

Roles of Library for Quality Education and Research: Emerging Trends in the Information Professions

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From a Time of Information Scarcity to a Time of Information Abundance.

- In times of information scarcity, libraries provided the most effective way of sharing material (book, magazines, music, film .etc).
- In time of information abundance, the internet provided the most effective way to access material. (even though users might access digital library resources via the Internet)
- “It is conceivable that the nation-states will one day fight for control of information, just as they battled in the past for control over territory”.
(Lyotard, Jean Francois, 1979)

Open Science

- The scientific enterprise is being transformed largely due to the digital revolution.
- Large datasets, lab notes, computational workflows (such as codes and algorithms), tools and software are all available in openly accessible cyber infrastructure.
- An increasing recognition of value by scholars as well as funders to openly share research publications and data and other artifacts.
- Thus, the practice of open access has expanded in scope beyond mere research publications. See for example the recently launched data infrastructure called “Whole Tale” <https://wholetale.org>

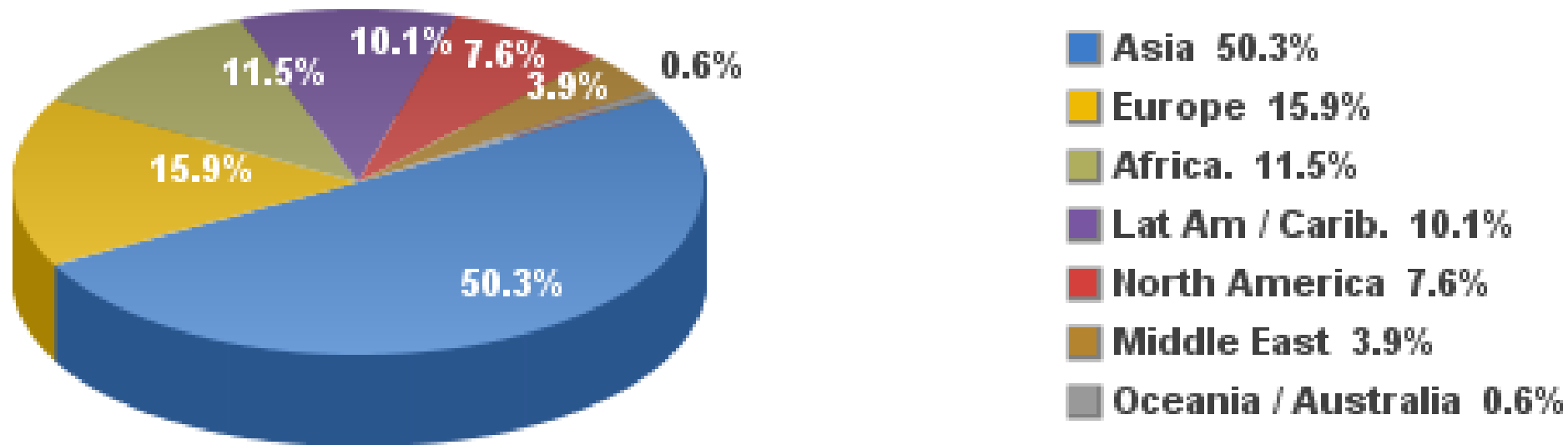
WORLD INTERNET USAGE AND POPULATION STATISTICS 2019 Year-End Estimates

World Regions	Population (2020 Est.)	Population % of World	Internet Users 31 Dec 2019	Penetration Rate (% Pop.)	Growth 2000-2020	Internet World %
Africa	1,340,598,447	17.2 %	526,374,930	39.3 %	11,559 %	11.5 %
Asia	4,294,516,659	55.1 %	2,300,469,859	53.6 %	1,913 %	50.3 %
Europe	834,995,197	10.7 %	727,814,272	87.2 %	592 %	15.9 %
Latin America / Caribbean	658,345,826	8.5 %	453,702,292	68.9 %	2,411 %	10.0 %
Middle East	260,991,690	3.9 %	180,498,292	69.2 %	5,395 %	3.9 %
North America	368,869,647	4.7 %	348,908,868	94.6 %	222 %	7.6 %
Oceania / Australia	42,690,838	0.5 %	28,775,373	67.4 %	277 %	0.6 %
WORLD TOTAL	7,796,615,710	100.0 %	4,574,150,134	58.7 %	1,167 %	100.0 %

NOTES: (1) Internet Usage and World Population Statistics estimates are for Dec 31, 2019; as of March 3, 2020. (2) CLICK on

Internet Penetration per Population. Source:
<http://www.internetworldstats.com/stats.htm>

Internet Users Distribution in the World - 2020 Q1



Source: Internet World Stats - www.internetworldstats.com/stats.htm

Basis: 4,574,150,134 Internet users in March 3, 2020

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Trends

- Digital technologies provide scholars with access to diverse and previously unavailable contents that span various formats, myriad technologies across institutions and nations
- The open access (OA) movement is part of the broader "open knowledge" or "open content" movement that transforms scholarly communication
 - OA is provision of unrestricted online access to results/outputs of research and development
 - A massive open online course (MOOC) is a large scale, open-access re-imagining of the more traditional forms of e-learning
 - Proliferation of non-text items (Flickr, Youtube, Netflix,...)


Exponential Growth in Cloud Storage Capacity

- **As cloud services increasingly become a de facto part of doing business, data storage to grow exponentially in the coming year.**
- **The Cisco survey estimates that in 2018, the total amount of global data storage capacity to grow to an estimated 1.1 zettabytes (ZB) , which is approximately twice the space available in 2017 (600 Exabyte (EB)).**
- **Annual global data center IP traffic will reach 15.3 ZB (1.3 ZB per month) by the end of 2020.**

The changing landscape of Librarianship



San Lorenzo de El Escorial, Spain


- 
- “The idea of a library becoming a “book museum”... a real scare for librarians)”. Will Sherman
 - The world’s oldest newspaper, Sweden's Post-och Inrikes Tidningar newspaper has dropped its print version and is now available only in an electronic format.
 - Inside Higher Ed. April 7, 2010 reported that Johns Hopkins University medical library has dramatically changed the way it is structured in order to reengage medical researchers. The library has reduced its physical footprint and embedded librarians within research departments as information experts

- Libraries and librarians are two different things.

“Our focus on the library as an institution would find its equivalent in the medical profession if the latter focused attention on the hospital as the major institutional element in health care delivery. By the same token, if medical education were modeled on library education, it would seek to prepare ‘hospitalarians’ rather than physicians”

(Lancaster 1983, 747)

- This does not mean that we ignore libraries, but it does mean that we must be willing to take on board other contexts and be preparing information professionals to work in those contexts
- While libraries as buildings might eventually cease to exist. Librarian as a profession will actually thrive



Library Services

Library Services include general services, services to support Learning, Teaching and Research.

Library Collections

Library Collections include both physical and online resources as well as online support presence.

Library Organisation

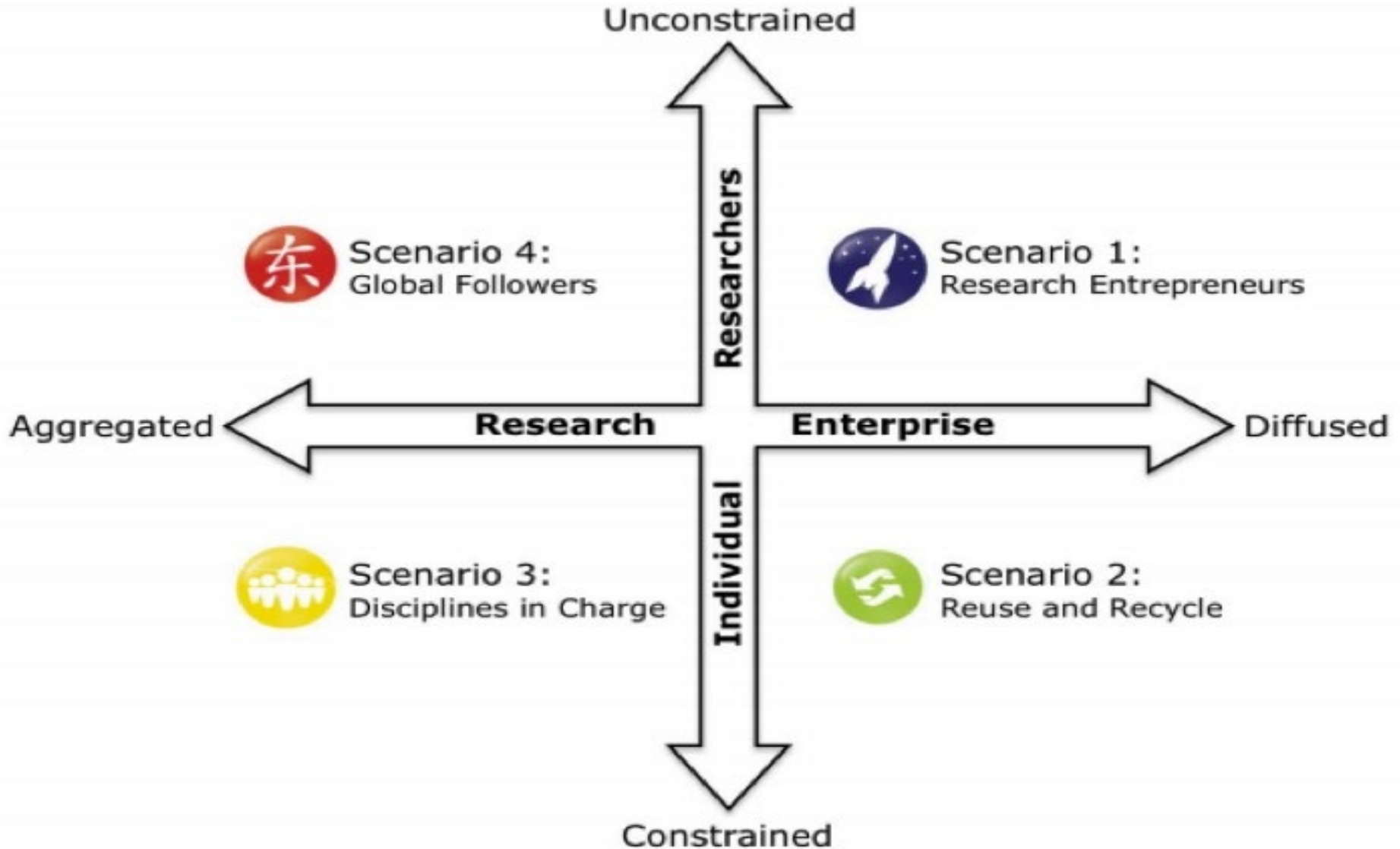
Library Organisation includes discussion of values and culture, leadership, staff and structure.

Library Facilities and Systems

Library Facilities and Systems encompasses branch facilities, including the location of facilities and the development of systems across all branches.

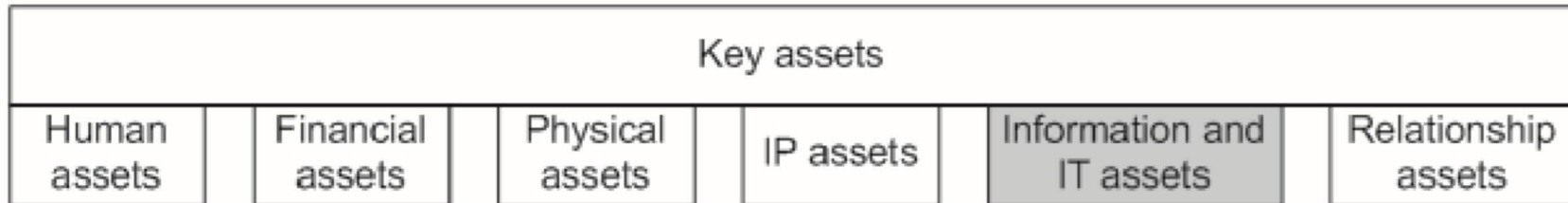
ARL Scenarios

(Creative Commons BY NC ND)



Big Data as Information Assets

- Information assets refer to “**facts having value** or potential value that are **documented**.” (Khatri & Brown, 2010, p. 148).



- The 5Vs of big data characterize the five dimensions of big data.
- To **derive value from data and information**, organizations need to invest in **technology** and systems.

