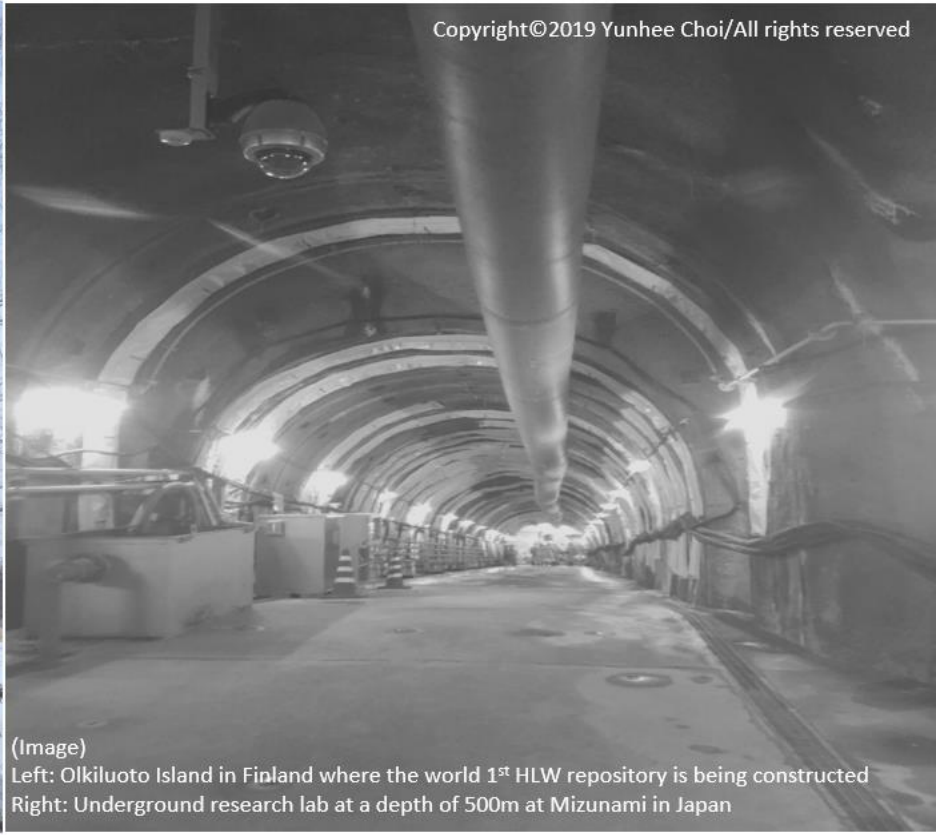
The Structure of Trust in Social Acceptance of High-level Radioactive Waste Management : Empirical Analysis based on the European Cases



(Image)
Left: Olkiluoto Island in Finland where the world 1st HLW repository is being constructed
Right: Underground research lab at a depth of 500m at Mizunami in Japan

Society of Environmental Science, Japan (SES)
Annual Conference 2020 (Online Conference)
20 September 2020・13:30-16:00
YUNHEE CHOI

THE ROLE OF TRUST IN HLW MANAGEMENT

A DECISIVE ROLE OF TRUST IN HLW MANAGEMENT

- **Well-established trust increases public support to the policy**
(Earle, 2010; Laurian, 2009; Siegrist and Cvetkovich, 2000; Putnam, 1993)

- **Trust has been a central discussion in the social acceptance of uncertain hazards in the field of risk management, and its decisive role concerning the acceptance of risks has been proved in many studies** (Vilhunen et al., 2019; Kari, 2009; Earle, 2010; Allum, 2007; Flynn et al., 1992; Kunreuther et al., 1990; Carter, 1987; Bronfman et al., 2009; Poortinga and Pidgeon, 2003; Siegrist et al., 2000; Peters et al., 1997; and Frewer et al., 1996; and Pijawka and Mushkatel, 1992).

- **In increasing trust in HLW management, deliberative public participation has been emphasized** (Pellizzoni, 2010; Beck, 1999).

