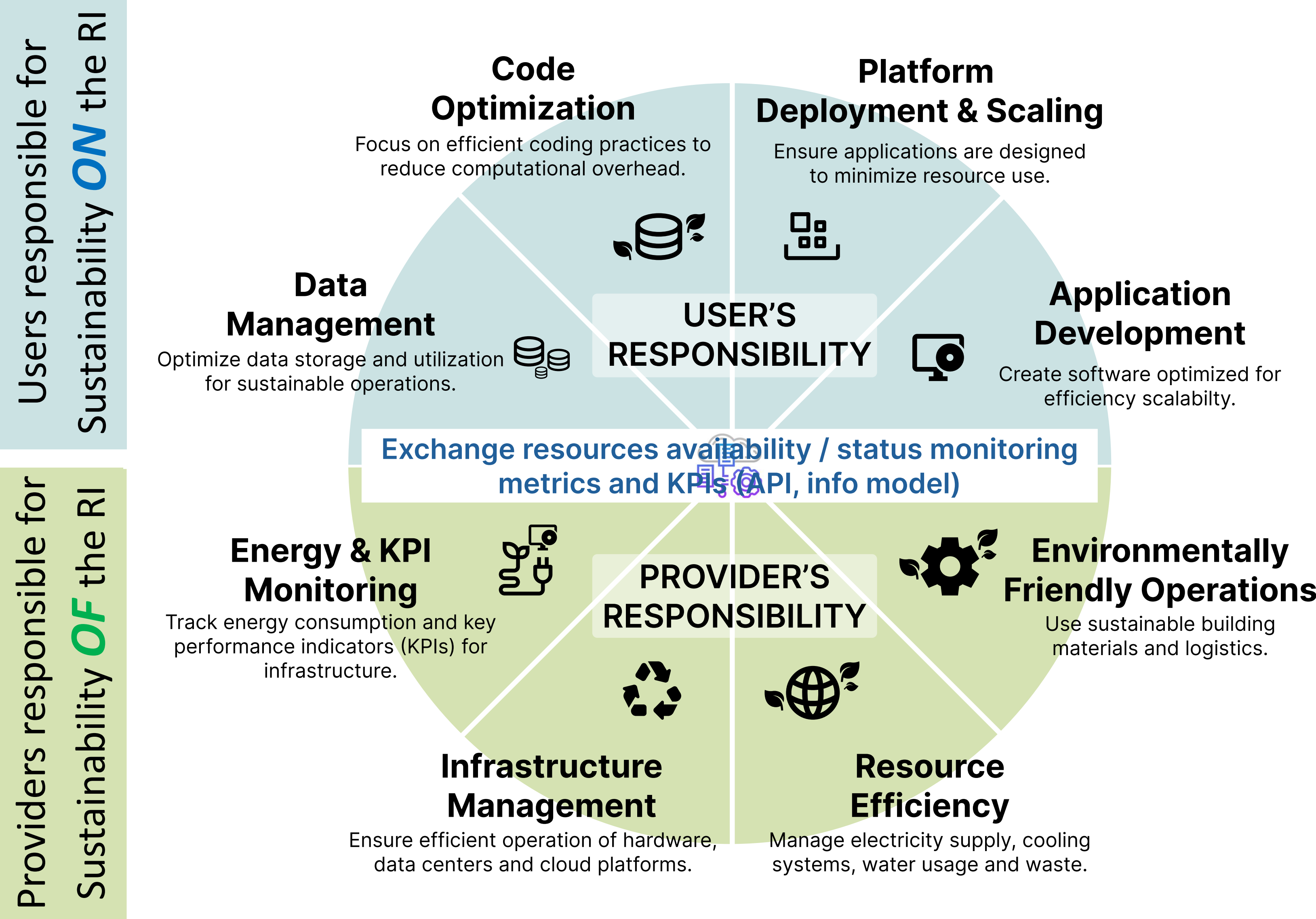# GreenDIGIT: Project and Initiative to Lower Environmental Impact of the Future Digital Research Infrastructures

GreenDIGIT Consortium (GreenDIGIT Grant number 101131207)

GreenDIGIT Shared Responsibility Model in Sustainability

Users responsible for Sustainability **ON** the RI

Providers responsible for Sustainability **OF** the RI

Code Optimization
Focus on efficient coding practices to reduce computational overhead.

Platform Deployment & Scaling
Ensure applications are designed to minimize resource use.

