Accumulated Intelligence: Reimagining Northern Industrial Landscapes through Data Centres

Anna Niia Varfolomeeva and Elena Palenova

This article discusses how former industrial sites in the North are now used for digital infrastructures, and how these transformations build upon earlier industrial histories and relationships with place. We focus on two cases: the former paper mill in Kajaani, Finland, now hosting the LUMI supercomputer, and the former aluminium plant in Nadvoitsy, Russia, reused as the KU data centre. Based on historical literature, company materials, media sources, and online discussions, we examine how industrial infrastructures are reused and how earlier narratives of modernisation, mobility, and technological progress reappear in contemporary digital development. We introduce the notion of accumulated intelligence *to describe the knowledge and capacities developed through successive interactions between people, technologies, infrastructures, and landscapes. In both cases, data centres are presented as symbols of technological innovation and future prosperity, while the histories of earlier industries remain visible in the landscapes and local discussions. However, the reuse of former industrial sites does not necessarily reproduce the employment opportunities, occupational knowledge, and roles in community life associated with earlier industries.*

Introduction

Data centres have become an increasingly prominent topic of public debate across Arctic states. While often presented as engines of innovation and regional growth, their expansion has also raised concerns about energy, water, and land consumption, electronic waste, and the relatively limited number of long-term jobs they create (Pickren, 2014; Brodie & Velkova, 2021). Recent controversies surrounding planned data centres in northern Finland (Yle News, 2026) and concerns expressed by Cree Nation representatives in Canada (Andersen, 2026) illustrate the tensions between digital development, environmental impacts, and local and Indigenous interests. Data centres are physical infrastructures that provide controlled environments for the operation of critical computing resources (Arregoces & Portolani, 2004). Their development, however, is not only a matter of technological innovation. It is also closely connected to the histories and existing infrastructures of the places in which they are established.

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Existing studies of data centres have examined continuities between extractive and digital economies (Vonderau, 2019; Saunavaara et al., 2022), their shared logics of land exploitation (Upham et al., 2022; Brodie, 2024), and the reproduction of colonial practices in digital infrastructure (Childs, 2022; Velkova & Plantin, 2023; Bresnihan & Brodie, 2025). Building on this scholarship, this article examines how earlier industrial histories also shape the imaginaries and meanings associated with data centre development in northern settlements. It discusses not only what is inherited from previous industries, but also how these inheritances are reinterpreted and which aspects of earlier relationships between people, industries, and landscapes are not necessarily carried forward.

Industrial and digital infrastructures are both driven by the modernist visions described as "enthusiasm of the imagination" (Mrázek, 2002: 166) or as a state-driven "collective fantasy" of a brighter future (van Veelen et al., 2021). However, data centres represent competing ideas of "flow" and "fixity" (Johnson, 2023: p. 9), as they are at the same time associated with mobility and speed, but also are grounded in specific places. In Northern regions marked by rapid climate change and close entanglements of human and more-than-human life, such grounding risks producing new ecological and social vulnerabilities. Data centres, as Julia Velkova (2023) demonstrates, are also not necessarily "here to stay" (p. 434): they also get dismantled when not used anymore, thus adding another layer to the infrastructural history of the landscape.

This article examines how the industrial imaginaries and human-landscape relations in selected northern locations are rethought and re-enacted through data centre development. We define these re-enactments as *accumulated intelligence*: cumulative capacities that emerge through successive interactions between people, technologies, infrastructures, and northern landscapes, and that continue to shape new technological developments. The article extends the notion of intelligence beyond human reasoning or algorithmic technologies, viewing it as a result of continuous human-landscape-infrastructures interaction.

To illustrate this argument, the article draws on qualitative analysis of two selected cases of digital-industrial reuse: Kajaani in Finland and Nadvoitsy in the Russian Federation. Drawing on historical literature, company materials, field visit to Kajaani, media sources, and online discussions, we examine how digital infrastructures build upon earlier industrial development and how these transformations are represented and discussed in relation to local histories. The geographical locations of the case studies are presented in Figure 1. The article also engages with two additional comparative case of digital reuse: Lefdal in Norway and Hamina in Finland. The case studies have been selected after an initial exploratory mapping of Arctic data centres.

The article approaches the North not as a fixed geographical category but as a historically produced and continuously negotiated space (Tennberg et al., 2019). Northern regions have often been framed as peripheral, but also strategically important and resource-rich territories (Wood-Donnelly et al., 2026; Varfolomeeva, 2026), shaped by successive phases of industrial and infrastructural development.

From this perspective, contemporary digital infrastructures are not introduced into previously undeveloped landscapes but become part of places already shaped by earlier industries, development priorities, and relationships between people and their environments. Understanding these earlier industrial histories can help contextualise current debates about data centre development.

Accumulated Intelligence

In this article, accumulated intelligence is understood as the knowledge and capacities developed through successive interactions between people, infrastructures, technologies, and more-than-human environments. Contemporary digital infrastructures are often associated with the rapid growth of artificial intelligence. However, they also rely on forms of intelligence, or accumulated understandings of landscapes, that have developed through mining, hydropower, forestry, and other forms of resource extraction. As this article argues, data centres build upon these inherited relationships between people and northern landscapes.

Intelligence is traditionally defined through human reasoning. For example, Cambridge Dictionary views it as "the ability to learn, understand, and make judgments or have opinions that are based on reason" (Cambridge Dictionary, n.d.) The notion of artificial intelligence implies that machines imitate human reasoning or work with humans – thus, the concept of hybrid intelligence appears (e.g., Dellermann et al., 2019). However, the human-centred understanding of intelligence has been challenged by multispecies scholars, who suggest to view intelligence in relational terms, as connected to various sensibilities and experiences (Despret, 2005; Bertoni & Beisel, 2013). In Indigenous notions encompassing intelligence, it is also viewed beyond human reasoning. For example, Sámi traditional knowledge could be shared as stories and music, or through family drums (Sjoholm, 2023: 11), and Inuit notion of *Sila* brings together the forces of air, nature, and intelligence (Sonne, 1988). Intelligence is also not a fixed notion, as even in humans it varies depending on context and has evolved through evolution, as it supports survival of various species (Giaccardi et al., 2026).

