

Chapter 6

The Green Industry of Northern Sweden—Will the Boom also Build Growth?



Lars Westin

Abstract Currently, Northern Sweden faces a phase of new industrialisation. Large “green” industrial projects are located or planned to be initiated in the region. Attractors are a reliable supply of green energy, land for large establishments and social as well as political stability. Initially, the actors are factories for the production of batteries and fossil-free steel, but also bitcoin mines, data server halls, etc. have been established. Following are consultants, real estate actors, architects, planners etc. In this respect, the green “reindustrialisation” has the potential to change the relatively slow growth in the region. The first long wave of industry ended in the 1970s, in a process that involved many elements of a “resource curse”. In the paper, after a presentation of facts, visions and narratives connected with this change, we analyse the economic background and forces behind the stagnation. We ask if the region have the insights and leadership that may exploit the situation and move the region on to a path of growth? Labour and housing are needed, but the region must also develop institutions, narratives and habits that will keep and attract a broader set of assets. Legislation, policy and narratives at national and European levels are other obstacles for growth.

Keywords Green industry · Sustainability · Regional growth · The curse of resources · International industry localisation · International trade · Northern Sweden · Regional policy

JEL F16 · F63 · N54 · N94 · O18 · R11

6.1 Introduction

For the moment, Northern Sweden witnesses an upsurge of major attention from industrial actors with an interest to locate new or develop current facilities in the region. Industries and investors are searching for locations of “green industries”. Although definitions are numerous, one aspect of a green industry is that it is an

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industry producing with low, zero or negative carbon impact.¹ For many reasons, of which the access to “green” hydroelectric and wind power is a core aspect, parts of Northern Sweden can offer locations that are economically advantageous from a green industry point of view but also offer a possibility to develop a narrative for the located company that may be attractive for a broad spectra of “green” minded customers.

As much of the Nordic sphere, Northern Sweden offers traditional factors of location for industrial production such as land, but it also offers hydroelectric power as well as political and social stability. Together those are factors that may create a trademark of sustainability for products from the region. This request from industry for “green locations” is also triggered by the overall global “sustainability mega trend” expressed by many households, civil organisations and policy makers. A fact that have inspired a large share of e.g. the European industry to take a lead in the development and supply of new fossil-free products, products that also have to be produced in places and in factories fulfilling high claims on overall sustainability, i.e. ecological, social and political conditions, while also be a profitable business.

The political and industrial response in Northern Sweden to this “new industrial reality” has by no means been slow, instead, the typical narrative is that the region now “is back on track”, back into its historical position, as a region strongly focused on natural resource-based industries and related production.

Actually, the region lost this industry focused position in a long process from around 1950 to 1980. Hence, since then, the future of Northern Sweden in many aspects has been perceived as problematic. As previously discussed in Westin (2015), the overall population for Northern Sweden, here defined as the four northernmost counties, has been locked in around 900 000 inhabitants. As we will come back to below, during the second half of the twentieth century the region was pressed by the global movement of industry towards Asia, where a lower unit cost than in Sweden was the attractor, while also global costs of transportation continued to fall.

For a while and due to this, the population of the relatively small cities of Northern Sweden has, with the exception for the largest city, Umeå, been almost unchanged. Although it is growing, Umeå only has around 132 000 inhabitants in the municipality, and around 160 000 if the local labour market (the functional urban region) is

¹ The definitions of “green growth” and “green industry” are numerous and rather wide. OECD (2015) defines green growth broadly, as growing the economy in an environmentally sustainable way, through the promotion of growth and development while reducing pollution and greenhouse gas emissions, minimising waste and inefficient use of natural resources, maintaining biodiversity, and strengthening energy security. Other definitions focus on the reduction of green-house gases. UNIDO (<https://www.unido.org/our-focus-cross-cutting-services-green-industry/green-industry-initiative>; read 2022–08-22) defines “green industry” as economies striving for a more sustainable pathway of growth, by undertaking green public investments and implementing public policy initiatives that encourage environmentally responsible private investment. Hence, especially for UNIDO, green industry is a public policy. As may become more obvious later, in this paper we deal with industrial actors that themselves are the driving force for development of green industrial solutions.

considered.² This places the city after the ten largest municipalities and local labour markets in Sweden.

This pessimistic consideration may be contrasted against the rapid industrialisation, population growth and general development the region could witness during the nineteenth century and the first half of the twentieth century. When the process of outsourcing and relocalisation of industry towards Asia now, in the beginning of the twenty-first century, in much has slowed down, due to global instability, a less optimistic view on especially the development in China, increasing unit costs of production from higher salaries in Asia and, for some consumer products, the time cost of trade from Asia to Europe, the return of industry to Western Europe is on the agenda.

According to common theories of international trade, transportation and industrial location (e.g. Isard, 1977), this would not come as a surprise, the patterns of comparative advantage in response to changes e.g. in factor proportions within countries could explain the initial movement to Asia, while the same processes more recently have been working in the reverse direction—towards Europe. If increased political and trade risks are added, a reverse of the patterns of localisation and trade becomes inevitable.

Given this, two questions are raised in this paper. Is the situation for North Sweden similar as it was during the most expansive phase, is it possible or even of interest for the region to search for, or have as a goal to find a path back to lost days? Secondly, what is needed for the region to take advantage of the interest for green locations, in order to find and develop a new path of growth, where it avoids the pitfalls that lead to stagnation?

The outline of the paper is as follows. In the following section we present the green industry initiatives, especially in Skellefteå, and analyse the current situation with respect to assets, factors of production and spatial structure in the region. Thereafter the processes that led to the parting of industry from the region in the fifties' and the path into stagnation from there are discussed. Clearly, the general competitive situation now is not the same as 50 years ago, a return to old strategies and narratives will with a high probability not take the region out of its stagnation. In the following section we try to find the roots of the stagnation in factors related to the curse of resources, although a resource curse will take other expressions in the Nordic welfare state than in other types of economies. This leads to our question regarding what is needed in order to find a new path of development that makes it possible for the region to leave the curse and find a sustained path of growth? We suggest what we consider as the most important steps that must be taken for this to happen. Finally, the paper is concluded.

