Spillover, sponge or something else? Dismantling expectations for rural development resulting from giga-investments in Northern Sweden

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The paradoxical situation of planning for growth while managing decline has long been a reality for politicians and planners in Nordic peripheries. In recent years, however, attempts to plan for demographic adaptation, smart shrinkage, and 'right-sizing' public services have become commonplace. While it has taken decades for this to become an accepted part of municipal planning, new opportunities are now arising in the Swedish North due to several unforeseen giga-investments. These are expected to trigger rapid socio-economic growth along the urbanized coast and in a few select inland locations. Yet the likely effects on shrinking rural and sparsely populated municipalities geographically adjacent to these investment hotspots are much less understood. Previous research suggests that such investment projects might cause pressure for rural labour and housing markets but may also offer a range of positive spillover effects and development opportunities for rural areas. We draw on structural level narratives and interviews with key informants, including local and regional political stakeholders, to identify how the prospects of the giga-investments are viewed in places that are not directly affected, and what opportunities and threats are discussed. An overarching theme identified in the empirical material concerns the a-spatiality of discourses of growth, which we divide into two concrete dilemmas: infrastructure and mobility. Our findings show that, while the investments are seen as ringing in a new 'golden age' for the northern region, such a-spatial understandings of regional characteristics might stand in the way of acting fast and being able to make the most of the potential spillover effects.

Keywords: Arctic Sweden, green (re)industrialization, planning, sparsely populated municipalities, spillover/sponge, sustainable development

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Introduction

The Swedish North is a sparsely populated region that has recently attracted several large-scale investment projects for re-industrialization and green transformation of the economy. An estimation from August 2021 suggests the investments are amounting to 1,100 billion EUROs. Examples of recent developments include the Northvolt battery production facility in Skellefteå, the Hybrit fossil-free steel project in Gällivare and hydrogen storage in Luleå, and the construction of the Norrbotnia railway from Umeå to Luleå. These investments are expected to trigger rapid socio-economic growth along the urbanized coast and a few select inland locations, and there are high hopes for the investments to contribute locally, in the region, as well as globally to a more sustainable future.

Investments in the Swedish North are being made in locations that have previously been hosting resource-based industries, mostly in the coastal area and in the mining belt of the North. How these investments will affect the more rural and sparsely populated municipalities in the hinterland that have long been battling socio-economic decline, withdrawal of public services, and loss of control over local planning decisions is yet to be disclosed. While the investments might cause pressures for rural labour and housing markets, they also offer a range of possible positive spillover effects, not least as a result of changing human mobility patterns motivated in part by lifestyle choices. This could mean increased rural amenity and lifestyle migration, rural-urban commuting, second home ownership, and tourism.

For several reasons, northern peripheries are experiencing high population turnover and continuous in- and outmigration (Lundmark *et al*. 2020), but there are high hopes on part of the governmental agencies that the investments will mean more permanent immigration from the south. Due to the extensive investments in the two northernmost counties Västerbotten and Norrbotten, the Swedish government has appointed a special socio-economic transition coordinator. According to him, a rough estimation is that the investments will over a 10 to 15-year period attract approximately 100,000 people to these counties with a current population of around 520,000 inhabitants (SVT nyheter 2021). Such a large inflow of people will create a high demand for a range of public and private services, putting pressure on municipal structures that have been forced to downsize their capacity for a long time. The effects of the investments are, thus, not only relying on the investments themselves but on the possibilities that are created and planned for to generate further positive developments in the surrounding municipalities.

Previous research on large investments in similar northern and sparsely populated peripheries suggests that such projects often result in highly localized growth hotspots, with little evidence of any significant labour, migration or economic linkage spillover to the broader region (Kauppila 2011; Tonts *et al*. 2016; Storey 2018). However, departing from the stated goals set by the government – to support and aid the transformation of the whole region – we aim to identify how the prospects of such giga-investments are viewed in places that are not directly targeted for investments, and what opportunities and challenges are discussed locally. To address the paper's aim, the research question regards what strategies are being considered by local and regional governments to manage potential positive (spillover) or negative (sponge or backwash) effects. Examples are drawn from Malå municipality, residing 120 kilometres from Skellefteå, and from a broader regional perspective. Figure 1 shows the location of the study area in focus. The material is based on discussions held at public events with the green industrialization of Northern Sweden as the main theme and interviews with key persons representing the region and the municipalities. In the end, we discuss how shrinking rural municipalities in Northern Sweden could be affected by the region's giga-projects, particularly in terms of attracting new populations and mobilities and socio-economic development opportunities.

The next section introduces the broader ideas around regional development in the Northern Sweden, including the concept of spillover and sponge relationships between urban growth hotspots and surrounding rural areas. Further, we discuss possible trends related to residential, labour, lifestyle and tourism mobilities that could result in positive population and economic development not only in the investment hotspots but in other rural municipalities in the North and a section outlining the methods and material used. This is followed by a brief account of the investments being made in the Swedish North. In the result section, place-based contextualizations of the green (re)industrialization

Fig. 1. The study area.

are made and we show how representatives at regional and municipal levels approach the new situation in the context of the structural level narratives to which they relate. The narratives identify issues of infrastructure, mobility and migration. We end the paper with a discussion and some thoughts on the meaning of the investments for the local and regional levels of the north with respect to the prospects of the giga-investments in places that are not directly affected by them.

Regional development in Northern Sweden

Spillover, sponge, and regional development relationships in peripheries

Large-scale investments in resource projects and transport infrastructure have been a common marker of economic development in many sparsely populated and northern peripheries (Bone 2003; Huskey 2005; Jóhannesson *et al*. 2011). While the so-called mega- or giga-projects are usually embraced by regional and national governments for their ability to trigger rapid economic growth and population inflows, they are often considered to be a 'curse' for more stable and sustainable regional development. Not only are they renowned for causing notorious boom-and-bust cycles and volatile populations (Barnes *et al*. 2001), but they often result in truncated regional development beyond the immediate investment hotspots and a widening socio-economic gap between the 'haves and have nots' (Taylor *et al*. 2011).