WHAT IS BIG DATA?

THE FIVE V'S OF BIG DATA

VOLUME

Vast amounts of data are being generated – the volumes are too large to be analysed with traditional database tools.

VELOCITY

Big data technology can analyze data while it is being generated (at ever increasing speeds) without putting it into databases.

VARIETY

Data is unstructured and diverse – it can be text, images, video, audio, sensors, location data etc...

BIG DATA

VERACITY

Data has different levels of trustworthiness, but the volume makes up for the lack of accuracy.

VALUE

The ability to turn the data into value (Insight and Intelligence) needs to be included.

Big data definition: The exact definition of big data is contested, but the "5 V's" is one of several definitions used by IBM.



Big Data Value Chain

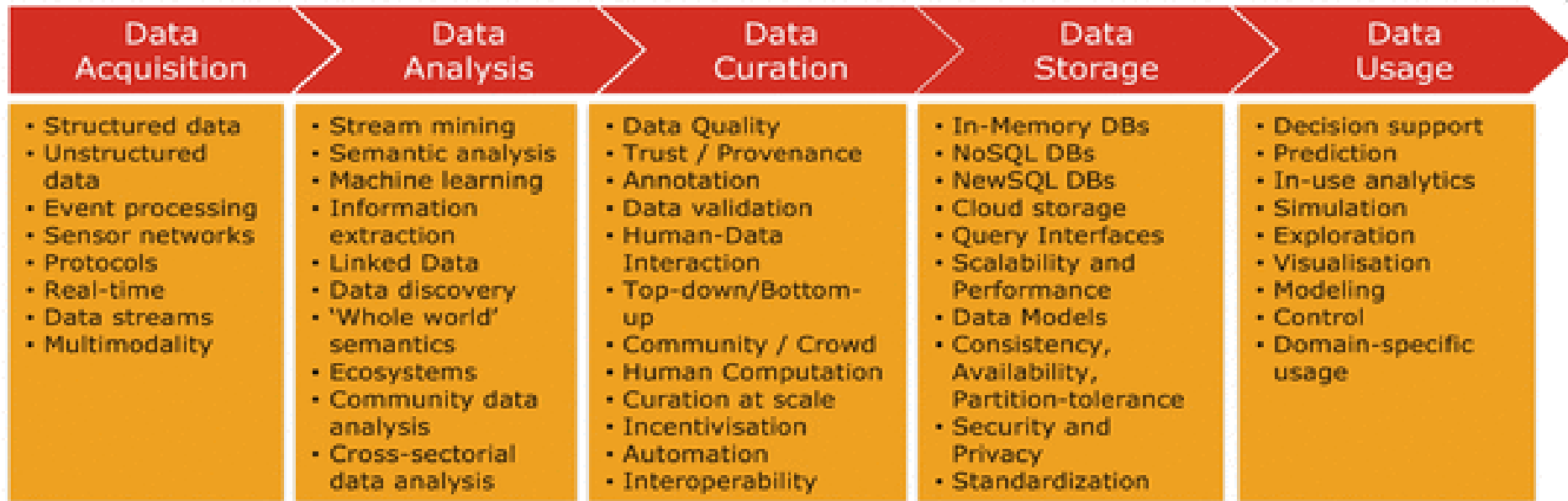
- Big data could be open or private data stored in an organization's databases and might be unstructured data from scattered/dispersed sources. **Open data** and its various data formats also create challenges for ensuring **data security and privacy**.
- Data security and privacy fit into the big **data** value chain at the **data storage** stage.

Big Data Value Chain

Industry Driven Sectorial Forums



Big Data Value Chain



Technical Working Groups



Digital Curation and Preservation

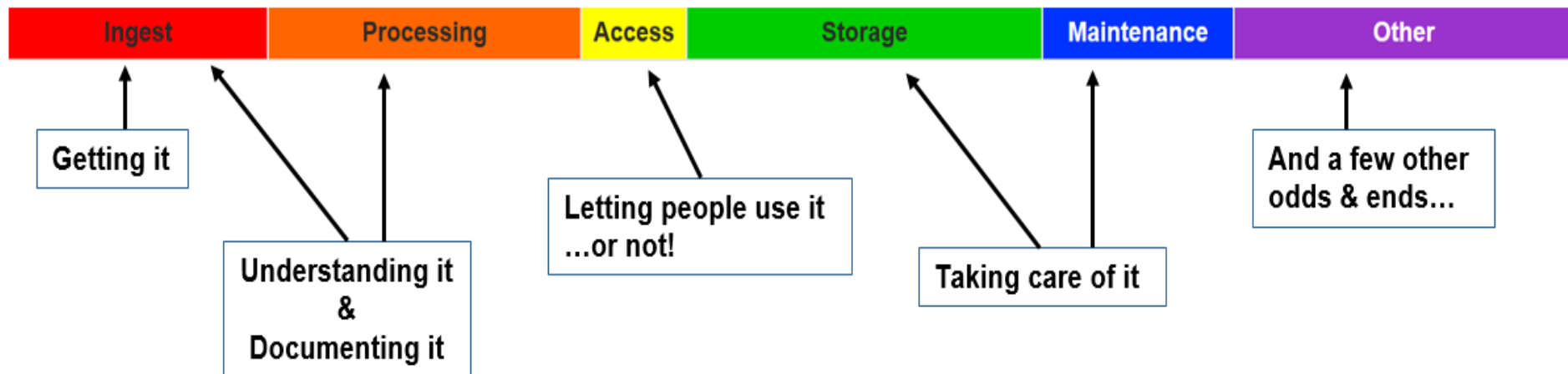
- **Digital curation is the management, preservation, and enrichment of digital resources.**
- **Involves maintaining, preserving, adding value, and facilitate use and re-use throughout its lifecycle and over time.**

Digital Curation and Preservation

- **Digital Preservation is defined as the management process of ensuring digital objects and information are accessible over the long term.**
- **Development of standards, format compatibility, format migration, and systems interoperability are important aspect of digital preservation process.**

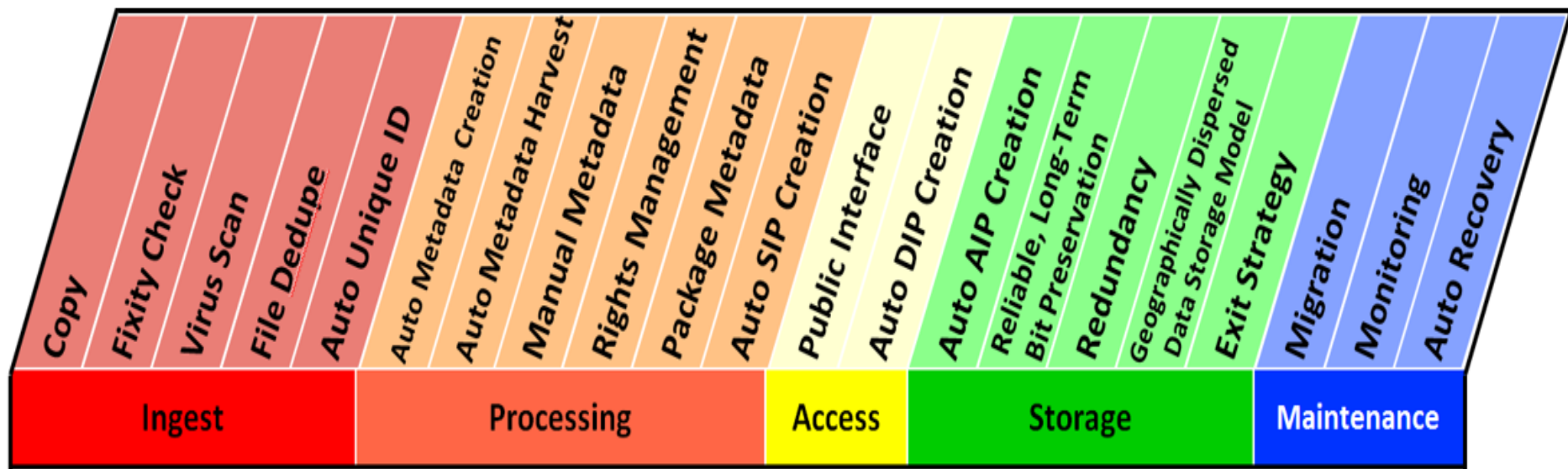
Source: Guidance Document for Lifecycle Management of ETDs:
<http://digital.library.unt.edu/ark:/67531/metadc282598>

Digital Curation Workflows Considerations



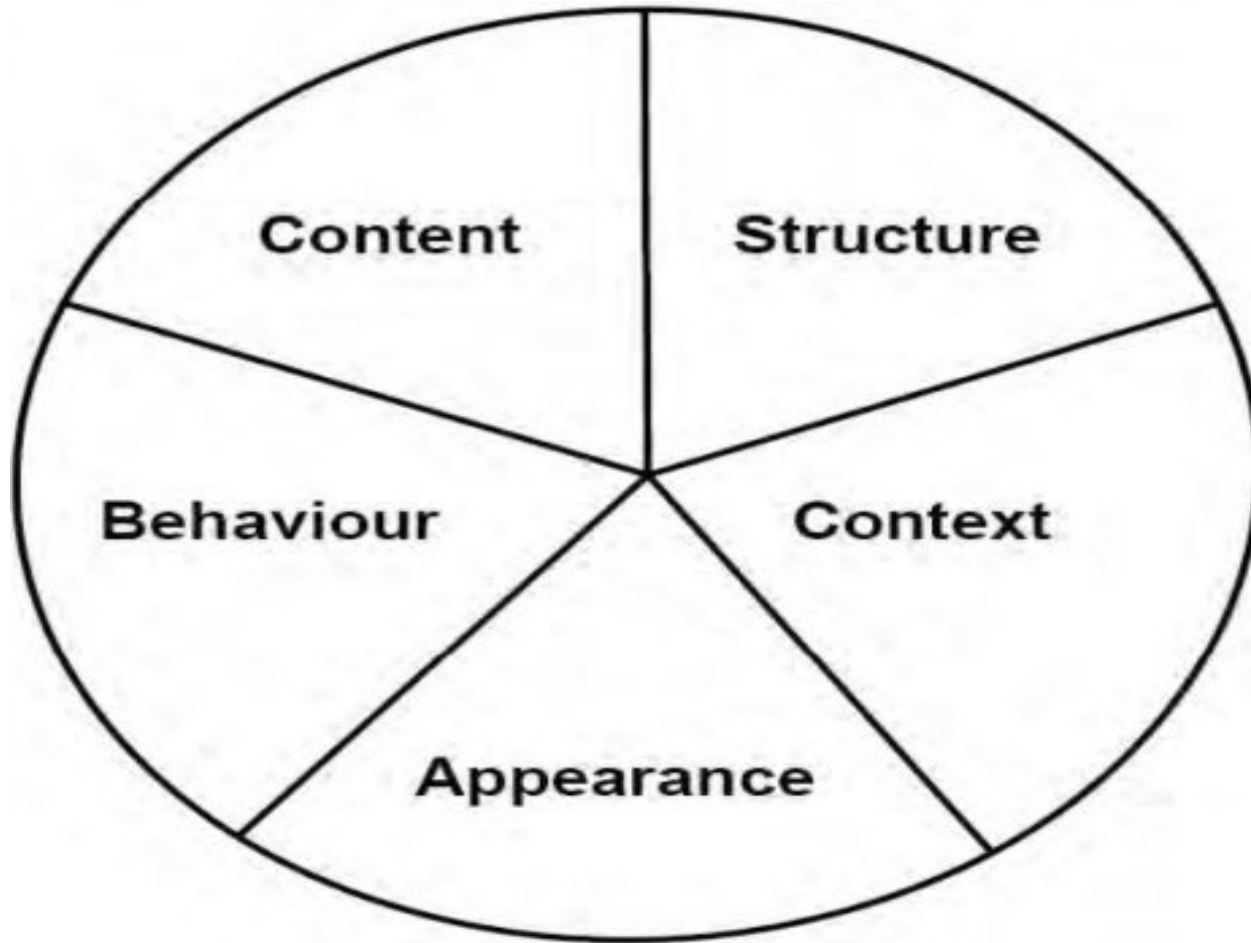
Source: A Digital POWRR Workshop:
<http://digitalpowrr.niu.edu/>

