



**SHARE**  
A roadmap for research  
in Decommissioning

# EU Project "SHARE" Objectives, Methodology and Results

<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/)

**Muhammad Junaid Chaudhry**



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**Research fields**

- Standardized dismantling of nuclear facilities
- Technologies and procedures for dismantling

**Funding of projects**

**Industrial, National, and International**

**Project consortium**

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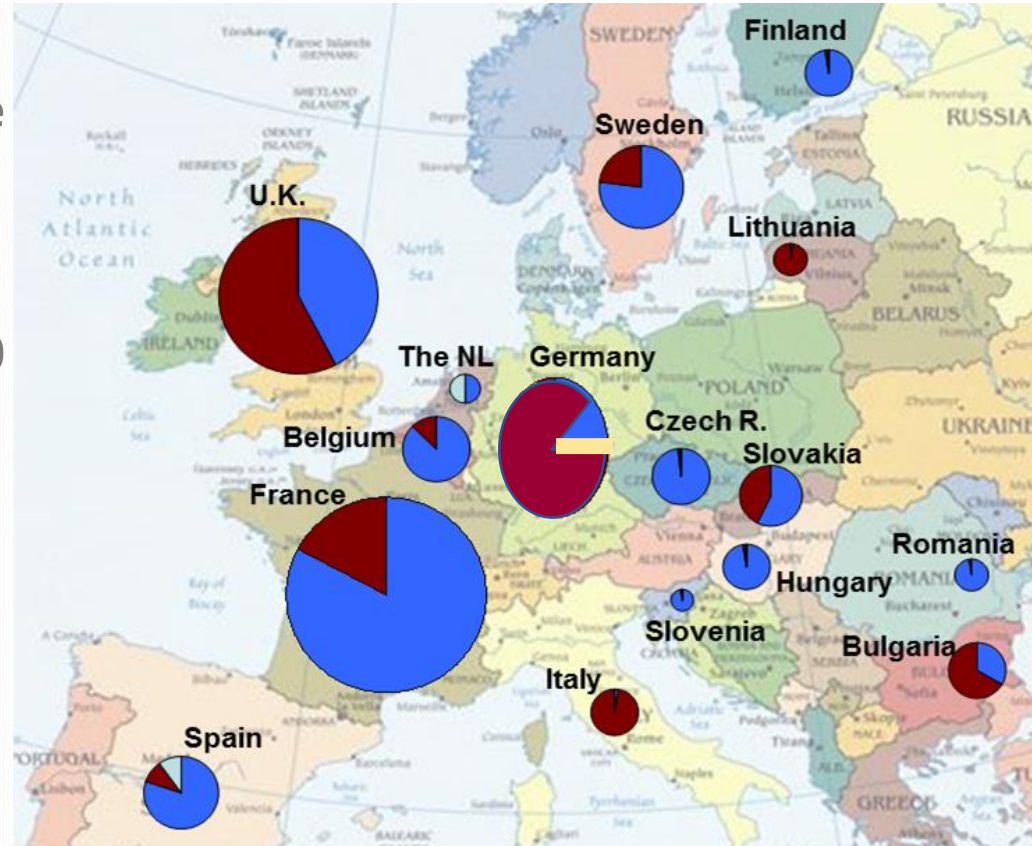


