HOW TO MOVE A CITY

MAPPING THE PROCESS OF **KIRUNA** RELOCATION

Giovanni Ceselli
Valeria Federighi

HOW TO MOVE A CITY,
mapping the process of KIRUNA relocation

University/**Politecnico di Torino**
Master's degree programme/**Architecture construction city**
Object/**Master's thesis**
Supervisor/**Valeria Federighi**
Host institution/**Kiruna kommun**
Host Supervisors/**Clara Nyström & Sofia Lagerlöf Määttä**
Candidate/**Giovanni Ceselli**
Academic year/**2023-2024**

Kiruna's demolition zone, the building at Föreningsgatan 7 under demolition. **Photo by author**.

April 30, 2024:

"The last moments before landing at Kiruna airport leave me breathless... suddenly, as a dream, Kiirunavaara and the mine appear, of an unheard-of power, immense, black, the entire hill completely reshaped into terraces, a testament to when mining activity took place on the surface. The mine appears strong to me, it is the symbol of man's victory over nature, an ideal of times now gone, but in a place where nature is so harsh and predominant, it still holds a certain charm. It is also the symbol of the strength of this people who proudly and confidently embark on the path of urban metamorphosis towards the future, a path that would be unthinkable in other places in the world. The plane lands, and with it, my thoughts... I board the bus that will take me to the city center, the old one... We pass by the new city center and my certainty about the full support of the population for the Kiruna relocation project begins to crack. I ask: what do you think of the New Center? The driver responds laconically: 'I prefer the old one.' I retort: 'Building buildings alone does not make a city, it takes much more.'... We arrive in the old city center and the driver stops and informs me that I have arrived, next to me stands the Church of Kiruna, I think: 'in a year it will no longer be here' and I head towards the hostel where I will spend the next month. On my left, a barrier with 'LKAB' written on it and some buildings in a horribly gutted state suggest that I am right in that part of Kiruna that is disappearing. A mural on the roof of one of these soon-to-be-demolished buildings catches my attention, it reads: Kirun dör...slass! I look it up on Google Translate, (I don't speak a word of Swedish). The result that comes out is: Kiruna is dying! I still don't know that the actual meaning of the inscription is different, but now I am aware of the two faces of this city: the Kiruna that is coming to life, full of dreams and hopes, for the inhabitants and for young architects like me who will design it, and the Kiruna that is dying, tearing at the feelings of those who have lived it and releasing the memories entangled in the corners of these streets and within the walls of these buildings."

ABSTRACT

Kiruna, located 145 km north of the Arctic Circle in Swedish Lapland, is historically renowned for Sami culture and its breathtaking Northern Lights. Over the past 20 years, it has gained fame as "the moving city." Kiruna is undergoing an ambitious relocation project due to the expansion of the world's largest iron ore mine, which, by extracting the ore beneath the city, compromises its stability. Consequently, the city center is being demolished and rebuilt 3 km to the east. The most significant historical buildings are being spectacularly relocated through extraordinary transport efforts. Starting from the design mechanism in the form of a strategy game, set in Kiruna in northern Sweden and tested over the course of three years within the "Architectural Design Theory A" course of the 'Architecture' degree program, this thesis proposes the development of a software tool aimed at mapping the process of the city's relocation, keeping track of all documents, controversies, and material effects that have had a direct influence on the territory. This project was then realized, in collaboration with the municipality of Kiruna, by computer engineering students from the Software Engineering II course of Polito, under the guidance of Professor Marco Torchiano.

TABLE OF CONTENTS

1 Introduction

The objective of the first chapter is to explain the **theoretical assumptions** and the **methods** used in the thesis, that is, the foundations from which it was possible to carry out this research work.

1.1 Theoretical background

During their years of training, architects focus their attention on built objects. This happens in both technical and theoretical courses, where they are inundated with various types of information related to architecture: from contemporary buildings, used in lessons to highlight new uses of construction materials, to older buildings discussed in history courses. However, the main activity of the student is design, which is expressed in architectural design classes, an activity that perhaps too often remains confined within the mind of the architect, or in this case the student, and rarely analyzed. Often, the project "*gets caught between the subject (architect) and the object (architecture)*." [1] In this thesis, I aim to change the paradigm and focus the research on this "intermediate element," which may be the key to understanding important aspects of the other two.

The desire to give significance to architectural design, beyond its mere function as a medium, has developed for me during the years I spent at the Politecnico di Torino, thanks to the project unit “Architecture and Urban Economy A” and the course “Theory of Design.” During this period, I embraced various concepts from this approach, which aims to elevate the project of architecture.

Therefore, the theoretical context in which this thesis is situated is described in the texts "Theory of Architectural Design" by Alessandro Armando and Giovanni Durbiano, and in "The Detroit Great Game" by Valeria Federighi and Edoardo Bruno. The theory takes its cue from the "*perception of the exhaustion of a historical cycle*" that ended about 40 years ago, which prospered from the idea that the architect could embody a personal vision of the world, a vision that would inevitably reflect in their architectures. This cycle gradually came to an end due to the decreasing interaction of architects with the outside world, the very world in which architectural projects once found their legitimacy.

Following these reflections, a perspective emerges where, instead of a subjective will for art, negotiations, exchanges, and interferences gain value as elements that attribute value and performativity to the design.

The theoretical framework in which this thesis is positioned is based, among other principles, on the "*density of the trace*", rather than on the "*ineffability of the spirit*". This principle will provide a precise direction for this research work, which will be explored in the next chapter.

This density of traces, which constitutes architectural design, seems particularly relevant in the case of Kiruna. Firstly, as it is an urban-scale project, it must adhere to a myriad of interests, regulations, and conditions that influence its form. Moreover, it is difficult to identify a specific project around which others revolve; therefore, it seems more appropriate to talk about a **process**, a process of relocation that nonetheless makes the design component its main activity.

This process is exceedingly chaotic due to the multiple stakeholders involved, most of whom, although categorizable as public entities, have diametrically opposed interests and form alliances that change rapidly based on the decision-making topic, a situation not always present in architectural projects. As a result, there is a whirlwind of negotiations, agreements, and conflicts that leaves a profound documentary trace. Given the theoretical premises of this thesis, it is crucial to analyze these traces to understand aspects of the process that are sometimes obscure even to the actors involved.

The production of documentary traces in Kiruna is so vast and varied that various interesting patterns can be found, further explored by the theoretical framework mentioned earlier, one of which is the concept of sudden irruption: viewing it not as a disastrous event but as fuel that powers the engine of urban transformation.

This pattern seems to recur repeatedly in Kiruna, sometimes manifesting in almost cinematic ways. Another pattern discussed in the theory is that of the project, which, upon reaching a certain degree of performativity, proceeds autonomously, with designers often finding its trajectory beyond their control. This concept is described by the term "*golem*," which originates in Jewish tradition and refers to an anthropomorphic creature made of clay or earth, brought to life through mystical formulas or spells. This metaphor is also intrinsic to the ongoing process in Kiruna and, although less frequent than the one mentioned earlier, manifests itself in an equally clear form.

[1] Armando A., Durbiano G. 2017. *Teoria del progetto architettonico. Dai disegni agli effetti.* Roma: Carocci.

1.2 Methodology

More than a case study, Kiruna in this thesis represents the study of a specific case. The process underway in this city in the far north of Europe is extremely peculiar, and it has been analyzed with such a particular approach and depth that the observations made in this thesis are hardly comparable to any other process currently taking place in Europe, except perhaps for the case of Malmberget, which is partly touched upon in this research project.

The initial phase of this thesis, aimed at describing the process underway in Kiruna, is structured according to a multiple-story scheme, with each story being textually separate but closely connected in terms of content.

Except for Chapter 2, which aims to provide a general overview of the geographical, historical, economic, and social context of Norrbotten, drawing on several popular texts as well as statistical data available online, the initial part of the thesis is based exclusively on documents. The choice to use documents as the primary source of information and subsequently narrate the story of Kiruna stems from recognizing the importance of traces as drivers of urban transformation. The documents were partly obtained online and partly from various physical archives during my journey to the far north of Sweden, most notably, the archive specifically focused on the relocation process of the city, created within the Department of Civil, Environmental, and Natural Resources Engineering at Luleå University of Technology.

Approximately 200 documents were analyzed, half of which were used to narrate the story of Kiruna in Chapters 3 and 4. The selected documents are those that had a direct impact on the form of the territory occupied by the city and its immediate surroundings. All documents, except one, were produced between March 16, 2004, the date that ideally marks the beginning of the process, and June 2, 2024, when the document collection phase for the thesis concludes. Most of these documents, being written in Swedish, required significant translation work. These documents were then grouped into clusters that formed the backbone of the various stories.

To find and attribute value to the documents, as well as to understand and integrate the information contained within them, several other tools proved to be crucial. Foremost among these was field analysis. The two-month period I spent between Kiruna and Luleå was essential for gathering documents, which I was able to analyze in physical archives, as previously mentioned.

One of my objectives during my stay in the city was to conduct site visits, which helped me better understand the ongoing processes, such as the visit to Gruvstadsparken and the guided tour inside the Kiirunavaara mine. I was also able to witness several important events, most notably the closing ceremony of the Kiruna church. In general, living for almost two months within one of the areas undergoing major transformation allowed me to follow the city's dismantling process on a day-to-day basis.

During my journey, I also had the opportunity to interact with various individuals involved at different levels in the process. The interactions I had with the residents of Kiruna and others, ranging from informal conversations to semi-structured interviews, were essential in filling the knowledge gaps that written documents inevitably leave. During these exchanges, I was able to better understand the positions of various stakeholders, their concerns, and hopes, thereby giving new meaning to the documents previously analyzed.

This phase of reorganization and additional information gathering culminated in eight formal interviews. The format used for the interviews was semi-structured, chosen for its versatility. A fixed set of questions, defined before my departure and identical for each of the eight participants, was supplemented with questions formulated on the spot to explore specific topics mentioned by the interviewee. The selection of interview categories was made before the trip. The five selected categories were: Kiruna municipality technicians, LKAB representatives, developers, residents of Kiruna who had recently moved to the new city, and residents who were about to move soon. The selection of specific individuals to interview, however, was carried out directly during my time in Kiruna.

The interviews varied in duration, ranging from just under half an hour to over three hours, amounting to nearly seven hours of recordings. During these interviews, I was able to learn about important documents and request and obtain others whose existence I was aware of but had been unable to find, as well as to understand the decisions and intentions that led to the drafting of these documents.

The content of the interviews was also analyzed using the software IRaMuTeQ, which enabled the identification of important statistics regarding the words used by both the interviewees and myself during the interviews, revealing the most relevant themes for each participant. Specifically, I conducted six types of statistical analyses with the software: the first focused on the absolute frequency of words used during the interviews, which showed that the most frequently used words were: "Build", "Move",

"City", "Plan", and "Person", with "LKAB" and "Municipality" ranking tenth and eleventh, having been mentioned 110 and 109 times, respectively. The second analysis examined the absolute frequency divided between words used by the interviewees and by the interviewer, which revealed, for example, that the word "Move" was mentioned 89 times by the latter and 149 times by various interviewees. Then, a relative frequency analysis was conducted, weighted according to the different amounts of time spent speaking by the interviewer and the interviewees. This analysis revealed important data, such as that the word "LKAB," although mentioned more times by the interviewees overall, was mentioned more frequently by the interviewer when compared with other words.

These last two analyses were also repeated by dividing the words according to which of the six interviews they were spoken in. In the final analysis, only words mentioned more than 28 times were considered to examine the relationships between them. Specifically, based on this analysis, a graph was created where the words are connected according to the frequency with which they appear in proximity to one another within the discourse.

The time I spent in Kiruna was important for defining the function of the tool, which is the design object of this thesis. During multiple meetings with the technicians from the Kiruna municipality and through discussions primarily with my supervisor, as well as with various PhD students and professors from the Politecnico di Torino from both the architecture and design departments and the automation and computer science departments, I was able to determine the most suitable function to assign to the web app.

The subsequent steps involved defining the users and then drafting user stories: short texts that represent user needs and serve as the main input for the work carried out by the students of the Software Engineering II course in the computer engineering program at the Politecnico, taught by Prof. Marco Torchiano. The stories were first organized into groups under the umbrella of larger narratives called epics. They were then prioritized based on their importance, which proved essential during the software development phase. Students were unable to implement a story with a given score until they had addressed the requirements of all stories with a higher score.

In this phase, I had to assume two roles: that of a researcher developing a project in the eyes of the users, namely the technicians from the Kiruna municipality, and that of a product owner in relation to the students, who were the actual developers of the tool. My task was to communicate with the technicians to understand their needs and to guide the computer engineering students in their work. This second activity was carried out through lectures and reviews, which I was able to conduct thanks to the knowledge I had gained about the process taking place in Kiruna, as well as through my design skills developed over the years spent both at university and in various architectural firms where I have worked.

The appeal of the case study, which is interesting both from a theoretical perspective and from a viewpoint that is accessible to a general audience, allowed me to have several moments of exchange during the development of the thesis. These moments were significant in shaping the narrative.

Usually, such exchanges, aside from those between a student and their supervisor, occur only once the project is completed, which does not allow for further revisions of the work. In contrast, during my journey, I had the opportunity to present my work on several occasions, such as during a seminar organized by Professor Jing Ma, attended by PhD students and professors from Luleå University. Thanks to my supervisor, I was able to present the progress made up to that point to people with significant knowledge of the case study and its context. Additionally, I presented my work at various meetings of the thesis seminar organized by Professors Alessandro Armando and Giovanni Durbiano in Turin, where I received valuable advice for the development of the design component of my thesis.

2 Kiruna

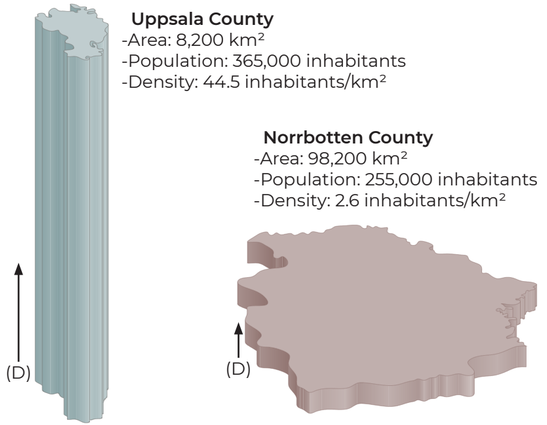
In this section, the **context** of the area where Kiruna is located is framed from a historical, economic, and partly social perspective. Additionally, a brief overview of the city's history from its founding until 2004 is provided, with the aim of illustrating the context in which the process takes place.

2.1 The Iron Way of Norrbotten

"[i]n the North, we'll have within our borders an India, if only we understand to use it."[2]

Axel Oxenstierna

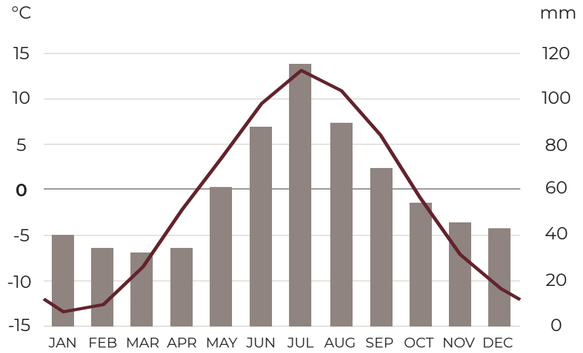
(considered one of the most important figures in Swedish history, having served as a collaborator to both King Gustavus Adolphus and Queen Christina of Sweden.)



Uppsala County
-Area: 8,200 km²
-Population: 365,000 inhabitants
-Density: 44.5 inhabitants/km²

Norrbotten County
-Area: 98,200 km²
-Population: 255,000 inhabitants
-Density: 2.6 inhabitants/km²

Comparison of Population Density between Uppsala County and Norrbotten County. Data from **Statistikmyndigheten**.



Kiruna's area annual average temperatures and annual precipitation chart. From **Climate data**.

2.1.1 Colonizations in the Far North

Norrbotten, the largest and northernmost county of Sweden, owes its name to the Gulf of Bothnia, which borders the largest of the Swedish counties to the south. Today, it is characterized by a population **density** of 2.6 inhabitants per square kilometer[3], making it the least populated area in all of Sweden, largely due to its harsh climate.

On the coldest nights of January, temperatures can plummet to as low as -28 degrees Celsius, with maximum temperatures in the same month rarely exceeding -10 degrees[4]. Situated predominantly above the Arctic Circle, regions further north, like Kiruna, experience nearly two months of continuous daylight during the summer, while enduring a polar night lasting 23 days. The absence of sunlight in these latitudes can lead to sleep disturbances, fatigue, and depression, a phenomenon known as seasonal affective disorder. This, coupled with vitamin D deficiency, are among the issues associated with the Arctic climate.

[2] Tidholm P. 2012. *Norrland: Essäer & Reportage.* Luleå: Teg Publishing.

[3] Population density data from Statistikmyndigheten.

[4] Temperature data from Climate data.

Despite these extreme conditions, the area ranging from the Gulf of Bothnia to the mountains marking the current border with Norway has been inhabited since ancient times. The first colonization of northern Scandinavia likely occurred between 9000 and 8000 BCE, concurrently with the colonization of North America, during the Mesolithic period. The initial inhabitants were tribes of hunter-gatherers from Central Europe or the northern Asian steppes, following their prey. This colonization was made possible by the end of the last Ice Age, which saw the retreat of the Fennoscandian glacier at a rapid rate that, in the final stages of deglaciation, reached up to 600 meters per year, accompanied by a significant isostatic uplift of 90mm per year[5], raising Norrbotten above sea level and leaving vast portions of land free from ice.

The early settlers primarily relied on hunting large mammals that inhabited the area after the glacier's retreat, such as moose, reindeer, and later on, ringed seals. Evidence of this can be found in discoveries linked to humans from the early period, consisting mainly of carbonized animal bones dating back to around 6000 BCE according to radiocarbon dating.

[5] Lindén M. 2006. *Glaciodynamics, Deglacial Landforms and Isostatic Uplift during the last Deglaciation of Norrbotten, Sweden.* Thesis: Lund University.

The first cultures to emerge in the region, newly freed from perpetual ice, were the Fosna and later the Komsa. The latter, particularly, whose members were believed to have originated from the Urals, are thought to be closely linked to the **Sami** populations. This connection stems from the fact that Sami languages belong to the Uralic language family, which developed from a common ancestor in the regions of inner Russia.

According to this hypothesis, Sami populations have inhabited Norrbotten for approximately 8000 years. However, in reality, the territories inhabited by these populations are much broader, stretching from southern Norway to the Kola Peninsula, spanning across four states: Sweden, Norway, Finland, and Russia.

The earliest accounts of these populations come from the Roman historian Cornelius Tacitus (ca. 55-ca. 117 C.E.). *"The Fenni live in astonishing barbarism and disgusting misery: no arms, no horses, no household; wild plants for their food, skins for their clothing, the ground for their beds; arrows are all their hopes; for want of iron they tip them with sharp bone. This same hunting is the support of the women as well as of the men"-"Unconcerned towards men, unconcerned towards Heaven, they have achieved a consummation very difficult: they have nothing even to ask for."*

Typical Sami enclosures near Kiruna, aerial photo. **Photo by author**.

If we delve deeper into the accounts of a Roman, whose culture was too different from that of the Sami to fully understand, we come to understand that 2000 years ago, the indigenous populations of Norrbotten were still hunter-gatherers. On average, they were happier and more egalitarian than settled farming populations, a quite common phenomenon, and were much more inclined to integrate women into hunting activities, a particularly distinctive characteristic[6]. Despite living above immense iron deposits, they did not possess the techniques for metal forging. However, according to the accounts of the Byzantine historian Procopius of Caesarea, we understand that these people had been familiar with ski technology for several hundred years.

It was only towards the end of the 7th century that, from Paul the Deacon, a Lombard historian at the court of Charlemagne, the Sami people were associated with reindeer husbandry, an activity they still practice with pride and devotion today[7].

While it's true that these people, inhabiting the northernmost lands of Europe, were not isolated as they maintained relationships with nearby Indo-European peoples, it's also true that these latter never ventured so close to the Arctic to encroach upon their territories. They were even untouched by the Christianization of Scandinavia, which began in the 10th century, further attesting to the Sami's identification with something distant and different from the Europeans.

It's intriguing to observe that the term "Sami," the preferred self-identification of the people from the extreme North, only appears in records from the 13th century onwards. Before then, these populations were referred to as "Phini," and later as "Lapps," a potentially offensive name that persists in Italy to this day. As for what the Sami thought of our ancestors, it remains unknown, as the Sami languages were never committed to writing before the 17th century. The first book in the Sami language wasn't published until 1910 by Johannes Olsen Thuri.

The pivotal shift in the relationship between the Sami residing in Norrbotten and the Swedes, who gained independence from Denmark in 1523 and regarded the Sami-occupied territories as their own, occurred in the sixteenth century. During this period, following the Swedish state's reform, the colonization of Sami lands took place a process some historians characterize as **internal colonization**[8] due to the perceived homogeneity of Swedish culture.

Contrary to violent conquests, the subjugation of these territories transpired through the integration of Sami populations into the Swedish taxation system. This involved taxing their traditional activities such as hunting, fishing, and, notably, reindeer husbandry.

Later on, the Swedish state initiated an agricultural colonization program in these regions. The program encouraged farmers from the south to migrate to Norrbotten. The strategy aimed to maintain a separation between Sami and Swedish farmers, to avoid interfering with each other's affairs. However, despite maintaining social distance, farmers inevitably encroached on Sami husbandry activities, leading to a shared land scenario where the Sami were forced to adapt their traditional practices to cultivated territories.

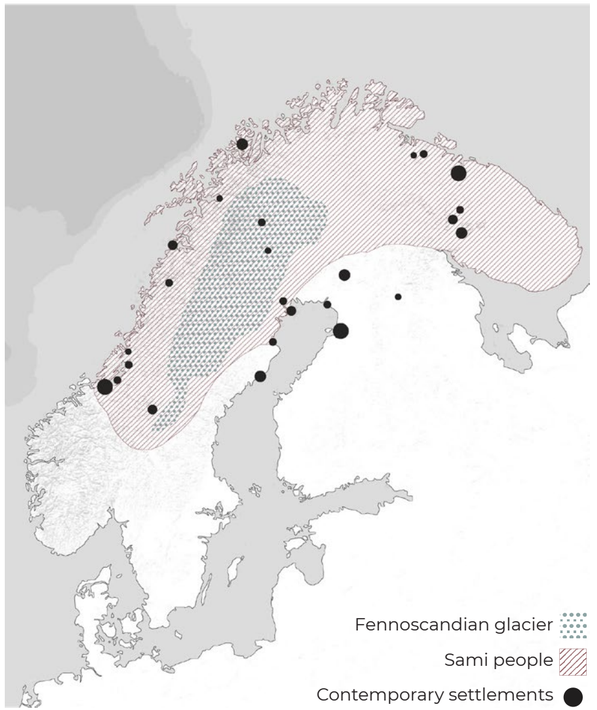
Indeed, the introduction of agriculture marked the onset of territorial disputes between the Sami people and the Swedes. The Swedes envisioned Norrbotten as a network of towns facilitating exports to Stockholm and beyond, a scheme that has remained largely unchanged, albeit with necessary adjustments, over time.

[6] Diamond J. 1997. *Guns, Germs and Steel: The Fates of Human Societies.* New York: Norton.

[7] Zachrisson I. 1997. *Möten i gränsland · samer och germaner i Mellanskandinavien.* Stockholm: Statens historiska museum.

[8] Forsell H. 2015. Modernizing the Economic Landscapes of the North. Resource Extraction, Town Building and Educational Reform in the Process of Internal Colonization in Swedish Norrbotten. International Journal for History, Culture and Modernity. Vol. 3, no. 2.

Trasformations in Norrbotten. The map shows the Fennoscandian glacier at its maximum expansion, the area historically populated by Sami people, and today's largest inhabited centers.



The process of establishing these settlements was not without its challenges; the Swedish government had to fund the construction of the new settlements from its own coffers. Due to adverse demographic trends, some towns were rebuilt multiple times and generally failed to reach their intended population numbers.

Even today, much like in the past, the major population centers are situated along the Baltic coast, originally serving as ports for transporting the wealth from the inland.

A larger colonization of the inland areas did not occur until around the mid-nineteenth century, coinciding with the increase in mining exploitation, due to railway construction. This prompted settlers to venture north of the Arctic Circle and establish inland settlements. To facilitate their exploitation, the Swedish state amended the cultivation law of 1867, which effectively delineated a boundary with the Sami, and permitted the establishment of **mining towns** in the far north of the state.

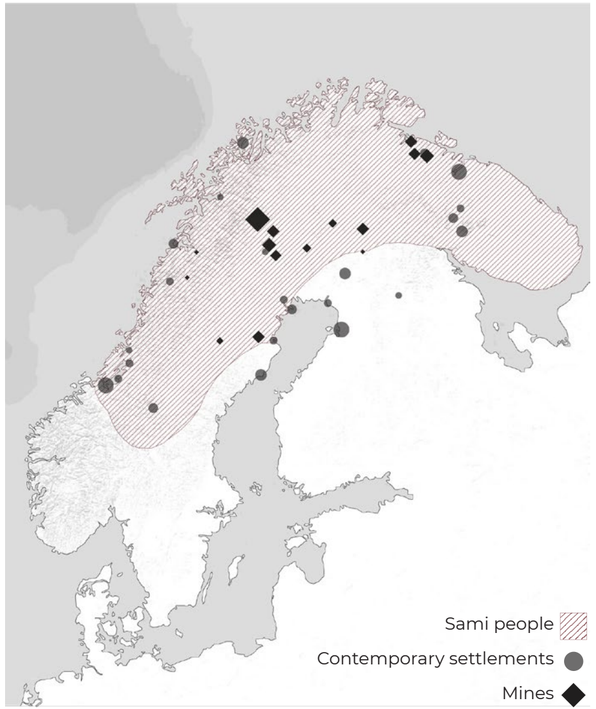
2.1.2 IRON

The iron was the primary driving force behind the development of the northernmost lands of Sweden. The first sentence of King Olof Trätälja in Sturlason's saga, written by Geijer, 'iron has opened up the land,' fully captures the Swedes' fervor for the true colonization of Norrbotten.

The presence of iron in Norrbotten has been documented since the seventeenth century, a period when the Swedish state commenced its internal colonization efforts.

During this time, a Swedish hunter exploring the northernmost reaches of the present-day county stumbled upon a valley flanked by the Kiirunavaara hills to the south and Luossavaara to the north. While retrieving an arrow from the southern hillside that had missed its mark, he noticed that the hill was primarily composed of iron. Such abundance of the mineral was a rarity, as it surfaced copiously, akin to few other places in the world.

The Swedish state long sought to exploit these and other deposits in the region, as indicated by Axel Oxenstierna's words: "[i]*n the North, we'll have within our borders an India, if only we*



Mines in Norrbotten. The map shows the areas historically populated by Sami people, today's largest inhabited centers, and the principal mines in Norrbotten.

understand to use it."[9] However, initial attempts at resource exploitation were hindered by the challenging climatic conditions and the region's isolation, which made transporting raw ore to processing sites in the south arduous and economically unfeasible.

The Kingdom of Sweden nationalized the iron industry as early as 1649. The first deposits to be exploited were those situated along the shores of the Gulf of Bothnia, such as Torneå, just a few meters beyond the present border between Sweden and Finland, or Malderstein a few kilometers inland. From here, iron could easily be transported by sea through the Baltic to the south.

Colonists quickly turned their attention to the richer inland mineral resources. Miners ventured as far as Svappavaara and Gällivare, located respectively 50 and 125 km south of Kiruna. However, conditions in these areas were harsh. The ore had to be transported by sleds pulled by reindeer, highlighting the ruggedness of the terrain and the challenges of transportation.

The **miners** faced significant hardships, with minimal comforts and a harsh climate. Enforcing Swedish government laws in these remote and desolate lands proved exceedingly difficult. Moreover, settlements were makeshift, with shacks extending nearly into the mines themselves. The mines were beset by frequent accidents, compounded by the volatile external demand for iron. This led to periods of closure for several establishments. Such fluctuations sometimes resulted in what were termed "*Lappification episodes*"[10], where Swedish miners turned to reindeer husbandry, integrating with the Sami population as a means of survival.

Despite this situation of instability, the extraction of resources from underground was already a **significant asset** for the Swedish crown. In 1750, ferrous minerals constituted 70% of the state's exports[11], and by 1770, mines were already exporting minerals worth 2 million Swedish Riksdaler of that time, the equivalent of 90 million euros today[12].

In those years, the official discovery of the Kiirunavaara and Luossavaara deposits took place. Indeed, it was known that in the far north near the mountains that now mark the border with Norway, which at the time was still undefined, there were hills where iron was abundant like nowhere else in Sweden.

Abraham Steinholtz, an industrialist and governor of the area at the time, was determined to investigate further and questioned a Sami from those areas, who reluctantly revealed to him the location of the ore deposits of the two hills, between which Kiruna now stands. The Sami, named Amund Amundsson Mangi, received tax exemption and 100 silver talers for sharing the information, a very modest reward that was nonetheless highly appreciated among the Sami population.

Once on the spot, the governor could not believe his eyes at the abundance of ore even on the surface. The Kiirunavaara and Luossavaara deposits promised to be the most prolific in the entire region, surpassing even those of Malmberget.

[9] Tidholm P. 2012. *Norrland: Essäer & Reportage.* Luleå: Teg Publishing.

[10] Ahlström G. 1969. *De mörka bergen: en krönika om de lappländska malmfälten.* Stockholm: Norstedt.

[11] Malmberg J., Buckland J. 2015. *The Norrbotten Technological Megasystem: Impact on Society and Environment.* Thesis: KTH Stockholm.

[12] Past values of currencies data from fxtop.