Recent work has rediscovered the metaphors of spillover versus sponge (or spread vs. backwash) effects to examine the flows of labour, capital and skills between northern growth centres (typically situated in urban hubs) and the more rural and sparsely populated remainder of their regions (Carson *et al*. 2021). Although contested, the idea of the centre as a sponge (Argent *et al*. 2008) suggests that the few urban growth hotspots will increase urbanization and polarization within the northern region and 'suck in' more people, labour and human capital from the rural and sparsely populated areas. The centres are also expected to redirect most external in-migration to the coast where labour is urgently needed, salaries are higher, economies are more urbanized and diversified, and broader service amenities exist (Bjarnason *et al*. 2021). A more positive take on what these investments could mean for rural areas, at least those located in closer proximity to the growth centres, relates to the idea of spillover. Here, urban growth may bring new in-migrants and economic linkages to rural areas. Typical examples of such spillover include sub-urban sprawl and the emergence of satellite towns or commuter villages (Partridge *et al*. 2007; Bosworth & Venhorst 2018). Positive effects could also emerge in terms of land-rent, since rural areas might have a competitive advantage in offering lower costs for industrial facilities, for example for the production of second or third tier input products.

What is clear is that not all rural areas will be affected in the same way. Spillover or sponge effects are highly dependent on distance to growth centres – the further away the more difficult it will be for rural settlements to derive positive spillover benefits, perhaps with the exception of a few isolated but well-connected settlements in high-amenity locations and tourism destinations (Partridge *et al*. 2007; Veneri & Ruiz 2016; Bosworth & Venhorst 2018). Also, the existence of functional regions with embedded reciprocal interactions and relationships are key to facilitating the exchange of people and capital. Functional ties can emerge, for example, through established transport links, accepted pipelines for access to services and markets, historic patterns of migration and mobility, common recreational and leisure exchanges, existing social and cultural ties, and a shared sense of regional identity (Smailes *et al*. 2019).

Both distance and functional ties are problematic when discussing regional development in northern peripheries due to their internal disconnectedness (Carson *et al*. 2021). According to this idea, settlements within the region have often evolved independently from one another and do not necessarily share the same labour markets, mobility corridors, and networks for access to markets, services and recreation. As such, functional regions in the North are often quite small or restricted to narrow corridors, depending on historic industrial relations or transport routes. More importantly, local growth hotspots tend to be oriented towards external (rather than regional) sources of capital, with a common reliance on temporary external workers who are attracted to a particular project and location, and do not necessarily circulate within the region once those projects are complete (Halseth 1999; Carson & Carson 2014). A mismatch between specialised skills and labour attracted to those growth hotspots, and general demands for skilled labour in the region can, thus, hamper the potential for regional spillover (Carson *et al*. 2021). Even spillover into nearby rural areas through the spread of commuter villages may be quite restricted in the North due to limited transport connections and the combined issues of distance, cost and time prohibiting daily commuting. Meanwhile, there are relatively few amenity-rich locations and tourist resorts in the North that provide the sorts of

infrastructure, transport links and service amenities to attract notable spillover from the urban growth centres through tourist, recreational or amenity migration flows.

Some lessons from other northern peripheries

Previous research is limited when it comes to regional spillover or sponge effects arising from giga-projects in peripheral regions. Across the Circumpolar North and Northern Australia, at least, there is some evidence from remote mining towns and larger industrial or transport hubs (Jóhannesson *et al*. 2011; Taylor & Carson 2014; Tonts *et al*. 2016; Storey 2018), as well as from remote tourism resorts (Kauppila 2011; Byström & Müller 2014), usually in the context of smaller single-industry towns. Findings from these studies suggest highly localised and 'self-contained' growth hotspots and generally little evidence of any significant regional spillover in terms of labour, migration or economic linkages. Likewise, since most of the workforce for these projects is sourced from outside, the role of these growth centres as regional sponges may be much smaller than generally assumed (see Argent *et al*. 2008; Bjarnason *et al*. 2021; Carson *et al*. 2021).

Moreover, economic and demographic growth (the 'boom' phase) is mostly confined to the construction phase of large-scale infrastructure, particularly in the context of resource or transport projects, while their operational workforces are rather small. As such, these projects tend to attract large cohorts of temporary construction workers (typically young and male) who need particular types of housing and lifestyle amenities that seem to concentrate in high-density urban environments (Taylor & Carson 2014). There is evidence of some temporary spillover into surrounding areas during the construction phase of large infrastructure projects, as in the case of confined purpose-built workers camps (Tonts *et al*. 2016; Storey 2018), as well as some 'crowding-out' of less affluent people to cheaper suburbs or satellite towns (Taylor & Winter 2013). Issues of housing shortages are common (Jóhannesson *et al*. 2011), but housing capacity to absorb surplus in rural surroundings is limited or existing communities are not compatible with resource projects, meaning that companies often build their own accommodations (Storey 2018). The resulting housing and infrastructure provisions are created with the specific needs of the company, or their temporary workers, at the forefront, and are often difficult to repurpose for other (less transient) populations afterwards.

Another lesson drawn from Darwin in Northern Australia (Carson *et al*. 2020a) suggests that urban giga-investments can also disrupt existing urban-rural spillover flows. During the city's recent construction boom related to major liquefied natural gas (LNG) projects, housing shortages meant that large cohorts of non-resident workers and fly-in/fly-out contractors were accommodated in commercial hotels and serviced apartments. This was driving up accommodation costs and made the city unaffordable for conventional leisure tourists, who would traditionally have dispersed to rural areas as part of their trips. While the city's tourism and hospitality sector was thriving, the rural areas suffered, as the workers and business tourists primarily stayed within the city and did not consume the same regional touring packages (Carson *et al*. 2020a).