<THE PURPOSE OF THE PRESENTATION>

- **By considering trust as a key that drives people to accept potential risks and uncertainty in risk management of modern society, the current presentation explains the mechanism of the dimensions of trust to promote social acceptance of HLW management in the three European cases, which are Finland, the United Kingdom, and France.**

- **The selected cases implemented deliberative public participation in dealing with HLW management. Nevertheless, the level of social acceptance of HLW management all varies.**

- **To build trust in HLW management, an in-depth understanding of the mechanism of trust, promoting social acceptance concerning procedural and distributive justice is essential.**

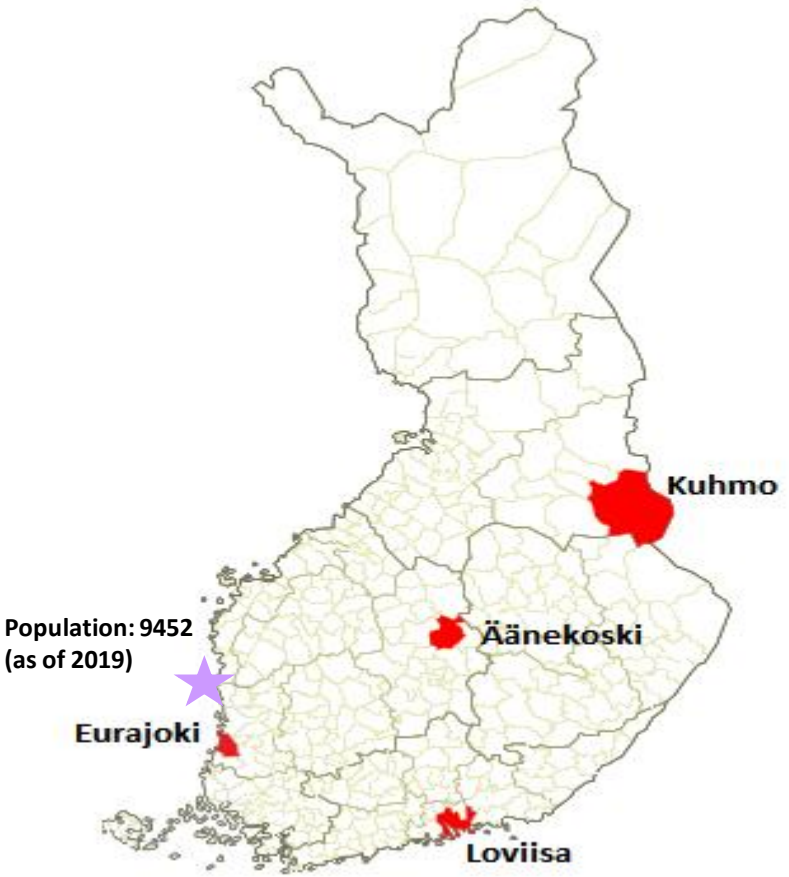
THREE EUROPEAN CASES

	ACCEPTANCE		APPROACHES		
	POLICY	REPOSITORY	PUBLIC PARTICIPATION	VOLUNTARY APPROACH	VETO RIGHTS
FINLAND	ACCEPTED	ACCEPTED	EIA (LOCAL LEVEL)	YES	YES
UK	ACCEPTED	FAILED	PSE (NATIONAL & LOCAL LEVEL)	YES	YES
FRANCE	CONTROVERSIAL	CONTROVERSIAL	CNDP (NATIONAL LEVEL)	NO	NO

Source: Author

THE OVERVIEW OF THE CASE OF FINLAND

FOUR CANDIDATE MUNICIPALITIES



Population: 9452 (as of 2019)

Source: Author's compilation based on the map downloaded from the Wikipedia Commons

GENERAL INFORMATION

Population1)		5,518,050
GDP per capita (USD)1)		50,152.30
Energy Self sufficiency rate2)		55%
Nationally produced energy resources2)		Nuclear/Renewable
Number of nuclear reactors3)	Operating	4
	Constructing	2
% of electricity generation from NPPs3)		27%
Electricity price for household (EUR per kWh)4)		0.135 (as of 2015)
Electricity price for industry (EUR per kWh)4)		0.09 (as of 2015)
Operator of NPPs5)		3 (TVO: Private/Fortum:State-owned/Fennovoima: Private)
Nuclear weapons program		No

