Risk Assessment of Digital Holdings

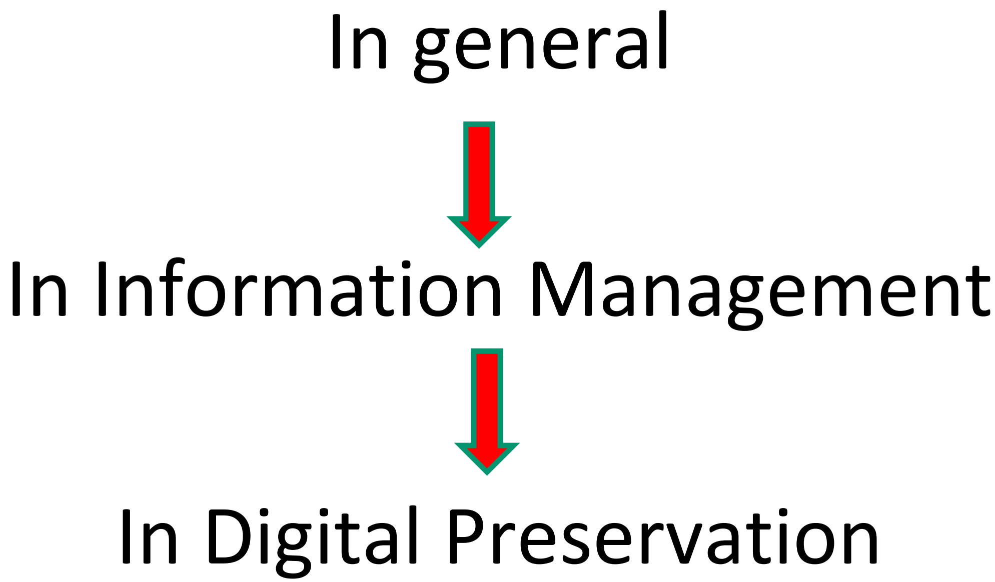
Angela Dappert

Digital Preservation Coalition

The TIMBUS Project

Overview

Risk management



In general

↓

In Information Management

↓

In Digital Preservation

Status of RM

in

Digital Preservation

- Examples
- Guidelines
- Applications
- Tools

Motivation: Risk Impact

- Damage to or loss of our digital assets
- Loss of access, understandability and authenticity
- Statutory or regulatory breach
- Deterioration of product or service quality
- Damage to reputation
- On repository staff
- On public well-being
- Damage to financial viability
- Environmental damage

Risk

is uncertainty of outcome

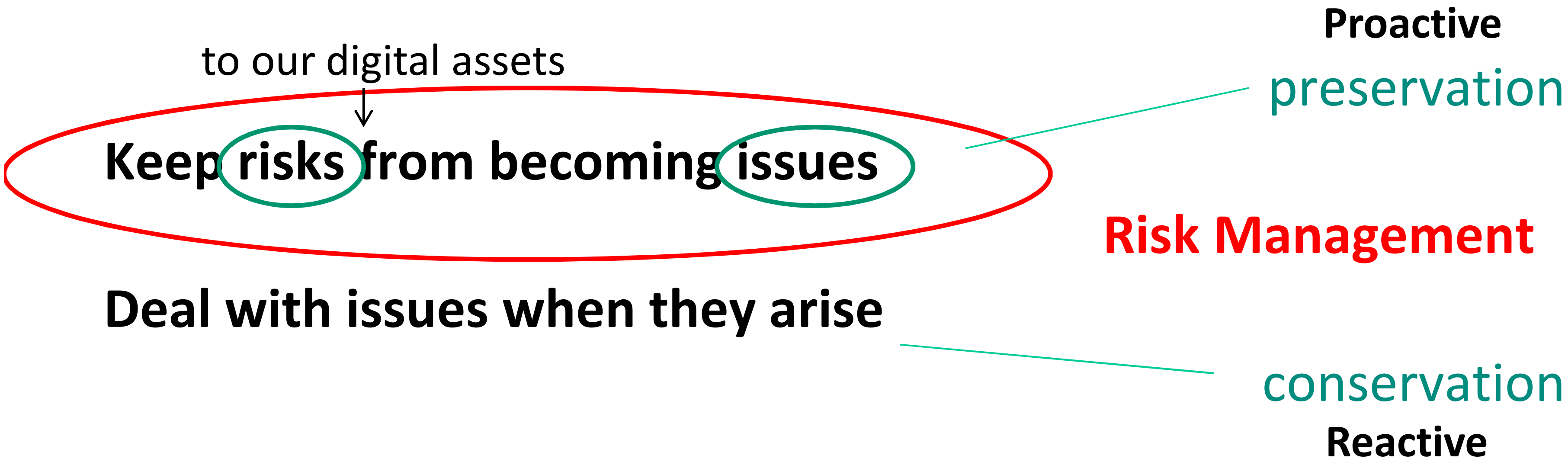
Digital Preservation

The series of managed activities necessary to ensure continued access to digital materials for as long as necessary.

Beagrie & Jones

How do you determine which action to take?

Digital Preservation



Proactive

preservation

to our digital assets

Keep risks from becoming issues

Risk Management

Deal with issues when they arise

conservation

Reactive

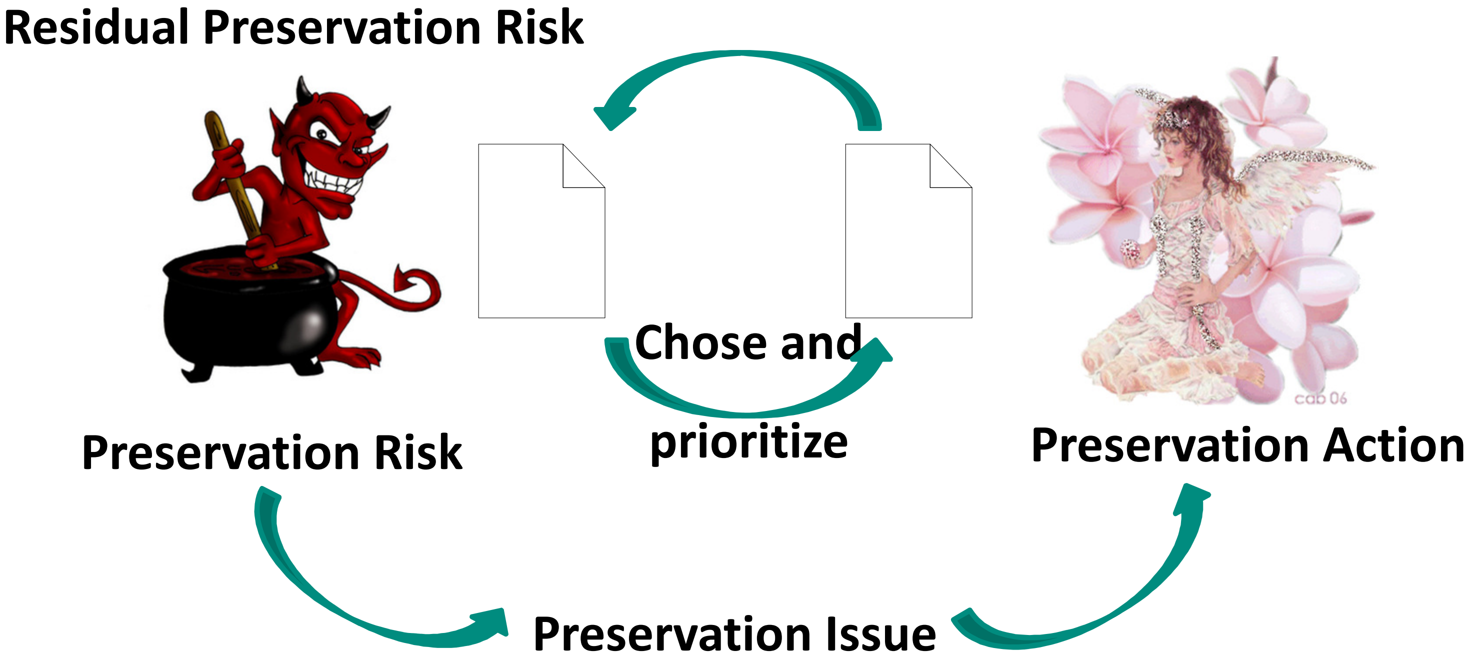
Risk: may happen

- ❖ negative impact - threat
- ❖ (positive impact - an opportunity)

Issue: has happened

Digital Preservation

- Central function: Risk Management



Residual Preservation Risk

Preservation Risk

Chose and prioritize

Preservation Action

Preservation Issue

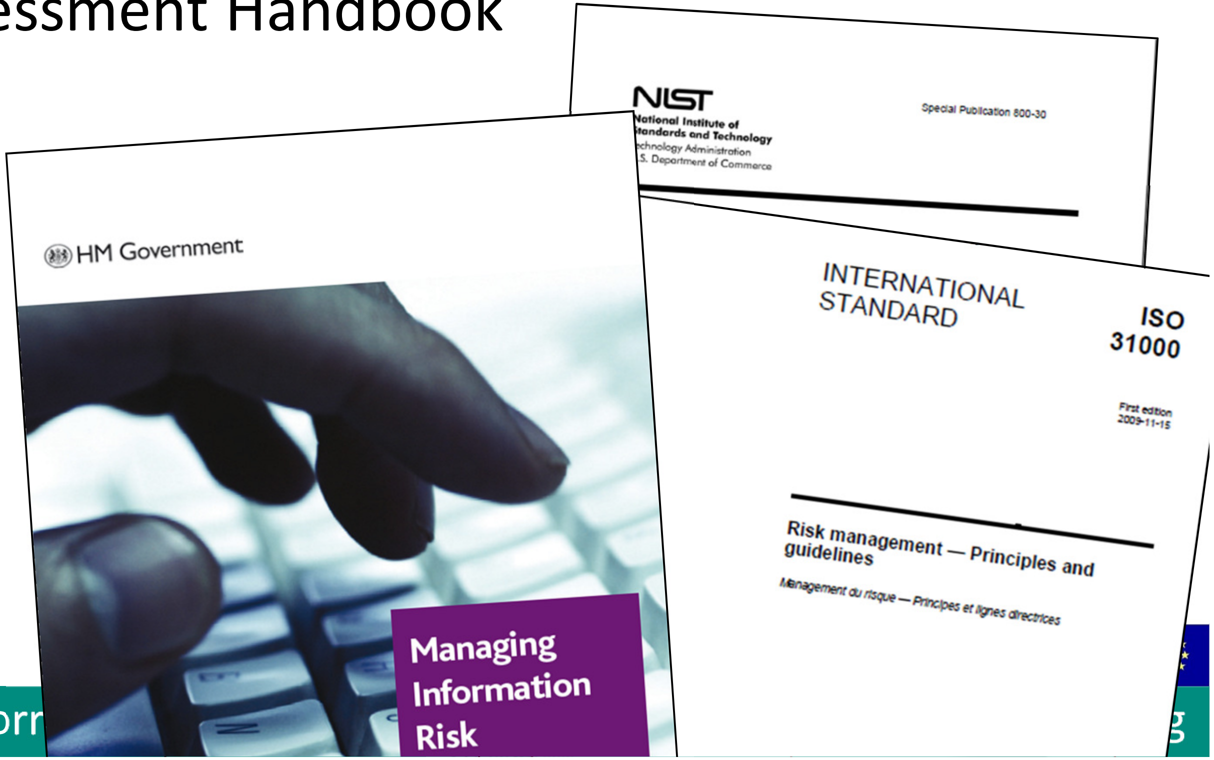
- A support function for the overall organization
- Integrated into the organizational flow

Risk Management – Familiar Terrain

Risk Management – Principles and Guidelines: e.g. ISO 31000

Information Risk Management &
Information Assurance Maturity Model IAMM

Digital Continuity
– e.g. TNA Risk Assessment Handbook



NIST
National Institute of
Standards and Technology
echnology Administration
S. Department of Commerce