Jeff Malpas refers to "the intelligence of place" as a term combining "the intelligible character that belongs to a place and… apprehension of that character in our own thinking" (Malpas, 2015: 1), i.e. the features of the specific places and human understandings of it. Similarly, Shannon Mattern (2021) argues that cities encompass multiple forms of local, place-based, and Indigenous intelligence that cannot be reduced to computational models. These forms of intelligence are connected to how people understand and maintain the places in which they live.

The notion of accumulated intelligence is inspired by work on energy accumulation (Sovacool, 2016; Günel, 2022), which offers a non-linear understanding of energy transitions by showing that while new energy sources enter the landscape, older ones do not simply disappear: their material and social traces remain visible. As a result, different forms of energy may coexist or re-emerge cyclically (e.g., Limbert, 2010, where anticipated oil depletion leads some Omani residents to recall pre-oil relationships with the landscape). This perspective also resonates with recent discussions of digital capitalism, which argue that digital development reconfigures rather than replaces earlier capitalist logics (Nost, 2026).

In this sense, accumulated intelligence is not a fixed sum of knowledge inherited from earlier industries, but an ongoing process through which relationships between people, technologies, infrastructures, and landscapes are developed. New industrial transformations build upon these existing relationships while also changing how places are understood and imagined.

Methodology

The article centres on qualitative analysis of two cases of digital infrastructure in former industrial sites: Nadvoitsy in the Republic of Karelia, Russia, and Kajaani in northern Finland. Both cases provide opportunities to examine how contemporary digital development intersects with earlier industrial histories. Additional examples from Hamina (Finland) and Lefdal (Norway) are briefly discussed to situate these transformations within a broader northern context.

The qualitative analysis focuses on historical literature, academic publications, local and national newspaper publications (in newspapers such as *Karelia.News* and *Stolica na Onego* for Karelia and *Kainuun Sanomat*, *Kaleva Media* and *Yle* for Finland, appr. 30 publications in Russian and 20 publications in Finnish), data centre public webpages and social media discussions in Russian and Finnish. These materials were analysed to examine how digital infrastructure projects are connected to earlier industrial histories and how they are framed through narratives of development, renewal, and future prosperity. The thematic analysis focused on industrial decline, digital redevelopment, and imagined local futures. The online discussions analysed in this article were drawn from publicly accessible Russian- and Finnish-language forums and social media platforms that could be read without registration. The analysis focuses on the content of these discussions rather than on individual users. Selected comments are presented in English translation, while others are summarised or paraphrased. Usernames and direct links to individual posts are omitted to reduce the possibility of identifying contributors.

This analysis was complemented by notes from field visits to LUMI data centre in Kajaani (February 2026) and to a community meeting with Google representatives in Muhos (September 2026). The LUMI field visit included observations of the former industrial site, notes taken during the presentations made by LUMI employees, and informal discussions. These discussions are used to provide contextual information, and individual interlocutors are not identified.

The selection of case studies was also informed by preliminary spatial mapping using OpenStreetMap data. During this exploratory exercise, we extracted the coordinates of data centres in eight Arctic states included into OpenStreetMap inventory. The mapping initially examined the distribution of recorded data centres across the Arctic states to identify potential locations for further analysis. However, most identified facilities were situated outside Arctic and sub-Arctic regions, while incomplete data coverage limited the usefulness of the inventory for systematic case selection. The mapping therefore served as an exploratory stage of the research, helping to contextualise the geographical distribution of digital infrastructures. A comparative map of four selected cases was subsequently produced to illustrate their locations and previous industrial uses.

Case studies of industrial reuse

In this section, we focus on two case studies of industrial reuse for digital infrastructure development: Nadvoitsy in Karelia and Kajaani in Finland. These cases are situated within a broader pattern of industrial-to-digital transformation across northern Europe. Other examples include the Lefdal Mine Data Center in Norway, established in 2015 within a former olivine mine, and Google's data centre in Hamina, Finland, operating since 2009 on the site of a former paper mill (Figure 1).

