



A roadmap for research
in Decommissioning

SHARE Decommissioning SRA

<https://share-h2020.eu/>
[linkedin.share-h2020-project](https://www.linkedin.com/company/share-h2020-project/)
[linkedin/group SHARE Road map for Decommissioning](https://www.linkedin.com/group/SHARE-Road-map-for-Decommissioning/)



efficient
— innovation —



IFE Institute for
Energy Technology



NATIONAL NUCLEAR
LABORATORY

sck cen



VTT



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 847626.

The content of this document reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

SHARE – **S**take**H**older based **A**nalysis of **R**esearch for Decommissioning

Consortium of 11 European Stakeholders :

- CEA, France (Coordinator)
- ENRESA, Spain
- IFE, Norway
- KIT, Germany
- LEI, Lithuania
- NNL, United Kingdom
- SCK-CEN, Belgium
- SOGIN, Italy
- VTT, Finland
- JRC, Belgium
- El, France

Timeline



Budget : 1.4 M€ (EU Grant NFRP-2018-5 847626)

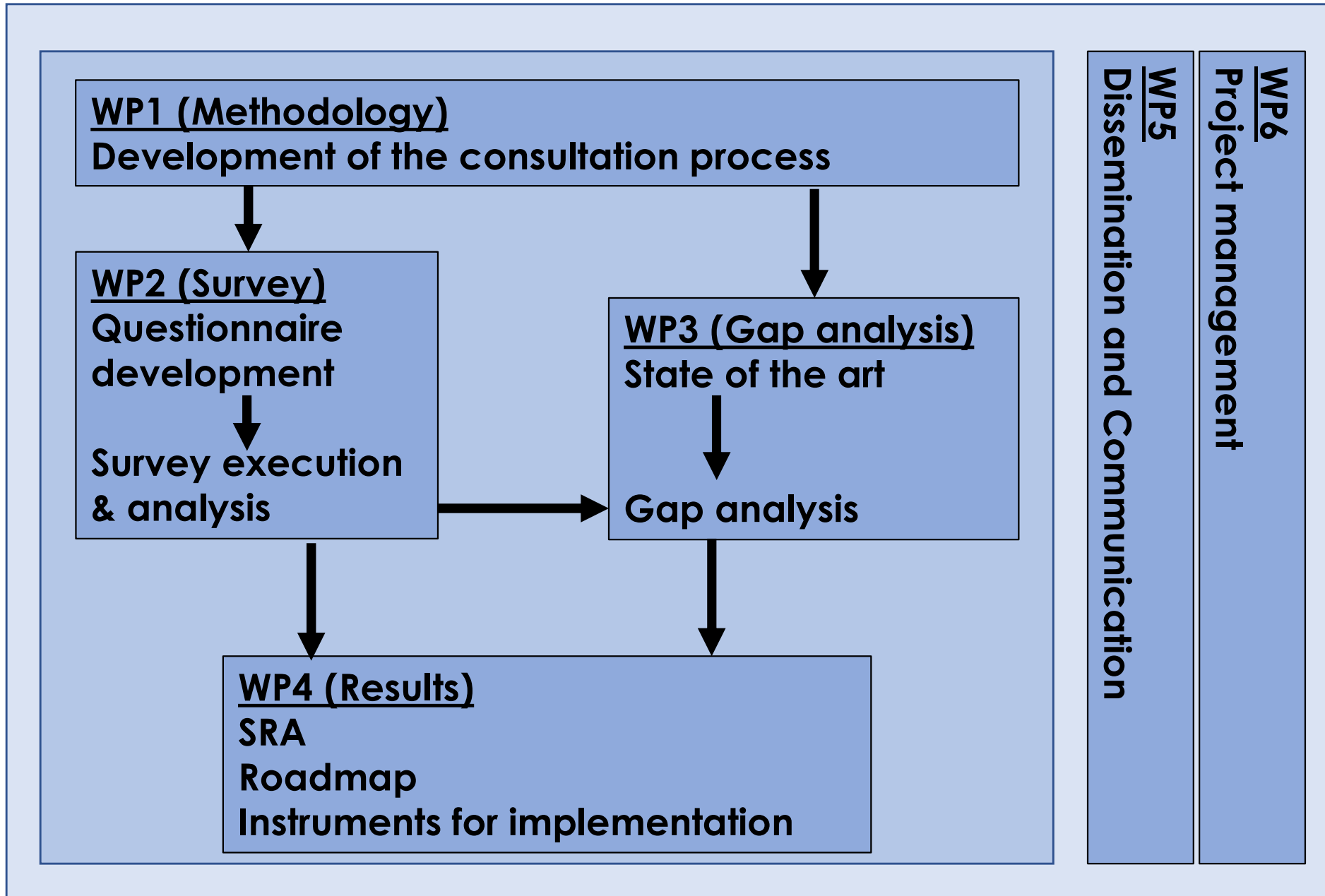
The main objectives



Main SHARE objective is to provide an **inclusive roadmap** for future research collaboration, for **Stakeholders** to jointly improve safety, reduce costs and minimize environmental impact **in the decommissioning of nuclear facilities.**