It is important to note that the examples above are illustrations from different geographical contexts, and it is possible that experiences in Northern Sweden might differ to some extent. First, in our case the new giga-projects are mostly located in or close to existing larger population centres where more diversified economies and amenities exist. These might be in a better position to attract a more diversified labour force, including women and families with children, whilst also accommodating populations such as the elderly and ethnic minorities, and industries of employment that are typically excluded from the sorts of homogenous single-industry or company towns described in the literature. Second, one could speculate that the introduction of 'green' industries may also change the situation since they might bring different labour, which may be less temporary, more educated, and more interested in sustainability and local development. Because it is not just about construction but also operational workforces, there could be more permanent/long-term in-migration, as well as more diversified demographics. And third, the Swedish North may also be less internally disconnected as a region than other sparsely populated northern peripheries (Carson *et al*. 2021). We might therefore see some spillover along certain historically connected corridors that reach much further into the hinterland than the standard commuting distance would suggest, particularly for leisure, second home or tourism mobilities (Lundmark & Åberg 2019; Müller 2019).

Rural mobility and migration in the Swedish North

Although much of the inland North of Sweden is commonly portrayed as an area affected by outmigration and population decline, an increasing body of literature has focused on identifying new or existing peripheral mobilities that seem to buck the trend. There is evidence that a range of populations are attracted to shrinking rural municipalities for varying reasons and varying periods of time, thus continuing to shape the advance and retreat of settlements across the North (Carson *et al*. 2019). These include, on the one hand, labour migrants attracted by work-related and economic motives, such as young 'escalator migrants' in search of faster career advancement opportunities (Martel *et al*. 2013; Bjerke & Mellander 2017), and seasonal or temporary labour attracted by higher salaries, signature recreation opportunities, the prospects for exotic or extreme work experiences, and opportunities to balance lifestyle and economic interest on a seasonal basis (Lundmark 2006; Thulemark 2017).

On the other hand, lifestyle motives related to exotic Arctic experiences, connected to ideas of sparseness, wild nature, outdoor recreation, and extreme winters for instance, have been key factors for international migrants from various central European countries, who in turn often contribute to small-scale tourism development through lifestyle entrepreneurship (Eimermann *et al*. 2020). Existing social and family ties are another key driver, particularly for return migrants including young families and early retirees (Sandow & Lundholm 2020), as well as second home owners, some of whom convert seasonal and second homes back into primary residences (Müller & Marjavaara 2012; Marjavaara & Lundholm 2016). Also, refugee migrants have been a prominent in-migration flow for rural municipalities in recent years (Hudson & Sandberg 2021), which is likely to continue with new cohorts of refugees with varying backgrounds also now coming from Ukraine.

Different mobilities are drawn to different rural geographies and settlement categories, partly conditioned by, and contributing to, an ongoing process of 'microurbanisation' (Eimermann *et al*. 2022). This means that the gap between reasonably well-serviced municipal centres and smaller outlying villages continues to increase even within rural and sparsely populated municipalities. The general pattern is that certain groups of in-migrants – including refugee migrants, but also early career escalator migrants and young families returning with children – largely favour the municipal centres in the inland due to better access to housing, services, and employment.

Local planning strategies reflect this assumption and prioritise urban concentration and densification strategies in a quest to make their municipalities more attractive to prospective in-migrants, which leads to an increasing abandoning of smaller villages that are too expensive to service (Jonsson & Syssner 2018; Syssner 2020). This is happening at the same time as the smaller villages attract their very own migration streams of mainly lifestyle-motivated migrants or those who already have access to a house. However, many municipalities in the inland battle with significant housing capacity limitations (Lundmark 2020; Eimermann *et al*. 2022), which restricts the potential of attracting these migrants.

Another key mobility that offers different prospects for development across the North is tourism. While it can be argued that tourism itself has led to the emergence of a few self-contained growth hotspots relying on external/international tourist and labour flows, for example through the remote ski resorts in the mountains and some isolated localities targeting international export markets with highly commercialized Arctic experiences, the general experience with tourism as driver for rural development has been rather low-key (Byström & Müller 2014; Lundmark & Carson 2020). Unlike in many other northern or Arctic peripheries, rural destinations in Northern Sweden have a long history of attracting regional visitor markets, including leisure tourists, business visitors, visiting friends and relatives (VFR), and second home-owners residing in the urban growth centres along the coast (Lundmark & Åberg 2019; Carson *et al*. 2020b). Despite high seasonality with winter for skiing and summer for drive trips and second home recreation, these markets have proven to be quite loyal over time with high rates of repeat visitation. From this perspective, the region seems to be somewhat connected as functional region, which may provide opportunities to mobilise existing tourism pipelines and relationships further as part of the region's re-industrialization.

There is also a need to geographically contextualize the development in terms of the variety of municipalities in the region, considering aspects of distance and remoteness, sparsity of populations and settlements, dominant industries of employment and land use, and historic relations with

the (re)industrializing growth centres. Applying a rurality spectrum (Koster & Carson 2019) to understanding rural settlement hierarchies within the North allows to differentiate between different rural geographies and their potential to attract spillover benefits. Firstly, a small *urban fringe* from which people can easily commute to the hotspots, but which are most likely limited to the immediate surroundings and transport corridors. Secondly, the *exotic remote*, including amenity-rich mountain locations and isolated resorts, which are well-connected to the coast by various transport routes, and which attract high degrees of purpose-built second homes and international mobility. And finally, extensive '*boring bits in between*' which are neither nor – they are too distant from the major centres to attract commuters and daytrip visitors, whilst also not unique and interesting enough to attract large volumes of tourists, second home mobility, and escalator labour (*ibid*.). It is these in-between areas that will most likely struggle to gain any meaningful spillover benefits from the growth hotspots, with private investments in housing stock and visitor infrastructure generally lagging, along with political incentives to improve public services and infrastructure delivery.

Numbers and narratives

This study draws on material from two sets of sources. One set of sources offers specific in-depth narrative insights derived from the 2021 Umeå Arctic Forum (UAF), from the 2022 Vinnova seminar on industrial green transitions, and from interviews with local and regional government stakeholders. More details on this set are presented in Table 1 and described in the remainder of this section before presenting in-depth narrative insights in the findings section. The other set indicates descriptions of the giga investments based on official data from Statistics Sweden, 'Kommuninvest' (2022) and Luleå Business Region (2020). The sums of investments are estimates rather than exact figures, and they are compiled from various sources since they are not available in full anywhere. The estimates are presented as an overview in Table 2 and as a map in Figure 2 when relating them to relevant planning issues (see next section).