Digital Curation Workflows and Micro/Macro-Services

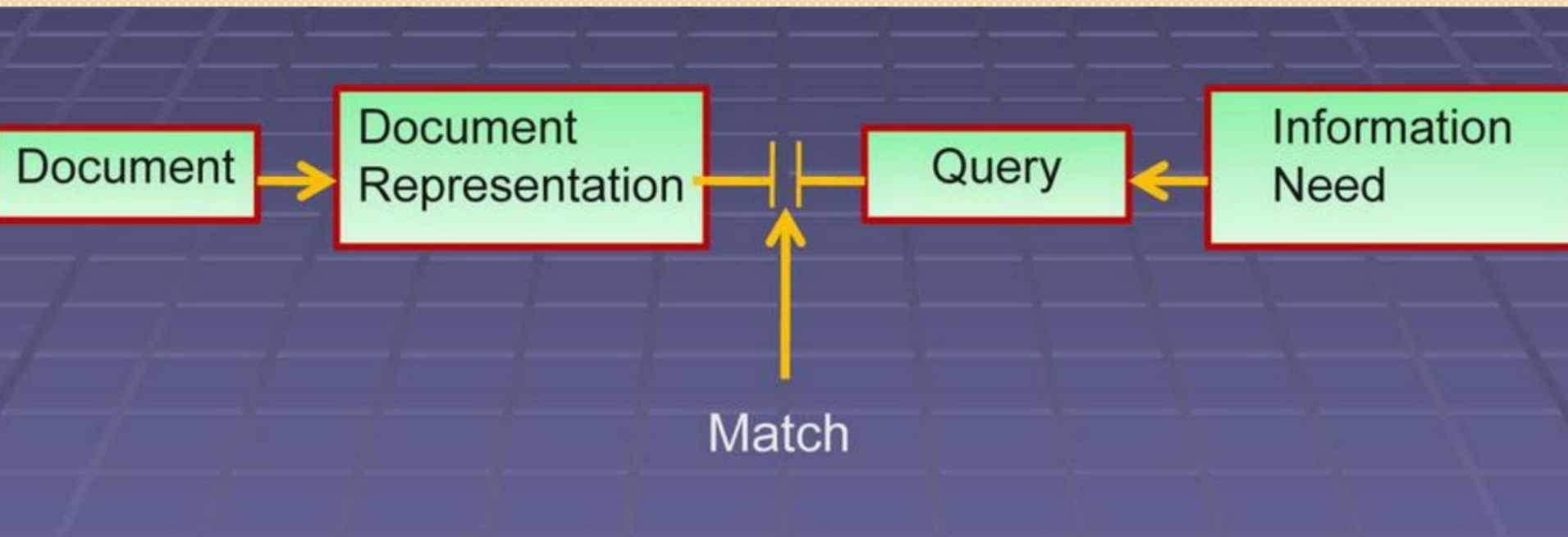


Source: A Digital POWRR Workshop:
<http://digitalpowrr.niu.edu/>

Five Basic Aspects of Digital Object



THE CLASSIC INFORMATION RETRIEVAL MODEL



Source: (Modified from) Bates, M. J. (1989). The design of browsing and berrypicking techniques for the online search interface. *Online Review*, 13(5), 407-424.

Inverse Relationship of Precision and Recall

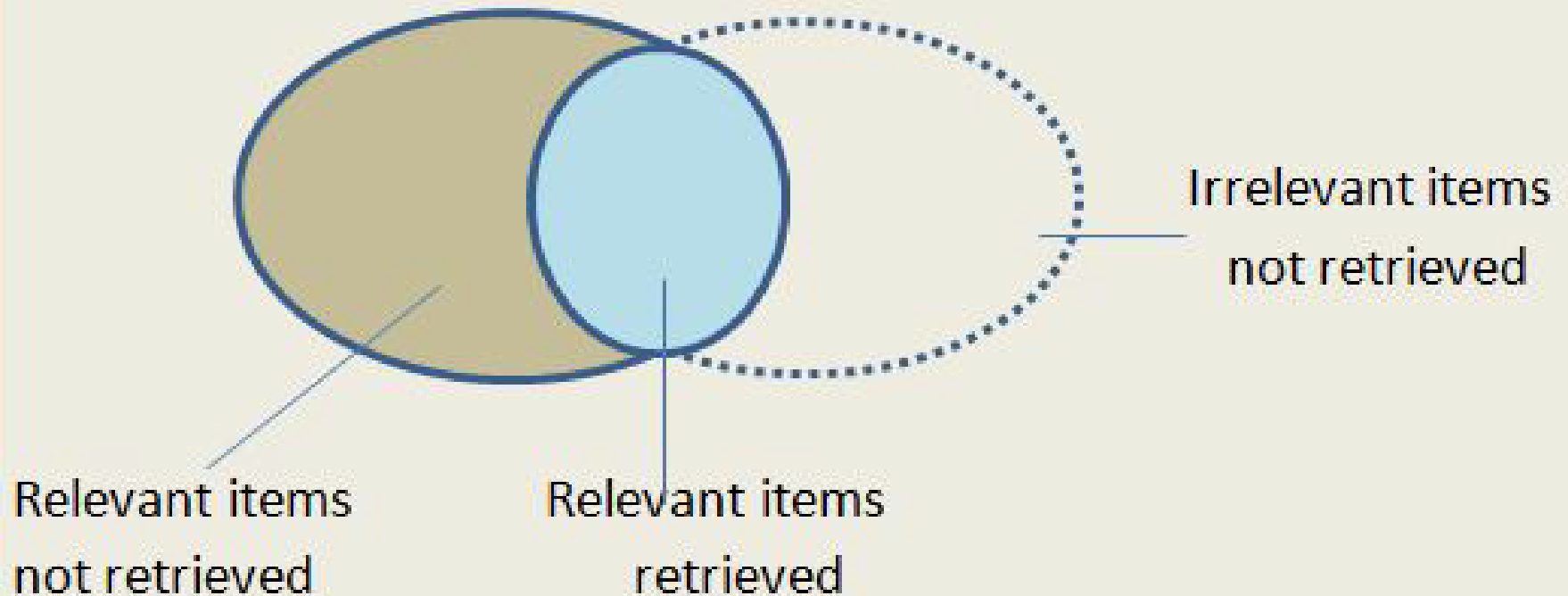
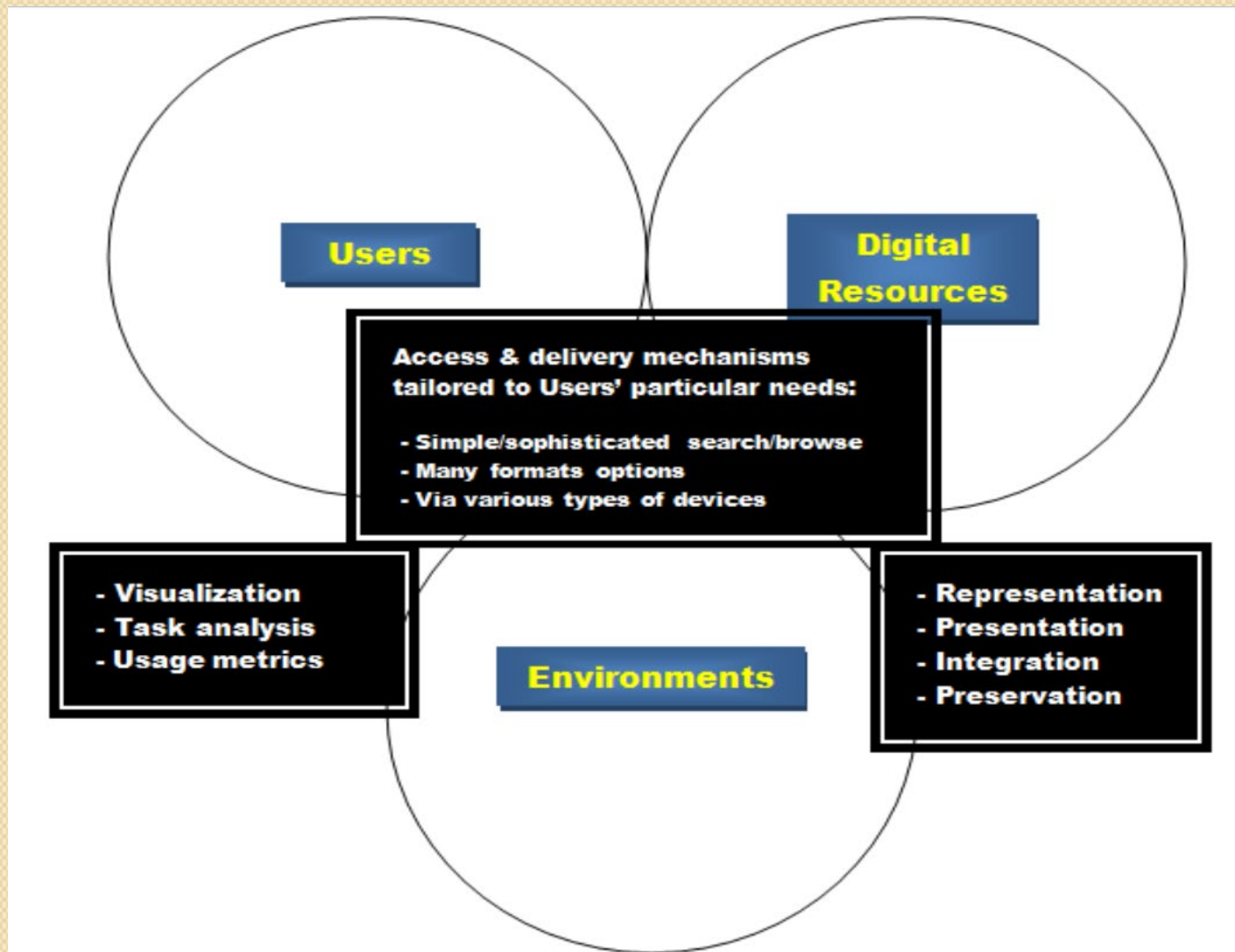


Figure-1: PRECISION & RECALL



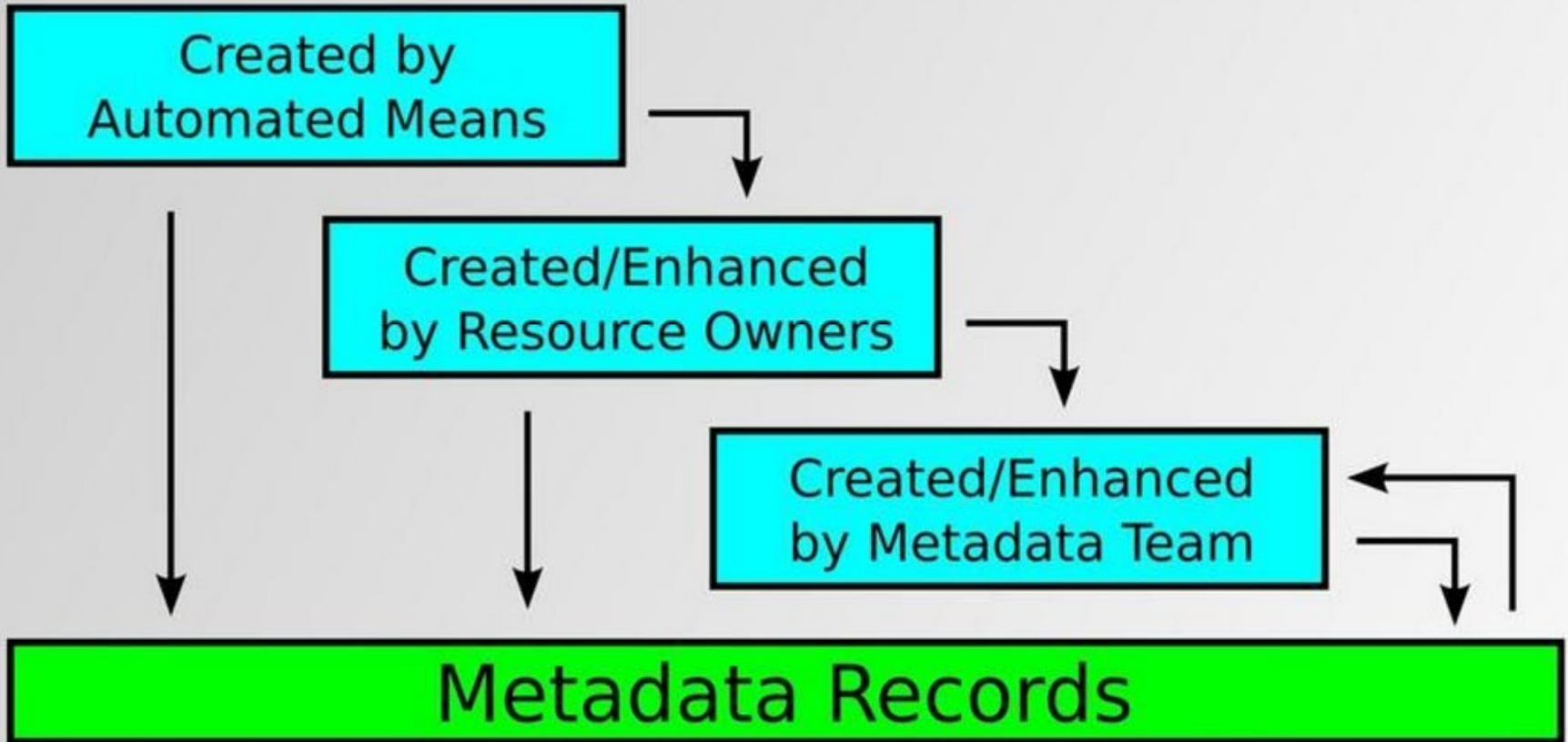


What is Metadata?