Data Management
Optimize data storage and utilization for sustainable operations.

USER'S RESPONSIBILITY

Application Development
Create software optimized for efficiency scalabilty.

Exchange resources availability / status monitoring metrics and KPIs (API, info model)

Energy & KPI Monitoring
Track energy consumption and key performance indicators (KPIs) for infrastructure.

PROVIDER'S RESPONSIBILITY

Environmentally Friendly Operations
Use sustainable building materials and logistics.

Infrastructure Management
Ensure efficient operation of hardware, data centers and cloud platforms.

Resource Efficiency
Manage electricity supply, cooling systems, water usage and waste.

RI/Systems Sustainability by Design Aspects

Architecture for Sustainability by Design
- Functional components, layers, API, Requirements
- Sustainability Architecture Design Principles (SADP)

Software and application components that can be optimised during design and controlled during operation
- Energy Efficient Software Design
- Green aware API including necessary energy, performance, environment information

(!) Common information/data model and metadata (naming)
- Including Requirements, KPI, Metrics
- Metrics and Metadata Registry
- Federated monitoring infrastructure
- Create a basis for research reproducibility
  - + FAIR for Sustainability

RI and applications lifecycle
- RI lifecycle stages (concept, design, development, deployment, operation, termnation) and scientific workflow and research data

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Sustainable RI and IT refers to the integration of environmental considerations into the design, manufacturing, use, and disposal of ITC products and services

1. Energy Efficiency: Designing IT systems & infrastructure consuming less energy
- Energy-efficient data centers, Power-saving modes on devices.

2. Reducing Carbon Footprint: Minimizing the greenhouse gas emissions associated with ICT:
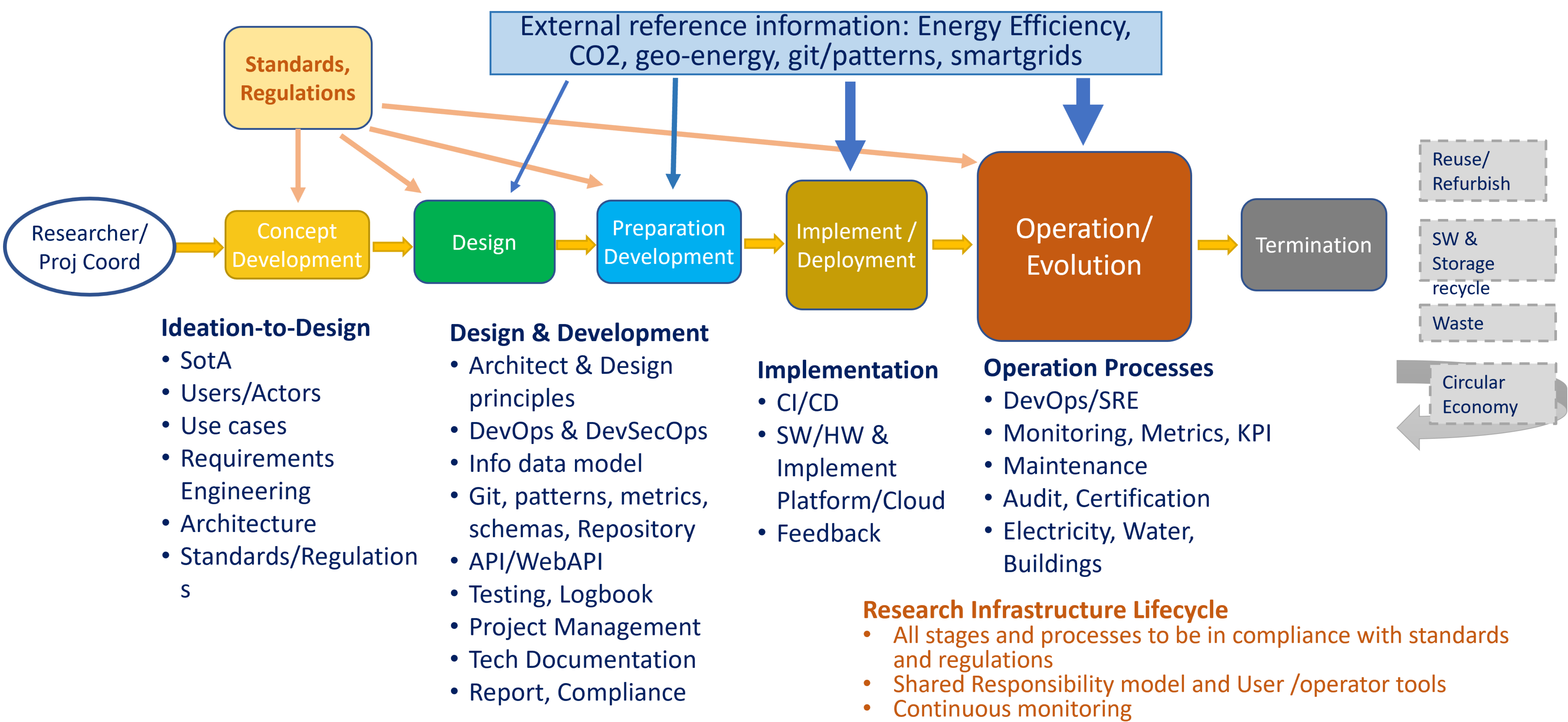- The energy sources of data centers, carbon impact of IT supply chains.

