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Original research article

The roles of the state and social licence to operate? Lessons from nuclear waste management in Finland, France, and Sweden

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ABSTRACT

The concept of social licence to operate (SLO) is an increasingly popular tool for companies to manage their relations with the local communities. SLO is very seldom used in the nuclear sector, which has nevertheless applied similar approaches, under notions such as partnership and participatory governance. This article explores the specific challenges that the application of SLO faces in the nuclear waste management (NWM) sector, by applying an often-used SLO framework of Boutilier and Thomson to illustrative case studies concerning nuclear waste repository projects in Finland, France and Sweden. Among the specificities of this sector, the article focuses on the central role of the state in the governance of a project designed as a local solution to a national, even a global problem, entailing extremely long-term challenges, in a context when the state has a vested interest in the project obtaining an SLO. The article suggests that state-related elements be added to the four key criteria of the Boutilier and Thomson framework, which consists of economic and socio-political legitimacy, and interactional and institutionalised trust. To account for the diversity of settings, such as the 'high-trust' contexts of Finland and Sweden and the French 'society of mistrust', further analysis and conceptual refinement are needed, especially concerning the multiple dimensions of trust and mistrust, the relationships between legal, political, and social licences, and the specific challenges of intergenerational justice in SLO work.

1. Introduction

With its roots in extractive and forestry industries, including energy and natural resource sectors, the concept of Social licence to operate (SLO) has become a preferred tool for an increasing number of companies and organisations, operating in various sectors, to manage their community relations and reputational risks [1, p. 1779; 2–7]. Whilst necessary, compliance with statutory regulations seldom suffices to meet the societal expectations on industrial projects [5, p. 473]. In broad terms, SLO denotes the approval or acceptance that the public or a community of stakeholders grants to the operations of a company or industry – to a specific project or land use change [1, p. 1779; 8, p. 346; 9, p. 61; 10, pp. 489–490]. SLO can help a company by alleviating social, economic and political risks stemming from local opposition; consolidating local support for a project; avoiding delays; eliminating unviable projects and siting alternatives early; and preventing a decline of the market value of the company's products [11,6]. For the affected communities, SLO offers a well-recognised concept that affords salience and legitimacy for their views and demands.

In this article, we explore the specific challenges that the application of SLO faces in the nuclear waste management (NWM) sector, by applying one of the most well-known SLO frameworks, the "arrowhead model" of Boutilier and Thomson [12; see also 1,11] to illustrative case studies concerning nuclear waste repository projects in Finland, France and Sweden. The article seeks neither to compare the degree to which the three projects have obtained an SLO, nor to test the framework of Boutilier and Thomson. Instead, we highlight the particularly central and complex roles of the state in nuclear waste policy. We then suggest ways of amending SLO frameworks in general, and the Boutilier & Thomson framework in particular, to better account for the multiple roles of the state. Our cases provide a non-exhaustive sample of real-world examples of the s of the state in waste management organisations' efforts to obtain an SLO.

While SLO is usually applied to private sector activities, a diverse range government bodies are involved in regulation, surveillance, implementation, R&D, communication and ownership related to nuclear

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waste governance. Recent research has highlighted how governance and institutions at multiple levels shape the acquisition of an SLO [e.g. 13–15], yet we argue that SLO theory and practice need to pay greater attention to the roles of the state. The extremely long timescales and risks involved in NWM set these projects apart from 'conventional' SLO projects: high-level radioactive waste needs to remain isolated from living organisms for up to hundreds of thousands of years. This accentuates the roles of the state, as a lasting albeit not eternal institution, mediating between the public, private and community interests. Insights from our case examples in the nuclear waste sector bear relevance for nuclear energy sector more generally, but also for climate policy, given the centrality of the state in dealing with the associated intergenerational challenges [e.g. 16, pp. 54–83].

The next section describes the research methods and justifies the choice of the case studies. Section three briefly defines SLO and its challenges, and presents the 'arrowhead' framework of Boutilier and Thomson [12], which provides a basis for the presentation of our arguments. Section four describes the specific and complex roles of the state in NWM, while section five presents our three illustrative cases. Section six illustrates our arguments by applying the Boutilier and Thomson framework to the case studies. Section seven concludes by summarising the key aspects that need to be considered in further work to integrate the 'state dimension', and suggests themes for further research.

2. Methods and choice of the illustrative case studies

Three features justify our choice of the illustrative cases. First, the roles of the state, and the relationships between various key actors at different levels of nuclear waste governance differ significantly between the three countries. Second, contrasting the Nordic 'high-trust' societies [e.g. 17] and the French "society of mistrust" [18,19] is particularly relevant, given the central role of trust as a key element of SLO. Third, these repository projects are nearer to implementation than similar projects in any other country. In terms of case study research [20, p. 30] our sample therefore represents a mix of "diverse cases" (as to the roles of the state), the "most different" cases (the Nordics vs. France in terms of trust), while being the "most similar" with regard to the advancement of the projects (three forerunners in NWM).

The article draws primarily on existing academic literature on SLO and on NWM in our three case study countries. Our choice to concentrate on the role of the state followed from findings from the initial literature survey, as well as from discussions with experts working on social aspects of NWM. These revealed that SLO was nearly absent from the vocabulary of NWM actors, and that SLO literature has thus far paid scarce attention to the role of the state. The secondary NWM literature, which served as the core material for the study, included also our own earlier extensive work concerning the Finnish, French and Swedish nuclear sector, on SLO-related topics such as repository site selection, local community perceptions, and the role of the host municipality [21–26]; long-term challenges of memory conservation [27]; community benefit schemes [28–30]; socioeconomics of NWM [31–35]; citizen participation and deliberation [36–38]; as well as politics and regulation of nuclear energy and NWM [39–43]. Data from opinion surveys provided additional insights especially concerning the levels of trust. As a complementary source, especially for the French case, we used the SLO-relevant material from the semi-structured stakeholder interviews conducted by the first author in earlier research on NWM. These interviews concerned NWM topics closely related to SLO, including notably citizen participation, socioeconomic evaluation of the repository project and the associated benefit schemes (in all three countries), public communication (Finland and France), and trust in NWM policy (Finland and Sweden). In Finland, fifteen interviews were conducted between April 2009 and August 2018; in France, 34 interviews in 2013–2014 and in 2019; and in Sweden, twelve interviews in 2013 and 2015. In France, most interviewees were local and departmental-level actors, but also national-level representatives from the nuclear industry, central government, safety authorities, and NGOs were interviewed. In Finland, the interviewees included representatives from the NWM company, the nuclear operators, the national authorities, researchers, and NGOs. The Swedish interviewees represented the NWM company, the safety authority, NGOs, the National Council on Nuclear Waste, local politicians, academics, and independent consultants. Annex 1 gives further detail on the interviews. On all three countries, numerous informal discussions over the years with stakeholders and experts provided further inputs.