- **Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called data about data or information about information.**

Source: NISO. Understanding Metadata.
<http://www.niso.org/publications/press/UnderstandingMetadata.pdf>

Capturing Metadata



Digital Curation Workflows Considerations

Diverse Collaborators

- Libraries
- Museums
- Historical Societies
- Individuals

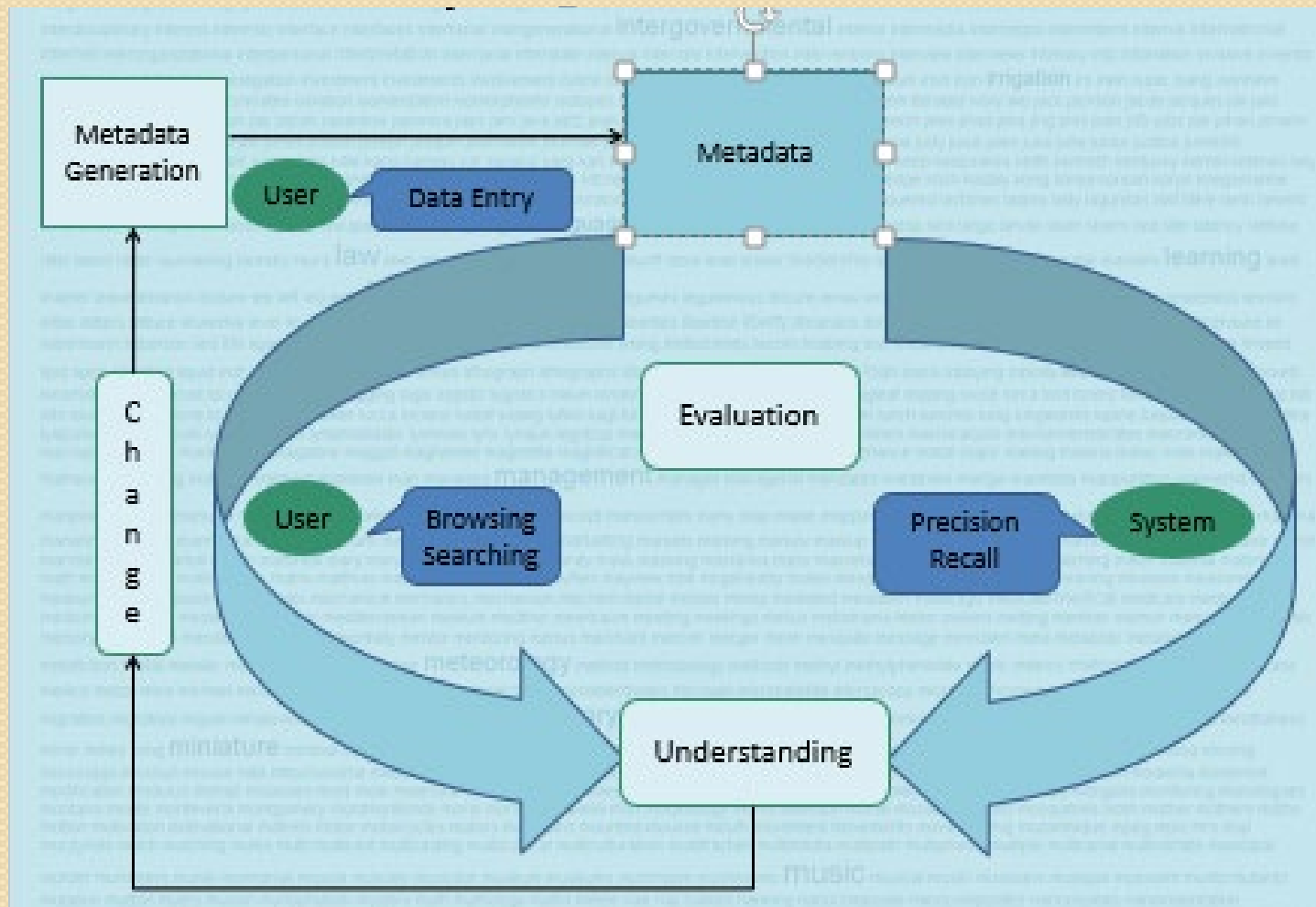
Heterogeneous Collections

- Scholarly Documents
- Museum Objects
- Archives
- Historical Documents
- Photographs

Diverse Users

- Students
- Researchers
- Historians
- Geneologists

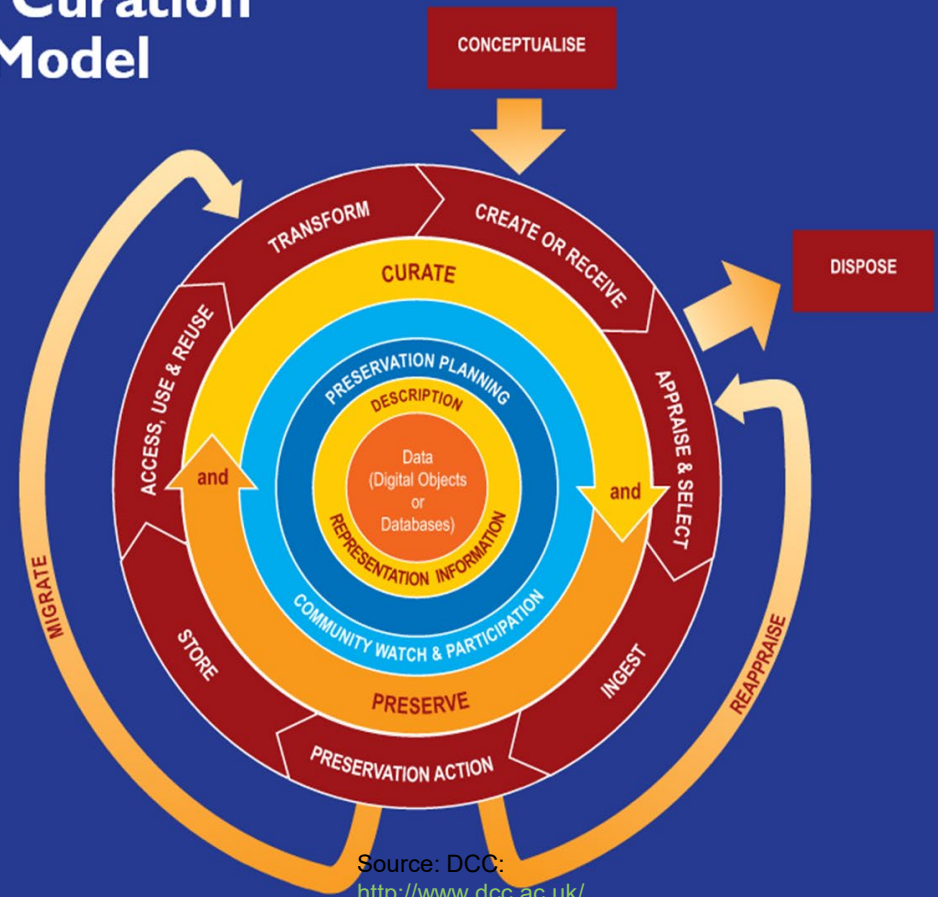
A Phased Approach to Ensuring Long-Term Access to Digital



Various Best practices and Conceptual Data Models for Digital Curation or Preservation: [DCC](#)

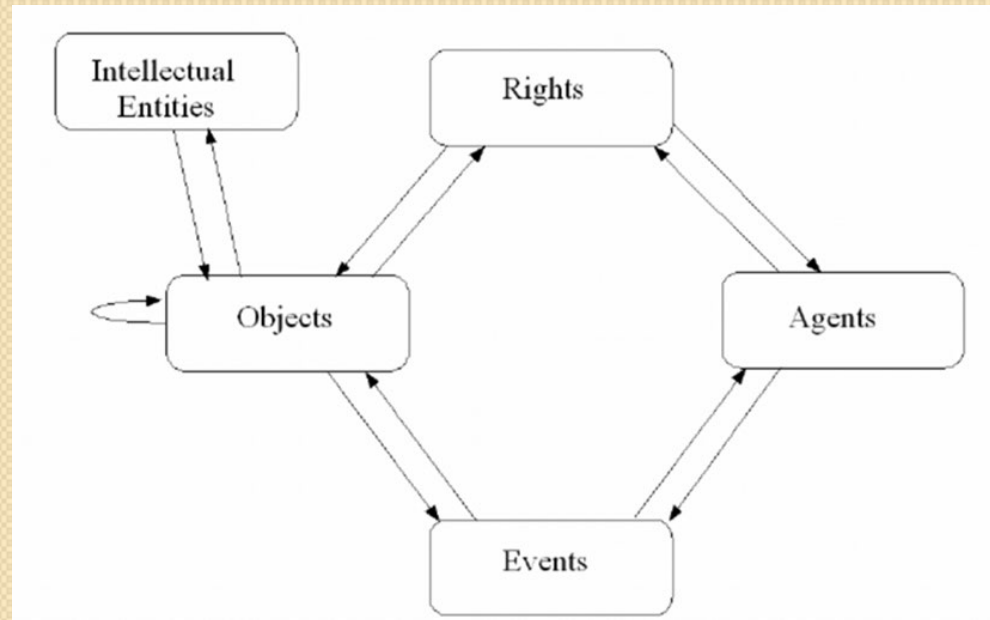
The **Digital Curation Centre (DCC)** was established to help solve the extensive challenges of digital preservation and digital curation and to lead research, development, advice, and support services for higher education institutions in the United Kingdom.

The DCC Curation Lifecycle Model



Various Best practices and Conceptual Data Models for Digital Curation or Preservation: PREMIS

PREMIS (or *PRE*servation Metadata: *Implementation Strategies*) is an international working group concerned with developing metadata for use in digital preservation.

