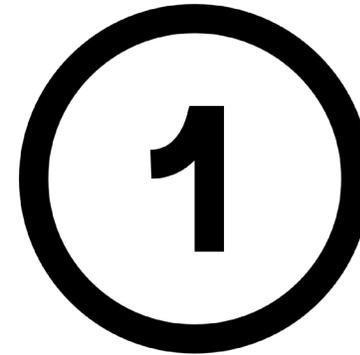
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- **Vision:** Give each child in world access to a laptop with open source software for less than 100.00 \$US/laptop
- Gage Global Effects For Education
- Why not try something similarly worthy, noble and significant for academic research institutions globally?

# One Server Per Research University Initiative

## 2020-2025, V 1.0

- **Vision:** Give ~ 1000 Research Universities Globally One Configured Research Ecosystem Server: 6 Open Source Research Software Components, set up weeklong trainings over 5 continents and a help network  
< \$1000.00 US/Server or set up Fractional Server Space in the Cloud with Mirror Sites Globally (SAAS)
- Gage Global Effects for Research!



# #1 Component for Open Science, Research Data Repository

## Texas State University Dataverse

A platform for publishing and archiving  
Texas State University's research data.

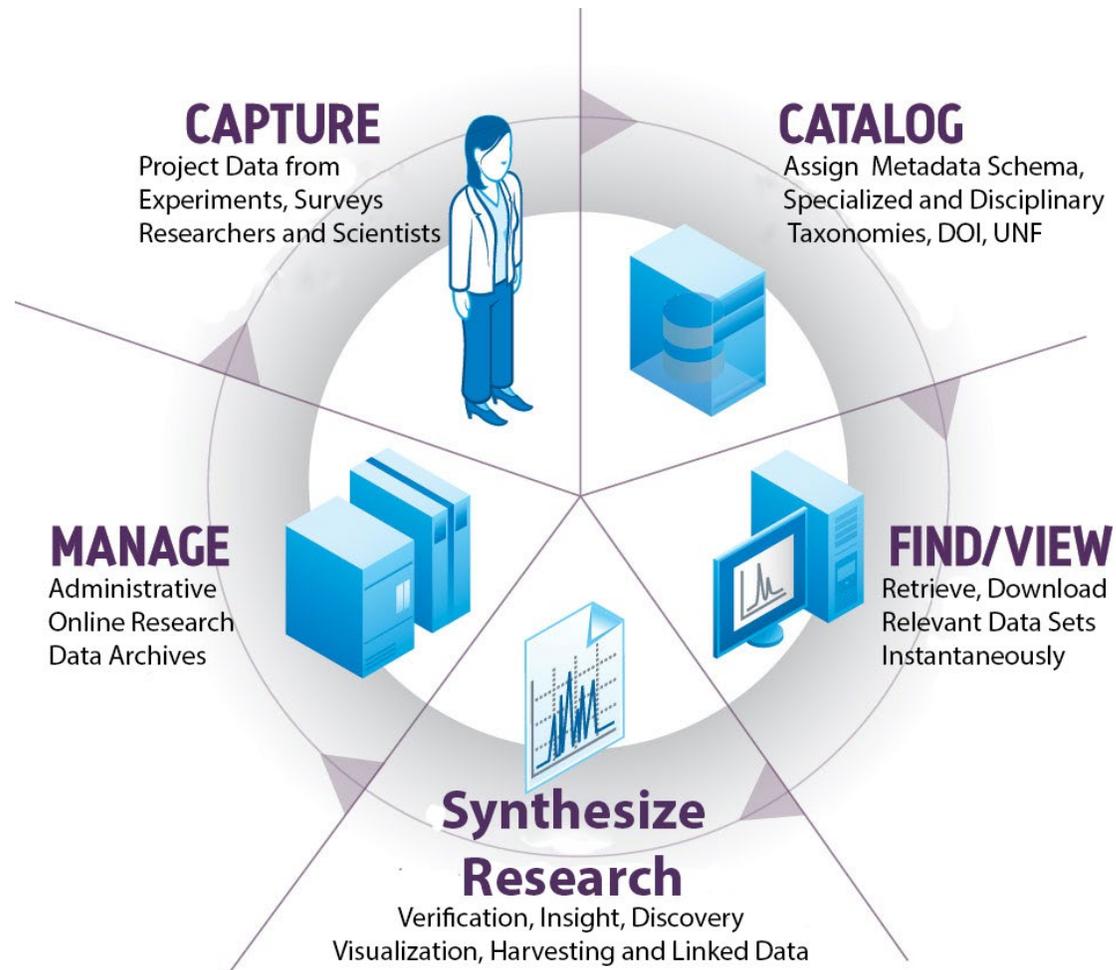
**Dataverse** 

TEXAS  STATE  