² Westin (2008) discusses the city system of Northern Sweden more detailed.

6.2 The New “Green Industry” in Northern Sweden

For the moment, the vision of Northern Sweden as a region for “green industry” is a mix of actual ongoing investments in factories and start-up of production on one hand and ideas, plans and mobilisation of capital for future investments on the other. Anyhow, all together this has become a new narrative for the region, a region where industry is in the forefront of the green transition to a sustainable, fossil-free or at least fossil neutral world.

The company Northvolt and its factory in Skellefteå, have become the forefront for the visual part of this narrative. In the city, with around 73 000 inhabitants, 700 kms north of Stockholm and 100 kms north of Umeå, Northvolt is since 2019 constructing a “Gigafactory”, a “mega sized” plant, the “Northvolt Ett” for the production of the “greenest battery cell” possible, currently batteries of lithium-ion (Li-ion) type.³ Another plant, Revolt, for the recycling of used batteries will also be established. As we have touched upon, this is an industrial response to a fast-increasing demand for batteries for electric vehicles, storage of energy and various industrial applications (Fig. 6.1).



Fig. 6.1 The Northvolt Ett “Gigafactory” in Skellefteå, Northern Sweden. *Source* [Northvolt.com](https://www.northvolt.com) homepage. With permission from Northvolt AB

³ In English Northvolt Ett would be Northvolt One. Below we will also mention Northvolt Fem, that is Northvolt Five.



Fig. 6.2 The Voltpack Mobile System. Produced by Northvolt. *Source* [Northvolt.com](https://www.northvolt.com) homepage. With permission from Northvolt AB

The first batteries and mobile energy storages (the “Voltpack Mobile System” in Fig. 6.2) are delivered with the goal to produce up to 40 GWh per year. The investment by Northvolt is estimated to become around 6 billion euros until 2025. Considering that the annual Gross Regional Product (GRP) of the county Västerbotten, where Skellefteå and Umeå are located, amounts to around 12 billion euros, while during an ordinary year around 3 billion euros of those are in the form of investments, the size of this specific investment in the region becomes obvious.⁴

The first activities in 2017 by Northvolt in the region and the associated media coverage, immediately increased the interest from existing companies, various entrepreneurs, and capital interest to announce other projects within “green industry” to be located in the region. LKAB, a large state-owned mining company active in the smaller mining cities Kiruna and Gällivare, 350 kms to the north-west of Skellefteå, soon presented a vision to produce fossil-free iron ore. Investments for about 20–30 billion euros until 2040. HYBRIT, a consortium consisting of LKAB together with SSAB (a state-owned steel company) and Vattenfall (state-owned producer of hydroelectric power) announced an interest to produce fossil-free steel and has initiated the construction of a pilot plant in Luleå, 100 kms to the north of Skellefteå as well. A competitor, the private company H2 Green Steel, with owners involved in Northvolt, also plans to produce fossil-free steel in the city of Boden, near Luleå. An investment that initially amounts to 2 billion euros until 2024.

Hence, it is estimated that around 100 billion euros will be invested in the coming years by private and state-owned companies in green industries in Northern Sweden (Nyheter, 2022). Such figures are obviously filled with uncertainty, but together with an estimated direct and indirect impact on employment from those industries of

⁴ The return of green industry to old industry cities with growth problems is for sure not only a Swedish phenomenon. The Economist (2022), in the tale of two American cities, points on how Youngstown, Ohio after years of population decline, manage to attract industries again, now battery production and production of electric vehicles to its “Voltage Valley”.

around 30 000 jobs in the region, the figure has added to the interest from local actors as well as from outside to consider the region with new eyes and with recalculated investment plans.

At most, when complementary investments and when the demand for new employees in both private and public sectors in the region are added, the special governmental coordinator for the transformation Peter Larsson in SVT, the Swedish public service television channel,⁵ argued that the population in the two northern counties where Kiruna, Gällivare, Boden, Luleå, Skellefteå and Umeå are located, will increase with around 100 000 inhabitants until 2035. From the current 500 000 inhabitants, this would be a substantial growth of around 20%.

Those figures have already been criticised. It has been argued that especially the investments above within iron and steel industry probably not will generate a large number of new employees direct in the factories. Instead, the tendency for many years has been that through investments in new machinery, the number of employees in capital intensive and process-oriented industries have declined, while total production and thus the productivity per worker has increased. Investments in “green” steel will over time probably not change this process, it has been argued.

There has also been a challenge to recruit workers to the Northvolt factory and to other jobs in the private as well as the public sector. Since 1990s, the level of unemployment in the region has fallen. If before the crash in the finance and property markets in the beginning of the 1990s, that followed from deregulations that opened up those markets for international transactions, younger unemployed people stayed in the region, after the crisis they started to move to jobs instead. Jobs also became available in larger cities like Stockholm, especially within the fast-growing IT and computer game industries. The economic recession also meant that due to a deficit in the state budget, various forms of support to the unemployed were reduced, adding to the interest to move.

Hence, when the region now meets the boom of green industry, there is not as in the 1960s and 1970s, unemployed young people available in the region. Salaries will increase in order to attract people. People will move from existing employments in e.g. the Skellefteå area to the new jobs. Hence the “green boom” will not only have an impact on the new factories but most companies and a wide part of the public sector will be affected by the increasing demand for labour.

In order not to “overheat” the local labour market, recruitment of labour from the rest of Sweden and internationally has thus become a critical and important part in the establishment of the new green industries. Adding to this, as many other cities in the region, Skellefteå has for long time had a real estate market with few transactions, a low rate of new construction and large public engagement in the housing sector. Higher incomes and a larger demand for housing will for sure in the short run increase property values. The benefits of green industry investments will be a windfall gain to existing property owners. It will give incitements for new construction but it will also

⁵ <https://www.svt.se/nyheter/lokalt/norrboten/historisk-satsning-i-norr-kraver-100-000-inflyttare>; access date 2022-08-24.

become more difficult for new comers to find the home that matches the eventual expectations that are associated with the move to the region.