2.1.3 The Norrbotten as a system

The construction of the Malmbanan Railway connecting the ports of Narvik in the Norwegian Sea and Luleå in the Baltic, passing through the metal ore deposits of Kiruna and Gällivare, is without any doubt the most significant turning point in the exploitation of natural resources in Norrbotten. The railway finally facilitated the transport of raw materials from inland to the coast, from where iron could be shipped and sent further south.

Over time, the system that developed in Norrbotten to support iron extraction and its transport to the final destination created a system of "*urban metabolism*"[13] with a distinctly infrastructural character, in which all elements of the system are closely interdependent, both among themselves and on fluctuations in the global steel price.

This system was first conceptualized in 1990 by Hansson[14], who renamed it the Norrbotten Technological Megasystem. The key elements of this structure are: the water-energy system along the Lule River, the iron ore mines in Kiruna and Gallivare, the ports of Luleå and Narvik, the railway line connecting the two cities, and the military fortifications in Boden.

The most important link in the chain is perhaps the **railway** extending for approximately 520 kilometers between the Baltic Sea and the Norwegian shores. The construction was entrusted to the English engineers of the Northern Europe Railroads Company Ltd. The first section of the project was built between 1882 and 1887 between Luleå's arbour and Gällivare's iron ore mine[15]. The line was later completed to its present configuration, and in 1902, the first load of iron ore extracted in Kiruna reached the shores of the Baltic Sea.

Today, the railway transports 13,700 and 68,000 tons of iron ore daily from the mines of Gällivare and Kiruna, respectively, for a total of 15 trains: 5 towards Luleå and 10 towards Narvik[16]. Since all resources are transported by train and the railway is still single-track, a disruption in service would lead to the collapse of the entire system. However, a certain degree of flexibility is provided by the railway's dual access to the sea. In the event of a localized interruption, the mines would still have a port to which they could direct their wagons. It should be noted, however, that this would lead to an overload of the railway line, not to mention that sea routes, with only one port available, would be longer. This is exactly what could be observed last winter when a train derailment disrupted iron transportation, causing losses to "*over 60 companies and other bodies, including mining and steel companies, Volvo, and Scania*"[17].

On this line, built with the exclusive purpose of transporting minerals, the passenger service also relies. SJ AB, operating only 2 trains per day, would not be able to keep the route open, so any fluctuations due to the global iron market would have collateral repercussions on civilian transportation as well.

On the other hand, while transportation and consequently tourism benefit from this infrastructure, it poses a significant obstacle for the Sami populations. The railway line, which divides their territories exactly in half[18], often becomes insurmountable for the

[13] Morata B. 2021. *The Northbothnian Technological Megasystem: Urbanization, territorial metabolism and political ecologies.* PhD Thesis: UPC-BarcelonaTECH.

[14] Hansson S. 2001. *Norrbottens Teknologiska Megasystem.* Överklinten: Hugin & Munin Kulturinformation.

[15] Informations from Persson B., Sten R. Sverige & Norge Järnväg, Swedish and Norwegian Railway Co Ltd.

[16] LKAB. 2017. *This is LKAB*. Luleå: Lule Grafiska.

[17] Newton J. 2024. Sweden to upgrade Ore Line from Luleå to Narvik. *International Railway Journal.*

[18] Kirthan S. 2024. *Back to the Future, Forward to the Past Rethinking Arctic Extraction from a Post-Extraction Perspective.* Thesis: Delft University of Technology.

The passenger train has to wait while the train carrying iron from Kiruna to Narvik passes it by near Lake Torneträsk in March 2011. **Photo by David Gubler.**

Cargo ships loaded with Swedish iron are waiting to leave the port of Narvik. **Photo by Hkonz.**

movements of reindeer herds.

After being transported by land to Narvik and Luleå, iron undergoes the sea journey to its final destinations around the world, Departing from the Norwegian **port** mainly to America and Asia, and from Luleå mostly to Europe. Narvik is the second busiest port in Norway in terms of cargo quantity, while Luleå ranks seventh in Sweden, with a combined total of 30 million tonnes of cargo transported annually. Additionally, an expansion has been approved for the port of Luleå, scheduled to be completed by 2026 and expected to quadruple the amount of cargo transported by 2030[19].

It goes without saying that the majority of the transported goods consist of steel. The jobs related to the port infrastructure managed by Luleå Kommunföretag AB and the steelworks owned by SSAB amount to approximately 15,000, constituting one-third of the city's total population. The same can be said for the port of Narvik, operated by Narvik Havn AS, which employs a significant portion of the city's 14,000 inhabitants, especially in winter, as the port remains ice-free, unlike Luleå which is ice-free only 7 months per year. It can be deduced that the entire transportation system of Norrbotten is dependent on **mineral extraction**, which primarily occurs in three sites: Kiirunavaara Hill, located west of Kiruna, Malmberget, and Aitik respectively to the north and south-east of Gällivare. The first two are the two largest mines in Sweden, responsible for extracting the iron ore. Both facilities are operated by Luossavaara Kiirunavaara AB, better known as LKAB, which also manages the deposit in Svappavaara.

The combined output from the three deposits accounts for 83%[20] of Europe's iron, generating an annual revenue of approximately €3.5[21] billion, roughly 0.6%[22] of Sweden's GDP. In the last mine, managed by Atik-Boliden, copper, gold, and silver are extracted. With its 900 employees, it is the largest employer in Gällivare. The employees of LKAB number nearly 4,000, around 20% of Kiruna's population.

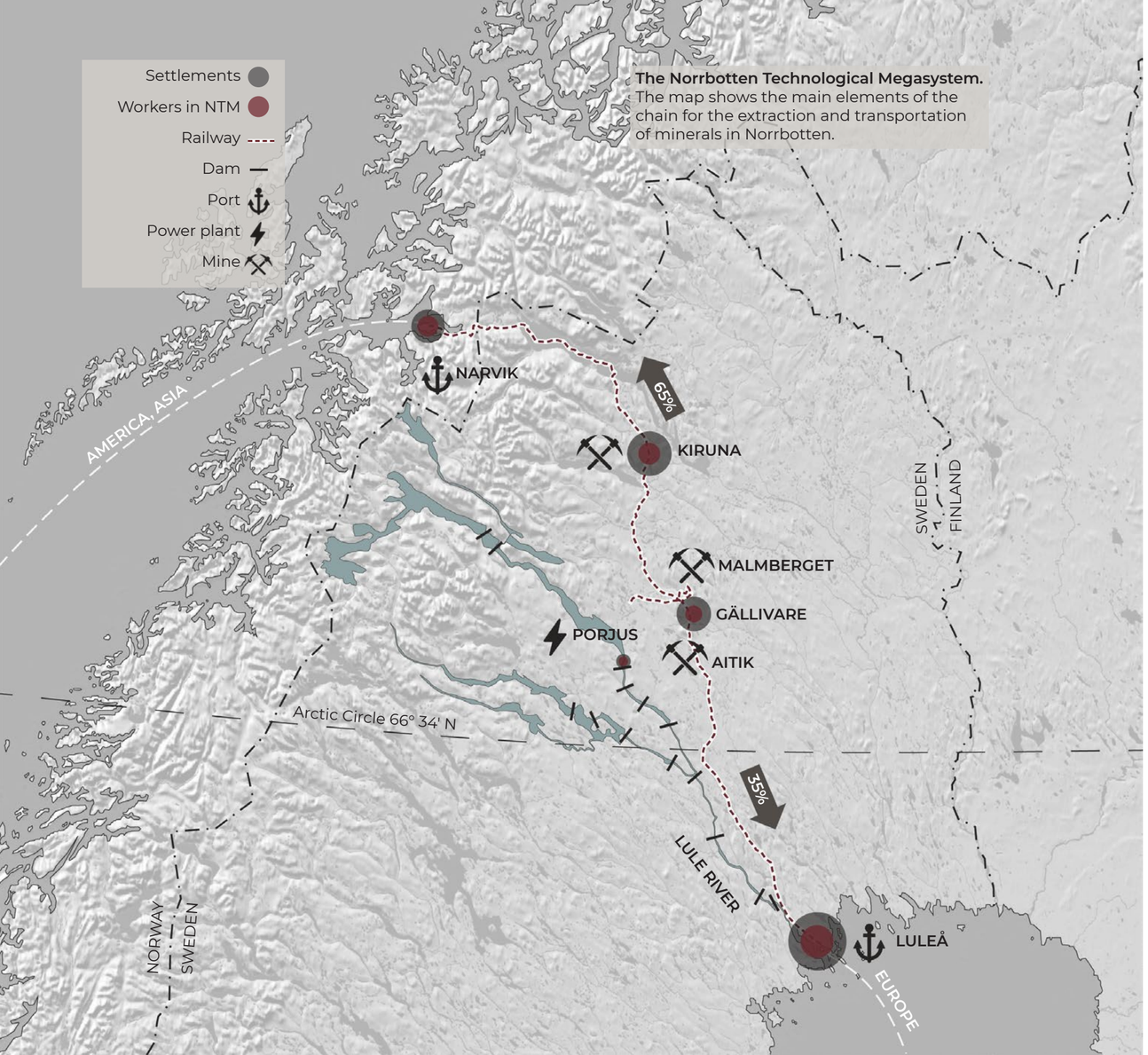
These large mining companies wield significant influence in the area, both due to the large number of people they employ and the substantial financial flows they generate, much of which ultimately ends up in Stockholm's coffers. Moreover, being state-owned, these companies benefit from a unique taxation regime: "*The mining industry*

[19] Project for the Expansion of the Port of Luleå from Luleå Hamn.

[20] LKAB. 2017. *This is LKAB.* Luleå: Lule Grafiska.

[21] LKAB. 2024. *Year-end report Q4 2023.* Luleå: Lule Grafiska.

[22] Sweden's GDP from Statistikmyndigheten.



The Norrbotten Technological Megasystem. The map shows the main elements of the chain for the extraction and transportation of minerals in Norrbotten.

is exempt from the landfill tax, has a reduced energy tax, and only pays the mineral charge on 0.2% of the excavated value of its minerals."[23]

However, mining wouldn't be possible without a significant source of energy. The enormous energy needs are largely met by **hydroelectric power**, a relatively low-cost and partially environmentally friendly energy, essential for the image of activities striving to appear more green.

The flows mainly come from the Porjus hydroelectric power plant on the Lule River, the fourth largest in the world, which has increased from a power of 50 MW in the second decade of the 1900s to 417[24] MW today, "*75% of which is used by energy-intensive industries*"[25], among which mining stands out prominently. The plant is managed by the state-owned company Vattenfall AB, which operates 14 other similar plants, all on the Lule River. Restrictions imposed by the European Union on the development of hydroelectric power plants, due to their impact on wildlife, have shifted the focus toward other sources of renewable energy such as wind power, still scarce in the area.

Relying solely on hydroelectric power, which is renewable but certainly subject to climate change, and moreover on a single water basin, constitutes another fragile link in this chain. Obviously, in this case as well, without adequate diversification, any issues related to drought or more generally to the malfunctioning of the plants would cause a chain reaction involving, in temporal order: the mines, the railway, and the ports, all infrastructure managed by state-owned companies.

It can be concluded that this system, although efficient and highly profitable, is extremely fragile. Events that occur with relative ease such as a derailment, a period of drought, or simply fluctuations in the global iron market put at risk the approximately 54,000 workers employed in the Norrbotten Megasystem[26], to the extent of having deep repercussions on the demography of the entire region.

[23] Morata B. 2021 *The Northbothnian Technological Megasystem: Urbanization, territorial metabolism and political ecologies.* PhD Thesis: UPC-BarcelonaTECH.

[24] Capacity of the Porjus Hydroelectric Plant from Vattenfall.

[25] Viklander M. 2011. *Sustainable living conditions in subarctic regions of Sweden.* Luleå: Luleå University of Technology.

[26] Borges M. J., Torres S. B. 2012. *Company Towns Labor, Space, and Power Relations across Time and Continents.* New York: Palgrave Macmillan.

Road signs for Luleå and Narvik on the E10 highway in Kiruna. **Photo by author**.

2.2 Kiruna, from 1890 to 2004

"There are two ways to reach Kiruna. The first is to take a plane from Stockholm Arlanda Airport. The flight lasts a little over an hour, allowing you to have breakfast in a major European city and digest it 145 kilometers inside the Arctic Circle. The second way is to board an overnight train at the central station of the Swedish capital, sit by the window, and look outside. What you will see, just after passing Uppsala, are forests of Pinus contorta, the particular type of conifer that covers almost the entire surface of Sweden, continuously interrupted by lakes as small as puddles and lakes as large as seas. The sun will set over this landscape, and a short night will follow. At dawn, there will be more pines and more lakes, stretching as far as the eye can see."

Gianluca Didino

(In an article for "Internazionale" titled Viaggio a Kiruna, la città lappone che aspetta di essere spostata (Journey to Kiruna, the Lappland city waiting to be moved). Published in 2016.)

2.2.1 A planned town

The presence of iron in the Kiruna area was documented as early as 1696[27], but it was not exploitable due to the high phosphorus content of the deposit and the lack of efficient transportation in the area. With the development of the method to separate the two elements by Thomas and the Bessemer process., and the construction of the railway, it became possible to start exploiting the mineral, which was extremely abundant in Kiruna.

The stretch of railway connecting the area where Kiruna now stands to the ice-free port of Narvik was completed in 1902, marking the beginning of mining operations. Kiruna was officially founded in 1900[28]; its name derives from the Sami toponym "Girona". The town's primary purpose was to accommodate mine workers, already managed by LKAB, which was founded in 1890 and counted 600 employees at the town's founding. In 1890, the B1 building was also constructed, the city's first

[27] Kiruna Municipality. 2000. *Kiruna – 100-årsboken.* Kiruna: Hs copy e mediaservice.

[28] Sjöholm J. 2016. *Heritagisation, Re-Heritagisation and De-Heritagisation of Built Environments: The urban Transformation of Kiruna, Sweden.* PhD Thesis: Luleå University of Technology.

building[29], which could not yet be properly defined as such. It was built to house geologists tasked with studying the composition of the terrain in preparation for the mine's opening, including the legendary founder of the city: Hjalmar Lundbohm (1855-1926).

The story of Kiruna's birth is closely tied to the image of its legendary founder, who served as the director of LKAB in its early years and also became the first mayor of Kiruna.

In the years just before the city's foundation, national attention was focused on the newly established Malmberget. This city, also born as a mining town, grew rapidly and without any urban planning. Shanties were built right up against the mine, creating a true shantytown characterized by "overcrowding, unhygienic circumstances, fire incidents, and a general lack of social services"[30], which led to a national scandal.

To obtain permission to found Kiruna, Hjalmar Lundbohm had to conceive and present Kiruna as a model city. After deciding to build the city on the western slope of the low Haukivaara hill, he called upon several important architects, including his friend Gustaf Wickman, who designed several significant buildings including the church, and Per Olof Hallman, who developed the urban plan. The city was conceived as the company town of LKAB, inspired by company towns Lundbohm had become familiar with during his time in the United States, such as Pullman City near Chicago[31], Port Sunlight near Liverpool, and the Krupp works in Essen[32].

In its early years, Kiruna was divided into three zones: Supply Town, designed by Hallman, and whose urban plan was declared "The country's first climate-adapted community plan"[33]. Instead of a classic orthogonal grid, Hallman opted for organic forms that adapted to the site's slopes, primarily to dampen the force of the cold winds blowing in northern Sweden.

[29] Persson C. 2009. *Tuolluvaara - ett gruvsamhälle i skuggan av Kiruna: en jämförande studie av tre samtida gruvorter i Malmfälten.* Thesis: Luleå University of Technology.

Portrait of Hjalmar Lundbohm, 1892, oil on canvas. **Portrait by Eva Bonnier**

The second zone, known as the "Company Area", was designed by Wickman as LKAB's company town. In this area were the residences of all company workers, from miners to executives, including Hjalmar Lundbohm himself, who had his residence built here. Several services were also located in this area: a hospital, fire station, hotel, and company offices, all funded by LKAB.

[30] Forsell H. 2015. Modernizing the Economic Landscapes of the North. Resource Extraction, Town Building and Educational Reform in the Process of Internal Colonization in Swedish Norrbotten. *International Journal for History, Culture and Modernity.* Vol. 3, no. 2.

[31] Borgogno F., Pozza A. 2016. *Build out Kiruna, from a mining city to a city with a mine.* Thesis: Politecnico di Torino.

[32] Sjöholm J. 2016. *Heritagisation, Re-Heritagisation and De-Heritagisation of built environments: The Urban Transformation of Kiruna, Sweden.* PhD Thesis: Luleå University of Technology.

[33] Kiruna's urban plan from Kiruna in swedish Lappland.

Map of the first established parts of Kiruna: the Company Area, the service and supply town, and the Railway Area. **Illustration by Saeed.**

The last of the three areas is the railway zone, developed near the station and along the western track between Luossavaara and Haukivaara, assuming an elongated form. This area was designed by Folke Zettervall, who at that time was the chief architect of the Royal Railway Board. In this area, all railway workers found accommodation, maintaining operation of the newly established railway line.

A characteristic shared by all three areas is their winding streets and the absence of a true "central square". Public spaces are scattered in small fragments in every corner of the city.

In the years following its foundation, Hjalmar Lundbohm, using his own wealth and the profits of LKAB, committed to the artistic development of the city. This strategy was not merely for aesthetic purposes but aimed to attract qualified workers who might otherwise find the newly established town unappealing. To achieve this goal, he brought important artists to the city such as Christian Eriksson, Prince Eugen, and Ossian Elgström. Among other contributions, they embellished the Kiruna church, designed by Wickman and constructed between 1907 and 1912[34].

[34] Persson C. 2009. *Tuolluvaara - ett gruvsamhälle i skuggan av Kiruna: en jämförande studie av tre samtida gruvorter i Malmfälten.* Thesis: Luleå University of Technology.

The beginning of the church's construction coincides with another significant event in Kiruna's history: the Swedish state acquires 50% of LKAB's shares, which until then had been a private company.

Despite being undoubtedly more stable than Malmberget, the Kiruna community still faced challenges associated with its status as a company town. The fact that the main source of employment was mining led to an imbalance in the ratio of male to female residents. Additionally, the city experienced waves of emigration whenever the global steel prices decreased, which slowed down mining activities.

With the rise in iron ore prices after World War II, LKAB thrived, and Kiruna expanded rapidly. In 1948, the three distinct areas, previously administered separately, merged when Kiruna was granted city status, marked by the construction of the Town Hall[35]. By that time, the planned zones were already fully developed. New residential areas such as Triangeln and Luossavaara were developed on LKAB's initiative. In the 1950s, the city center was renovated, replacing many old residential buildings and shops with larger structures, such as the Ortdrivaren block, designed by Ralph Erskine. In the 1960s, the city further expanded southeast into the Lombolo area and incorporated the settlement of Tuolluvaara, located east of Kiruna.

[35] Kiruna Municipality. 2000. *Kiruna – 100-årsboken.* Kiruna: Hs copy e mediaservice.

In its first 60 years of history in Kiruna, despite ups and downs, iron continued to be extracted continuously. In this initial phase of its history, the ore was mined in open pits. Over the years, the Kiirunavaara hilltop, originally entirely composed of iron, gradually lost its iron content, creating a valley where the ore had been. The period spanning the 1950s and 1960s saw a series of significant events in Kiruna, foremost among them the acquisition by the state of the remaining 50% of LKAB shares, making it a wholly state-controlled company from 1957 onward. Additionally, starting in 1962, it was no longer feasible to extract material from open pits, necessitating the adoption of a new method. Its implementation marked a turning point in Kiruna's history.

2.2.2 The Iron Heart of the City

To understand how mining activity has influenced Kiruna's urban metamorphosis in recent epochs, it is essential to comprehend the physical characteristics of the ore vein.

Geologists disagree on the origin of Kiruna's iron ore deposit. Previously, the most common theory was that the vein was of an intrusive type, meaning the molten mineral slowly approached the surface and solidified at great depths[36]; this type of iron ore was termed "Kiruna Type." However, this theory has been questioned for several years now, leading to the paradox that Kiruna's iron ore is not of the "Kiruna Type." According to another theory, the vein could have been generated by the volcanic activity of an underwater volcano[37].

Even though the formation process remains unclear, there are precise details about the Kiirunavvara iron deposit: it exhibits an exceptionally regular geometry that simplifies extraction activities. The iron body stretches from northeast to southwest along the entire hilltop for a total length of 4 km, with a thickness varying between 80 and 120 meters. Regarding its depth, the exact extent into the Earth's depths is not known, but recent measurements confirm that the vein extends at least 2000 meters below the hilltop, which was already exposed in the early years of mining.

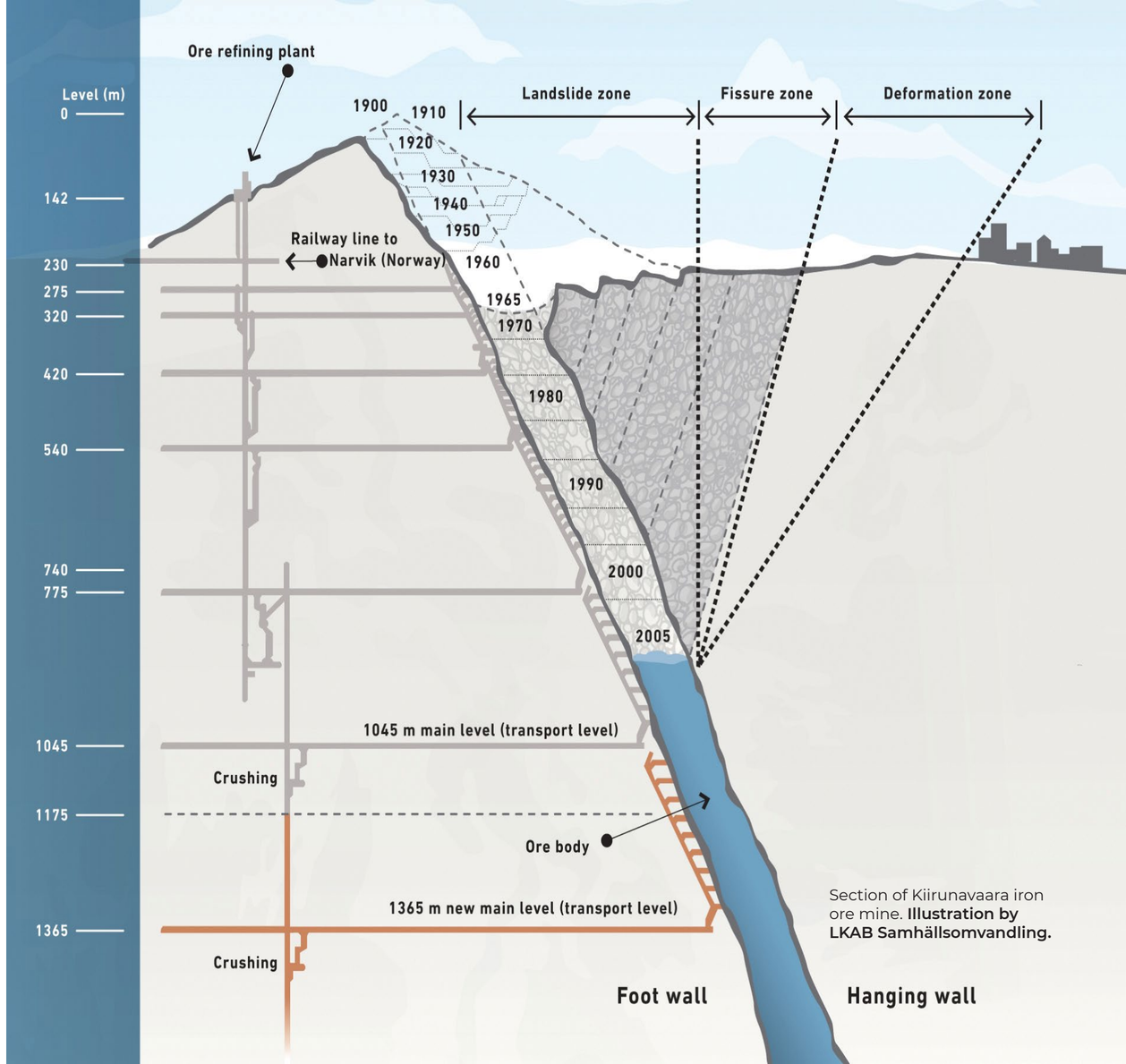
This 800 million cubic meter monolith of iron slopes at a 60-degree angle towards the southwest. It is nestled between two layers of rock that form the slopes of Kiirunavaara Hill: the northwest side is termed the "supported wall," where LKAB's extraction plant is located. On the opposite side of the hill, where Kiruna is built, is the "hanging wall."

Since 1962, open-pit mining has been impractical, leading to a shift to the "sublevel caving" extraction method. This method is considerably more expensive, exacerbated by challenges in transporting ore due to climate conditions and the high wages miners earn, which are notably higher than Sweden's already elevated average. Consequently, the mine operates with significantly higher operating costs compared to open-pit mines in Brazil and Australia.

The mining operations in Kiruna re-

[36] Frietsch R. 1978. On the magmatic origin of the iron ores of the Kiruna type. *Economic Geology*. Vol. 73, no 4.

[37] Parak T. 1975. Kiruna iron ores are not “intrusive-magmatic ores of the Kiruna type”. *Society of Economic Geologists*. Vol. 70, no. 7.



Section of Kiirunavaara iron ore mine. **Illustration by LKAB Samhällsomvandling.**

Kiruna old city center and Kiirunavaara mine from the top of Luossavaara hill.
Photo by Marzia Carosi.

mained economically viable thanks to the high purity of the ore vein, which ranges between 60% and 70%, increasing with depth. Another factor contributing to the sustainability of the new method is the composition of the deposit, primarily magnetite. Magnetite represents only 10% of the Earth's total iron ore, whereas the vast majority is hematite. Magnetite offers a significant advantage over hematite due to its magnetic properties, which allow for efficient separation of iron from waste materials, greatly reducing processing costs.

The "sub level caving" extraction method involves digging tunnels beneath the ore deposit and using controlled explosions to collapse the ore into the tunnels below. The ore is then collected and transported to the surface. The sudden void created by the collapse of the ore causes portions of the "hanging wall" to subside into the empty space left by the iron ore, a phenomenon known as subsidence. The deeper the level from which the ore is extracted, the larger the area susceptible to subsidence.

This method, while more expensive than open-pit mining due to its technical complexity and the challenges associated with subsidence and transportation, remains feasible and sustainable in Kiruna primarily due to the high-grade magnetite ore and its magnetic properties facilitating cost-effec-

tive separation during processing.

Starting from 1962, several underground levels were created to continue exploiting the ore that had become inaccessible from the surface. The first of these levels was located just 275 meters deep below the now non-existent summit of Kiirunavaara. The subsidence caused by mining at this level initially did not affect a large area. However, over the years, as deeper levels were constructed within the mountain, deformations due to subsidence began to affect an increasingly larger area, reaching the vicinity of the Ön neighborhood in the 1970s, when the main level was situated at a depth of 420 meters[38].

The Ön neighborhood originally emerged as an informal and unplanned settlement in the early years of the city's existence. It was the only residential area beyond the railway, which already separated the city from the mine at that time. The deformations caused by the growing mining activity eventually forced authorities to demolish the residential neighborhood and convert it into an industrial area, which was ultimately abandoned. The Ön neighborhood's fate deeply affected the residents, marking the beginning of a process that would impact a significant portion of the city many years later.

During the first half of the 1970s, mining activities in Kiruna were thriving. "1*973 was a record year with 24 million tonnes of ore transported from Kiruna and Svappavaara to the export ports*"[39] However, during this peak period, mining operations faced a severe setback. In 1975, a sharp decline in global steel prices significantly impacted the industry. Despite LKAB's proactive reduction in extraction activities, mineral reserves grew excessively due to low demand. Two years later, the company reported losses for the first time in several decades.

The crisis persisted for several years, with the company's financial deficit widening drastically. Starting from 1979, the Swedish government injected a total of 6 billion kronor into LKAB to prevent its otherwise certain bankruptcy. During this period, the Tuolluvaara and Svappavaara mines were closed, and LKAB was forced to carry out mass layoffs, reducing the workforce from 8,000 pre-crisis to 4,000.

By 1983, production levels had returned to those of the 1920s, indicating the depth of the downturn. However, signs of recovery began to emerge simultaneously. For the first time in many years, the company ended the year with a positive financial outcome.

The years of crisis also had some positive consequences, during this period LKAB streamlined the extraction process, reducing costs and significantly downsizing the workforce. Another major innovation occurred in 1978 when the abolition of laws prohibiting women from working in mines allowed LKAB to increase its female workforce[40], which had already been growing steadily over the years. By the second half of the 1980s, with the crisis behind them, the company experienced rapid growth. Despite fluctuations in global steel demand, LKAB has thrived ever since and, consequently, so has Kiruna.

[38] Borgogno F., Pozza A. 2016. *Build out Kiruna, from a mining city to a city with a mine*. Thesis: Politecnico di Torino.

[39] Kiruna Municipality. 2000. *Kiruna – 100-årsboken*. Kiruna: Hs copy e mediaservice.

[40] Borges M. J., Torres S. B. 2012. *Company Towns Labor, Space, and Power Relations across Time and Continents*. New York: Palgrave Macmillan.

3 How to Move the City

Chapter 3 encompasses the history of **Kiruna's relocation** from April 2004 to June 2024. The narrative is based on documents that have impacted the urban environment, organized into **17 stories**.

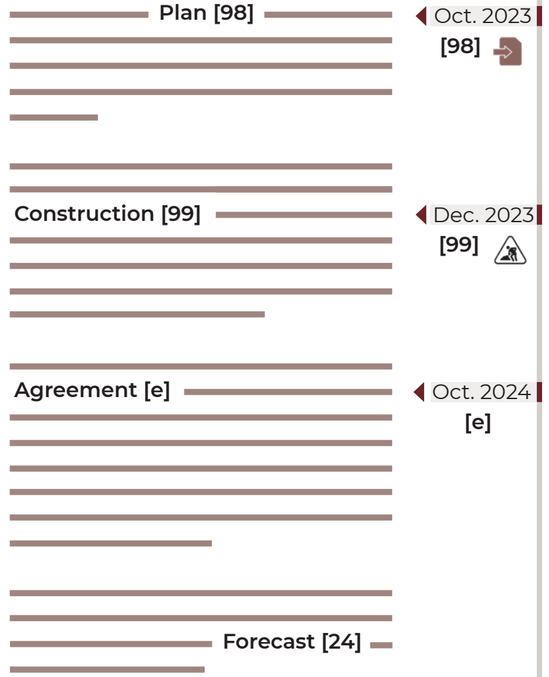
How to read the sidenotes:

Foundational **Document** of a story, present both in the Diagram and in the References.