UNIVERSITY LIBRARIES

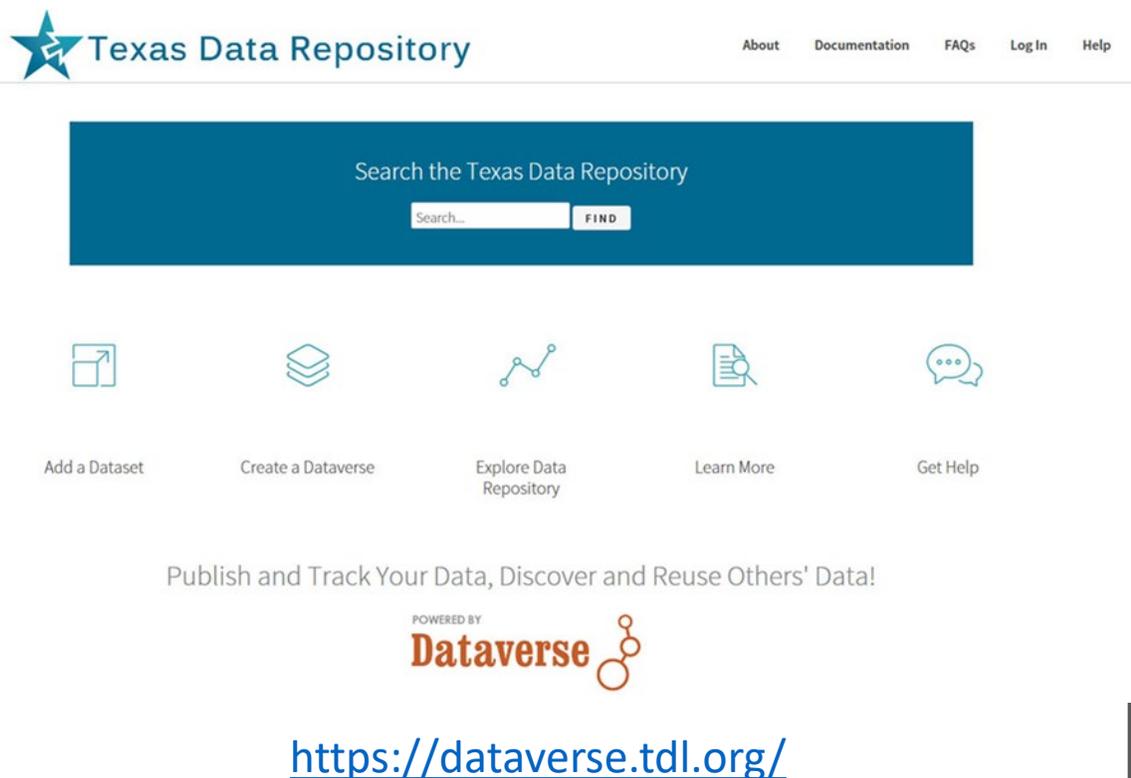
<https://dataverse.tdl.org/dataverse/txstate>

# Research Data Repository

<https://dataverse.tdl.org/dataverse/txstate>

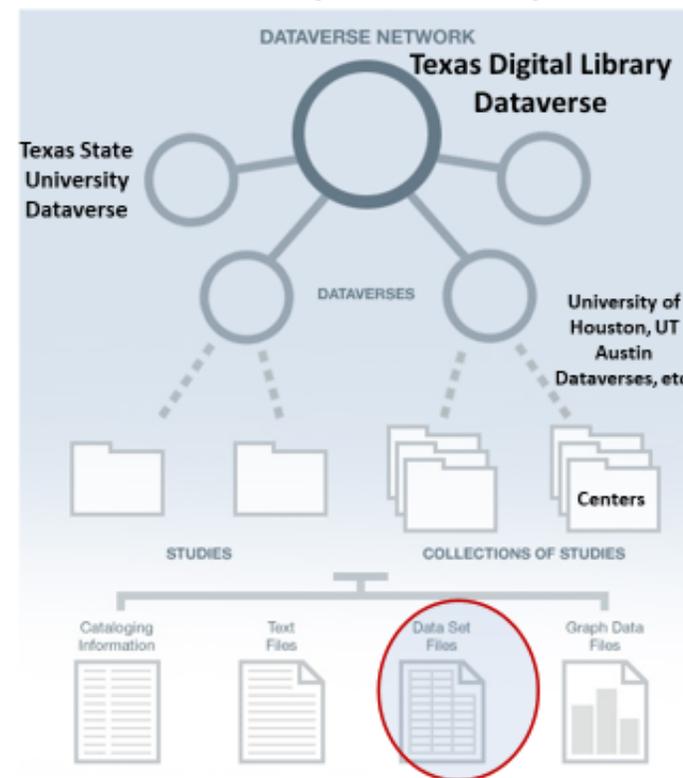


# Dataverse can be configured as Single Instance or as a Consortial Model



The screenshot shows the Texas Data Repository website. At the top left is the logo with a star and the text "Texas Data Repository". To the right are navigation links: "About", "Documentation", "FAQs", "Log In", and "Help". Below the navigation is a large blue search bar with the text "Search the Texas Data Repository" and a "FIND" button. Underneath the search bar are five icons with labels: "Add a Dataset", "Create a Dataverse", "Explore Data Repository", "Learn More", and "Get Help". At the bottom, there is a banner that says "Publish and Track Your Data, Discover and Reuse Others' Data!" followed by the "POWERED BY Dataverse" logo. The URL <https://dataverse.tdl.org/> is displayed at the bottom.