Special Publication 800-30

HM Government

Managing
Information
Risk

INTERNATIONAL
STANDARD

ISO
31000

First edition
2009-11-15

Risk management — Principles and guidelines

Management du risque — Principes et lignes directrices

Risk Management

Principles

that need to be satisfied to make risk management effective

Framework

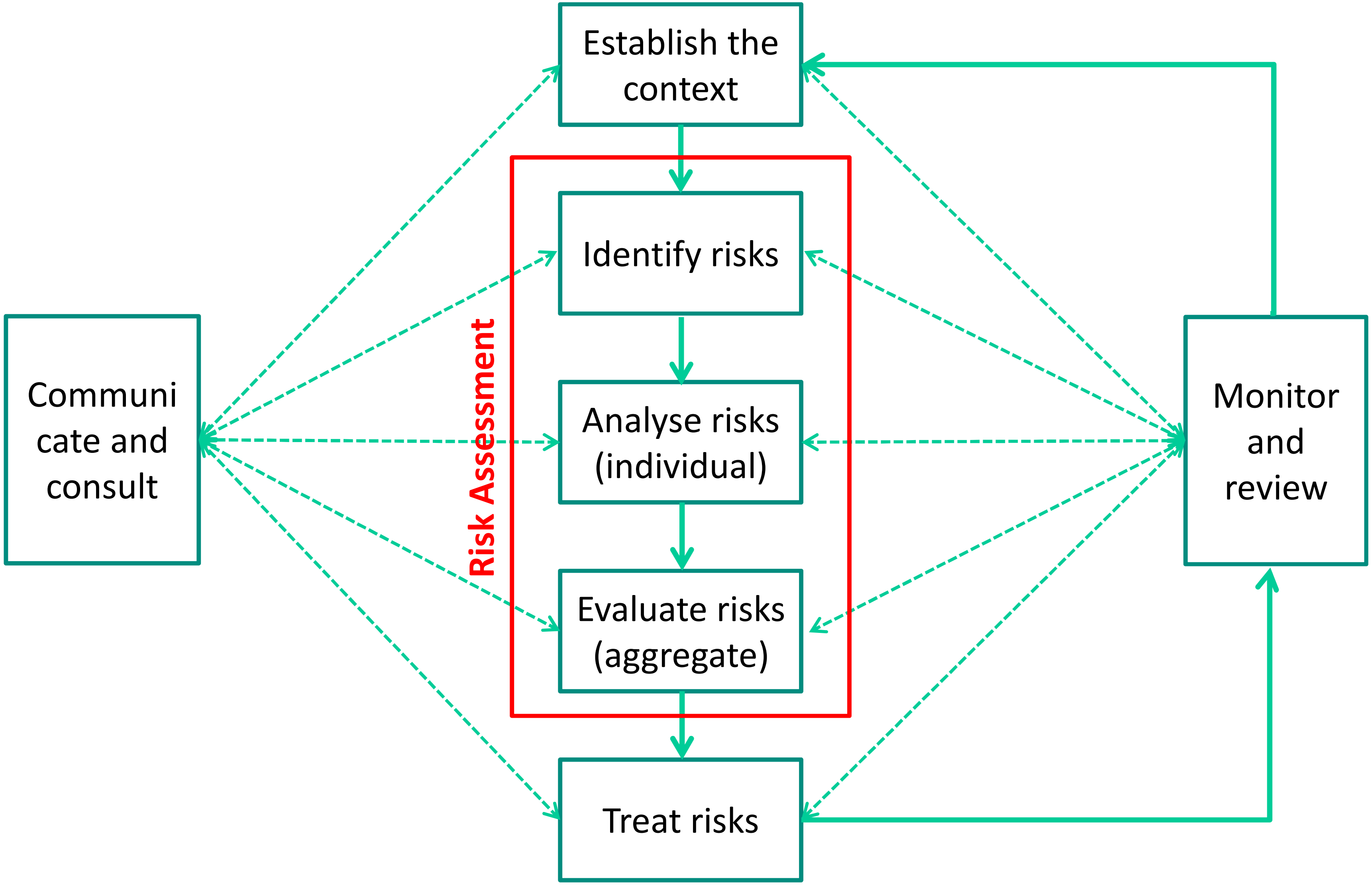
organizational arrangements for

- designing,
- implementing,
- monitoring,
- reviewing
- continually improving

risk management throughout the organization

Process

Risk Management Process



Establish the context

Identify risks

Analyse risks (individual)

Evaluate risks (aggregate)

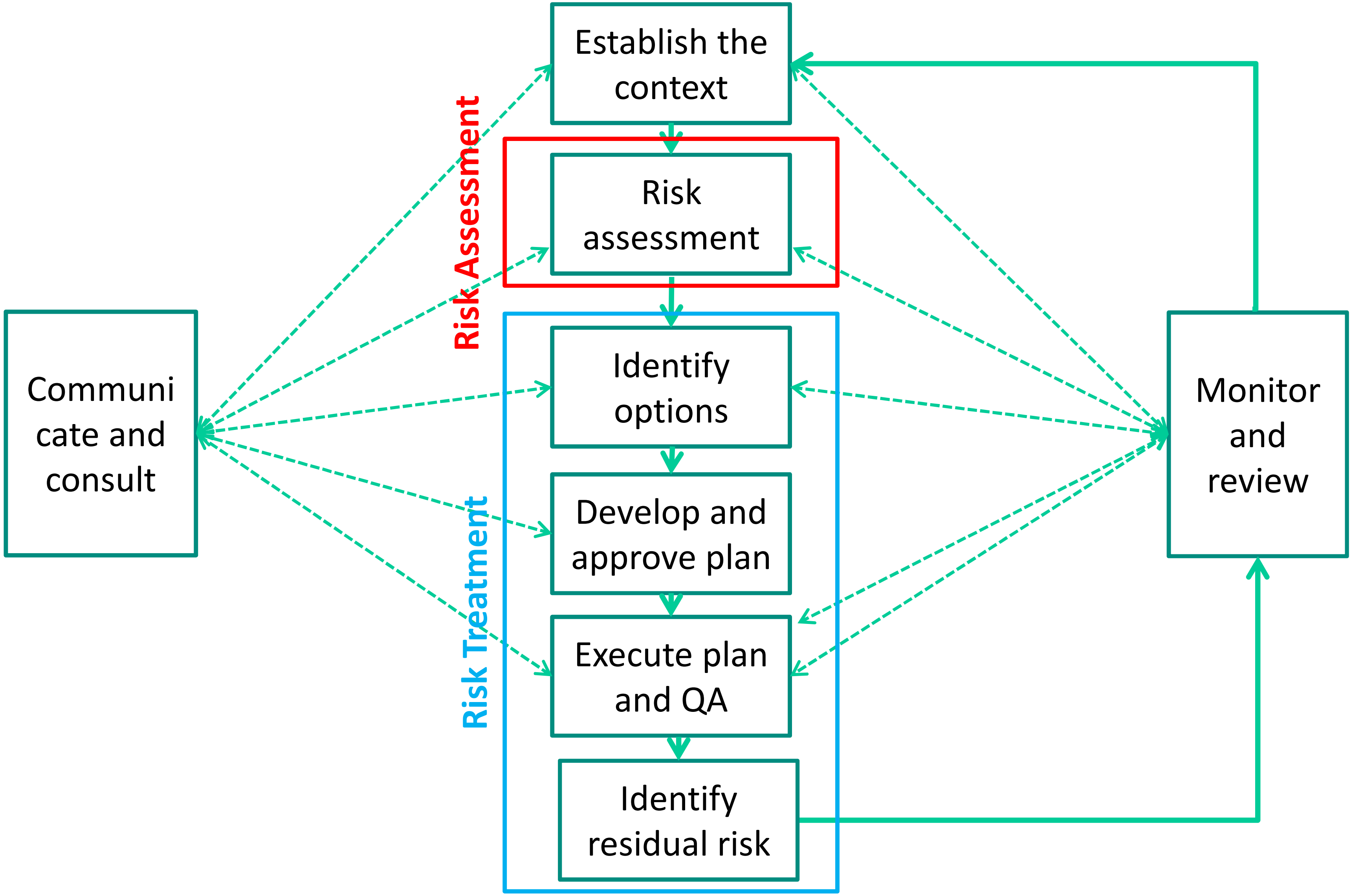
Treat risks

Communicate and consult

Monitor and review

Risk Assessment

Risk Management Process



Establish the context

Risk assessment

Identify options

Develop and approve plan

Execute plan and QA

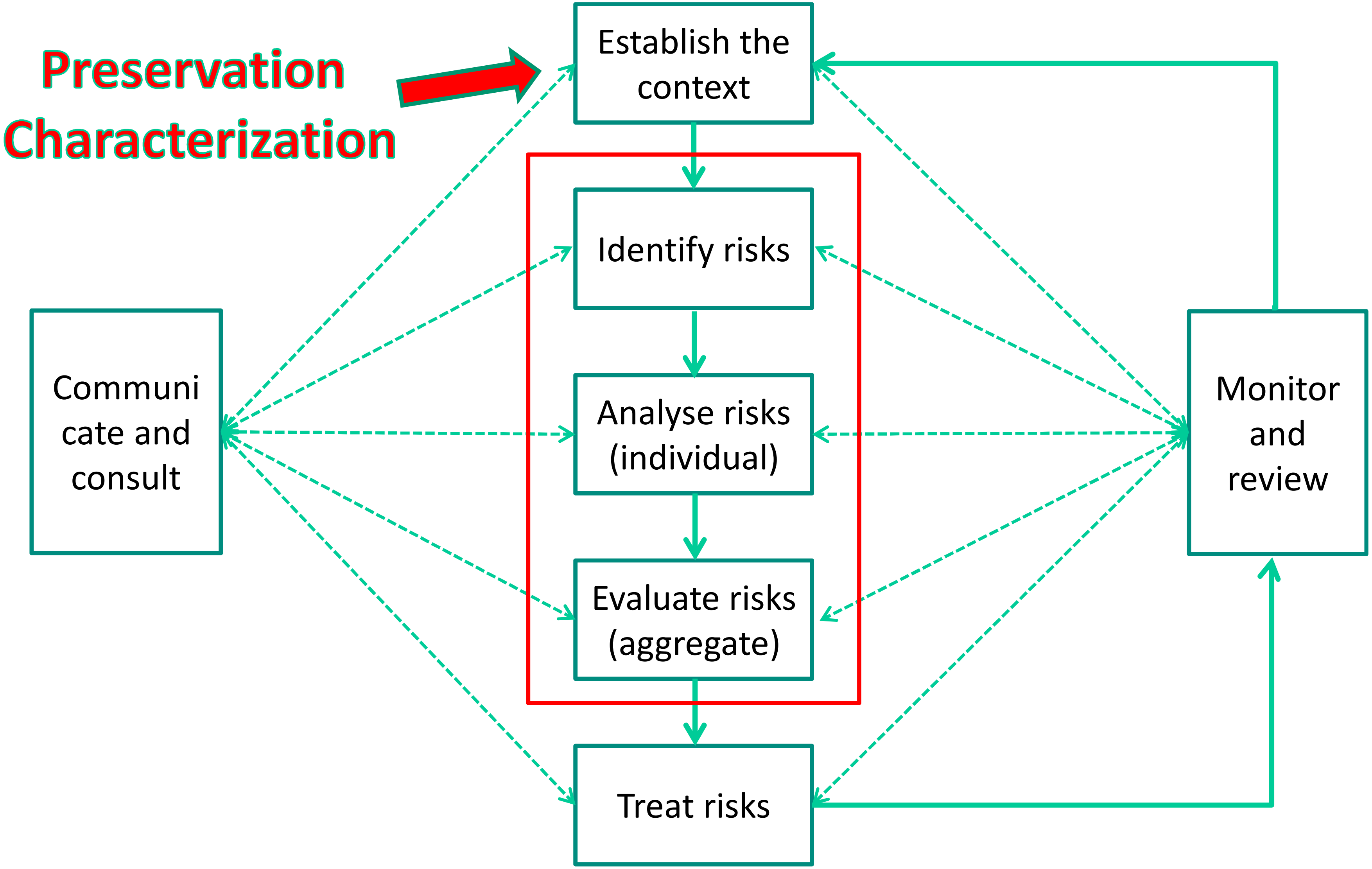
Identify residual risk

Communicate and consult

Monitor and review

Risk Management Process

Preservation Characterization



Establish the context

Identify risks

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Evaluate risks (aggregate)