Foundational **Action** of a story, present in the Diagram but not in the References.

Foundational **Document** of a story, present in the References but not in the Diagram as too detailed to contribute to the general story of the urban process.

Document that is not foundational to the specific story.



[98] Plan

[e] Agreement

[24] Forecast

3.1 A slow-mo earthquake

"The discussion has always been about how to move, not whether we should or not... that's the issue."

Project manager, TVAB

(in an interview to an anonymous manager of TVAB, conducted by Chelsey Jo Huisman in his doctoral thesis for the Uppsala University "Transforming the City of Kiruna")

3.1.1 An email from LKAB

In the early 2000s, within the offices of LKAB, the idea of constructing a new main level for iron ore extraction matured. At a depth of 1,365 meters within the hill, a significant 320 meters below the then-main level at 1,045 meters, which was expected to be depleted.

LKAB is a large and structured company, which is why it needs medium to long-term plans. The opening of level 1,365 is scheduled for 2012 **[18]**, but it will only reach full exploitation by 2016[41], also due to the global decrease in demand for iron between 2012 and 2016, which slowed down mining activities.

So far, no problem. With the gradual depletion of the ore vein, it becomes necessary to begin extracting iron from deeper levels, and Luossavaara-Kiirunavaara Aktiebolag is preparing to do so. The problem is that by digging deeper, the area subject to subsidence will also increase, compounded by the approximately 60-degree inclination that

[18] Kiruna kommun. Oct. 2010. **Detail plan for Bolagsomradet Gruvstadspark.**

[41] Full exploitation of level 1,365 from LKAB. Questions and answers concerning the situation.

causes the vein to extend towards the city. With the opening of the new level, the area of deformations will reach the city starting from the city center, the bustling heart of Kiruna where buildings of the highest historical and cultural value stand.

LKAB immediately mobilizes and requests more in-depth studies of the city areas that will be subject to subsidence. In the midst of 2003 and 2004, LKAB organized a **series of meetings** to communicate the problem to city institutions: Planning Group for Land Use on November 19, 2003, and two informational meetings with participants from the Planning Department of the Municipality of Kiruna on December 9, 2003, and February 25, 2004. During these meetings, information was provided about the extent of the subsidence zones from the Kiirunavaara mine within the city of Kiruna.

Nov. 2003

Dec. 2003

Feb. 2004

The solution proposed by LKAB is straightforward: move Kiruna.

The official announcement arrived on March 19, 2004, via email, addressed to the Municipality of Kiruna and signed by Jouni Hansen Haug. In "the" **email [2]**, which ideally marks the beginning of the story of Kiruna's relocation, it is stated that in light of the previous meetings, the Municipality of Kiruna is urged to modify the urban plan and thus begin the planning of the new city.

Feb. 2004

[2]

10 lines divided into three paragraphs, seemingly innocuous at first glance, hold the power to ignite a process of immense consequence for the residents of Kiruna. It can be likened to a fuse, triggering a series of actions, negotiations, promises, agreements, and countless other documents that translate into transformative interventions in urban planning and architecture. This whirlwind of actions and reactions has enveloped Kiruna since 2004 and will continue at least until 2035, the year when even level 1,365 is expected to be depleted.

Certainly, for the inhabitants of Kiruna, this is not a bolt from the blue. They are well aware that the city and the mine were born together; a significant portion of them work in the mining sector, and rumors must have circulated long before. This is not even the first time the city has faced a transformation due to subsidence. As stated in chapter 2.2.2 in the '70s, because of the deformations, the neighborhood Ön was dismantled.

Moreover, the phenomenon of subsidence is then evident to all; between the city and the mine, where once stood the peak of Kiirunavaara Hill, now lies a deep rift, dotted with craters. At night, the earth trembles; this is the only seismic zone in Sweden, earthquakes are caused by blastings inside the mine as well as aftershocks. These detonations occur 10 times per night, 365 days per year. They are scheduled at night to minimize the risk of accidents. The strongest earthquake ever recorded reached a magnitude of 4.1 on May 2020[42].

Furthermore, in Malmberget, where the other mine managed by LKAB is located, subsidence phenomena have been affecting buildings for over 30 years, forcing residents to leave their homes swallowed by the "Capitan's Pit", a sinkhole that opened right in the middle of the town, dividing it in two. One should not imagine catastrophic events, at least not in the common sense of the word; the deformations do not destroy cities in a single day as in the movie "The Abyss", but they do so extremely slowly. In Kiruna, for example, the first to be affected are the sewers and water pipes, which, if broken, risk contaminating their precious product with the polluting materials from the mine. Therefore, no disaster movie scenario, but for the residents of Kiruna, the result is the same: leaving their homes.

One would expect that the perspective triggered by the famous email would have caused protests, if not outright popular revolts. Instead, the annals of that period do not report any signs of opposition, "*The discussion has always been about how to move, not whether we should or not... that's the issue*"[43].

In Sweden, according to the National Planning and Building Act, it is the municipalities that are responsible for urban planning. This implies the drafting of plans for land management. Consequently, no one can intervene to modify the urban layout of a city without first consulting the municipal authority. For this reason, the letter from LKAB was sent to the municipal council, which therefore had to make the final decision on whether to relocate Kiruna or close the mine. Both options would have serious consequences for the city, and despite the contrasting opinions of the 12 political parties in power at the time, in December 2004 the **decision [3]** to move the city was made.

Dec. 2004

[3]

[42] Magnitude of strongest earthquake ever recorded from Sky News. Kiruna: Sweden suffers one of its strongest earthquakes at an Arctic iron ore mine.

[43] Huisman C. J. 2021. *Transforming the City of Kiruna: Stabilizing Change and Changing Stability.* (Personal interview, Project manager, TVAB) PhD Thesis: Uppsala University.

[2] LKAB. Mar. 2004. **Mail to Kiruna kommun.**

[3] Kiruna kommun. Dec. 2004. **Agreement on city relocation.**

3.1.2 The Red Line is moving

The decision to move the city will entail the demolition and reconstruction of various buildings, as well as the physical relocation of others. Buildings of certain cultural value will indeed be placed on trucks to be transported to their new destination in the new center of Kiruna, weight permitting, of course. This complex process consists of three main actions: demolition, reconstruction, and relocation. Two actions are extremely familiar to an architect, while one is entirely new.

Now that the big decision is made, a spontaneous question arises: who will pay? However, this, like the question regarding the possibility of moving Kiruna or not doing so at all, is a question that for those who live here has an obvious answer: the entire cost will be covered by LKAB. In fact, the Swedish Minerals Act makes it clear that all damages caused by mining activities are the responsibility of the company managing the mine. Although "*the law has never been applied to such a large swath of properties before now*"[44].

Another pressing question for all residents of Kiruna, one that will continue to arise intermittently throughout the city's transformation period, is: which buildings to move and when should it be done?

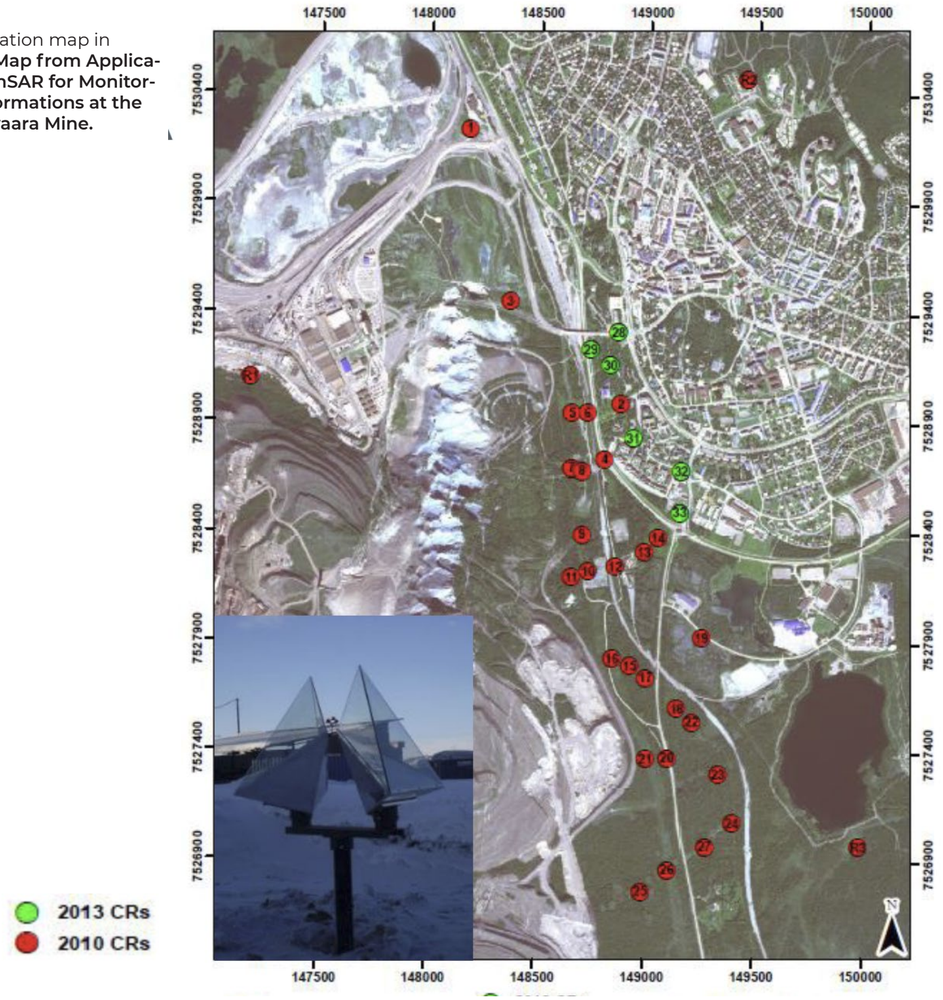
The answer to this question, like the first two, is non-negotiable; there can be no agreements or shared decisions. The buildings that need to be demolished or, in a few cases, relocated are defined by the so-called "Red Line." This line is a crucial player in Kiruna's relocation, as it has the power to decide what needs to be moved and when it must be done. The "Red Line" is unilaterally defined by LKAB technicians who monitor ground deformations in the city center and forecast the long-term consequences of mining activity.

To fulfill the daunting task of predicting how the ground beneath Kiruna will deform, hundreds of GPS detectors were spread out in the city, replaced a decade later by the more advanced InSAR[45] system. This system relies on satellite detection like GPS but has the dual advantage of being more precise and requiring fewer ground elements (CR) to operate, Moreover, it is much more precise in winter

[44] Rhys T. 2014. Moving Kiruna: what does it take to relocate a city? *World Finance*.

[45] Mäkitaavola K. 2016. Application of InSAR for Monitoring Deformations at the Kiirunavaara Mine. Conference paper: *3rd International symposium on mine safety, science and engineering, Montreal Canada.*

CR's Location map in Kiruna. **Map from Application of InSAR for Monitoring Deformations at the Kiirunavaara Mine.**



2004
[1]

when snow covers everything. The acceptable deformations are 3‰ horizontally and 2‰ vertically, thresholds beyond which LKAB considers the use of buildings unsafe.

Since the process of relocating the city is extremely slow, the forecasts cover a time frame from 2012, the year projected for the opening of level -1365, to 2035, the year when the said level is expected to be depleted. Despite the efforts made by the mining company, it is practically impossible to have accurate predictions with such a wide time horizon, which is why there have been several updates to the deformation forecasts.

The first **Deformation Forecast [1]** dates back to early 2004. In this initial map, it can be appreciated how LKAB does not yet fully expose the timing of the phenomenon. Only two scenarios are shown in the tables, one for the year 2023 and one for 2033. The second line in particular emphasizes the entire area that will sooner or later be dismantled, accounting for roughly one-third of Kiruna's surface. This line divides Lake Ala Lompolo, rising towards the hill where the city center is located. It includes the hospital and the church, then settles along Adolf Hedinsvägen, the main city artery connecting Kiruna to Tuolluvaara, which at this stage is not yet clear if it is affected or not. The line continues northward and bends back towards the mine just before Luossavaara School, sparing it. This forecast has been used for over 10 years for the planning of Kiruna and is included in important documents such as the Architecture Competition Brief **[26]**, for the development of the master plan for the new city.

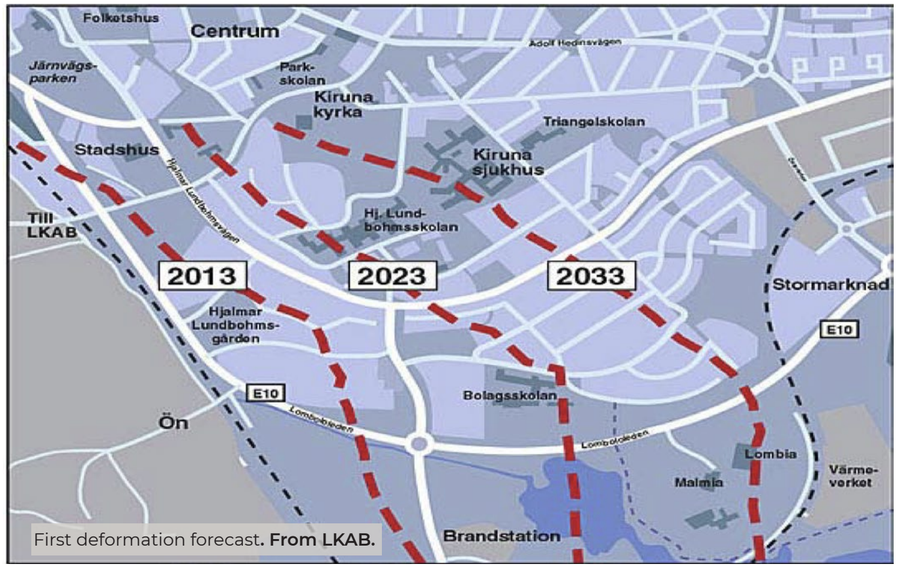
In December 2014, after the first deformations due to activities at level 1365, LKAB released a new **Deformation Forecast [45]**.

Dec. 2014
[45]

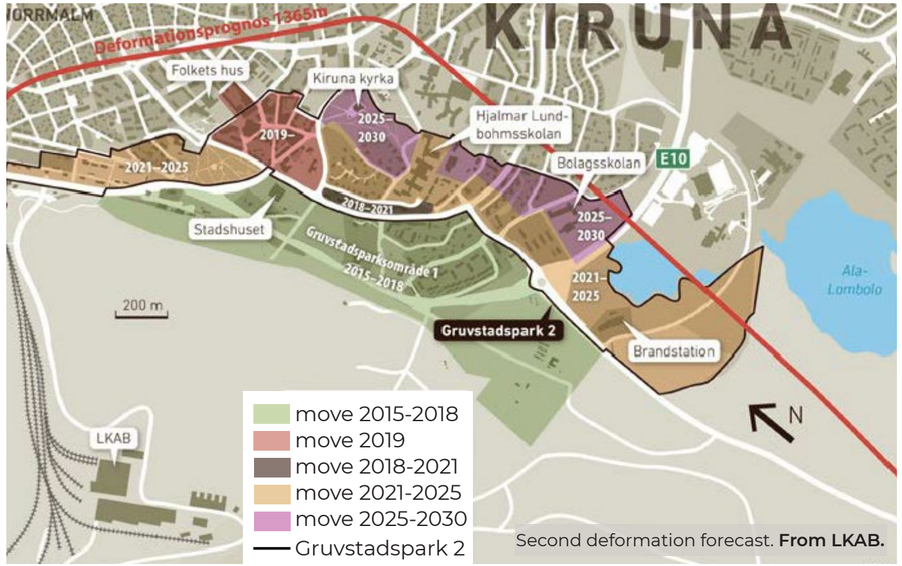
[1] LKAB. 2004. **Deformation Forecast.**

[26] Kiruna kommun & Swedish Association of Architects. Jul. 2012. **Architecture competition brief.**

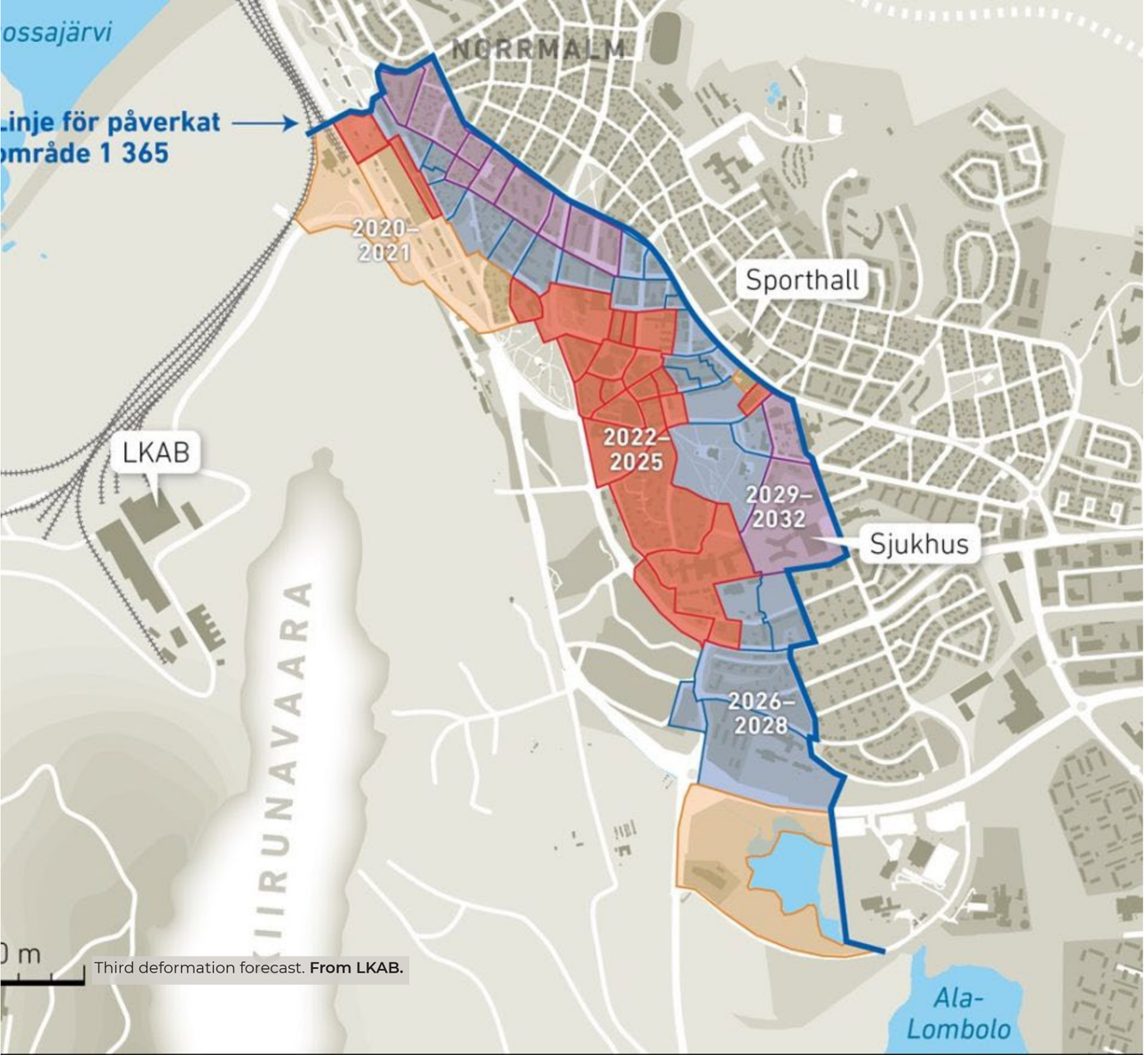
[45] LKAB. Dec. 2014 **Deformation Forecast.**



First deformation forecast. **From LKAB.**



Second deformation forecast. **From LKAB.**



Third deformation forecast. **From LKAB.**

In this new forecast, the "Red Line" retreats slightly, excluding, among the others, two important buildings from the deformation area that, according to the previous version, were slated for demolition: the Actic Kiruna Sports Hall and a large residential building housing the Thule Restaurant, one of the most renowned in the city. A more significant difference compared to the previous forecast is the presence of the attachment: "timetable for moving," which specifies which buildings will need to be demolished and when. In this document, there are 4 zones marked with a range of years corresponding to the dismantling period. The zone closest to the mine where the town hall is located will be demolished between 2015 and 2018. The furthest zone, however, houses another iconic building of the city: the church, and the area's last area, there remains a large zone whose decommissioning is scheduled between 2025 and 2030. Beyond this whose demolition is not yet scheduled.

As of today, the current **deformation forecast [62]** is the one released in April 2019. In this case, the Line has not moved; what changes, as in the previous version, is the timing of the interventions and the shape of the areas underlying the deformation area. Four zones are reformulated, covering the entire deformation area this time. The timing is more precise, ranging from a minimum of 2 years to a maximum of 4, compared to the previous plan's 6, and overall, the deformations seem to be progressing faster than expected.

As mentioned earlier, the forecasts are updated every few years, with the first two released approximately 5 years apart from each other. Now, 5 years after the last forecast, it is reasonable to expect a new one soon. Even though there is no official confirmation yet on the new forecast, rumors have already started to circulate and they are not the most reassuring. "*I have reason to believe that LKAB will communicate the new line by October or at the latest by Christmas, and the area will be much larger than the current one*"[46]. An expansion of the new line would be disastrous for Kiruna; the city would be even more "divided in two," and the roads connecting the new city to the old one, already heavily trafficked, would be further reduced in number, resulting in extremely congested traffic in the years to come.

Apr. 2019
[62]

The first signs that the Red Line is advancing can already be seen today: two buildings outside the forecast area already show the first cracks, a sign that sooner or later they will fall victim to ground deformations. The first is the

[62] LKAB. Apr. 2019. **Deformation Forecast.**

[46] Member of the Culture and Education Department of Kiruna kommun. Personal interview, May 6, 2024.

piezometric building, the second is one of the city's schools. Both buildings are made of bricks, which suggests that deformations occur at different speeds depending on the weight of the construction[47]. If this hypothesis were confirmed, the deformation area of the next forecast would have a leopard-spot configuration, further complicating the urban functioning of old Kiruna.

The so-called "Red Line," being a prefiguration of space, can be considered an architectural document, but its purely technical nature prevents it from rising to the level of a design document. Deformation forecasts embody the reason why Kiruna is moving, a question to which the actors involved in the process respond with a myriad of agreements, documents, and interrelated actions that this thesis aims to undertake, mapping the challenging endeavor. Unlike the forecasts, these latter documents are design documents, and as such, they are the product of ideas, including political, and opinions, often discordant.

[47] Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 7, 2024.

Cracks in the ground straddling the restricted area in Kiruna. **Photo by author.**

3.2 Where to move the City

"Kiruna is overlapped by two different national interest claims - for valuable substances and minerals and for cultural heritage. In the balancing act between these competing national interests, cultural heritage must yield to the mineral interest."

LKAB

(In "Building Relocation Plan for Structures Affected by Level 1365" By Kiruna kommun & LKAB in Feb. 2017.)

3.2.1 Space paradox

Shortly after becoming aware of the extent of the area subject to the deformations of Level 1365, the question that the municipality and LKAB had to address seems quite obvious: where will we relocate the city? This is the first real design challenge that the involved parties must face.

The municipality of Kiruna, with its 19,140 square kilometers is the largest municipality in the European Union, roughly equivalent to Slovenia. It is home to approximately 22,500 inhabitants, resulting in a density of 1.1 inhabitants per square kilometer, another absolute record for the Union, this time in a negative sense.

Given these data, one might think that there is ample choice as to where to position the city center, especially considering that most of the territory under Kiruna's jurisdiction is flat. However, the situation is much more complex: Kiruna is the crossroads of three important national interests. The first is the presence of minerals underground, the second is the declaration of national interest for the entire building heritage of the city of Kiruna, and the third is the reindeer herding activity that encompasses much of the national territory.

The first of these three interests to be established by the Swedish crown is indeed reindeer herding. The reference area is delineated by a line, where all territories north of the line are dedicated to perpetuating Sami traditions. Established in 1867, this line runs just north of Gällivare, the northernmost active mining station at the time, and just south of Kiruna, which would become of national interest for mining activities later on, resulting in the overlapping of the two interests, a situation not occurring elsewhere in Sweden.

The interest in cultural heritage in the areas of Kiruna and Kiirunavaara was established in 1990 and renewed by the Swedish National Heritage Board in 2009 **[43]**, overlapping this interest with the existing two.

Although theoretically these three interests should be equivalent, it is clear that this is not the case. The most powerful interest is undoubtedly mining, as seen in 1900 when extraction began on Sami territory and in 2004 when the decision was made to relocate part of the city, even though it was subject to cultural constraints.

The other two interests have never come into conflict except because of the relocation. In fact, the push of the mining interest drives Kiruna to move, but it cannot move freely due to the reindeer herding interest that surrounds all of Kiruna's territory. Hence arises the spatial paradox: in a territory of 22,500 square kilometers, there is very little space to relocate the city, namely the few non-built-up areas and the former mining areas, the only places where none of the 3 interests are present. Building on Sami territories would imply "*Buying the land from the State, which would entail a long and complex process practically not feasible for the municipality*"[48].

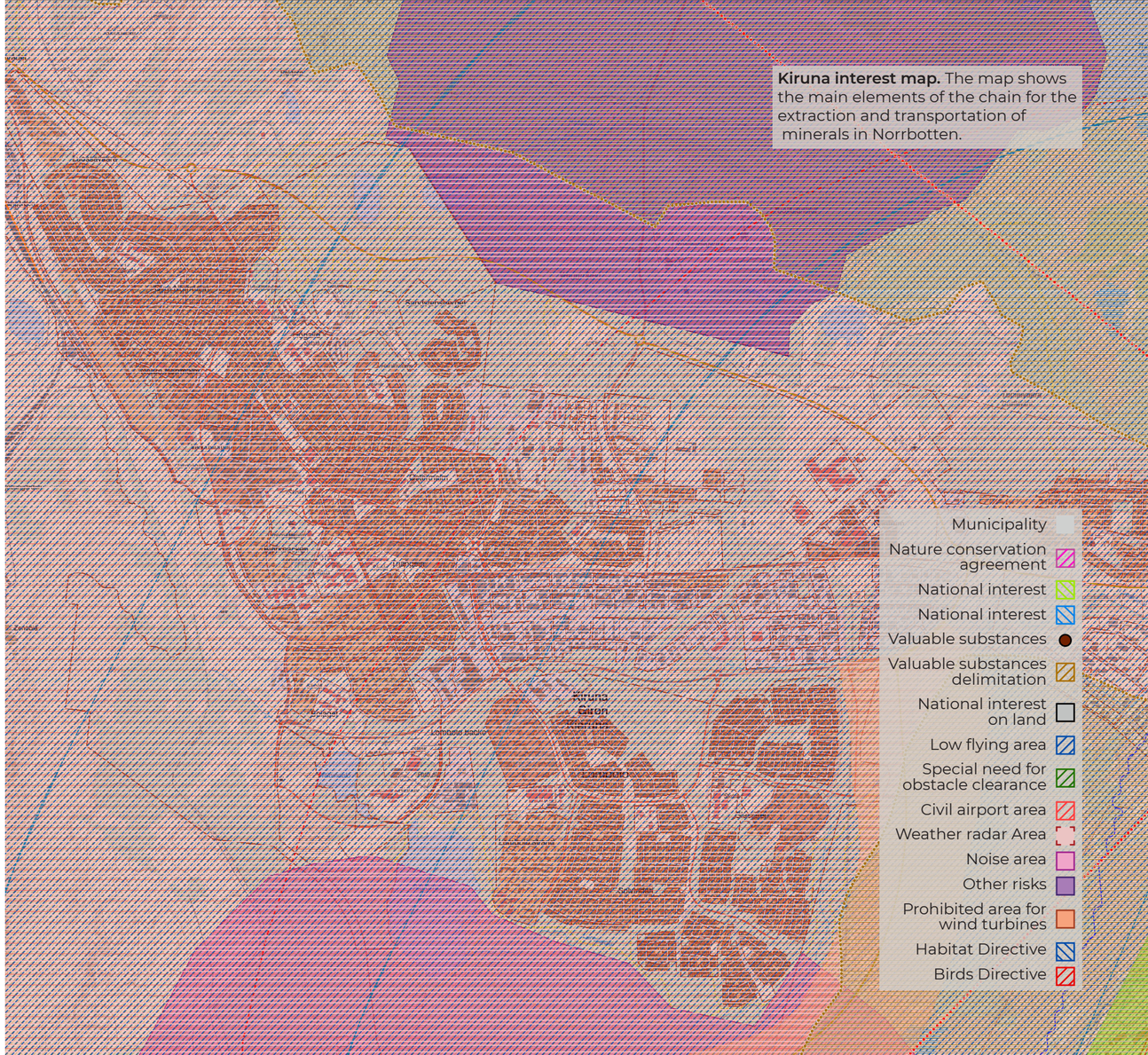
The first design question, namely where to relocate the city, will find an answer only several years after it has been formulated, but some of the implications stemming from this initial instance manifest immediately. The first design response is indeed that due to the limited available space, the city will be denser.

These reflections are collected in an initial project document produced by the municipalty: Vision2099 **[4]**. This document, which takes its name from the time frame it aims to cover, is an embryo of the project for the future Kiruna, or rather of the com-

[48] Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 7, 2024.

[4] Kiruna kommun. 2004. **Vision 2099**.