## Dataverse Architecture (Consortial)



(Texas Aggregates 22 Individual Instances, through the Texas Digital Library)



# #2 Institutional Digital Collections Repository (Dspace)

Organizes, centralizes and makes accessible research and knowledge generated by the institution's research community (Research Faculty and Graduate Students):

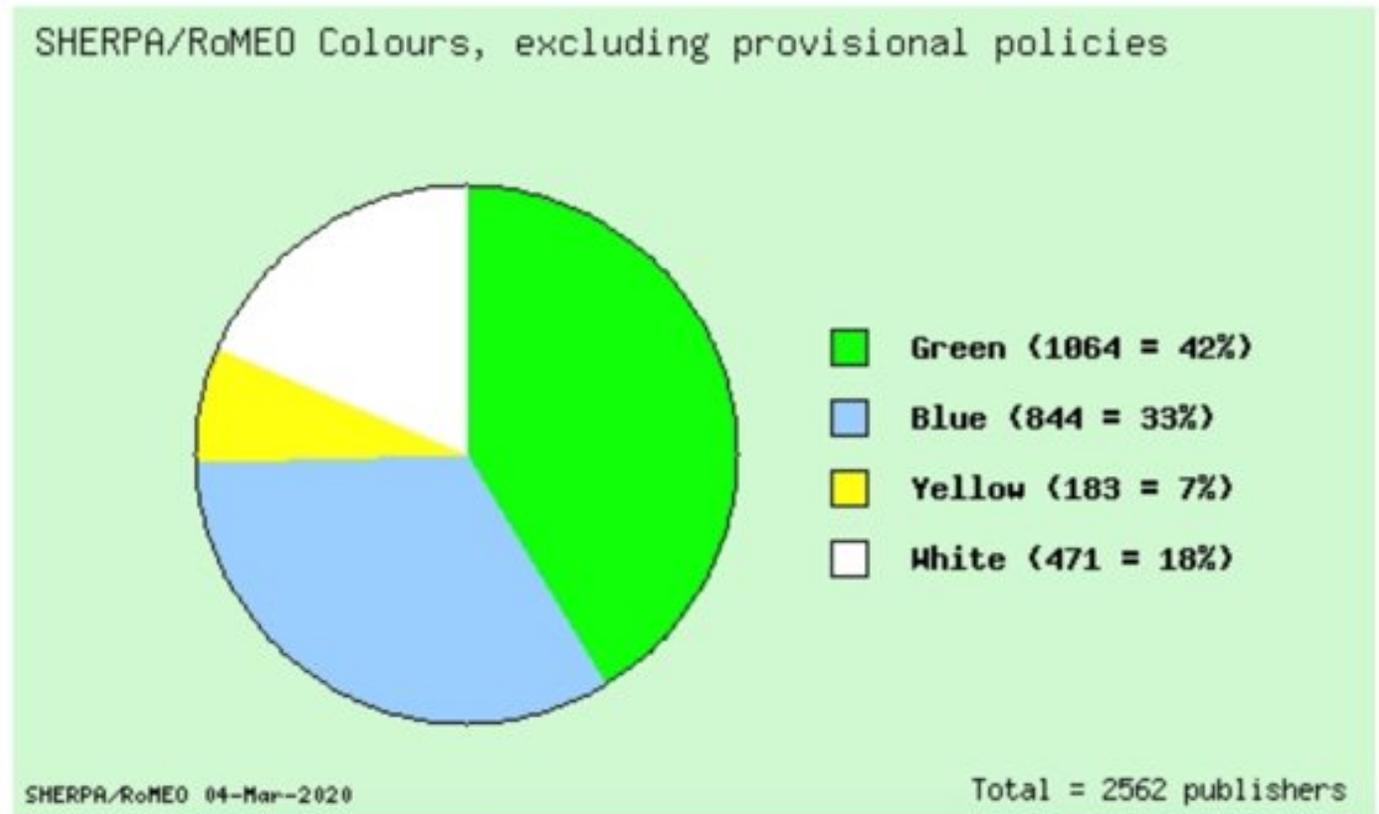
- Pre-prints
- Faculty Publications
- White Papers
- Conference Presentations
- Graduate Student Theses and Dissertations

A Vast Majority of Publishers Allow Digital Archiving in some form. (82% from 2562 publishers)

March 2020 Sherpa/Romeo Copyright Polices

RoMEO colour	Archiving policy	Publishers	%
<a href="#">green</a>	Can archive pre-print and post-print	1064	42
<a href="#">blue</a>	Can archive post-print (ie final draft post-refereeing)	844	33
<a href="#">yellow</a>	Can archive pre-print (ie pre-refereeing)	183	7
<a href="#">white</a>	Archiving not formally supported	471	18

Summary: **82%** of publishers on this list formally **allow** some form of self-archiving.