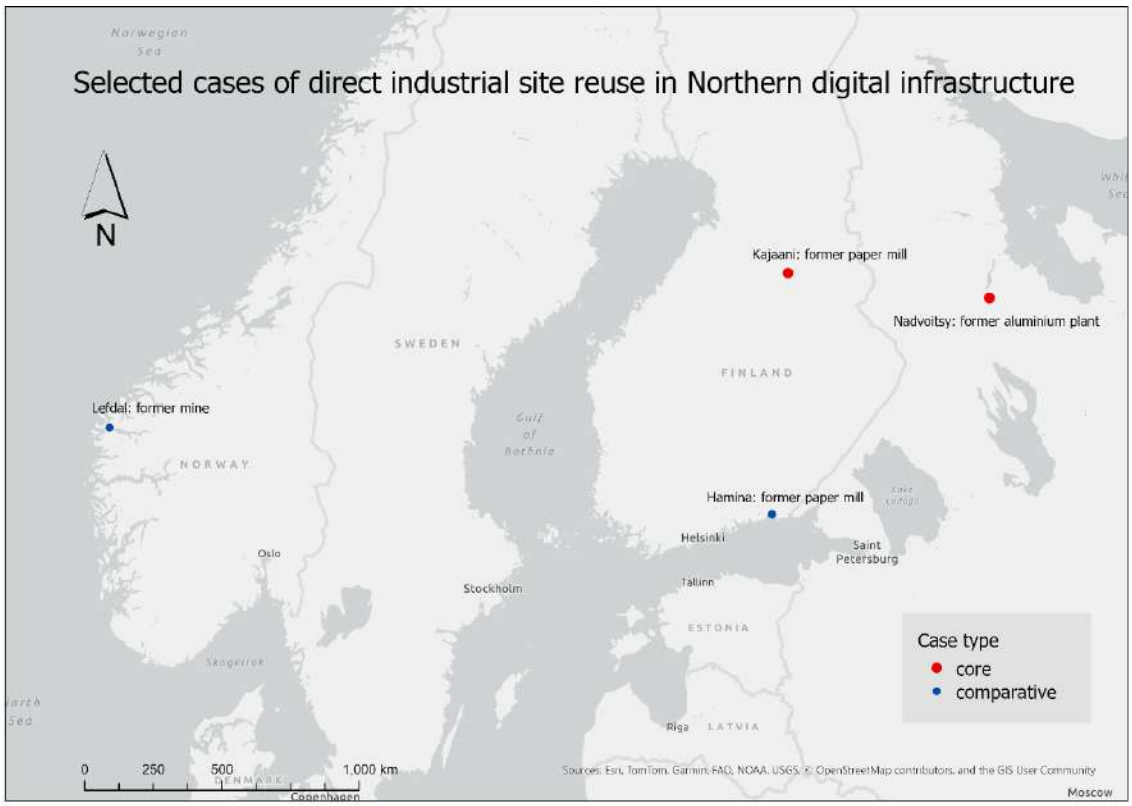

Figure 1. Map of core case studies (Nadvoitsy and Kajaani) as well as additional examples mentioned in the article (Hamina and Lefdal) by Elena Palenova (2026).

Both Lefdal and Hamina illustrate how earlier industrial infrastructures are incorporated into contemporary digital development and presented as advantages for new technological uses. The promotional booklet of Lefdal data centre states that the facility relies on the industrial legacy of former mine: "It offers 120,000 square metres of floor space distributed across 6 levels and a total of 75 chambers ready for data centre whitespace. The temperature in the mine is 9 degrees Celsius all year." (*Lefdal Mine Datacenter*, n.d., p. 4) In this case, the industrial past is presented primarily through the material characteristics of the site, which acquire new functions in digital infrastructure development.

In Hamina, the reuse of the former paper mill is similarly presented as a combination of technological innovation and respect for the site's industrial history. Google's promotional materials, as cited by Happonen (2024), emphasise the repurposing of the former paper mill, the use of sustainable energy sources, and the recovery of heat for local households. Hamina has also become a reference point in discussions of Google's planned data centres in northern Finland. During a community meeting in Muhos in September 2026, Google representatives repeatedly referred to Hamina as an example of successful local partnership. At the same time, recent reporting on tree felling and subcontractor working conditions at the Hamina facility has raised questions about the environmental and social implications of this development (Tahkokorpi & Kaipainen, 2025; Bryant, 2026).

These examples suggest that industrial reuse involves more than the adaptation of existing buildings and infrastructures. Earlier industrial sites also become part of narratives of technological

progress, environmental responsibility, and regional development, although such narratives may be contested. The following analysis examines these relationships in greater detail through the cases of Nadvoitsy and Kajaani.

Nadvoitsy

Nadvoitsy in Karelia represents an example of a former aluminium plant repurposed as a data centre, with another data centre project under development. The settlement, known in Karelian as *Vojačču*, has a history dating back to 1620, shaped by successive phases of industrial and infrastructural development, including copper and gold extraction, hydropower, and aluminium production.

Nadvoitsy gained strategic importance in 1916 with the construction of the Murmansk Railway, connecting central Russia with the Arctic port (Golubev, 2011). During the Soviet period, the area became associated with the construction of the White Sea–Baltic Canal (*Belomorkanal*, or BBK) and the network of labour camps established for the project. The canal was intended to improve the transportation of raw materials and support the development of northern Karelian industry (Baron, 2002). At the same time, it was a highly ideological project, presented by the Soviet state as a symbol of technological advancement and a means of transforming prisoners through socialist labour (Draskoczy, 2010).

In 1954, the Nadvoitsy aluminium plant (*Nadvoitskii aluminievyi zavod*, or NAZ) opened, becoming the settlement's principal industrial employer and shaping its development for decades (Filimonchik, 2021). Its products included primary aluminium, silumin (an aluminium–silicon alloy), and aluminium powders. Aluminium was commonly referred to in the Soviet Union as "the metal of the future", reflecting its association with technological progress, including the development of space technologies. The location of aluminium production was closely connected to the availability of inexpensive and reliable electricity, while Soviet industrial location decisions were also shaped by broader priorities of regional development and strategic importance (Fortescue, 2008).

For decades, the aluminium plant served not only as Nadvoitsy's principal employer but also shaped local understandings of the settlement and its future. In the late 1990s and early 2000s, residents referred to Nadvoitsy as "the settlement around the plant" (*poselok pri zavode* in Russian), closely associating their well-being with industrial development (Filimonchik, 2021). In 2004, to mark its 50th anniversary, the plant published a collection of materials, including dozens of interviews with former workers conducted and edited by the Karelian historian Svetlana N. Filimonchik.

In these interviews, former workers recalled both the hardships of the early post-war years and the sense of security and community that developed around the plant. Many had moved to Karelia from other regions and initially faced difficult working and living conditions, including adjusting to the northern climate. Over time, however, housing and living conditions improved, and many workers came to feel part of a united labour collective. Despite acknowledging the negative environmental and health impacts of aluminium production, interviewees often associated the well-being of the settlement with the prosperity of the plant and expressed hopes for its continued operation (Filimonchik, 2004). However, the subsequent development of Nadvoitsy took a different direction.