To identify and organise the relevant information in our material, we used as a guide the 'arrowhead' framework of Boutilier and Thomson [12], which we present in section four. This allowed us to structure the analysis and the presentation in section six according to the four key elements of the framework: economic and socio-political legitimacy, as well as interactional and institutionalised trust. When analysing the data from multiple sources, we sought to identify the specific roles that the state played in our three cases, in the key processes falling within these four categories of SLO criteria.

3. What is a social licence to operate?

After twenty years of use, SLO lacks a standardised definition and is applied somewhat differently depending on the sector and context in question [44]. SLO constitutes a metaphor [e.g. 7], yet scholars have developed elaborate means of measuring SLO, for example via tailor-made questionnaires [e.g. 11,45]. A general consensus nevertheless prevails over the key ideas: an SLO is granted by the local community hosting a project [e.g. 46], it entails processes of acceptance and approval of industry's activities, and it is constructed via dynamic interaction between community, stakeholders and companies [44]. Although usually employed for industrial projects, Jijelava and Vanclay [47] applied SLO to humanitarian NGO action. As a 'soft contract' [48, p. 1], SLO complements and interacts with the statutory legal licence granted by the authorities, and the 'political' licence (PLO) denoting the degree to which national decision-makers are in favour of the project in question [49,46]. Intricately linked with the (economic) development agenda of the state, PLO can result from trade-offs with issues unrelated to the project in question [53]. While PLO alone would generally suffice in authoritarian settings, state's development objectives can override or at least threaten SLO even in democratic regimes [49].

An SLO needs to be constantly maintained, and align with the changing values and objectives of the community [e.g. 1, p. 1779]. Multiple SLOs, or several 'sub-licences' would be needed to account for the heterogeneity among the different parts of community [cf. 50, pp. 189–190; 6, p. 1084]. For example, a project may have an SLO from municipal leaders and local businesses, but not from citizen movements.

As a rule, an SLO is granted to a specific project or activity – a company may have an SLO for one of its projects, but not for another [1, p. 1781]. Sometimes the 'owner' of an SLO is extended to cover the company and its local operations [12, p. 2] or even an entire industry branch [e.g. 51, p. 45]. In practice, when considering a project and its SLO, citizens draw on their earlier experience concerning the company and industry in question, as well as on their ideological convictions [e.g. 25,15,52, p. 45]. In this sense, SLO contrasts with the more 'calculative' political licence [53].

3.1. The four-ladder model of SLO: legitimacy and trust as the key prerequisites

To illustrate our argument about the roles of the state, we apply an oft-used SLO framework, developed by Thomson and Boutilier [1; see also 12,54,6,7,55]. Since NWM is not always the responsibility of a private company, we replace the habitual SLO term 'company' by 'organisation'.

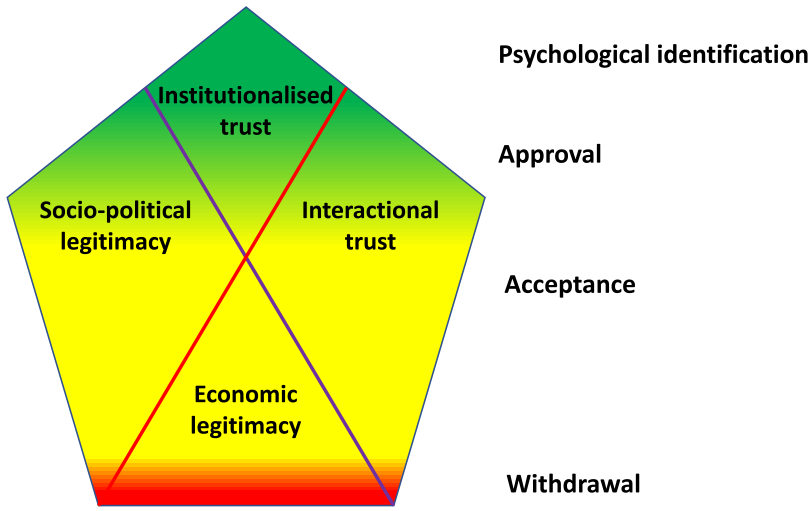

Fig. 1. The four factors that determine the proportions of stakeholders at each level (source: adapted from 12, pp. 2–5).

The framework distinguishes four levels in the formation of an SLO. At the lowest level, the community rejects or withdraws the SLO from the organisation, whereas at the second level, it accepts and tolerates the project. At the third level, the community explicitly approves the project and encourages the continuation of the activity. At the top of the ladder, the community perceives the project as its own, as an integral part of its identity and values. We rely on a slightly more refined 'arrowhead' version, presented in Fig. 1, in which the four levels (*withdrawal, acceptance, approval, psychological identification*) form a continuum, and constitute the key elements shaping the acquisition of an SLO: economic legitimacy, socio-political legitimacy, interactional trust, and institutionalised trust [12, pp. 3–6].

3.1.1. Economic and socio-political legitimacy: distributive and procedural justice

Legitimacy represents "the acceptance of the project by the host community especially in terms of its fairness" [6, p. 1078]. ***Economic legitimacy*** – the minimum requirement for ***acceptance*** – relates to distributive justice, i.e. citizens' perception that costs and benefits of the project are shared equitably. Community benefit schemes often seek to ensure this kind of legitimacy.

Socio-political legitimacy can allow a project to win true ***approval***. It posits ***procedural justice*** as a key concern, requiring that the organisation shows willingness to protect the community's social, environmental and cultural ways of life from harmful impacts. The organisation should inform the community about its activities, listen to community concerns, establish and explain the project's rationale, and demonstrate that the benefits clearly outweigh the downsides [1, p. 1785; 12, p. 4; 7]. Procedural justice is ultimately anchored in international and national law, via legislative acts such as the Aarhus Convention on access to information, participation and justice; Environmental Impact Assessment and Social Impact Assessment procedures; or laws governing access to and ownership of land [46,7,32].

3.1.2. Interactional trust: keeping the promises

Legitimacy is a foundation for mutual ***trust***, that is, a situation in which parties voluntarily accept their vulnerability to actions by others [1, p. 1786]. In the case of SLO, trust implies confidence by the community members that the organisation will always act in the community's best interests [1, p. 1786; 6, p. 1078]. An organisation should appear as honest and sincere in its communication and attempts to keep its promises but must also demonstrate that it has the requisite technical, financial and other resources [e.g. 6, p. 1078; 7,56, p. 2645]. While listening and communicating suffice to ensure legitimacy, ***interactional trust*** requires responsiveness to citizens' concerns and views [1, p. 1785; 57, p. 141], mutual dialogue, respect for local ways of life, and a shared vision of the future of the region [12, p. 4; 10]. Concrete measures include envisioning new development goals with the community; capacity building and economic development; and delegation of aspects of the project to the community, allowing shared ownership of risks and opportunities [1, p. 1786]. For participatory governance to build trust, citizens must be informed about how their views have been taken into account in decision-making.