[43] Kiruna kommun. Sep. 2014. **Analysis of Kiruna's Cultural Heritage Phase 2.**



petition that will be announced for the design of the new city 8 years later.

The document is presented in a very anonymous manner, similar to a letter to LKAB, consisting of written text barely covering a couple of A4 pages. Even the content is quite generic, including all those typical requests to which a European architect usually adheres when interacting with a public actor.

This document would not be of any interest if it were not for the fact that today, as the new city center is taking shape, we can see its effects firsthand. The request that environmental resources such as lakes and watercourses should be positioned as close as possible to settlements, for example, will be given great consideration by the jury of the future competition. Another task listed in the document is the need to avoid emission routes from the mine. The authors of Vision 2099 also ensure that to limit travel, the mixing of functions is maximized.

In general, in the few lines of the document, it is understood how the movement of the city is seen as a unique opportunity for the development of Kiruna as a "modern model city."

3.2.2 Six hypotheses plus one

During the period from 2004 to 2011, it won't be clear where the new city center will be built. This period is characterized by the production of various documents by the involved actors. Among them are study documents, which seek to rationalize and understand the premises of the relocation as well as to "*find ways to evaluate and distinguish different consequences of the proposed relocation and, thus obtain guidance for future planning decisions*"[49].

However, perhaps the most interesting documents are the design documents that, in this phase, contain extremely defined spatial prefigurations but which will not always find confirmation in reality. Nevertheless, it will be important to understand which paths are not feasible and especially why.

In this phase, a total of 8 options[50] for relocating the city will be considered,

[49] Adolphson M., Olsson. K. 2009. Urban design and social life - the relocation of Kiruna. Conference paper: *AESOP*.

[50] Gimberger C., Norberg K. 2006. *Uppdrag att flytta en stad – en studie av planeringsprocessen i samband med Kiruna stadsomvandling*. Thesis: Uppsala University.

2004 [4]

Mar. 2006 [8]

Aug. 2006 [10]

Dec. 2006 [11]

Sep. 2011 [21]

all in line with **Vision 2099 [4]**.

The first hypothesis to be developed is the so-called **Northwest Alternative [8]**, which was made public by architects from the Wilhelmson studio on behalf of LKAB in March 2006. Following this initial hypothesis, there will be those from the municipality, expressed through two fundamental documents for this phase: The first is the **Comprehensive Development Plan for the Central Area of Kiruna [10]**, drafted in many versions with the first one published in a couple of months earlier in the same year, followed by the **Environmental Impact Assessment for Comprehensive Development Plan for the Central Area of Kiruna [10]**, published in December. These two documents, in particular, will evaluate a wide range of hypotheses, which remained pending until September 2011 when the discussion was concluded by choosing one of the hypotheses in the **Agreement of the Municipal Board [21]**.

[4] Kiruna kommun. 2004. **Vision 2099.**

[8] LKAB & Wilhelmson Architects. Mar. 2006. **The New Kiruna - Northwest Alternative.**

[10] Kiruna kommun. Aug. 2006. **Comprehensive Development Plan for the Central Area of Kiruna.**

[11] Kiruna kommun. Dec. 2006. **Environmental Impact Assessment for Comprehensive Development Plan for the Central Area of Kiruna.**

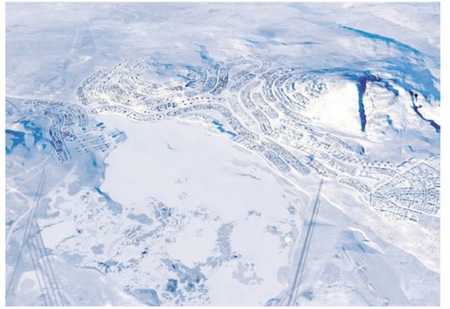
[21] Kiruna kommun. Sep. 2011. **Agreement of the Municipal Board on city relocation.**

Among all these documents, the one that pushes forward the most is the hypothesis promoted by LKAB, as the name suggests, it expresses the intention to move the center of Kiruna to the northwest, really close to the old one, occupying the pass between the hills Kiirunavaara and Luossavaara, as well as Luossavaara's former mining area.

The proposal takes into account many urban aspects but does not provide a very clear overall vision. In the first pages, the issue of mobility is addressed, and solved by moving the railway to the west beyond Kiirunavaara, a hypothesis that will then be reused for the temporary relocation of the line. Additionally, the document addresses the relocation of buildings, placing significant emphasis on the church. It proposes relocating the church to the shores of Lake Luossajärvi outside the city, primarily for aesthetic reasons, with Kebnekaise, Sweden's highest mountain, serving as a picturesque backdrop. However, it does not consider the church's current location.

The description of the new city is extremely detailed, going as far as defining the blocks and even their possible internal configurations. The organic lines drawn by Wilhelmson Architects follow the slopes of the various hills in the area, deliberately leaving the city without a new center.

The document ends with several enticing references for inspiring the future development of the city, including the realization of an indoor ski slope, a rather curious hypothesis for a place where skiing often continues until late May. Another reference is the Seagaia Ocean Dome, the world's largest indoor water park, located in Miyazaki, Japan. The reason why it was selected is certainly clearer, but the realization seems to be somewhat unrealistic as the Ocean Dome itself failed just 8 months after the presentation of the Northwest Alternative.



Overview of the new city center. **From The New Kiruna - Northwest Alternative.**

Seagaia Ocean Dome, Miyazaki Kyushu Japan 1993. **From The New Kiruna - Northwest Alternative.**

This document asserts LKAB's desire to move the city to the northwest in an area owned by the company, closer to the mine as well as to the lake and hills as in Lundbohm's philosophy. The publication of this project by LKAB without notifying the municipality was seen by some of its members as a strategy to discredit the municipality and influence public opinion, in addition to being a violation of roles, as planning is the responsibility of the local government.

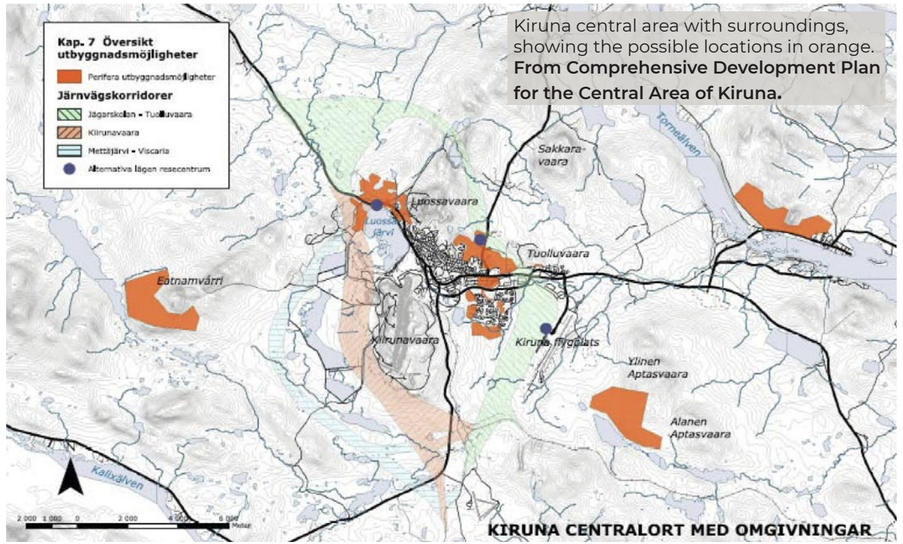
The fact remains that, although extremely visionary and detailed for the time, most of the hypotheses highlighted in the Northwest Alternative will not influence the urban metamorphosis., making it a classic "leap forward" justified only by being able to take a step back.

The municipality, in its proposal, em-

ploys a strategy diametrically opposed to that of LKAB. The proposal arising from the Comprehensive Development Plan for the Central Area of Kiruna **[10]** does not present futuristic visions or premature leaps in scale but rather tackles the problem of where to relocate the city head-on, leaving nothing to chance.

The plan indeed analyzes 6 possible locations for the placement of the new city center. Three hypotheses involve moving the center to the immediate vicinity of the existing city. The strengths of these hypotheses are based on the fact that it is currently not necessary to move the entire city, but only a third of it. In these hypotheses, only the city center would be relocated, and the part of the city not affected by level 1365 would remain in place.

The three hypotheses are the northwest, which occupies the same area proposed by LKAB, the northeast which intends to position the city center between Kiruna and the village of Tuolluvaara, effectively merging them into a single urban agglomeration, and a mix of the two hypotheses that foresees the possibility of moving the city partly to the northwest and partly to the northeast without specifying where the new center will be. The main issue with this group of options is that once level 1,365 is exhausted if a new level is decided to be created deeper underground, the new city center would suffer the consequences. The northeast hypothesis would be directly affected[51], while the other two would be indirectly affected, as the city would be divided in two by the subsidence area.



Kiruna central area with surroundings, showing the possible locations in orange. **From Comprehensive Development Plan for the Central Area of Kiruna.**

The positive aspects of these three options undoubtedly include dispelling the specter of a future second relocation. However, there are multiple negative aspects. Firstly, the new settlements would be on virgin territories difficult to acquire and challenging to connect with new road infrastructures. Additionally, relocating the city so far away would either result in its division into two or necessitate the relocation of districts unaffected by deformations. The last alternative named "Alternative 0" is not to move the city at all. This hypothesis was included in the document merely for the sake of completeness because the consequence would be to close the mine, never taken seriously into consideration among the involved stakeholders.

Just 4 months later, the municipality made public the Environmental Impact Assessment for Comprehensive Development Plan for the Central Area of Kiruna **[11]**. From the title, the document might seem marginal regarding the topic of where the city will be relocated. However, in the final pages, the initial 7 hypotheses are reduced to 4, which means that a preliminary selection has already been made, discarding the less plausible hypotheses.

The hypotheses presented are: "Alternative 0", Eatnamvárri, and two new hypotheses, which are essentially reorganizations of the 3 hypotheses from the group that involved the development of the city center near

[10] Kiruna kommun. Aug. 2006. **Comprehensive Development Plan for the Central Area of Kiruna.**

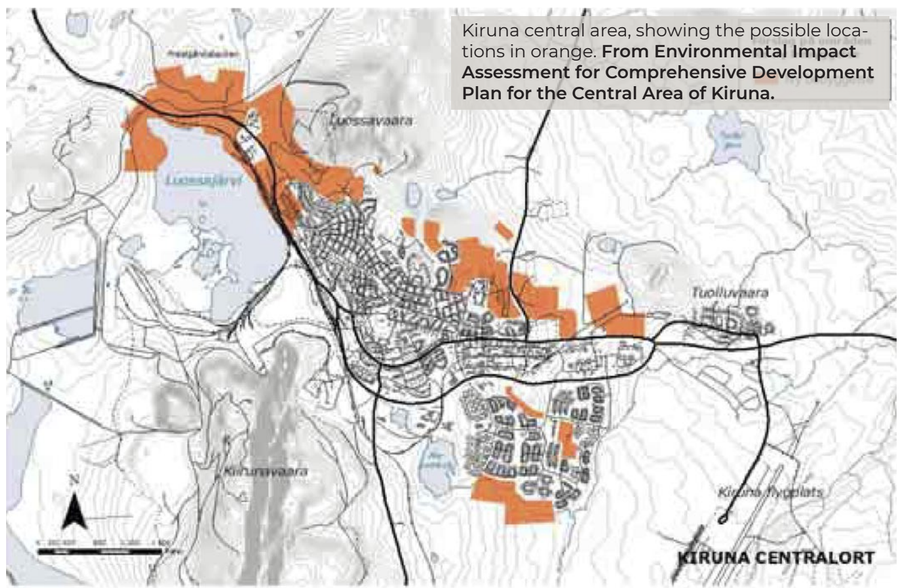
[51] Gimberger C., Norberg K. 2006. *Uppdrag att flytta en stad – en studie av planeringsprocessen i samband med Kiruna stadsomvandling.* Thesis: Uppsala University.

[11] Kiruna kommun. Dec. 2006. **Environmental Impact Assessment for Comprehensive Development Plan for the Central Area of Kiruna.**

the old city center. These two hypotheses, called "Alternative 1" and "Alternative 2", are the only ones left in the running, as the Eatnamvárri hypothesis, referred to in this document as "Alternative 3", is simply mentioned as a reminder that there are possibilities to relocate Kiruna far from its current position, which at this point in the discussion seems rather remote.

The two remaining alternatives were actually the most favored for some time; in fact, they are the only two that appear in a study **[5]** conducted by the municipality of Kiruna, predating even the first version of the Comprehensive Development Plan. The first of the two alternatives envisages development both northeast and northwest but with a focus on the northeast, while the other, conversely, still foresees development in both directions but with

[5] Kiruna kommun. Jun. 2005. **Sketch proposal - Alternatives for expansion and densification.**



Kiruna central area, showing the possible locations in orange. **From Environmental Impact Assessment for Comprehensive Development Plan for the Central Area of Kiruna.**

a focus on the northwest, resembling more closely the one devised by LKAB. For this latter option, two possible alternatives are also foreseen regarding the relocation of the railway line.

The advantages of "Alternative 1" are its proximity to the airport and the favorable climate, as the area is shielded from the north winds by the Tuolluvaara hill. The drawback of this option is obviously that the new city could be relocated once again, finding itself in a potential future subsidence area. This zone wouldn't affect the new city center in "Alternative 2", which would nevertheless be divided from the rest of the city. This option is also less favorable climatically, as a part of the new expansion would be exposed to the north. Various sources attest that in the following years the most accredited hypothesis was the Northwest alternative. For example, in a pamphlet produced by the municipality in 2007, it is stated that: "*The council decided to broadly follow the northwest alternative, but still not exclude settlement to the east*"[52].

The final decision on where to relocate the city was made only in 2011, and as often happens, it was the overlapping of new issues that had not yet arisen that settled the matter.

[52] Kiruna Municipality. 2007. *Kiruna - A city in trasformation.* Kiruna.

During the month of September, the city council voted to move the town to the northeast **[21]**. The main reasons why the other option was rejected are the limited space for further expansion of the city due to the desire of the Australian company Avalon to exploit the Viscaria copper deposit located right where the new city would have been built in "Alternative 2". The Swedish company Copperstone Resources also became involved in the matter, but preparations for the reopening of the Viscaria mine are still ongoing. The companies plan to start exploiting the vein by 2025[53], but in the meantime, Kiruna has taken the northeastern way.

[21] Kiruna kommun. Sep. 2011. **Agreement of the Municipal Board on city relocation.**

[53] Expected start of mining activities in Viscaria from Copperstone resources. Time plan Viscaria.

2007
[15]

3.2.3 Participation

Understanding the opinion of Kiruna's residents regarding the relocation process has always been a priority for the city administration. Their objective was "*to develop a cohesive, legitimate, and consensus-based vision for the future of Kiruna*"[54]. The involvement of the population in Kiruna has been a source of pride for the administration, but it has also been complicated, as is typical of processes of this nature. According to the administration, great consideration has been given to the opinions of the residents. However, according to some academics who have analyzed the issue, it may have been perceived as mere tokenism.

The tools used by the municipality to understand the population's opinion have included workshops, meetings, and surveys. The first notable survey

2007
[12]

was conducted in 2007, titled "**What is your impression of Kiruna?**" **[12]** The results of this survey were then compiled into another significant document titled "**So what did the people of Kiruna think?**" **[15]**

The questionnaire was distributed in paper format and placed in various key locations throughout the city, such as the library and one of the department stores. In total, 439 people participated in the survey, which is a significant number considering the population of Kiruna.

The questionnaire was divided into 5 parts. The first 3 parts included open-ended questions and asked citizens about general topics such as housing situations and the quality of pedestrian paths. The last two sections focus on the value that citizens attributed to certain historical buildings, aiming to gauge perspectives on relocating some of these buildings in the new city. The 42 buildings to be analyzed were already defined by the survey, which raised some criticisms: "*The usefulness of the survey is, however, relatively limited considering the fact that the objects and areas comprised are pre-defined*"[55].

[54] Sandberg L., Ronnblom M. 2016. Planning the new city-emotional reaction and positions. *Emotion, Space and Society.* Vol. 21.

[12] Kiruna kommun. 2007. **Survey "What is your impression of Kiruna?**

[15] Kiruna kommun. 2007. **"So what did the people of Kiruna think?" - Compilation of responses from the survey "What is your impression of Kiruna?"**

[55] Adolphson M., Olsson. K. 2009. Urban design and social life - the relocation of Kiruna. Conference paper: *AESOP.*

From the citizens' responses to this last part of the survey, it is evident that certain buildings such as the Kiruna Church, the Hjalmar Lundbohmsgården, and the Town Hall are considered of significant value to the population.

The municipality assesses the experience of this survey positively, to the extent that over the years it will propose various consultation[56] opportunities, such as in 2013, the results of which are reported in the **Kiruna 2.0 Vision report [a]**, or those launched in 2018: **Care of Kiruna** and **Kirunabo [b]**.

A recurring issue in each of these experiences is the difficulty of filtering out the true needs of the inhabitants from the designers' input. For instance, one element that the residents of Kiruna expressly requested is a large square in the new city center, a space that was lacking in the old town. The square, now built, appears to be of a certain architectural quality, but for many residents of Kiruna, it is too sprawling due to its size. According to the municipality, the two major criticisms were: "*The fact that residents change their minds over time and that since they are consulted, they rightly expect their requests to be listened to, and sometimes it is not possible to do so*"[57]. However, for the municipality representative, the experience remains highly positive.

As mentioned at the beginning of the chapter, not everyone evaluates this experience positively. In his master's thesis, Gebremedhin argues that residents' participation is deemed "*insufficient*"[58] providing several examples to support his hypothesis. He asserts that citizens were consulted only on decisions of minor significance and that they were never asked the main questions.

[a]
2013
2018
[b]

An example provided in the thesis is both specific and paradigmatic. Due to the city's relocation, it was necessary to relocate a railway track in an area used as pasture for the Sami reindeer. The solution proposed by LKAB was to build a bridge to allow the passage of the reindeer, and they consulted various representatives of the Sami community, but not to ask whether they agreed with the repositioning of the railway track, only about the characteristics of the bridge[59], obviously a topic of secondary importance for the devel-

[56] Huisman C. J. 2021. *Transforming the City of Kiruna: Stabilizing Change and Changing Stability.* PhD Thesis: Uppsala University.

[57] Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 7, 2024

[58] Gebremedhin F. 2018. *Urban planning from scratch: collaboration and participation of stakeholders in the urban transformation of Kiruna.* Thesis: Örebro University.

[59] Gebremedhin F. 2018.

opment of the territory.

While not overly critical of Kiruna's relocation management in general, Gebremedhin F. asserts that in terms of participatory aspects, it was utilized by the administration as a form of tokenism. Both in this thesis and in the article published in March 2021 by Tepecik D.A. and Karimnia E. for the online journal MDPI, it is highlighted how despite involving citizens in many processes, they were not allowed to express themselves regarding the main issue of the process: "*the same level of enthusiasm for engaging the residents did not seem to be visible in the decision-making process regarding whether the relocation should take place or not*"[60].

Even Hygerth J., in her thesis, while not accusing the institutions of tokenism directly, reports that most residents preferred Luossavaara or Etnavaara as the site for the construction of the new city center and that: "*Many residents also claim not to have been involved in the decision on the location of the new center*"[61]. Somehow agreeing with the previous two hypotheses that important decisions were unilaterally made by the political class.

It is not easy to determine years later how much influence the residents of Kiruna really had on the process, primarily because the original documents are unavailable. Some of the citizens' wishes were indeed respected, but it could be argued that the interventions requested would have been carried out regardless, such as the relocation of the church and the Hjalmar Lundbohmsgården. Some of the requests were not fulfilled, but many of them were due to unforeseen circumstances or issues that arose after the participatory events, such as the request to preserve the town hall building, whose relocation was not possible due to technical reasons.

In conclusion, it is difficult to establish whether the participatory process was a positive experience as claimed by the municipality, or merely superficial, as stated in several studies. What is certain is that the theme of "participation," for better or for worse, has played a prominent role in the chessboard of Kiruna's relocation.

[60] Tepecik D. A., Karimnia E. 2021. Reframing Kiruna's Relocation—Spatial Production or a Sustainable Transformation? *MDPI Sustainability.* Vol. 13, no. 3811.

[61] Hygerth J. 2014. *"Vart ska jag ta vägen?" En kvalitativ studie om kirunabornas, LKABs och Kiruna kommuns olika åsikter om den pågående stadsflytten.* Thesis: Uppsala university.

3.3 A master plan for Kiruna (from documents to buildings)

"Now we build our new city!"

Kristina Zakrisson

(Kristina Zakrisson, Chairman of the Municipal Executive Board, in the introduction of the Development plan, made by Kiruna kommun, White Arkitekter, and Ghilardi+Hellsten, published on March 2014.)

3.3.1 The municipality's request

When the discussion on where the new city should be located finally concluded, it was time to define what shape the new city center should take. This process also covered a quite extensive period: from 2011 to 2014.

Sep. 2011
[21]

The municipality's first step after consulting the residents to understand their needs regarding the new Kiruna was to announce a competition for the design of the new master plan that will guide the future development of the city. The decision to announce a competition was made in the same **city council meeting [21]** where the decision to relocate the city to the north-east was made. The master plan will be a central design document in this story, as are the documents produced by the city administration to announce the competition.

These documents, in particular, represent the demand to which the designers will have to respond with their proposals; they take into account various aspects such as: "*establishing the guidelines for urban transformation is defining a clear strategy that consid-*

[21] Kiruna kommun. Sep. 2011. **Agreement of the Municipal Board on city relocation.**

ers social, cultural, practical and experiential aspects"[62]. And they are to be considered as design tools in every respect.

The competition for the development of the master plan for the new city took place in two distinct phases: the objective of the first phase was to preselect 10 architecture firms capable of advancing a project as complex as the relocation of a city. The announcement for this first competition is described in the document titled "**A new city centre for Kiruna invite to an architecture competition**" **[24]**, made public by the city administration on April 12, 2012. Both for the specific requests they contain and for the influence they will have on the final master plan and the shape of the city.

Apr. 2012
[24]

Subsequently, in July of the same year, the jury announced the 10 finalists and the requests for the drafting of the master plan collected in a second fundamental document called "**Architecture competition brief**" **[26]**. This represents the actual competition from which only one winner will emerge.

Jul. 2012
[26]

[62] Nobile M. L. 2023. *Kiruna, lost and found: identity and memory in the streetspace of an Arctic town.* In Everyday Streets. London: UCL Press.

[24] Kiruna kommun. Apr. 2012. **A new city centre for Kiruna invite to an architecture competition.**

[26] Kiruna kommun. Jul. 2012. **Architecture competition brief.**

The first phase of the competition is open to everyone, with a multitude of architecture offices from all over Europe participating. Through this competition, the municipality aims to get an idea of which firms are more structured and which have more experience in urban planning.

The document presents an initial section where the city's situation and the administration's requests are described, as well as, of course, the project characteristics for where the new city will be established. One key aspect is the proximity of the disused mineral area of Tuolluvaara, which is intended to be integrated into the project as a historical memory.

The second part of the document contains the core of the problem. Through 15 questions grouped into 5 macro-themes, the expectations from the designers are highlighted. The questions range from the relationship between the old and new cities: "*How can the new city centre be integrated with the existing city? What do the functional and spatial interconnections look like?*" to purely climatic and obviously fundamental themes: "*How can development help to achieve a good microclimate, with shelter from cold winds, good solar irradiation, and temperature equalization?*" **[24]**

[24] Kiruna kommun. Apr. 2012. **A new city centre for Kiruna invite to an architecture competition.**

Area subject of the competition. **From A new city centre for Kiruna invite to an architecture competition.**

Although the sole objective is to select those worthy of moving on to the second phase of the competition, the authors of the document do not resist the temptation to guide the various submissions by listing possible examples of what could be integrated into the projects. The suggestions range from the generic "*Kiruna is very much a winter city. The natural potential here can be further developed in various ways for recreation, design, and enjoyment*", to the much more specific: "*The possibility is being explored of constructing a cabin ropeway to link the airport/ travel centres and the new city centre together*" **[24]**. This foreshadowing of the space shows that this is already, in every respect, a design document.

In the final pages of the text, the required deliverables are listed: 5 projects carried out by the participating studio, at least 3 of which must be completed, intended to be used as references for the future masterplan, and 1 A4 sheet of text encapsulating the design ideas. These A4 sheets constitute the embryo of what will be the project for the next phase, and one of them will be the gem of the future new city project.

A jury of 7 architects from the Kiruna municipality administration, the County Administrative Board, and the Swedish National Association of Architects will have the daunting task of selecting the 10 finalists, each of whom will be rewarded with 400,000 SEK, equivalent to about €45,000 today[63].

In July 2012, one month ahead of schedule, the municipality published the "Architecture Competition Brief" **[26]**, which constitutes the final phase of the competition. This document presents the 10 winners selected in the preselection phase, including renowned names like MVRDV and Ecosistema Urbano. From the depth of the content of the call for proposals and the breadth of topics covered, it is clear that this is a crucial phase for Kiruna. This is also evident from the refined graphic design, which will be reused in all future calls issued by the municipality.

This time, the stakes are not money but the assignment to assist the municipality in developing the master plan that will shape an entirely new city. The jury that will determine the winner is the same as in the first phase, except for the landscape architect Lisa Diedrich, who has been co-opted onto the jury.

[63] Data on the past values of currencies from fxtop.

[24] Kiruna kommun. Apr. 2012. **A new city centre for Kiruna invite to an architecture competition.**

[26] Kiruna kommun. Jul. 2012. **Architecture competition brief.**

Cover of the Architecture competition brief.
From Architecture competition brief.

1st PHASE

- **5** references
(of which **3** completed)
- design ideas — A4x1

2nd PHASE

- Description of a vision for Kiruna in 2030.
- Description of a strategy and basic structure for the phased urban transformation process, covering the whole of Kiruna in an easterly direction.
- Principles and structure of the new city centre in the easterly son of the entry, with standpoint rationales.
- Site plan, the entire city.
- Site plan, new city centre, scale 1:500.
- Longitudinal and cross-sections.
- Volume study, in three phases. The first development stage, with the two city centres interacting, and when the urban transformation is complete.
- Perspective of the site – air photo.
- Freely chosen perspectives and other descriptive images.

— A1x6

Request. Documents required for the two competition phases.

In the final phase of the competition, the requirements become more specific: the city must be able to evolve over time, so the possibility that another level may be created in the mine, necessitating a further relocation of the city, must be considered. Another requirement is the integration of the built environment with the surrounding natural context, to which the residents of Kiruna are deeply attached. The designers must also take into account the period during which the city will effectively have two centers, and create a strategy for repositioning historic buildings in a way that enhances their value.

Participants are also invited to rethink the area's infrastructure system, with a particular focus on the main communication routes: the railway and Highway 870. The municipality also communicated the urgent need to create an attractive city open to tourists to increase the population, ensuring the city's survival in the event of the mine's closure.

As expected, the opportunities for expression for the 10 groups in this phase are much broader. The deliverables requested by the jury range from "description of strategy" to materials at a scale of 1:500.

Each group will have 6 A1 sheets at their disposal, which must be submitted anonymously to ensure greater transparency in the jury's judgment. To claim authorship of the projects, each one will be marked with a motto.

Participants will have approximately 5 months to develop their projects, with the final submission date set for December 3. The jury also lists the criteria by which the proposals will be evaluated:

1 The extent to which the entry creates value for Kiruna as a whole.

2 The entry's qualities of urban design.

3 The functioning of the new city center and its relation to the existing settlement.

4 Possibilities of developing the entry.

5 Feasibility.

Vitruvius, in "De Architectura," stated that an architectural project is the offspring of both the designer, who represents the mother, and the client, who is the father. This statement seems to find perfect resonance in the case of Kiruna, where the masterplan for the new city is a result of the ideas of both the designers and the clients, represented by various stakeholders involved in the process, such as the municipality of Kiruna, the residents, and LKAB. These stakeholders have sought the advice of various architects who should be considered no less significant than those participating in the competition when it comes to the creation of the new city.

Architects who have the responsibility of selecting the winning project of the competition, a project that will be decided unanimously and announced in March 2013.

3.3.2 Kiruna Forever

"Kiruna Forever" was the motto featured on the boards of the winning project, but which firm had the daunting task of designing "Nya Kiruna"? More than a single firm, it was a collaborative effort, although the other competitors were also notable.

Dec. 2012 **[29]**

The team behind "Kiruna Forever" consisted of two architectural firms responsible for the urban design: White Arkitekter from Stockholm and Ghilardi+Hellsten based in Oslo. Spacescape conducted studies on the city's functionality, analyzing flows and areas of greatest attractiveness. Vectura Consulting handled the analysis of public transportation, and Evidens BLW evaluated the economic sustainability of the project[58]. These last three companies, like White Arkitekten, are based in Stockholm, confirming that knowledge of the Swedish territory and culture played an important role in the successful outcome of the project.

May 2012 **[25]**

Unfortunately, little is known about the **submission of the first phase [25]** which was delivered a month after the invite to the architecture competition. **[24]** The documents related to this time are unfortunately no longer available, likely because their production must not have required significant effort from the participating team and, at that time, they did not have the power to alter the built environment of Kiruna. But today, knowing that the group led by White Arkitekter was the winner and contributed greatly to shaping the new city, these documents are of vital importance, as they can be considered, as stated in the previous chapter, the embryo of the New Kiruna project.

The **project submissions [29]** from the teams were delivered in early December 2012. The winning project is distinguished by its density and the relationship between the inhabited area and the surrounding natural environment. The new city will develop starting from the eastern outskirts of the old city, which is the westernmost part of the lot, and then gradually proceed as buildings in the old city center are demolished, moving eastward following the E10 highway.

The first nucleus to be rebuilt will be the new city center, starting with the new town hall and the large square requested by the inhabitants of Kiruna.

Kiruna Forever, site plan. The entire city. **From A new city center for Kiruna. Jury Pronouncement.**

[25] White Arkitekter & Ghilardi+Hellsten. May 2012. **First delivery**.