In 2012-2013, first news emerged that the Nadvoisy plant was in danger, experiencing financial difficulties. In 2013, the aluminium industry experienced a major downturn, with global aluminium prices falling from approximately USD 2,800 to USD 1,700 per tonne. Local residents addressed regional and federal governments in their desperate letters, saying that the plant closure would mean the death of the settlement (Kuznetsov, 2018). Despite the efforts to save the enterprise, in 2018 the production of aluminium stopped, and the plant was closed.

At that time, the construction of a data centre in the premises of former aluminium plant was already planned (Belianchikov, 2018). In 2016, Nadvoitsy received the status of "territory of advanced economic development" from the Russian state, meaning that new enterprises and business coming to the settlement would have significant tax incentives. At the same time, the settlement was experiencing population decline: between 2013 and 2018, approximately 2,000 residents left Nadvoitsy permanently (Larchenko, 2019). According to the data of the Russian Federal State Statistics Service (Rosstat), Nadvoitsy had 8,372 residents in 2010, compared with 5,763 in 2025.

The redevelopment of the former aluminium plant for digital infrastructure was promoted by the Karelian authorities as an opportunity to revitalise the declining industrial settlement. In 2019, KU Data Centre began operating in Nadvoitsy, becoming one of Russia's largest data centres. In 2020, plans were announced for another data centre, Arktika-2. According to its website, KU Data Centre provides approximately 100 jobs. The front page of KU Data Centre notes that this new technology in Nadvoitsy is in the avant-garde: they are holding the records as the longest data centre building in Russia and the most powerful data centre situated in one building (Interrecord, n.d.-a, n.d.-b). The front page optimistically states: "The team of KU Data Centre are the people capable of changing the world to the best. We believe in innovations and digital future, in green energy and hi-tech. We know, that a human is the main value… We make the future we could not even dream about 10 years ago happen now" (KU Data Centre, n.d.).

However, the new enterprises have not been able to compensate for the loss of industrial employment. Moreover, jobs in data centres often require different qualifications from those associated with earlier industries. As Elena Nedoseka and Nikolai Karbainov (2020) analyse, while the number of able-bodied population in Nadvoitsy in 2020 was 4541, the number of jobs provided by (bankrupt) aluminium industry was less than 100, and the 5 new entreprises, including KU Data Centre, provided 181 jobs all together. The authors conclude: "The number of new jobs, even in the aggregate, is far from the real needs of the population of single-industry towns" (Nedoseka & Karbainov 2020: p. 151). For comparison, in 2012, Nadvoitsy aluminium plant provided 41,1% of local residents' income (Krivichev et al., 2020).

As a result, many residents are still leaving the settlement, some of them find employment as fly-in-fly-out workers in other Russian regions. As the discussions in the local online forum suggest, in the recent years, many public facilities and residential buildings were abandoned or left underutilised. In a local social media group, one resident noted in 2024: "Demolished buildings are everywhere, good at least that the school has been renovated and now looks less depressing. The settlement has died." Another one wrote in the same year: "This is a decaying place… Broken buildings everywhere, as well as sorrow and depression."

In another online discussion, a visitor shared photographs and impressions from a trip to Nadvoitsy in 2019. While describing the surrounding nature as exceptionally beautiful, the visitor

also reflected on the environmental impacts of industry and the abandoned buildings in the settlement. One photograph depicted a former daycare centre decorated with images of familiar Soviet cartoon characters, alongside the ruins of a former House of Culture, a state-sponsored community and leisure centre. The contrast between the cheerful decorations and the present state of the buildings illustrates how infrastructures once associated with community life and care have become traces of an earlier industrial period.

Another photo shared in the post depicts an empty building with the slogan "Miru – Mir" as a part of its decoration. In Russian, this is a multifaceted slogan, that is generally translated as "Peace to the World", and evokes the images of post-WWII reconstruction, but simultaneously connects to the space station "Mir," for which Soviet aluminium was used. At the end of the post, the same user notes: "When looking at the houses in Nadvoitsy, there was a recurring thought in my head: All this is in the past, or will be in the past soon."

For many decades, aluminium production as the main settlement's enterprise contributed to local identity of "the settlement near the plant" and collective understandings of the settlement's future connected to industrial advancement. The public materials of contemporary data centre projects similarly invoke narratives of modernization, innovation, and regional revitalization (hi-tech, green energy, digitalization, and care for the people as the main value). However, while the industrial site is reused and the promise of a technologically advanced future persists the new enterprises provide far fewer jobs and have not reversed the settlement's demographic decline. The unevenness of accumulated intelligence in the transition from aluminium production to digital infrastructure therefore illustrates how certain material and institutional foundations of industrial development can be retained and repurposed, while other aspects of industrial life, including employment and community infrastructure, are not reproduced.

Kajaani

Kajaani is a town situated around 500 km north of Helsinki. Its population in 2025 was slightly above 36,000 residents. Kajaani's location along major transport routes facilitated the growth of its timber industry, centred on Kajaani Oy (later UPM), which became a key driver of the town's development (Häyrynen & Semi, 2019).

Kajaani Oy was part of a long industrial tradition in the Kainuu region. Chemical wood processing began in Kajaani in 1909 with the opening of Northern Finland's first pulp mill, while the first paper machine started operation in 1919. Although pulp production ended in the early 1980s, significant investments continued and a new newsprint machine was inaugurated in 1982 as a symbol of confidence in the factory's future. Through a series of mergers, the mill eventually became part of UPM. Similarly to the aluminium plant in Nadvoitsy, pulp and paper plant in Kajaani played an important role in the town's life. The report on the impact of the plant's closure published in 2010 was titled "In the shadow of the paper mill" (In Finnish, *Paperitehtaan varjossa*) (Rotko et al., 2010), evoking the expression of "the settlement next to the plant" used by Nadvoitsy residents.