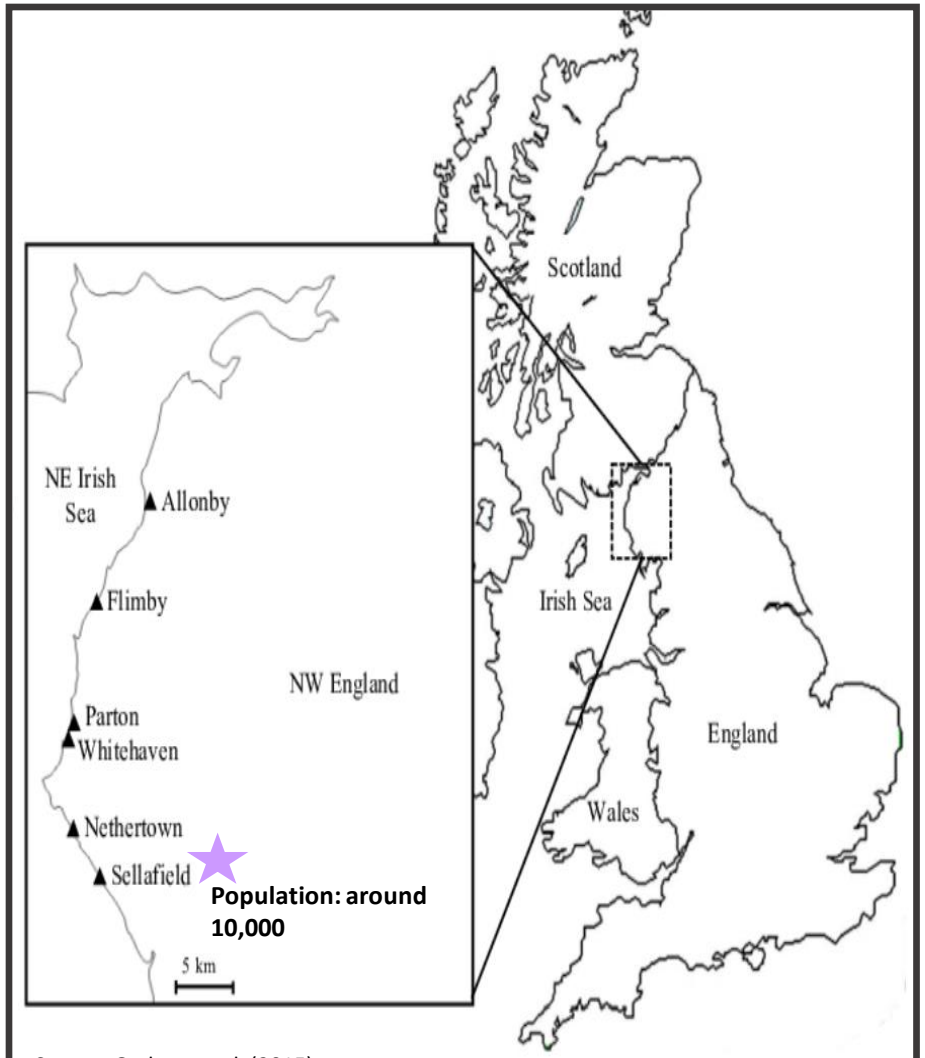
Source: Author's compilation based on 1) World Bank (as of 2018); 2) METI (2018); 3), 5) World Nuclear Association; and 4) Eurostat

CURRENT STATUS

- The site officially decided in 2001 at Olkiluoto island in Eurajoki municipality.
- Posiva received a construction license of the deep geological disposal repository called Onkalo, in 2012.
- Onkalo is only for spent fuel from nuclear waste produced by TVO and Fortum, existing nuclear companies.
- Fennovoima, a new nuclear company, should go through its siting process for the repository to dispose of spent fuel from a newly constructing nuclear power plant (Hanikivi 1).

THE OVERVIEW OF THE CASE OF THE UK

FOUR CANDIDATE MUNICIPALITIES



Source: Graham et al. (2015)

GENERAL INFORMATION

Population1)		66,488,991
GDP per capita (USD)1)		42,943.90
Energy Self sufficiency rate2)		n/a
Nationally produced energy resources2)		Gas, Nuclear, Wind, Coal, Bio-Energy, Solar, Hydroelectric, Oil
Number of nuclear reactors3)	Operating	15
	Constructing	1
% of electricity generation from NPPs3)		21%
Electricity price for household (EUR per kWh)4)		0.2122
Electricity price for industry (EUR per kWh)4)		0.1517
Operator of NPPs5)		
Nuclear weapons program		YES

Source: Author's compilation based on 1) World Bank (as of 2018); 2) METI (2018); 3), 5) World Nuclear Association; and 4) Eurostat

CURRENT STATUS

- The national policy of HLW management is deep geological disposal decided followed by the public stakeholder engagement (PSE) program carried out from 2004 to 2006.
  ➔ The overall consensus on the policy achieved

- Failed to continue with the siting process in Cumbria in 2011, despite implementing the PSE program at the local level.