Google search results for "athermal annealing of low-energy boron". The search bar shows the query. Below the search bar, it says "About 105,000 results (0.36 seconds)". The first result is "Scholarly articles for athermal annealing of low-energy boron". The second result is "Athermal annealing of low-energy boron implants ... - Scita...". The third result is "Athermal annealing of low-energy boron implants in silicon".

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dc.contributor.author	Donnelly, David W.	
dc.contributor.author	Covington, B. C.	
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dc.contributor.author	Fischer, R.P.	
dc.contributor.author	Peckerar, M.	
dc.contributor.author	Felix, C. L.	
txstate.contributor.author	Donnelly, David W., Southwest Texas State University, Dept. of Physics	
txstate.contributor.author	Covington, B. C., Southwest Texas State University	
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Access  
Find  
Search Engine  
Optimization

# Primary Use Case Value Application of Structured Metadata Schema for Search Engine Optimization

#2 of 105,000  
Immediately  
Available

Search results for "Athermal annealing of low-energy boron implants in silicon". The search bar shows the query. Below the search bar, it says "About 105,000 results (0.36 seconds)". The first result is "Athermal annealing of low-energy boron implants in silicon". The second result is "Athermal annealing of low-energy boron implants in silicon". The third result is "Athermal annealing of low-energy boron implants in silicon".

Download

Name: Donnelly-2001 APL ...  
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## Athermal annealing of low-energy boron implants in silicon

Donnelly, David W., Southwest Texas State University, Dept. of Physics;

Covington, B. C., Southwest Texas State University;

Grun, J., Naval Research Laboratory, Washington, DC;

Fischer, R.P., Naval Research Laboratory;

Peckerar, M., Naval Research Laboratory;

Felix, C. L., United Industries Inc.

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Athermal annealing at room temperature and ... - Shao - Cited by 19

Athermal annealing of low-energy boron implants in ... - Donnelly - Cited by 10

Hydrogen passivation of silicon carbide by low-energy ... - Achziger - Cited by 53

### Athermal annealing of low-energy boron implants ... - Scita...

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Athermal annealing of low-energy boron implants in silicon. D. W. Donnelly) and B. C. Covington. Department of Physics, Southwest Texas State University, ...

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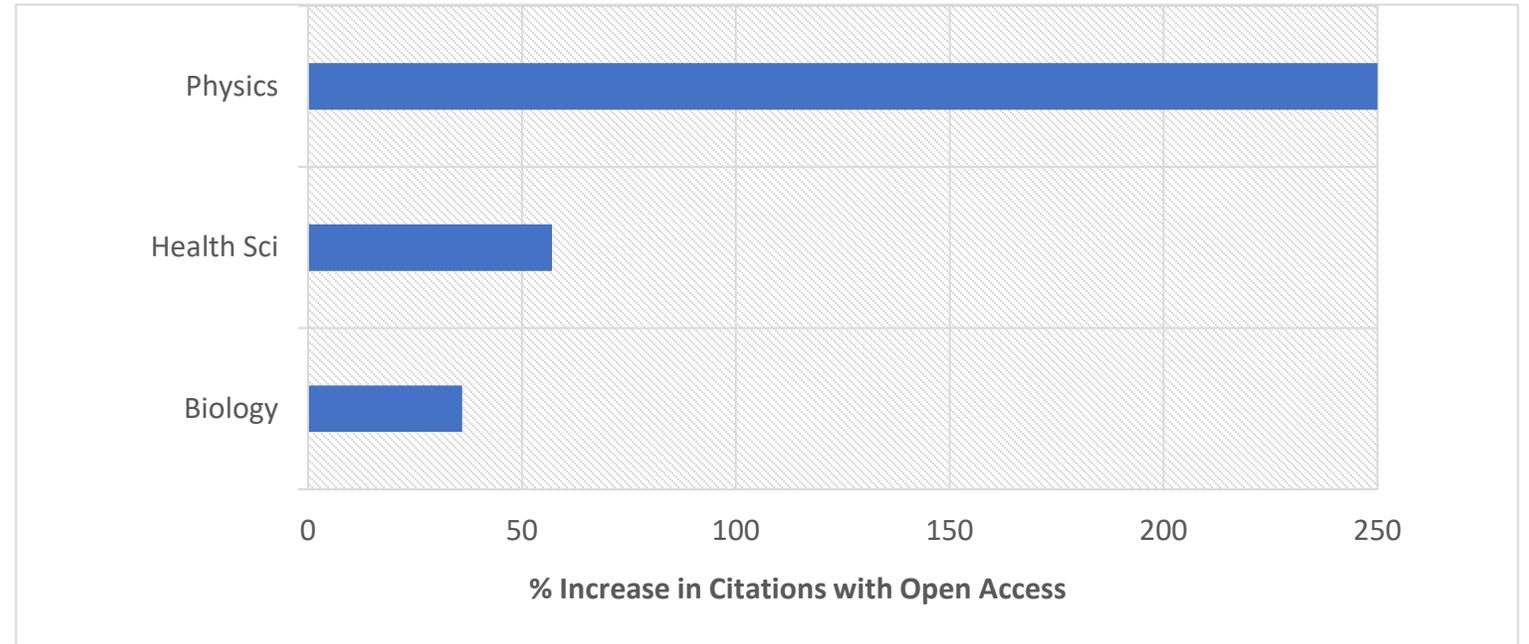
### Athermal annealing at room temperature and enhanced ...