# Nuclear Decommissioning Activities

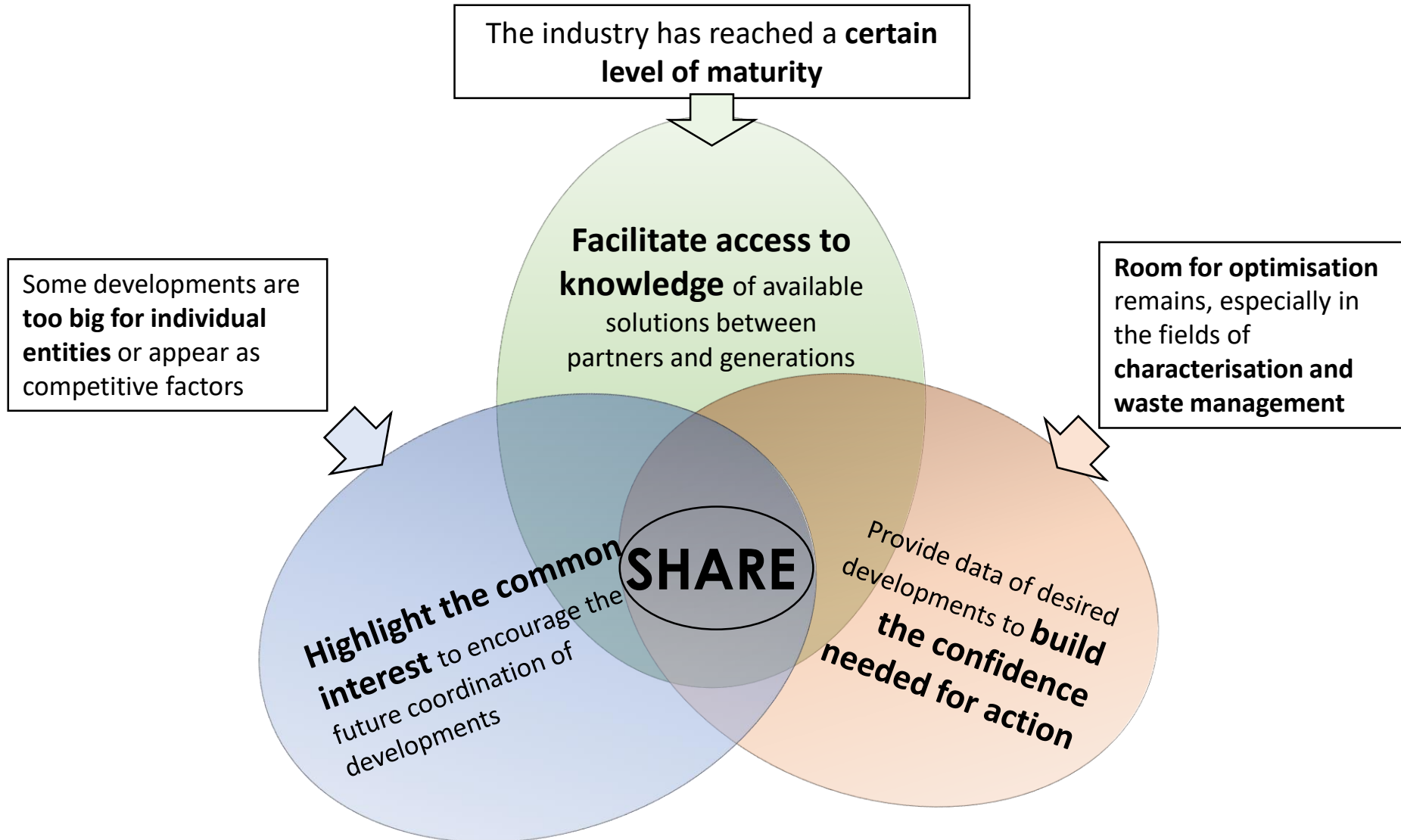
Decommissioning activities have increased and will further grow in the European Union

Total projected expenditures in decommissioning in the EU until 2060 are estimated at ~EUR 65 billion