3.1.3. Institutionalised trust: psychological identification with "our project"

SLO at its strongest implies ***institutionalised trust*** or "full trust", that is, a situation in which relations between the community and the organisation are "based on an enduring regard for each other's interests" [12, p. 4; 6, p. 1079; 1, p. 1784; 11]. Both parties then take trust for granted, the citizens psychologically identify themselves with the values and interests of the organisation – the organisation and the community see each other as partners, as "good buddies" [54,6]. The community actively supports and adopts the project as its own, takes pride of it, and designs and implements its own activities as part of the project [6, p. 1079].

While interactional trust is temporary and directly linked to a specific project, institutionalised trust is more stable over time, although ultimately subject to the general 'rule' of trust being hard to earn, but easy to lose [58, p. 677]. Institutionalised trust can be seen as an outcome of long-term interaction of the community with its environment and stakeholders, trust-building measures by the project organisation being only one among many causal factors.

The 'arrowhead model' (Fig. 1) illustrates how a company *may attain* approval for its project in the presence of either: 1) economic legitimacy and socio-political legitimacy; or 2) economic legitimacy and interactional trust. On the basis of their empirical analysis, Boutilier and Thomson [12, p. 4] concluded that economic legitimacy is a minimum requirement for an SLO, whereas full/institutionalised trust is possible only when all three other key criteria are present at the same time.

4. The vital role of the state in nuclear waste management

Although facing social acceptability challenges similar to those of the extractive industries – the most common 'user' of an SLO – the nuclear industry has only recently shown interest in the concept [59].[1] It has nevertheless applied similar approaches, especially in nuclear

[1] With the notable exception of uranium mining, where SLO is a well-established notion e.g. [63,64].

waste repository siting, under denominations such as local partnerships, or broad public and stakeholder participation [e.g. 37,60–62]. Terms such as partnership and stakeholder confidence have been institutionalised internationally, e.g. in the activities of the Forum on Stakeholder Confidence (FSC) of the OECD Nuclear Energy Agency,[2] and nationally, in regulatory frameworks via mandatory Environmental Impact Assessment procedures, multistakeholder expert committees, national commissions of public debate (e.g. in France, Canada, and Italy), local liaison committees, and community benefit schemes, for example. These approaches face similar challenges as SLO, including the risk of participation being used for merely instrumental purposes [e.g. 65,37,66], SLO legitimising "questionable company practices behind an SLO veneer of respectability" [53], and benefit schemes being denounced as a form of bribery [e.g. 67,68,30]. Participation, partnerships and efforts at gaining an SLO may then fail in their shared main objective, that of engendering trust.

Despite these similarities, nuclear waste disposal projects exhibit specific features that bring to the fore the roles of the state, and complicate the key questions of "who should grant an SLO, to whom/what, and on which grounds". While industry projects are typically designed to generate profit for private business enterprises and to foster national, regional and local socioeconomic development, nuclear waste repositories aim to provide a **local solution to a national – even a global – problem**. This public-interest nature of nuclear waste projects complicates the arbitration between the SLO and the political licence [49], accentuating the role of the state as a **guardian of the public interest**.

The extremely long timespan of NWM adds an inter-temporal aspect to the already complex arbitrations between the different types of licences, and between the local, national and global levels of governance. Can the present local community legitimately grant an SLO to a project that can have implications for innumerable generations of future residents in that community? SLO scholars have argued that the concept can reflect the concerns of broader (e.g. multinational) civil society [1,8]. In principle, an SLO can therefore address intergenerational concerns, which are central in NWM projects. Specific ways of dealing with **intergenerational justice** in SLO theory and practice would merit a separate treatment, and will not be addressed in detail in this article.

SLO scholars have drawn attention to the role of complex governance and institutional arrangements in shaping SLO processes and outcomes [e.g. 8,13]. Heffron et al. [46] underline that although an SLO is essentially an informal contract, law is often crucial in giving effect to SLO, for example through minimum legal standards. However, extant SLO literature has seldom addressed the internal **heterogeneity of the state,** and, by implication, its various roles in SLO processes. The government is sometimes treated merely as a third-party regulator [e.g. 48], or an actor that tends to unduly complicate SLO processes. Yates and Hovarth [69] illustrated how local governments can help the project owner to identify the key stakeholder groups. From a slightly different angle, an SLO has been portrayed as a prerequisite for, but independent from, the formal legal licence granted by the government [13]. Mundeva [48] highlights social inclusion policies as vital determinants of SLO processes, while Raufflet [51] stresses the ways in which the state can actively promote private-sector projects in pursuit of economic and territorial development. The complexity of the very notion of 'the state' is particularly pronounced in the NWM sector, for instance because the state is not only a key actor in energy policy, but in some cases (e.g. France) also the project owner seeking an SLO for a repository. Furthermore, the sub-national public actors, at different levels of governance, are often torn between multiple loyalties towards the state on one hand and their local constituencies on the other.

This heterogeneity also stems from the **distinct patterns of economic interests involved**, in particular the close ties between nuclear energy policy and NWM, and the contentious nature of nuclear power in public discussion. Even in the most economically liberal countries, the state has, since the early years of nuclear development, laid the essential foundations for the success of the industry, via state-funded R&D, communication and knowledge-creation, regulation, as well as direct and indirect economic and institutional support to an industry initially born out of the efforts to construct nuclear weapons. This has created a dense network of partly transnational links between the industry, government institutions, local and national politicians, taxpayers, and voters. As an enduring threat to the continued use of nuclear energy, the unresolved 'waste problem' further reinforces these connections.

5. SLO challenges in the nuclear waste sector: illustration via examples from France, Finland, and Sweden

5.1. France: a state-led and conflict-ridden project

The planned repository, Cigéo,[3] to be built in clay host rock, would receive the high- and medium-level waste from the 58 reactors currently supplying over 70% of France's electricity consumption. Andra, the national radioactive waste management agency, plans to start construction in 2022 and pilot stage operations in around 2030 [70, p. 56]. Via Andra, the state is therefore the ultimate agent seeking to obtain an SLO, although the financing for the project comes via taxes levied on the largely state-owned waste producers: EDF, Orano (until late 2017 Areva), and the national nuclear R&D agency, CEA.[4] The nuclear sector enjoys a special place among state interests, as a major export sector, a key actor in the modernisation of the country since the 1950s, and a source of national pride [71].