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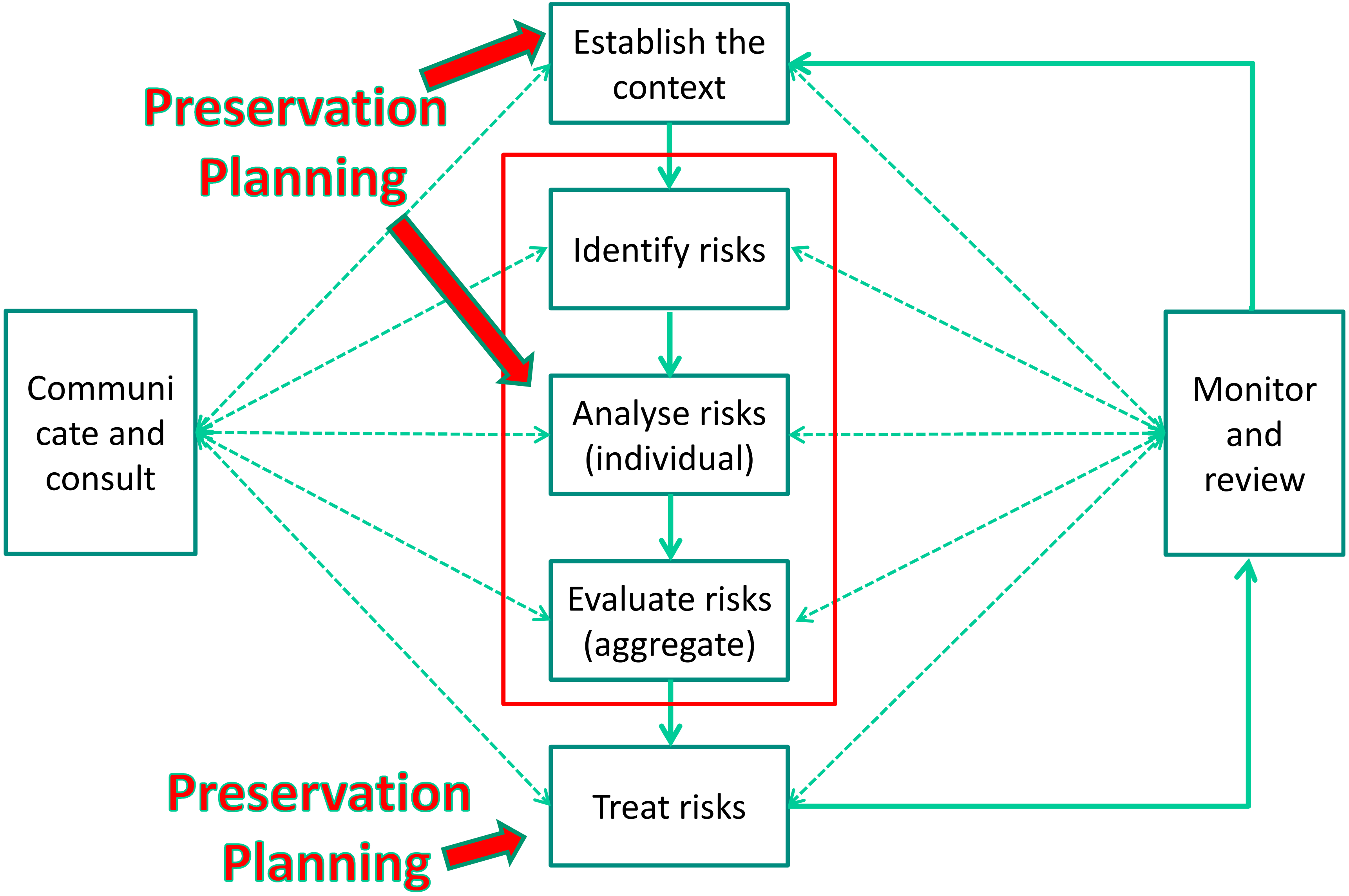
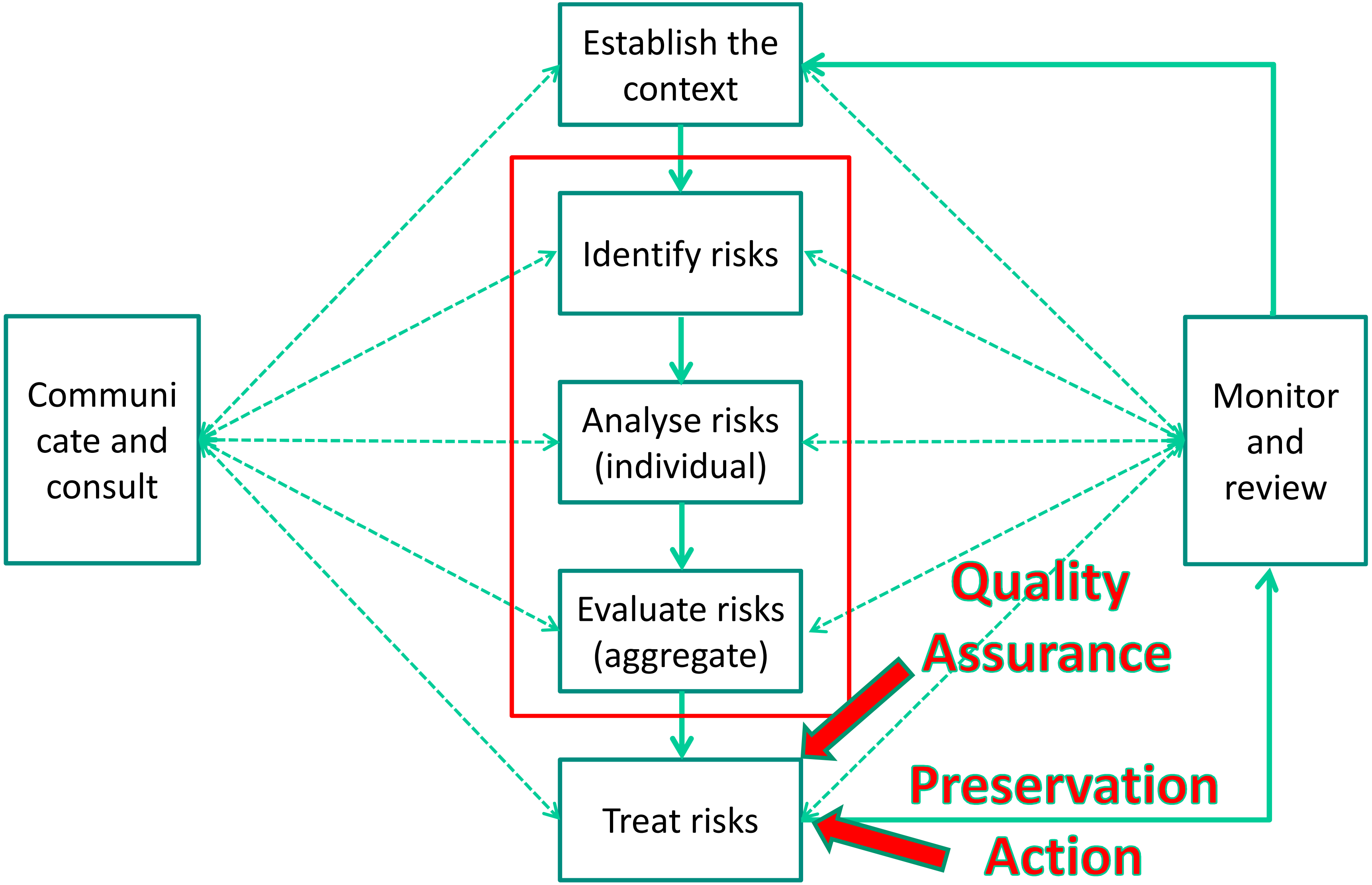
Monitor and review