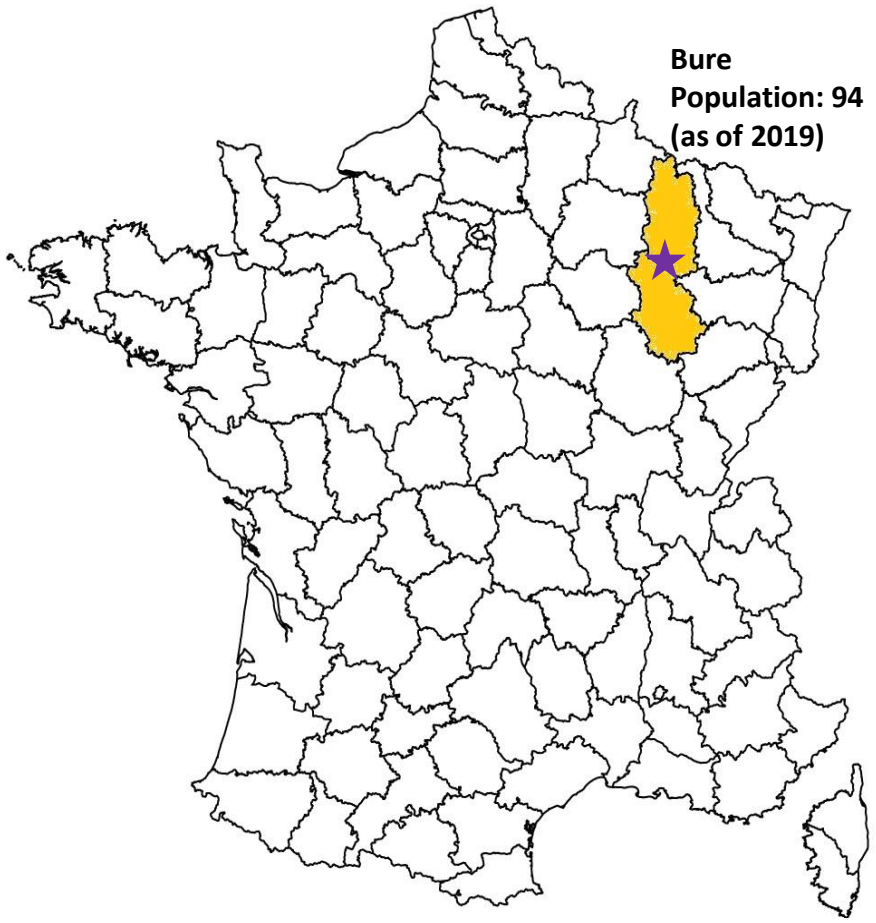
- No site for the URL and the repository has been decided yet.

- Continuously conduct public stakeholder engagement programs and revise the White Paper (policy).

- New White Paper was announced in December 2018.

THE OVERVIEW OF THE CASE OF FRANCE

LOCATION OF URL



Source: Author's compilation based on the map downloaded from France_Pub.com at https://www.france-pub.com/emap1.php

GENERAL INFORMATION

Population1)		66,987,244
GDP per capita (USD)1)		41,463.60
Energy Self sufficiency rate2)		54%
Nationally produced energy resources2)		Nuclear
Number of nuclear reactors3)	Operating	58
	Constructing	1
% of electricity generation from NPPs3)		75%
Electricity price for household (EUR per kWh)4)		0.1765
Electricity price for industry (EUR per kWh)4)		0.1024
Operator of NPPs5)		1 (EDF/State-run company)
Nuclear weapons program		YES

Source: Author's compilation based on 1) World Bank (as of 2018); 2) METI (2018); 3), 5) World Nuclear Association; and 4) Eurostat

CURRENT STATUS

- Meuse and Haute-Marne Departments accepted an underground research laboratory (URL) at Bure in 1998 for deep geological disposal research.
- The first public debate of the CNDP carried out upon the Ministries' request before deciding the national option for HLW between 2005-2006.
- In 2006, the government decided deep geological disposal for a national policy.
- The CNDP carried out two more public debates concerning HLW management.
- Conflicts have escalated in Bure, and controversies have been continued over the HLW policy.

DIMENSIONS OF TRUST & ITS INTERRELATIONS WITH PROCEDURAL AND DISTRIBUTIVE JUSTICES

- The previous studies identified various dimensions, such as competence, knowledge, expertise, care, concern, value similarity, access to information, opinion to be heard, shared identity, fiduciary responsibility, etc.

- By considering the characteristic of these dimensions, in this study trust has been categorized into two dimensions in the domain of HLW management and called "**competence-dimension of trust**" and "**care-dimension of trust**".

- Competence-dimension of trust is based on the level of technology, expertise, and knowledge to handle the project.

- The care-dimension of trust is based on the relationship between actors; people place trust based on how they have been treated and emotional bondedness built through interaction. It is closely linked to procedural justice and distributive justice.