[24] Kiruna kommun. Apr. 2012. **A new city centre for Kiruna invite to an architecture competition.**

[29] White Arkitekter & Ghilardi+Hellsten. Dec. 2012. **Kiruna Forever.**

The Kiruna Portal. Recycling house factory and meeting point. **From A new city center for Kiruna. Jury Pronouncement**

This strategy will optimize transportation during the intermediate phase when the two city centers will coexist and is consistent with the "2100 scenario" that the winning team wanted to explore. Indeed, if more buildings than anticipated need to be demolished for a new expansion of the mine, the city could continue to expand eastward without too many problems.

The first phase of city development will be carried out on a rectangular plan divided into a non-orthogonal grid to mitigate the strength of the wind, a fundamental requirement in Arctic territories. In a subsequent phase, portions of a linear city will branch out from this rectangular plan, gradually extending towards the natural areas. These areas will be easily accessible to all inhabitants thanks to the "fingers" of untouched land that will be left between one segment of the linear city and the next.

The arrangement of open spaces is certainly a strong point of the project. In addition to the "natural" parks, a linear city park will stand out, cutting the city in two along the tracks of the old railway that once served the now abandoned area where the Tuolluvaara mine was located. The area that will serve as the endpoint of this new main axis of the new city will be converted into a cultural hub, leveraging its value as an industrial archaeology site. The other end of the park will be connected via a pathway to the mining park that will replace the old city center, maintaining a physical as well as an ideal connection with the Kiruna of the past.

The strategies of the group led by White Arkitekter do not stop at the planning of the urban environment as a physical place but propose a series of strategies to facilitate the relocation process. One example is the "Kiruna Portal" **[29]** tool, which is both a physical and digital tool designed to recycle materials from the old Kiruna in the construction of the new city.

The strength of the winning project lies in the simplicity with which it combines abstract and futuristic visions that extend up to a horizon of 100 years with extreme pragmatism, making it objectively the most functional and easily achievable of the 10 projects in the competition.

As already stated at the end of the previous chapter, in March 2013, after 4 months of consultation, the 8 members of the jury proclaimed the winner and, once again, produced a document: "**A new city center for Kiruna. Jury Pronouncement**" **[32]**. The document in question is divided into 3 parts; in the first part, the work of the jury is reviewed, from which it emerges that the decision was also made based on the will of LKAB, the municipality, and the inhabitants, stakeholders with whom the jury claims to have interacted repeatedly.

Mar. 2013
[32]

In the second part of the document, the jury outlines its own vision for the city's development, providing advice for future planning, both in terms of organizational aspects: "*The Municipality and LKAB creating a joint model for urban development so as to realize the*

[29] White Arkitekter & Ghilardi+Hellsten. Dec. 2012. **Kiruna Forever.**

[32] Kiruna kommun. Mar. 2013. **A new city center for Kiruna. Jury Pronouncement**.

vision of the New Kiruna". As well as strictly design-related aspects: "*Changes need to be made to the entry. This applies to the routing of the E10 and 810 highways and to the need for grouping public and historic buildings more closely*" **[32]**. Thanks to the work of the jury, which goes beyond the mere task of selecting one of the participants, this document rises to the level of a design document on par with that produced by White&co.

The jury intervenes in the process by recommending which changes to make to the winning project, what to take from other projects, and what to include based on the knowledge they have gained in the decision-making process.

Mar. 2014
[41]

In the final part of the document, the jury comments on the projects, dedicating 2 pages to each starting from the winner, to which it allocates 8 pages, in which the reasons for the jury's unanimous decision are evident. There are many aspects that the jury emphasizes, stating the reasons why this project was chosen above the others, foremost among them being a clear starting point, namely the city center, and a strong strategy for the future development of the city which, according to the jury, has the peculiarity of providing: "great liberty for building further from there in several different directions[83]" minimizing the risk of urban transformation being hindered by future mineral discoveries. The judges, in addition to rewarding the adaptability of the project, highlight how the relationship of the new city with nature fully meets the expectations of the inhabitants. According to the jury, following the framework produced by White&co, the inhabitants will have the opportunity to express their will to the fullest.

Once the best team has been chosen, it's time to design the new master plan for Kiruna based on the winning project. This task will be carried out by the designers of Kiruna Forever together with the municipality, as per the agreement.

The process lasted another year, at the end of which, on March 17, 2014, the "**Development Plan**" **[41]** was finally made public, definitively shaping the form of the new city. The document, unlike previous ones, is written entirely in Swedish, which reflects the target audience: the citizens of Kiruna. The plan contains many elements of the winning masterplan from the competition, some recommended by the jury, and others that were deemed appropriate to integrate later.

[32] Kiruna kommun. Mar. 2013. **A new city center for Kiruna. Jury Pronouncement**.

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

Map of the new city center with green highlighting the areas with vegetation. **From Development Plan.**

Render of the new square of Kiruna in winter. **From Development Plan.**

The document is divided into 4 parts, with the third part, spanning 80 pages, describing the development plan for the new city.

A first change compared to the initial project is the shape of the main square, which in this phase takes on the characteristic hexagonal shape very similar to the one that will then be realized: "*The square becomes a reference point and a meeting place thanks to its strategic position in the city's road network and its hexagonal shape that gathers*" **[41]**. Furthermore, the choice of the irregular hexagon is dictated by the microclimate of the area, as it has been tested how the space is extremely sheltered from the strong winds blowing in the area. Inside the space, the new city hall is already included, as planned in the previous master plan.

From the new plans, it is also evident how the hypothesis of expansion through linear city sections, which was initially planned only at a later stage, has been included in the nearest scenario. In fact, in the new plan, there are three expansion directions towards the north. This necessity arises from the need to replace all the structures that will be demolished in the new city in a perfectly symmetrical manner, ensuring that no one is left without a home, as well as the same services as the old city. To achieve this, the Development Plan is accompanied by an in-depth study of the fabric of that third of the city that will be dismantled.

The management of open spaces, on the other hand, is consistent with what is described in the White&co. project. Green spaces are organized according to 3 levels: the "natural parks" in continuity with the virgin area outside the city that penetrate the city through the "green fingers," ensuring that the maximum distance to reach one of these areas is always less than a kilometer; the "city park," which remains substantially unchanged; and the "neighborhood parks," small in size to ensure that the maximum distance from each residence is less than 300 meters. Another strong point of the winning project that is being taken up is the temporal development, which plans to start building the new city in continuity with the old one and then continue eastward so that "Kiruna is not relocated – it evolves." Development will be guided by public spaces, which must always come before private structures.

In the central area, buildings will be taller to ensure the desired density, while in the outskirts, buildings will be of smaller dimensions to maximize the supply of sunlight to the natural parks so that they can be used even during the coldest moments of the year.

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

The plan describes in detail where the various functions will be located, with most services placed in the center, demonstrating the desire to create a strongly monocentric city. Another section is entirely dedicated to public and private vehicular mobility, as the car is the main means of transportation used.

Oct. 2014
[44]

On page 85, a possible arrangement for the historic buildings that will be transported from the old city is also described, showing how at this stage the intention was to scatter them as much as possible, trying to place them in high-traffic areas where they are highly visible.

The document does not shy away from making significant leaps, using isometric renderings to describe key buildings such as the new tourist center hoped to coincide with the railway station.

Finally, the plan highlights decisions that were not possible to make due to lack of time and divergent visions, decisions that will be made in the years to come, and some of which are still pending, such as the positioning of the railway station or the route of the E10, which the jury hoped would be moved out of the city center **[32]**. Or even the number of historic buildings to be relocated, on which the Municipality, LKAB, and County Administrative Board have not yet been able to agree.

However, this comprehensive document is not just a technical object, because to implement the future forecasts contained within it, a series of documents with the force of law are needed. The first of these, published in October 2014, is the "**Detailed Overview Plan for the Central Area of Kiruna 2014**" **[44]**, which makes certain provisions of the plan mandatory.

The detailed overview plan is one of the three planning instruments that Swedish municipalities have to control the territory, according to the Planning and Building Act of 2010 **[c]**. Like the overview plan, it is not mandatory, but modifying it, as stated by the municipality's technicians[64], is extremely difficult, and the process involves presenting overwhelming evidence to the County Administrative Board of the need to modify the current plan. However, this tool is based on documents that rarely exceed the scale of 1:10,000, making the forecasts extremely generic and not reaching the level of an Italian PRG.

Therefore, to implement the highly specific provisions of the Development Plan **[41]**, the third and final tool available to Swedish municipal administrations will need to be utilized: the detailed plan, which is mandatory, unlike the other two. This type of plan can be compared in terms of detail level to an Italian PP. Due to its characteristics, this tool covers a much smaller area compared to the detailed overview plan, which is why several will be produced to realize the new center of Kiruna, and it will take time to do so.

[32] Kiruna kommun. Mar. 2013. **A new city center for Kiruna. Jury Pronouncement**.

[44] Kiruna kommun. Oct. 2014. **Detailed Overview Plan for the Central Area of Kiruna 2014.**

[c] Jul. 2010. Ministry of Rural Affairs and Infrastructure SPN BB. **Planning and Building Act (2010:900)**

[64] Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 7, 2024.

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

3.3.3 Who pays for what?

In 2014, when the master plan for Kiruna was finally ready, LKAB, according to World Finance[65], had already invested 2.1 billion euros. It has already been stated that the mining company that "caused the damage" will cover all the expenses for the reconstruction of the city, but this statement is too simplistic. Understanding how the economic flows from LKAB for the relocation of Kiruna work is essential to comprehend the process itself.

The agreement that LKAB proposes to compensate those who lose their properties makes no distinction between public entities and private citizens, whether they are entrepreneurs with commercial activities or simple residents who own the house they live in. Everyone can choose between two options: they can either accept to be relocated to the new center in a building with the same characteristics and size as the one that will be demolished or sell their property at a price increased by 25% compared to the market value. The only exception is for apartment owners in a multi-story building; for them, the only option is to sell. However, LKAB still allows them to purchase a new apartment in the new city center for the same amount they sold their previous one.

Both options have their advantages and disadvantages. The first option is less risky; if one chooses this path, they are assured of receiving a property at least equivalent to the previous one, which also includes the same type of building. For example, those who own a single-family home will receive a home of the same type. Those who want a higher-value property, such as a larger house, can simply pay the difference to LKAB. Property owners can choose from a range of available options at the time, which can be very limited depending on the uniqueness of the property they are leaving. This limited decision-making power is the main issue with this option.

The second option has an underlying problem: the price of the properties is determined by LKAB itself, which creates a significant conflict of interest. Up to now, there haven't been many complaints, but there are rumors that "*some dissatisfied property owners challenged the mining company's valuation and received much more money than initially offered*"[66]. Even though LKAB claims that the properties will be "*valued without any effect of the urban transformation process*"[67], it is extremely difficult to assess a property in an area that will soon be completely dismantled[68]. Moreover, will the money be enough to buy a house in the new Kiruna?

Another mistake made by the municipality was selling all the properties immediately, only to find themselves, several years later and due to the significant devaluation of the SEK, with half the purchasing power. This means they will have to pay for most public buildings with taxpayers' money.

LKAB also offers former property owners the possibility to continue using their properties until it is time to demolish them. These owners must, of course, pay rent. This solution allows LKAB to purchase properties well in advance and recoup part of the expenses through rental income. For the owners, it allows them to stay in their homes until the last moment or continue their business if the property has a commercial use.

In this sense, the story of one of the hotels in the old city center is emblematic: the hotel is located within the deformation area and, at the time this thesis is being written, is waiting to be demolished.

The owners decided to sell the hotel because, as good entrepreneurs, they want to have full control over the construction of the new hotel that will be built a few kilometers further east in "Nya Kiruna." The hotel was **sold [d]** in February 2024 but remained open throughout the summer with rent being paid.

Feb. 2024 **[d]**

In October, it was time to **close [e]** the doors to allow LKAB's bulldozers to demolish it. During this period, the owner was searching for a plot in the new city center to build the new structure but without success. Space is limited and difficult to find. Additionally, construction is very expensive due to land reclamation costs; about 4 meters of sand contaminated by radon **[42]** by the disused Tuolluvaara mine need to be removed. All these factors are making the hotel owner consider not rebuilding it at all[69].

Oct. 2024 **[e]**

The scarcity of building space is also due to the strategy the municipality is using: since the timeline does not al-

[65] Rhys. T. 2014. Moving Kiruna: what does it take to relocate a city? *World Finance*.

[66] Member of the Culture and Education Department of Kiruna kommun. Personal interview, May 6, 2024.

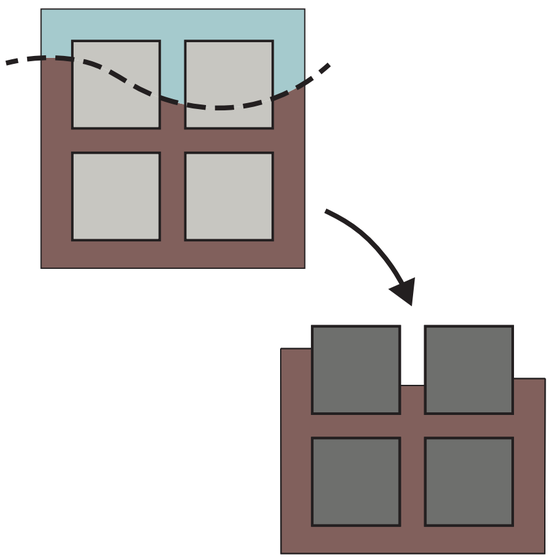
[67] Information on property valuation from LKAB For people who own a house.

[68] Gebremedhin F. 2018. *Urban planning from scratch: collaboration and participation of stakeholders in the urban transformation of Kiruna*. Thesis: Örebro University.

[42] Kiruna kommun. Mar. 2014. **Detailed plan for LINBANAN 1.**

[69] Hotel manager. Personal interview, May 28, 2024.

Schema of demolitions and reconstructions. In brown, the streets affected by deformations and those reconstructed; in blue, those not affected by deformations.



low for knowing in advance who will sell and who will move, the strategy so far has been to construct buildings with the same characteristics as those being demolished. This ensures that, in the worst-case scenario where no one decides to sell, there would be a suitable property for everyone. However, this means that many single-family houses are being built, just like those in the old center, which significantly increases land consumption.

But perhaps the biggest problem is that the damage compensation system is extremely rigid. If LKAB has to dismantle 1 km of road, it will pay for 1 km of road[70], regardless of whether this is enough to adequately connect the new city. Furthermore, it does not consider all those citizens who have suffered damage indirectly, such as those living in the areas of the old city spared from demolition. These people used to live near a city center full of services and now find themselves on the outskirts.

Another example of this issue is represented by one of the schools just outside the deformation area, which, when the new city center is completed, will be at the other end of the city. This will increase travel times for those who use it. The problem of travel will be even more pronounced if the red line, as seems imminent, advances, leaving a narrow passage between the old city and the new one[71], which the municipality predicts will be the Achilles' heel of urban mobility. And as far as we know, the problem will fall on the citizens if solutions are not found.

These secondary damages are a very slippery subject. While it is relatively easy to assert that there are numerous indirect issues related to the relocation of the city, it is equally difficult or almost impossible to quantify their extent. For now, at an institutional level, the topic has not yet been discussed, and it is not expected to be addressed anytime soon.

[70] Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 7, 2024.

[71] Member of the Culture and Education Department of Kiruna kommun. Personal interview, May 6, 2024.

3.3.4 Where are we at?

It's interesting to note that in 2014, 10 years after the start of the Kiruna relocation process, no urban transformation has yet taken place. A myriad of assemblies and meetings, countless agreements leading to the drafting of hundreds of documents, some characterized by strong projectivity and others less but equally important, all this without seeing the effects. In fact, at this point, no building has yet been demolished, rebuilt, or relocated.

2015 **[46]**

But of course, all this preparatory work has not been done in vain, and soon the process of physical transformation will begin, which will be no less complex than the projective one. Before these documents finally begin to transform into buildings, however, one last step is missing: detailed planning. The first detailed plan for the city of Kiruna covers an area of only 2,800 square meters and envisages only one building. The plan has been drawn up for the construction of the first building in the new Kiruna: the new Parliament. A Parliament that has been designed following another important competition, but that's another story.

2015 **[47]**

Mar. 2014 **[42]**

The "**Detailed plan for LINBANAN 1**" **[42]** was drawn up concurrently with the publication of the master plan **[41]** in March 2014 and even before the drafting of the new detailed overview plan **[44]**, in order to expedite the process. The plan presents only two provisions: the land use designation "Urban center development and culture" and the maximum height the building can reach: 504 meters above sea level[72], which corresponds to about 65 meters above ground level at the project site, to avoid interfering with air traffic from the nearby city airport.

Construction [46] work on the new city hall began a year later in the autumn of 2015, the same year in which further modifications were made to the general master plan, which is published under the name "**Adjusted Development Plan [47]**", and still represents the version used today after 10 years.

Certainly, there are no drastic differences compared to the previous plan, but upon careful comparison, several elements that have been modified stand out. For example, the central square

[42] Kiruna kommun. Mar. 2014. **Detailed plan for LINBANAN 1.**

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

[44] Kiruna kommun. Oct. 2014. **Detailed Overview Plan for the Central Area of Kiruna 2014.**

[72] Altitude data from calcolopercorso.

[47] Kiruna kommun & White Arkitekter. 2015. **Adjusted Development Plan.**

Plan of the new city center, In red, the locations where the buildings will be relocated. **From Adjusted Development Plan.**

now takes its final shape, and even the large school complex just north of it, appears for the first time. It can be noted that buildings to be repositioned, highlighted in red, take on a different layout compared to the previous plan, concentrated in small clusters. Finally, perhaps the most noticeable difference is the residential area to the northwest, where the ratio between the famous "Green Fingers" and portions of linear city is altered in favor of the latter to meet the ever-increasing need for space.

Jul. 2016 [49]

The first detailed plan to be implemented from the new master plan is the "**Detailed plan for square and commercial street**" **[50]**, approved in July 2016. This plan defines the entire area near the town hall, comprising 9 blocks known for their density. Among these are the 6 buildings that will face the main square. The functions are mixed, both public and private, with residential being prominent, as well as the possibility of incorporating accommodation facilities such as hotels. For all buildings in this plan, the only height limit is imposed by air traffic.

Nov. 2018 [59]

Three years after the start of construction, the town hall is finally **completed [59]**, and its inauguration takes place on November 22. It's a milestone in

Detailed plan for LINBANAN 1.

Detailed plan for square and commercial street.

[49] Kiruna kommun. Jul. 2016. **Detailed plan for square and commercial street.**

Detailed plan for retail park and center, part of property Tuolluvaara 1:1 and others.

Kiruna's history. Finally, after 14 long years since that fateful letter, residents can see the first results of the relocation process firsthand.

However, at the time of its construction, the town hall stood as a cathedral in the desert, with no trace yet of the buildings that would form the city's first nucleus. This was mainly due to the financial crisis that led to a collapse in the steel market, resulting in a halt in extraction activities between 2014 and 2016. A stop in mining activities means no more deformations and consequently no need to relocate buildings. But with the rise of global steel price, the process will soon need to accelerate exponentially.

Mar. 2019 [61]

In March 2019, the municipality produced another plan: the "**Detailed plan for retail park and center, part of property Tuolluvaara 1:1 and others**" **[61]**. This plan covers the entire eastern zone of the new expansion, extending to the route of the new A10, which forms the eastern boundary of the new city. Here, the anticipated functions are both retail and wholesale commercial activities, with residential functions also planned for the central part of the plot. Additionally, one of the lots is earmarked for the construction

[61] Kiruna kommun. Mar. 2019. **Detailed plan for retail park and center, part of property Tuolluvaara 1:1 and others.**

of the city's prison. Unlike the central zone, the height of the buildings here is divided into two concentric bands: in the inner band, buildings can reach up to 29 meters, while in the outer band, the limit is 23 meters, to facilitate sunlight exposure for the natural areas as envisaged in the 2014 masterplan **[41]**. Just one month after the approval of the "Detail plan for retail park and center" **[61]**, the area regulated by the "Detail plan for square and commercial street" **[50]** is beginning to take shape: **construction [63]** of the Scandic Hotel has begun. The Scandic was a historic hotel in the old center of Kiruna, located inside the red area. The construction company Skanska is building it for LKAB, which purchased the hotel from its previous owners, who decided to leave Kiruna. This will be followed by the **construction [65]** of the Aurora Center and the residential building that closes the town hall square to the west named "Block 1".

Apr. 2019 **[63]**

Nov. 2019 **[71]**

Apr. 2019 **[65]**

A few months later, construction also begins on blocks 7, 8, and 9, three large block buildings located east of the town hall that fully occupy the three blocks they stand on. The primary use of these buildings is residential, except for the ground floor, which is entirely dedicated to commercial purposes. The unique feature of these buildings is that the shops face both outward and inward onto an enclosed public space, creating a shopping arcade.

Nov. 2019 **[72]**

The reconstruction process is now in full swing. The entire area, which had previously seen only the construction of the town hall, is now a large construction site that will shape the central core of Kiruna.

From this moment on, the process will further accelerate. In fact, in November 2019, two more detailed plans were released. The first is the "**Detailed plan for part of Tuolluvaara 1:1**" **[71]** which will initiate the expansion of the center towards the north. This area is planned to primarily feature housing, neighborhood services, and a small school, in a predominantly residential area where the buildings, according to the plan's prescriptions, must be more modest in size compared to the city center.

The other document is the "**Detailed plan for the KNOWLEDGE HUB**" **[72]** which concerns an area northeast of the center where the Tuolluvaara mine once stood. Here, the most extensive

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

[61] Kiruna kommun. Mar. 2019. **Detailed plan for retail park and center, part of property Tuolluvaara 1:1 and others.**

[50] Kiruna kommun. Jul. 2016. **Detailed plan for square and commercial street.**

[71] Kiruna kommun. Nov. 2019. **Detailed plan for part of Tuolluvaara 1:1 m. fl.**

[72] Kiruna kommun. Nov. 2019. **Detailed plan for the KNOWLEDGE HUB.**

Detailed plan for part of Tuolluvaara 1:1 m. fl.

Detailed plan for the KNOWLEDGE HUB.

and important building in the city is planned: the educational complex, which is not subject to height restrictions to leave all possibilities open for its construction. The plan also includes a swimming pool whose design was in a very advanced stage, which is why the municipality had to hurry to approve the plan that was drafted in just a year and a half, a short period for such a document[73].

Meanwhile, the design of the police station with an attached prison, as provided for in the "Detailed Plan for Retail Park and Center, part of property Tuolluvaara 1:1 and others" **[61]** has begun, and soon the swimming pool and the educational complex named after Hjalmar Lundbohm will follow.

The educational complex, in particular, is one of the city's showpieces, encompassing all the high school programs in the city. A large atrium with full-height ceilings welcomes students from the main entrance. The roof, supported by slender truss beams, opens into a skylight, shedding diffuse light onto the atrium and the adjacent areas on the first floor. The structure also features state-of-the-art laboratories, a library,

[73] Former Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 29, 2024.

[61] Kiruna kommun. Mar. 2019. **Detailed plan for retail park and center, part of property Tuolluvaara 1:1 and others.**

and several multifunctional rooms, totaling approximately 40,000 square meters.

Feb . 2022
[85]

In February 2022, the Scandic Hotel was **completed [85]**, its iconic silhouette standing out against the Kiruna skyline, and in April, it hosted its first guest. A skyway connection to the library, as in the old city center, was also built. The library was completed shortly afterward, followed by Block 1 and then Blocks 7, 8, and 9. The moment for the

Sep. 2022
[90]

inauguration of the city center [90] finally arrived, with the ceremony taking place on September 1, 2022.

Due to the increasing demand for housing due to the progressing deformations in the old town center, the city is expanding to the northwest. Two more plans were drafted: the "**Detailed plan Tuolluvaara 1:1 and others part of, Western green finger**" **[91]** in November 2022, and a month later, the "**Detailed plan Tuolluvaara 1:1, part of Northeast of Vinterleden**" **[93]**. These two plans complete the northwest quadrant of the city, and, as suggested by the name, include the project for the "Green Finger." The function of these areas is primarily residential and features the typical height gradient of buildings decreasing towards the natural areas, as previously mentioned.

Nov. 2022
[91]

Dec. 2022
[93]

These two documents, however, are atypical compared to the other detailed plans seen so far. They do not merely regulate the functions and heights of the various lots; both also include a more detailed plan, providing an example that the designers of the buildings in the area can follow. These examples were requested by the developers of the areas themselves, who often "*follow them to the letter*[62]" to expedite the process and avoid problems with the municipality.

The latest plan to be developed by the municipal technical offices is the "**Detailed plan proposal for the City Park**" **[98]** of October 2023, which, as the name clearly indicates, concerns the linear park. This was followed by the **inauguration [99]** of the educational complex Dedicated to Hjalmar Lundbohm in December of the same year.

To date, the police station and the prison have also been completed, along with most of the residential buildings in the northwest sector. The swimming pool and a hotel located between blocks 7 and the library, commissioned by the municipality to LKAB, will be inaugurated shortly.

Within about a decade, the new inhabited center has emerged, but it will take much longer before it becomes a true city. Buildings alone do not make a city; much more is needed. However, the crucial first step of transforming the space has now been accomplished, and with surprising results.

Detailed plan Tuolluvaara 1:1 and others part of, Western green finger, housing etc.

Detailed plan part of Tuolluvaara 1:1 etc., northeast of Vinterleden, housing etc.

Detailed plan proposal for the City Park.

Oct. 2023
[98]

Dec. 2023
[99]

[90] Kiruna kommun & LKAB. Sep. 2022. **Inauguration ceremony of blocks 7, 8, 9.**

[91] Kiruna kommun. Nov. 2022. **Detailed plan part of Tuolluvaara 1:1 etc., Western green finger, housing etc.**

[93] Kiruna kommun. Dec. 2022. **Detailed plan Part of Tuolluvaara 1:1 etc., northeast of Vinterleden, housing etc.**

[98] Kiruna kommun & LKAB. Oct. 2023. **Detailed plan proposal for the City Park.**

Housing in New Kiruna. **Photo by author.**

Kiruna, New City Center. **Photo by author.**

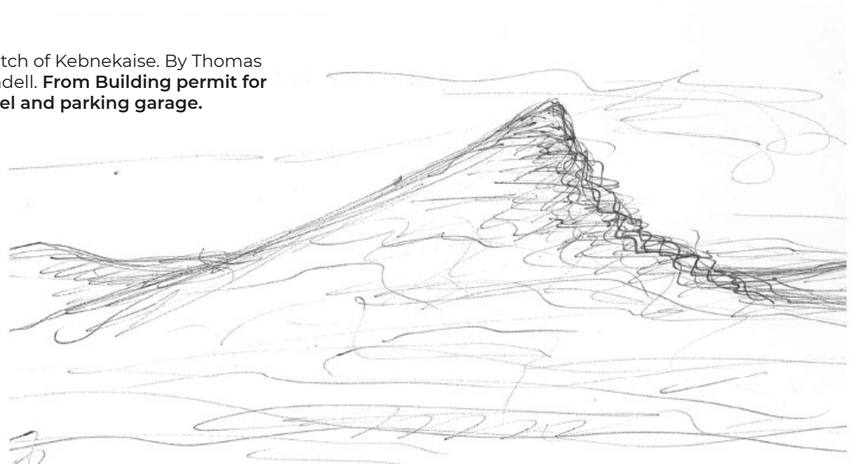
3.3.5 Scandic

The idea of repositioning the city's main accommodation facility in the new central square dates back to the **Development Plan** of 2014 **[41]**. Shortly thereafter, a Call For Proposals was issued for the design of the three lots that close the square to the north and east, including the Scandic and the Aurora conference center. Subsequently, the municipality decided to hold three separate competitions, one for each lot, to assign them individually to different developers, perhaps concerned that a single stakeholder might not be able to manage all of them.

The competition for the Scandic was won by the group led by the development company Skanska, which is very active in Kiruna and had also participated in the previous competition for the entire area. For the drafting of the project, Skanska hired Thomas Sandell. The famous Swedish architect designed the new hotel, which "*draws inspiration from Kebnekaise*" **[f]**, the highest mountain in Sweden, visible from the old center of Kiruna on clear days.

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

[f] Kiruna kommun & Skanska. Nov. 2018. **Building permit for hotel and parking garage.**



Sketch of Kebnekaise. By Thomas Sandell. **From Building permit for hotel and parking garage.**

The ridge of the roof on the west facade features a curve that enhances the silhouette of the Scandic, reaching up to the limit of 504 meters above sea level, a height that must be respected to avoid obstructing air traffic. The south facade, on the other hand, descends with terraces. The two facades represent the slopes of the mountain: one gentler and more regular, the other rocky and rugged.

However, for at least two years, due to the aftermath of the 2008 financial crisis, which led to a decrease in mining activities, the project came to a halt. This was not due to reduced income for LKAB but to the slowdown of activities within the mine, which in turn caused a slowdown in other operations. No more deformations meant no more need to move the city.

In 2016, with the resumption of activities in the depths of Kiirunavaara, negotiations began between the municipality, eager to assign the lots in the city center and the developers. However, these private actors were in no hurry and were instead waiting to see which other private stakeholders would be involved in the project. No one wanted to risk building without being absolutely sure that others would also be starting. Skanska, in fact, ensured through the **land acquisition agreement [g]**, also signed by the municipality, that all the lots near the one hosting the hotel would be developed to avoid the Scandic standing alone. Since all the developers interested in operating in Kiruna were reluctant to begin construction without absolute certainty that the other projects would also be realized, the municipality, through Kiruna Boostader and LKAB, was forced to finance a large part of the operations.

During this period, the two parties also agreed on the construction of the parking lot, incorporated into the hotel structure but financed with public funds. The Scandic required only 60 parking spaces, while the structure is expected to contain 170, with the remaining 110 available to the citizens of Kiruna.

In the same year, after purchasing the area in the new city, Skanska reached an agreement with LKAB and the former owners of the Scandic, who were still involved at this point in the story, to develop the hotel project.