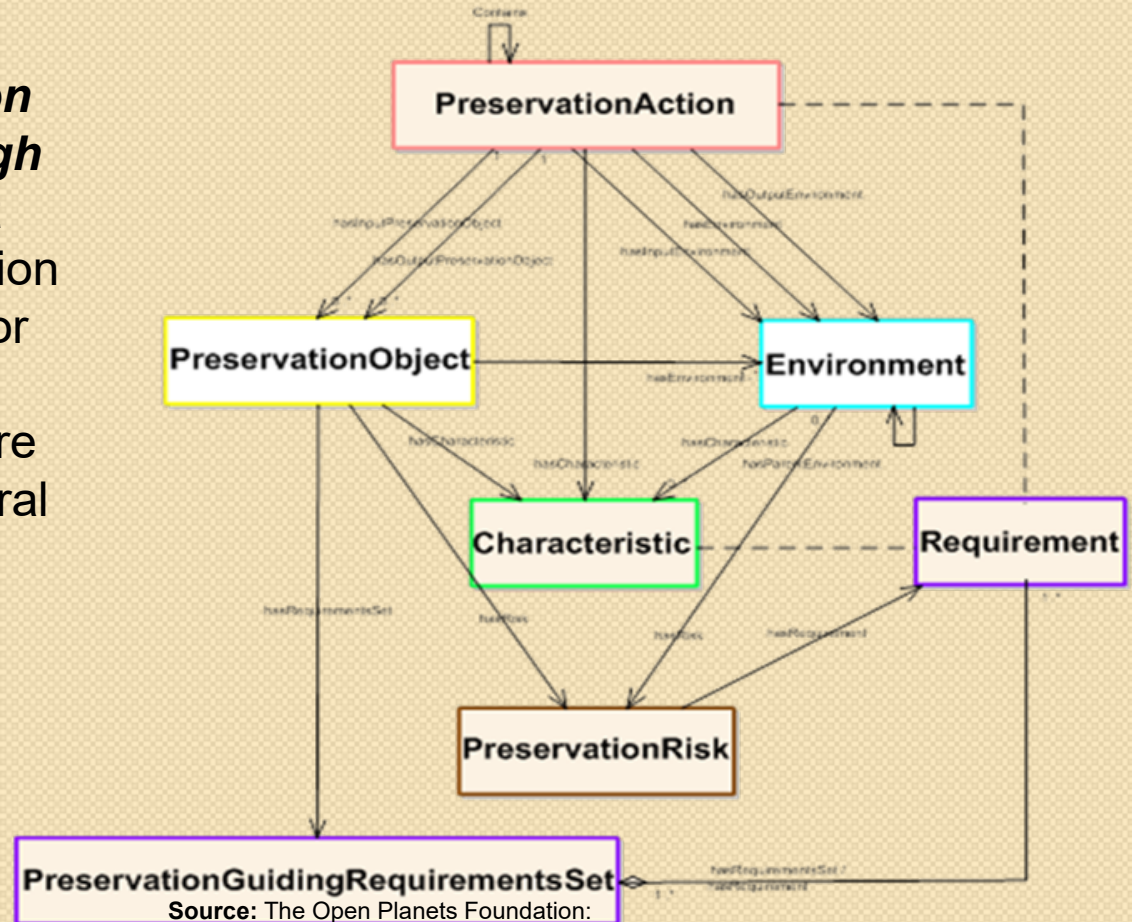


Digital materials require constant maintenance and migration to new formats as technology changes. In order to survive into the future, digital objects need preservation metadata that can exist independently from the systems which were used to create them. Without preservation metadata, digital material will be lost.

Source: PREMIS:
<http://www.loc.gov/standards/premis/>

Various Best practices and Conceptual Data Models for Digital Curation or Preservation: Planets

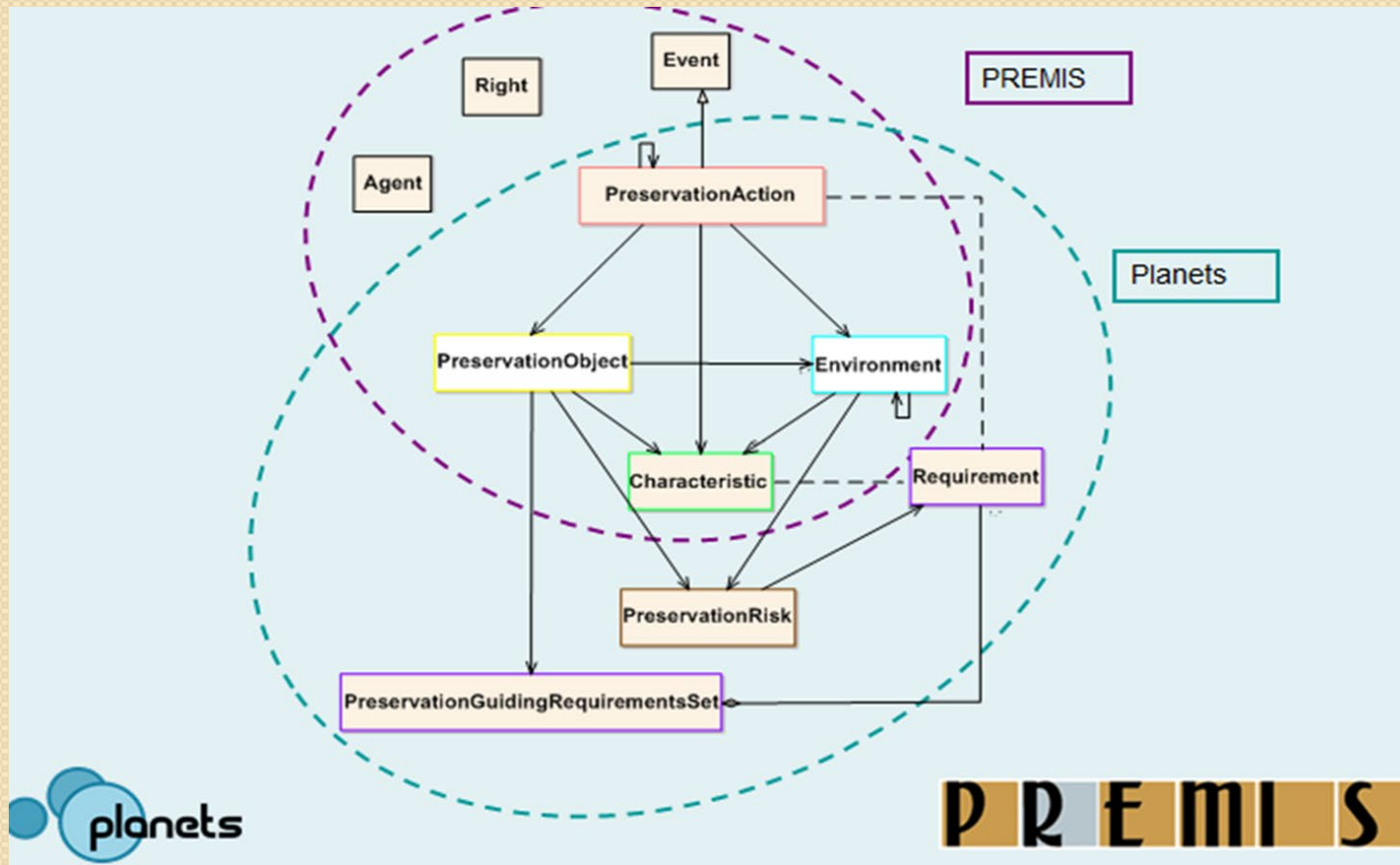
PLANETS (or the Preservation and Long-term Access through Networked Services) project addressed core digital preservation challenges. The primary goal for Planets was to build practical services and tools to help ensure long-term access to digital cultural and scientific assets.



Source: The Open Planets Foundation:

<http://www.openplanetsfoundation.org/>

No single Approach or Model Addresses all Aspects of Digital Curation or Preservation Issues





A GLOBAL NETWORK OF EXPERTS ARCHIVING THE WEB FOR FUTURE GENERATIONS.

[Learn More About IIPC](#)



I

P

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WHY ARCHIVE THE WEB?

Information published on the World Wide Web today will be the primary resources for future





Definition of Terms:

► **Web archiving :**

Web archiving is the process of collecting portions of the World Wide Web to ensure the information is preserved in an archive for future researchers, historians, and the public..

Internet Archive:

<https://archive.org/>

Search the history of over 484 billion pages on the Internet.

WayBackMachine





Web

Texts

Video

Audio

Software

Image

Search

Anonymous



EXIT BETA

FEEDBACK



Internet Archive is a non-profit library of millions of free books, movies, software, music, and more.



7.6M



1.9M



2.3M



96K



948K



148K



119K

Universal Access to Knowledge

GO

Announcements

Locking the Web Open, a Call for a Distributed Web

Knight Foundation to Support Toolsets for Building Libraries Together

The New Yorker: The Cobweb—Can the Internet be archived?

[SEE MORE](#)

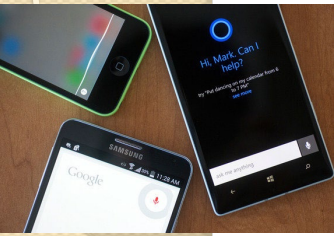
Emerging Trends

- **Various studies and conferences**

highlighted:

- The growing number of non-traditional LIS jobs.
 - **Data/Information/Knowledge managements**
- The gaps between job requirements and the current LIS programs.
 - **Interdisciplinary Collaboration in Curriculum Developments**

Language Technologies



- Systems that perform language-related tasks
- Some examples: keyboard input programs, machine translation, predictive text, text-to-speech, voice recognition, part-of-speech labeling, syntactic analysis etc.
- Applications using these systems: dialogue systems, digital assistants, search engines, health information systems, learning platforms etc.

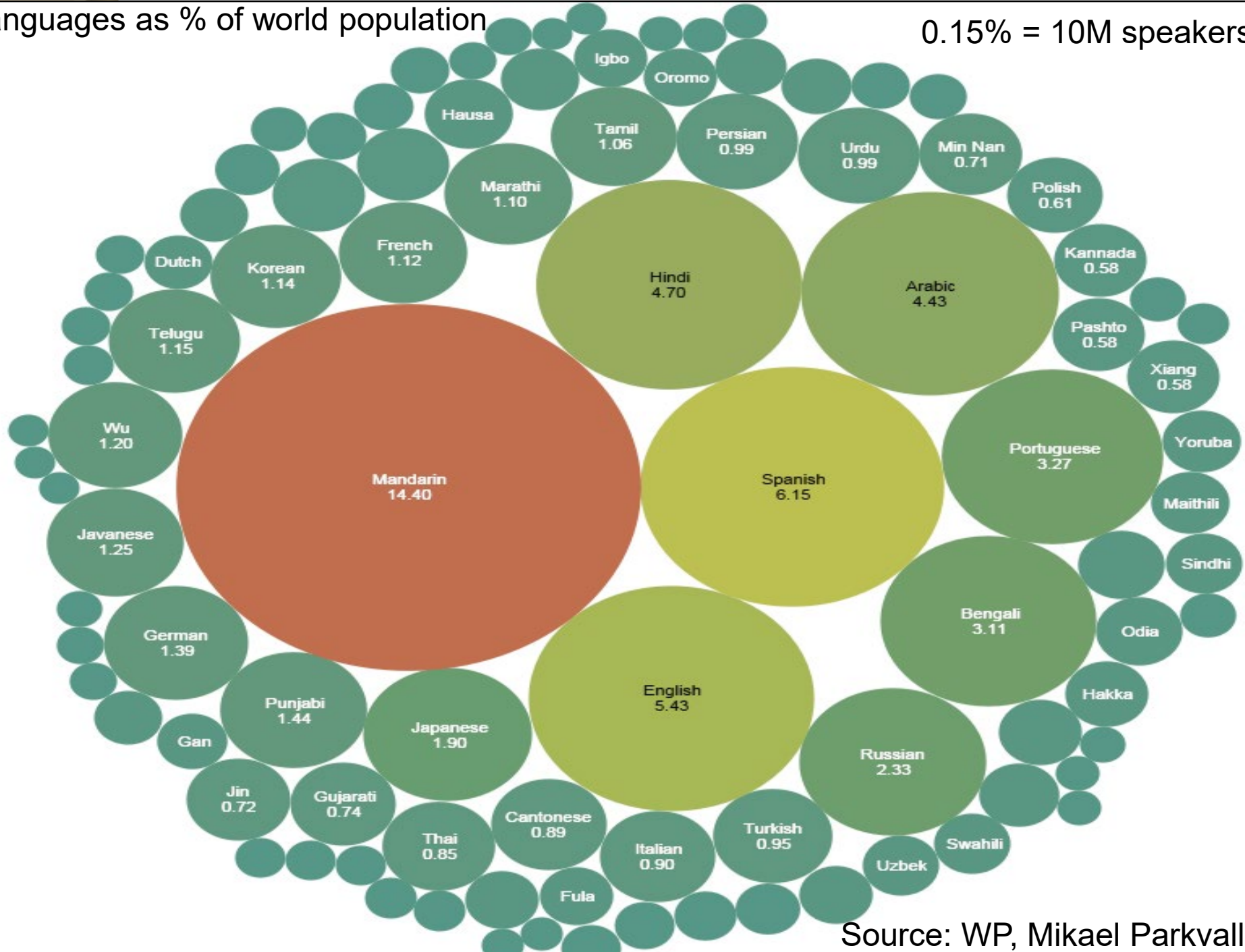


Low-resource Languages

- More than 7000 languages spoken in the world
- Many of these endangered/threatened – losing speakers at a rapid rate
- Fewer than 10 can be considered high-resource from the perspective of language technologies
- Language technologies support access to information, education, participation in global community