DG ENER STUDY Market for decommissioning of nuclear facilities -09/10/2019

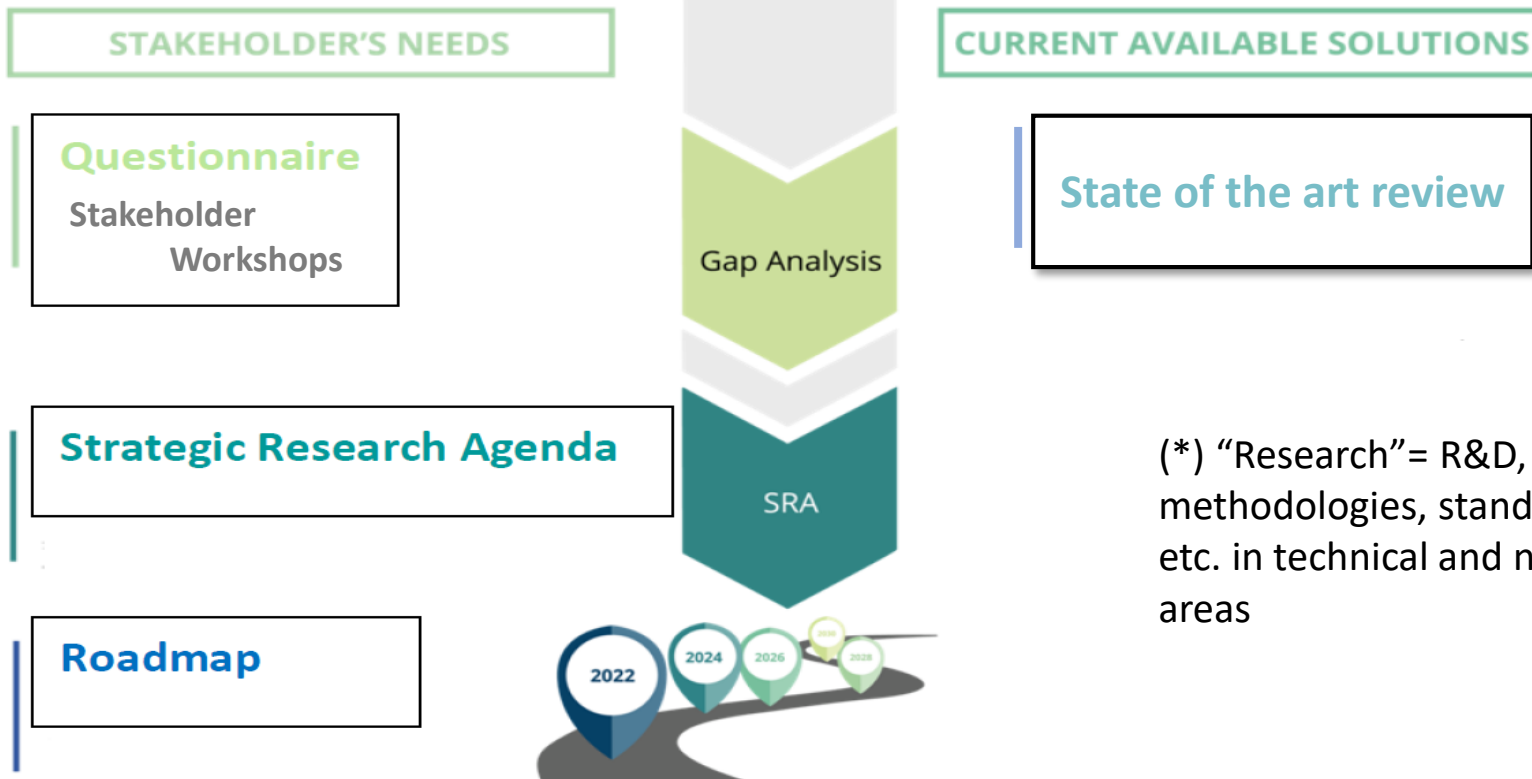


- Operational
- Shutdown - Dismantling
- Fully Dismantled
- Long Term Safe Enclosure