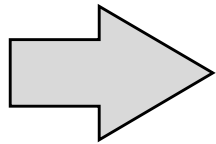
- Determine the **research needs** based on the opinions collected from Stakeholders in an inclusive process
- **Review the state of the art** in collaboration with the Stakeholders to **identify the gaps**
- Construct a **Strategic Research Agenda (SRA)** to fill the gaps with **activities** together with consolidated with the Stakeholders that will feed a **roadmap of activities** for the next 10-15 years and will allow to propose **instruments for implementation** for the activities using identified mechanisms

The work structure



Objectives

- Development of the questionnaire survey



Consortium developed a questionnaire that was consolidated with the Expert review panel



Worldwide
Stakeholders

8 Thematic Areas
71 Sub-thematic Areas

5 POINT SCALE

Closed Questions

Open Questions

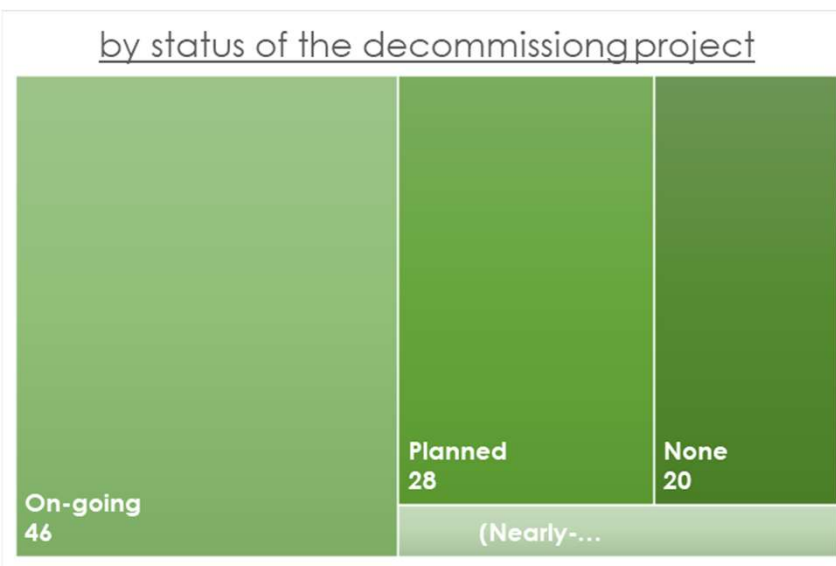
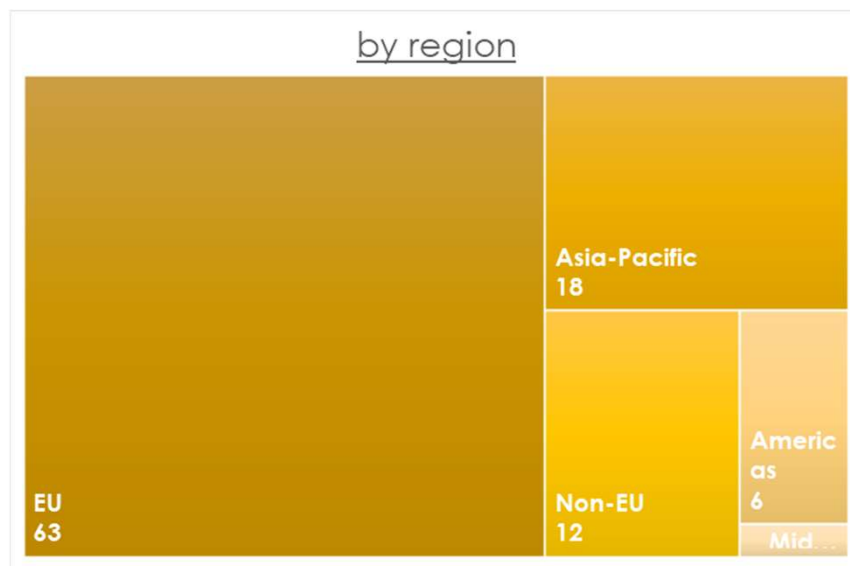
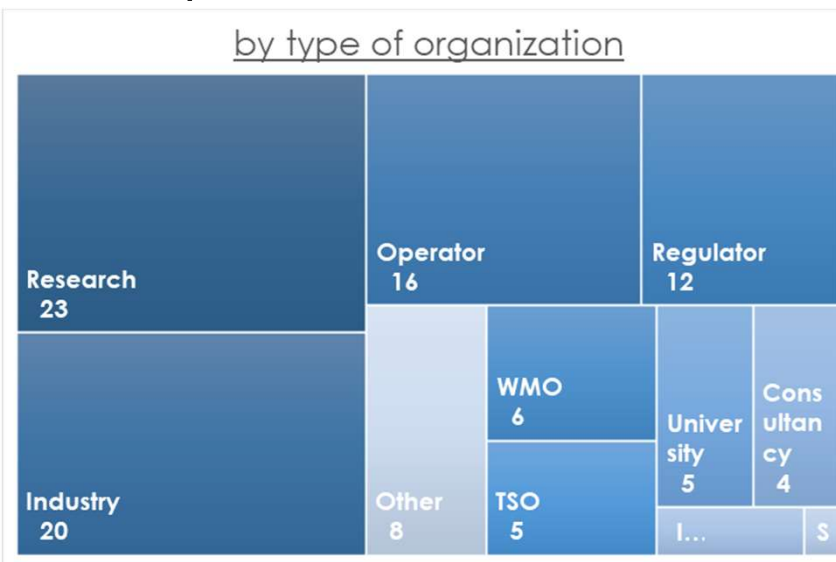
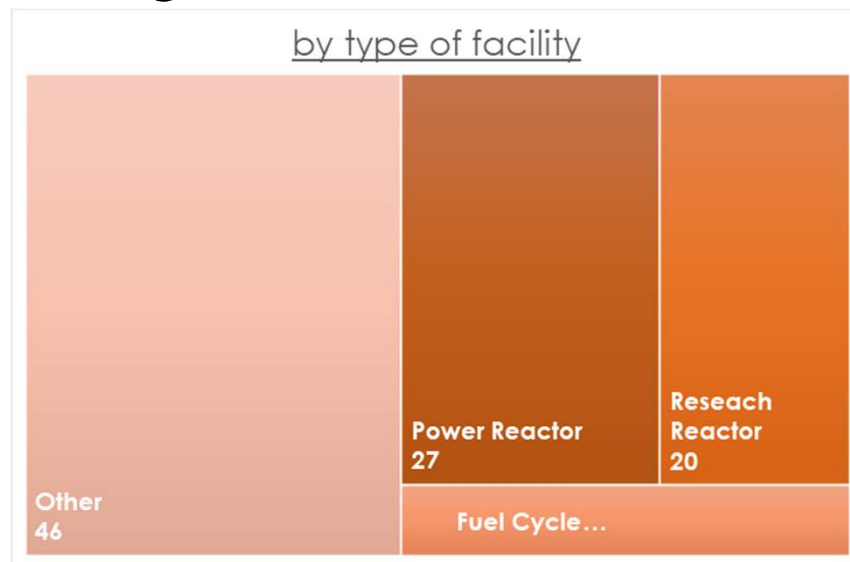
Urgency