Through its construction company, Skanska built the building for LKAB, which, in the meantime, had bought the old Scandic Ferrum, one of the most profitable hotels in Sweden, still awaiting demolition in the old center of Kiruna. However, LKAB remained inactive in the debate regarding the final form of the building, which could

Nov. 2016
[g]

[g] Kiruna kommun & Skanska. Nov. 2016. **Land acquisition agreement.**

Render of the Scandic Hotel (first project).
From Nordisch Info.

still change since the winning design of the competition was not binding for the construction of the building.

In this debate, the two main actors were the municipality's technicians, who pushed to maintain the aesthetic qualities of the architecture that won the 2014 competition as much as possible, and Skanska, which tried to modify the initial project to make it as simple and economical to build as possible. This aligned with the future operators' goal to maximize functionality, given that the winning project of the competition was not binding for the construction of the building.

For the Municipality, it is particularly important to maintain three features that the project presented during the competition phase: the first is the shape of the building, the second is the material (initially, all three buildings in the first competition were supposed to be clad in wood), and the last feature is the presence of two particular spaces: the sky bar on the top floor to allow the viewing of the northern lights, and the courtyard, accessible from the outside and designed as a public space.

The shape does not vary much from the original. The irregular plan of the tower was simplified into a rhombus so that the sides were parallel in pairs. Additionally, a third floor was added at the request of the future operators of the hotel to increase the total volume, a modification that made the building bulkier and less graceful. The upper part of the west facade, which was supposed to be slightly curved, was straightened for construction ease, and the tower plan became larger to avoid the vertical connections significantly impacting the total floor area, which contributed to making the building less slender.

Regarding the cladding material, Thomas Sandell managed to convince the Municipality to change the wood to concrete panels. This was due to the greater familiarity that the construction company Skanska had with the material and its greater resistance to weather conditions, in addition to the lower maintenance needs, which were fundamental given the building's height and the area's extreme climatic conditions. The panels were designed to resemble the snow formations on Kebnekaise, a feature that the Municipality liked, and they accepted the modification.

The windows, which were initially supposed to decrease in size as the building rose, underwent a process of standardization. Instead of having a different size on each floor, there were only four types of windows, which reduced costs. The sky bar was retained but without an open terrace at the top due to obvious issues related to snow removal and the impossibility of using such a space for most of the year be-

Nov. 2018
[f]

cause of the prohibitive temperatures and strong winds. Regarding the internal courtyard, in the final project, access from the outside was closed, and a central space was built instead. This central space, a floor designated as a banquet hall at the request of the future hotel operators, replaced the courtyard, which had been designed for the disposal of the heavy snowfall. Snowfall is so abundant in Kiruna that it is a fundamental consideration in building design. Specifically, there must be places throughout the city to accumulate snow until summer, and one of these places was supposed to be the courtyard of the Scandic.

Apr. 2019
[63]

Flat roofs, although not the primary choice in a city so far north, can still be cleared of snow manually by simply pushing it off. However, this is not possible in the constructed courtyard, which acts like a sink. The ingenious solution that the designers found in this case was to create an opening between the roof of the banquet hall and the first floor of the parking garage. Through this opening, snow can be moved into the garage and then outside. However, this system, while smart, does not seem to work very well because the opening tends to freeze when it gets too cold, preventing snow transport through it[74].

The negotiations that led to these changes are contained in a series of documents culminating in the **Building Permit [f]** issued in November 2018, which authorized Skanska to start construction work.

After two extensions of the land acquisition agreement, necessary because this document in Sweden is valid for only two years, **construction [63]** of the hotel finally began in 2019. The second extension mentions the municipality's intention to create a skywalk between the Scandic and the Aurora Congress Center, allowing hotel guests to access the cultural center directly without going outside. This feature was borrowed from the old city where the two buildings are still connected by a skywalk today. The document also mentions that Skanska would be responsible for its construction on behalf of the municipality.

However, since at the time of constructing the Scandic the Aurora Congress Center had not yet been built, Skanska had to design the building so that the skywalk could be added later. Apparently, something went wrong because the first-floor heights of the two buildings do not match, leading to a dispute over which party should modify their building, the municipality or Skanska.

[74] Project development company head manager. Personal interview, Jun. 6, 2024.

[f] Kiruna kommun & Skanska. Nov. 2018. **Building permit for hotel and parking garage.**

Render of the Scandic Hotel (last project). **From the Quality program for the new Kiruna City Center.**

To resolve the disagreement, it was decided to include an internal staircase in the Aurora Congress Center, especially since the municipality's building was constructed later, implying responsibility might fall on them.

Feb. 2022
[85]

The hotel was **completed [85]** in February 2022, two months ahead of the final deadline set in the Land Acquisition Agreement **[g]**, which was stipulated for April.

[g] Kiruna kommun & Skanska. Nov. 2016. **Land acquisition agreement.**

The skywalk between the Scandic and the Aurora Congress Center. **Photo by author.**

3.3.6 Malmbanan

The history of the railway relocation runs parallel to that of Kiruna, much like the tracks run parallel to the city. However, unlike two straight lines that never intersect, these two histories have multiple points of intersection, as is natural. These intersection points are the city's planning documents, which always contain interesting information regarding the railway.

In most of these cases, it can be observed how the railway has been subordinate to the decisions regarding the city, changing its route several times to adapt to the various plans produced over time. However, this should not lead one to think that the railway is less important than the city, because, without the railway line, it would not be possible to transport iron, and without iron, according to many, Kiruna would not exist. The significance of this issue is evidenced, in an interview with the head of the secretariat of the Kiruna municipality from 2006: "*If we do not resolve the railway issue, we do not need to worry about the rest, because LKAB cannot survive without the railway, it is that simple*"[75].

The municipality, on the other hand, sees the relocation of the railway as an opportunity to enhance passenger transport, possibly making the railway double-tracked as has been desired for a long time. Passenger transport, for LKAB, is seen only as a hindrance. Moreover, wherever the railway is moved, it will negatively impact reindeer grazing, to a greater or lesser extent depending on the various alternatives.

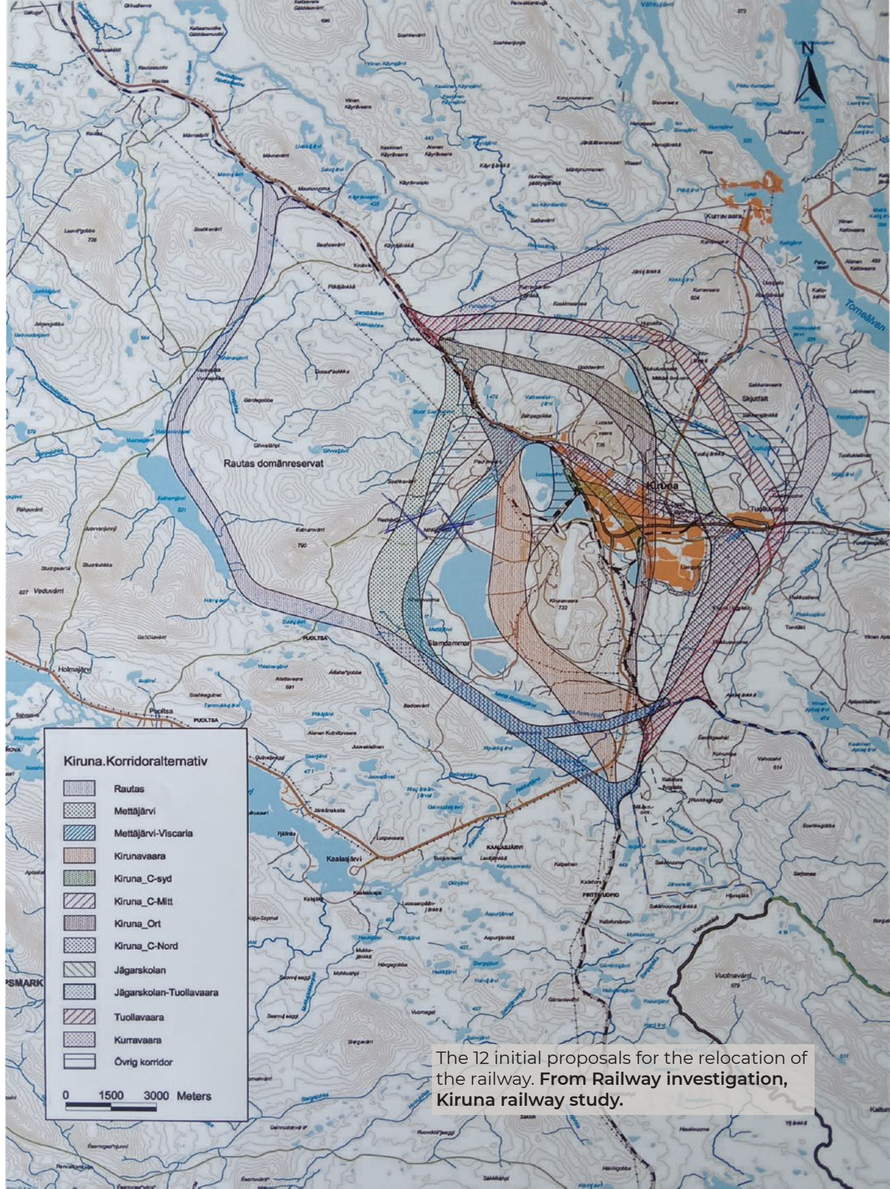
In 2004, the railway line ran between the city and the mine, making it the second infrastructure to be affected by deformations after the bridge that links the city to the mine plant. As a result, it was one of the first structures to require relocation, with initial deformation forecasts setting 2012 as the maximum deadline for moving the railway.

The initial hypotheses for locating the railway are developed by Banverket, the state authority responsible for managing railway lines in Sweden, between April 2005 and April 2006, when the "**Railway investigation, Kiruna new railway**" **[9]** is made public. The number of routes is reduced from the initial 12 to just 3 presented in the final document: Mettäjärvi-Viscaria, which runs west of Kirunajarvi; Kiirunavaara, also known as the central corridor, proposes to relocate the railway between the

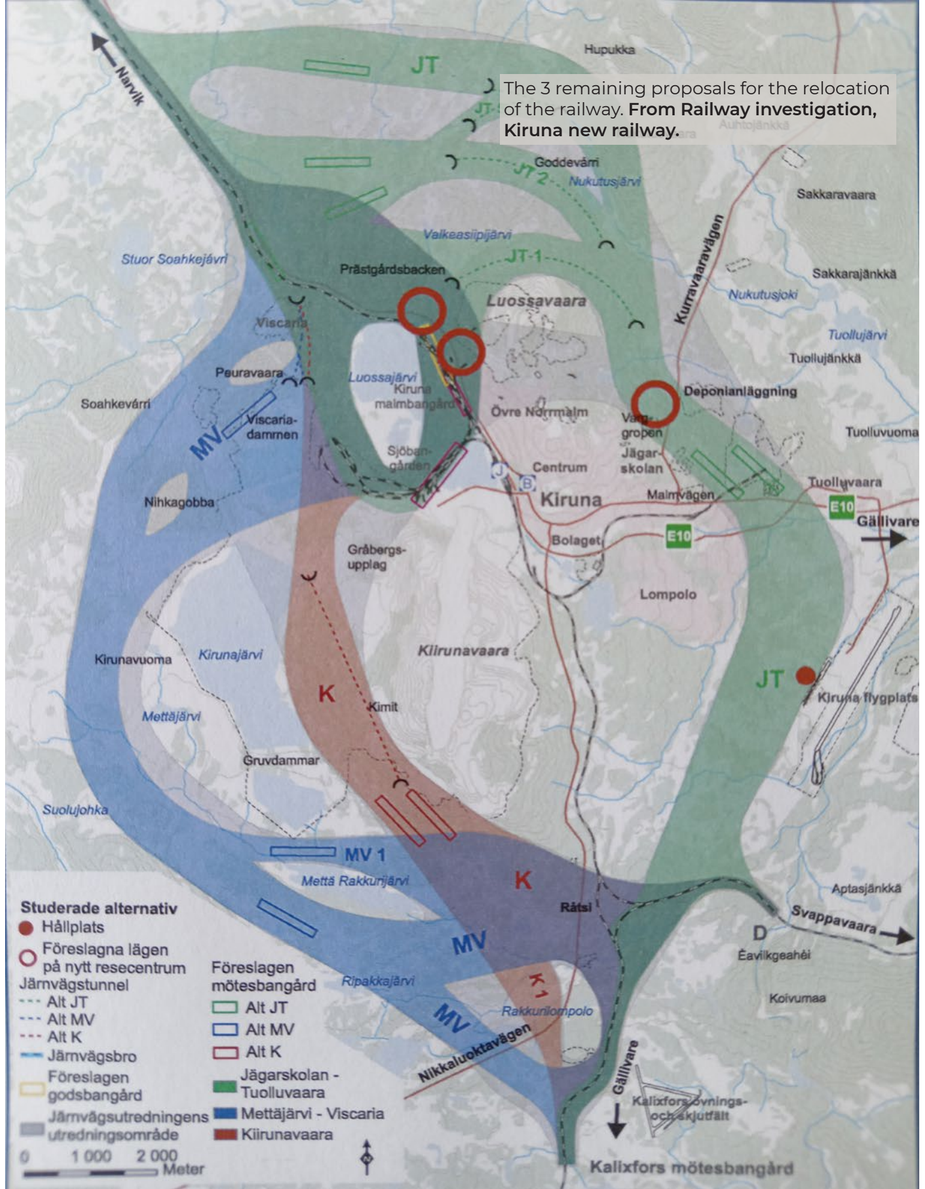
[75] Gimberger C., Norberg K. 2006. *Uppdrag att flytta en stad – en studie av planeringsprocessen i samband med Kiruna stadsomvandling.* Thesis: Uppsala University.

[9] Banverket. Apr. 2006. **Railway investigation, Kiruna new railway.**

Apr. 2006
[9]



The 12 initial proposals for the relocation of the railway. **From Railway investigation, Kiruna railway study.**



The 3 remaining proposals for the relocation of the railway. **From Railway investigation, Kiruna new railway.**

mine and the marsh basins that contain water pumped from the mine. In this scenario, the station would remain unchanged, resulting in reduced time and costs. This option also appears in the Northwest Alternative **[8]** of LKAB and in "Alternative 2" of the Comprehensive Development Plan for the Central Area **[10]**, discussed in Chapter 3.2.2. The last hypothesis is Jägarskolan-Tuolluvaara. In this proposal, the railway is suggested to pass east of the cemetery, dividing the new residential area and then crossing Luossavaara Hill through a tunnel. This is certainly a more expensive and impactful proposition for urban transport and is presented as the preferred option in "Alternative 1" of the Comprehensive Development Plan.

In March 20007, Banverket published the **Final Report: Kiruna New Railway Investigation [14]**. This document evaluates the last two alternatives based on feedback from stakeholders involved in the process, as the first one had already been discarded earlier. The Kiirunavaara alternative is the most appreciated and has been chosen to be further developed in the subsequent stages of planning. This alternative minimizes damage to cultural and natural environments and reduces interference with the reindeer activities. Additionally, it is the most favorable for future urban development, and it involves fewer technical complications and costs compared to other proposed solutions.

In 2012, since the decision on where to rebuild Kiruna was delayed, the stakeholders decided to temporarily relocate the railway to avoid disrupting transportation while waiting to define the location and morphology of the new urbanization. The hypothesis chosen for this temporary phase was the first one proposed by LKAB; obviously, economic reasons weighed heavily on this decision since it was only a temporary solution. The new stretch was **completed [23]** in 2012 as planned and has been the only route for all trains from Luleå to Narvik for the past 12 years. In the years following, instead of diminishing, the planning activity increases in intensity. Starting in 2012, a series of documents were produced with the ultimate goal of identifying the best location for the new Kiruna railway station. The first of this long series of documents is the **Preliminary study on railway relocation [27]**. In this initial study, 9 hypotheses for the possible location of the station appear, which will be reduced to 7 already in the

2012
[23]
Mar. 2007
[14]
2012
[27]

[8] LKAB & Wilhelmson Architects. Mar. 2006. **The New Kiruna - Northwest Alternative.**

[10] Kiruna kommun. Aug. 2006. **Comprehensive Development Plan for the Central Area of Kiruna.**

[14] Banverket. Mar. 2007**. Final Report: Kiruna New Railway Investigation.**

[27] Trafikverket. 2012. **Preliminary study on railway relocation.**

9 hypotheses for the Kiruna station relocation. **From Preliminary study on railway relocation.**

study [31] completed the following year.

The various hypotheses have been discarded over time by evaluating their compatibility with 7 criteria established in advance:

A Accessibility for passenger traffic.

B Capacity (to and from Kiruna).

C Urban planning and urban development.

D Road connections.

E Environment and sustainability (Positive impacts).

F Environment and sustainability (Negative impacts).

G Economic sustainability.

The first 9 hypotheses formulated by the Swedish Transport Administration in 2012 are extremely diverse: the first two hypotheses to be eliminated are ÖI and LON-3. The ÖI envisaged the tracks entering the city center from the east and was discarded because, among all the hypotheses that foresaw the station near the new city center, it was the one that required the longest route (8 km) and presented objective maneuvering difficulties for the trains.

Feb. 2013 **[31]**

On the other hand, the LON-3 was simply assimilated in the subsequent phases into the hypotheses LON-1 and LON-2. This group of hypotheses aimed to reach the city center from the south, positioning the station near Lombololeden Road. Completing the quintet of urban hypotheses is the KNC hypothesis, which extends beyond Lombololeden Road to reach the heart of the city, roughly following the same route as the southern approaches of the LON hypotheses.

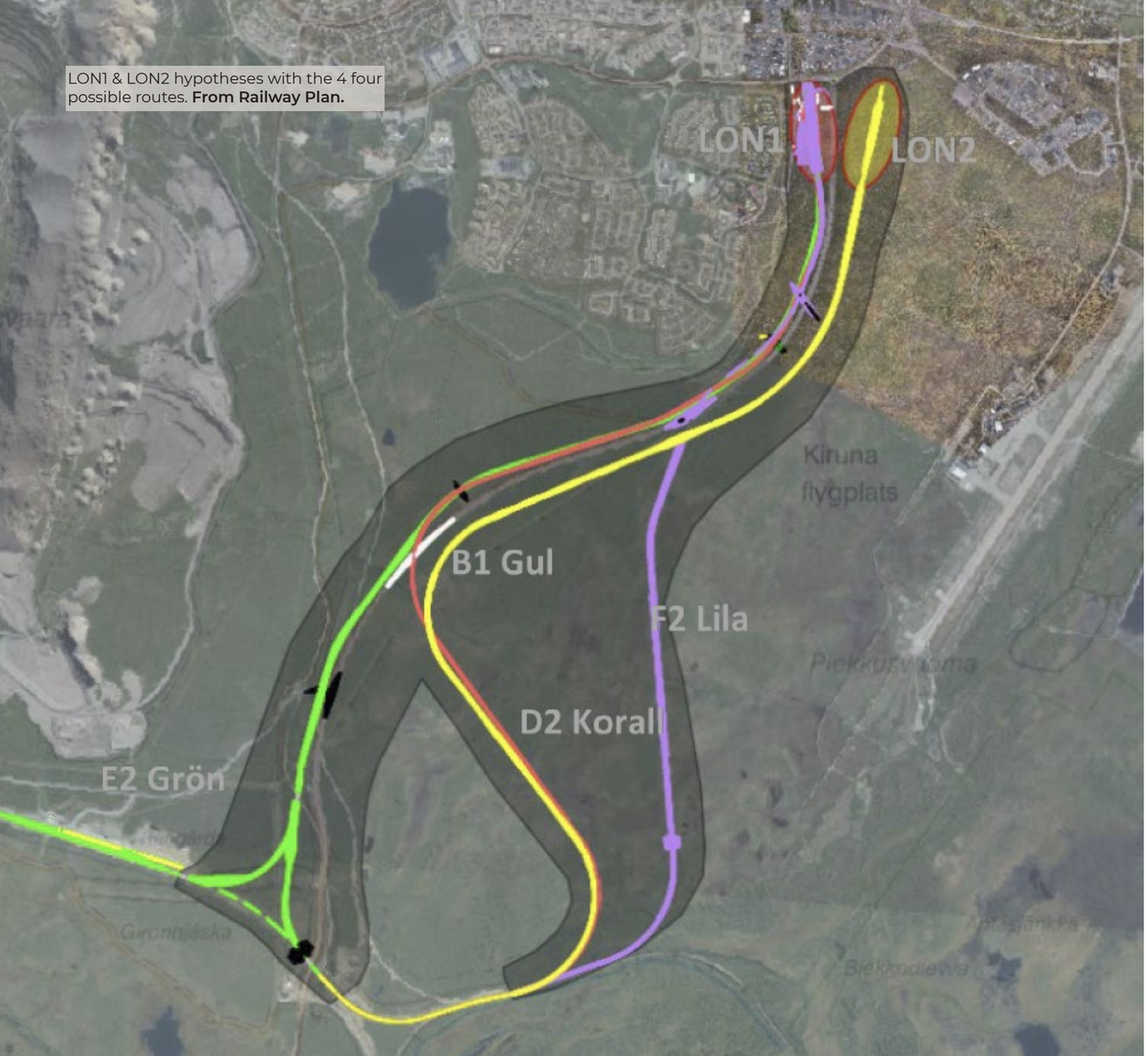
The other group consists of 4 scenarios where the station is far from the city center: KFP, near the airport, also feasible in combination with one of the 5 urban hypotheses; KIA, to the south where there is the junction between the old line, now closed, and the temporary line built in 2012; PEA located in an area 7 km north of the new center in an area called Peuravaara; the last hypothesis: KMB essentially consists of leaving the station where it was at the time and still is today, in its temporary position north of Kiruna.

The topic of station positioning remained dormant for several years until it returned to prominence in 2020. After several consultations, the **Railway Plan [75]** is drafted, and every hypothesis of the group of external ones are discarded: KIA and PEA are lacking in objective C

2020 **[75]**

[31] Trafikverket. Feb. 2013. **Preliminary Study Kiruna Railway Station.**

[75] Trafikverket. 2020. **Railway plan.**



LON1 & LON2 hypotheses with the 4 four possible routes. **From Railway Plan.**

due to their distance from the city, as well as in objective D since both stations require several kilometers of new road infrastructure to be accessible. Additionally, PEA is less economically sustainable compared to the others and is located in the area where the opening of the copper mine is planned.

Regarding the KMB option, despite having excellent scores in the E, F, and G categories, its main drawback is the distance from the new urban center and especially the possibility of being affected by deformations in the future. The KFP hypothesis, while not receiving an overall negative score, was discarded because it does not surpass the KMB hypothesis in any of the 7 indicators and is inferior to the latter in terms of environmental impact, with negative repercussions on the natural environment and pastoralism, as well as in terms of economic sustainability. In subsequent developments, the KRC hypotheses were compared with those of the LON group. Despite surpassing rivals in category A, the KNC, by penetrating deeply into the new city, creates a significant barrier and occupies a central space that could be used for other purposes. Additionally, the KNC loses the comparison on one of the fundamental points: economic sustainability.

As a result, the LON1 and LON2 alternatives are selected for further investigation. The two alternatives are only a few tens of meters apart and share the same characteristics, particularly being close to the city and the airport without excessively obstructing urban traffic.

Subsequently, four possible route hypotheses are formulated to reach the two stations. The "E2 Green" reaches the LON1 alternative from the east, following the 870 Road; The "B1 Corral" and "G1 Yellow" alternatives feature a straight section over the marshy area south of Lombolo and reach the LON1 and LON2 stations respectively, and finally, the "F2 Violet" alternative, studied to reach LON1 with the shortest route.

The choice between the 4 hypotheses and consequently between the two remaining hypotheses for the location of the station will be made in October 2021 through the document: **Comprehensive Assessment of Line Studies [84]**. The selected hypothesis is LON1 in combination with the E2 Green path, the latter being inferior to the others only in terms of economic aspect. The alternative proves to be successful because it exploits the proximity to road 870, resulting in less impact as a barrier for outdoor activities, for landscape criteria, and for reindeer grazing.

Oct. 2021 **[84]**

After nine years, the decision is finally made, and the Swedish Transport Ad-

[84] Trafikverket. Oct. 2021 **Comprehensive Assessment of Line Studies.**

ministration can begin developing the plans for the new infrastructure. However, this process was abruptly interrupted in September 2022 when the municipality, in an **agreement [89]**, stated that the hospital would be relocated to the area where the station was supposed to be positioned.

Sep. 2022 **[89]**

In response to this development, the Swedish Transport Administration issued the document "**New railway line studies [92]**", where the station is repositioned halfway between the LON1 and LON2 alternatives. This will consequently lead to the relocation of Road 870.

Dec. 2022 **[92]**

A new position that will not change even in February 2024, when the Regional council (Regionfullmäktige), legally responsible for managing hospital facilities, took the **decision [100]** to build the hospital in Tuolluvaara[76], where the municipality had planned to establish the cultural hub **[29]**. Consequently, the space initially intended for the station and then for the hospital remains available for a new function.

Feb. 2024 **[100]**

The fact that the Swedish Transport Administration has not reverted to the October 2021 plan further demonstrates how, once a project reaches a certain stage, it becomes difficult or impractical to go back. It can be said that from this point on, the project is like a golem that moves forward autonomously until the next deviation.

The history of the Malmbanan relocation is also a perfect example of how external agents can sometimes be the main driver of urban development. In this case, nine years of planning had to adapt to a spatial reconfiguration decided by another actor within a few months. This decision, despite not achieving the intended goal, has nevertheless irreversibly impacted the city's development.

As of today, even though the main hypothesis remains that of 2022, LKAB is also pushing to keep the temporary station, leveraging its full functionality to avoid bearing considerable construction costs. Additionally, it has returned to the agenda of the county administrative board to double the Malbanan, to avoid the inconveniences highlighted in chapter 2.1.3, leading to a general standstill while waiting for this issue to be resolved, since it could have significant repercussions on the railway connection with Kiruna.

[89] Kiruna kommun. Sep. 2022. **Agreement of the Municipal Board on hospital relocation.**

[92] Trafikverket. Dec. 2022. **New railway line studies.**

[76] Member of the Environmental and Building Department of Kiruna kommun. Personal interview, May 7, 2024.

[29] White Arkitekter & Ghilardi+Hellsten. Dec. 2012. **Kiruna Forever.**

3.4 Media attention

"Understandably, such an ambitious task has drawn attention from around the globe idea of having a city and then moving it has never happened before are unique-"

Goran Cars

(Goran Cars, head of development at the Kiruna municipality, in an article from CNN titled "A Swedish town's dilemma: Move brick by brick or be swallowed by a mine.")

3.4.1 Superficial attention

Starting from the second half of the 2010s, increasing media attention has been recorded towards the ongoing process. Kiruna, primarily known for Sami culture and spectacular northern lights, and perhaps for some obscure events from World War II, has in just a few years become "The City that moves."

The phenomenon has garnered worldwide attention, with newspapers from all corners of the globe writing about Kiruna. However, the media attention has mostly been quite superficial, with most outlets reporting dramatic and somewhat unrealistic scenarios, such as the BBC in a 2014 article: "*huge fissures are appearing across the city, creeping towards the centre*"[77] or CNN in an article the following year: "*A huge hole has opened up in the earth. Thousands of people will soon be packing their belongings and moving on*"[78] or even La Stampa with the headline: "*Sweden, journey into the city swal-*

[77] Kinder T. 2014. Kiruna: How to move a town two miles east. *BBC*.

[78] Maguire E. 2015. A Swedish town's dilemma: Move brick by brick or be swallowed by a mine. *CNN*.

lowed by the mine."[79]
Some other articles, in order to exaggerate the phenomenon, talk about the relocation of the entire city, as the New York Times[80] does, or The Atlantic, which in 2015 headlined "*The Plan to Move an Entire Swedish Town*"[81] and a year later published another piece titled "*Sweden Is Moving an Entire City*"[82]. This tactic certainly makes the topic more striking to readers but diminishes its complexity.

The fact that Kiruna has attracted so much media attention is not surprising. Kiruna is, after all, located in Europe, where it is very rare to witness the construction of a new city for obvious demographic reasons. Furthermore, the process underway is even more peculiar, as it involves moving a city rather than building one from scratch, which complicates things considerably in a context where individual rights are undoubtedly greater than in almost the rest of the world.

The peak of media attention occurred in the years following 2013, a period during which the masterplan was produced, and even in the subsequent years, media attention remained quite constant, thanks also to the spectacular transportation of buildings, another event that is certainly not seen every day.

All this media attention also led to the creation of the Netflix film "The Abyss," a natural disaster thriller set in Kiruna, where, as mentioned in the articles cited at the beginning of the chapter, the city is swallowed by the mine within a few hours. The film has been available on the platform since early 2023, reaching the top of the most-watched films on the renowned streaming platform a year later, recording impressive numbers: "*The film drew a staggering 22.3 million viewers on Netflix last week alone*"[83].

he film was not particularly appreciated by the residents of Kiruna due to its extreme distortion of facts, and many of them did not even want to watch it[84].

Even though it presents a blatant total distortion of what is happening in Kiruna, "The Abyss" also contributes to

[79] Prino M. 2014. Svezia, si sposta un'intera città per fare posto a una miniera. *La Stampa.*

[80] Bromwich J. 2016. How Do You Move a City? Ask Kiruna, Sweden. *New York Times.*

[81] O'Sullivan F. 2015. The Plan to Move an Entire Swedish Town. *The Atlantic.*

[82] Poon L. 2016. Sweden Is Moving an Entire City. *The Atlantic.*

[83] Perry K. 2024. Netflix's The Abyss: The true story of the Swedish town that's sinking into a crater. *The Independent*

[84] Member of the Culture and Education Department of Kiruna kommun. Personal interview, May 6, 2024.

The transportation of a building in Kiruna in the summer of 2017. **From the BBC report: Kiruna: Why this mining town is moving home.**

catalyzing media attention on the city as well as introducing the new city to the world. The film, shot in Kiruna in 2022, shows several glimpses of the new city center.