Languages as % of world population

0.15% = 10M speakers

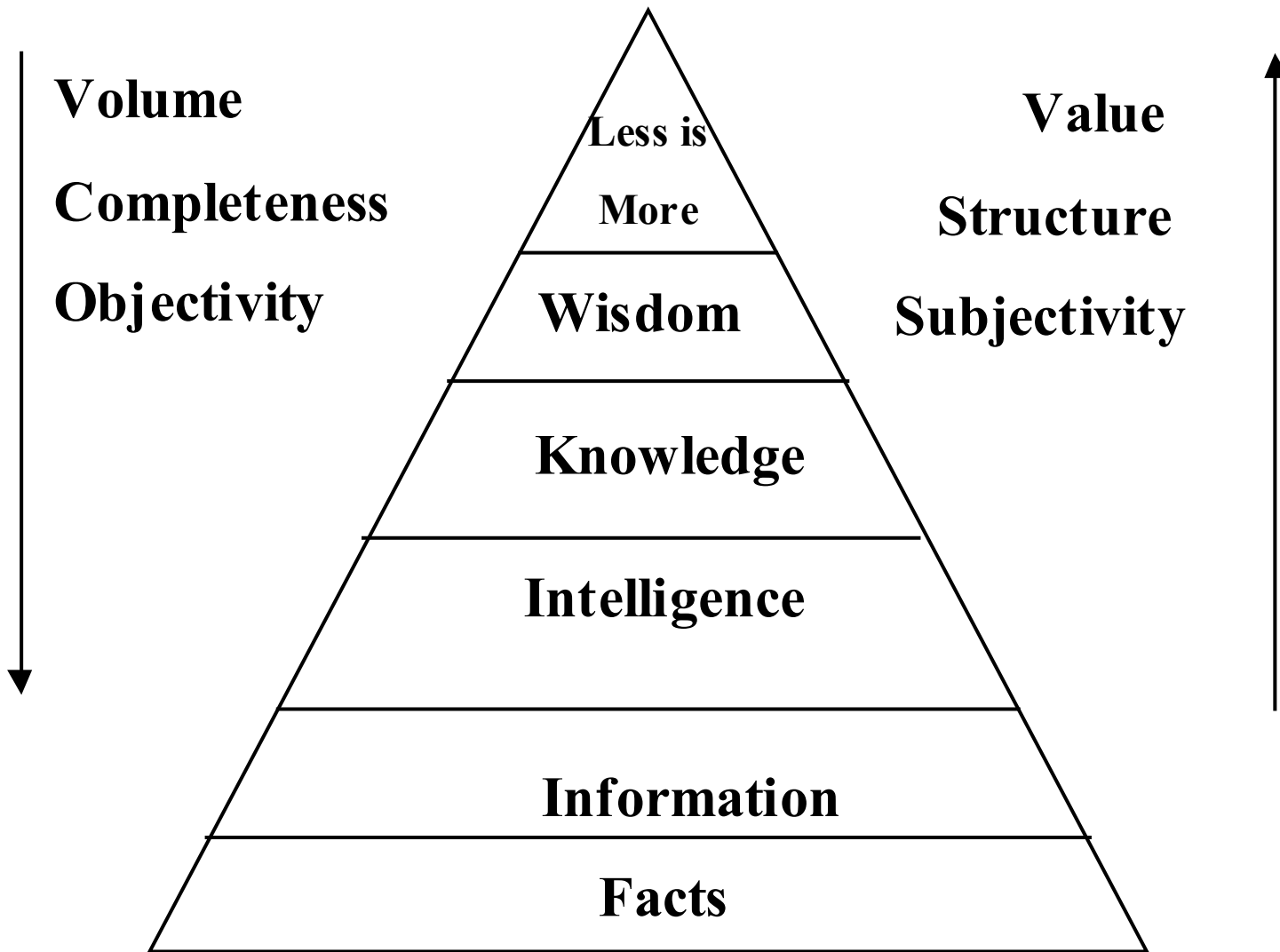


Source: WP, Mikael Parkvall

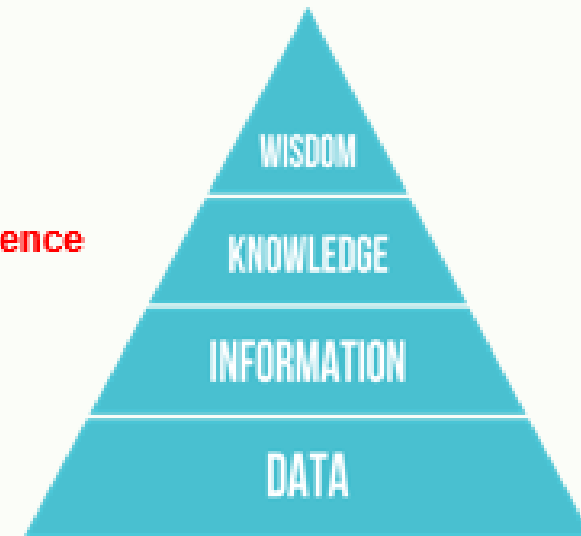
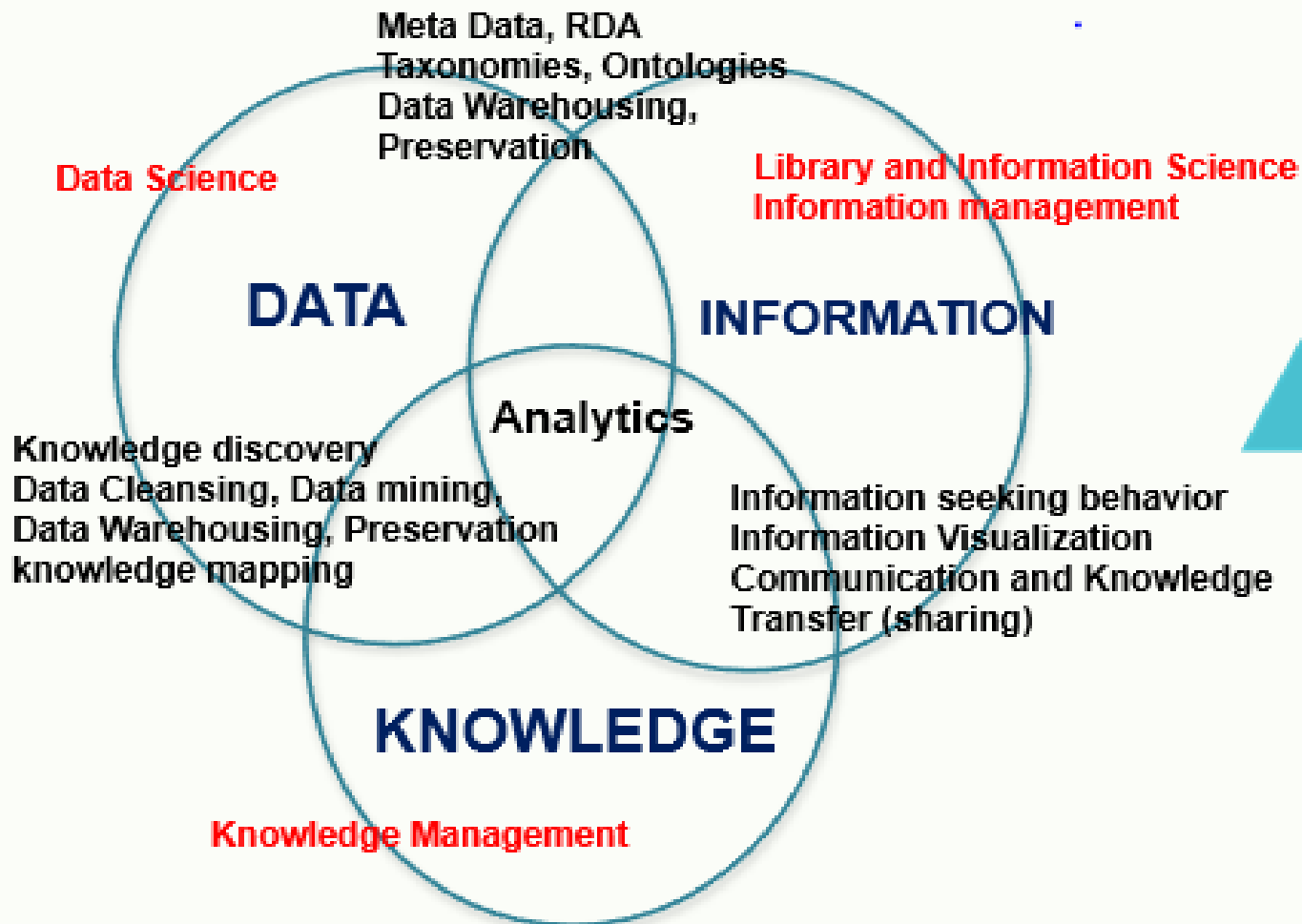


Possible Research Area in Broadening Access to Ethiopian Languages

- Adapting current machine learning methods for low-resource languages, using cross-lingual approaches
- Developing computational methods to support documentation of endangered languages
- Improving data availability and standardization, for example with archival materials for endangered languages



The Information & Knowledge Profession



Rethinking DIKW

LIS Schools and Professional Societies

- The LIS schools evolve continuously adding new programs to advance the information field, and prepare students to meet the demands of the 21st Century.
- Professional organizations have provided forums in which information scholars, researchers, educators, and professionals could share their insights on the ever-expanding horizon in the field of library and information science.

Information Science Programs

Historical Perspectives

- **Different geographical locations, different systems and different teaching philosophies (US, Britain, Europe, Africa, and Asia; Different Levels such Graduate vs Undergraduate)**
- **The inherit gap between theory and practice**
- **ICT and resources (size, independence of the programs, Level of expertise, IT, digitization etc.)**
- **Programs are shaped by location & expectations (Social sciences, Humanities, Sciences, engineering, Business, Fine Arts etc.)**
- **Diversity issues, librarianship is views by many as "woman's profession" with more than 80%. Despite that 73% of the library directors are men*. How is the shift to information science changing the diversity conversation?**

Information Science Programs Trends and Changes....