Importance

Representativity of responding stakeholders

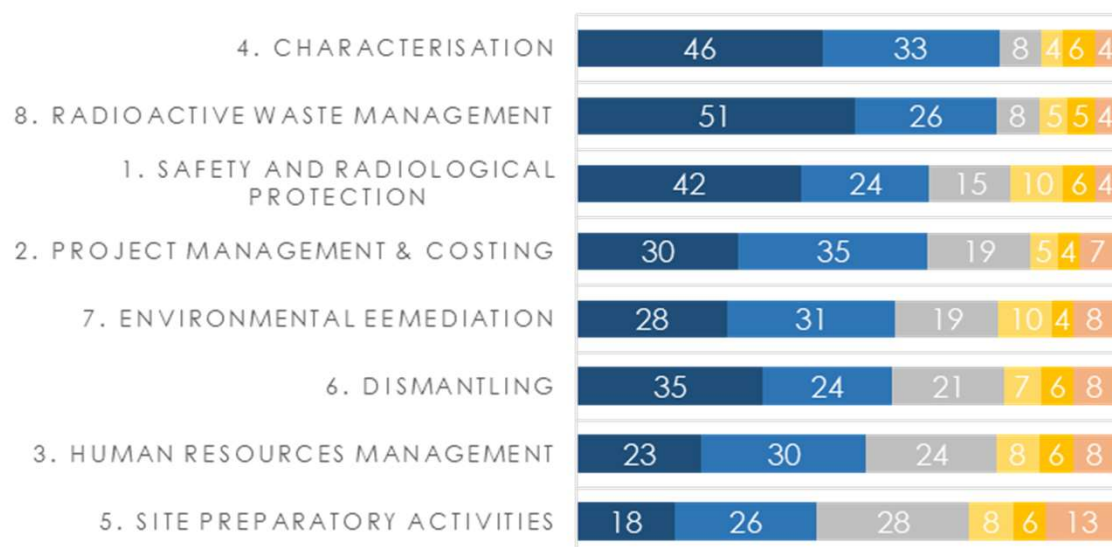
The survey

Percentage of Stakeholders in the survey

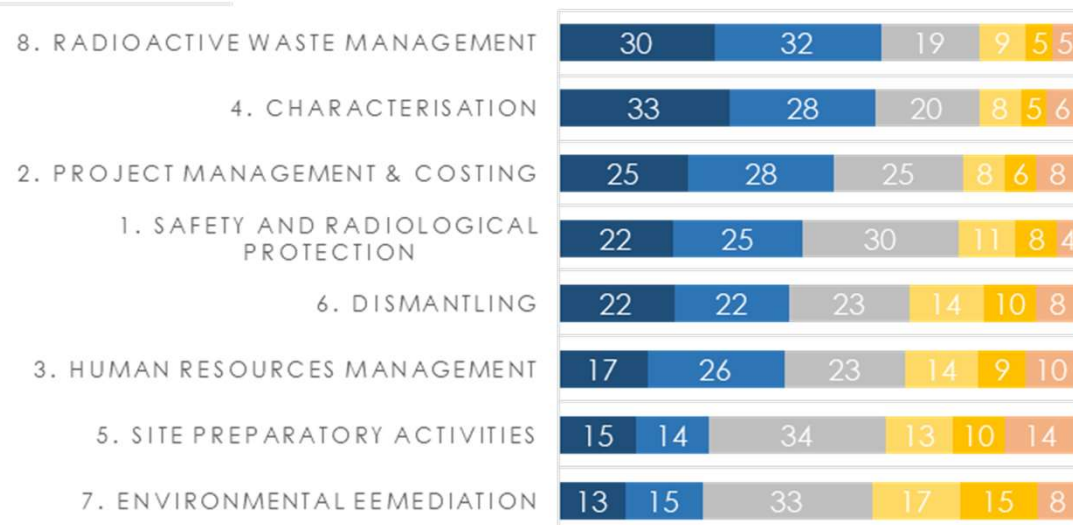


Main outcome: Urgency and Importance ranking

IMPORTANCE



URGENCY

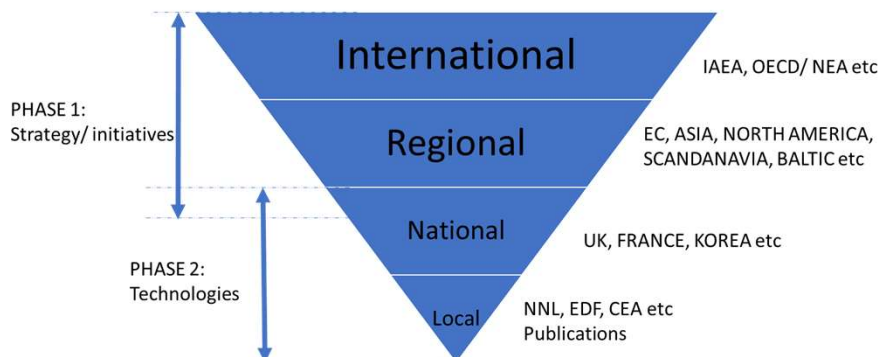


WP3 outcomes

The State of the Art review

Consortium literature review

(journals, industry reports, conference proceedings, expertise)



Extensive review on the existing practices and on-going developments in the 8 thematic areas

SHARE

H2020 NFRP-2018 CSA: Coordination and Support Action

Grant Agreement n° 847626

D3.1: Report detailing applicable technologies/ methodologies

Author: Federica Pancotti, [SOGIN]