In the late 1990s, paper production was still considered one of the most important sectors of Finnish industry (Ketolainen, 1998). Forests have also played a central role in Finnish national identity, carrying cultural significance alongside their economic importance (Mäkelä & Linkola, 2024). However, the industry also raised environmental concerns. In 2003, Greenpeace identified

the Kajaani mill as a purchaser of timber from old-growth forests in northern Finland (Greenpeace International, 2003).

In September 2008, UPM announced the restructuring measures, including the closure of the Kajaani paper mill, due to the slowing demand for newsprint paper as well as increased prices on wood, energy, as fuels (UPM, 2008). The closure of Kajaani paper mill resulted in the direct loss of 535 jobs and wider economic decline for the region. The closure was accompanied by significant support measures introduced by UPM and public authorities, including employment assistance, retraining, psychological support, and funding for regional redevelopment. The assessment conducted in 2009 concluded that these measures had helped mitigate the immediate negative consequences of the closure, with half of the former employees already re-employed and another fifth participating in training. Nevertheless, the researchers noted that the transition affected different groups of workers unequally, while its long-term impacts on wellbeing and the wider community remained uncertain (Rotko et al., 2010).

Following the closure of the paper mill, since 2012, the Renforsin Ranta industrial area was gradually transformed into a centre for digital infrastructure and technological innovation. Today, it hosts the LUMI supercomputer (short for Large Unified Modern Infrastructure, while *lumi* is also translated from Finnish as "snow"). LUMI is one of Europe's most powerful computing systems, operated by an international consortium of European countries. The facility relies entirely on renewable energy, primarily hydropower, while the waste heat generated by its operation is redirected into Kajaani's district-heating network. The choice to locate LUMI within the premises of the former paper mill also reflects an effort to build digital infrastructure upon existing industrial foundations rather than creating an entirely new site (Oikarinen, 2026).

Digital infrastructure development in Kajaani continues to expand. In 2026, construction began on a new facility intended to host the pan-European LUMI-AI supercomputer and the LUMI-IQ quantum computer as part of the LUMI AI Factory initiative. The facility is expected to become operational in 2027. An additional data centre developed by XTX is also planned near the Renforsin Ranta area. These developments further position Kajaani as a centre for digital infrastructure, extending the transformation that began with the redevelopment of the former paper mill.

During a field visit to the LUMI data centre in February 2026, traces of the site's industrial past remained visible in the landscape, including former railway lines, paper mill buildings, commemorative objects associated with the factory's history, and the former factory café, now used by data centre employees. The surface of the LUMI supercomputer itself was designed to resemble origami (see Figure 2). This is the tribute to its paper mill legacy, as the supercomputer is occupying the former halls where paper production took place. During discussions with employees and engineers at LUMI, the transformation from paper production to data processing emerged as a recurring theme. Several interlocutors noted that paper represented a tangible and easily understandable product, while data is largely invisible and therefore more difficult for local residents to relate to. During an informal discussion, interlocutors noted that data centres in the Renforsin Ranta area currently employ around 500 people, a figure comparable to the 535 jobs lost following the UPM closure. However, they also pointed out that many of these employees live outside Kajaani.

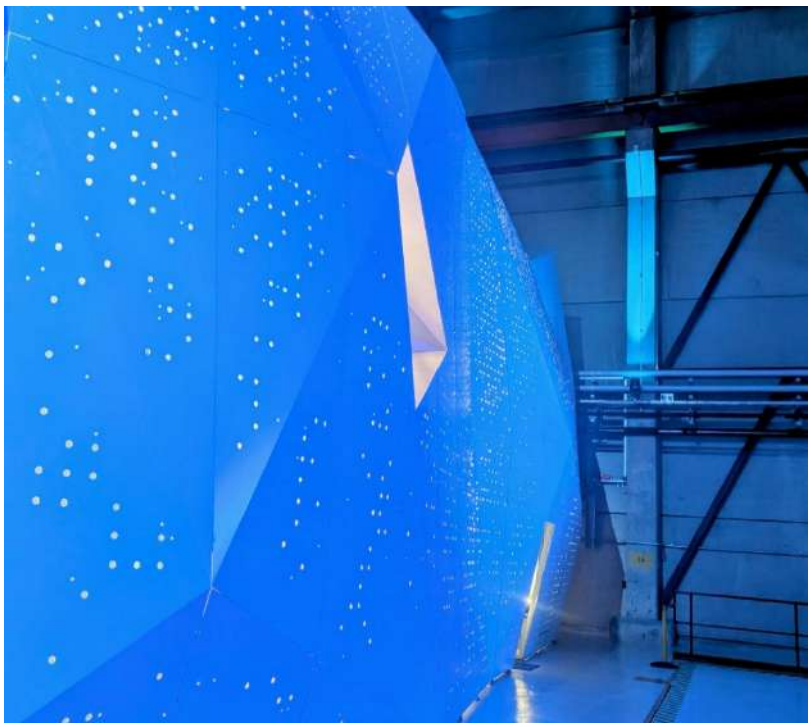

Figure 2. Origami-like design of LUMI supercomputer in Kajaani, set in the former factory halls. Photo by Anna Niia Varfolomeeva (2026)