The repository project has a long and conflict-ridden history. Andra's initial site investigations in the late 1980s generated vehement local opposition [e.g. 72,65]. To unblock the subsequent stalemate, the government reopened the search to include three different RWM options, and opened the discussion to a wide range of actors [72]. The ground-breaking Waste Act 1991 [73] introduced the concept of reversible geological disposal and community benefit schemes. It also led to the establishment of multistakeholder commissions, external evaluating bodies, and local information and liaison committees (CLIS). These added further complexity to the governance of the project, underpinned by the French politico-administrative system, which involves two parallel lines cutting across various tiers of governance: state administration on one hand, and autonomous territorial politico-administrative structures on the other. The safety authority, ASN, is supported by the technical safety expert organisation, IRSN.

Towards the late 1990s, local conflict aggravated again, in the context of declining public trust in the governance of risk,[5] and following government decision to designate as a site for an underground research laboratory (URL) Bure – a small village in a remote, rural, sparsely populated, and socio-economically declining region in the east of France [41]. The other sites eliminated one by one, Bure soon became also the *de facto* only candidate for hosting a repository [65]. The National Commission on Public Debate (CNDP) organised mandatory public consultations on radioactive waste policy in 2005–06 and on the Cigéo project in 2013–14. In 2019, it organised yet another similar consultation, on the national strategy on managing radioactive waste

[2] The Canadian NEA delegates had mentioned social licence in some of the Agency's meetings (Personal e-mail communication, a former NEA consultant, 14 March 2018).

[3] Centre industriel de stockage géologique.

[4] The French state owns over 80% of the shares of EDF, the operator of France's 58 nuclear reactors, and more than 90% of those of the full-fuel-cycle nuclear company, Orano.

[5] Including the widespread perception that the government had sought to conceal the true extent of Chernobyl fallout in France [42].

and spent fuel (PNGMDR).

Most parliamentarians, departmental authorities, business organisations, trade unions, and local mayors are in favour of the project, conditional on guarantees of safety and transparency [74, p. 7]. Some opposition persists, including from a handful of mayors of the small rural communes in the immediate vicinity of the installation. Increasing contestation by local and national activists has recently led to clashes between the police and the demonstrators.

5.2. Finland: advancing smoothly, to become the first in the world?

The industry-owned Finnish NWM company, Posiva, hopes to start disposing of spent nuclear fuel (SNF) in Olkiluoto, in the municipality of Eurajoki, in the 2020s, almost on schedule established in a 1983 government Decision-in-Principle (DiP). The highly technical approach to site selection generated local opposition in the late 1980s and early 1990s. In 1994, a law amendment banned SNF exports from Finland, and thus spurred the two nuclear power operators, the state electricity company IVO (today, Fortum Power and Heat Ltd), and the privately-owned TVO, to set up a joint waste management company, Posiva [21]. The government today holds about 51% of the shares of Fortum, which operates in ten countries, with emphasis on the Nordic and Baltic area, Poland, Russia, and India [75]. TVO is owned by a consortium of power and industrial companies, with Pohjolan Voima (57%) and Fortum (28%) as its largest shareholders [76]. The governance arrangements are simple compared to the French one, with the Ministry of Economic Affairs and Employment responsible for policy planning and coordination (including in the processes of Environmental Impact Assessment, EIA), the Radiation and Nuclear Safety Authority (STUK) as the main regulatory body, the highly autonomous municipalities as the key local-level actors, and Parliament as the ultimate decision-maker.

In response to the 1994 Act on Environmental Impact Assessment Procedure [77], which made an EIA mandatory, Posiva started planning what was to become in the prevailing context an unprecedentedly participatory and ambitious EIA [78,79], going beyond mere legal requirements. Four candidate sites were studied, yet Posiva soon focused on the two nuclear communities, Eurajoki and Loviisa, expecting these to be the most willing to host a repository [80, p. 95]. Approval by the Eurajoki municipal council in 2000 led to a favourable Parliament DiP in 2001, followed by another DiP in 2002 for the construction of a new TVO-owned Olkiluoto 3 reactor in the same municipality. Posiva started constructing the underground rock characterisation facility in 2004, and obtained in 2015 construction licence on the same site for the final repository constructed according to the Swedish KBS-3 concept in granite bedrock [43]. The repository is to receive SNF from the four nuclear reactors and from the Olkiluoto 3 – foreseen to start operating in 2020 and to bring the share of nuclear in electricity supply from the present 27% to about 45% [81]. At the time of writing, the fate of the SNF from the planned sixth reactor remains uncertain [24].

5.3. Sweden: trust-building via dialogue and municipal power

The Nuclear Stipulation Act from 1977 imposed upon the Swedish nuclear operators a legal obligation to demonstrate an “absolutely safe” solution to the waste problem, before new reactors could be licenced [82,83]. Since then, the future of nuclear power in Sweden has been tied to the ability of the industry to demonstrate the possibility of such a solution [82,60]. The initial search for a willing site by the private industry-owned waste management company, SKB, in the 1980s and early 1990s proved unsuccessful in the face of public opposition [84]. The state-industry relations are complex and intricate, extending outside of the Swedish borders [82]. SKB's shareholders are the 100% state-owned Vattenfall, Forsmarks Kraftgrupp (with Vattenfall as its majority owner), OKG, and Sydkraft Nuclear Power [85]. The Finnish, mostly state-owned, Fortum owns shares in Swedish nuclear power stations, while other Swedish companies owning shares in the country's nuclear plants are Fortum's subsidiaries.[6] Sweden was one of the early adopters of nuclear power, and the industry has played a significant role in the country's economy [83]. Following a referendum in 1980, the government committed to phasing out nuclear power, yet the schedule has been repeatedly delayed. Eight nuclear reactors today provide about 40% of the country's electricity [86]. The governance structure resembles that of Finland, with strong municipal autonomy as a founding pillar. However, unlike in Finland, the provincial authorities have a coordinating role in the EIA, and the licencing system entails two ‘tracks’” – one based on the Nuclear Activities Act, and another on the Environmental Code [87].

In 1993–2000, SKB conducted feasibility studies in eight municipalities. Like Posiva, it ended up concentrating its efforts on nuclear communities, of which Oskarshamn and Östhammar proved to be the most eager to engage [84]. Hosts for nuclear power stations and repositories for long-lived and short-lived radioactive waste – and with a largely favourable local opinion – the municipalities engaged in competition for the project. However, they also collaborated closely, constituting a joint negotiating force towards SKB, including via highly elaborate and participatory multistakeholder dialogue, partly in connection with the mandatory EIA consultations [88,26]. In 2009, SKB chose Östhammar as the repository site, while Oskarshamn would receive the encapsulation plant. SKB submitted a construction licence application in 2011, yet the final decision is still pending, notably because of doubts concerning the corrosion rate of the copper-clad waste containers, and the financing of the facility. The Swedish example is frequently portrayed internationally as a model for democratic and dialogical planning and decision-making in the area of NWM [60].