- **Procedural justice** refers to the perceived fairness of the decision-making process; **distributive justice** refers to the perceived fairness in the allocation of risks and benefits.

- **Deliberative public participation** allows to address both competence and care-dimensions of trust.

- Ensuring procedural justice by setting up deliberative platform for public participation does increase overall trust and lead to HLW policy acceptance.

- However, policy acceptance does not automatically lead to the repository acceptance.

- Deliberation should be designed to adequately address local people's concern in terms of distributive justice to promote the repository acceptance.

METHODOLOGY

DATA	FINLAND	UK	FRANCE
① PRIMARY SOURCE	n=2	n=83	n=4
② SECONDARY SOURCE	n=12	n=11	n=14
③ FIELD RESEARCH	n=10	n=16	n=21
④ SURVEY DATA (CONDUCTED BY FINNISH ENERGY)	n=1880		
PERIOD OF FIELD RESEARCH	February 5-10, 2018	① February 10-15, 2019 ② December 8-15, 2019	① February 11-18, 2018 ② February 1-9, 2019

- **The analysis is based on the combined technique based on both qualitative and quantitative approaches.**

- **The case of Finland: Data analysis by employing the ordered logit model based on the survey data conducted by Finnish Energy (accessible upon request) and context analysis**

- **The case of the UK: A content analysis based on the official documents of the PSE meetings (National/Local)**

- **The case of France: A content analysis based on the official transcript of the CNDP meetings (Focusing on the first four meetings during the first CNDP)**

*** Interview transcripts from the field research are used as a supplementary source to verify data collected from the existing documents.**

FINDINGS

FINLAND

▪ **HLW policy acceptance achieved based on ensured procedural justice (by the Nuclear Energy Act) without severe social conflicts**

: Local veto power
: Public participation (Environmental Impact Assessment, EIA program)

➔ Care-dimension of trust addressed by securing procedural justice

▪ The result from data analysis in the four candidate municipalities show that competence-dimension of trust is the most significant factor for social acceptance of the repository.

▪ However, the context analysis shows that local people do not accept the repository solely relying on the competence-dimension of trust.

: Intense interaction between the local community and the nuclear company (TVO & Posiva) over lengthy time

: Government's responsiveness on the concerns of the local people (Amendment of the Nuclear Energy Act to prohibit import of foreign nuclear waste, local tax revenue from the nuclear infrastructure)

➔ Distributive justice was addressed adequately based on the local people's concern

THE UK

▪ The traditional approach in the site selection process of the radioactive waste repository in the 1990s by Nirex ➔ Failure in the siting process & Eroded trust

▪ The PSE program carried out by the CoRWM
: Starting over the option selecting process from the zero-option
: Phased deep geological disposal with long-term interim storage
: Increased level of social acceptance over the HLW management policy