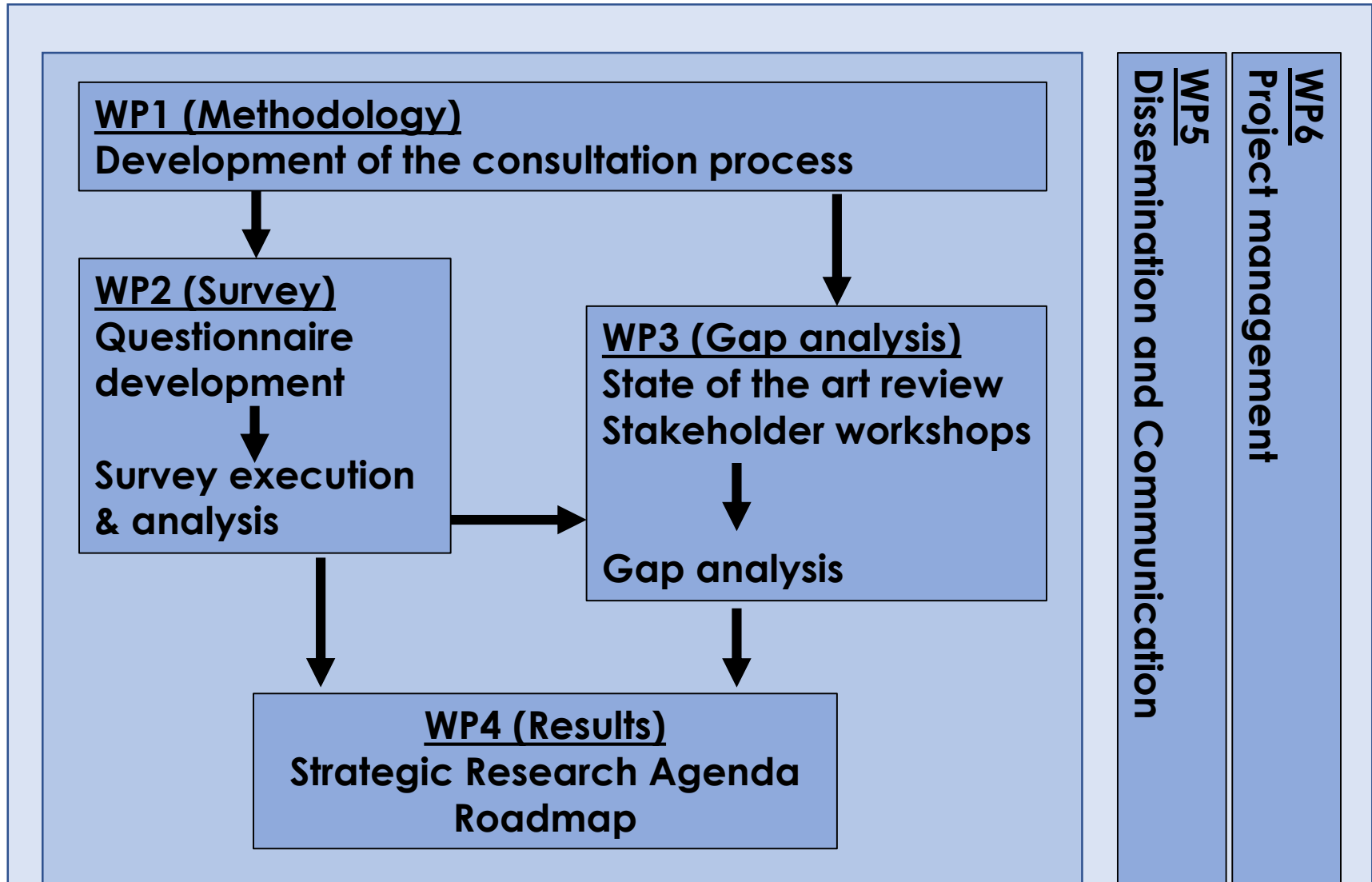


“Development of a roadmap for decommissioning Research\* aiming at safety improvement, environmental impact minimisation and cost reduction”

## Horizon2020 – SHARE

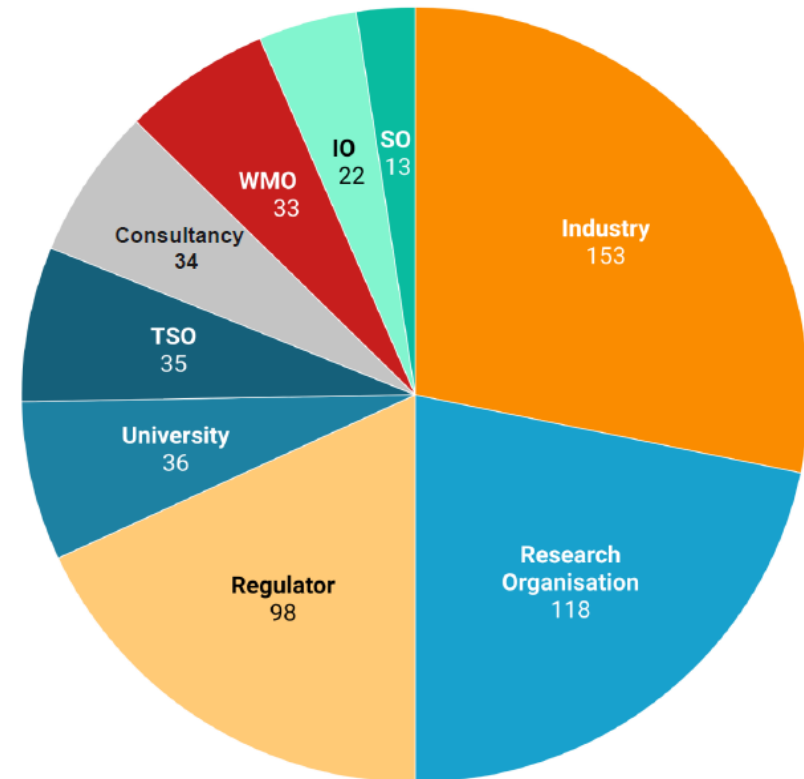


(\* “Research”= R&D, R&I, methodologies, standardisation, etc. in technical and non-technical areas



## Objectives

- Elaboration of list of stakeholders that is representative of the decommissioning activities
  - Consortium members established a list based on contacts and publicly available information (650 contacts)
  - Stakeholders' type (Industry, regulator...) and country are observed for representability
- Development of a methodology of evaluation for the questionnaire
  - Work towards a ranking system for the items in the questionnaire