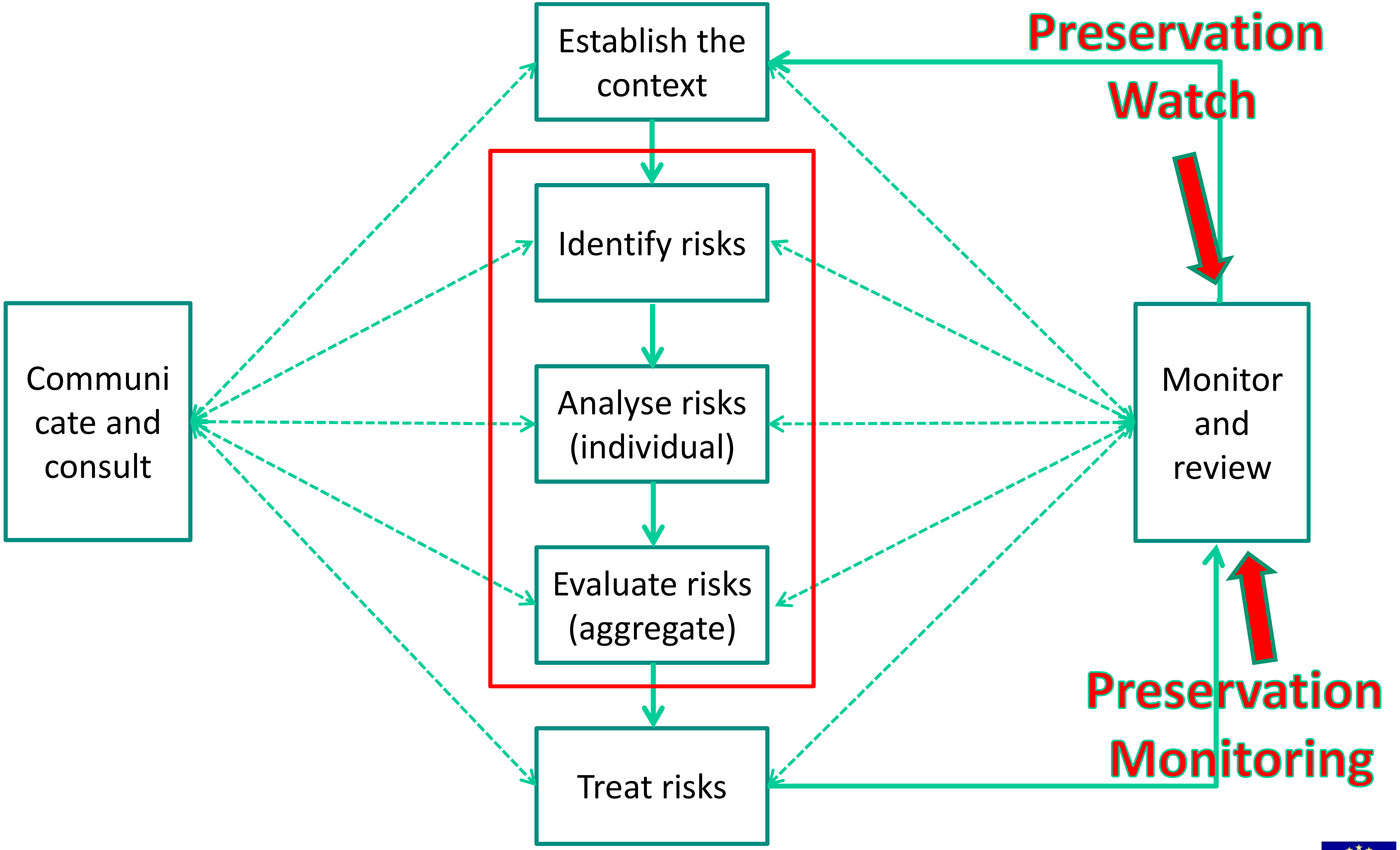
Risk Management Process



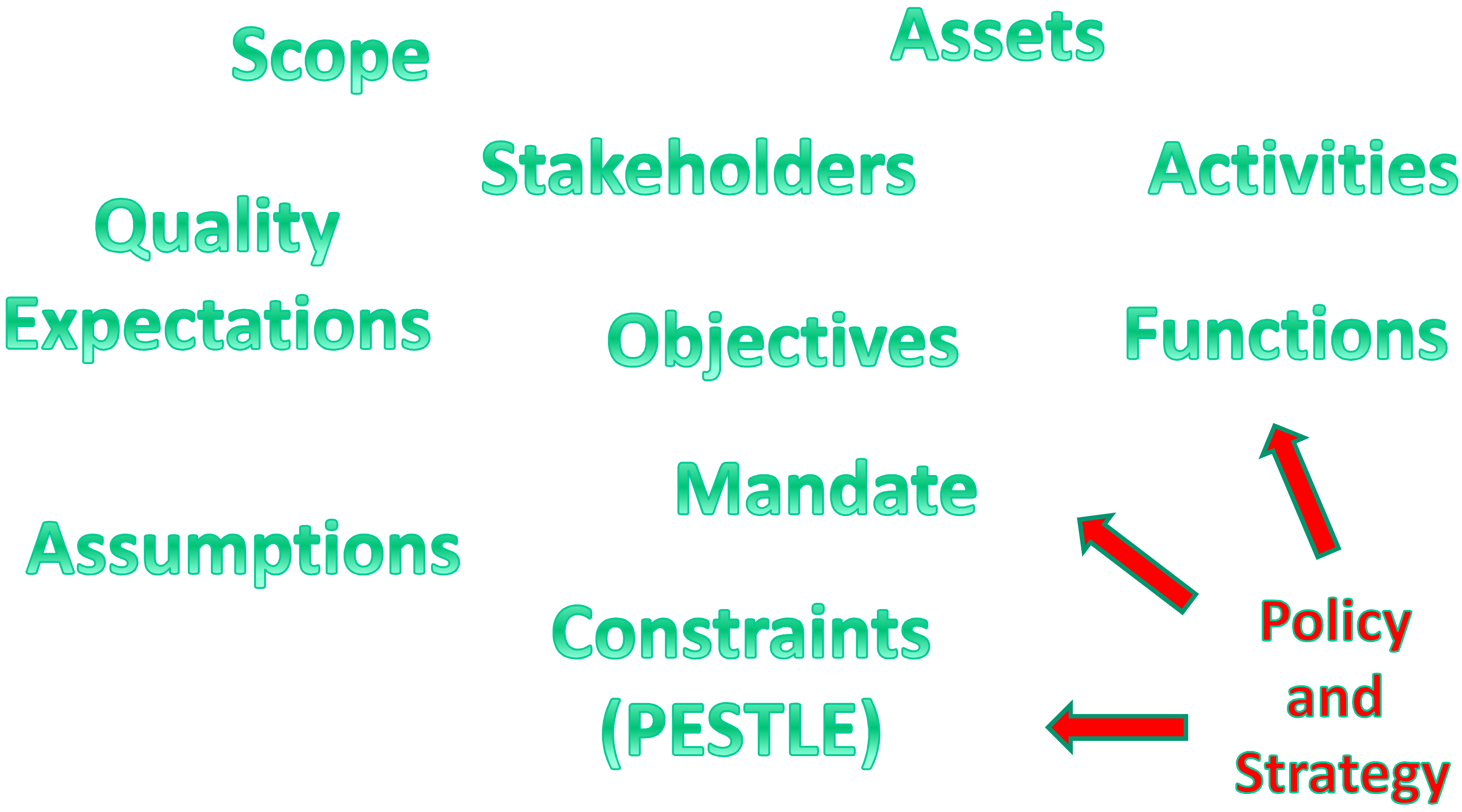
Risk Management Process



Risk Management Process



Risk Context - Dimensions



Scope

Assets

Stakeholders

Activities

Quality Expectations

Objectives

Functions

Mandate

Assumptions

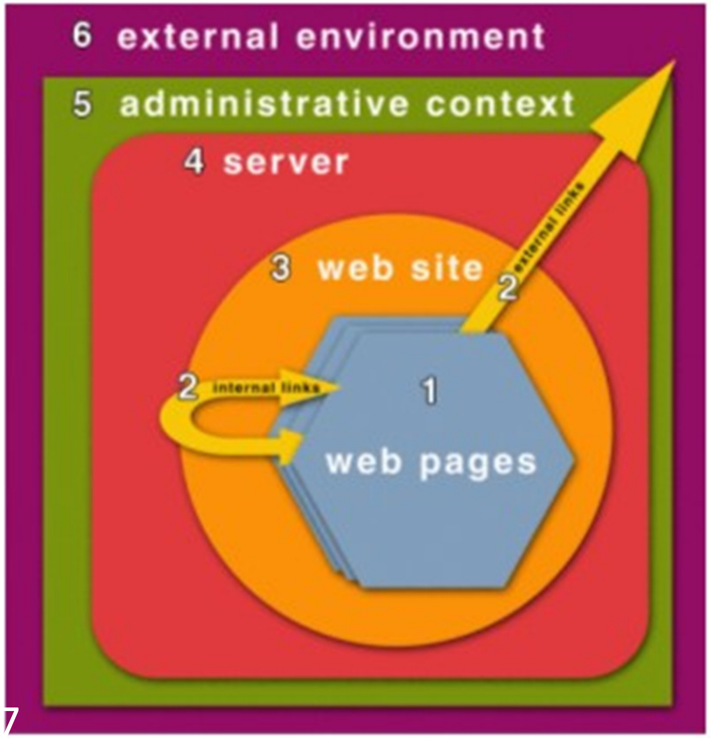
Constraints (PESTLE)

Policy and Strategy

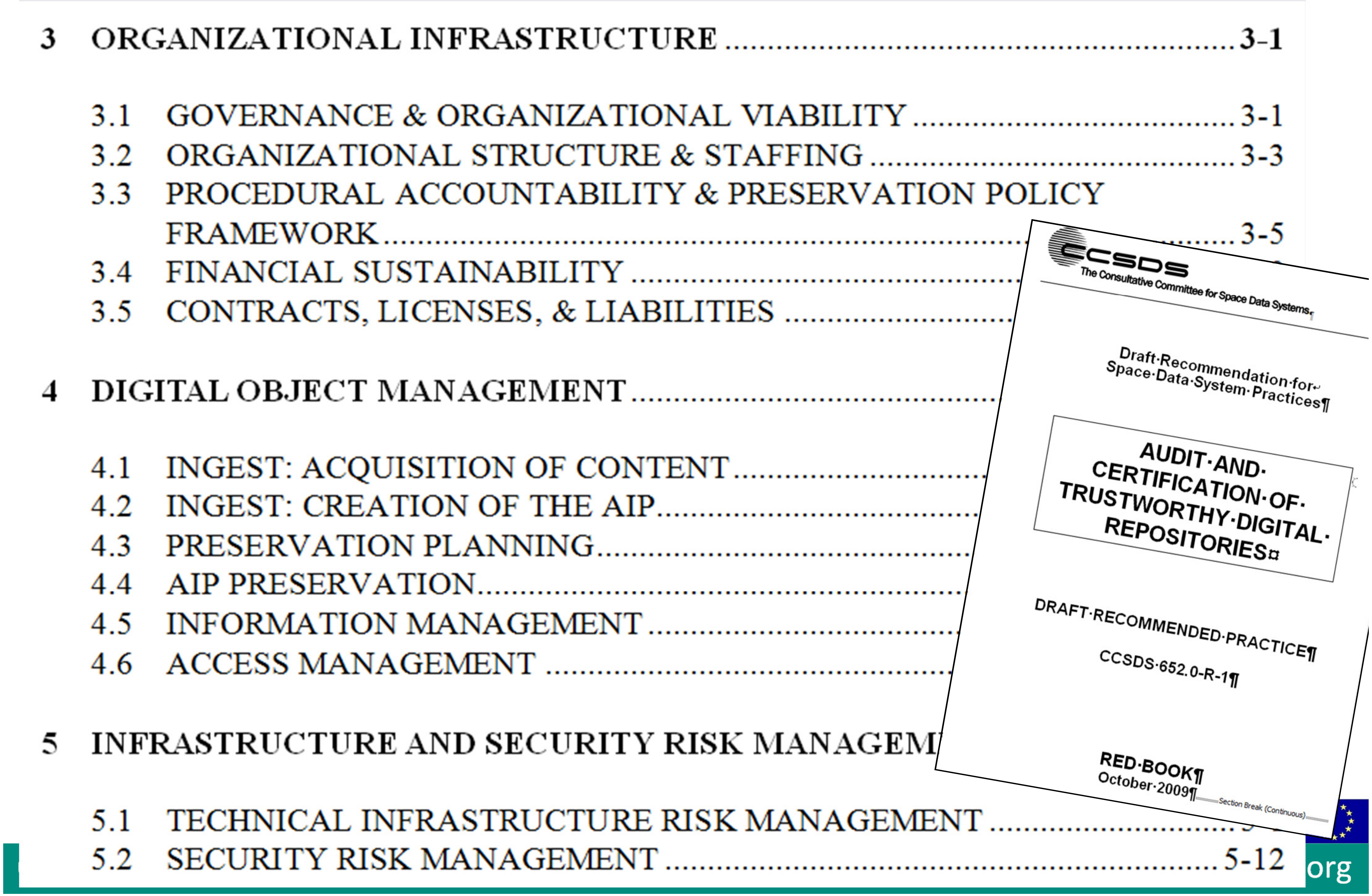
Risk Context: Scope

Virtual Remote Control for web archiving

- A web page as a stand-alone object
- Considering the links into it and out from it
- A semantically coherent set of linked web pages
- A digital entity residing on a server
- A website as an entity within an administrative setting
- A website as part of an external environment



The Context: The Bigger Scope



3 ORGANIZATIONAL INFRASTRUCTURE 3-1

3.1 GOVERNANCE & ORGANIZATIONAL VIABILITY 3-1
3.2 ORGANIZATIONAL STRUCTURE & STAFFING 3-3
3.3 PROCEDURAL ACCOUNTABILITY & PRESERVATION POLICY FRAMEWORK 3-5
3.4 FINANCIAL SUSTAINABILITY ....
3.5 CONTRACTS, LICENSES, & LIABILITIES ....

4 DIGITAL OBJECT MANAGEMENT ....

4.1 INGEST: ACQUISITION OF CONTENT ....
4.2 INGEST: CREATION OF THE AIP ....
4.3 PRESERVATION PLANNING ....
4.4 AIP PRESERVATION ....
4.5 INFORMATION MANAGEMENT ....
4.6 ACCESS MANAGEMENT ....