The 2021 UAF's overall theme was 'the local, the global and sustainability in the North'. The conference consisted of invited speaker presentations and a panel discussion moderated by this article's lead author. Sweden's Innovation Agency Vinnova's one-hour online seminar included brief introductory questions for the chief sustainability officer at H2 Green Steel, a company with a "mission to undertake the global steel industry's greatest ever technological shift" (H2 Green Steel 2022). The seminar's first panel discussion included the mayor of Luleå, the director of industry decarbonization of Sweden's major energy company Vattenfall, and the division manager at Lernia AB, a leading company in vocational skills training and development. The second panel consisted of the chairperson at the Swedish council for sustainable cities, the pro-vice-chancellor at Luleå University of Technology, the theatre director at Västerbotten's theatre in Skellefteå, and the cluster manager of Arctic Game Lab (2022), a collaboration between several game companies in the towns of Umeå, Skellefteå, Piteå, Luleå and Boden. This shows the breadth of stakeholders involved in the seminar, which was finalized with summarizing reflections from the state secretary of the Swedish Minister of Trade and Industry.

The 2021 UAF and the 2022 seminar were public events, making data derived from them useful as public sources. During the presentations and discussions, we took detailed and verbatim notes, which we refined afterwards using the presentations' slides. It is hard to anonymize well-known people in public positions; instead of using names, we describe functions to help protect their identity. This is because we focus on structural narratives in organizations rather than on individual opinions. Although local and regional stakeholders may be able to identify the people from the function descriptions, this is less straightforward for international readers, and less clear after a while when the narrators may have moved on to other positions.

Table 1 further shows interviews with key informants, conducted to deepen our understanding of the investments' expected socio-economic effects. The main questions related to broad developments (What local and regional future developments do you expect in economic, environmental, social and demographic terms?, How does your municipality relate to the nearest larger town?) and to specific planning issues (What regional and local opportunities and challenges related to the planned green industry investments do you find important for planners and communities?). All narrative material is gathered and analysed in Swedish, and translated to English by the authors when writing this article.

Table 1. Sources for narrative analysis.

Source	Title / theme	Description
Umeå Arctic Forum (UAF), organized by Umeå University's Arctic research centre Arcum in December 2021	The green transition empowers Northern Sweden	Presentation by Swedish government's socio-economic transition coordinator
	Västerbotten's new future	Presentation by chair of regional development committee (Västerbotten)
	Sustainable climate investments in the North?	Presentation by regional journalist
	Umeå municipality and sustainable growth	Presentation by local leading politician (Umeå)
	Above themes and questions combined	Panel discussion: above presenters and a representative for Biosphere reserve Vindelälven Juhttátahkká
Vinnova Seminar, organized in February 2022	Sustainable expansion in the North	Panel discussions between stakeholders at structural level
Interview in March 2022	Green growth and investments in an inland municipality	Chair of Malå municipality's municipal board (political view)
Interview in April 2022	Opportunities and challenges for rural tourism	Regional tourism strategist, Region Västerbotten
Interview in June 2022	Green industrialization and its effects on Malå	Malå municipality's mayor (public servant view)

The presentations, discussions and interviews were transcribed and then brief, bounded segments were identified as key parts of the stories expressing the organizations' identity, experiences and expectations. These segments were analysed to identify structures in the narratives with a focus on how they are organized, what they say, what this way of telling can mean, and what the narrator wants to achieve with this choice of words (Labov 1982; Riessman 2004). Rather than objective reflections, such stories are selective representations of activities put into the context of the current giga-investments (Riessman 2004). Such narrative analysis identifies more nuances and detailed dimensions than thematic analysis, connecting layers of meaning with the studied giga-investments' social relations in Northern Sweden's periphery (Wiles *et al*. 2005; Sandberg & Tollefsen 2010).

With the main themes indicated in Table 1 as a key to understanding the narratives, we followed Labov's (1982) socio-lingual model of structural categories, focusing on reference and temporal order in the stories. Using Labov's model implied reducing stories to a core structure to look at how the presenters, panellists and interviewees say what their organizations do and what their underlying motives are. The next section offers an understanding of the narratives' situatedness in social, cultural and institutional perspectives on the giga-investments.

Setting the scene: 'green industrialization' and giga-investments in Northern Sweden

Green industrialization is a concept entailing the greening of resource-dependent processes for reducing negative climate effects and is part of the United Nation's (UN) Sustainable Development Goals, where Goal 9 focuses on industry, innovation and infrastructure. Within the European Union (EU), the concept of the green economy has been an important part of policy since the 2010 report *Europe 2020: A strategy for smart, sustainable and inclusive growth*. The EU does not consider sustainable development and growth to be in juxtaposition, but rather, growth is solving those negative effects of development. Since there are policies aimed at reducing these negative effects it has become evident that there is a possibility to earn money by developing technologies and structures that support this ambition.

The North of Sweden has a long tradition of developing new and better technology in relation to its resource industries, which means that networks, skills, organisations and knowledge needed for such

development are abundant in the region. This tradition of constant development and innovation has made the region relevant at the global level when adapting the resource-based industries to the challenges faced globally by climate change. The following sub-section will briefly describe the type, location and scale of investments made in the region as part of the green industrialization transition.