## Objectives

- Development of the survey questionnaire
- Survey execution
- Survey analysis



@JRC

**Worldwide**  
**Stakeholders**

**8 Thematic Areas**  
**71 Sub-thematic Areas**

**5 POINT SCALE**

**Closed Questions**

*Open Questions*

**Urgency**

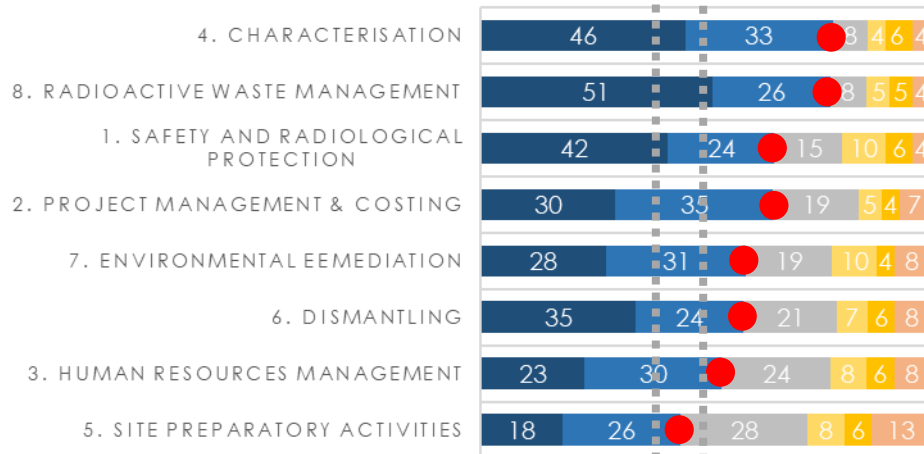
*Importance*



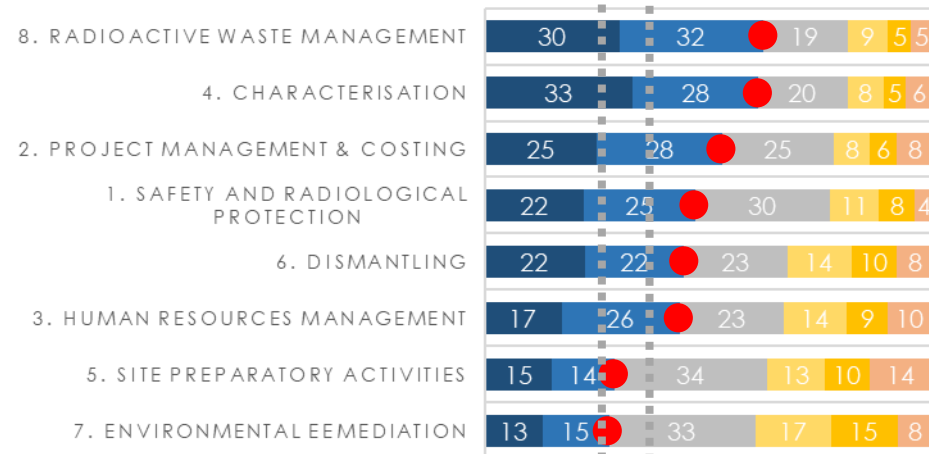
# WP2: Survey results (Importance and Urgency ranking)

Top 2 ranking indicated by ●

## IMPORTANCE



## URGENCY



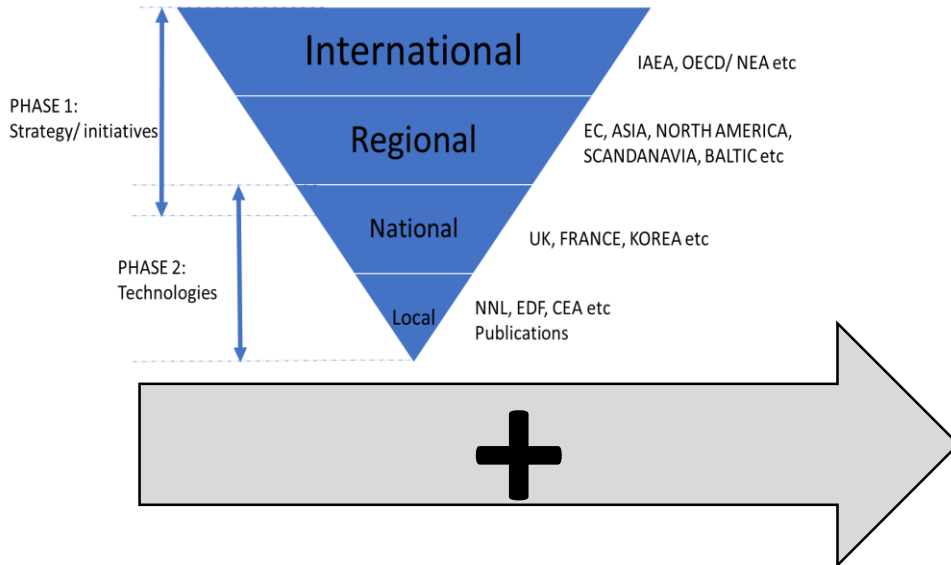
Three categories

	High	Medium	Low
Importance	>50	50-40	<40
Urgency	>40	40-30	<30

Same procedure for the sub thematic areas

## Consortium literature review

(journals, industry reports, conference proceedings, expertise)