In general, all this media attention, although superficial, has played an important role in the development of the city: first and foremost in the publication phase of the various competition notices, particularly the one for the creation of the master plan. In this case, media attention allowed the reach of many renowned architecture firms, as discussed in Chapter 3.3.2. Having the eyes of the world upon them has also been an additional push for the many stakeholders involved to act responsibly, especially LKAB, which invested significantly in the construction of the new center, partly in response to the important image return.

This media attention has also attracted several researchers who, by studying the process, indirectly provide ideas for its continuation[85]. This situation has allowed Kiruna to apply for the title of European Capital of Culture for the

year 2029 **[h]** in January 2024 and to be selected for the final stage. Through this candidacy, the municipality saw an opportunity to keep media attention high with the ultimate goal of attracting new residents to the city.

The other side of the coin, however, is the ephemeral nature of media attention. By catalyzing such a superficial flow of information, Kiruna runs the significant risk of suddenly finding itself deprived of one of its development drivers. This driver, although it is difficult to determine to what extent it has influenced the process, has been an integral part of it so far.

[85] Borgogno F., Pozza A. 2016. *Build out Kiruna, from a mining city to a city with a mine*. Thesis: Politecnico di Torino.

[h] Kiruna kommun. Jan. 2024. **Submission of the application for European Capital of Culture 2029.**

3.4.2 Gällivare, an overlooked case

In reality, the case of Kiruna, upon closer examination, is not the only one. 25 km further south in Malmberget, a district of Gällivare, another iron mine operated by LKAB is causing serious subsidence problems.

Gällivare is a mining town very similar to Kiruna; here too, the economy relies heavily on the mining industry, with LKAB dominating the job market. The town was founded as a mining center in 1742[86], but before the construction of the railway, it had only 276 permanent residents[87]. In 1888, the railway line reached the town[7], allowing for iron extraction, an activity that boosted the population to the current total of 16,000 residents[88] (including those from the nearby districts of Malmberget and Koskullskulle).

[86] Sjöholm J. 2013. *Heritagisation of built environments: a study of the arb transformation in Kiruna, Sweden.* Licentiate Thesis: Luleå University of Technology.

[87] Forsell H. 2015. Modernizing the Economic Landscapes of the North. Resource Extraction, Town Building and Educational Reform in the Process of Internal Colonization in Swedish Norrbotten. *International Journal for History, Culture and Modernity.* Vol. 3, no. 2.

[88] Population density data from Statistikmyndigheten.

The Gällivare deposit has a much more complex and irregular shape compared to that of Kiruna. The various deposits are scattered around Malmberget, except for one, which is located directly beneath the town. In the early 1970s, subsidence phenomena began to occur starting from the center of Malmberget, and over time, this phenomenon led to the opening of a gigantic circular pit named Captain's Pit. As time passed, the pit expanded and now divides Malmberget in half, with predictions that by 2032, two-thirds of the district will have sunk into the pit[89].

In Malmberget as well, agreements between LKAB and local authorities stipulate that the company finances the reconstruction of affected buildings and the relocation of those with cultural value, the first of which was the church, located in the exact center of the town.

Seen through the eyes of an outside observer, the two towns might seem like two peas in a pod, where two very similar processes are taking place, with one major difference: Malmberget is completely devoid of any media attention.

[89] Houston G., Glindmeier V., Hermann C. 2020. Adapting historic places to climate change: Proceedings of the international virtual conference of the project Adapt Northern Heritage. *Adapt, Northern Heritage Conference.*

Malmberget and the Captain's Pit, aerial photo.
From Eye on the Arctic.

To understand the causes and effects of this fundamental difference between the two cases, it is necessary to focus on the few elements that differ.
Some reasons for this different attention from the media, especially foreign media, according to some residents, stem from the fact that the Kiirunavaara iron mine is the largest in the world[90]; for this reason, any news about Kiruna would be amplified. Additionally, being the northernmost town in Sweden makes it generally more well-known.

However, the real reason for this difference in treatment is likely found in the timing of the process: in Kiruna, everything happened relatively quickly. In the span of 8 years, from the famous letter **[2]** to the first demolitions, this speed resulted in a large number of buildings needing to be relocated at the same time, leading to significant planning efforts.

In Malmberget, however, the process is significantly slower, and having been ongoing for more than 50 years, it has become a constant condition of the area, and a constant condition rarely makes the news.

Regarding the differences that can be attributed to this media attention, one clear example is that Malmberget, unlike Kiruna, is not being rebuilt. As a village, it ceases to exist as the buildings are reconstructed in the nearby Koskullskulle. Additionally, only 30 historic buildings will be relocated compared to 41 in Kiruna, and most of these belong to LKAB. While both areas are entirely designated as sites of national interest due to their cultural value, the area expected to be affected by deformations in Kiruna is not comparable to that of Malmberget, which is much smaller.

Furthermore, it's important to consider that the funds used to rebuild and relocate the buildings come from mining activities. The operation must be economically viable for LKAB; otherwise, they would simply halt the mining activities. The quantity of iron ore extracted in Kiruna is five times that extracted in Malmberget, though this is partially offset by the fact that the process in Malmberget is much slower, allowing the costs to be spread over a longer period.

In conclusion, it can be said that the twin cases of Kiruna and Malmberget are an example of how media attention can influence urban transformation processes. Of course, as already stated in the previous chapter, it is difficult to determine the extent of this factor's impact, but there is still a sense that it played an important role.

[90] Former inhabitant of Malmberget. Personal interview, Jun. 12, 2024.

[2] LKAB. Mar. 2004. **Mail to Kiruna kommun.**

3.5 A memory worth preserving (and from buildings to documents)

"You cannot quite convince me, you who say that the soul of a town resides with its people. If great parts of the city are gone then perhaps its soul must be partly gone with it."

Lars Levi Laestadius

(A Swedish writer of Sami origin, ecologist, mythologist, ethnographer, and leader of the Swedish state Lutheran church in Lapland.)

3.5.1 The City that dies

If, in the last 20 years, the new city has managed to take shape with results that most of the inhabitants of Kiruna find very positive, the old city center has undergone the opposite process.

The gradual demolition of the areas that are, or will be in the future, subject to subsidence has left a void in the urban fabric as much as in the hearts of Kiruna's citizens. A void that cannot be filled by building a new city, even if it is in some ways better than the previous one. This is because, as Linda Sandberg and Malin Ronnblom state: "*Urban areas are not just physical, concrete structures (buildings, roads, squares, parks, etc.) they are also emotional spaces*"[91].

The dismantling of the old center of Kiruna is comparable to a cataclysm that destroys buildings and forces their inhabitants to move, with the difference that in this case, the cataclysm happens little by little, and the only victims are the memories entangled in the disintegrating urban fabric.

The process for the demolition of build-

[91] Sandberg L., Ronnblom M. 2016. Planning the new city-emotional reaction and positions. *Emotion, Space and Society.* Vol. 21.

ings follows a rather rigorous procedure. It all starts with the prediction of deformations made by LKAB. In these documents, it is established by which date a certain portion of the city must be dismantled because its stability can no longer be guaranteed. However, before demolishing the buildings, it is necessary to first modify the land use, making its sole function "mining industry." This task, as stated in Chapter 3.3.2, falls to the municipality, which carries it out through detailed plans.

Oct. 2010 **[18]**

Starting from 2010, 8 detailed plans will be drawn up, all with the same purpose, the first of which is the "**Detailed plan for Bolagsomradet Gruvstadspark**" **[18]**. This plan regulates the entire area closest to the mine, extending from the railway to Hjalmar Lundbohmsvägen. The area is both central and peripheral because Kiruna has developed from the mine in only one direction: towards the east. The area contains the town hall and the Ullspiran district, as well as the A10 highway, and it will be the first to be dismantled.

The plan gained legal validity in 2012, and in March 2015, after LKAB had purchased and evacuated the first buildings, the first **demolitions [46]** began. The first buildings to be demolished are Ullspiran 2 and 4.

Mar. 2015 **[46]**

[18] Kiruna kommun. Oct. 2010. **Detailed plan for Bolagsomradet Gruvstadspark.**

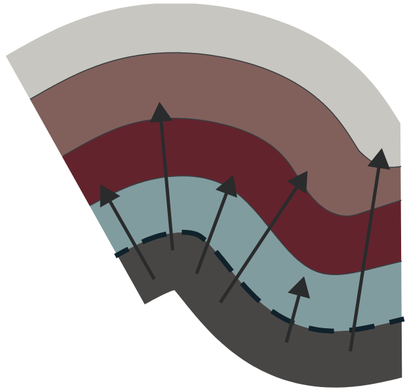
The impact on the population is significant. In 2013, when most of Ullapiran had already been evacuated, the Swedish radio referred to it as a "*ghost town*"[92]. The demolition operation was managed by Kolbäcks and cost LKAB a whopping 5 million SEK[93].

However, the area won't collapse the day after the demolitions. The process will take many years, which is why it has been decided that the areas subject to demolition will be turned into parks so that they remain in possession of the people of Kiruna until deformations require them to be permanently fenced off. These areas also serve as a memorial for the demolished city, preserving the imprints of the buildings on the ground, changing their function to become for example a skate park or a playground.

Beyond the park, a fence delineates the area that is not accessible due to deformations that jeopardize the safety of the population. The result is a concentric zone pattern starting from the mine and continuously advancing toward the city with the progress of deformations: the first area is the

[92] Sandberg L., Ronnblom M. 2016. Planning the new city-emotional reaction and positions. *Emotion, Space and Society.* Vol. 21.

[93] Huisman C. J. 2021. *Transforming the City of Kiruna: Stabilizing Change and Changing Stability.* (Personal interview, Project manager, TVAB) PhD Thesis: Uppsala University.



Mine expansion scheme.

Demolition of Ullspiran. **From TU.**

fenced-off, now inaccessible zone, followed by the mining park, then the area of building demolition, and finally the evacuated areas awaiting demolition.

The delay in exploiting level 1365 has led to an extension of the timeline for drafting detailed plans for the area to be dismantled. The second plan, the first of the second phase, named "**Gruvstadspark 2 etapp 1 Kiruna 1:1**" **[50]**, was only completed in August 2016. The area in question is a narrow strip running east and north of the area covered by the previous plan. This area was almost entirely used as a park even before the drafting of the new plan, with the only buildings, predominantly residential, located to the north next to the old railway. The effects of the plan, namely the start of demolitions, were supposed to begin in the fall of the same year but were effectively postponed by several years because demolitions in this area proceeded more slowly than anticipated and the wooden structure holds up better.

Dec. 2016 **[50]**

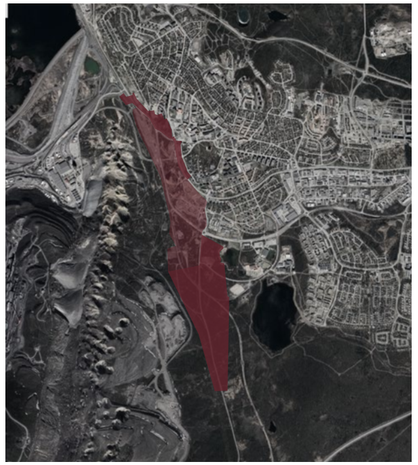
In October 2017, the **demolition [55]** of the other two large residential buildings of Ullspiran, Block 6 and Block 8, was completed, thus completing the demolition of the Kiruna neighborhood closest to the mine.

Oct. 2017 **[55]**

[50] Kiruna kommun. Dec. 2016. **Detailed plan. Gruvstadspark 2 etapp 1 KIRUNA 1:1 m.fl.**

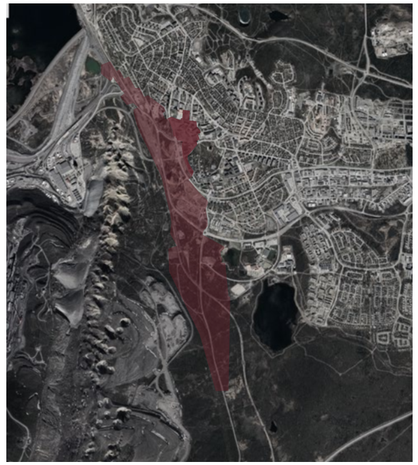
Detailed plan for Bolagsomradet Gruvstadspark.

Detailed plan Gruvstadspark 2 etapp 1 KIRUNA 1:1 m.fl.



Detailed plan Gruvstadspark 2, etapp 3, del av SJ-området m m.

Detailed plan Gruvstadspark 2 etapp 2 del av centrum.



From this point onwards, there is an exponential increase in the pace at which detailed plans are being developed. This is to address the accelerating deformations revealed by the new deformation forecast **[62]** from LKAB in 2019, although it had been anticipated for quite some time.

Two more detailed plans are drafted around the time of the publication of the new forecast. The first is "**Gruvstadspark 2, etapp 3**" **[58]**, from October 2018, which includes the area north of the previous plan characterized by single-family homes as well as a very dense and central area featuring police barracks. Demolition of this area is scheduled between 2021 and 2023, but to date, only the residential part has been dismantled; the barracks are still standing but have been closed since the completion of the new barracks in Nya Kiruna.

Oct. 2018 **[58]**

The second of the two plans was drafted in June 2019, a month after the **demolition [64]** of the town hall, which marks the final act of the first phase of the decommissioning plan. The name of the plan is "**Gruvstadspark 2 Etapp 2**" **[67]**

May. 2019 **[64]**

Jun. 2019 **[67]**

[62] LKAB. Apr. 2019. **Deformation Forecast.**

[58] Kiruna kommun. Oct. 2018. **Detailed plan for Gruvstaspark 2, etapp 3, del av SJ-området m m.**

[67] Kiruna kommun. Jun. 2019. **Detailed plan for Gruvstadspark 2 Etapp 2 del av centrum.**

and contains the most dense and central area of Kiruna. Compared to the others, this area features a much more compact fabric made up of residential buildings in a courtyard and linear typology interspersed with tower buildings reaching up to 9 floors above ground. In the area, there are also large accommodation structures such as the Hotel Bishop Arms and the Royal Night Club, whose opening caused quite a stir.

Dec. 2020 **[77]**

In December 2020, following pressure from LKAB, the plan for step 4 of phase 2 was drafted: "**Gruvstadspark 2 etapp 4**" **[77]**. It comprises an area roughly the size of the combined area of the other plans in Phase 2. The area in question is located southeast of the city center and includes, in addition to various types of residential buildings, 2 important school buildings, including the Hjalmar Lundbohmsskolan already rebuilt in the new center as previously stated in chapter 3.3.4.

Aug. 2021 **[81]**

The last detailed plan of the second planning phase is called "**Gruvstadspark 2, etapp 5, Kyrkan**" **[81]**, and, as the title suggests, concerns the area of the Kiruna church. Being immersed in a park, the area includes only 6 buildings,

Detailed plan for GRUVSTADSPARK 2 ETAPP 4, BOLAGSOMRÅDET m fl.

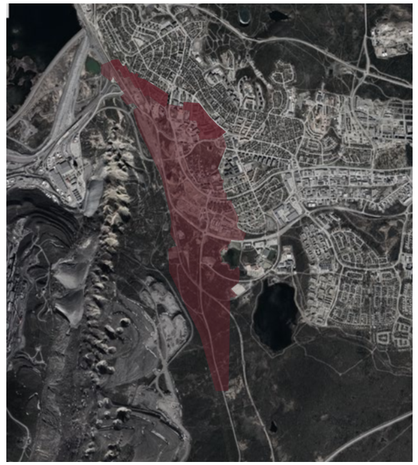
Detailed plan for Gruvstadspark 2, etapp 5, Kyrkan 11 m fl.

[77] Kiruna kommun. Dec. 2020. **Detailed plan for GRUVSTADSPARK 2 ETAPP 4, BOLAGSOMRÅDET m fl.**

[81] Kiruna kommun. Aug. 2021. **Detailed plan for Gruvstadspark 2, etapp 5, Kyrkan 11 m fl.**

Detailed plan for Gruvstadspark 3, etapp 1, Hovmästaren 1, centrum 4:2 m fl.

Detailed plan for Gruvstadspark 3, Etapp 2, del av centrum, nedre Norrmalm m fl.



half of which have religious functions. The plan also states that the church will be dismantled between 2025 and 2026 and reassembled at the new site by 2029. It highlights that, in the summer of 2021 when the plan was drafted, the decision to move the church entirely without dismantling it had not yet been made. This relocation is currently scheduled for the summer of 2025.

Aug. 2021 **[83]**

Simultaneously with this plan, the municipality also produces the first plan of phase 3: "**Gruvstadspark 3, etapp 1, Hovmästaren 1, centrum**" **[83]** The plan includes a small and very central area bordering to the south with the area covered by the June 2019 plan. In this area, there is a single large complex of buildings that includes the congress center connected to the Scandic Ferrum Hotel by means of a bridge. Both buildings have been rebuilt in the new city with a connecting bridge and inaugurated in 2022. According to the document, the area also includes the atomic shelter for which no reconstruction is planned.

Dec. 2022 **[94]**

The last act of planning appears to be the "**Gruvstadspark 3, etapp 2**" **[94]**, from December 2022, which regulates two

[83] Kiruna kommun. Aug. 2021. **Detailed plan for Gruvstadspark 3, etapp 1, Hovmästaren 1, centrum 4:2 m fl.**

[94] Kiruna kommun. Dec. 2022. **Detailed plan for gruvstadspark 3, etapp 2, del av centrum, nedre Norrmalm m fl.**

areas: one to the north and one to the east of the center. The eastern area, which extends to the outer limit of the red line, is densely populated and characterized by linear buildings, making it the first in terms of total floor area for the quarter.

Many areas within the deformation zone are still governed by old detailed plans and are yet to be addressed by the municipality in the future **Gruvstadspark 4** plan. These zones include very important buildings such as the hospital, which, however, will be affected by mining extraction in several years. Furthermore, there is a concrete possibility that the municipality will need to negotiate with LKAB for a **Gruvstadspark 5** plan in case a new deformation forecast is published, as mentioned in chapter 3.1.2, which is speculated to be imminent.

The detailed plans for the central area of Kiruna represent many pieces of a puzzle that, within a few years, barring the opening of a new level below 1365, will be completed. These pieces, when united, paint a very clear picture of Kiruna's future. Unlike the plans for the new city, all these plans have a single designated use: the mining industry.

The history of these plans is quite particular: they had to account for a double change of use over time. First, the city would be transformed into a park, and then the park would be transformed into industrial land. Naturally, the timing of these transformations could not be precisely predicted, and this was not provided for by Swedish law. Additionally, many buildings were to be demolished up to five years after the drafting of the plans, implying that these parts of the city would remain frozen without any possibility of modification since the only designated use of the land was the "mining industry." A possible solution would have been to approve several detailed plans for each area, but this would have further overloaded the city's planning apparatus, which was already very busy with planning the new city center. The solution reached, which does not completely solve the problem, was to overlap the two land uses in a single plan, effectively combining two plans into one document.

Much more fragmented is the situation of demolitions at present. In the summer of 2024, LKAB acquired almost all properties within the Red Line, including those governed by detailed plans dating back up to 50 years. Many of these buildings have already been evacuated, while others can still function and will continue to do so for several years, provided rent is paid to the mining company. Among them is the Galleri Lito, a Sami art gallery positioned exactly along the path of the Red Line, whose owners still have 3 to 4 years to decide whether to close or relocate to the new city[94].

2024
[i]

At the time of writing this thesis, the bulldozers have reached the heart of Kiruna, completely **dismantling [i]** the areas covered by Gruvstadspark 2, stage 2 **[67]** and Gruvstadspark 2 stage 4, Company Area **[77]**, in the summer of 2024. The other areas, apart from the few already mentioned, sadly await the same fate and will be temporarily converted into parks before sinking forever into the void.

[94] Art gallery owner. Personal interview, May 25, 2024.

[67] Kiruna kommun. Jun. 2019. **Detailed plan for Gruvstadspark 2 etapp 2 del av centrum.**

[77] Kiruna kommun. Dec. 2020. **Detailed plan for GRUVSTADSPARK 2 ETAPP 4, BOLAGSOMRÅDET m fl.**

Buildings being demolished in the southern area of downtown Kiruna. **Photo by author.**

3.5.2 Built Heritage in motion

As stated in Chapter 3.2.1, Kiruna is characterized by overlapping constraints. We know that the cultural constraint must yield to the mining one, but the municipality, LKAB, and the residents of Kiruna were determined to do something to preserve the city's historical building heritage. In 2005, the idea of moving some buildings to the new city through exceptional transport began to take shape. In a conference[95] held on October 14th, reference was made to the relocation of an airport terminal in Kastrup, Denmark, which took place in '98 as a case study to emulate in order to preserve part of Kiruna's historical architectural heritage.

The cultural constraint applied to the entire city of Kiruna, and 4 buildings, among which stands the town hall, were endowed with the highest level of protection under Swedish law. Moreover, as early as 1984, the municipality had foreseen a **conservation plan [I]** that considered more than 200 buildings and various areas worthy of preservation. Unfortunately, the plan could not foresee the changes that would sweep over the city starting 20 years after its drafting.

It quickly became clear that not all buildings could be moved for two reasons: the first is purely technical, as only wooden buildings are light and resilient enough to be transported. The second reason is economic: transporting buildings is significantly more expensive than demolishing and reconstructing them. For these reasons, only a small portion of Kiruna's historical building heritage will be selected for relocation, and all brick or reinforced concrete buildings will be demolished despite some, like the old train station, having even higher protection levels than others.

The decision on which buildings to move, unlike the areas to be dismantled, is subject to a political decision. The three actors who must negotiate which buildings are worthy of surviving and being transported to the new city are: the municipality, responsible for urban planning; the County Administrative Board (Länsstyrelsens), the regional authority responsible for cultural constraints; and LKAB, which must pay for and manage the transports and bear the responsibility if something goes wrong. These three actors have interests that sometimes converge and sometimes diverge, and they will come to an understanding through

[95] Brorsen L. 2005. Kiruna - Cultural heritage in motion. *Conference paper.*

[I] Kiruna kommun. 1984. **Kiruna's conservation plan.**

The conservation plan of 1984, with the red stars highlighting the protected buildings. **From Heritagisation of Built Environments.**

Supplementary Agreement on Building Relocation, the red stars highlight the buildings to be moved. **From Heritagisation of Built Environments.**

various agreements that will be revised multiple times as conditions change, notably the deformation forecasts.

The first document concerning the relocation of buildings was drafted by the Norrbotten Museum in February 2008 and is titled: "**What is Kiruna Worth? Kiruna - a Cultural Valuation Analysis**" **[16]**. In the nearly 300 pages, all of Kiruna's tangible and intangible assets are listed, with the intention of understanding which ones are worthy of preservation in light of the painful relocation process that will result in the destruction of most of them. In particular, a list of 98 culturally valuable buildings is drawn up, selected by 10 influential stakeholders in the area.

This is the first step that will lead, exactly 3 years later, to the drafting of the agreement: "**GP1-atvalet**" **[20]**. This agreement concluded exclusively between LKAB and the municipality of Kiruna, stipulates that 19 particularly important buildings from a cultural standpoint will be relocated, and the burdens and responsibilities for the relocation of the buildings will fall on LKAB. Among these are buildings whose protection is specified in detailed plans, such as the Länsmansbostaden, and historic buildings like the Hjalmar Lundbohmsgården, the director's residence, built between 1895 and 1909 and designed by the artist Christian Eriksson and architect Elis Benckert.

However, in entering into this pact, the two main actors in Kiruna did not take into consideration the will of the Norrbotten Länsstyrelsens, which prompted a request for a revision of the agreements. This revision took place in November 2013 with the drafting of the "**Supplemental Agreement on Building Relocation**" **[39]**. However, the Länsstyrelsens only settled for adding two more buildings of their choice to the list, bringing the total number to 21.

Feb. 2008 **[16]**

Nov. 2013 **[39]**

It's important to consider that each historic building is strongly tied to its context, so even if some of them are saved, one of their characteristics will be lost forever. For this reason, after determining which buildings to relocate, the involved actors invested a lot of effort in understanding the best strategy for their repositioning. The task falls on the Municipality of Kiruna, but LKAB and the County provide assistance in this matter. The strategies are outlined in the document titled "**Analysis of Kiruna's Cultural Heritage Phase 2**" **[43]**,

Feb. 2011 **[20]**

Sep. 2014 **[43]**

[16] Norrbotten museum. Feb. 2008. **What is Kiruna Worth? Kiruna - a Cultural Valuation Analysis.**

[20] Kiruna kommun & LKAB. Feb. 2011. **Agreement: "Gp1-atvalet".**

[39] Kiruna kommun & LKAB. Nov. 2013. **Supplementary agreement on building relocation.**

[43] Kiruna kommun. Sep. 2014. **Analysis of Kiruna's Cultural Heritage Phase 2.**

and there are essentially 4: organizing all the buildings to be moved in a single neighborhood, organizing them around a park, dividing them into small clusters, and scattering them as much as possible within the new city.

The new deformation prediction of 2014 **[45]** disrupted the plans. In this prediction, the red line receded, resulting in 11 buildings that had been selected for relocation now being outside the area.

With the number of buildings to be moved halved, the municipality, in agreement with the county, requested renegotiation of a new agreement to include more buildings to at least reach the number stipulated in the previous agreement, a request accepted by LKAB and the Länsstyrelsens. While stakeholders were discussing the new agreement, it was time to demolish parts of the city and therefore also to relocate the first buildings. On the morning of May 24, 2017, Kiruna witnessed the **first special transport** in its history **[54]**. The first building to be moved was "B5," the fifth building constructed in Kiruna to accommodate mine workers.

Feb. 2017
[52]

May 2017
[54]

By October of the same year, the first relocation stage was completed, involving a total of 8 historic buildings, of which only the Länsmansbostaden, built as a residence for Kiruna's first official policeman, will be transferred to the new center **[m]**. The other 7 will be located at the foot of Luossavaara on the northern outskirts of the city because, during this period, the new center only hosted the construction site of the town hall, meaning that if these buildings had been moved there, they would have found themselves in the middle of nowhere.

Simultaneously with this first relocation phase, the second agreement begins to take shape, effectively replacing the GP1-atvalet. Already in 2017, through the document: "**Building Relocation Plan for Structures Affected by Level 1365**" **[52]**, the main objective of the agreement is set, which is to find a common ground on which buildings are worthy of relocation in view of the imminent implementation of the detailed planning process for Gruvstadspark 2.

The working group consists of two representatives from LKAB, 2 from the municipality of Kiruna, and 3 from the county, along with Magnus Lindmark, who, thanks to his experience as a project manager in relocation projects in Malmberget, will provide technical insight. The document also establishes the strategy to reach a compromise: each of the 3 stakeholders must present a list of buildings that will form the basis of consultations from which the buildings to be relocated will be selected.

Reaching this new agreement will be more challenging than the previous one, and the stakeholders will take more time to reach a consensus. This is because after the initial demolitions and relocations, "a deeper awareness has matured regarding the importance of preserving the memory of Kiruna's past"[96].

An initial **agreement [60]** was reached in 2018, in which the total number of buildings to be relocated increased from 21 to 31. It was also decided to retain the buildings mentioned in the previous agreement. All newly selected buildings were constructed before 1930, as mandated by the county. This limitation can be justified by the fact that it was during this period that the buildings considered specific to Kiruna were constructed.

Additionally, the strategy for relocating the buildings was decided: to group them in small clusters because "as solitary entities, the relocated buildings risk becoming picturesque and difficult to understand in the new environment. Grouped as a separate entity, they might form an anomaly[316]".

The final act of this story is represented by the document: **Agreement on heritage buildings to move [68]**. In June 2019, the agreement was further revised according to the method already established in the 2017 documents. The three main stakeholders each presented a list of buildings, making clear their interests. The municipality and the Länsstyrelsens are primarily concerned with the historical value of the artifacts. The municipality also pays attention to the aesthetic aspect, as citizens usually attribute value to the buildings. LKAB, on the other hand, seeks to include buildings important to its history, as well as its properties with significant economic value, to minimize the losses due to relocation costs, which fall exclusively on the mining company.

Jun. 2019
[68]

Nov. 2018
[60]

LKAB and the municipality each presented 37 buildings, while the Länsstyrelsens presented 31, resulting in a total of 60 buildings, considering that many appeared on multiple lists. In selecting

[45] LKAB. Dec. 2014. **Deformation Forecast.**

[54] LKAB. May 2017. **Now we are moving Kiruna-Press invitation.**

[m] LKAB. Oct. 2017. **Länsmansbostaden will now be moved-Press release.**

[52] Kiruna kommun, County Administrative Board & LKAB. Feb. 2017. **Building Relocation Plan for Structures Affected by Level 1365.**

[96] Member of the Culture and Education Department of Kiruna kommun. Personal interview, May 6, 2024.