Ongoing development and investments in Northern Sweden

Initially, the investment interest in Northern Sweden was directed toward the traditional mining industry and the expansion of wind power. In recent years, interest has exploded with giga-investments (Table 2) in 'green industry' projects. The flagship is Northvolt's battery factory in Skellefteå, but there are also ongoing investments in several other locations, and expansion of new establishments to an extent that was neither expected nor has its equivalent elsewhere in Sweden. Another concrete example is HYBRIT, which is a cooperation between Swedish Steel (SSAB), Loussaavaara-Kiirunavaara (LKAB) and Vattenfall to make fossil-free steel by using hydrogen instead of coal. According to Kommuninvest, the highest levels of investment in Sweden per capita in 2018 occurred in the North, with Gällivare, Kiruna, Boden and Skellefteå in the top four, but the expected investments are accelerating, thus increasing the number of towns affected as well as the sum per capita in the region.

Table 2. Summary of investments in Sweden's Norrbotten and Västerbotten Counties. Large-scale projects already planned and/or decided. Sums are estimates based on available statistics on their respective web pages.

Name of investment	Sum of investment (MSEK)	Type of investment	Municipality of investment
The City transformation and moving of the city Kiruna	15000	City transformation	Kiruna
Hybrit pilot project Malmberget/Vitåfors	80	Energy	Gällivare
SSAB, LKAB and Vattenfall are building fossil-free hydrogen storage (pilot project), Luleå	250	Energy	Luleå
Northvolt, Skellefteå	4000	Energy	Skellefteå
Markbygdens Wind farm, Piteå	60000	Energy	Piteå
SETRA forest company	700	Industry	Malå
H2 Green Steel, fossil-free steel, Boden	3000	Industry	Boden
LKABs shift to Direct-Reduced Iron (sponge iron), Malmberget, Kiruna and Svappavaara	400000	Industry	Kiruna
Facebook computer centre FB3, Luleå	1000	IT	Luleå
New Boliden Kristineberg mine	1300	Mining	Lycksele
Talga graphen extraction, Vittangi	5000	Mining	Kiruna
Polarbröd factory, Älvsbyn	200	Production, other	Älsvbyn
SCA Obbola is investing in new and improved facilities	7500	Production, other	Umeå
Grupo Fertiberia (10 billion SEK)	10000	Production, other	Luleå
Malmporten, Luleå. Harbour development	2700	Transport	Luleå
The Norrbotnia railway (Norrbotniabanan)	4000	Transport	Luleå, Umeå, Piteå and Skellefteå

The Norrbotnia railway is a 270 km long railway going from Umeå to Luleå, thus connecting the main investment hotspots along the coast. It is paid for by Trafikverket, which is a publicly owned entity. However, the investment is important for the other investments, as well as for expected spillover effects at least to municipalities adjacent to the railway line.

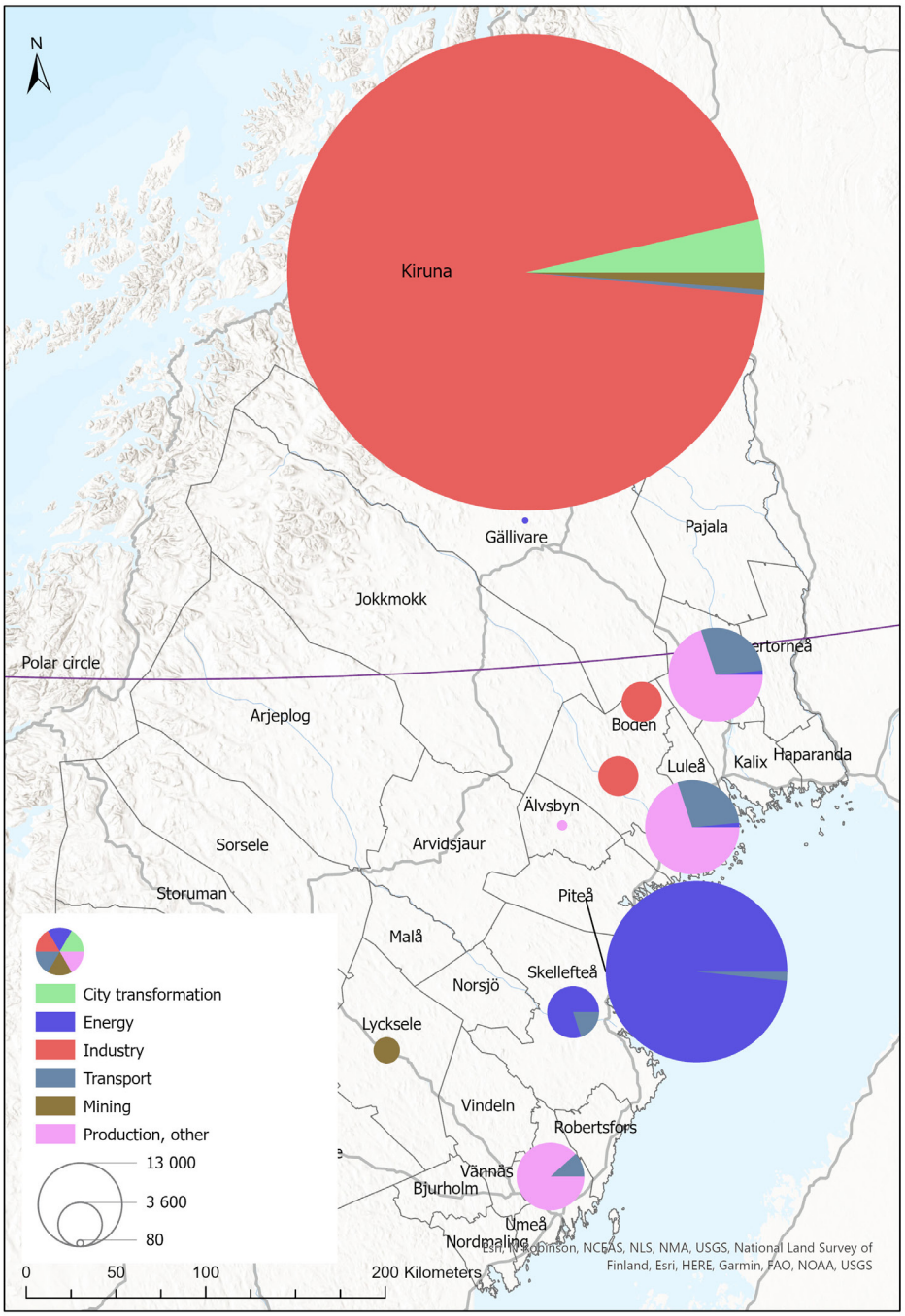

Fig 2. The investments in the study area by type, by sum (MSEK) and municipality.