3. Software/Applications Sustainability: Building and using software applications in a manner that requires fewer resources
- Sustainable Architecture Design principles to ensure durable technical solutions
- Efficient coding practices and Cloud-based services to optimize server loads

4. Resource Management and Waste Reduction: Reducing the use of non-renewable resources in IT products and minimizing e-waste

5. Awareness, green practices and education and training: EU GreenComp

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GreenDIGIT: RI Lifecycle Model (RILM) Stages and Activities

External reference information: Energy Efficiency, CO2, geo-energy, git/patterns, smartgrids

Standards, Regulations

Researcher/ Proj Coord → Concept Development → Design → Preparation Development → Implement / Deployment → Operation/ Evolution → Termination

Reuse/ Refurbish
SW & Storage recycle
Waste
Circular Economy

Ideation-to-Design
- SotA
- Users/Actors
- Use cases
- Requirements Engineering
- Architecture
- Standards/Regulations

Design & Development
- Architect & Design principles
- DevOps & DevSecOps
- Info data model
- Git, patterns, metrics, schemas, Repository
- API/WebAPI
- Testing, Logbook
- Project Management
- Tech Documentation
- Report, Compliance

Implementation
- CI/CD
- SW/HW & Implement Platform/Cloud
- Feedback

Operation Processes
- DevOps/SRE
- Monitoring, Metrics, KPI
- Maintenance
- Audit, Certification
- Electricity, Water, Buildings

Research Infrastructure Lifecycle
- All stages and processes to be in compliance with standards and regulations
- Shared Responsibility model and User /operator tools
- Continuous monitoring

RILM Stages & Roles

RI Lifecycle Stage	Involved Actors
RI Concept develop.	• Researchers (target RI users) • Infrastructure and System Engineering team (professional, experienced)
Design and Developm. (preparation)	• Researchers (consulting of domain related research facilities) • Infrastructure and System Engineering team (professional, experienced) • Application and service developers • Project management
Implementation, Deploymen (pre-operation)	• Researchers (for pre-op testing) • Infrastructure and System Engineering team • Project management
Operation	• RI Management (including staffing and financial aspects) • Operation team • (Potentially, sustainability officer)
Termination	• Management • Operator team

GreenDIGIT: European Policies and Regulations Compliance

European Strategy Forum on Research Infrastructure (EFRI) Roadmap 2026:
- Environmental Sustainability of the European/ESFRI Research Infrastructures
- Compliance with ESRS (European Sustainability Reporting Standard) compliant with EU CSRD (Corporate Sustainability Reproting Directive)

European Code of Conduct for Data Centers
- JRC BCP Sections 2024 Best Practice Guidelines for the EU CoC on Data Centre Energy Efficiency
- Commission Delegated Regulation (EU) 2024/1364 of 14 March 2024 for Data centers

ISO/EN/ITU-T Standards Compliance – Basis for Certification and Audit
- ISO 50000, ISO 30134, ISO 14002
- EN 50600-4-1 and EN 50600-4-2 Datacenter and supporting infrastructure

GreenDIGIT Partners: European ESFRI Digital Research Infrastructure
UvA (NL) - Coordinator

EGI (EU) and EGI Group
CESNET (CZ)
CNRS (FR)
CSIC (ES)
SZTAKI (HU)
GSP (FR)

SLICES-RI Group
SU (FR)
TUM (DE)
UTH (GR)
PSNC (PL)
MI (CH)

SoBigData Groups
CNIT (IT)
CNR (IT)

EBRAINS EU
EBRAINS

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