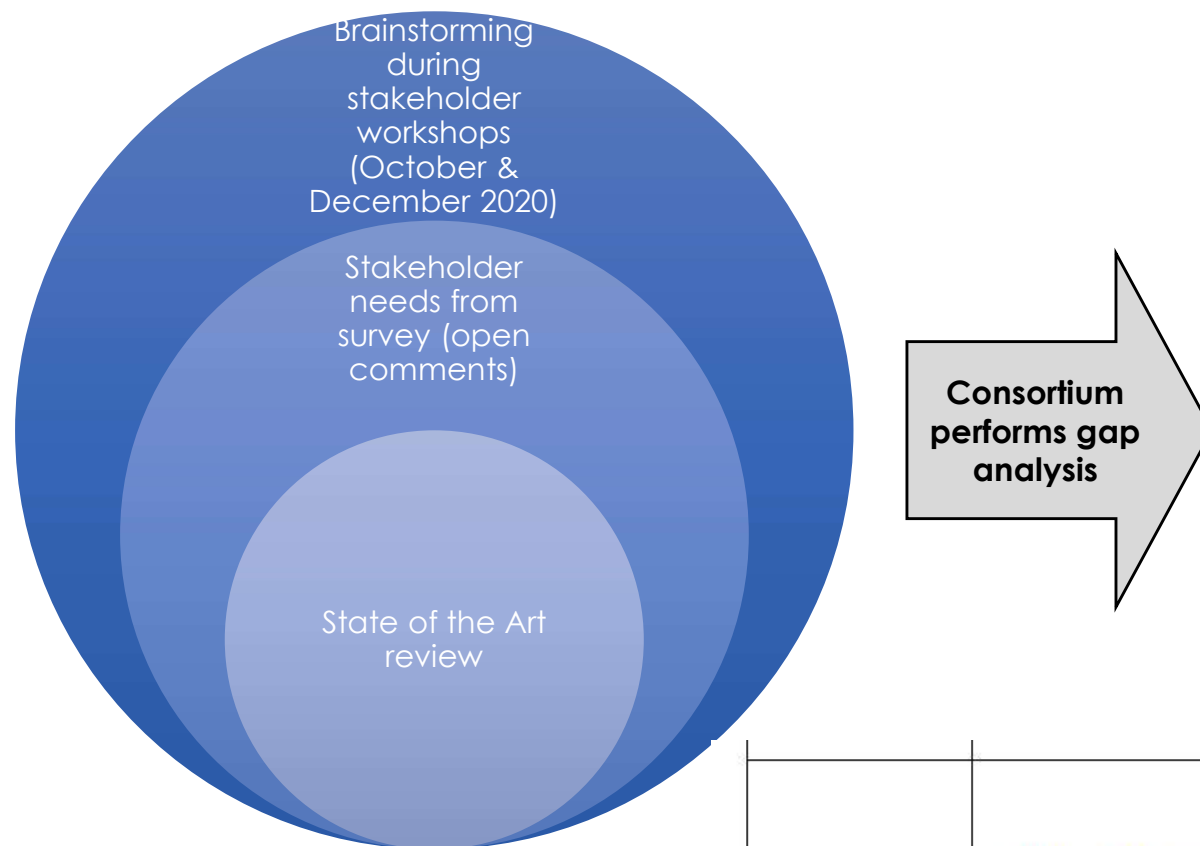
With contributions from: Fanny Fert [CEA], Ludovic Vaillant [CEA/CEPN], Jorge Borque Liñán, Emilio Garcia Neri [ENRESA], Istvan Szöke, Lucas Stephane [IFE], Angelika Bohnstedt, Simone Müller [KIT], Gintautas Poškas, Povilas Poskas, Egidijus Babilas [LEI], Samantha Ree, James Dewar, Ed Butcher [NNL], Kurt Van Den Dungen, Luc Noynaert [SCK-CEN], Alessandro Mattioli, Domenico Lisi, Rossella Sciacqua, Valerio Maturo, Gianpaolo Di Bartolomeo, Carlo Rusconi [SOGIN], Markus Airila, Raimo Launonen, Rafael Popper, Antti Rätty, Anumaija Leskinen, Liro Auterinen, Jaakko Leppänen, Petri Kotiluoto [VTT]

Reviewers: Christine Georges [CEA], Réka Szöke [IFE], Laura Aldave de las Heras [JRC], Muhammad Junaid Ejaz Chaudhry [KIT], Anthony Banford [NNL]