As is shown in Figure 2, the majority of investments are concentrated in a few hot-spots. However, the exact location for some of the investments is not available, such as for the mining activities in Kiruna that also includes some investments that are intended for the mine in Gällivare.

Findings from structural-level narratives and interviews with key informants

Infrastructure

One issue identified in the narratives regards infrastructure and connections between various places through public transport. In his presentation, Västerbotten's regional development committee chair argued that "we get to write history" because Northern Sweden is in the epicentre of climate change mitigation. He argued:

> To develop, we need to create jobs, we need more people to move here and pay taxes, and we need a cohesive infrastructure and transport system. We shouldn't stop transporting people, goods and products, we should use more sustainable means. (Umeå Arctic Forum 2021)

According to him, increased possibilities to fly electronic airplanes using Västerbottens five airports, would bring favourable developments to the region. But even more so, he was urging that Sweden's national government should prioritize the Norrbotnia railway construction to benefit from the 'uniquely gigantic' investments in Northern Sweden. Stressing the importance of Northvolt's battery factory and expected spillovers to neighbouring regions, he argued "we can create a Nordic battery belt including parts of Norway and Finland, and regions south of Västerbotten". This argument also illustrates how railways, even more so than airports, lock transport into particular corridors and a few hubs or end destinations. The focus is mainly on transporting goods, people and capital in a south-north direction. Mobility is, thus, not spread evenly across Northern Sweden, and the inland does not necessarily gain from raw material extraction in mining towns or the green industry developments along the coast.

The mayor of Malå emphasized how transportation for his municipality was not possible through railways: "We need to work with the current conditions. Transportation to our inland municipality is only possible by road". This illustrates uneven developments within the region that are also shaping and shaped by private company investments. Both interviews in Malå pointed at such developments within 20 km from Malå's municipal centre: forest company SETRA investing in a forest production plant and New Boliden mining company's investments in Kristineberg, a sum of 2,000 million SEK in total. This is linked with commuting and local tax bases; although the Kristineberg mine itself is in Lycksele municipality, it is closer to Malå town than to Lycksele town, and the interviewees expected the mine to provide work for people living in Malå, thus generating tax income for Malå municipality. Linked with these developments, a group of professionals in Malå is working on plans to attract and establish new businesses and industries, and to extend possibilities for the construction of new industrial buildings, second homes and housing.

This exemplifies how the giga-investments are increasing local expectations related to planning and different demands on both hard and soft infrastructure. For example, if the SETRA and New Boliden investments attract new residents wanting to move to Malå, hard infrastructure includes not only transportation possibilities, but also housing capacity, leisure and community infrastructure (Lundmark *et al*. 2020). Soft infrastructure includes local public and private services, social network opportunities, knowledge production and better connections for commuting and temporary mobilities. For local planners, this would mean novel ways of thinking and working around temporary recreational visits and amenities attracting lifestyle mobility from more densely populated areas. One interesting aspect about Malå is that it has a shared industrial history with Skellefteå, and has maintained steady tourism and second home relationships with the coast (Lundmark & Åberg 2019). Yet, the discussions with Region Västerbotten's tourism strategist revealed that there are few (if any) formal plans or strategies in place to connect places like Malå more with Skellefteå, either by targeting new labour migrants as potential markets or connecting through business tourism and meetings/events. While tourism stakeholders in Skellefteå itself were apparently more proactive in trying to identify local tourism spin-offs from the giga-investments, the attitude of stakeholders in the inland was described as more reactive (i.e. waiting to see what the actual increase in demand might be).

This resonates with Luleå University of Technology's (LTU) vice-chancellor, who indicated that the whole region should be included in planning for better infrastructure and services, by which he meant a variety of local places in Northern Sweden's vast areas beyond the urban agglomerations and the mining towns:

> A lot of investments are concentrated in the coastal area and the ore fields. But Northern Sweden is much bigger than that: how do we include the rural and sparsely populated inland? [...] we need to distribute the green industry's added value across the whole region, and we all have a major responsibility regarding societal questions like health care, schools and social care. (Vinnova seminar 2022)

Mobility and migration

The Vinnova seminar's introductory video addressed "how to create sustainable and attractive societies while at the same time securing the human competence we need for the industry's green transition". The chair of the Swedish council for sustainable cities indicated that building attractive living environments is necessary "to avoid becoming a fly-in/fly-out society". Recognizing such challenges and risks of land-use conflicts, the general narrative was nonetheless optimistic. This was exemplified by H2 Green Steel aiming to grow from 70 to 1,800 employees and Vattenfall's trainee program attracting 5,000 applicants (instead of 300 in previous years).

Vattenfall's director of industry decarbonization pointed out that transitions like these can only be realized if all stakeholders, from local entrepreneurs to the national government, are committed to collaborating in broad terms. He said that the green transition is a long-term investment based on the attractiveness of the Swedish North and favourable conditions, regarding "the kind of work that future generations want to commit to". Likewise, thinking about local implications, the mayor of Luleå specifically raised the importance of attracting external labour and having to be attractive for broader demographic groups, beyond industrial workers:

> We need youngsters to move to this area, but it is much harder to influence thousands of people's individual life choices. It is about different stages in the life course, the entire picture should function well: children, schools, entertainment, theatres, homes. Most people whom we want to attract have not been here before, so good place marketing is important. And collaboration with businesses and academia. (Vinnova seminar 2022)

Luleå's mayor viewed teamwork on local and regional scales as essential because these investments are about people's entire life course, including issues of where to construct new sustainable housing, attracting investors to build such housing, and collaboration with civil society to increase place attractiveness.