5 INFRASTRUCTURE AND SECURITY RISK MANAGEM

5.1 TECHNICAL INFRASTRUCTURE RISK MANAGEMENT ....
5.2 SECURITY RISK MANAGEMENT 5-12

CCSDS
The Consultative Committee for Space Data Systems

Draft Recommendation for Space Data System Practices

AUDIT AND CERTIFICATION OF TRUSTWORTHY DIGITAL REPOSITORIES

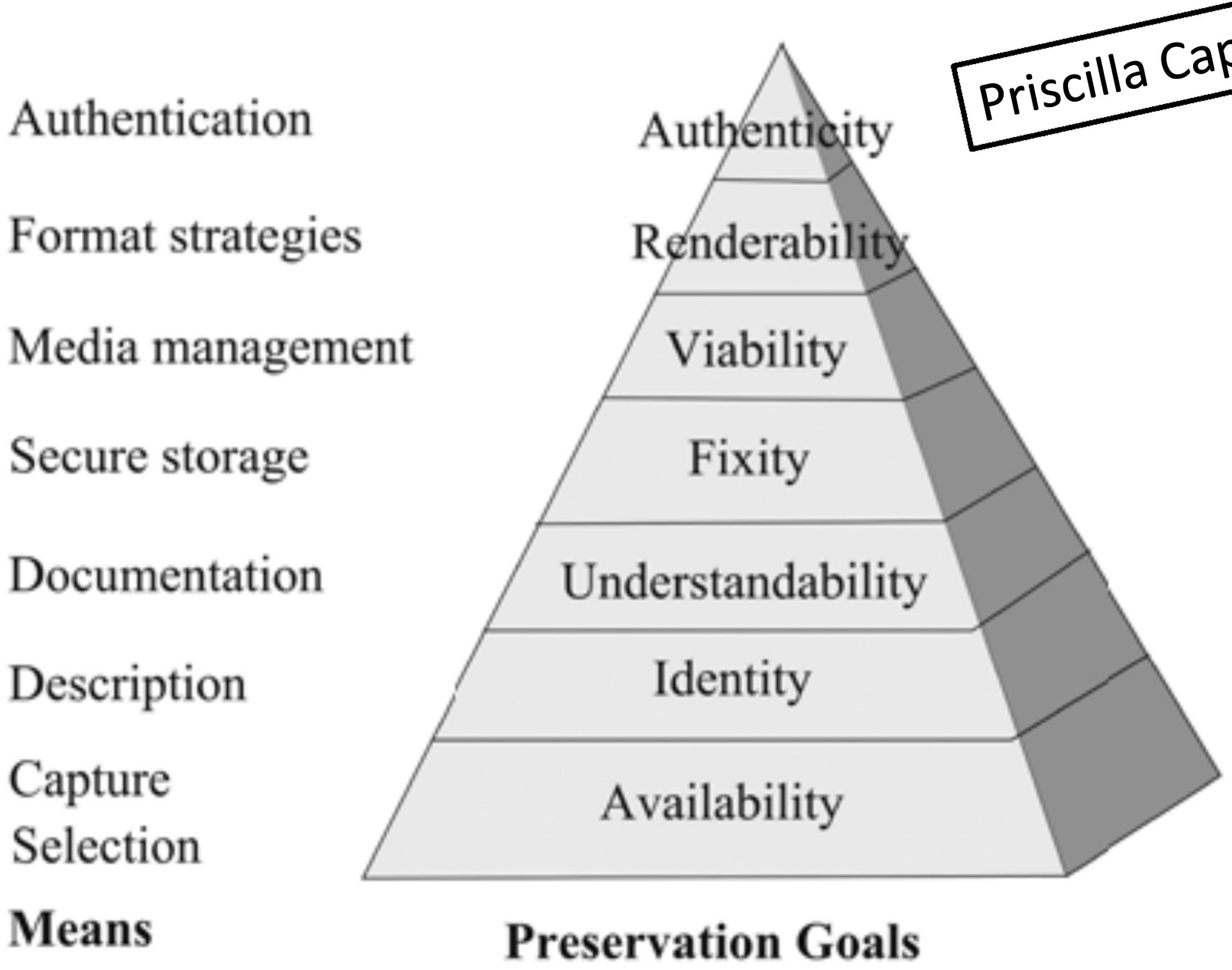
DRAFT RECOMMENDED PRACTICE

CCSDS 652.0-R-1

RED BOOK
October 2009

The Context:
Preservation Goals => Objectives

Priscilla Caplan



Authentication

Format strategies

Media management

Secure storage

Documentation

Description

Capture

Selection

Means

Authenticity

Renderability

Viability

Fixity

Understandability

Identity

Availability

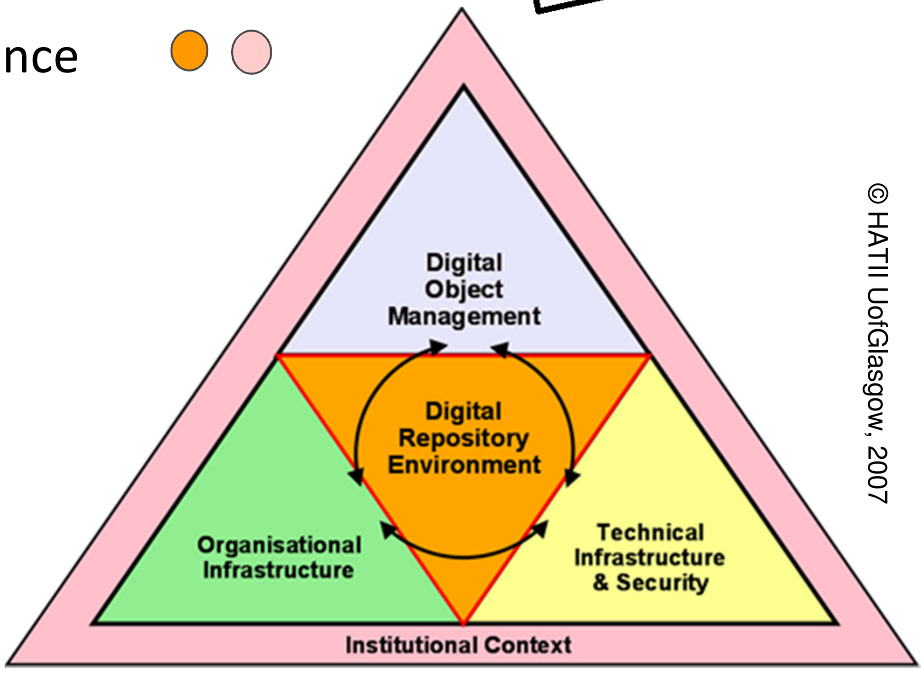
Preservation Goals

The Context: Preservation Functions

DRAMBORA

An intellectual context for the work:

- Commitment to digital object maintenance ● ●
- Organisational fitness ●
- Legal & regulatory legitimacy ●
- Effective & efficient policies ●
- Acquisition & ingest criteria ●
- Integrity, authenticity & usability ●
- Provenance ●
- Dissemination ●
- Preservation planning & action ●
- Adequate technical infrastructure ●


Digital Object Management
Digital Repository Environment
Organisational Infrastructure
Technical Infrastructure & Security
Institutional Context

© HATII UofGlasgow, 2007

(CRL/OCLC/NESTOR/DCC/DPE meeting, January 2007)

Risk Identification: Breakdown Structures and Prompt Lists

- Technological
- Physical
- Organisational
- Socio-cultural
- Legal

- Economic
- Financial
- Political
- Contractual
- Environmental

DRAMBORA

Risk Identification: Sources

Planets Project

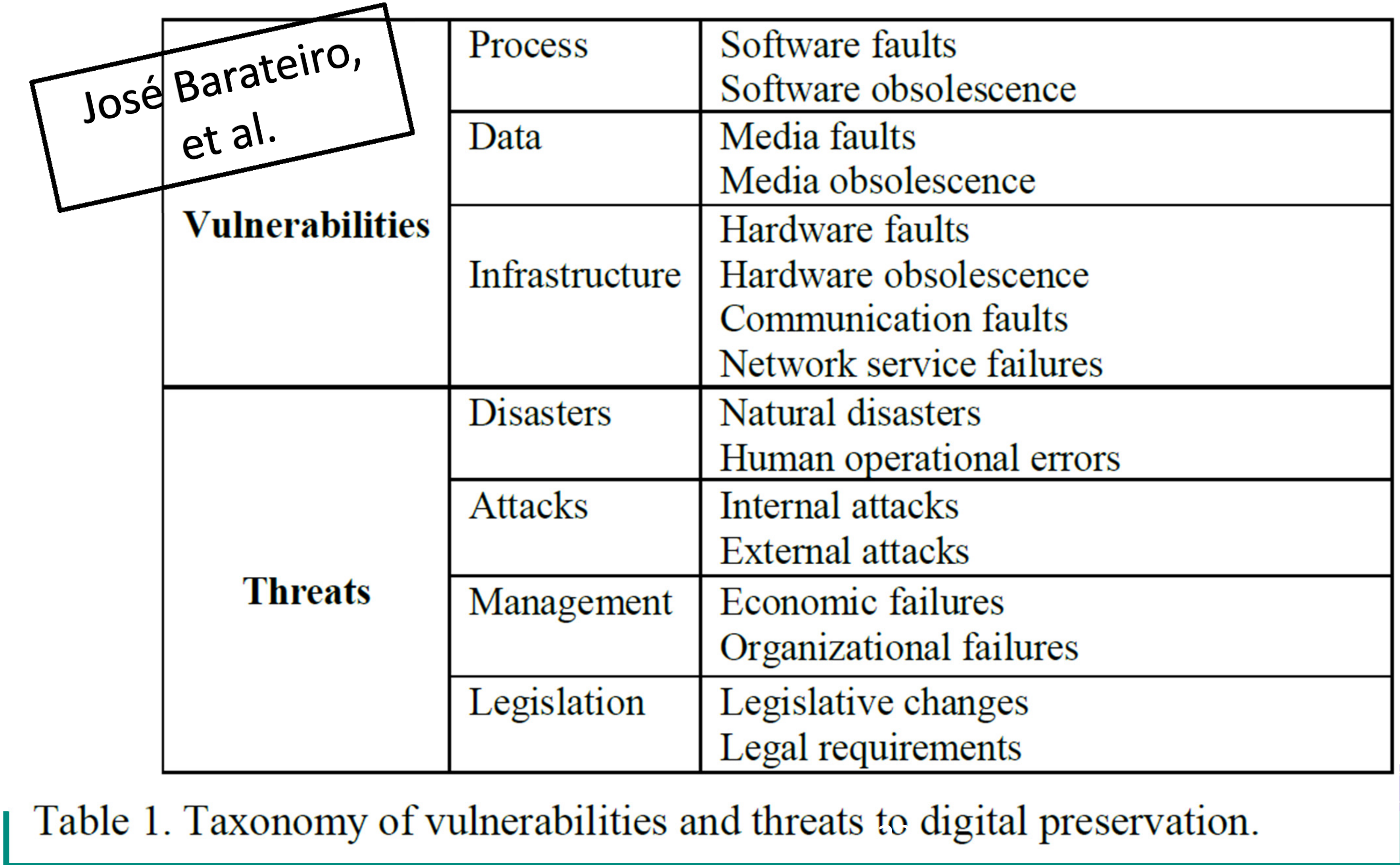
Risk sources

- New Version
- Obsolescence
- No Support
- Unmanaged Growth
- Deterioration
- Loss
- Access Inhibitors
- Defects
- New Requirements

Digital Environment

- File System
- Operating System
- Hardware
- File Format
- Software
- Content
- Representation Information
- Data Carrier
- Users
- Legal or Statutory System
- Budgets

Risk Identification: Vulnerabilities and Sources



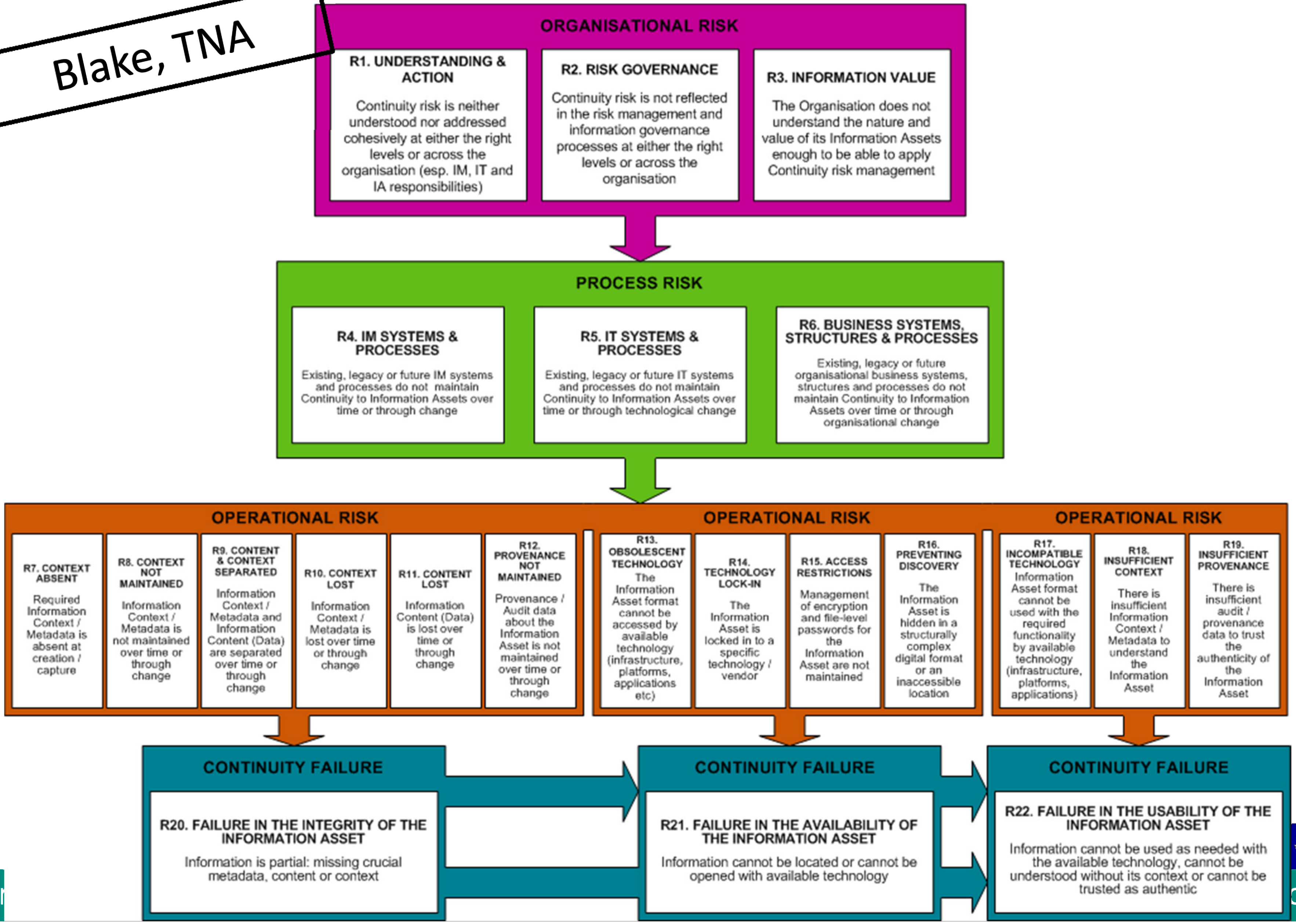
José Barateiro, et al.