In Finnish-language online discussions, participants appreciated Kajaani's surrounding nature and opportunities for outdoor activities but also expressed concerns about young people leaving the area due to limited opportunities. Unemployment and economic difficulties were recurring themes, including references to food assistance for unemployed residents (*ruokajono*, or food queue). The town was also discussed in relation to both its former pulp and paper industry and its contemporary digital infrastructure. One participant noted: "There was more life here [in Kajaani] before the paper mill left," while another jokingly remarked, referring to LUMI: "If you like supercomputers, Kajaani may be the place for you." This joke could potentially suggest different ways in which residents may relate to successive industries; while seen as economically important, they may not necessarily be perceived as an integral part of an ordinary resident's daily life, unlike natural surroundings, immediate service providers, or social services. Excess heat from LUMI is used in Kajaani's district heating system, although this connection is not necessarily visible to residents. This raises a question: can residents "like", or develop a a sense of connection and care for digital infrastructures? Nete Schwennesen (2019) suggests that algorithms per se lack agency, while their agentic capabities are produced through a set of relations between socio-material actors, including companies, IT workers, municipalities, and policies. Perhaps strengthening these connections between different actors, including data centres themselves, could create more opportunities for care and relatedness.

These discussions suggest that the paper mill's closure remains part of how Kajaani's present and future are understood. While the former mill was closely connected to employment and the town's economic and social life, LUMI appears in the selected discussions primarily as a symbol of technological development rather than as an equally familiar part of everyday experience. This does not mean that digital infrastructure lacks local significance, but its relationship to work and

community differs from that of the former paper mill. As in Nadvoitsy, the transition from industrial production to digital infrastructure therefore involves not only changes in economic activity but also changes in how work, community, and regional futures are understood.

Conclusion

This article has explored the notion of accumulated intelligence as a way of understanding how successive industrial transformations build upon historically developed relationships between people, technologies, materials, and northern landscapes. By introducing this notion, we aim to demonstrate that data centres, although often promoted as groundbreaking, unprecedented, or future-oriented developments, are strongly embedded in earlier industrial histories.

In both Nadvoitsy and Kajaani, the core case studies of this article, data centres are presented as symbols of innovation, regional renewal, and future prosperity. These projects inherit more than material foundations alone. They emerge within landscapes shaped by earlier experiences of industrial development, decline, and uncertain futures. Narratives of modernisation, technological progress, improved connectivity, and economic revival that accompanied earlier industrial and infrastructural projects, from the construction of the White Sea–Baltic Canal to aluminium and paper production, reappear in contemporary discussions of digital infrastructure.

Earlier industries were also closely connected to local identities and everyday life. Nadvoitsy was described as a *poselok pri zavode* ('settlement around the plant'), while the title *Paperitehtaan varjossa* ('In the Shadow of the Paper Mill') captures the historical significance of paper production for Kajaani. These expressions suggest how industrial activities shaped not only local economies and built environments but also understandings of the places themselves. Although data centres are also dependent on specific material and geographical conditions, the cases examined in this article do not yet suggest that data centres have developed comparable relationships with community life, or collective identity. Such relationships may emerge over time, but currently, the article highlights the limits of continuity between successive industries.

Data centres are often represented through metaphors of the cloud: distributed, immaterial, neutral-coloured, and seemingly detached from specific places. However, their development often depends on landscapes already transformed by earlier industrial activities, including energy infrastructures, industrial facilities, transport networks, and settlement development. These material foundations are inseparable from the histories of human and more-than-human interactions through which they were established.

Accumulated intelligence, in this sense, does not imply that earlier forms of knowledge and expertise remain unchanged. Rather, this concept brings attention to how historical relationships with place persist and change over time. For example, data centres may reuse former industrial buildings and reproduce promises of technological progress and innovation. At the same time, they do not necessarily reproduce the employment opportunities, skills, and role in community life associated with earlier industries.

Understanding these continuities and transformations is important because the implications of digital infrastructure extend beyond technological innovation. The cases discussed in the article suggest that digital redevelopment should be considered in relation to the longer histories of industrial places, including the different social and economic roles of earlier industries and technologies. Future research should pay closer attention to how local and Indigenous

communities experience, negotiate, and evaluate these transformations, and under what conditions digital infrastructures may contribute to sustainable regional futures.

References

Andersen, E. (2026, August 12). 'We have serious concerns,' northern Alberta chief says after hosting community meeting on Wonder Valley. CBC News. https://www.cbc.ca/news/canada/edmonton/sturgeon-lake-cree-nation-wonder-valley-engagement-session-9.7305052

Arregoces, M., & Portolani, M. (2004). *Data Center Fundamentals. Understanding Data Center network design and infrastructure architecture, including load balancing, SSL, and security*. Cisco Press.

Baron, N. (2002). Production and terror: The operation of the Karelian Gulag, 1933-1939. *Cahiers du monde russe. Russie-Empire russe-Union soviétique et États indépendants*, *43*(43/1), 139-180.

Belianchikov, E. (2018). Rusal nachinaet zakrytie Nadvoitskogo zavoda. Chto budet s liud'mi? [Rusal begins the closure of the Nadvoitsy plant. What will happen to the people?]. *Karelia.News*. August 7. https://karelia.news/news/2119393/rusal-nacinaet-zakrytie-nadvoickogo-zavoda-cto-budet-s-ludmi/

Bertoni, F., & Beisel, U. (2013). More-than-human intelligence: Of dolphins, Indian law and the multi-species turn. *Society and Space*, *22*. Available at: https://www.societyandspace.org/articles/more-than-human-intelligence-of-dolphins-indian-law-and-the-multispecies-turn

Bresnihan, P., & Brodie, P. (2025). *From the Bog to the Cloud: Dependency and Eco-modernity in Ireland.* Bristol University Press.

Brodie, P. (2024). Smarter, greener extractivism: digital infrastructures and the harnessing of new resources. *Information, Communication & Society*, *28*(6), 1061–1080.