- CoRWM: Independent committee providing advice to the government

➔ HLW policy acceptance achieved based on ensured procedural justice

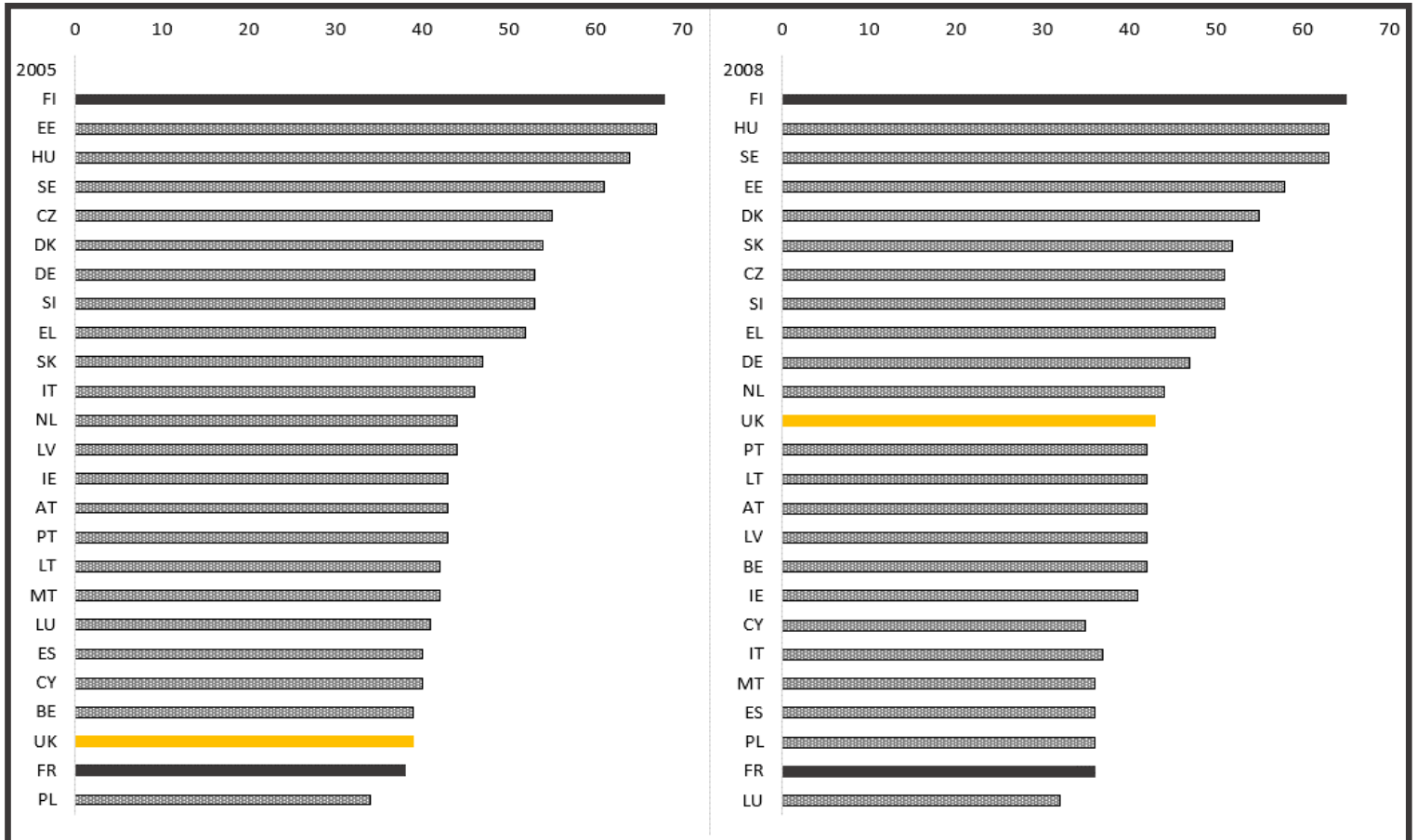
▪ Based on the new Managing Radioactive Waste Safely (MRWS) policy, ensuring voluntary approach and right to withdrawal of the siting process, Cumbria County joined the siting process for the HLW repository.

▪ Procedural justice was continuously ensured throughout the PSE program carried out by the MRWS Partnership. : Failed to further proceed with the siting process after three years : Remained distrust in the central government

➔ Local people's concern related to the issues of distributive justice was not addressed enough.

THE UK: CHANGES IN ATTITUDES TOWARDS DEEP GEOLOGICAL DISPOSAL AFTER THE PSE PROGRAM

CHANGES IN VIEWS ON DGD BETWEEN 2005 & 2008

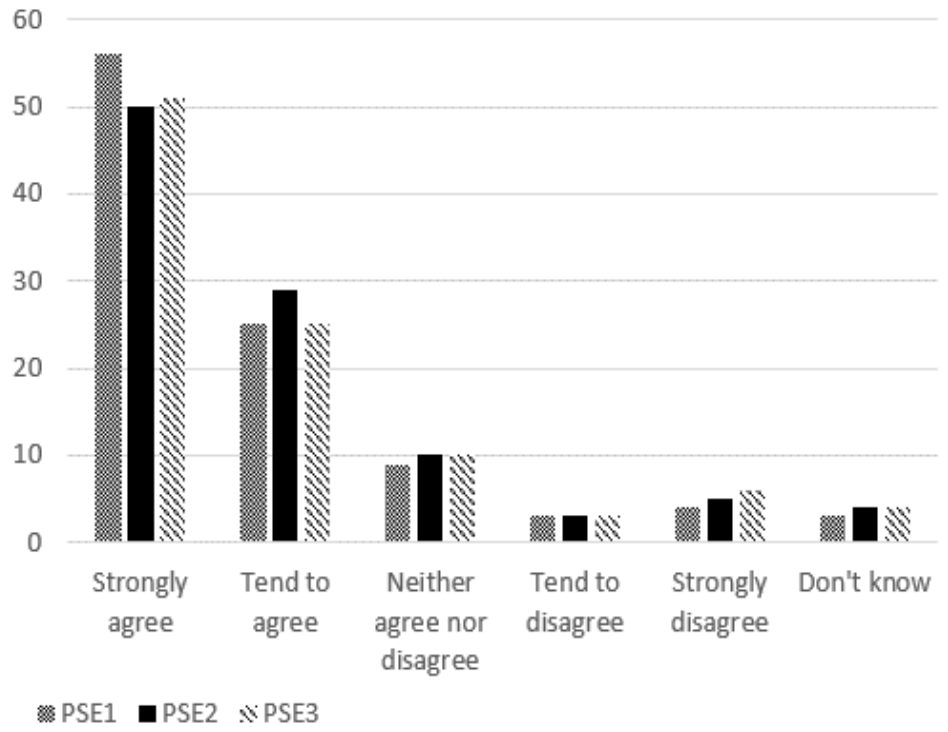


Deep underground disposal represents the most appropriate solution for long-term management of highly radioactive waste