6. The roles of the state: analysis via the four elements of SLO

In this section, we will illustrate the roles of the state and long-term risks in nuclear-waste sector SLO, by applying to our three cases the concepts presented above.

6.1. Economic legitimacy and bribery allegations: tax bonuses and legally mandatory or privately negotiated benefit schemes

Since the designation of Bure as the host for a URL in France, the two departments (Meuse and Haute-Marne) sharing the facility have received substantial support (today, EUR 30 million per year for each department) in the form of legally mandatory benefit schemes [89]. The schemes – designed to help the region prepare for the arrival of the repository – are governed at the departmental level by multistakeholder bodies, GIPs,[7] and financed via charges levied on the waste producers [89]. As our interviews revealed, even many 'pro-Cigéo' mayors contest the fairness of the distribution of the GIP benefits, not least following the government decision to extend the range of beneficiaries from the 33 small communes nearest to the facility to more than 300 surrounding municipalities [90, p. 26] hosting about 168 000 inhabitants.

Our interviewees – project opponents and defenders alike – blamed GIPs for inefficiency, wasting public money on luxury projects, creating dependence on state funding, distorting competition by privileging local entrepreneurs over those from elsewhere in the country, spreading funding too thinly, and for failing to create truly “endogenous development”. Proponents typically described GIPs as fair and just compensation, designed to promote acceptance [91][8] and prepare the region for the arrival of a project of national interest, yet allegations of bribery were widespread [see also 65,92]. Opponents – mostly local

[6] For example, Värmlandkraft OKG-delägarna, Mellansvensk kraft group.

[7] Groupement d'intérêt public.

[8] A view expressed also by Nicolas Lacroix, the President of Haute-Marne departmental council, in a TV debate at France 3 Régions, "Dimanche en Politique", 11 March 2018.

NGOs – described the benefit schemes as illegitimate albeit legal bribery that has failed to generate the promised territorial development. Some mayors supporting the project argued that GIPs indeed were a form of bribery, but legitimate as such: 'buying' acceptance was a fair way of compensating communities for their willingness to sacrifice for the common good [cf. 68].

In Finland and Sweden, benefit schemes are not legally mandatory, yet Finnish nuclear municipalities receive substantial revenue in the form of a property tax.[9] Almost a third of Eurajoki's tax revenue in 2010 came from the nuclear industry [28, p. 46]. Economic motives, desire to gain an advantage over Loviisa in the rivalry for a planned new reactor, and, according to local newspapers, pressure from TVO, helped ensure municipal council's support for the repository project [21, pp. 176–184; 28]. The council successfully lobbied the government to provide a higher property tax rate and specify this in legislation [21]. Communities hosting nuclear installations in France benefit from similar tax bonuses [93,65, p. 140] – in the case of Cigéo estimated at EUR 43 million/year on average – a total of EUR 5.5 billion over the planned 124-year (2020–2144) construction and operation period [94].

In the absence of property tax arrangements in Sweden, the municipalities negotiated with SKB, prior to the siting decision in 2009, the so-called 'value added programmes', imposing these as an absolute condition for their engagement.[10] The programmes would provide a total of SEK 2 billion (nearly EUR 200 million) of added value, from 2010 until the end of the construction period, via projects in education, training, infrastructure, innovation, and business development [28]. The chosen host community would receive 25% of the funds, while three-fourths would go to the 'loser'. The schemes are governed jointly by the municipalities and SKB, and, like in France, involve elaborate arrangements to ensure that the money is spent appropriately and generates added value [28]. A decade earlier, as part of siting negotiations, the Finnish Eurajoki had negotiated with TVO and Posiva a much more modest benefit scheme [21, pp. 174–184]. The so-called Vuojoki agreement was vital in ensuring the municipal council's support. Via the agreement, Posiva rented the Vuojoki Mansion from the municipality for use as its headquarters, gave Eurajoki a loan of over EUR 7 million, and helped it to establish a business development fund and build an ice stadium [21, pp. 183–188]. Eurajoki essentially got what it wanted: a new NPP, the associated tax revenue, and an additional benefit scheme.

In Finland and Sweden, we could find only two instances of bribery allegations. Local opponents in Eurajoki argued that the Vuojoki agreement aggravated the municipality's dependence on the power company [21, pp. 184–188], while in Östhammar, opponents denounced the use of benefit money for financing the municipality's day-to-day statutory duties [95]. The relevant courts rejected the claims filed by opponents. It is notable that the bulk of attention and critique in France concentrated on the mandatory and legally binding GIP scheme, whereas critics less seldom evoked the support from the industry, which is voluntary but strongly encouraged by the state [92]. The waste producers (Areva, EDF, and CEA) have since 2006 provided training to local businesses, investment loans, support to energy efficiency and renewable energy investments, and financing to nuclear-related high school curricula, worth a total of EUR 159.5 million in 2006–2016 [96].

The French and Finnish examples highlight the role of the state as a key provider of economic legitimacy, whether via tax benefits or legally mandatory benefit schemes. Several of our interviewees argued that, given the state-led character of nuclear industry and the *dirigiste* political culture in France, circulating industry money via a state-governed benefit arrangement was the only legitimate option. One might hypothesise that the critique in France was particularly vehement partly because citizens tend to place greater expectations and ethical norms upon the state than on private companies.

6.2. Socio-political legitimacy: state-guaranteed municipal veto, transparency, and public consultations

SLO literature recognises the role of the state in establishing the conditions for procedural justice and exerting pressure upon private companies. In France, the government is generally seen as the only legitimate guardian of the public interest [e.g. 97], and can decide on the project alone, in principle even against the will of the affected numerous small communities [93, p. 55]. In Finland and Sweden, the **legally guaranteed veto right** gave significant leverage for the municipalities in their negotiations with the industry and the project owner. In Sweden, the host municipality's right to withdraw applies until the very last stage of the siting process, but in Finland only until the Decision-in-Principle [43]. In principle, even the Swedish government can grant a construction licence without the municipality's consent, in the name of national interest, but this is considered highly unlikely [93, pp. 84–85].