Hence, it has been a demanding task to initiate, vitalise and expand the housing market in the area. Since in Sweden municipalities have the planning monopoly, every construction has to be handled by and get a start permission from the municipality. There are moreover so called “national interest” with respect to nature, water, recreation, military security, heritage, etc. that at least in the short run constrains what is possible to develop. Since neighbours also have the right to have objections against a plan, it may take a while before a question by an actor to construct a house or develop a property has led to a decision to start.

Obviously, the new interest to develop the market for real estate in Skellefteå as well as in surrounding municipalities implies a demand for planners and case managers in the administration of Skellefteå and other municipalities. A more active property market also demands experience to tackle legislation and various interest from neighbours, and from the state. The municipality also has to develop new long-term plans, plans that have to be negotiated in order for a decision to be taken. Incomplete acts and missed consultations with legitim interests, implies a risk that a decision will be appealed at a higher legal entity. The time to start and costs of the process will increase for the actors.

On the other hand, when Northvolt contacted the city, Skellefteå was relatively well prepared. Since around 2010 the situation in and the future of the city had been discussed more intensively.⁶ Umeå, to the south had been growing and had an active housing market for many years. The housing market in Skellefteå was not even characterised by vacancies. Hence, the municipality had initiated a process for new plans that could open for future development and an increase in the number of inhabitants. New staff within municipality management, planning and communication had been recruited and introduced. The dialog with various actors had been intensified.

But the process was not without obstacles. When the attempts to renew Skellefteå resulted in a suggestion to construct a new bridge over the river through central parts of the city, all political parties but the ruling party voted against the initiative. A referendum was made in 2014, and the votes said also here no to the bridge. The project was postponed. This could be said to be typical for a municipality where planning related initiatives have been low for many years, while suddenly the municipality or other developers take initiatives for change. When the Northvolt initiative was presented, it was so large and in line with the industrial narrative of Skellefteå that when in this process the bridge project once again, and against the outcome of the referendum, was actualised, there were no public objections.

Skellefteå has now in an as it seems intensive process formulated planning goals for its population growth with 90 and 100 thousand inhabitants as guidelines.⁷ As said, the municipality was to some extent prepared, but the Northvolt factory has

⁶ Although in Swedish, Steinvall (2021), attempts to present the history behind the decision by Northvolt to locate its first plant to Skellefteå and the activities that had been taken in Skellefteå before this became an option.

⁷ According to the head of planning for Skellefteå. In Hedqvist, Lars. (2018).

been such a large commitment that the resources of the municipality almost are exhausted. The matching between the company Northvolt and Skellefteå as a municipality must although be considered as almost optimal. In any other of the cities in Northern Sweden with 70 000 or more inhabitants, Northvolt had had to compete with other interests and facts, such a location had meant a much more diffuse signal of sustainability to the market.

Skellefteå was a strong, relatively prepared municipality, a population that understood industry, perhaps more often as a history told by elderly and dominating politicians instead of from their own experience but a population with a strong social commitment, high degree of engagement in various associations and clubs. Altogether a strong social and cultural capital. The municipality is not dominated by a single strong manufacturing industry, but a set of medium and small sized industries. Boliden, the gold a copper mine company is important, but the mines of Boliden are outside the city and not visible in the city, as e.g. in Kiruna. Skellefteå also has its own municipality owned hydroelectric power company. If a location further to the north, in e.g. Luleå, Boden or Kiruna was chosen, Northvolt would have to compete with steelworks and mines about labour, it also had to deal with Vattenfall, the state-owned power company that would have its own agenda. In the university town Umeå to the south, the housing situation would be worse and further to the south various paper and pulp companies and aluminium plants would be competitors for labour and for energy. Those would also be more distorting for the Northvolt image as a green factory in a green city.

But still, can in this rather short time Skellefteå fulfil the task and deliver what is necessary? The two critical factors are construction of housing and recruitment of employees. Facing the risks associated with those, Northvolt has chosen a risk diversifying strategy, where the Skellefteå factory in the North of Sweden, producing the world's greenest battery in a city with the attitude of sustainability, continues to be the important production site in public communication and a strong market signal, but where Northvolt Labs in Västerås, as well as Northvolt Dwa in Gdansk, Poland, Northvolt Drei in Heide, Germany, Northvolt Volvo in Gothenburg, Northvolt Fem in Borlänge and Cuberg in the San Francisco Bay Area, USA are other facilities established, with production as well as development, research and management.

This points at a critical aspect of the "green industry" narrative and the future of the region of North Sweden, the fact that the region has had a long period of stagnation, only have small cities and that even if there are four universities within the region, the research and education within the appropriate fields of engineering is not strong. The small cities have neither been advantageous for the development of a rich industrial and consultant environment. Hence, Northvolt labs were located in Västerås in the larger Stockholm area, a city where also the engineer intensive industry company within energy, digitalisation and automatization, ABB, is located, ABB is among other products producing robots for industrial use.

The picture given above of the green industrial boom would not be complete if we not did mention that the cities of Boden and Luleå also have attracted interest for energy intensive facilities for storage of data in datacentres, mainly Facebook, and from Bitcoin miners. MNC Miner was such a company in Boden, although closed

down in 2016 after around two years of activity. Other smaller datacentres have been established in the region, but ownership seems to some extent to be located in Stockholm. Also, in this case, there are two stories told. One is telling a story of success, such as Coates and Holroyd (2021) where the success story of the region is underlined.⁸ A closer reading reveals that the only source to this positive picture is an article by Nilsen (2016) where the CEO of Luleå Business and Economic Development, a public–private company with the objective to create growth in the business in Luleå is interviewed. The other story is told from a study of the relative population growth of the city and its county, where the story of stagnation instead is told.

In order to understand how the region ended up in this situation, where over time many stories about booms and development have been told, but where growth related statistics, especially statistics related to human capital, instead have told the other story, we have to look back into the history of the region. This is an entry to our final aim, to give advice regarding pitfalls that have to be avoided if the region not shall find itself in a similar situation after the growth and coming normalisation, or even decline, of green industry investments.