Source: Author's compilation based on Eurobarometer 2005, Eurobarometer 2008

VIEWS ON THE DGD IN CUMBRIA COUNTRY (2009)

The Government should place HLW in a deep underground disposal facility, as recommended by the CoRWM



Source: Author's compilation based on Ipsos MORI (2009)/Radioactive Waste Survey

FINDINGS

FRANCE

- The traditional approach in the site selection process of the radioactive waste repository in the late 1980s

➔ Failure in the siting process and eroded trust

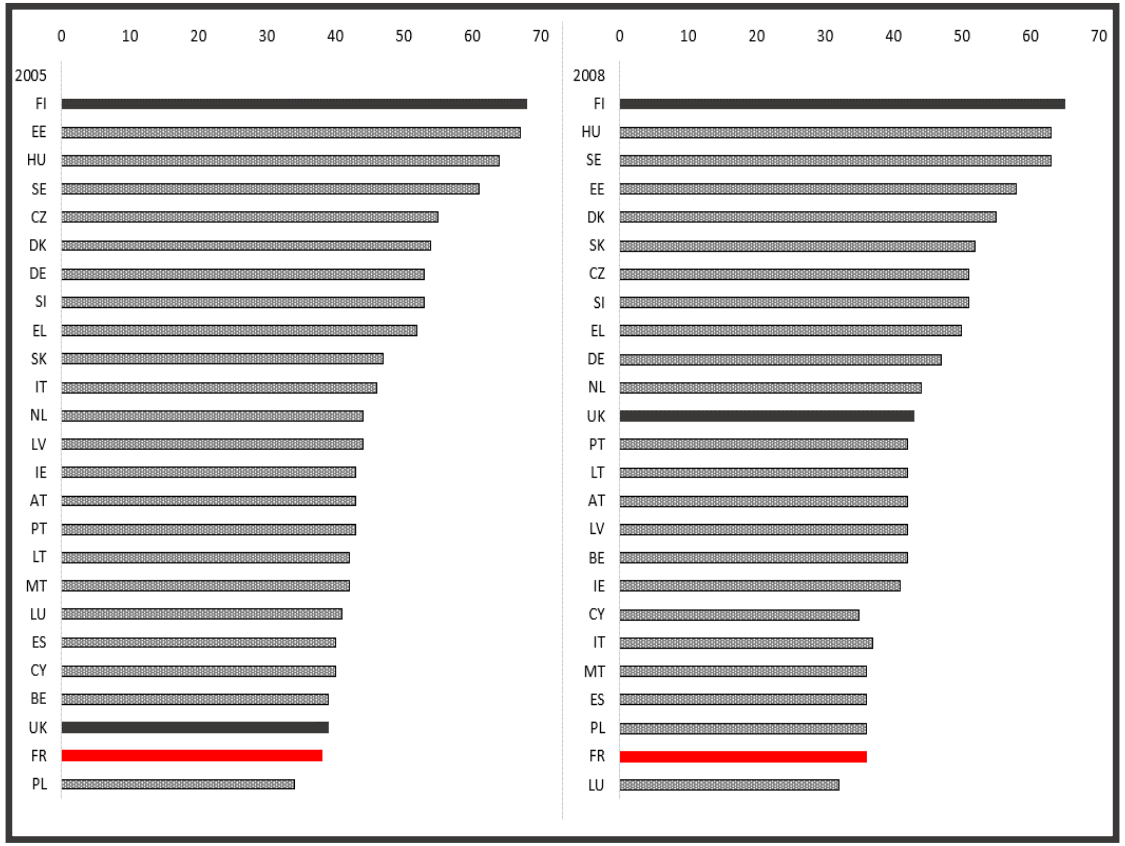
- Parliamentarian Bataille attempted to listen to the local people's concern
: The emergence of the reversibility concept
: Four local communities voluntarily joined the siting process of the underground research laboratory (URL)

➔ Care-dimension of trust addressed through the approach implemented by Bataille

- Perceived violation of the Bataille Law during the first public debate of the CNDP
: Having only one URL
: Bure being considered as a potential site for the repository
: Lack referendum (no veto power as well)

➔ Public participation was institutionalized. HOWEVER, the other aspects concerning procedural justice were violated
➔ Controversies over the policy and increased conflicts

BEFORE & AFTER THE FIRST CNDP 2005-2006: NO CHANGES IN THE PUBLIC PERCEPTION OVER THE POLICY



Source: Author's compilation based on Eurobarometer 2005, Eurobarometer 2008

CONCLUSION

- Competence-dimension is trust (the level of technology, expertise, knowledge) is a pre-requisite for HLW management. However, it is not the only factor leading to social acceptance of HLW management.