Transparency is in Finland and Sweden grounded in the legislation, dating back to the mid-18th century, which stipulates free access to public documents [98]. Originally an offspring of atomic weapons industry, the French nuclear energy sector suffers from a reputation of secrecy and opacity [e.g. 72,71,99]. The state has over the years pushed for transparency, responding to pressure from civil society, especially since the controversy over the impacts of the Chernobyl accident [42, pp. 63–75]. Transparency has since then become an enduring topic in nuclear-sector debates in France, and is increasingly institutionalised in legislative acts, multistakeholder bodies, and 'counter-expertise' organisations recognised by the state [e.g. 42,100].[11] Efforts at transparency are set within the highly complex governance setting of the French repository project, involving authorities, experts and multistakeholder bodies at various levels of policymaking. However, critics - not only in France, but also in Finland and Sweden - often describe transparency as an excuse for the industry and project owners to drown citizens in information overflow and thereby conceal the essential [101,87,102]. Interviewed local project proponents and opponents blamed the state – especially Andra – for withholding key information concerning the socioeconomics of the project. Likewise, while legislation guarantees access to public information, interviewed NGOs in Sweden as well as academics in Finland have faced difficulties in accessing documents produced by the private waste management and nuclear operators [26]. However, it is precisely the state-imposed norm of transparency that has allowed this criticism to arise, by providing an ethical norm and benchmark for private-sector practice.

Mandatory public consultations constituted another means of ensuring transparency. The EIAs in Finland and Sweden and the CNDP debates in France allowed waste management organisations to inform citizens, and citizens to express their concerns [79,78,87,103]. This was the case although these procedures are only advisory, and despite the fact that only relatively small proportion of citizens participated. However, the lack of clarity concerning the role of these processes in decision-making engendered criticism. In Sweden, the two-track licencing process, and the room for interpretation that it allows for key actors created confusion [87]: for construction and operating licences, SKB needs approval from the Radiation Safety Authority, SSM, (under the Act on Nuclear Activities) and from the Land and Environment

[9] Municipalities are allowed to fix a considerably higher tax rate on power plants, including nuclear installations (3.1% in Eurajoki in 2018), than on other industrial facilities (0.93-2% in 2018).

[10] Interview with an SKB official responsible for the community benefits schemes, 20 August 2013.

[11] Explicitly reflected in regulatory acts and institutions such as the Act on nuclear transparency and security (2006), and the High Commission for Transparency and Information on Nuclear Security (HCTISN).

Court, MMD (following the Environmental Code). The latter provides unique transparency, as demonstrated by the multistakeholder hearings, organised in spring 2017, whose procedural fairness was recognised by all participants.[12] The hearings led to further delays as the Court required that SKB provide additional information [104].

Two state-led measures are essential in helping to advance procedural justice by reducing resource asymmetries in Sweden. The Nuclear Waste Fund (financed by the nuclear reactor owners) channels substantial economic support to NGOs and municipalities for their review, information and communication activities [93, pp. 91–93]. The National Council for Nuclear Waste, a multidisciplinary expert advisory body, organises independent evaluation and national-level public debates and thereby helps to ensure the plurality of perspectives on NWM [43]. Yet, NGOs have recently criticised the paucity of independent research not financed by the industry [105].

6.3. Interactional trust: the state (breaking its) promises, framing the debates, and ensuring the respect for the spirit of the law

The interviewed French stakeholders at both local and national level repeatedly evoked 'broken promises', notably those relating to the socioeconomic benefits of the project. Furthermore, while the Meuse and Haute-Marne departments indeed volunteered in the mid-1990s to host a URL, the way in which this volunteering then turned Bure to a repository host, “almost by stealth” [65], generated discontent amongst the locals, in the face of overwhelming state power. “We've been conned”, a local mayor lamented. In Finland and Sweden, feelings of deception seemed absent,[13] and the industry and authorities underlined the importance of continuous political commitment, patient and determined long-term work towards implementation, following prescribed steps and a realistic timetable [e.g. 106,107,60].

The legally mandatory consultations faced similar criticism in all three countries: absence of alternatives (esp. the zero-option); alleged attempts to wear out the opponents via endless consultations [101]; striking resource and information asymmetries between the project owner and civil society actors; excessively technical and expert-led framing; and the dominant role of the project owner in the process – including the possibility to ignore critical questions [103,78,87,108, pp. 74–76; 82,66,109,74].

Two negative examples help to highlight the crucial role of the state. First, in all three countries, citizens and stakeholders suspected the mandatory consultations for being mere efforts to legitimise decisions already made, and regretted the exclusion of nuclear energy policy from the debates. In France, the 2013–14 consultation turned into a farce, as opponents prevented the public meetings from taking place. They labelled the consultations as “masquerade” and “a travesty of democracy”, given that the necessity of the project could no longer be discussed [110, pp. 457–458]. CNDP hence decided to replace the meetings by expert debates on the Internet. An interviewed Posiva official indirectly acknowledged the legitimating role of the Finnish EIA consultations, noting that, as “sparring partners”, opponents helped the company to strengthen its credibility and arguments [see 82 for similar findings in Sweden]. Second, via the secretive Vuojoki community benefit agreement, Posiva effectively selected Eurajoki as a host while the EIA process was still underway [79,46,53,55,21]. This undermined the EIA's role as the key forum for citizen participation [e.g. 78],[14] and betrayed the implicit promise that the EIA would influence decisions. Both in Finland and in Sweden, stakeholders blamed the coordinating EIA authority (Ministry of Economic Affairs and Employment in Finland; the state provincial authority in Sweden) for passiveness and unwillingness to ensure that the project owner and the entire process respect not only the letter but also the spirit of the law [21,87].

The processes crucial for interactional trust therefore include also other stakeholders than the company and the community – most notably the safety authority and other state authorities. In France, even many opponents considered that the first consultation (2005–06) organised by the National Commission on Public Debate (CNDP) engendered trust in the CNDP as an independent and authoritative guardian of fair and equal public engagement [103, p. 64]. The failed 2013–14 debate, by contrast, undermined trust in the CNDP [110, pp. 459–460].[15] Also the French safety authorities have engaged in participatory dialogue involving NGOs. However, the ‘Swedish model’ of stakeholder dialogue, while anchored at the municipal level, probably provides the clearest positive example of how the state actively helped to build interactive trust. In the early 1990s, as Oskarshamn set up its highly elaborate and participatory municipal organisation for dialogue with SKB, the safety regulator initiated so-called ‘dialogue projects’ [84,82]. State support for municipalities and NGOs for their ‘counter-expertise’ and communication activities, participatory review and monitoring schemes [26], and the dialogical Environmental Court hearings, all contributed to interactional trust. The two-track licencing may have complicated the process, yet it also strengthened and specified the role of environmental NGOs in the EIA, putting on a more equal footing the competing paradigms of ‘planning’ and ‘precaution’ [87]. In a way, trust-building reached beyond the Swedish borders, as SKB and consulting firms transformed the dialogical approach into a new Swedish ‘export product’, under the denomination of “Riscom model” [e.g. 93,60,111].