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Athermal annealing of implantation damage induced by low energy boron implants at room temperature was observed after coimplantation and such annealing ...

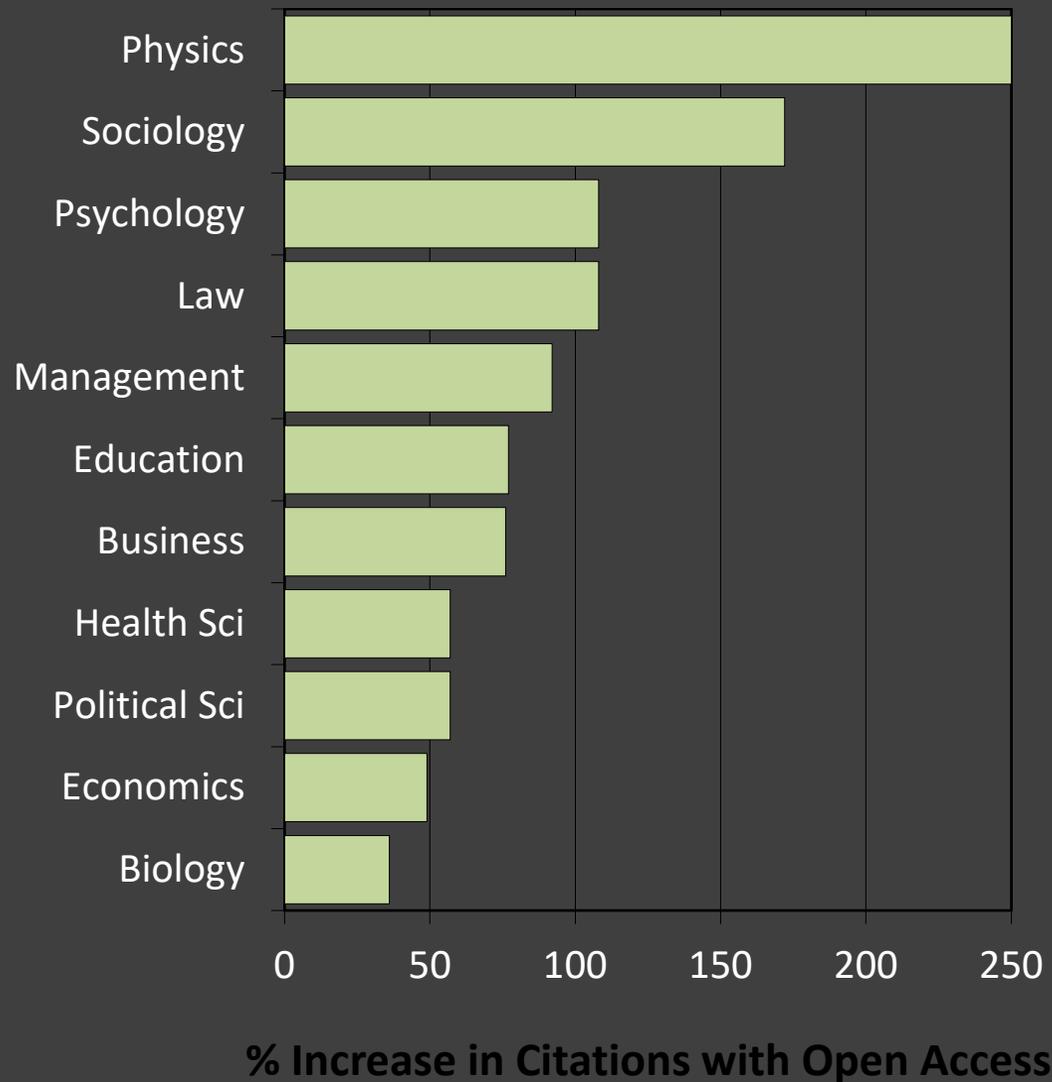
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Percent Increase  
in Article  
Citations by  
Discipline with  
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**Range = 36%-250% Increase in Citations over 2 Year period**

(Data: Stevan Harnad and Heather Joseph, 2014)