Stakeholder workshop in October 2020

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



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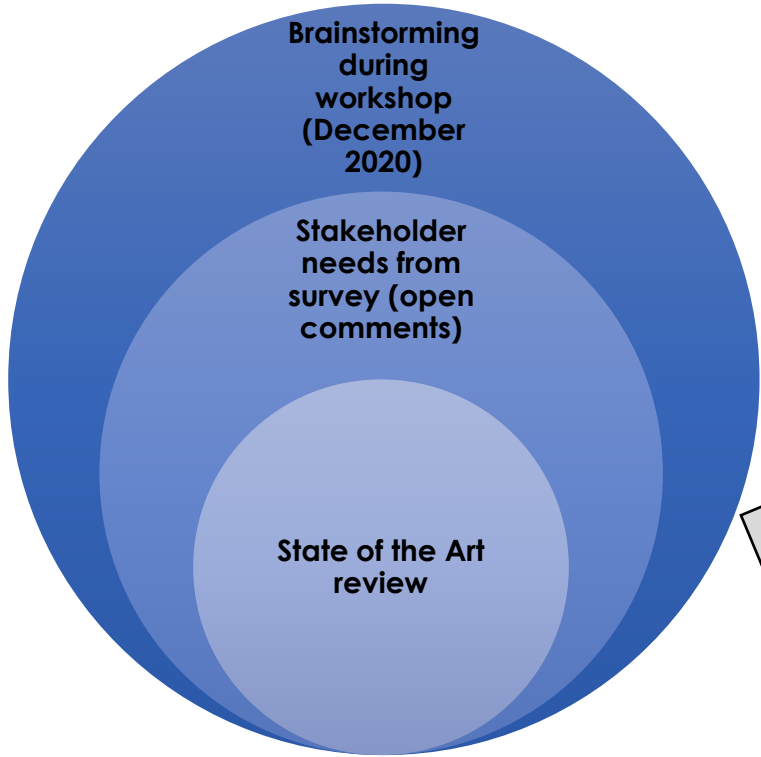
### D3.1: Report detailing applicable technologies/ methodologies

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]

Background for the Gap Analysis



Consortium performs gap analysis

Results of gap analysis

## 250 proposed actions for the 71 sub-thematic areas

- consolidated with the help of the stakeholders at DigiDecom 2021



Sub-thematic area	Needs, Challenges, Issues, missing	Desired state	Possible solutions/opportunities	Review from D3.1	Type of action proposed	Impact/ reason/ outcome of proposed action on
56.Segmentation of interior concrete structures (e.g., bioshield)	Diamond wire cutting is slow and tedious.  Investment in Laser and Nitrocision	Benchmarking and guidance for tools	LD-Safe project	A lot of advancement in technology commercially	Guidance	already implemented segmentation technologies for interior concrete structures and biological shield

# WP3: Key aspects of the gap analysis by thematic area

Thematic areas	Key aspects
Q1. Safety and radiological protection	<p><b>Harmonization</b> and Enhancement of international/national regulations                      Future coordination and collaborations                      Regulatory guidance</p>
Q2. Project Management and Costing	<p><b>Guidance</b> on tools for cost management and digitization                      Development of IT tools for project management  <b>Enhance use</b> of BIM and virtual software</p>
Q3. Human resources management	<p><b>Coordination</b> among EU, IAEA, and NEA to update existing documents                      Enhance use of IT tools, training methods and education of employees                      Benchmarking on methods and tools for knowledge management</p>
Q4. Characterisation	<p>Fast and cheap methods of radionuclide measurements                      Technology for <b>digital methods and automation</b>                      Developments towards knowledge management, training and industrialization</p>
Q5. Site preparatory activities	<p>Moved to waste management</p>
Q6. Dismantling technologies	<p><b>Development of technologies</b> for detection of contamination, decontamination and cutting of metals and concrete                      R&amp;D towards automation and digitization  <b>Enhance use of mobile systems</b> and robotics for worker safety</p>
Q7. Environmental remediation and site release	<p>Models, digital tools, multi-criteria analysis, and international guidance for remediation and site release                      Benchmarking of technologies and IT tools</p>
Q8. Radioactive waste management	<p><b>Harmonization of best practices</b>, waste minimization                      Simpler and cheaper processes for secondary waste handling  <b>Experience sharing</b> for IT tools and specific waste forms (asbestos)                      Harmonization and standards for waste acceptance criteria</p>

# WP4: Strategic Research Agenda (SRA)

## Objectives

- SRA visualises and summarises the outcomes of previous WP's and result of gap analysis prioritised (considering importance ranking) and grouped thematically with a list of activities to be addressed by the SHARE Roadmap

## 3 key input deliverables

Structured in 8 thematic areas

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**D2.5: Matrix and explanatory report from Task 2.3**