6.3 The Birth and Parting of Industry in Northern Sweden

There have for a while been clear signs that the long cycle of out localisation of industry from Europe, Sweden and its regions to factories in Asia, that was initiated after WW2 has begun to reach its end. After succeeding wars and institutional instabilities, the economies of Asia one by one became integrated in the international economy, found their comparative advantages and developed trade. Incomes increased, efforts were put into education, research and infrastructure, with further increasing trade as the outcome. As previously in Europe and North America, country after country in Asia moved to production of more high-tech commodities. This also meant that industry establishments were relocated. Industry moved from country to country in search for cost reductions within fairly stable economies. Japan was early, followed by South Korea, currently each of the ASEAN countries are on their way to expand their economies and increase incomes (Westin, 2017). In the 21 century, it thus has become evident that the global balance has shifted, from the European-North American Atlantic sphere over to a North America–Asian Pacific sphere.

North Sweden had a strong comparative advantage in heavy industry based on natural resources from forestry, mines, hydroelectric power and land. This advantage had been built up over a long period from the eighteenth century. When railways in the end of the nineteenth century could replace shipping as the dominating means of transportation, this advantage was strengthened drastically. Both since deliveries became more regular and the market could be expanded, but also since it was possible

⁸ “This essay (.. demonstrate...) that creative and determined northern regions can compete successfully in the age of technological transformation.” Coates and Holroyd (2021), p.7.

to stabilise the food supply to Northern Sweden, with its shorter summers. The railway also meant that various machineries and tools could be imported to the region, a fact that improved productivity, increased salaries and lay a foundation for an increasingly market-based service economy, instead of the highly self-sustained economies of households that was common until then.

Together with investments in health care and education, the demographic shift took off in Sweden. Death rates decreased drastically, while birth rates were lagging and remained high for a couple of decennia. Demand for labour in the expanding industries of North Sweden could, at least initially, take care of the fast-growing population. New settlements, based on forestry and agriculture were developed all over the region, simple roads were constructed and a sparse network of rail tracks was established. Cities started to grow and public facilities for administration, health care, a system of justice and military installations were established. In much this started from the south, in the end of the nineteenth century, the city of Sundsvall had become the centre for economic activities in Northern Sweden and also played a role nationally. From Fig. 6.3, the fast growth of the population during the nineteenth century becomes obvious.

However, Fig. 6.3 also clearly shows the stagnation in the number of inhabitants that has been a sign for Northern Sweden since 1950. The reason behind this sharp break was the intensed mechanisation of agriculture, forestry, mining activities and household services (Westin, 2015). The chain saw, the tractor, the truck the washing machine are all symbols for how demand for labour was reduced. Nevertheless, in

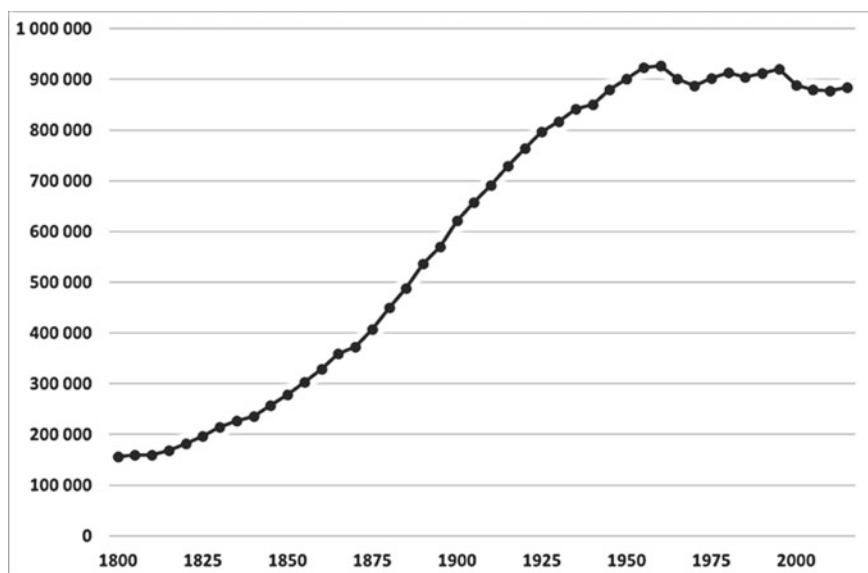


Fig. 6.3 Population in Northern Sweden, the four northern counties of Sweden 1800–2020. *Source of data* Statistics Sweden

contrast to many other natural resource-oriented economies in other countries, the region has not met an overall decline.⁹ This is not to say that the development has been even. Some parts have continued to grow, but especially very sparsely populated areas and cities strongly specialised in natural resource industry, have had problems.

If mechanisation meant that the number of jobs in agriculture and industry declined in the 1950s and 1960s, the aforementioned competition from low cost countries in southern Europe and later in Asia, hit the industry in the region quite hard in the 1970s. It was only thanks to an increased ambition within public services and in the cities, development of private services and higher education that the population figures to some extent could be stabilised.¹⁰

When the Soviet Union collapsed in 1990, the Baltic states and Eastern Europe became new very close competitors with salaries only a fifth of those in Sweden. Northern Sweden had not established a stronger urban structure, and another wave of out localisation of industry hit the region, as well as Sweden as such. It took a couple of years before new IT focused industries could make Sweden competitive again, while Northern Sweden lost more of its population.¹¹

6.4 The Curse of Resources, Resource Rents and the Narratives of Northern Sweden

Hence, if Sweden, in the beginning of the new millennia, showed signs to be back on a growth path based on the IT, human capital and “creative” industries, the situation in Northern Sweden was not equally advantageous. The growth of the IT based industries as well as new media was strongly focused on Stockholm and the Stockholm region. Figure 6.4 compares the shares of the total Swedish population registered as living in Stockholm country, and in the four counties in Northern Sweden taken together.

The figure is a complement to Fig. 6.3 above and summarises well the relative development of Northern Sweden during the last 200 years. In the first half of the nineteenth century, the interest from investors, often international, for the forests of Northern Sweden attracted labour and made the population grow. At the same

⁹ For example, sometimes the high-profile supporters of the boom of green industry in the region categorises it as a modern Klondike. In that case the city in centre was Dawson City, that at most had around 40 000 inhabitants. Today the city has around 1 500 inhabitants.