Percent Increase in Article Citations by Discipline with Open Access Online Availability Through Google

**Range = 36%-250%**

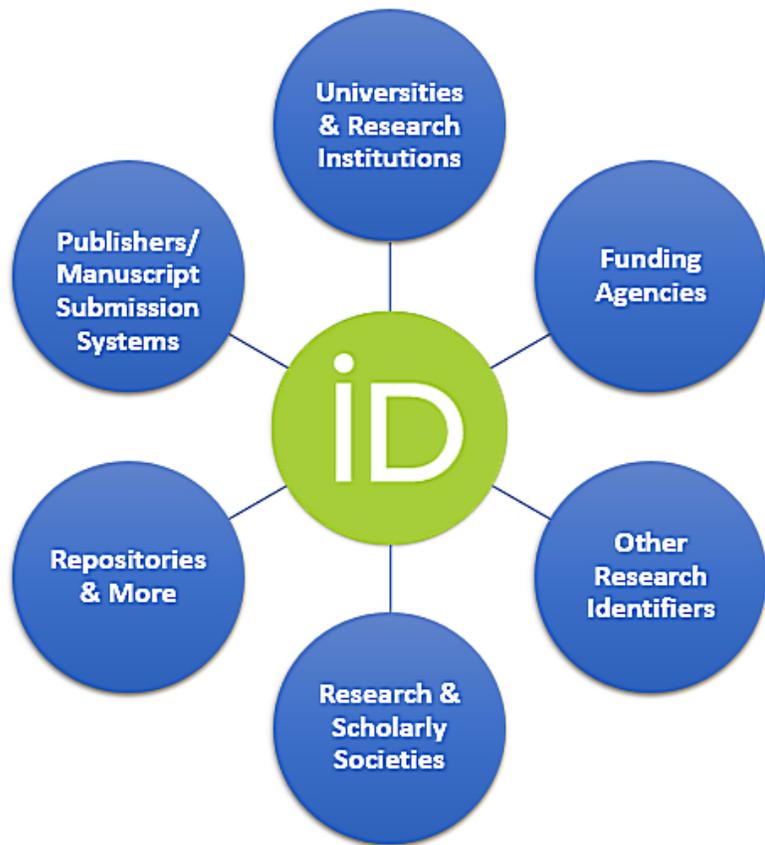
(Data: Stevan Harnad and Heather Joseph, 2014)

# Vireo



## **Electronic Thesis and Dissertation Management System**

- Bridges Student Thesis/Dissertation Submission with Graduate School Review,
- Connects the Collections Repository And Data Repository so graduate students can publish and link their theses/dissertations, data and research
- Addresses Intermediary steps in the ETD Process



ORCID is a hub connecting the research landscape



## Researcher Identity Management System

- Gives Researchers Unique Number (ORCID ID) Connecting and Disambiguate Scholars names:

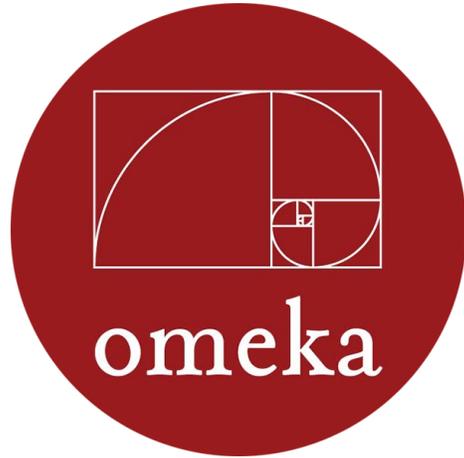
Maria Hernandez, Biochemist

Maria Hernandez, M.D. or Astrophysicist

- Allows Papers in the collections repository and datasets in data repository to be associated with ORCID ID's for aggregation of research profiles.

Orcid can act as a Network Hub aggregating from several sources and connecting to other internal and external networks