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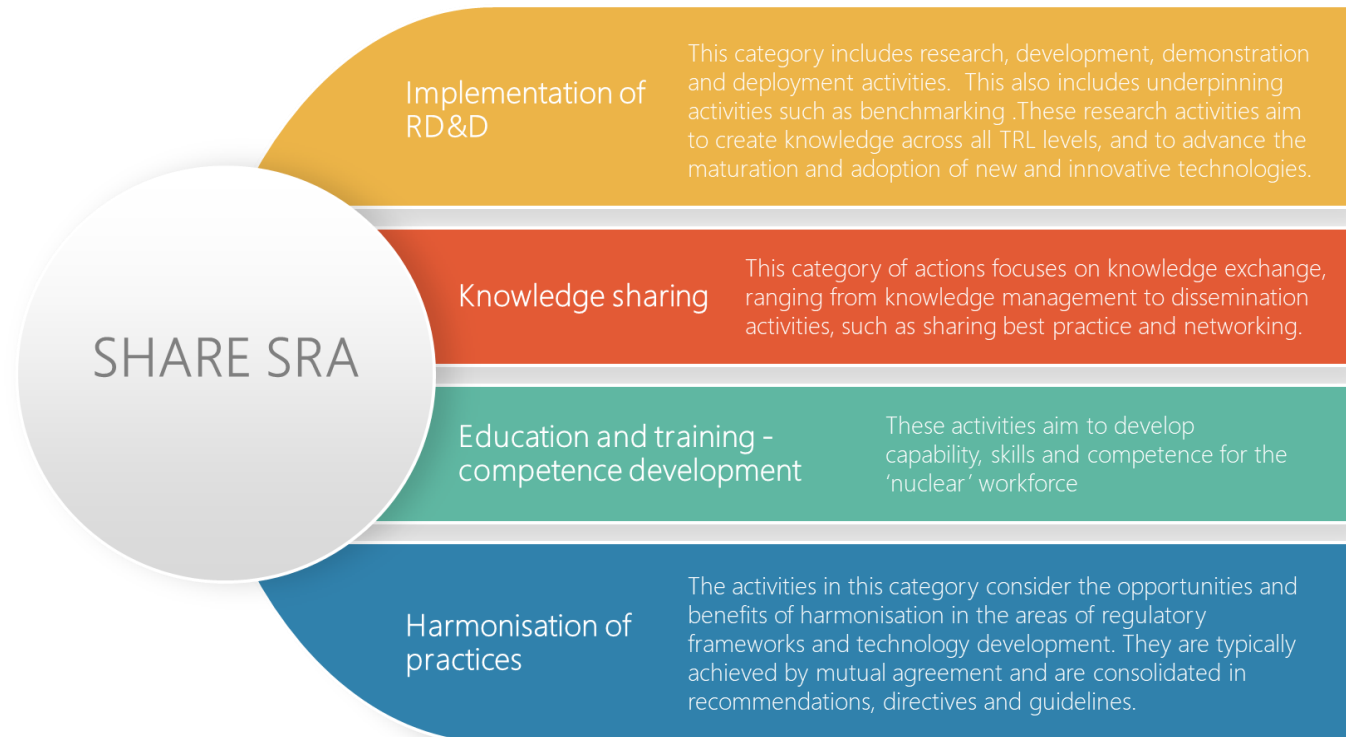
**D3.1: Report detailing applicable technologies/  
methodologies**

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**D3.2: Technology assessment/ gap analysis report**



## Objectives

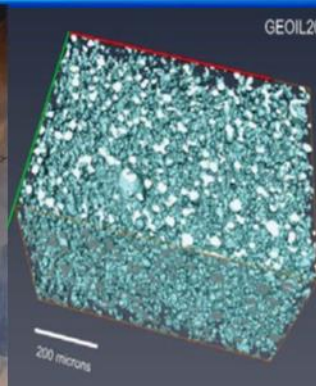
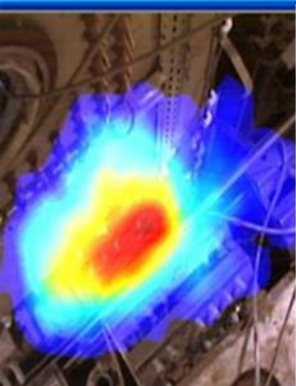
- The roadmap is the Strategic Research Agenda (SRA) organised along with a time schedule for implementation of different actions and activities in the coming 5 to 10 years.
- The roadmap proposes for each Key Topic the desirable end state and the timeframe (considering urgency rating) for their development.