¹⁰ An active regional policy also had a strong impact on the process. Eriksson, M. and L. Westin (2013) and Westin, L. and M. Eriksson (2015) discuss how regional policy were formed, but is also critical against some aspects of the policies. Especially how to much resources were focused on small settlements instead of giving substantial resources to some larger cities, in order to create an urban system in the region with cities that could compete with Stockholm and Gothenburg about labour and jobs, especially within more advanced human capital-intensive industries.

¹¹ Eliasson, K., M. Johansson och L. Westin (1998) studies how the changing comparative advantage of Sweden in relation to e.g. the Baltic states and other states in Eastern Europe will hit Swedish regions differently, dependent on their factor intensities and exiting industrial specialisation.

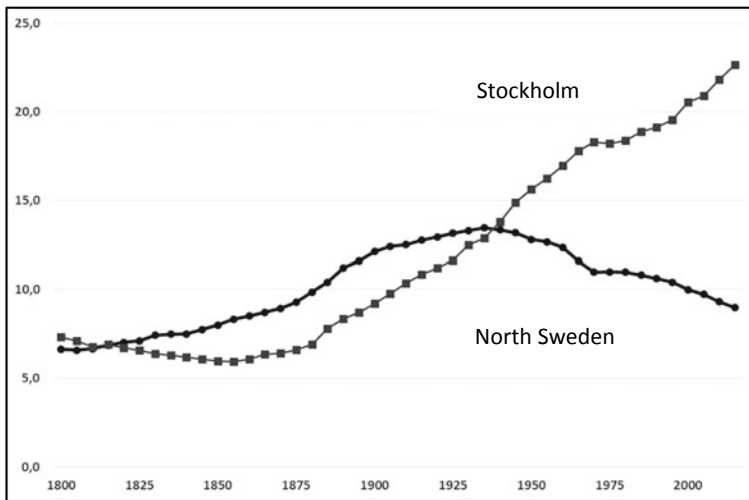


Fig. 6.4 Share of the Swedish total population for the Stockholm county and North Sweden, defined as the four northern counties of Sweden during 1800–2020. *Source of data* Statistics Sweden

time, the city of Stockholm was in a difficult period, due to underdeveloped waste management, sewage systems and water purification, core aspects of a functional city.

With the railways, and investments in water disposals for the city, Stockholm became a liveable city, but also became the city in the middle, the core, of the Swedish railway network. Stockholm central station was constructed in 1871, a building that can symbolise the return of Stockholm as an important city. As we have said, the railway network was important for Northern Sweden, but railway transportation implied an even larger positive impact on Stockholm. In this respect, the second half of the nineteenth century implied a growth of both Stockholm and Northern Sweden. But around 1900 the speed of growth started to decline in the north, while Stockholm continued or even periodically increased its growth. Around 1930, the “switch” was a fact. Stockholm profited from the fact that it now had become a “modern” capital, increasingly integrated in an international context, and could benefit from economies of agglomeration.

Northern Sweden instead, was as we saw in Fig. 6.3 still growing, but the growth rate declined. The problem Northern Sweden met is well known in association with “the curse of resources”. If the natural resources in the region had been a blessing for over hundred years, they and the industrial, political and cultural structures this economy had established, in the middle of the twentieth century locked the region in a growth trap, what Watkins (1963) denoted the “staple trap”.¹²

Regions locked in by the staple trap are hampered by power structures within the resource industries, but also labour unions, politicians and other elites with a base in

¹² Much of the writings about the curse and the staple trap, has its origin in the experiences from the Canadian economy. Others important authors in this respect are Innis, H. (1930, 1956) and North, D. (1955).

the resource sector. The forces for change, for new service industries and generally for stronger urban contexts in the region have in this context difficulties to gain power (Westin, 2006). A typical feature of the curse of resources is a combination of external ownership and weak internal capital and real estate markets. Generally, this is shown in the relatively flat urban structure of a resource rich region. In 1950 the largest municipality, measured by the administrative borders of today, in Northern Sweden was Sundsvall with a population of 77 000 inhabitants. The same year, the Stockholm municipality alone had 975 000 inhabitants with a county consisting of many strong smaller adjacent municipalities. During the period 1900–1950, Sundsvall had met periods of low growth, much of this could be explained by the increased competition from Stockholm due to the improved railways (sic!) and road connections, as well as a malfunctioning property market. Actually, already since the nineteenth century a substantial share of the resource rent from the forest industries in the Sundsvall area had been invested in real estate at attractive locations in the central parts of Stockholm.

Table 6.1 below shows how the urban hierarchy of Northern Sweden has continued to be problematic, but also how it has gone through major changes during the last seventy years. In 1950, when the total population in Northern Sweden began to stagnate, Skellefteå, where Northvolt now invests, had become almost as large as Sundsvall, so far the largest city in the region. The growth of Skellefteå had been fast since around 1930, when gold was found in the smaller village Boliden to the west of the city.

Umeå and Luleå were still relatively small cities. Overall, the urban structure was more compressed. Sundsvall was although still stronger as a city, had a longer history, was richer and with municipalities around it that added to its agglomerative strength. The surrounding of Skellefteå was weaker and possible supporting structures were at a larger distance from the city.

The table also shows that Skellefteå almost has had a constant population since 1950. The gold mine in Boliden was important for the establishment of various

Table 6.1 Major cities (municipalities) in Northern Sweden, population 1950 and 2020, population growth and share of total population in Northern Sweden 2020. Current administrative borders. *Source of data* Statistics Sweden

City	Population 2020	Population 1950	Per cent growth 1950–2020	Share of total population in Northern Sweden 2020
Umeå	130 224	46 282	181	14
Sundsvall	99 439	76 657	30	11
Luleå	78 549	40 174	96	9
Skellefteå	72 840	73 715	-1	8
Östersund	63 985	43 400	47	7
Örnsköldsvik	55 807	60 143	-7	6

successful mechanical industries in Skellefteå, and those became the fundament to the current strong industrial self-image. That self-image of being an industrial city was deep. When the Swedish government offered the city, due to its industrial profile, the planned School of engineering at the university level for Northern Sweden, the city turned the offer down, and instead asked for even more industries to be located in the city. Instead, the School of engineering was located to Luleå, in 1971. It has had a positive impact on Luleå, the city passed Skellefteå in number of inhabitants. But Luleå has had a similar strong self-image as the town with a steel work. It has taken a long time for the city to broaden its self-image from steel towards a knowledge-based city, especially since the Luleå University of Technology, the current name of the School of engineering, has a research profile with a focus on materials, geology, geoscience and other aspects of natural resources engineering.