Stakeholder workshop in October 2020

Background for the Gap Analysis

The Gap Analysis



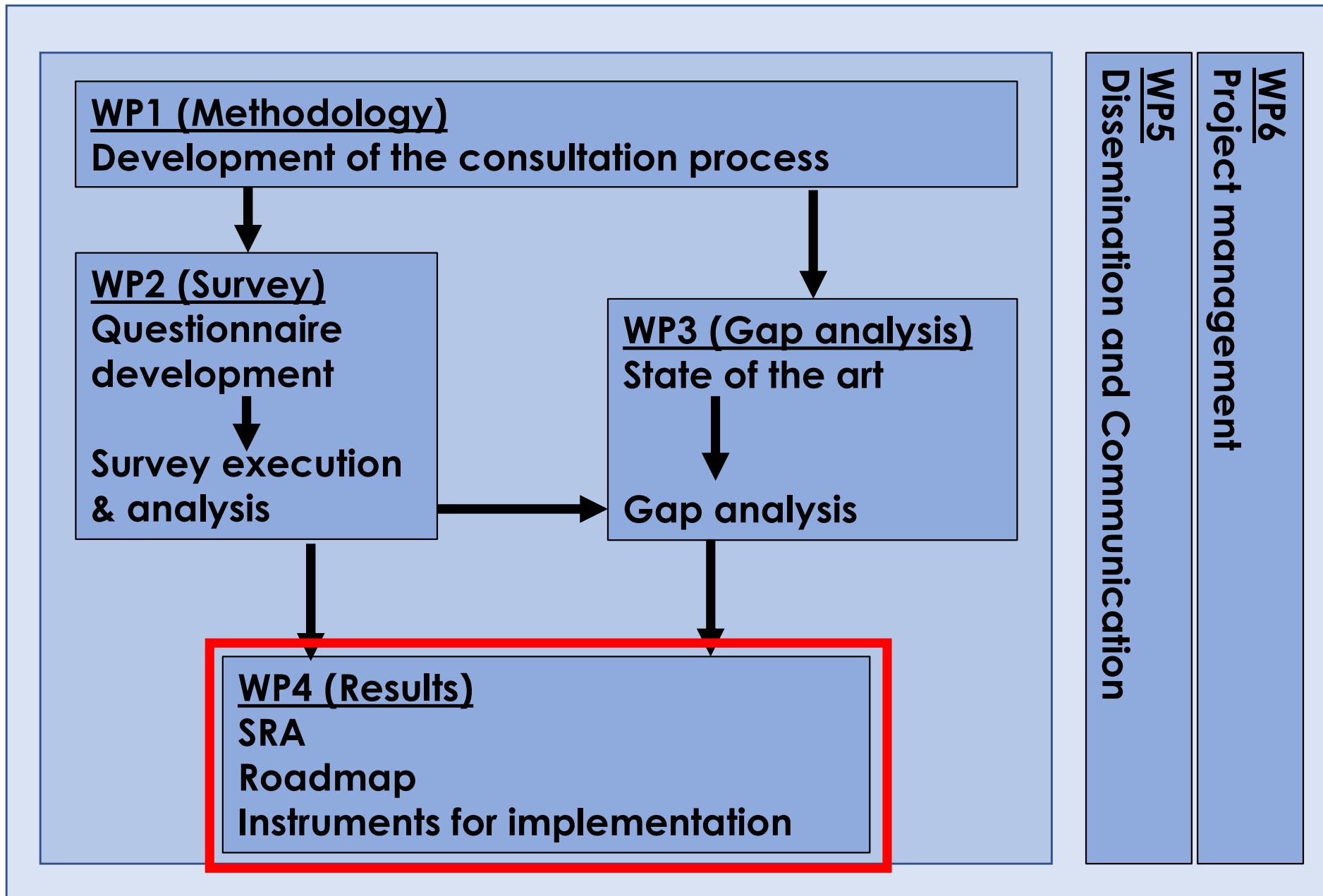
250 proposed actions for the 71 sub-thematic areas

- consolidated with the help of the stakeholders at DigiDecom 2021



Q59. Demolition of large, reinforced concrete structures	Safety reference	Benchmarking	for the safer techniques for demolition of large structures with reinforced concrete.	Guidance
		Guidance	for using remote demolition that provides worker safety.	Guidance
	Innovation and improvements in Laser technology	Benchmarking	for laser technology considering secondary waste minimisation and efficiency	Development
		Development	in laser technology by considering micro melting phenomenon	