Dismantling & Decontamination	High Urgent	Medium Urgent	Low Urgent
<b>RD&amp;D</b>	<p><b>Robotic and Remote Systems for D&amp;D</b> New cost-effective and more general purpose modular and mobile systems and robotic solutions Easy to access database for robotics Technologies and methodologies for hard to access areas (tele-operated remote arms) Testing methodologies for robotics in mock-ups <b>H</b></p> <p><b>Digitalisation, 3D Modeling and Simulation</b> Enhance the use and interoperability of digital technologies to assist the workers' training and the modelling and simulation of dismantling alternative scenarios <b>H</b></p>	<p><b>Robotic and Remote Systems for D&amp;D</b> Benchmarking on long reach manipulators with greater dexterity, concrete decontamination techniques with the implementation of remote operations and remote systems with integrated characterisation and decontamination equipment <b>H,M</b></p> <p>Development of automated handling, segregation and packaging systems</p> <p><b>Digitalisation, 3D Modeling and Simulation</b> Integration of remote control dismantling techniques with 3D models &amp; simulations <b>H</b></p> <p><b>Improvements in D&amp;D technologies for secondary waste minimisation and efficiency</b> Benchmarking of technologies and methodologies for in-situ building surface decontamination and laser decontamination technology <b>H,M</b></p>	<p><b>New solutions for D&amp;D</b> Innovative solutions in electrochemical decontamination and new or optimised waste forms Technologies and methodologies for hard to access piping for surveying and segmentation <b>L</b></p> <p>Pipe cutting technologies that provide secondary waste minimisation and good rate including industrialisation on electrochemical cutting</p> <p><b>Laser technology for DD&amp;D</b> Benchmarking and research activities on laser technology for decontamination, dismantling and demolition, considering secondary waste minimisation, efficiency and micro melting phenomenon <b>L</b></p>
<b>Knowledge Sharing</b>	<p><b>Robotics and Remote Systems for D&amp;D</b> Sharing of experiences and best practices for efficient remote cutting technologies <b>H</b></p>	<p><b>Segmentation and decontamination strategy optimisation</b> Dissemination and sharing of experiences and best practices for selection and optimisation of segmentation strategy for large irradiated metallic and large surface-contaminated components compatible with decontamination techniques <b>H,M</b></p> <p>Dissemination and sharing of standard safety case for transportation of material for segmentation in the facility or on site and on management of embedded waste</p> <p><b>Improvements in D&amp;D technologies for secondary waste minimisation and efficiency</b> Sharing of experiences and best practices for efficient technologies for segmentation of large surface-contaminated components <b>M</b></p>	<p><b>Segmentation and demolition techniques</b> Dissemination and sharing of experiences for already implemented technologies for interior concrete structures and biological shield segmentation <b>M,L</b></p> <p>Dissemination and sharing of experiences for safer techniques for the demolition of large, reinforced concrete structures</p>
<b>Harmonisation of Practices</b>	<p><b>Robotic and Remote Systems for D&amp;D</b> Harmonisation of practices for the safety case definition and development of standards for robotic verification and demonstration <b>H</b></p>	<p><b>Robotic and Remote Systems for D&amp;D</b> Harmonisation of safety and demonstration approaches for remote autonomous tools for RPV segmentation <b>H</b></p> <p><b>LCC and LCA for segmentation and decontamination techniques</b> Guidance and methods for the Life Cycle Cost and Life Cycle Assessment for segmentation equipment, concrete decontamination equipment and mechanical decontamination systems <b>H,M</b></p>	
<b>Education &amp; Training</b>			<p><b>Remote segmentation and demolition techniques</b> Education and training programmes and guidance for the use of remote segmentation and demolition techniques <b>L</b></p>



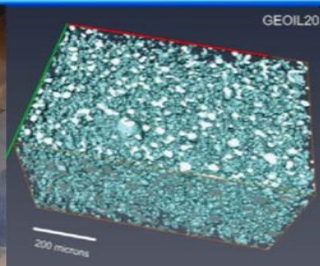
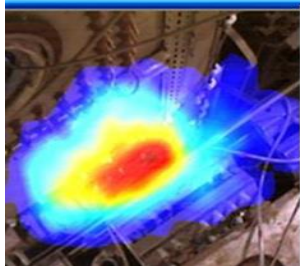
# Conclusions

- Consultation process from the global decommissioning community helped to understand issues and challenges and identified needs and opportunities
- SHARE Strategic Research Agenda (SRA) and roadmap for next 5-10 years will support policymakers for investment towards potential future collaborative Research projects
- This will facilitate the establishment of collaborative projects among organisations with common need sets and may lead in the future to better harmonisation in decommissioning research





- Der Befragungsprozess der weltweiten Stilllegungsgemeinschaft hat geholfen, Probleme und Herausforderungen zu verstehen und Bedürfnisse und Möglichkeiten zu ermitteln.
- Die Strategische Forschungsagenda von SHARE (SRA) zusammen mit der Roadmap für die nächsten 5-10 Jahre soll die Entscheidungsträger bei Investitionen in potenzielle künftige gemeinsame Forschungsprojekte unterstützen.
- Die Ergebnisse von SRA und Roadmap werden die Erstellung von Kooperationsprojekten zwischen Organisationen mit gleichen oder ähnlichen Herausforderungen erleichtern und können in Zukunft zu einer besseren Harmonisierung der Stilllegungsforschung führen.





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