- **Branding and repositioning (Name change, Dual Programs, ...)**
- **Relocation and merger with other units (Communication, Computer Science, Learning Technologies ...)**
- **Expansion of LIS programs and specializations (Health Informatics, Cybersecurity, Data Science, Data Analytics,**)
- **Pedagogical shift (Online offering, collaboration, Engagement)**
- **The multidisciplinary and interdisciplinary nature of the discipline (Specialization & Concentrations within LIS programs, Dual Degrees, Graduate Academic Certificate etc.)**
- **The shift from a traditional library science focus to the broader information science focus required IS schools and IS programs to prepare students for jobs outside the traditional market and possibly for jobs that might not exist today.**

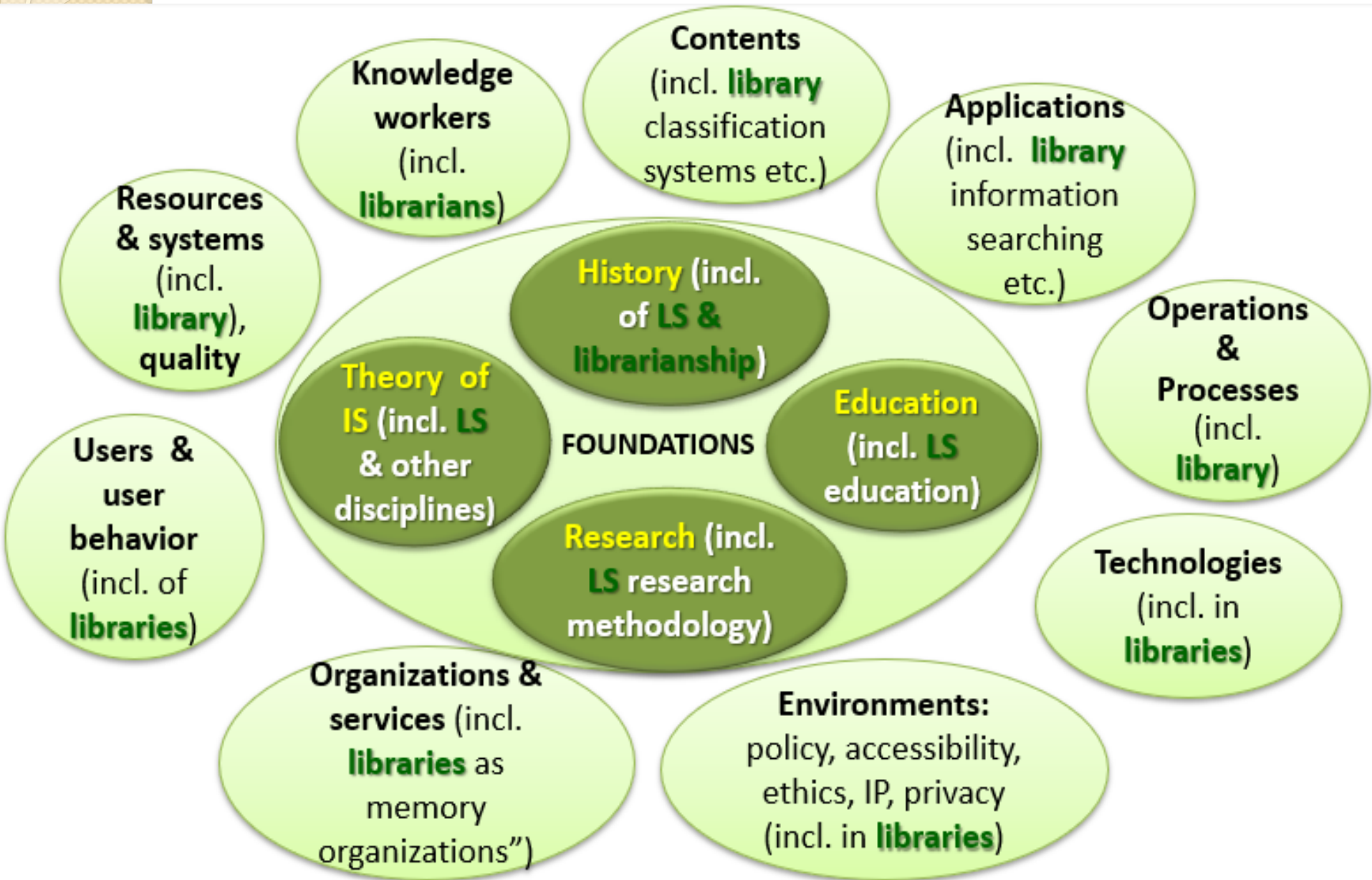
Information Professionals Challenges

- Engage in problem-setting, problem-solving and developing creative ways forward
- Demonstrate autonomy of thought and decision-making within the context of working with other professionals
- Able to transcend the boundaries of their discipline and work with issues holistically while contributing their particular expertise and skills
- Engage in continual learning and development at a number of levels, from basic updating to re-evaluation of their overall practice and envelope of capability
- Go beyond uncritical acceptance of a professional code, to a deep-rooted commitment to personal ethical standards & professional practice principles.

Information Professionals Challenges ...

- Moving from traditional predefined tasks and functions to an environment with increased complexity and uncertainty requires certain level of competencies (knowledge, skills and attitude ...).
- Competencies and marketable skills (nice to learn vs necessary to learn). How do we create a balance?
- The challenge of creating rich and flexible curriculum. Most IS programs are reducing the number of required courses in favor of giving students more flexibility in choosing electives and therefore strengthening their specialization and concentrations.
- Grounding students in theory and research. For students to adapt, innovate and function in a complex environment, they need to master theory and acquire research skills.
- The challenge for IS Schools and IS programs in creating rich curriculum and competency based education is finding the resources and expertise.

Structure of Information Science (IS)



**Information
Systems &
Management**

**Information
Visualisation
& Navigation**

CISA

**Human-Machine &
Human-Information
Interaction**

Information Governance in the Big Data Era

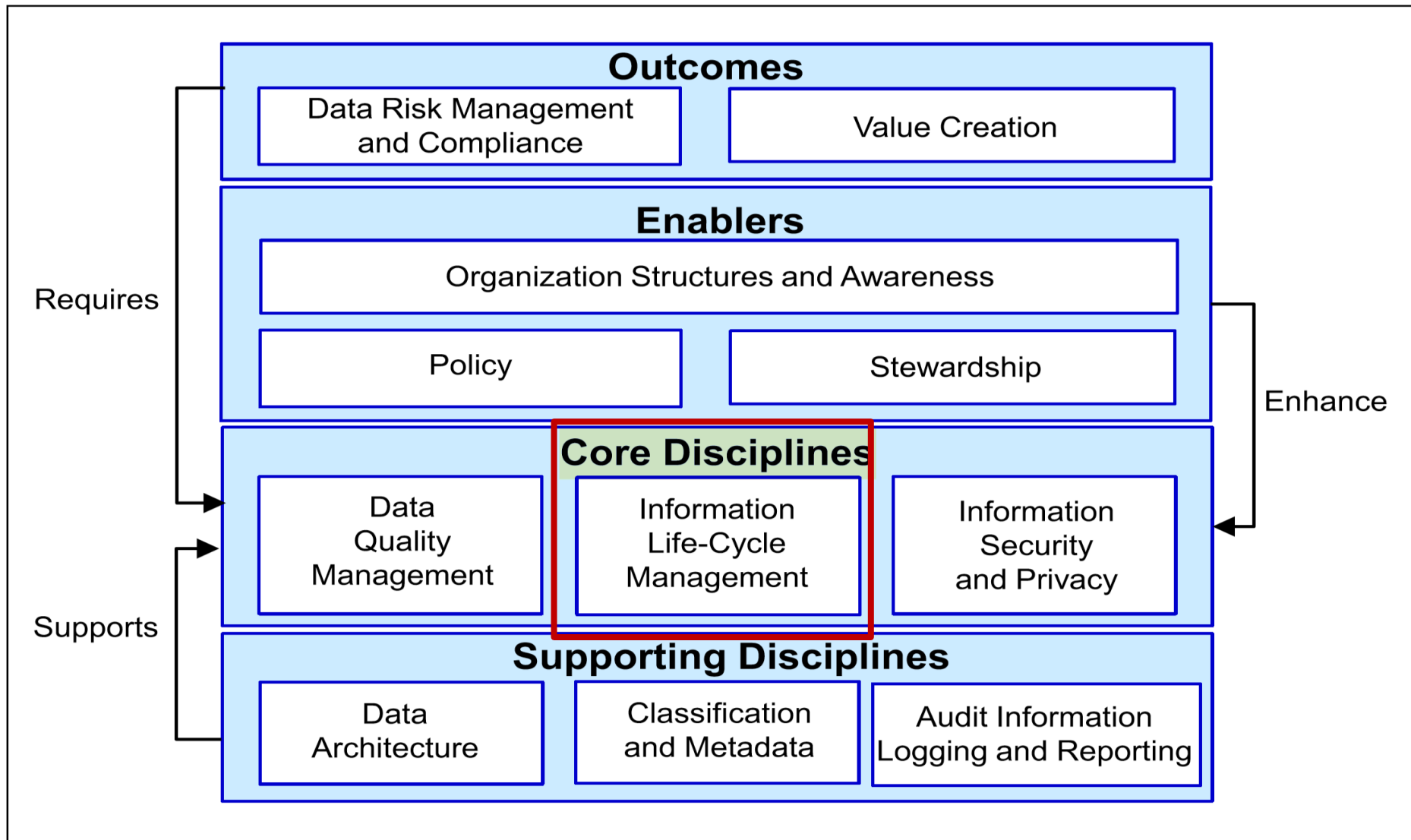


Figure 2-1 IBM Information Governance Capability Maturity Model

Source: Ballard, C. et al. (2014) Information Governance Principles and Practices for a Big Data Landscape. IBM Redbooks publication. <http://www.redbooks.ibm.com/redbooks/pdfs/sg248165.pdf>

Information Professionals' Contributions to Cybersecurity and Data Privacy



Information Governance Initiative
www.iginitiative.com

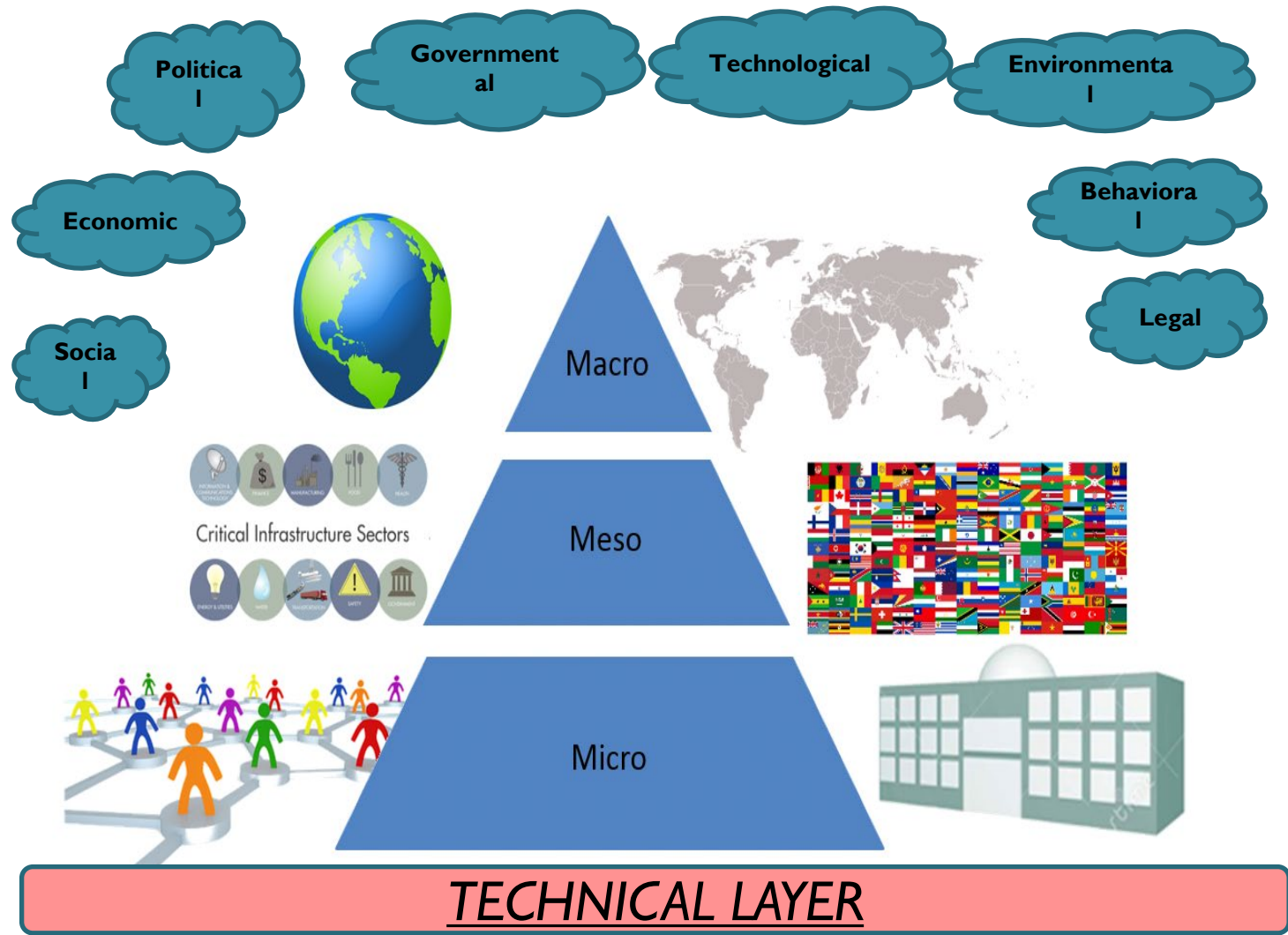


Data derived from the Information Governance Initiative 2014 Annual Report. More info at www.iginitiative.com. © 2014 Information Governance Initiative. Licensed under the Creative Commons Attribution-NonDerivatives 4.0 International License. This license allows for redistribution, commercial and non-commercial, as long as it is passed along unchanged and in whole, with credit to the Information Governance Initiative.