The general view presented in the meetings and also in the media is that we should expect large-scale in-migration to the region as a whole. This view is not necessarily shared by municipalities outside of the growth hotspots. One reason is that the capacity to plan for and host a large inflow of people is limited. There is a need to invest in schools, the health and welfare sector, and to build housing for those moving in. This takes time and resources, which are limited in municipalities that have been planning for shrinkage and trying to adapt to decline for decades. Norsjö, which is only about an hour from Skellefteå, claims that they could accommodate 20 new inhabitants per year (SVT nyheter 2022), while Malå argues that a positive development for them would be to increase by 50 working-age inhabitants, which would already improve overall access to skilled labour substantially.

The other reason for not anticipating more in-migration is simply that these municipalities are happy with smaller migrant numbers and do not see large in-migration as necessarily sustainable. The chair of Malå's municipal board further emphasized the local value of "small" numbers and money. Although from a regional perspective this may be "peanuts", he argued that the regional developments have contributed to retaining the 30 people working at the local sawmill, who otherwise would have moved away. He maintained that "one should not underestimate this, they generate small intangible and unmeasurable spillovers for the municipality" and "when digging deeper, one might find other specific local projects that provide some light at the end of the tunnel". These insights provide concrete examples of the LTU vice-chancellor's plea, that we should not forget the local perspective. While the spillovers might be small in absolute terms and the expectations are somewhat

modest compared to the suggested inflow of inhabitants to the hotspots, also small numbers on a local scale are increasing, putting different demands on hard and soft infrastructure.

A-spatiality

On a more abstract level, we identified a sense of a-spatiality in the structural narratives. For example, we view the narrative of Västerbotten's regional development committee chair as a-spatial in that it ignores geographical urban-rural nuances and relationships to emphasize regional macro-economic benefits and opportunities. Buzzwords linked to growth industries (like knowledge, creativeness, greenness, innovation, acceleration) are often presented as synonymous with urban areas' assets regarding proximity or access to large labour forces and knowledge centres which are by default in urban centres (Pugh & Dubois 2021). It is also unclear in the narratives what the bigger transport infrastructure could mean for socio-economic development in the inland.

A regional journalist exemplified this, when he during his presentation at the Umeå Arctic Forum questioned Arctic green energy transitions. He critiqued that the hype around the largely positive growth discourse of green transitions ignores the broader structural limitations in northern sparsely populated areas and the communities at the local level. These new projects, according to him, come with new demands for resources that might lock the rural areas further into a resource periphery status:

> The problem of investments in industries like Northvolt is that this requires large volumes of electricity! [...] And where will the extra electricity come from? Natural resources like mines, forests and hydropower are already under pressure. More exploitation would encroach the land of the Sámi. And carbon emissions are a problem. Another big problem is the need for metals and minerals for the batteries. This shows that we have not even started a green industry transition. (Umeå Arctic Forum 2021)

In this sense, the "Nordic battery belt" analogy above illustrates the narrow corridor (be it north-south or east-west) that such developments will most likely have an impact on. A focus on considering the whole region, advocated by LTU's vice chancellor, has so far largely been absent. Instead, the broader regional development discourse ignores intraregional differences when claiming that these developments are a huge opportunity for Northern Sweden as a whole. The narratives may implicitly also assume that broader regional benefits will somehow spill over to local levels automatically, but there is little thought about how to functionally and physically better connect green (re)industrialization hotspots with different rural parts of the region.

Concluding discussion: dilemmas and recommendations

This paper addresses the fundamental issue of how giga-investments are assumed to affect places that are not directly taking part in those investments but are within a distance that might raise expectations of direct (spillover or sponge) effects nevertheless. Our study context is the sparsely populated Swedish North, but the ideas we present might also be relevant for other areas experiencing rural shrinkage despite the emergence of large investment hotspots in other parts of the region.

At a structural level, the analysis might be that the relatively small-scale spillover of people and investments expected by adjacent rural municipalities is contributing further to increasing spatial inequalities and diverging development trajectories. However, how this might be interpreted depends on the vantage point we choose. Concerns of being left behind in comparison with the growth hotspots were not clearly apparent from the interviews, but instead some investments of smaller magnitude are being made that are perceived to have come about as a consequence of the giga-investments, and more investments that are part of the multiplier effects are still expected.

The issue is rather about how much these hotspots are enforcing on the rest of the region in terms of migration within the region. If the municipalities are not able to use the opportunity to plan and invest for development of infrastructure, service and housing etcetera, then eventually, this could be more negative for the surrounding municipalities than a lower in-migration flow. It could even exacerbate the negative population development in the more sparsely populated areas in favour of those hubs for giga-investments. Rather than acting as sponges that suck everything in from the

region, the hotspots could be considered as magnets that divert new capital and populations to just a few select locations. In contrast, a more positive view would be that rural municipalities might contribute to regional diversity by staying rural and through lifestyle opportunities created by using natural resources as part of the green industry (through tourism for example) and thus the transformation towards a sustainable future in the region and at a global scale.

An overarching theme identified in the empirical material concerns the a-spatiality of discourses of growth, which we divide into two concrete dilemmas: infrastructure and mobility. The narratives often present the North as one homogenous region, which – as pointed out by LTU's vice chancellor and the regional journalist – is not the case. This bears the risk of ignoring or neglecting the highly individual local opportunities and challenges that different rural municipalities and settlements could face in relation to the giga-investments. A-spatial views on northern development are not uncommon, as recently critiqued by Copus and colleagues (2022), who illustrated with examples from Scotland and Finland how regional development policies often depart from urban-centred theories, assuming that urban growth will automatically trickle down in some unspecified form to rural areas. Such urban growth-centre strategies often mask the fact that there are no targeted strategies for specific rural areas and divert attention away from the continuing socio-economic problems in rural areas for which there is no quick and easy fix. A similar a-geographic rhetoric about the growth potential of 'the North' has been present in other countries, most recently in Australia, where northern development policies have also failed to acknowledge and address the spatial and socio-economic heterogeneity of a vast region. Not only have the ambitious overall growth predictions and population targets for the region not been reached, but population growth has remained limited to a few smaller urban hubs, while the regional divides in terms of amenities, infrastructure, services, and socio-economic indicators have continued to intensify (Taylor *et al*. 2022).