Vulnerabilities	Process	Software faults Software obsolescence
	Data	Media faults Media obsolescence
	Infrastructure	Hardware faults Hardware obsolescence Communication faults Network service failures
Threats	Disasters	Natural disasters Human operational errors
	Attacks	Internal attacks External attacks
	Management	Economic failures Organizational failures
	Legislation	Legislative changes Legal requirements

Table 1. Taxonomy of vulnerabilities and threats to digital preservation.

Risk identification

Blake, TNA



ORGANISATIONAL RISK

R1. UNDERSTANDING & ACTION
Continuity risk is neither understood nor addressed cohesively at either the right levels or across the organisation (esp. IM, IT and IA responsibilities)

R2. RISK GOVERNANCE
Continuity risk is not reflected in the risk management and information governance processes at either the right levels or across the organisation

R3. INFORMATION VALUE
The Organisation does not understand the nature and value of its Information Assets enough to be able to apply Continuity risk management

PROCESS RISK

R4. IM SYSTEMS & PROCESSES
Existing, legacy or future IM systems and processes do not maintain Continuity to Information Assets over time or through change

R5. IT SYSTEMS & PROCESSES
Existing, legacy or future IT systems and processes do not maintain Continuity to Information Assets over time or through technological change

R6. BUSINESS SYSTEMS, STRUCTURES & PROCESSES
Existing, legacy or future organisational business systems, structures and processes do not maintain Continuity to Information Assets over time or through organisational change

OPERATIONAL RISK

R7. CONTEXT ABSENT
Required Information Context / Metadata is absent at creation / capture

R8. CONTEXT NOT MAINTAINED
Information Context / Metadata is not maintained over time or through change

R9. CONTENT & CONTEXT SEPARATED
Information Context / Metadata and Information Content (Data) are separated over time or through change

R10. CONTEXT LOST
Information Context / Metadata is lost over time or through change

R11. CONTENT LOST
Information Content (Data) is lost over time or through change

R12. PROVENANCE NOT MAINTAINED
Provenance / Audit data about the Information Asset is not maintained over time or through change

OPERATIONAL RISK

R13. OBSOLESCENT TECHNOLOGY
The Information Asset format cannot be accessed by available technology (infrastructure, platforms, applications etc)

R14. TECHNOLOGY LOCK-IN
The Information Asset is locked in to a specific technology / vendor

R15. ACCESS RESTRICTIONS
Management of encryption and file-level passwords for the Information Asset are not maintained

R16. PREVENTING DISCOVERY
The Information Asset is hidden in a structurally complex digital format or an inaccessible location

OPERATIONAL RISK

R17. INCOMPATIBLE TECHNOLOGY
Information Asset format cannot be used with the required functionality by available technology (infrastructure, platforms, applications)

R18. INSUFFICIENT CONTEXT
There is insufficient Information Context / Metadata to understand the Information Asset

R19. INSUFFICIENT PROVENANCE
There is insufficient audit / provenance data to trust the authenticity of the Information Asset

CONTINUITY FAILURE

R20. FAILURE IN THE INTEGRITY OF THE INFORMATION ASSET
Information is partial: missing crucial metadata, content or context

CONTINUITY FAILURE

R21. FAILURE IN THE AVAILABILITY OF THE INFORMATION ASSET
Information cannot be located or cannot be opened with available technology

CONTINUITY FAILURE

R22. FAILURE IN THE USABILITY OF THE INFORMATION ASSET
Information cannot be used as needed with the available technology, cannot be understood without its context or cannot be trusted as authentic

Risk Analysis

Determine

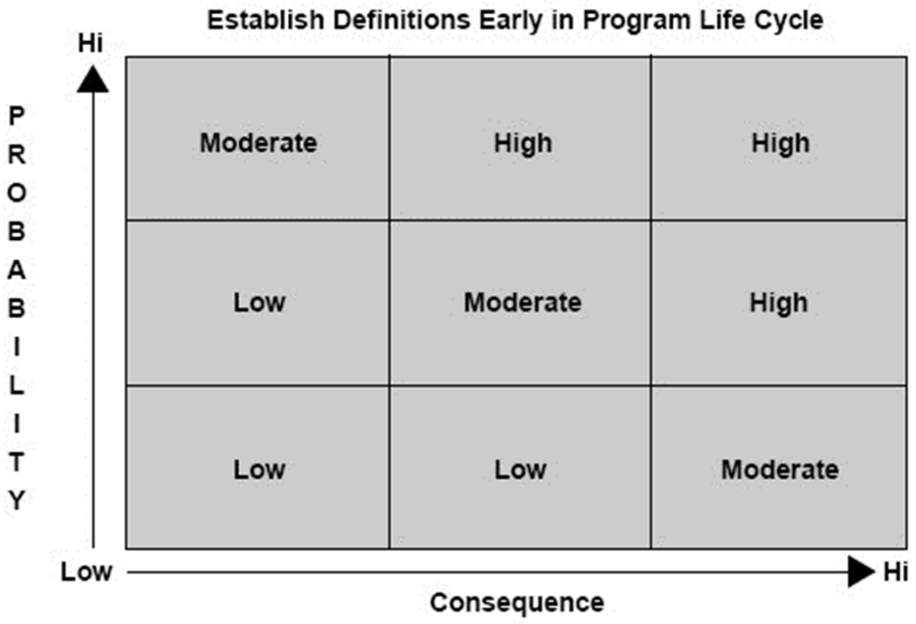
Probability

Impact

(Proximity)

of the identified risks

Calculate severity



Establish Definitions Early in Program Life Cycle

Moderate	High	High
Low	Moderate	High
Low	Low	Moderate

Hi
PROBABILITY
Low
Consequence
Hi

Factors Influencing Risk Impact

Risk of loss

- Future rarity
- Alternative storage provision
- Heritage value

Mandatory requirement

- Legal deposit obligation
- Existing external commitment

Strategic considerations

Opportunity & timing

- Size & rate of growth

Opportunities for access

- Alternative access provision
- Revenue

User need

- User demand
- Risk to physical collections
- Remote access

Doability

- Effort
- Freely available

Operational improvements

British Library

Risk Impact Influenced by

Virtual Remote Control for web archiving

- relevancy to the organization's collection(s);
- significance (essential, desirable, ephemeral);
- archival role (primary archives for resource, informal agreement for full or partial capture, other);
- maintenance (key indicators of good site management);
- redundancy (captured by more than one archive);
- risk response (time delay and action based on test notifications);
- capture requirements (complexity of site structure, update cycle, MIME types, dynamic content, and behaviour indicators);
- size (number of pages, depth of crawl required, etc.).

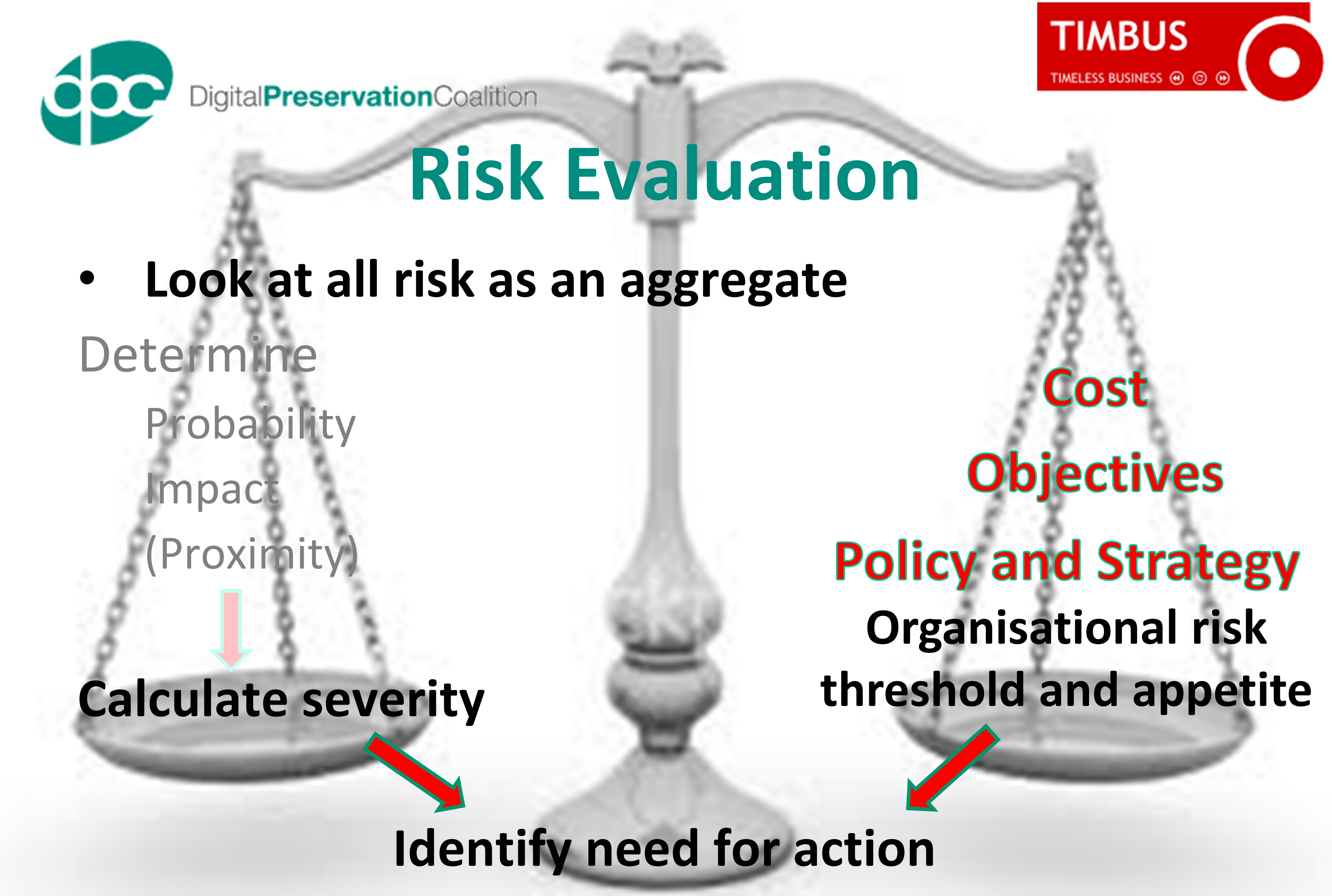
Risk Impact

DRAMBORA

- on repository staff
- on public well-being
- damage to or loss of assets
- statutory or regulatory breach
- damage to reputation
- damage to financial viability
- deterioration of product or service quality
- environmental damage
- loss of authenticity and understandability