Pedagogic Cybersecurity Framework (PCF)

Model	OSI Model (ISO, 1984; 1994)	Extended OSI Model (Gregg et al., 2006)	Pedagogic Cybersecurity Framework (PCF) (Swire, 2018)
Layers			
	10	-	-
	9	-	-
Human Layers	8	-	People
	7	Application	Application
	6	Presentation	Presentation
	5	Session	Session
Technical Layers	4	Transport	Transport
	3	Network	Network
	2	Data Link	Data Link
	1	Physical	Physical
			Nation
			Government
			Organization

The Cyberspace vs. Information Environment



The Cybrsecurity Domain Mape



Cybersecurity in LIS Schools – A Study

- Selected 18 iSchools
- Total of 212 Programs & 328 tracks/concentrations were analyzed
- Only 11 (5.2%) fully-fledged Cybersecurity/Information Assurance programs
- Only 28 (8.5%) fully-fledged Cybersecurity/Information Assurance tracks/concentrations

Cybersecurity in LIS Schools

- Cybersecurity/Information Assurance programs were mostly at the graduate (master's, Ph.D., and graduate certificate)
- More Cybersecurity/Information Assurance courses are offered at the undergraduate level
- Courses cover a broad spectrum of topics – from network security and cryptography to cybercrime, law, and privacy – reflecting the interdisciplinary nature of LIS programs
- A gap remains. LIS schools need to take advantage

Examples of most recent professional events fostering interdisciplinary collaboration

- ASIS&T 2018 workshop *Big Metadata Analytics*
- JCDL 2019 workshop *Organizing Information, Data & Knowledge in the Big Data Environment*



Conferences on LIS



“Exploring learning in a global information context”

- **ALISE-2019:**
 - The Conference theme is *Exploring Learning in a Global Information Context*.
 - Hope to reiterate that education for LIS is truly a global enterprise.
 - Intended to encourage engagement across the globe from those in LIS, as well as those in cognate fields such as archives, knowledge management, information management, media studies, informatics, data science, computer science, communication, etc.

Opportunities for LIS

- **What is the job market like for LIS?**
 - Are the trends that we discussed so far indeed, creating KM jobs?
- **Who are the potential employers?**
 - Identify the diverse job postings that require LIS skills but in different names

Areas of Growing Importance

Digital Curation

Electronic Resource Management

Information and Knowledge Organization

Diversity, Cultural Heritage and Talent Management

Knowledge Management Processes and Practices

Information Architecture

Cybersecurity

The Social Context of Information

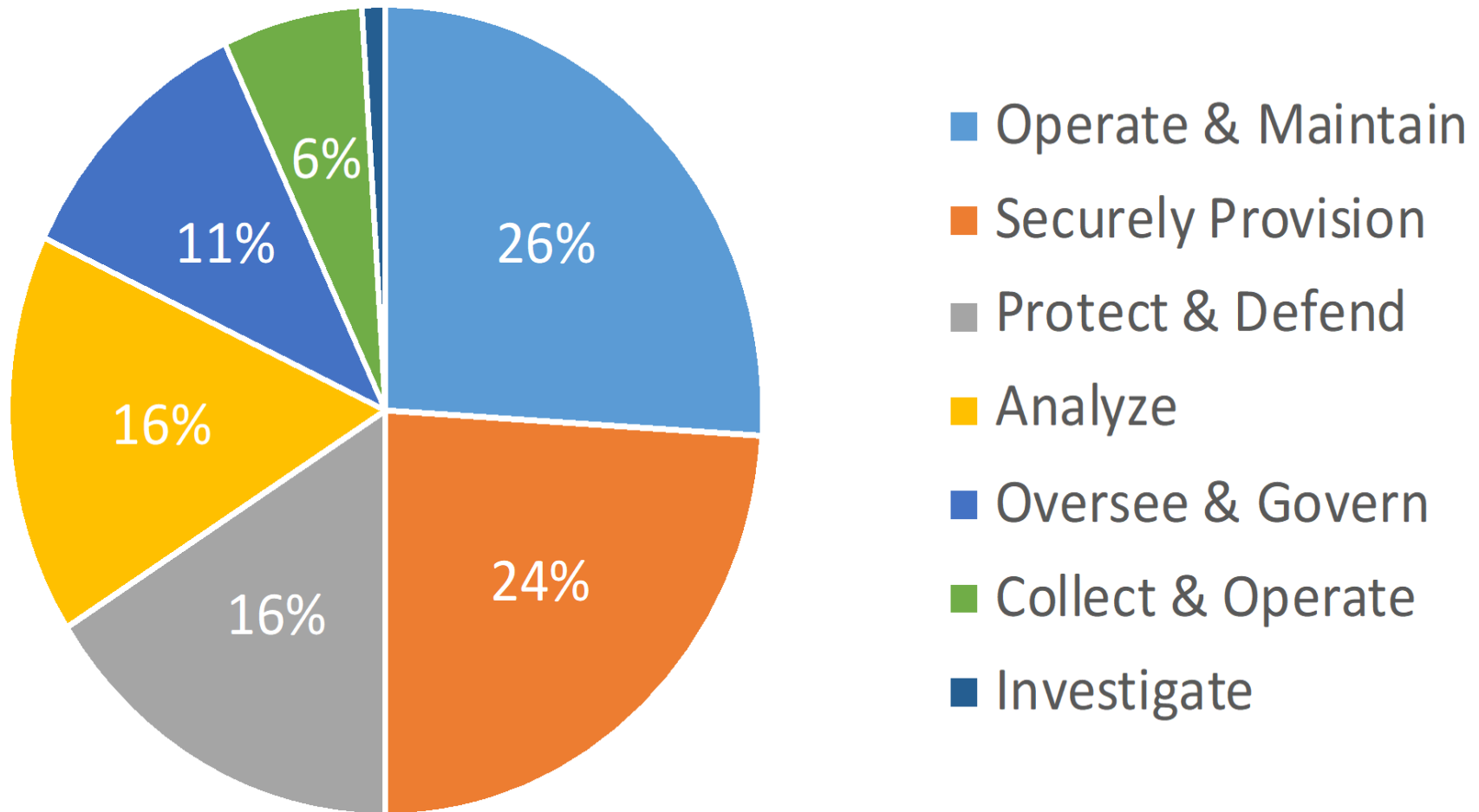
Communities and Networks

Discourse and Identity

Data Science and Data Analytics

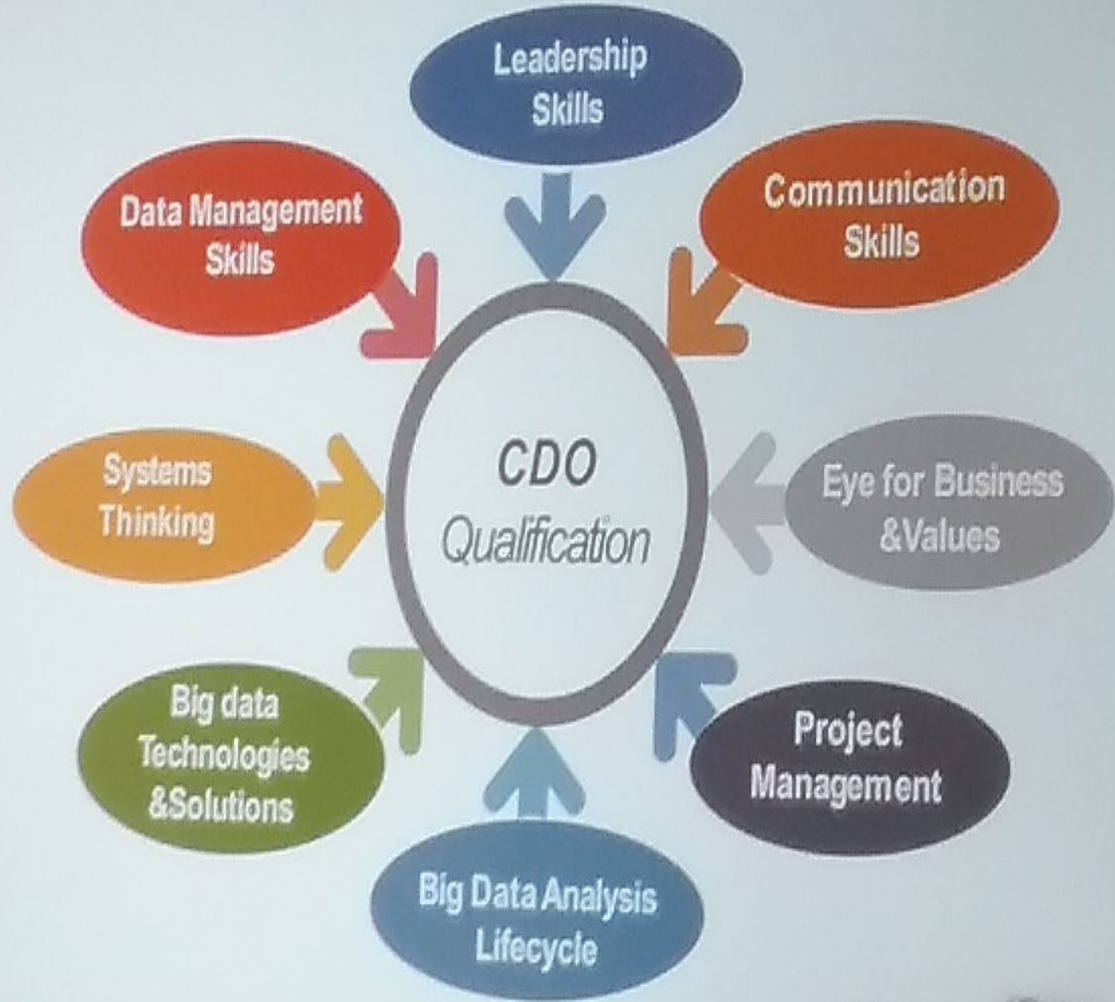
Professionalization and Professional Identities

Cybersecurity - Areas of Job Openings



US Cyber Security Job Openings based on the NICE Framework – Source: CyberSeek

iSchool students have an excellent potential to learn desired skills and characteristics of a Chief Data Officer (CDO)



CONCLUSION

- **Acknowledge the Impact of IT and leverage and take advantage the available tools and best practices.**
- **Considering the multiple stakeholders in the digital ecosystems, a collaborative approach is the only way to addressing Scholarly Communications and Digital Curation Challenges!**

Conclusion

- **Yes, with others, you can accomplish what you cannot accomplish alone.**
 - **Eg. Consortium**
- **“When spider webs unite, they can tie up a lion.”** *(Ethiopian proverb)*

Glossary

- **Aggregator** – A service that harvests content or metadata from multiple organizations to provide another mode of access.
- **Born-Digital** – “An item is born-digital if it has been generated entirely electronically by using a word processor” and/or electronic hardware such as a digital camera.
- **Digital Curation** – The management, preservation, and enrichment of digital resources.
- **Digital Preservation** – “The management process of ensuring digital objects and information are accessible over the long term. Development of standards, format compatibility, format migration, and systems interoperability are important aspect of this process.
- **Metadata** – Information about an object.
- **Open Access (OA)** – “Information readily available on the Web at no cost to users and without access restrictions.

Sources:

Assefa, S., Rorissa, A., Matusiak, K., Alemneh, D. and Hastings, S. (2014). *Open Access: The Global Scene*, Panel Presentation at 77th ASIS&T Annual Conference. October 31–November 5, 2014, Seattle, WA. Retrieved February 27, 2020 from: <https://www.asis.org/asist2014/abstracts/panels/90.html>

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Nicol, A., Caruso, J. &, Archambault, E. (2013). *Open Data Access Policies and Strategies in the European Research Area and Beyond*. Produced by Science-Metrix for the European Commission DG Research & Innovation. Retrieved February 27, 2020 from: http://www.science-metrix.com/pdf/SM_EC_OA_Data.pdf

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Thank you!

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