6.4. Institutionalised trust shaped by the ambiguous and multidimensional trust in the state

SLO literature has highlighted how citizens seldom are able and willing to clearly distinguish between their views on a given project, the company, and the industry in question [e.g. 15]. The relatively stable 'institutional' trust in the company and industry therefore shapes the project-specific and more contingent SLO. In the NWM sector, the often polarised views on nuclear energy play a vital role. However, more general aspects of “ideological trust” [112,113] – perceptions concerning the legitimate role of entities such as state, market, and community – decisively influence local-level SLO. These perceptions can either foster or hamper the emergence of sentiments of pride, taken-for-granted mutual trust, and shared interests between the community and the NWM organisation.

In the Finnish and Swedish municipalities, the local populations take special pride in hosting a repository, and a cognitive understanding of nuclear industry activities has been instilled into the local culture [22]. Our interviews in France, by contrast, revealed rather a situation of institutionalised mistrust, with entrenched and culturally anchored 'us and them' relationships between the state and the local actors. The interviews revealed similar tensions in relations between Andra's Paris headquarters and its local office – the latter allegedly more in tune with local views. Despite its efforts to establish itself as a recognised and respected actor in the region, Andra hardly appeared to the locals as a ‘good buddy’, in the context of lacking municipal veto, marginality of local-level actors in the governance of the benefit schemes (the state – via the local prefect – and the departmental

[12] Personal communication by Arne Kaijser, an independent researcher present at the hearings, 27 April 2018.

[13] Despite a promise by TVO in 1980 that the “waste would not stay in Eurajoki” – a promise that local opponents reminded about, but absent from the collective memory.

[14] An interviewed Posiva official (1 June 2009) admitted that this “was slightly embarrassing”, but added that the local politicians did not want to take the risk that Posiva might choose another location.

[15] The debate was largely considered as a failure, although Andra insisted on declaring the debate as a success, as it allowed numerous exchanges that would help further improve the project [110, p. 460].

Table 1
Local-level trust in the safety of the repository and in the waste management organisation as a source of information.
Sources: 25; 114; 115; 24; 116.

	Eurajoki, Finland	Bure region, France	Östhammar region, Sweden
Repository safety	41%	78%	86%
Implementer	57%	63%	76%

authorities hold a majority of votes sufficient to override even an unlikely united front of mayors), and the state-centred politico-administrative tradition.

While not fully comparable with each other because of differences in methodologies, surveys on citizen trust in repository safety and the project owner provide clues on the role of broader state-related and ideological aspects. Table 1 shows that in the Finnish Eurajoki, locals have relatively low trust in repository safety (41%) and in the reliability of the information provided by the project implementer, Posiva (57%), as compared to the high local-level trust in France (78% and 63%, respectively) and Sweden (86% and 76%).

The low trust figures in Eurajoki seem surprising in view of the absence of critique, seemingly high satisfaction in economic and procedural legitimacy, and the scant concern that the citizens showed for risk issues during the EIA [78, pp. 183–202]. This may partly be explained by the well-known reluctance of residents in nuclear communities to explicitly address risks, in a situation of economic dependence on a possibly risky industry [e.g. 65]. For instance, in the French host region, the locals acknowledge risks, but express conditional trust in the safety experts, along the lines "it must be safe, because otherwise they [experts and authorities] would not build a repository here", or "I think", "I dare to hope" that the experts have examined all eventualities [e.g. 117, pp. 37–38]. In both France and Finland, citizens express great trust in the competence of experts, especially in their own country's engineers [117, p. 37; 108]. French national-level surveys indeed show high (76.5%) trust in the **competence** of the nuclear safety authorities (ASN and IRSN), although trust in the willingness of these authorities to tell the truth about nuclear risks (**sincerity**) – is only 40% for the regulator (ASN) and 57% for the safety expert, IRSN [118, p. 129].

This is where a certain Finnish exceptionalism seems to come to play: as many as 82% of citizens, both nationally and in Eurajoki, trust in the safety authority as a source of information, i.e. its sincerity [25,23,24]. In Eurajoki, this trust manifests itself in the municipality's nearly symbiotic relationship with the companies essential for its prosperity, and its willingness to fully delegate risk-related analysis to the safety authority [43,26]. The shortcomings of the EIA in building interactional trust [101,78,66] did little to undermine this trust and silent acquiescence in the face of a project that the community saw as indispensable for its socioeconomic wellbeing and survival. The two Swedish host municipalities, by contrast, have taken a highly proactive role, seeking to build independent competence also in safety matters [43,26]. The Swedish municipalities transformed themselves from "nuclear communities of fate" [88, p. 41] into true NWM stakeholders by actively forging their image and role as local 'nuclear powers' conscious of their bargaining power over SKB, which sorely needed a willing host for the repository.

Institutionalisation of trust seemed to rely primarily on procedural justice and interactional trust in the Swedish municipalities, while economic legitimacy and deference to authority appeared as more significant in Eurajoki. Furthermore, in Östhammar, only 61% of the citizens express trust in the regulator as source of information on nuclear-related issues [119], well below the Finnish 82%. Differences concerning the nature of democracy in the two Nordic countries may go some way towards explanation: the Finnish tradition tends to emphasise trust in state bureaucracy, and show tolerance to authoritarian governance, while the Swedes esteem corporatist political representation and a democratic leadership style [120, p. 78; 121–123, pp. 22–26].

Local-level attitudes towards Andra and the repository project revealed ambiguous perceptions concerning the role of the state in France. The state appears at the same time as highly trusted (e.g. via the 'public service' tradition) and mistrusted (as a natural adversary of grassroots and civil society action) [e.g. 97]. In France, the nuclear sector represents a source of national pride, a symbol of the country's modernisation and technological prowess [71], a significant employer and source of export revenue, but also a target of criticism as an allegedly secretive "Nuclear State" [99,42]. Ambiguities are arguably even greater in the repository host region, with local imaginaries (repeatedly evoked in our interviews) deeply marked by the notion of a "sacrificed land", intentionally abandoned by the government as a buffer zone against Germany during the war hostilities in the 19th and 20th centuries [e.g. 124]. And yet, the locals frequently called for the state to take a more active role and lead the project with a firm hand. Local project proponents sought to nurture the idea of pride for a nationally vital project. In a region unfamiliar with the nuclear industry, it seems difficult to instigate the kind of pride that characterises

Table 2
Summary of the four criteria for obtaining an SLO, augmented with conditions applying to state actors.