The work structure



WP 4 Strategic Research Agenda

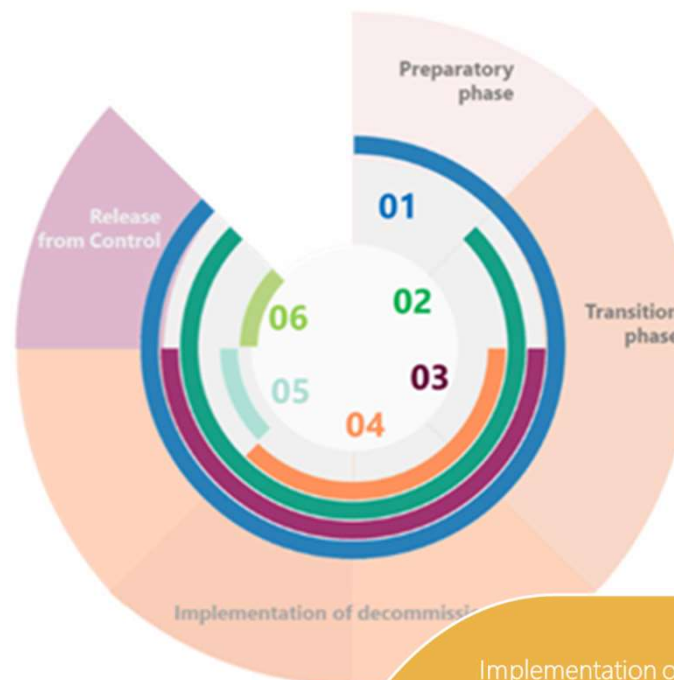
The Strategic research agenda

3 key input deliverables

Structured in 8 thematic areas

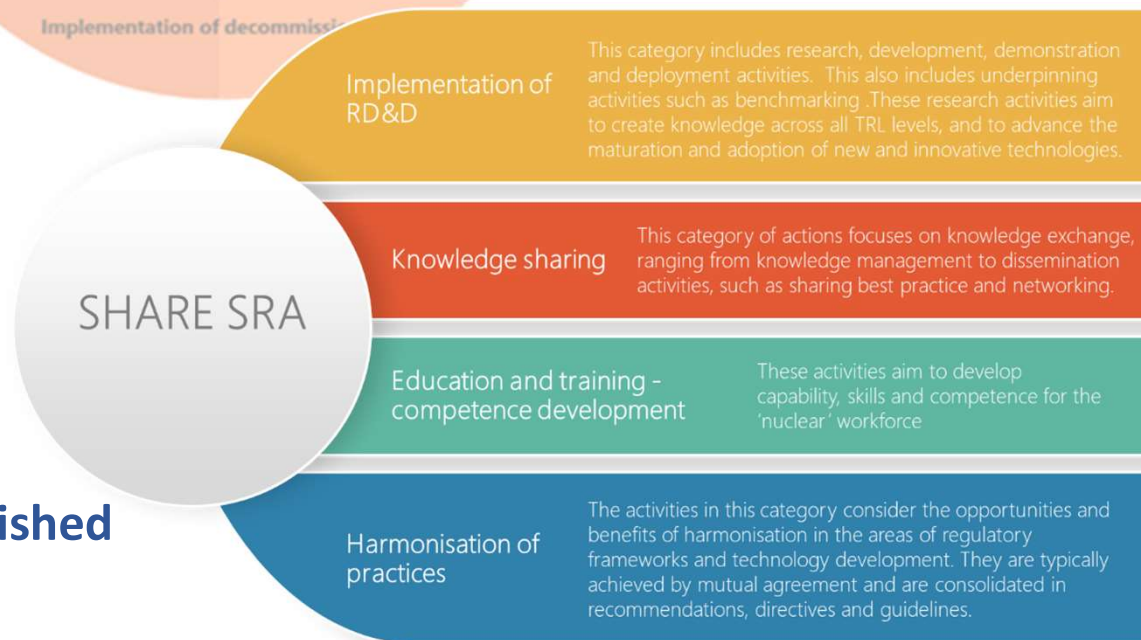
SHARE H2020 NFRP-2018 CSA: Coordination and Support Action Grant Agreement n° 847626
D2.5: Matrix and explanatory report from Task 2.3
SHARE H2020 NFRP-2018 CSA: Coordination and Support Action Grant Agreement n° 847626
D3.1: Report detailing applicable technologies/ methodologies
SHARE H2020 NFRP-2018 CSA: Coordination and Support Action Grant Agreement n° 847626
D3.2: Technology assessment/ gap analysis report

**SHARE SRA and Roadmap to be published
shortly on <https://share-h2020.eu/>**



SRA

Structured in 6 thematic areas
& by 4 action types



WP4: Strategic Research Agenda

Four Action Types

Implementation of RD&D	<ul style="list-style-type: none"> Includes research, development, demonstration and employment activities. Includes underpinning activities such as benchmarking Knowledge creation across all TRL levels
Knowledge Sharing	<ul style="list-style-type: none"> Focusses on knowledge exchange ranging from knowledge management to dissemination activities Includes best practices and networking
Education and Training	<ul style="list-style-type: none"> Activities that aim to develop capabilities, skills and competences for the nuclear workforce
Harmonisation of Practices	<ul style="list-style-type: none"> Opportunities and benefits of harmonisation in the areas of regulatory frameworks and technology development Achieved by mutual agreement and consolidated by recommendations, directives and guidelines