Risk Evaluation

- **Look at all risk as an aggregate**



Determine

Probability

Impact

(Proximity)

Calculate severity

Cost

Objectives

Policy and Strategy

Organisational risk threshold and appetite

Identify need for action

Risk Treatment Options

Accept

accept the potential risk

Reduce

implement controls to lower probability or impact of the risk

Avoid

eliminate the risk cause and/or consequence

Fallback

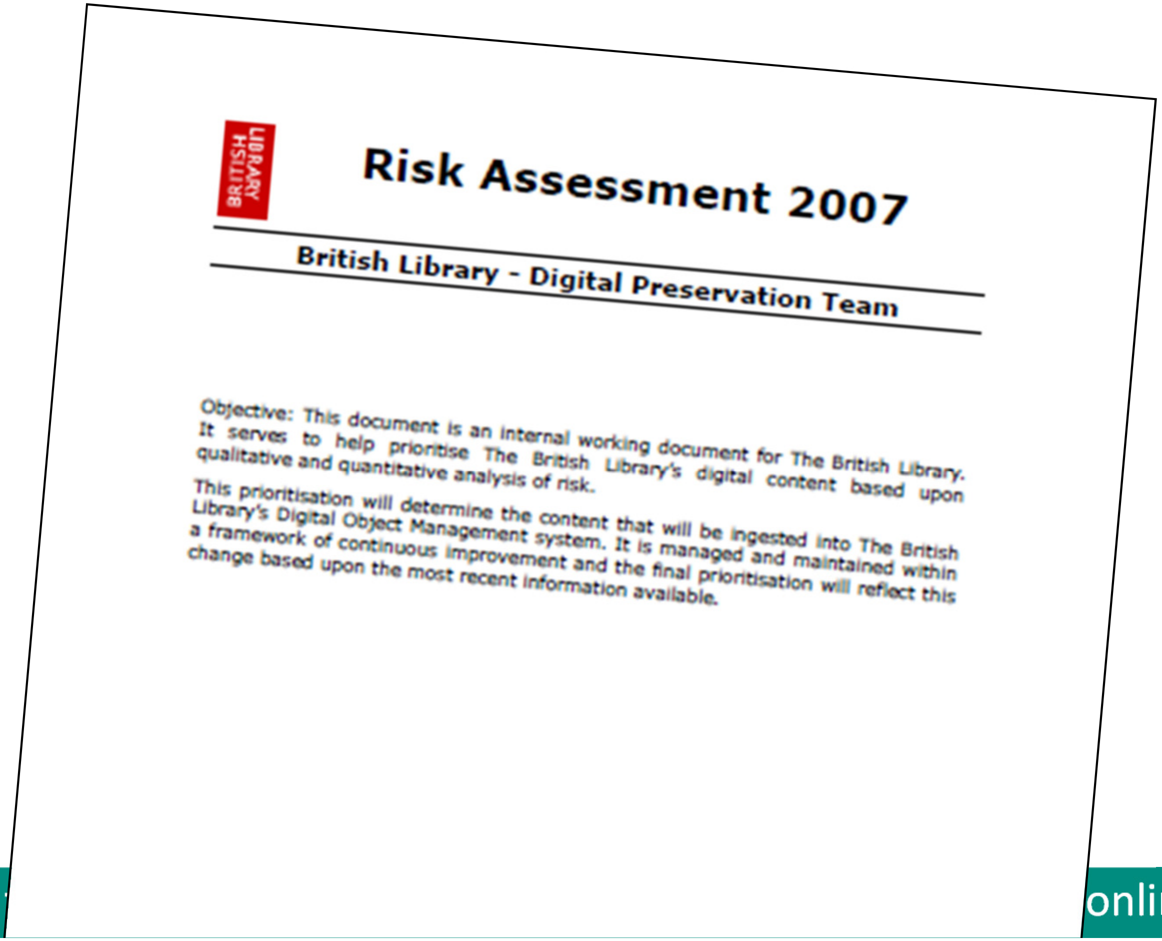
Put in place alternative action for when the risk materializes

Transfer

compensate for loss, such as purchasing insurance

Example Risk Assessment: The British Library 2007

Available online



BRITISH LIBRARY

Risk Assessment 2007

British Library - Digital Preservation Team

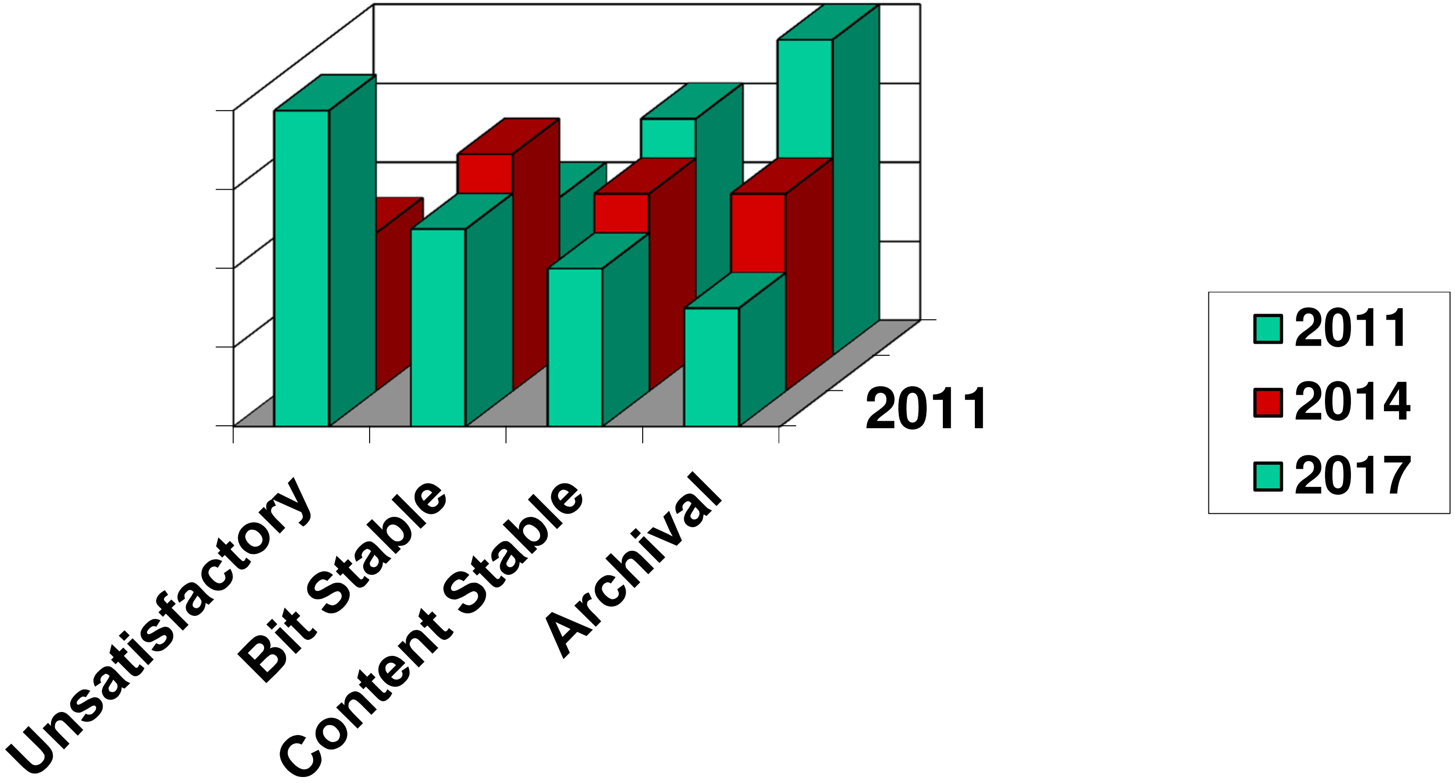
Objective: This document is an internal working document for The British Library. It serves to help prioritise The British Library's digital content based upon qualitative and quantitative analysis of risk.

This prioritisation will determine the content that will be ingested into The British Library's Digital Object Management system. It is managed and maintained within a framework of continuous improvement and the final prioritisation will reflect this change based upon the most recent information available.

How much information do we need?

Unsatisfactory storage	Bit stable storage	Content stable storage	Archival storage
Hand-held carriers	Images have been transferred on managed hard disk storage Storage is backed up	Content has been QA'ed Metadata has been produced and QA'ed File formats have been identified Representation Information has been deposited	Automatic check for corruption via checksums Automatic replication over remote locations Digital signatures Integration with Primo / ILS