Four of the cities in Table 6.1 have been growing between 1950 and 2020. All of them are county capitals and sites for public administration and universities. Umeå also has the university hospital, serving the four northern counties. However, the degree of urbanisation in northern Sweden is still rather low. Umeå, the largest city is not among the ten largest municipalities in Sweden and its share of the population in Northern Sweden is as can be seen in the table only 14%. Taken together those six largest municipalities only include 56 per cent of the regional population. Northern Sweden is still quite sparsely populated with many municipalities and villages of small size.

As we have seen, already in the 1930s, the small size of the cities in the region was a hold back on its growth. Since Sundsvall, the previous major city not managed to take the lead, a natural leader, a centre and a strong voice for the region has been lacking for a substantial time. Instead, competition among the cities for grants has been a typical behaviour (Westin, 2006). Umeå has almost constantly been growing, from a small start as a city for schools, a diverse set of industries and military units to becoming the largest municipality with administration, two universities and the university hospital, as well as a steadily growing sector of mechanical and engineering industries, IT and game related business. More recently, a broadening set of consultants and private services have located themselves in the city. In this respect, the city has another, more diverse structure and social life compared with Sundsvall, Luleå and Skellefteå. The city Östersund is from an urban culture aspect, more similar to Umeå with its small-scale industries, winter sport and tourism. During recent years, the Umeå region and the region around Östersund thus belong to the parts of Northern Sweden that are growing.

However, none of those cities can attract advanced private services directed towards business or advanced institutes of research, etc. at any larger extent. In Sweden, an urban area seems to have a size of over 300 000 inhabitants in order to become reasonably well represented within those sectors. Of course, there are always services that only can be located in the national capital.

To summarise this part, since 1950 the region has made an internal transformation with regard to its urban hierarchy as well as its employment structure. From employment in natural resource-based industries and associated machinery production to a more diversified structure, with a large share of employment in public sector works

and services. It is not the case that employment in the resource-based industries and to this connected business has disappeared but it is not as dominating as previously.

Nevertheless, both in internal and external mindsets the region still often is considered as the resource base for Sweden, from which export of forest, ore and steel builds a stable fundament for the Swedish economy at large. The region is in this respect not considered as a region with an urban future, contrary, it should be preserved as a country side dominated region, a heritage that may be visited now and then. From both accessibility and export considerations, investments in infrastructure have been the dominating policy measure of interest for politicians and businesses. Public sector employment and infrastructure in exchange for state incomes from export of resources has been the implicit development agenda (Westin, 2006). Once again, Umeå has been an outlier, urban development, culture, construction and an active property market instead have been targets for the city.

Taken together, the policies and actions taken, have kept the regional population constant, while as we have seen, the regional share of the Swedish population slowly decreases. This has had at least two impacts. The number of parliamentarians from the region decreases and the region has since 1930 slowly lost political power, mainly to the Stockholm area. Now and then, strong regional politicians have counteracted this process, but those voices seem also the have become fewer. For a region with a “growth” policy in much based on public investments, grants and jobs, this loss of political power will obviously sooner or later be fatal. Secondly, the unbalanced growth between cities and change of urban “leadership” within a constant regional population causes tensions and a lack of coordinated action.

Moreover, Northern Sweden does as a “region” only consist as a narrative. It has no real arena of itself for policy making, strategic considerations and decision making. Instead the four counties have by themselves, well-developed internal policy arenas, while policy makers from each of those counties have their centres of policy debate and actions in Stockholm. For those, communication with Stockholm often is more important than with other parts of the geographically large region, a structure that easily is visible in the passenger transport networks.

So, when Northvolt decided to establish their “giga factory” in Skellefteå, after a process where also other cities in the region had been on the list of possible locations, their reactions were diverse. It seems that the other cities did have unclear priorities and perhaps also lacked understanding of the broad impact such an establishment could have. Especially, when the size of the investments became clearer, the criticism was directed internally towards leading politicians in each city for their lack of preparedness and insights in the possible benefits and gains it would imply for the municipality. More indirectly some also criticised Northvolt for their choice of location.¹³ Other regional actors started to search for an investor with another

¹³ At the national level, another debate started. With the electricity the green industries needed in order to produce their products for storage of electricity and fossil-free steel, the export of hydroelectricity to the southern and central parts of Sweden from North Sweden may drastically be reduced. Excess supply in the north seemed to be shifted to excess demand. Since the already existing excess demand for electricity in the south had caused the price in the south to increase, the question was if the green industry really was the way to take for Sweden. The picture and debate

battery producer. Clearly, the Northvolt project offers a multitude of risks for the municipality engaged, risks that some municipality leaders took notice of. Today, it is too early to make a summary of costs and benefits for the municipalities or for the region. However, so far at this date, the impact on and in Skellefteå of the Northvolt factory has been considerable. The question is if this only will change the internal order of size between the cities in Northern Sweden again or if the overall stagnation also may be aborted?

6.5 Leaving the Curse—Actions Needed for Sustained Growth

Northern Sweden has attracted interest from investors within “green industry” developments. Obviously, this is an important and eager task. During history, factors of production such as forests, mines, land for agriculture, wind power plants, or land for reindeer herding as well as waters for fishing, fish farms and hydroelectric power have been other attractors of interest. Those have in turn given locational advantages for manufacturing industries, data centres, handicrafts of various kinds etc. Tourists and explorers have for long been attracted to the region. Recently the quality of service in the tourist sector has improved. After decades of unconcern, lack of management and capital, tourism in the region has become increasingly professionalised.