Brodie, P., & Velkova, J. (2021). Cloud ruins: Ericsson's Vaudreuil-Dorion data centre and infrastructural abandonment. *Information, Communication & Society*, *24*(6), 869–885.

Bryant, M. (2026). 'Pure arrogance': anger in Finland as Google illegally fells 250,000 trees for datacentre. *The Guardian*, October 22. Available at: https://www.theguardian.com/environment/ng-interactive/2026/oct/22/finland-google-felling-trees-datacentre

Cambridge Dictionary. (n.d.). Intelligence. In *Cambridge Dictionary*. Retrieved November 11, 2026, from https://dictionary.cambridge.org/dictionary/english/intelligence

Childs, Q. (2022). "This Has Nothing to Do With Clouds": A Decolonial Approach to Data Centers in the Node Pole. *Commonplace*. https://doi.org/10.21428/6ffd8432.59c985d5

Dellermann, D., Ebel, P., Söllner, M., & Leimeister, J. M. (2019). Hybrid Intelligence. *Business & information systems engineering*, *61*(5), 637-643.

Despret, V. (2005). Sheep do have opinions. In B. Latour & P. Weibel (Eds.), *Making things public: Atmospheres of democracy* (pp. 360–368). MIT Press.

Draskoczy, J. S. (2010). *A Body of Work: Building Self and Society at Stalin's White Sea-Baltic Canal* (Doctoral dissertation, University of Pittsburgh).

Filimonchik, S. N. (Ed.). (2004). *Nadvoitskii aliuminievyi zavod: Ocherk istorii: Dokumenty i materialy. Vospominaniya. Khronika sobytii* [*The Nadvoitsy aluminum plant: A historical overview. Documents and materials. Memoirs. Chronicle of events*]. Petrozavodsk.

Filimonchik, S. N. (2021). Poselok pri zavode: Nadvoitsy v 1950–1970-e gody [A settlement around the factory: Nadvoitsy in the 1950s–1970s]. *Gosudarstvo, obshchestvo, tserkov' v istorii Rossii XX–XXI vekov*, 772–777.

Fortescue, S. (2008). Location decisions in the Russian aluminium industry. *Australian Slavonic and East European Studies*, *22*(1–2), 23–44.

Giaccardi, E., Roudavski, S., & Tironi, M. (2026). Participation and the Troubles with Intelligence. In *Proceedings of the 19th Participatory Design Conference 2026, Vol. 1: Full Papers* (pp. 385–390).

Golubev, A. A. (2011). Formirovanie infrastruktury Murmanskoi zheleznoi dorogi v khode ee stroitel'stva [The formation of the Murmansk Railway infrastructure during its construction]. *Izvestiya Peterburgskogo universiteta putei soobshcheniya*, (2), 209–217.

Greenpeace International. (2003). Finnish forestry: Destroying forests, destroying livelihoods. https://www.greenpeace.org/static/planet4-netherlands-stateless/2018/06/finnish-forestry-destroying-f.pdf

Günel, G. (2022). Accumulation: Exploring the materiality of energy infrastructure: Energy. In M. H. Bruun, A. Wahlberg, R. Douglas-Jones, C. Hasse, K. Hoeyer, D. B. Kristensen, & B. R. Winthereik (Eds.), *The Palgrave handbook of the anthropology of technology* (pp. 689–702). Springer.

Happonen, H. (2024). *The coolest data center in the world.* December 3. Medium. https://medium.com/@henrihapponen/the-coolest-data-center-in-the-world-e288cb19d921

Häyrynen, S., & Semi, J. (2019). Revitalizing the successful past in the North: Narratives of change in the peripheral post-industrial city of Kajaani, Finland. *Urban Science*, *3*(4), 110. https://doi.org/10.3390/urbansci3040110

Interrecord. (n.d.-a). *Samoe dlinnoe zdanie data-centra* [*Longest data centre building*]. https://www.interrecord.ru/samoe-dlinnoe-zdanie-data-centra-cod/

Interrecord. (n.d.-b). *Samyi moshchnyi data-tsentr (odno zdanie)* [*The most powerful data centre (one building)*] https://www.interrecord.ru/most-powerful-data-center-one-building/

Johnson, A. (2023). *Where cloud is ground: Placing data and making place in Iceland.* University of California Press.

Ketolainen, T. (1998). Syntynyt: Suomen paperituotemuseo. *Tekniikan Waiheita*, *16*(3), 63-64.

Krivichev, A. I., Maximov, Y. I., & Sidorenko, V. N. (2020). Assessment of town-forming enterprises' economic sustainability for Karelia's monotowns. In *IOP Conference Series: Earth and Environmental Science* (Vol. 539, No. 1, p. 012070). IOP Publishing.

KU Data Centre. (n.d.). *KU Data Centre.* https://kudc.center/

Kuznetsov, A. (2018). *Alyuminievyi krizis: Kareliya mozhet ostat'sya bez NAZa.* [Aluminum crisis: Karelia may be left without the NAZ aluminum plant]. *Stolitsa na Onego*. August 7. https://stolicaonego.ru/articles/aljuminievyj-krizis-karelija-mozhet-ostatsja-bez-naza/

Larchenko, O. V. (2019). Sovremennye problemy monogorodov i puti ikh resheniia: zarubezhnyi i otechestvennyi opyt. *Regional'nye problemy preobrazovaniia ekonomiki*, *8* (106), 121-128.

Lefdal Mine Datacenter: Norwegian data centre combines flexibility and reliability with DEIF [Promotional brochure]. (n.d.). https://www.deif.cn/media/dzond4k1/lefdal-mine-data_handout-for-web.pdf

Limbert, M. (2010). *In the time of oil: Piety, memory, and social life in an Omani town*. Stanford University Press.