Performance Goals



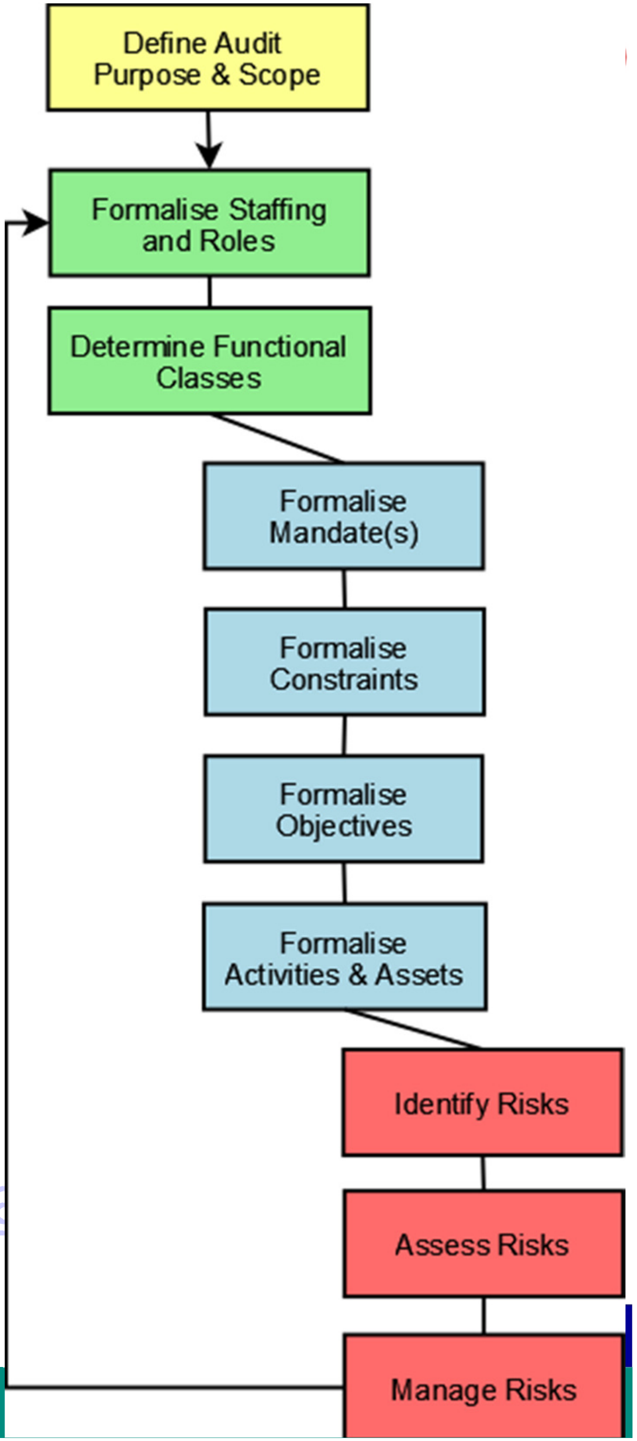
Tools to Help

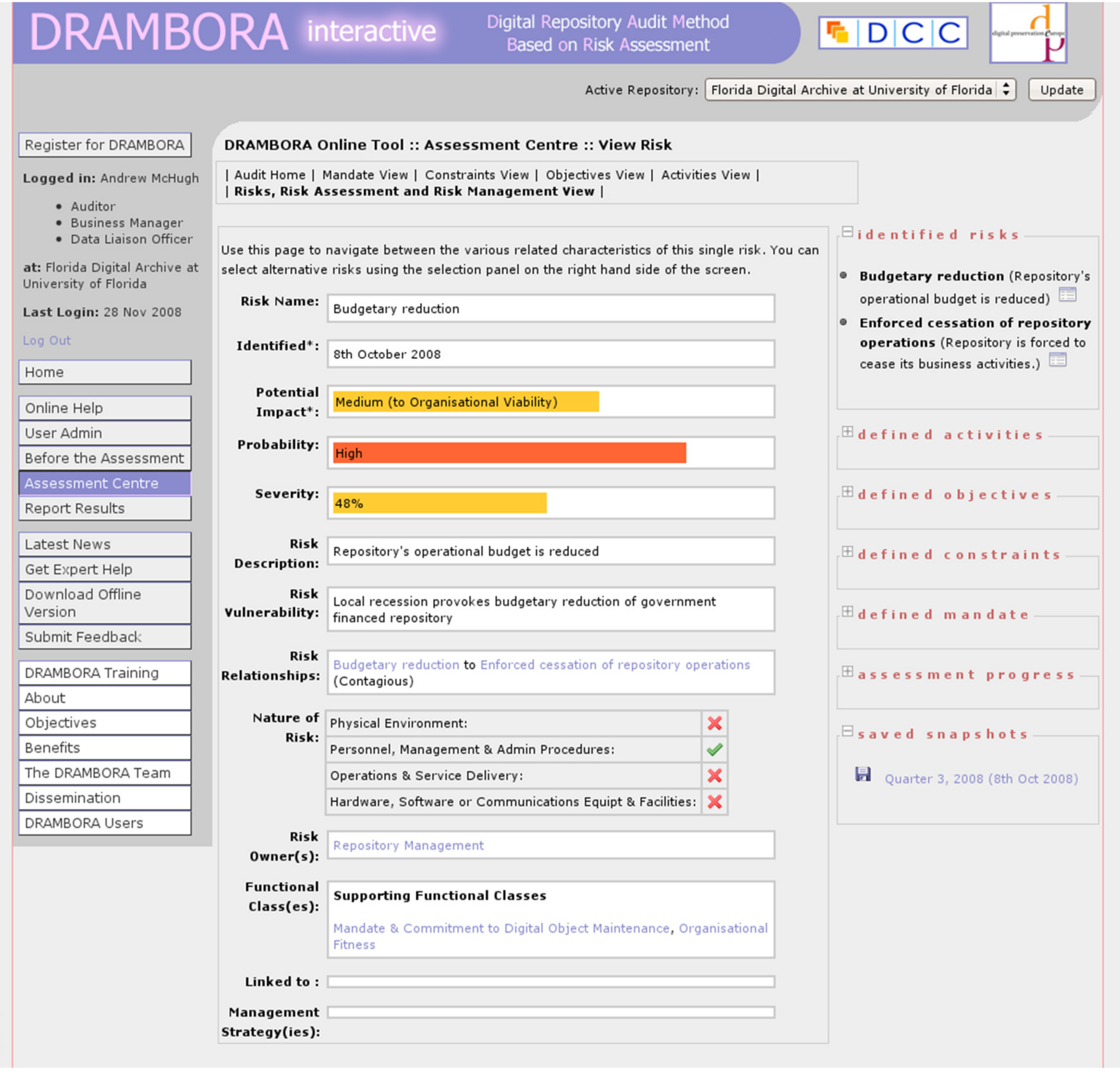
- Risk management:
  - Drambora (The Digital Repository Audit Method Based On Risk Assessment) : self-certification

DRAMBORA

- Digital Repository Audit Method Based On Risk Assessment
- Online interactive tool
- Developed by the Digital Curation Centre (DCC) and Digital Preservation Europe (DPE)
- Identify, assess, manage, and mitigate risks
- Risk ontology

http://blogs.ecs.soton.ac.uk/keepit/ta g/drambora/


Define Audit Purpose & Scope
Formalise Staffing and Roles
Determine Functional Classes
Formalise Mandate(s)
Formalise Constraints
Formalise Objectives
Formalise Activities & Assets
Identify Risks
Assess Risks
Manage Risks



DRAMBORA interactive

Digital Repository Audit Method Based on Risk Assessment

Active Repository: Florida Digital Archive at University of Florida

Update

Register for DRAMBORA

Logged in: Andrew McHugh

- Auditor
- Business Manager
- Data Liaison Officer

at: Florida Digital Archive at University of Florida

Last Login: 28 Nov 2008

Log Out

Home

Online Help

User Admin

Before the Assessment

Assessment Centre

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Submit Feedback

DRAMBORA Training

About

Objectives

Benefits

The DRAMBORA Team

Dissemination

DRAMBORA Users

DRAMBORA Online Tool :: Assessment Centre :: View Risk

| Audit Home | Mandate View | Constraints View | Objectives View | Activities View |
| **Risks, Risk Assessment and Risk Management View** |

Use this page to navigate between the various related characteristics of this single risk. You can select alternative risks using the selection panel on the right hand side of the screen.

Risk Name:	Budgetary reduction
Identified*:	8th October 2008
Potential Impact*:	Medium (to Organisational Viability)
Probability:	High
Severity:	48%
Risk Description:	Repository's operational budget is reduced
Risk Vulnerability:	Local recession provokes budgetary reduction of government financed repository
Risk Relationships:	Budgetary reduction to Enforced cessation of repository operations (Contagious)

Nature of Risk:

Physical Environment:	✗
Personnel, Management & Admin Procedures:	✓
Operations & Service Delivery:	✗
Hardware, Software or Communications Equipt & Facilities:	✗

Risk Owner(s):	Repository Management
Functional Class(es):	**Supporting Functional Classes** Mandate & Commitment to Digital Object Maintenance, Organisational Fitness
Linked to :	
Management Strategy(ies):	

identified risks

- **Budgetary reduction** (Repository's operational budget is reduced)
- **Enforced cessation of repository operations** (Repository is forced to cease its business activities.)

defined activities

defined objectives

defined constraints

defined mandate

assessment progress

saved snapshots

Quarter 3, 2008 (8th Oct 2008)

Our c

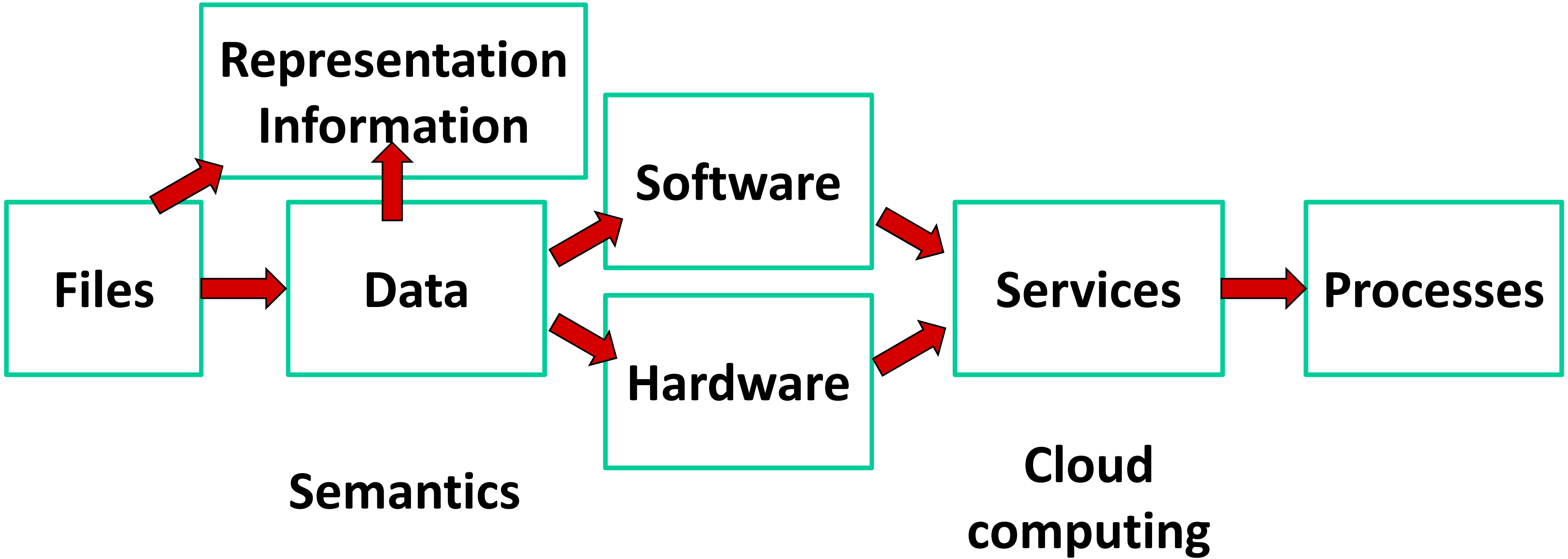
Tools to Help

- Risk Management:
  - Drambora (The Digital Repository Audit Method Based On Risk Assessment) : self-certification
  - TIMBUS project: ERM (Enterprise Risk Management) tools extended to digital preservation

TIMBUS

Digital Preservation

Risk and Business Continuity Management



TIMBUS Task 4.1 ERM

- Intelligent Risk Management
  - Learning from previous situations
  - Reasoning from context
  - Automating risk detection and response
- Complete business modelling, including IT systems, legal constraints, etc.

Rather than DP focus alone

Tools to Help

- Risk management:
  - Drambora (The Digital Repository Audit Method Based On Risk Assessment) : self-certification
  - TIMBUS project: ERM (Enterprise Risk Management) tools extended to digital preservation
  - TDR: framework for establishing certified trustworthiness

4.4.1 The repository shall have specifications for how the AIPs are stored down to the bit level.

Supporting Text

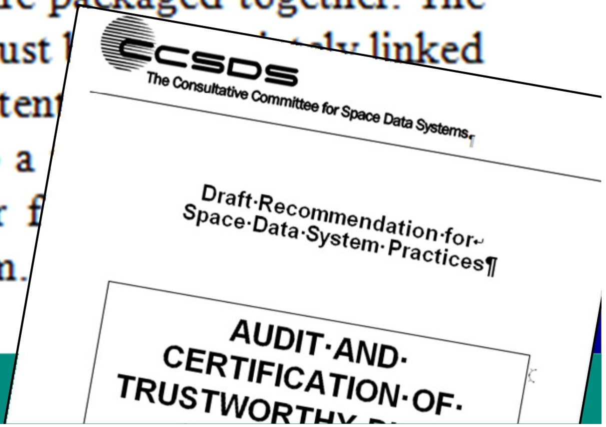
This is necessary in order to ensure that the information can be extracted from the AIP over the long-term.

Examples of Ways the Repository Can Demonstrate It Is Meeting This Requirement

Documentation of the format of AIPs; EAST and DEDSL descriptions of the data components (see references [B6] and [B7]).

Discussion

The repository should specify the Representation information down to the bit level of each AIP component and must specify how the separate components are packaged together. The
Representation Information must be available for each AIP and must b ly linked
to the AIP. Often, repositories are tempted to describe AIP conten
where a program will then be used to convert the information to a
their Designated Communities. However, if those programs ever f
information would be lost in all the AIPs that relied on that program.



CCSDS The Consultative Committee for Space Data Systems

Draft Recommendation for Space Data System Practices

AUDIT AND CERTIFICATION OF TRUSTWORTHY

Tools to Help

- Risk management:
  - Drambora (The Digital Repository Audit Method Based On Risk Assessment) : self-certification
  - TIMBUS project: ERM (Enterprise Risk Management) tools extended to digital preservation
  - TDR: framework for establishing certified trustworthiness
- Context identification: DROID, JHOVE, FIDO, FITS, file, …
  - Assess the characteristics of your digital assets
  - Profile your collections
- Risk Identification: Risk analysis tool (RAT):
  - scans collections for known preservation issues and risks, reported via a traffic-light rating system
- Risk treatment planning: Plato
- Risk treatment: A variety of preservation and QA tools

Thank you