Economic legitimacy *Distributive justice*	Socio-political legitimacy *Procedural justice*	Interactional trust *Competence, sincerity & responsiveness*	Institutionalised trust *Full trust, psychological identification*
• costs (including risks) and benefits of the project are shared in an equitable manner within the community • **community benefit schemes are arranged in such a manner as not to provide grounds for allegations of illegitimate bribery**	• the company and **the relevant authorities** are open and transparent, as well as willing to listen, demonstrate the project's social value, and protect the community from harmful impacts • **adequate legal and regulatory measures are in place to ensure transparency, as well as access to information, participation, and justice**	The company **and the relevant state authorities** • keep their promises • respond to citizen and stakeholder concerns and views • engage in mutual dialogue • respect local ways of life • share a similar vision of the future of the region • are competent, reliable and sincere in implementing and regulating the project (esp. risks and safety), and in their communication • ensure the respect for the spirit of the law	• the project supports local well-being • community is proud of the project and for taking responsibility on behalf of the rest of society • the company, **the state actors**, and community show mutual regard for each other's interests • **the regulator is independent and reliable** • **the state is always there to protect the community against risks and harmful impacts** • **the company, state actors, and community mutually delegate duties to each other**

institutionalised trust. An interviewed French nuclear-sector professional referred to the Swedish example, asking with irony: "would you ever imagine the French readily evoking the notion of responsibility for the common good?"[16]

7. Conclusions: integrating the role of the state into SLO frameworks

Via illustrative examples from nuclear waste repository projects in three forerunner countries, this article has argued that SLO scholarship and practice need to pay greater attention to the crucial role of the state, if the SLO concept is to be truly useful in the area of NWM. The state plays a pervasive and multifaceted role via its interest and involvement in nuclear energy policy, via the complex ownership relations, and as a key actor in the governance of long-term risks and safety – a central citizen concern in NWM. Unlike in most industry projects, the state has a vested interest in ensuring a local-level SLO for a repository, and sometimes (e.g. in France) even as the implementer of the project. This underscores the asymmetries of power between the local community and the actors seeking an SLO. Local communities have, however, a degree of bargaining power. They can threaten to withdraw or withhold an SLO, in a "mutual hostage situation", as the NWM organisation depends on a willing host community, and needs to deliver at least economic legitimacy [cf. 53, p. 218]. The NWM sector provides a useful breeding ground for further development of SLO theory on the role of the state in megaproject governance and energy-sector megaprojects more generally.

Especially the highly complex multilevel governance setting in France and the Swedish double-track licencing system illustrate the heterogeneity of the state: the involved government bodies do not always act in concert towards a shared objective. The 'us vs. them' set-up in the French case included contradictions between authorities at different levels, while the Swedish licencing system ultimately witnessed the juxtaposition of two contrasting governance philosophies. Our observations echo earlier findings from SLO research concerning the crucial articulation of 'the project' and 'the local' with the broader national and international context [e.g. 14, p. 1064; 15], notably the wider relations of trust and mistrust. This articulation is highly country- and culture-specific, as are the statutory and perceived roles of the state. The virtual absence of the SLO concept from the French discourse, for instance, partly reflects the negative connotation that the associated terms – acceptance and acceptability – have earned in this highly conflict-oriented political culture.[17]

The framework of Boutilier and Thomson [12] offers a useful basis for further work, yet state-related criteria need to be integrated within all of its four dimensions. The state is a major provider of economic legitimacy, and local perceptions of community benefit measures crucially depend on the role of the state in steering those measures. Perceptions concerning the state, in turn, influence the design of the community schemes. The state – also through international cooperation – establishes the setting for procedural justice and socio-political legitimacy: companies and organisations need to be open and transparent, as well as willing to listen and treat involved parties equally, yet the government policies set the conditions for this to happen. As for interactional trust, state actors can be active or passive in ensuring the respect for the spirit of the law. The state has also a more direct role, as the involved governmental actors need to keep their promises, integrate the views of the citizens in decision-making, and, when appropriate, actively facilitate dialogue. Ultimately, the degree to which trust between the nuclear waste repository operator and the local community becomes institutionalised depends on broader ideological factors, notably perceptions concerning the appropriate roles of the state, the private sector, and local communities in governance processes. These perceptions underpin public trust in state authorities – especially in those responsible for safety.

Table 2 summarises the key conditions for the granting of an SLO, based on the framework of Boutilier and Thomson, but augmented by key state-related criteria evoked in this article (indicated in bold). Bearing in mind that SLO is essentially about perceptions, the specific criteria under the four headings refer to community perceptions, instead of company declarations or presumably objective external criteria of analysis.

Our analysis calls for caution concerning the assumption of trust as the ultimate precondition for and an indicator of an SLO. In particular, the complex interaction between trust and mistrust [e.g. 125,126] – illustrated in particular by the French and Swedish cases – would deserve attention. Another aspect worth consideration in SLO scholarship concerns the dynamics between trust in institutions and ideological trust. For example, SLO and local-level interactional trust seemed to have less importance for the advancement of the project in the French state-centred setting than in the two Nordic cases, not least because of the absence of a municipal veto. However, the advancement of French project appears to depend on the solid ideological trust in the state and its legitimacy as the guardian of the public interest. The kind of passiveness observed in the Finnish case, including the municipality`s willingness to fully delegate risk analysis to the safety authority [26], seems to reflect the prevailing asymmetries of power. As such it may reflect "overtrust" [127, p. 203] in institutions, and insufficient vigilance between parties that Lacey et al. have warned against [125, p. 24]. In the French context of seemingly all-encompassing mutual mistrust between actors, excessive ideological trust in the state may have fed unrealistic expectations, feelings of disappointment and betrayal, and thereby have further aggravated mistrust towards institutions.

Further research could usefully explore more in depth the potential virtues of mistrust, the roles of the various (interpersonal, institutional and ideological) dimensions of trust and mistrust, and the associated exercise of power. Analysis could include systematic empirical cross-country comparisons, which could not be carried out within the scope of this study. It could also examine the issue of intergenerational justice, which is particularly acute in NWM, given the specific challenges of extremely long-term radiation safety concerns, and – at slightly shorter yet intergenerational timescales – in climate and energy policy. The primacy of community approval as the ultimate foundation of an SLO might therefore need to be revisited, and greater attention given to the complex arbitration between public and private interests, at different temporal and spatial scales. The state plays various essential roles in addressing such challenges of arbitration.

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Supplementary materials

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[16] Interview in Paris, 4 March 2019.

[17] Many of our French nuclear-sector informants underlined that their respective institutions have practically banned the concepts of acceptance and acceptability from their vocabulary.

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