Non-technological areas (Safety, project management, human resources)

- Mainly cross-cutting activities (KS, HP, E&T)
- Education and recruitment of the next generation work force
- Development of adequate digital tools
- Development of cost estimation methodologies

Characterisation and Radioactive Waste Management

- Most important thematic areas
- Measurement optimisation (Difficult to measure RN, in-situ)
- Waste treatment and conditioning techniques
- Harmonisation of waste criteria

Dismantling, Decontamination and Environmental remediation

- Waste minimisation
- Improvement of efficiency, mobility and automation
- Sharing best practices and development of guidance

ROADMAP

SHARE TIMELINE

SHARE roadmap, based on the SHARE Strategic Research Agenda, compiles the various activities by activity bundles. These bundles are prioritised to establish visibility of the necessary action in 5, 10 and 15 years from the stakeholder perspective.

TYPE OF ACTIVITY

- RD&D
- Knowledge Sharing
- Harmonisation of Practices
- Education & Training

Enhance **international cooperation and coordination** (IAEA, NEA, WNA, WENRA, ENSREG) on **harmonisation of WAC**.
Strategy and promotion for international **sharing of facilities** (treatment and/or storage of waste from decommissioning).
Enhance harmonisation of practices in **VLLW management** (metal, concrete etc.) regarding clearance and acceptance criteria.
Enhance international harmonisation of **clearance criteria for Solid/Liquid/Gaseous** radioactive materials from decommissioning.
Enhance harmonisation of practices in **packaging** (transport, storage, disposal).

New **cost effective** and more general purpose **modular and mobile systems** and robotic solutions.
Technologies and methodologies for **hard to access areas** (tele-operated remote arms).
Testing methodologies in **mock-ups**.

Easy to access **database** for **robotics**.
Sharing of experiences and **best practices** for efficient remote **cutting technologies**.

Harmonisation of practices, development of **standards** for robotic verification and demonstration.

in situ WASTE CHARACTERISATION & SEGREGATION

Remote, **integrated** and **automatic technologies** for in situ waste characterisation and segregation (Improvement of existing technologies, active demonstration to increase the **technology readiness and demonstrate maturity**).

INTERNATIONAL STANDARDISATION & HARMONISATION

DIGITALISATION, MODELLING & SIMULATION

Best practices and **guidelines** on the implementation of digital technologies to improve key tasks in the decommissioning. **BIM** and **Digital twins** to add value and accelerate the decommissioning programmes.

EDUCATION FOR DECOMMISSIONING

Harmonisation of education levels required for decommissioning (i.e., certificates for specific skill sets).
E&T at **international level and cooperation** between different stakeholders by internships and certifications for attracting young workforce.
Enhance the use of **immersive training methods** (VR) for task specific training through certificates and standards.
Implementation of **E&T programmes** to ensure sufficient and skilled staff are available for the sector with a special focus on the use of **new technologies**.

DIFFICULT TO MEASURE RADIONUCLIDES (DTM)

Fast, **cheap** and straightforward methods for difficult to measure (DTM) radionuclides. **in situ alpha and beta measurements** and automation.

ROBOTICS & REMOTE SYSTEMS FOR D&D

SRA THEMATIC AREAS

- 01 Safety, Radiological Protection & Resources Management
- 02 Characterisation
- 03 Material & Waste management
- 04 Site Preparatory Activities, Dismantling, Decontamination & Demolition
- 05 Environmental Remediation
- 06 Final Release

Thank you to the consortium!



**Initiator and founder of
SHARE Christine Georges**

Anne Fornier
Ludovic Vaillant
Fanny Fert



Rékà Szőke
Istvan Szőke
Lucas
Stephane



Samantha Ree
Anthony Banford
James Dewar
Ed Butcher



Laura Aldave de las Heras
Karin Casteleyn



Kurt Van Den Dungen
Luc Noynaert



Pierre Joly
Romain Tricon-
Duez



Angelika Bohnstedt
Muhammad Junaid Ejaz
Chaudhry
Simone Müller



Federica Pancotti
Rossella Sciacqua
Alessandro Mattioli



Emilio Garcia Neri
Jorge Borque Liñán



Gintautas Poškas
Povilas Poskas
Egidijus Babilas



Anumaija Leskinen
Rafael Popper
Iiro Auterinen



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 847626.

The content of this document reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.



Thank you

<https://share-h2020.eu/>
[linkedin.share-h2020-project](#)
[linkedin/group SHARE Road map for Decommissioning](#)



efficient
innovation



IFE
Institute for
Energy Technology



NATIONAL NUCLEAR
LABORATORY

sck cen



VTT