➔ It functions together with care-dimension of trust (procedural and distributive justice must be tackled adequately)

- Ensuring procedural justice is likely to increase social acceptance of the HLW policy.

➔ People would perceive the ensured procedural justice through public participation, channels to listen to the public opinion concerning HLW management, veto power, and voluntary approaches. However, it is not automatically linked to the social acceptance of the repository.

- Providing adequate assurance concerning distributive justice is critical for social acceptance of the repository.

➔ In order to start discussing issues concerning distributive justice, procedural justice must be ensured. Then, the aspects concerning distributive justice must be discussed with the local people and adequately reflect local people's wishes and concerns. When the local people perceive no answer to assure long-term risks, it is unlikely to accept the repository.

- Institutionalizing platforms for public participation itself is not the most critical part. The more important aspect is the way to address people's concerns and set up institutional assurance to provide accountability over potential long-term risks.

REFERENCES (selected)

Carter, L. J. (1987) Nuclear imperatives and public trust: Dealing with radioactive waste. Washington DC: Resources for the Future, 473pp.

Earle, T. C. (2010). Trust in risk management: A model-based review of empirical research. Risk Analysis: An International Journal, 30(4), 541-574.

Flynn, J., Burns, W., Mertz, C. K., & Slovic, P. (1992). Trust as a determinant of opposition to a high-level radioactive waste repository: Analysis of a structural model. Risk analysis, 12(3), 417-429.

Frewer, L. J., Howard, C., Hedderley, D., & Shepherd, R. (1996). What determines trust in information about food-related risks? Underlying psychological constructs. Risk analysis, 16(4), 473-486.

Kari, M. (2009, December). Nuclear oasis or something else? Analysing Eurajoki as nuclear community. In Managing Radioactive Waste-Conference (pp. 15-17).

Kasperson, R. E. (1992). The social amplification of risk: progress in developing an integrative framework in social theories of risk.

Kunreuther, H., Fitzgerald, K., & Aarts, T. D. (1993). Siting noxious facilities: A test of the facility siting credo. Risk Analysis, 13(3), 301-318.

Laurian, L. (2009). Trust in planning: Theoretical and practical considerations for participatory and deliberative planning. Planning theory & practice, 10(3), 369-391.

Peters, R. G., Covello, V. T., & McCallum, D. B. (1997). The determinants of trust and credibility in environmental risk communication: An empirical study. Risk analysis, 17(1), 43-54.

Pijawka, K. D., & Mushkatel, A. H. (1991). Public opposition to the siting of the high-level nuclear waste repository: The importance of trust. Review of Policy Research, 10(4), 180-194.

Poortinga, W., & Pidgeon, N. F. (2003). Exploring the dimensionality of trust in risk regulation. Risk Analysis: An International Journal, 23(5), 961-972.

Putnam, R. D., Leonardi, R., & Nanetti, R. Y. (1994). Making democracy work: Civic traditions in modern Italy. Princeton university press.

Siegrist, M., & Cvetkovich, G. (2000). Perception of hazards: The role of social trust and knowledge. Risk analysis, 20(5), 713-720.

Siegrist, M. (2008). Factors influencing public acceptance of innovative food technologies and products. Trends in Food Science & Technology, 19(11), 603-608.

Vilhunen, T., Kojo, M., Litmanen, T., & Taebi, B. (2019). Perceptions of justice influencing community acceptance of spent nuclear fuel disposal. A case study in two Finnish nuclear communities. Journal of Risk Research, 1-24.

THANK YOU

Source: Official twitters of the CNDP and the CoRWM

SPECIAL THANKS TO MR. HIROYUKI UMEKI OF THE NUMO, JAPAN
FOR INTRODUCING CONTACT PERSONS OF POSIVA IN FINLAND, RWM IN THE UK, AND ANDRA IN FRANCE
WHEN PREPARED FOR FIELD RESEARCH CONDUCTED IN 2018 AND 2019