Dilemma 1: infrastructure

One of the major dilemmas that arises as a theme in the interviews is infrastructure and transport which is key in connecting the region. The built infrastructure will be decisive in defining the corridors in which spillover can more easily occur. The Norrbotnia railway reflects the focus on connecting the region along a narrow coastal corridor to external markets and sources of labour. This means that any spillover of populations will most likely happen along this corridor, as it already has in the past south of Umeå with locations along the railway line benefiting most as bedroom commuter villages.

At the public forums, discussions or considerations of how to connect the non-affected inland areas better to the hotspots, and how to allow for mobility exchanges such as through commuting, education, or tourism, were largely absent, although the interviewed municipality stakeholders mention this as imperative for development. This might indicate that there is a difference in how the municipalities and the regional and national governments are dealing with spatial connectivity, thus emphasizing the importance of political connections and dialogues between different parts of Northern Sweden and the national Swedish government. It also means that while the coast and urban settlements are becoming more interconnected as part of the green transition process, functional regions with spillover patterns may extend north-south along the coast but could, if not supported, mean the exclusion of the inland.

Dilemma 2: migration, tourism, and pace of development

It is clear that future migration and mobility flows will be affected by the current development in the North. However, what rural mobility dimensions (and respective lifestyle aspirations and service demands) will emerge as a result of the expected influx of largely external (including 'southern' and international) labour migrants attracted by the giga-investments is currently not clear and requires careful monitoring to understand the opportunities and challenges for rural municipalities. For example, spillover of amenity-driven migration and tourism from the hotspots into rural areas will depend on the development of better infrastructure, service amenities and tourism products that currently only really exist in a handful of remote mountain resorts (Müller 2019). Meanwhile, much of

the rural inland has little competitive advantage in this respect since the natural landscapes and tourism experiences are simply not all that different from areas closer to the hotspots to expect automatic spillover beyond daytrip excursions. However, modest tourism development as opposed to resort development and boosterism could also be considered successful and desirable for some inland areas (Lundmark & Åberg 2019). For municipalities to have control over the development of the 'destination', they need to have a more long-term and slow development pace due to the small amount of resources available locally and the lack of tourism entrepreneurs. Malå is a case in point with only one (or two) private tourism operators. The idea that this would increase manyfold is most likely not feasible within the next few years, but a steady and slow increase could be sustainable as part of the diversification of the economy and the green transition. Since Malå already has a relatively strong functional relationship with Skellefteå, including for tourism and second home mobility exchanges (Lundmark & Åberg 2019), this could pave the way for increased future visitor (rather than residential) spillover. Yet, public discourses – along with public tourism strategies – do not really seem to have picked up this theme yet. There appears to be little to no discussion of how the alleged hundred thousand new labour migrants (not to mention the additional non-resident workers and business tourists attracted as part of the giga-investments) could be harnessed as regional visitor markets for the inland.

Part of this dilemma lies in a skewed focus on almost utopian numbers of new in-migration from external sources in the public discussions. The main priority is to attract external workers and much-needed skills, which means that the discussions mainly revolve around how to better equip the urban hotspots with attractive amenities and services. At the same time, there is little or no mention of how to attract those in-migrants (or other visitor mobilities) to rural areas, or what sorts of amenities and services are needed in rural areas to increase their attractiveness. While the focus is mostly on external labour, there are few concerns about the inland losing workers to the growth hotspots. This would suggest that the sponge effect is perhaps not expected to be a problem since the remainder of the region is not considered a labour pool for the hotspots.

Recommendations and suggestions for further research

Having identified essential prospects, opportunities and challenges of the giga-investments with a concern for places that are not directly targeted by these investments, this final subsection highlights development issues with relevance for policymakers and researchers.

An initial issue regards whether and how peripheral municipalities could respond to this change in terms of actual local planning. The question arises how smaller municipalities already facing socio-economic challenges may tackle the changed circumstances now that periods of growth and decline appear to be followed by growth again. It can be questioned to what extend these municipalities can refocus on progressive and growth-oriented local planning, and how they can make this socially, environmentally and economically sustainable. Future studies of northern peripheries provide unique opportunities to examine such areas' re-emergence as alternative lands of the future (Sörlin 1988) at the forefront of green industrialization and green transformation.

A second issue regards the various mobilities expected in relation to such re-emerging lands of the future, and their spatial implications. In the emerging economic landscape, old relationships need to be re-evaluated and possibly re-established because they may rest on essentially altered logics of production and supply. Previous intra-regional dynamics and interpersonal relationships between private stakeholders, long-standing common interests and historically moored co-operations might become obsolete, disturbed or unproductive. If sustainably managed, the implications can be decisive for future opportunities, providing potential novel corridors of socio-economic and other transformations. Sustainable management can here be understood with a critical view on how realistic it is to obtain for instance the UN Sustainable Development Goal 9 and the EU's (2010) report on a strategy for smart, sustainable and inclusive growth. To avoid an overly urban focus, it may be key for municipalities outside the direct giga-investments to increasingly integrate their development strategies with each other and with different parts of the region. This may be through relation-building activities between local private industry stakeholders, regional public authorities and newly established industries. For example, this includes assessment of

common employment issues, the distribution of sub-contractors in the region, and availability of cheaper production facilities outside hotspots.

These issues will influence how regions like Northern Sweden (as a whole) may both socially and economically benefit from the expected prosperity following hotspot investments and corridor building. As such, a final issue regards how various existing and evolving structures may hamper or boost potential spillover of prosperity: employment structures, available housing and quality of life aspects. This calls for further research on how and where to stimulate housing and other amenity provision in such regions, particularly taking into account demands and expectations of new markets previously not considered in declining municipalities.

These development issues should be considered to avoid that the future will take shape as in the structural narratives, guided by regional and national development goals around Northern Sweden's green (re)industrialization to invest for urban growth, right-size where possible and neglect most rural areas.

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