Various supporting activities to the resource industries within e.g. transport engineering, machinery for sawmills, paper and pulp industries, mines and treatment of timber have as a consequence been developed regionally. Where distance and time of communication to larger agglomerations have been substantial, local services and public production, like schools, social services, justice and police have been established.

The research and education facilities in the region have attracted resources from actors within forest and mining as well as organisations and public actors associated with those. Health care, business economics, public administration, social services etc. have also attracted public money.

The enumeration of activities above could sign a region in fast and broad growth. Instead, while producing and exporting its resource related products, the region has continuously had a net import of food stuff and engineering products. Since the 1950s, the region has had difficulties to employ its inhabitants, with unemployment and outmigration as consequences. Unemployment almost disappeared in the 1990s, when a distinct shift in attitude could be witnessed among young people, from preferences for employment in local traditional industries over to more service and knowledge-oriented sectors. Those were although underdeveloped sectors in the

got a picante addition, when municipalities in the south said no to wind power mills, due to negative impacts on their views, at the same time as the number of mills in northern Sweden passed one thousand.

sparsely populated region. Hence, unemployment almost disappeared, while outmigration of young people increased. If previously smaller localities had experienced unemployment and outmigration, now outmigration of young, especially educated youngsters, also became a feature of the cities.

In this long, periodic process, now and then Northern Sweden has faced the sort of hype and hopes a new wave of interest may offer, of the sort that now may be witnessed in association with “green industry”. Buzzwords for each of those periods are transport industry, universities, airports, high speed railways, a new steel factory, textile industry, plastic bicycles, space, car test facilities, IT, digitalisation, broadband, public sector works, a line of gold mines, data centres etc. A lesson that has to be remembered is that each such wave, or perceived boom, from a new technology or a new policy measure with associated interest from politicians, public administrators or various investors, has an end. Not always by a complete layoff, but a substantial reduction of employment and financial flows to the region. The force of liquidation may be international competition or competition from other regions in Sweden with associated outsourcing, closure or labour-saving investments.

In all those cases, the threat to the region has been associated with the problem to keep human capital and any rents from the assets in the region. This would not have been a problem if the region had had cities large enough to develop service and knowledge intensive industries, i.e. if the region had higher capacity internally to shift its growth from its abundant capital in the form of natural resources over towards growth of human capital. The lack of larger cities also has meant that a substantial part of the resource rent and other rents from various assets leave the region.

A part of this leakage takes the form of taxes and profits within state-owned enterprises, that to some extent is returned as public sector investment. This has reduced the speed of contraction and actually helped to keep the region with its stable population. Hence, given our sketched experiences from history and before we suggest ways for the region to gain from this recent interest from “green industry” investments, we must thus distinctly identify the threats visible on the horizon.

In this respect, one has to remember that the “green industry” boom of Northern Sweden actually consists of two parts, the “green” part that indicates what sort of products North Sweden now has an absolute advantage in, compared with the rest of Sweden, and the “industry” part that indicates that not only North Sweden but also other countries in Europe, again has gained a comparative advantage in industry production related to machinery and engineering.¹⁴

First of all, manufacturing industries and industries based on natural resources will both continue to be an important part of northern Sweden but these industries will also face labour-saving productivity improvements through automatization and

¹⁴ Had it not been for the war by Russia on Ukraine, Eastern Europe with its relatively lower cost for labour would have had an even stronger general advantage for industry that moves back from Asia. As we have touch upon, Northern Sweden to some extent, and for a while, compensates for higher labour cost by offering green energy, a well-educated labour force and cities that with social and political stability fulfil the request from an industry that want to market itself as sustainable in a broad sense.

introduction of robots. In the case of battery production, like the Northvolt factory in Skellefteå, we would expect it initially to be relatively labour-intensive. Over time, when the technology of making and recycling batteries have been developed, also in this case labour will be replaced by increasingly automated production lines and production will be more capital intensive. In the industries connected with green steel and mining, this first labour-intensive phase may not even materialise. We have also seen that Northvolt is investing in other places, as the Northvolt Labs factory in Västerås, where besides the development of batteries, research and development in relation to the design of an efficient line of production for batteries etc., may be assumed to be on the agenda.

The Northvolt factory in Skellefteå is marketed as a site for production of the world's greenest batteries with a low-carbon footprint as well as battery recycling. That claim probably is true, but sooner or later more sites and companies, even in Central and Eastern Europe, will probably also develop similar, or almost similar, attributes with respect to their production. For a while, it will although give Northvolt in Skellefteå both a comparative and absolute advantage. But for the municipality Skellefteå and the larger region it already now is time to cogitate on the next step after, or in parallel with, the Northvolt induced boom. Competition will increase, more factories will be located in the region and salaries will be raised, this will demand more robots, but first of all a socially and culturally efficient working environment, a city and region that is attractive as an area for living and raising children.

By this, we are ready to discuss our policy suggestions. Over time, Northern Sweden has experienced wave after wave, cycle after cycle of new industries entering the region. They have for some time dominated the agenda, peaked and declined. Some, like textile industry has almost completely disappeared, others like log-driving in the rivers and forestry work have moved over to trucks and more recently to trains, or have been mechanised so that only a couple of forest harvesters make the same work as previously thousands of workers. In private services such as banks and shops, employment also is reduced due to digitalisation. Data servers and storage halls, as well as wind power mills mostly employ technicians for regular maintenance. Those are not large employers in relation to the cost of investment or annual turnaround. Fly in of maintenance staff—and fly out after the work is done, is another risk for the region.

In this situation, it is possible to put efforts in attempts to attract even more battery plants or to figure out what the next boom will entail. Instead, our suggestion here, is that the three most urgent and important tasks for the region to focus on are the following:

- Develop structures that may as far as possible guarantee that the salaries, taxes and rents generated from the green industry boom, the natural resources and coming cycles of new production will be reinvested in the region in order to increase its assets.
- Develop strong structures for the attraction of human capital to the region
- Develop the urban system of Northern Sweden, the small cities have to be supplemented with stronger cities and urban areas.