# Omeka and OJS3



## **Open Source User Interface Software**

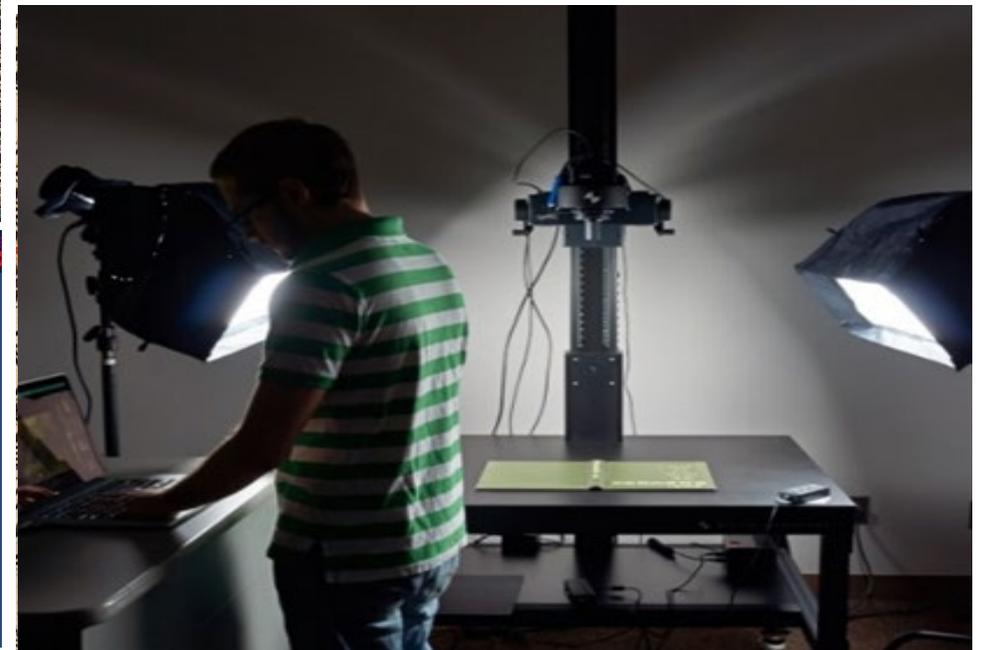
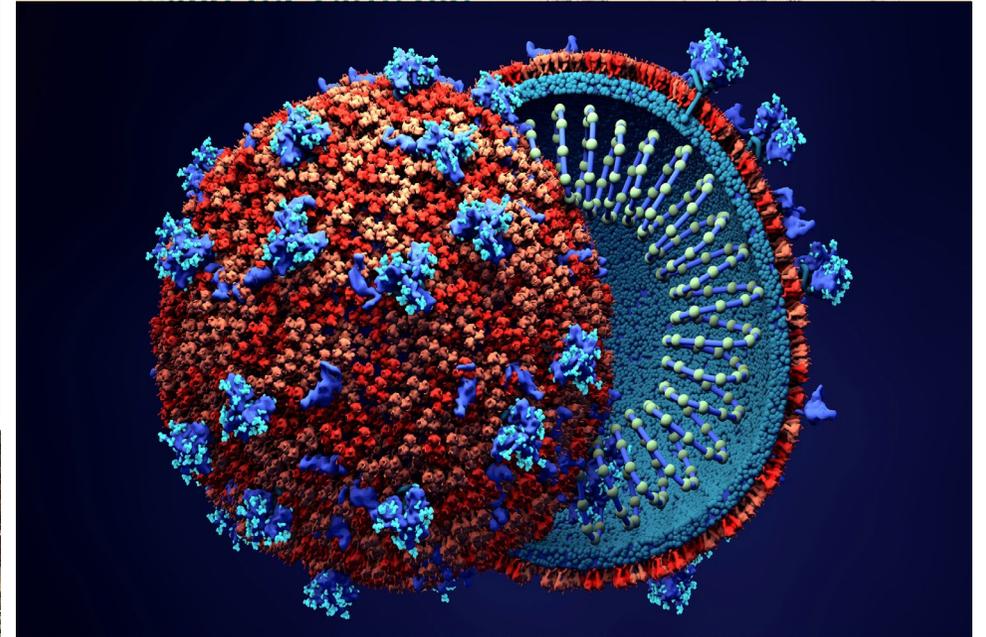
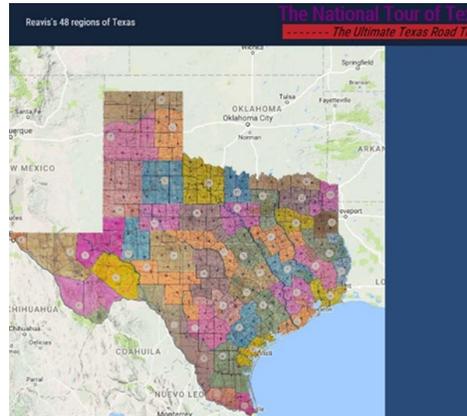
Provides a front end gateway for more complex research projects  
- linking text, image media and datasets and acting as a front end for connecting components.



**Open Access Academic Journal Software** for refereed journal online publishing, workflow and connections with background research and datasets etc. through Dataverse/Dspace connections

# The Digitization Lab

- Expands Possibilities for depth of Faculty/Graduate Student Research Projects
- Possibilities range from OCR, scientific slides, GIS image, manuscript & journal digitization to 3D objects, audiovisual material and visualization technologies



# HUMAN RESOURCES



# Human Resources

## Essential

- **System Administrator/Programmer**  
server infrastructure set-up/maintenance/basic customization
- **Digital Collections Librarian:** Administration, Marketing, User Support, Collections and Data Repository, OJS/ORCID

## Optional as System Expands

- **Metadata Librarian:** Dublin Core, Specialized Schema
- **Web Developer/Programmer:** OMEKA, System Integration
- **Project Manager/Department Head** (PMP Certification)
- **Digitization Specialist**
- **GIS Specialist/Data Visualization Specialist**
- **AI Specialist/Post-Doc/CLIR Fellow**