Malpas, J. (2015). Introduction: The intelligence of place. In J. Malpas (Ed.), *The intelligence of place: Topographies and poetics* (pp. 1–10). Bloomsbury Publishing.

Mattern, S. (2021). A city is not a computer. In K. Willis & A. Aurigi (Eds.), *The Routledge companion to smart cities* (pp. 17–28). Routledge.

Mäkelä, H. H., & Linkola, H. (2024). Nation-space and the transtemporal woodlands: The politics of the past in the heritagised narratives on forests in twenty-first century Finland. In G. Bozoğlu, G. Campbell, L. Smith, & C. Whitehead (Eds.), *The Routledge international handbook of heritage and politics* (pp. 362–379). Taylor & Francis.

Mrázek, R. (2002). *Engineers of Happy Land: Technology and Nationalism in a Colony*. Princeton University Press

Nedoseka, E., & Karbainov, N. (2020). "Dying" or "new life" of single-industry towns (the case study of socio-economic adaptation of residents of single-industry settlements in the North-West of Russia). *Arktika i Sever [Arctic and North], 41*, 139–154. https://doi.org/10.37482/issn2221-2698.2020.41.163

Nost, E. (2026). Surplus environments of the digital hinterlands. *Dialogues in Human Geography*, 20438206261461597.

Oikarinen, A. (2026). *Tiedon kerääminen Kajaanin kaupungin ilmasto-ohjelman laadintaa varten* [Data collection for the preparation of the City of Kajaani's climate programme] [Bachelor's thesis, Turku University of Applied Sciences]. Theseus. https://www.theseus.fi/handle/10024/910446

Pickren, G. (2014). Political Ecologies of Electronic Waste: Uncertainty and Legitimacy in the Governance of E-Waste Geographies. *Environment and Planning A: Economy and Space*, *46*(1), 26-45.

Rotko, T., Palosuo, H., Sihto, M., & Husman, P. (2010). *Paperitehtaan varjossa: Kajaanin paperitehtaan lakkauttamisen ja siihen liittyvien tukitoimien terveys-ja hyvinvointivaikutusten arviointi*. Helsinki: Yliopistopaino.

Saunavaara, J., Laine, A., & Salo, M. (2022). The Nordic societies and the development of the data centre industry: Digital transformation meets infrastructural and industrial inheritance. *Technology in Society*, *69*, 101931.

Schwennesen, N. (2019). Algorithmic assemblages of care: Imaginaries, epistemologies and repair work. *Sociology of health & illness*, *41*, 176-192.

Sjoholm, B. (2023). *From Lapland to Sápmi: Collecting and Returning Sámi Craft and Culture*. University of Minnesota Press.

Sonne, B. (1988). In Love with Eskimo Imagination and Intelligence. *Etudes Inuit Studies*, Vol. 2 Nos 1-2., 21-44.

Sovacool, B. K. (2016). How long will it take? Conceptualizing the temporal dynamics of energy transitions. *Energy research & social science*, *13*, 202-215.

Tahkokorpi, M., & Kaipainen, M. (2025, January 14). *Puolalaiset paiskivat jopa 12 tunnin päiviä Googlen työmaalla Haminassa – sitten tarkastaja sai eteensä oudon sopimuksen* [Polish workers worked up to 12-hour days at Google's Hamina construction site—then an inspector was presented with a strange contract]. *Yle*. https://yle.fi/a/74-20203996

Tennberg, M., Lempinen, H., & Pirnes, S. (2019). The resourceful North: Divergent imaginaries from the European Arctic. In M. Tennberg, H. Lempinen, & S. Pirnes (Eds.), *Resources, social and cultural sustainabilities in the Arctic* (pp. 175–181). Routledge.

Upham, P., Sovacool, B., & Monyei, C.G. (2022). Imaginaries on ice: Sociotechnical futures of data centre development in Norway and Iceland. *Environment and Planning E: Nature and Space*, *6*(3), 1905-1922.

UPM. (2008, September). UPM continues restructuring measures – Company plans to close paper and pulp capacity in Finland. https://www.upmspecialtymaterials.com/news-and-stories/2008/09/upm-continues-restructuring-measures---company-plans-to-close-paper-and-pulp-capacity-in-finland-/

van Veelen, B., Rella, L., Aiken, G. T., Judson, E., Gambino, E., Jenss, A., Parashar, A., & Pinker, A. (2021). Interventions on democratizing infrastructure. *Political Geography, 87*, 102378. https://doi.org/10.1016/j.polgeo.2021.102378

Varfolomeeva, A. N. (2026). Beyond the "great white nothing": Resourcefulness in northern infrastructural landscapes. In G. Espinoza-Rivera & J.C. Skewes (Eds.) *The Political Economy of State Reaching: Remote Areas, Expansion, and Territorial Reorganization* (pp. 85-98). Routledge.

Velkova, J. (2023). Retrofitting and ruining: Bunkered data centers in and out of time. *New Media & Society*, *25*(2), 431-448.

Velkova, J., & Plantin, J.-C. (2023). Data centers and the infrastructural temporalities of digital media: An introduction. *New Media & Society, 25*(2), 273-286.

Vonderau, A. (2019). Scaling the cloud: Making state and infrastructure in Sweden. *Ethnos*, *84*(4), 698-718.

Wood-Donnelly, C., Chuffart, R., Stjernström, O., Larson, K., & Sandersen, H. T. (2026). (Ab) using the Land: Environmental and Climate Justice in Public Policy of the Nordic North. In D.C. Nord (Ed.) *Contemporary Nordic Public Policies: Degrees of Exceptionalism and Inner Diversity* (pp. 179-196). Cham: Springer Nature Switzerland.

Yle News. (2026, October 8). Google halts work on data centres as Finnish police probe suspected illegal logging. https://yle.fi/a/74-20250446