During the foreseeable future, Northern Sweden will encompass production based on the natural resource capital located in the region. However, this production will employ less labour direct in production, while technicians, consultants and advanced researchers may increasingly be demanded. Hence, in order for the region to reap the salaries from resource-based production, those more advanced categories of labour must be attracted to the region. Generally, those jobs are localised in larger urban agglomerations, where the labour market is denser, alternatives ample and information spreads fast.

If the region, as soon as possible can give priority for a development of such urban environments and attractive housing areas, the risk is reduced that fly in-fly out will be a dominating feature and outcome on the labour market. Unfortunately, this has already often become the case when it comes to investments in large machineries and specialised construction tasks, such as bridges. Fly in - fly out of labour imply that the municipality where a facility or object is located, will miss the incomes from municipality taxes. It also means that a substantial part of the salaries paid to labour active in the municipality will leak out from the local economy and thus reduce the size of the indirect and induced impacts on the economy from investments in the region. It is thus important to critically consider the investment phase of a green industry as different from the phase of operation. Nowadays, a phase of investment will be characterised by substantial leakages out from the region, while the injection and number of employees from the operational phase per euro turnover, will be very dependent on the type of production. Data centres are a typical sector with relatively few employees and a low injection per euro produced by the centre.

Resource-based production will generate company tax incomes. In Sweden, those will be a part of the national budget. If the region wants to “attract back” a part or an increasing part of those incomes through political activities, one important aspect is that the share of the regional population in relation to the total national population should not decline, rather increase. Over time and in a parliament based on a democratic voting system, where one person has one vote, a region with an increasing share of the national population will increase its number of parliamentarians. The political interest for the region and the future of its voters will also increase. As we have noted, the regional share of the Swedish population, and actually also the number of parliamentarians instead has decreased. Obviously, public investments are not made only with the share of population as a single criterion, but various public investments within the educational, social, cultural and communication sectors are related to the size of population and the growth of population. Once again, we thus can conclude that a region with an ambition to leave the course and transform resource rents into human and cultural related capital, must take its attractiveness on labour seriously and for that reason especially focus on the development of larger cities.

Finally, successful resource-based industries generate a resource rent that belongs to the owners of the industries. In the case of state-owned companies, the impact on the region is similar as for the tax incomes, strongly dependent on its share of population and its growth. Even if the owners are not local, some rents may anyhow be reinvested in the region, but lack of knowledge regarding potentially profitable alternatives in the region and personal knowledge may instead with slightly higher

probability lead to investments more nearby the owner's place of living or in other environments with established channels of information to the owner and places that offer a reasonable long run return at a low risk. The real estate market of growing and large cities is one such option. For a long time, Northern Sweden has, in line with this argument, generated resource rents that instead have been invested in the property market of e.g. the growing Stockholm area.

Clearly, this reasoning is crucial when it comes to the second point above, development of the human capital of the region. The major obstacle for the region is housing. As said, overall the level of unemployment is low in the region, while especially the cities with more than 50 000 inhabitants have an excess demand for housing. Typically, privately owned homes are a shortage. Hence the shortage of labour with various competences, that often is a dominating theme for a large part of the labour market in North Sweden, in much actually is a housing problem. The region urgently needs a higher rate of construction.

Our analysis of the city system has showed (Westin, 2008) that the region cannot offer a competitive alternative in the sizes of urban agglomerations from 150 000 inhabitants and above. In Sweden around ten municipalities have a population between 150 000 to 200 000 inhabitants, none of those are in Northern Sweden, needless to say, neither of the three Swedish cities with more than 300 000 inhabitants are within the region.

Hence, it is of an urgent need for the region to develop at least one city with initially at least 150 000 inhabitants. If the region could create a city with 200 000 inhabitants, this city would become one of the five largest cities in Sweden. The municipality of Umeå has as its explicit goal to reach 200 000 inhabitants, it thus needs 70 000 more inhabitants compared with today. That is the size of the current cities of Luleå and Skellefteå. A demanding task.

6.6 Conclusions

In this paper we have analysed some central aspects of "the boom" generated by ongoing and planned "green industry" investments in Northern Sweden. Factories has been constructed, but so far, the direct impact on the regional economy most of all is located to the municipality of Skellefteå. However, this has already caused tensions among other cities in the region. Land for large scale industrial development is now prepared also in other municipalities. Attempts to attract other battery producers have been made. In this respect, the existing relations between the cities in the urban system of North Sweden to some extent have been challenged.

Such tensions and measures taken are clearly local and regional signs both of how a changing international order with respect to global localisation and international trade generally always have local impacts, but also a sign of how the need to transform current ways of production into sustainable production, have created new forms of advantages for some nations, regions and cities. A new narrative, a new vision, for Northern Sweden has in this respect also to be found.

Apparently, investors within the green industry as such, but also investors focused on real estate have turned their interest toward the north. In several respects, this came as a surprise for a large part of the region, but also for national leaders. The need for new housing, premises for business and for public service has been apparent for a long time. For cities that generally have had a very low annual rate of construction and an overall risk adverse property sector, this meant a new challenge. Even if both the number of vacancies and the rate of unemployment have been low in the region, expected risks have often dominated over expected returns from construction.

We have highlighted that so far, the visible impacts of green industry is located in the city of Skellefteå, but most of all the green industry investments have challenged the dominating narrative for the region, the internal narrative as well as the narrative upheld by external actors. From our point, the most important is that the scepticism or even negative attitudes, especially among parts of the dominating cultural actors against growing cities in Northern Sweden has lost general attention. At the political arena, definitely an agenda more positive to urban development can be heard. However, still, the view that Northern Sweden should continue to be a large countryside, a site for Europe to gain minerals from or a remote sparsely populated region open for excursions and voyages of discovery is frequently articulated.

The regional economic history of Northern Sweden offers a rich source for students of industry location and policy, where path dependence and policy failures as well as successful industrial and policy initiatives may be identified. For those that have a positive attitude, seventy years of stagnation may have come to an end. However, our thought is that this demands quite drastic changes both in the narrative and visions of the region, as well as in realised practices. There is thus a strong need to develop a new urban policy for the region but also to abandon or loosen many national legal constraints on land use in the region. The question is if the region has the capacity and leadership to take such a struggle with the national, and European levels, and to remake itself in a more urban way.

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