# Implementation Paths For Open Science

(Many Roads To Rome for Timelines, 1-5 Year Paths)

## Year 1

Data Repository and Digital Collection Repository

## Year 2

User Interface Software (OMEKA), Identity Management System, ORCID

## Year 3

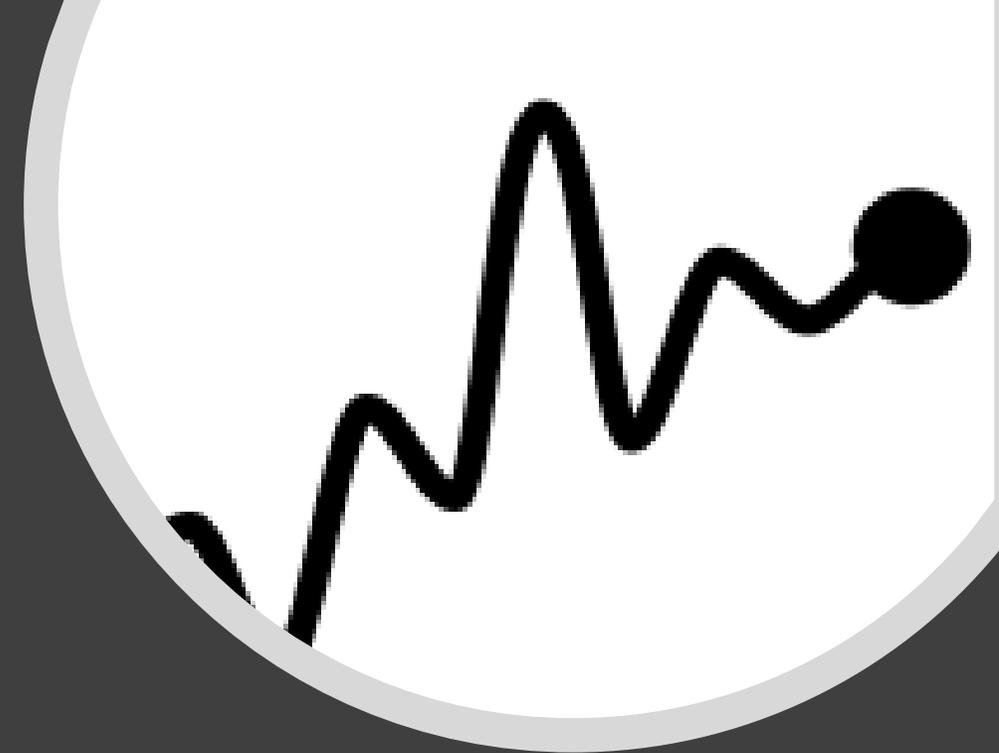
Digitization Lab

## Year 4

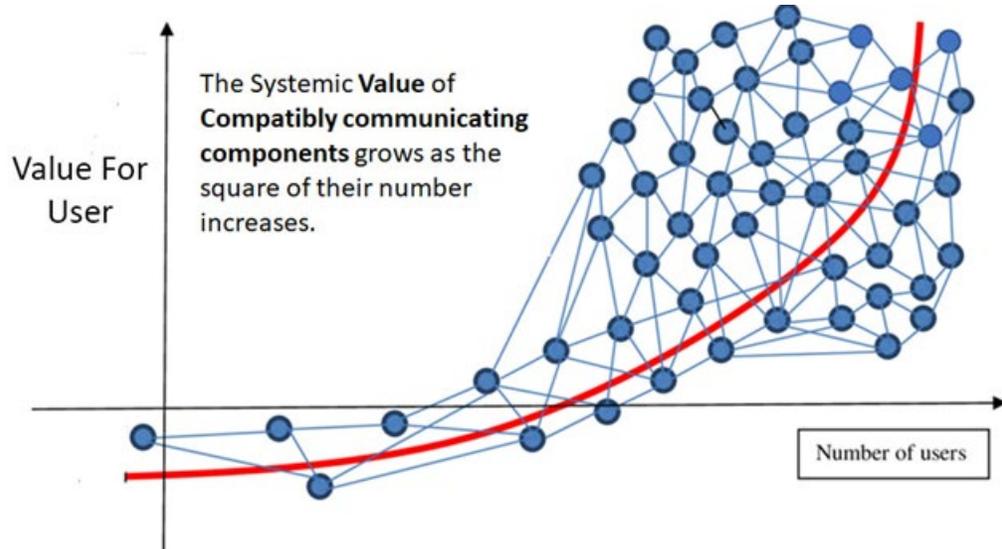
ETD Middleware (VIREO) and OJS Software

## Year 5

Complex Digitization Projects, IIF Server, Faculty Grant Projects etc.



1



Questions, Comments and Funders and Foundations with global vision and a passion for solving one of the 21<sup>st</sup> Centuries Grand Challenges for Global Research



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