[60] Kiruna kommun, County Administrative Board & LKAB. Nov. 2018. **Management of Cultural Buildings for Relocation due to Level 1365, Version 3.**

[68] Kiruna kommun & LKAB. Jun. 2019. **Agreement on heritage buildings to move.**

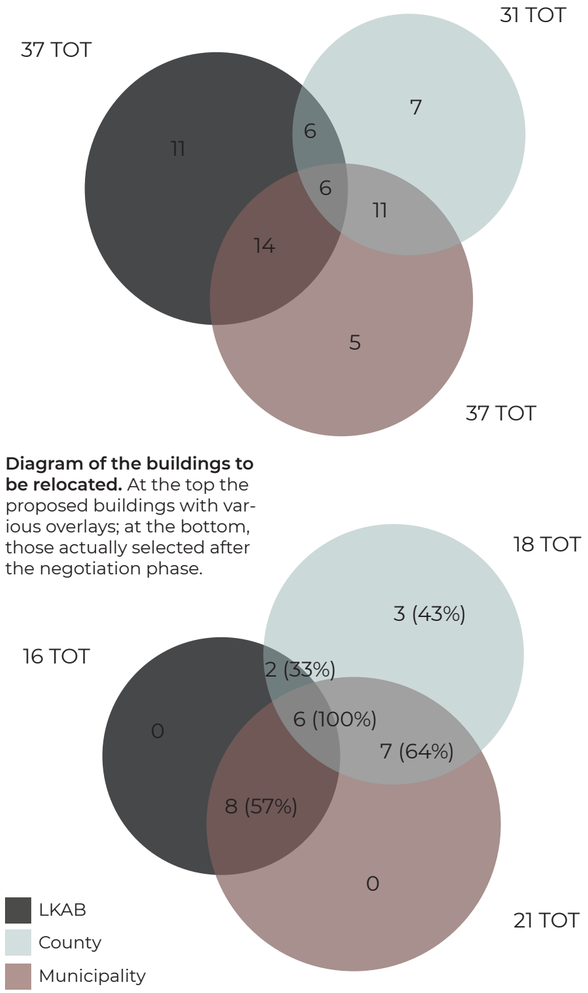


Diagram of the buildings to be relocated. At the top the proposed buildings with various overlays; at the bottom, those actually selected after the negotiation phase.

the buildings, the committee focused on those appearing on more than one list, representing the intersection of the interests of the three parties. Eleven buildings were present on both the municipality's and the county's lists, of which six were selected. Of the 14 buildings common to both the municipality and LKAB, eight were deemed worthy of relocation, as were two out of the six present on both LKAB's and the county's lists. The six buildings present on all three lists were selected, as expected. None of the buildings that appeared on only one list were selected, except for three of the seven that appeared solely on the Länsstyrelsens's list.

Following this agreement, 26 new buildings that were on the lists were selected, in addition to the eight already moved in 2017 and seven that were decided during the meeting, even though they were not on any of the three lists. This fact is quite unexpected. A possible explanation, supported by the presence of highly valuable buildings such as the Kiruna Church among these seven, is that the three stakeholders avoided listing buildings whose value was well known to everyone to keep the number of requests low and increase their negotiating power, counting on the fact that the other groups would inevitably include them in their lists.

In addition to being an excellent tool for understanding the strategies of the various actors involved, this document is also useful for understanding their negotiating power. Based on the selected buildings, it is apparent that the stakeholders have roughly equal power regarding the relocation of buildings, with only the Länsstyrelsens slightly surpassing the others by managing to get 3 of the buildings that were solely on its list approved, something the others failed to achieve. Another explanation could be that the main conflict was between the municipality and LKAB, with the third party benefiting as a result.

The agreement thus includes a total of 41 buildings, including those already relocated. The final issue to be resolved concerns two of the selected buildings: the old hospital and the fire station. These two buildings have already been sold by the municipality to LKAB in anticipation of future demolition, and LKAB refuses to return them to the municipality to avoid the transport costs, which, as previously stated, would be higher than demolishing and reconstructing them. Unable to reach an agreement, the municipality decided to manage the operation, partially funding it with the money received from LKAB for the sale of the buildings.

Starting from October 2019, another phase of **relocation [73]** began, linked to the Gruvstadspark 2 planning phase, involving the repositioning of 12 buildings. All these buildings were successfully relocated to the new city center grouped in small clusters as planned by Management of Cultural Buildings for Relocation due to Level 1365, Version 3 **[60]** by the summer of 2024.

Through all these relocations, the technical knowledge necessary to carry them out has grown enormously, making them safer and more efficient. Alongside, the technologies used have also improved, transitioning from simple trucks to specialized vehicles with hundreds of wheels to ensure greater stability during transport. However, with the improvement of technologies, costs have also increased, further exacerbated by the fact that only two companies are currently capable of performing such operations, leading to a lack of real competition among operators.

These high costs are willingly borne by both LKAB and the municipality to preserve these historic buildings, which represent the only physical continuity between the emerging city and the one that is disappearing.

Oct. 2019

[73]

[60] Kiruna kommun, County Administrative Board & LKAB. Nov. 2018. **Management of Cultural Buildings for Relocation due to Level 1365, Version 3.**

The relocation of a building in the summer of 2017. **Photo by Jessica Nieldén.**

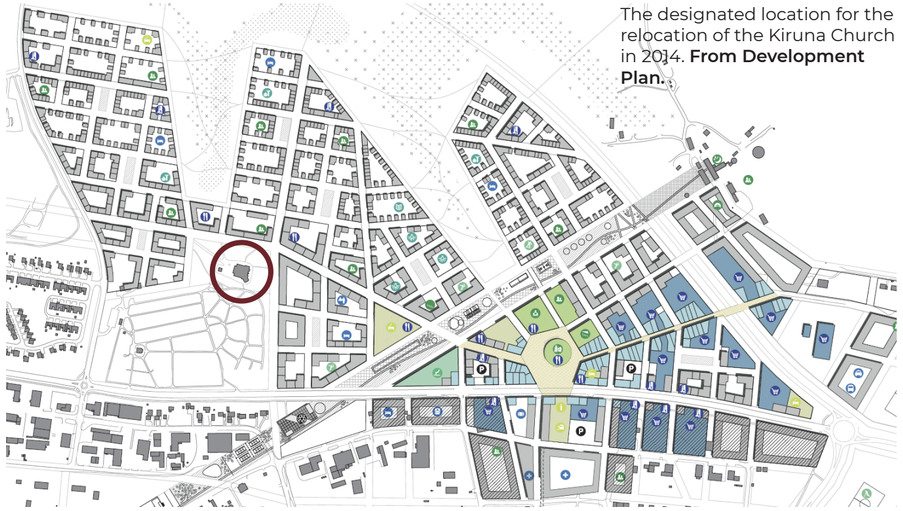
Buildings relocated to the new city center in the second phase. **Photo by author.**

3.5.3 Kiruna's Kyrka

The Kiruna Church, designed by Gustav Wickman and built between 1909 and 1912, can be considered the most iconic building in the city. It combines neo-Gothic forms with elements typical of Sami culture and is inspired by Norwegian stave churches. The building's aesthetics are highly appreciated by both the residents of Kiruna and Swedes in general, who voted it the most beautiful building in Sweden constructed before 1950. Despite being located centrally, just east of the city center, the church is surrounded by a large naturalistic garden that it overlooks from a small hill.

After the demolition of the town hall, it remains the only true symbolic building of the city. Due to its high cultural value attributed by the Norrbotten County, it was clear from the outset that every effort would be made to preserve it.

The building is one of the largest entirely constructed of wood in Sweden. Its square plan measures 40 meters on each side, and the roof reaches nearly 50 meters in height. Due to its imposing size, the preservation strategy was to dismantle it and reassemble it in the new city center.



The designated location for the relocation of the Kiruna Church in 2014. **From Development Plan.**

The first hypothesis regarding the relocation of the church appears in the **Northwest Alternative [8]** proposed by LKAB in March 2006. The document emphasizes the importance of relocating the church, which the Wilhelmson study plans to move northward on the shores of Lake Luossajärvi, where the church would benefit from a natural setting enhanced by the presence of the lake and the view of Kebnekaise in the background. This would make the building an attractive destination for tourists and ideal for weddings, but it would substantially alter its context. However, this hypothesis, along with the idea of moving the city to the northwest, was short-lived for the reasons listed in Chapter 3.2.2.

Within the "**Kiruna Forever**" **[29]** project, the church is situated west of the central square of Nya Kiruna, on a wooded hill between the new City Park and the cemetery, along the E10. Although this design document does not prioritize the positioning of the church, it remains essentially unchanged to this day. This is evidence that unstructured hypotheses can gain value over time and, for various reasons, can withstand multiple iterations of documents, ultimately bringing about The new hypothesis regarding the relocation of the church is first confirmed in the Jury Pronouncement **[32]** and further developed in the **Development Plan [41]** of March 2014. In this document, the church appears in a slightly different position, north of the cemetery but essentially in the same area. In the 2015 plan, the position is further refined and essentially returns to the one proposed by the Kiruna Forever project.

[8] Mar. 2006

Mar. 2014 [41]

The first significant document solely addressing the theme of relocating the Kiruna church is the "**Study on the relocation of the church of Kiruna**" **[66]** carried out by the municipality of Kiruna in collaboration with White Arkitekter in April 2019. Surprisingly, in the plan highlighting the new positioning, the church is oriented towards the east. This decision is indicative of the fact that among the factors considered for the relocation of buildings, orientation is

Apr. 2019 [66]

Dec. 2012 [29]

[8] LKAB & Wilhelmson Architects. Mar. 2006. **The New Kiruna - Northwest Alternative.**

[29] White Arkitekter & Ghilardi+Hellsten. Dec. 2012. **Kiruna Forever.**

[32] Kiruna kommun. Mar. 2013. **A new city center for Kiruna. Jury Pronouncement**.

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

[66] Kiruna kommun & White Arkitekter. Apr. 2019. **Study on the relocation of the church of Kiruna.**

The designated location for the relocation of the Kiruna Church and other 7 buildings in 2019. **From Study on the relocation of the church of Kiruna.**

not included. The church, like all Christian churches, traditionally has its entrance facing west, a symbolic element of significant value, although not always adhered to in Lutheran countries.

Much more attention is placed on recreating an environment coherent with the one where the church is currently located. The church will be immersed in a park, and the paths have been designed to be non-orthogonal and not to directly frame the building, unlike the bell tower, which is currently framed centrally by a path, an aspect that is sought to be recreated in the new plot. Moreover, the religious building will be positioned on top of a small hill. Unfortunately, this height, combined with that of the church, could pose a hindrance to air traffic, which will likely require the placement of a signaling light on its summit, much to the dismay of the residents of Kiruna[97].

Following what was stated in the "Management of Cultural Buildings for Relocation due to Level 1365, Version 3," **[52]** from the previous year, the Kiruna church is also included in a "cluster" composed of a total of 7 buildings, 9 if the church and the bell tower are considered separately. Five of these buildings: 3 rectangular-plan villas and 2 square-plan villas, will be positioned south of the plot in two adjacent blocks parallel to the E10 Road. The fire station and the old hospital, the relocation of which should be managed by the municipality, are instead positioned east of the plot towards the city center. The document particularly elaborates on the position of these two buildings, dedicating several pages to the topic.

As is customary, the municipality evaluates the pros and cons of all possible hypotheses through an analytical process and gradually reduces their number. The initial hypotheses are 7, and the document narrows them down to 2 for future studies. Option 0B proposes placing the buildings in the same block as their original arrangement, while Option 3 suggests placing the fire station beyond the city park, thus separating the two structures.

Apart from this significant study, none of the previous documents had thoroughly addressed the positioning of the church. This is because the area where the building currently stands will be one of the last to be affected by deformations. The detailed plan "**Gruvstadspark 2, etapp 5, Kyrkan**" **[81]** envisaged that the church relocation

Aug. 2021
[81]

[97] Member of the Culture and Education Department of Kiruna kommun. Personal interview, May 6, 2024.

[52] Kiruna kommun, County Administrative Board & LKAB Nov. 2018. **Management of Cultural Buildings for Relocation due to Level 1365, Version 3.**

[81] Kiruna kommun. Aug. 2021. **Detailed plan for Gruvstadspark 2, etapp 5, Kyrkan 11 m fl.**

would start around 2025 or 2026 and be completed by 2019. The significantly longer timeframe compared to the relocation of other buildings is due to the fact that, as stated in the previous chapter, the main idea at this stage was to dismantle and reassemble the building in its final position.

As previously stated, it will be LKAB's responsibility to handle the relocation. For this reason, as the time for the building to be moved approaches, the mining company commissions the engineering firm Afry, based in Kiruna, to prepare a detailed study of the surrounding environment of the church, the results of which are compiled in the document "**Landscape Analysis - Old Kiruna Church Site**" **[82]**. The study focuses on aspects such as the topography and tree species, with the aim of developing a plan to relocate the church while minimizing tree felling. The ultimate goal of the study is to thoroughly understand the context of the church in order to replicate it as faithfully as possible in the new site. As stated in the document itself, the new site should "resemble the old one in terms of dimensions, structure, pathways, and differences in altitude." The conclusions include recommendations for future design, even suggesting the possibility of transplanting trees from the old site to the new one.

Aug. 2021
[82]

Jun. 2024
[102]

The exact timing is not clear, but in the subsequent years, thanks to the knowledge gained from multiple building relocations, the idea of transporting the church without disassembling it emerged.

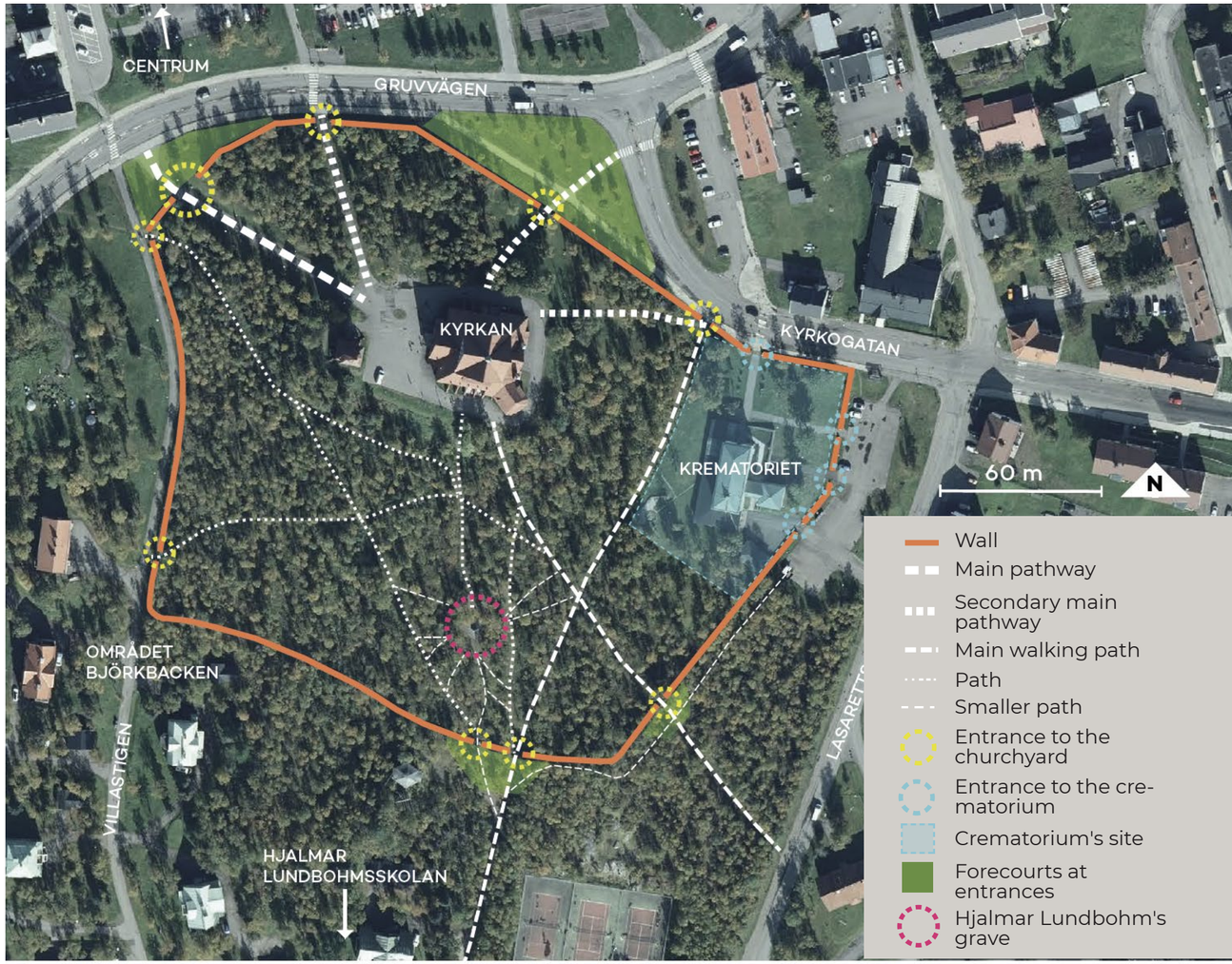
The weight of the church is estimated at around 600 tons[319], making it by far the heaviest building ever moved in Kiruna. Additionally, its 1600 square meters spread over a square plan does not make relocation any easier, especially considering the challenging compatibility with the elongated shapes of the articulated trucks used for transportation up to now.

The transportation of the church is by far the most complex ever devised in Kiruna, and the daunting task has been entrusted to the company Veidekke. At the beginning of 2024, the company decided on the route along which the transportation would take place. The church will travel down Gruv Street before turning left and proceeding along Hjalmar Lundbohm Street, Lombololeden, and Lastvägen to its final destination. The estimated time for transportation is 2 days and 2 nights. The church was **closed [102]** to the public in a solemn farewell ceremony on June 2,

[82] LKAB & AFRY. Aug. 2021. **Landscape Analysis - Old Kiruna Church Site.**

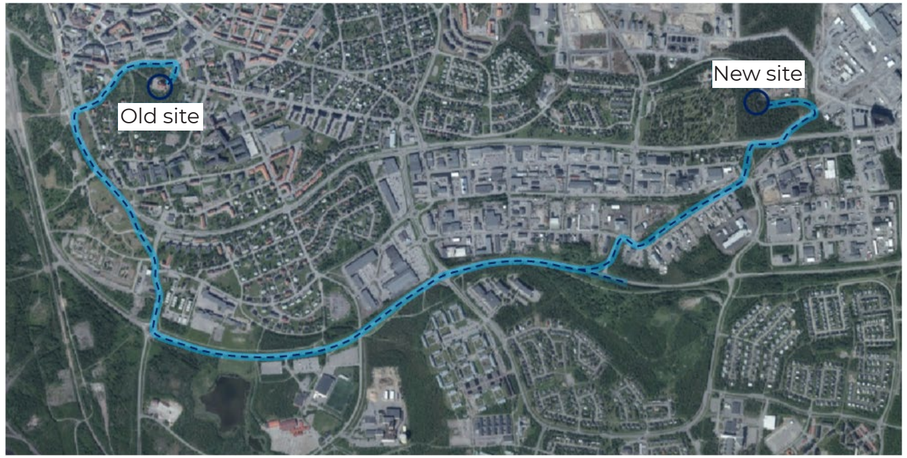
[102] Veidekke. **Veidekke begins the move of Kiruna church.**

Analysis of the Kiruna Church site. **From Landscape Analysis - Old Kiruna Church Site.**



2024. Work to separate the structure from its foundations began immediately afterward and will last for one year, with transportation scheduled for the summer of 2025. In the meantime, Veidekke operators are widening the roads along the route to allow for the passage of the church, whose reopening is currently planned for 2027.

The relocation of the church is a highly symbolic moment, occurring halfway through the city's relocation process, and can be considered the watershed event where the old Kiruna gives way to the new.



Kiruna Church path. **From LKAB samhallsomvandling.**

West facade of the Kiruna's church. **Photo by author.**

3.5.4 Kiruna's living room

The relocation of the Kiruna Church is a bold and risky challenge, but also a great opportunity to preserve the historic building's heritage. The move has been made possible thanks to the wooden structure of the building, which gives it a suitable weight and stability for transport. In Kiruna, only wooden buildings can be moved; those made of brick or concrete must be demolished, regardless of their significance to the residents or the level of protection granted by the County of Norrbotten board.

The most important of the demolished buildings is undoubtedly the Kiruna Town Hall, both for its architectural qualities and for what it represented to the inhabitants: a symbolic place and a meeting point. Named "Igloo," the building was designed by Arthur von Schmalensee in 1963. The name comes from the fact that the building was open inward and closed outward. The structure had a square plan of about 50 meters per side and was developed over 4 levels. At the center of the plan, there was a large open space spanning the entire height of the building, nicknamed "the living room of the Kiruna residents," a multifunctional space open to everyone and very popular, especially during the long and cold Arctic winters. The reinforced concrete frame structure was complemented by brick infill walls, and the galleries surrounding the central space were supported by finely crafted reinforced concrete floors.

Oct. 2010
[18]

Due to the materials the building is made of, it was never included in any of the multiple lists of structures to be relocated that have been drafted over time. Therefore, the desire to preserve this important building clashes with a technical issue: its weight. However, the fact that the building cannot be moved will only increase the ingenuity of the Kiruna residents, who will find various other ways to preserve the memory of their town hall.

There was never any doubt that the building designed by von Schmalensee was within the red line. It is located very close to the mine, just like the entire oldest part of the town center. Specifically, the building, being beyond Hjalmar Lundbohm Road, is included in the first phase of demolitions characterized by the detailed plan **Bolagsområdet Gruvstadspark [18]**, as discussed in section 3.5.1. In 2010, when the plan was drafted, it happens, became official that the town hall would be decommissioned. However, before the

[18] Kiruna kommun. Oct. 2010. **Detailed plan for Bolagsomradet Gruvstadspark.**

West facade of the Kiruna Town Hall. **From Ettelva.**

2012
[n]

2012
[30]

The clock tower in its new location in the central square of Nya Kiruna. **Photo by author.**

2013
[33]

decommissioning happens, it must first be downgraded from a building with the highest level of cultural protection to one that is not protected, allowing the bulldozers to proceed. In 2012, the municipality **applied [n]** to request the downgrading of the building, but the County Administrative Board, which is responsible for removing the restriction, **opposed [30]** it, stating that the building should be dismantled and reassembled. The municipality in agreement with LKAB **appealed [33]** twice this decision and won the case in 2013.

In the document certifying the downgrading, an initial strategy for preserving the memory of the building is also outlined: some highly symbolic architectural elements of the old town hall will be transported and incorporated into the new structure that will arise in Nya Kiruna. The county proposed a list of these elements, which became a point of contention with the municipality, as they wanted to have a say in the matter and disagreed on which elements were worthy of preservation.

Eventually, the two parties reached an agreement: the steel clock tower that once stood atop the building would be relocated to the central square of the new town, in front of the town hall. Additionally, the handles of the main door, made of intricately carved wood and a fine example of traditional Sami craftsmanship, would still open the door of the first building in New Kiruna. Other elements such as the interiors have been preserved and are now on display in Stockholm.

Once the new building was completed, the old one could be **closed [57]** in preparation for its future demolition in August 2018, although the **demolition [64]** would only occur in April 2019. This period allowed the municipality to implement a second strategy aimed at preserving the memory of a building that was highly symbolic for the community.

This strategy involved conducting a detailed analysis of the building, both before and during its demolition, as the demolition offered a unique opportunity to study the construction elements from perspectives that were impossible when the building was in use. The analysis was extremely meticulous, resulting in a comprehensive 162-page document authored by the Norrbotten Museum named **Demolition documentation, Kiruna City Hall [76]**. The study delved into the physical and chemical composition of every single material present in the building, showcasing the dedication and strong desire to preserve knowledge of even the smallest and seemingly insignificant details. To allow the town hall to be visited before its demolition, a virtual tour[98] was created and made freely accessible through the municipality's website.

[57]
Aug. 2018
Apr. 2019
[64]

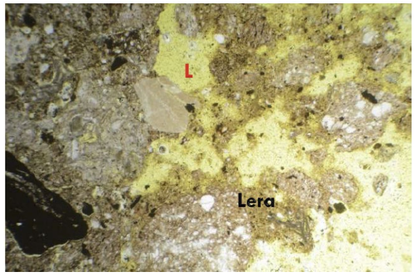
These strategies aim to transform the building into a document, with the ultimate goal of extending the life of the architectural artifact. Thus, while the new Kiruna witnessed the process of transforming documents into buildings, the old town attempted to implement the reverse process to ensure it did not entirely disappear.

In the fall of 2019, after the demolition was completed, a playground with community gathering spaces and seating that traced the square plan

[98] Old Kiruna City Hall virtual tour from Norrbottensmuseum.

Nov. 2020
[76]

Sample 14 – Mortar under the iron plate of the stove. **From Demolition documentation, Kiruna City Hall.**



[76] Norrbotten Museum. Nov. 2020. **Demolition documentation, Kiruna City Hall.**

of the building was created in place of the town hall. This area, although temporarily, returned the space to the community, maintaining its function as a meeting place. The maintenance of its function can be considered another strategy to preserve the memory of this place, which today, awaiting its eventual sinking into the mine, presents itself as a public space, albeit very different from what it was just five years ago.

The mining park area where the town hall once stood. **From Udda Utflykter.**

4 Kiruna Relocation in a Diagram

In this chapter, the 17 stories from the previous chapter are reorganized into a single **synchronic diagram**, aiming to provide a unified view of the process.

4.1 Ex ante considerations

Chapter 3, which aims to narrate the story of Kiruna's relocation, is structured with a multiple plotline approach[99]. The stories, although overlapping in terms of time and geography and intertwined through events and incidents, are narrated separately. This structure allows for a detailed view of different aspects of Kiruna's relocation process, which is, by its nature, multifaceted and extremely complex, much like urban projects tend to be. Had a linear timeline been adopted for the narration, the thread that ties the various aspects together would inevitably have been lost in the intricacies of such a complicated process.

The narrative structure adopted is perhaps the most effective in this specific case, but it comes with the weakness of failing to provide an overall vision of Kiruna's relocation, which, although at times fragmented, remains a unique process. In this process, the different documents, conflicts, agreements, and actions influence each other like irregular pieces of a domino chain.

In this chapter, the aim is to provide an overall view of the otherwise elusive process through a hypertextual object represented in the form of a diagram. The goal is to bring together the various stories and their components, such as documents, disputes, and the physical transformations that have occurred in Kiruna. The diagram focuses not on the actors but on the actions, based on the conviction that documents and interactions are the true drivers of urban transformation, sometimes forcing actors to make decisions that do not align with their own principles: "*But when the process undergoes interruptions, deviations, and rethinks, its articulation becomes more complicated: new, unexpected players are added, roles can be questioned and may change, and, at the end of the day, the reasons for the deviations can no longer be traced back to the relationships between the subjects and their positions*"[100].

Given these premises, the hypertextual tool takes inspiration from the "Shenzhen diagram". Created for the 2012 Shenzhen Architecture and Urbanism Biennale, the diagram was designed to map the controversies inherent in the urban transformations of four distinct river areas, one in China one in Hong Kong, and two in Northern Italy. By focusing on the design process rather than the outcomes of the intervention, this diagram seems perfectly suited for application to Kiruna, where the final results can only be assessed in the future, and not in the near term.

In the ongoing process in Kiruna, the form of the city and key events are often influenced by sudden disruptions, which this type of diagram is designed to highlight. In a linear process, utopian for an urban transformation intervention, the diagram would lose its effectiveness, becoming a series of straight lines, whose endpoints would be political decisions upstream and the completed architectural works downstream. The diagram was first published in the book *Watersheds*, which inspired a number of PhD and master's theses, from which the diagram proposed in the following pages also draws its inspiration.

However, the aforementioned diagram diverges from the on described in *Watersheds* in its attempt to give a different spatial order to the various nodes. These nodes are not arranged according to the four phases of action theorized in the Shenzhen Diagram but follow a different criterion, which is explored in the following chapter. Nevertheless, the four phases can still be identified through other graphical elements.

[99] Herman D., Phelan, J., Rabinowitz P. J., Richardson B., Warhol R. 2012. *Narrative Theory: Core Concepts and Critical Debates*. Columbus: Ohio State University Press.

[100] Armando A., Bonino, M., Frassoldati F., Federighi. V. 2015. *Watersheds, a narrative of urban recycle*. Guangzhou: Sandu Publishing.

4.2 Diagram framework

The diagram is essentially the visualization of all the documents, negotiations, and material effects that have had or will have an impact on the form of the emerging city, namely the new Kiruna, and the city that is dying: the old town center. These 3 entities represent the nodes of a network that aims to depict the phenomenon of Kiruna's relocation.

The diagram consists of two elements: the **nodes** and the **connections** between them. The nodes are arranged in a two-dimensional Cartesian space. The horizontal axis represents **time**, and the nodes are positioned based on either their effective date (in the case of documents) or their occurrence (in the case of events or material effects). The time span represented ranges from 2004, the year when LKAB sent the email to Kiruna kommun, and the moment when the process ideally begins, to the present, which corresponds to the end of the data collection phase of the thesis, namely July 2024. However, time does not flow uniformly in Kiruna; as shown in the diagram, some years cover a larger area of the graph compared to others. This is because these years feature a higher density of nodes, an unmistakable sign that the process accelerated during those periods.

On the vertical axis, there is essential information about a characteristic of the documents: the **scale**, understood both as an architectural scale, with various ranges from 1:100,000 to 1:1000 (typical dimensions for urban planning), but also as a scale related to how close the urban/architectural intervention is to realization. This scale adds three categories to those already mentioned, two of which are above the architectural scale: text documents and concept drawings (understood as designs without scale references). The final category, positioned at the bottom, is labeled as blueprint/effects.

The presence of the scale on one of the two axes is the most important innovation that the diagram presents compared to the one described in the book *Watersheds*. The need to incorporate this feature arises from the assumption (though not always accurate) that the closer a node is to the lower part of the diagram, the more localized its impact will be in space and the sooner it will occur.

However, most of the documents analyzed exhibit more than one characteristic. For example, the document titled Northwest Alternative **[8]** includes both numerous concept-level drawings and various texts. In cases like this, the document is placed as low on the axis as possible. This "dominance" of the larger scale can be explained by the fact that architectural documents are almost always accompanied by conceptual sketches or texts that serve a supporting role to the plans and sections. Additionally, in many cases, documents encompass multiple temporal phases, with the final phase (often closest to the document's publication or effective date) presented at the lower scale.

Another characteristic of the nodes, visualized through color, is the stakeholder that generated them. The nodes can be one of six colors, five of which represent the most recurring actors: primarily the **Municipality** and **LKAB**, followed by the **Regional Authority**, an umbrella term covering both the Norrbotten County Administrative Board (Länsstyrelse) and the regional council (Regioner), the **Inhabitants** of Kiruna, and **Architecture Firms**, including all private designers who have influenced the process. The term "others" refers to all other actors who have impacted the process, with the most represented in the diagram being Trafikverket, the Swedish Transport Administration. If a node is the product of multiple stakeholders, it features a bicolor or even tricolor design, as seen, for example, in the "Management of Cultural Buildings for Relocation due to Level 1365, Version 3" **[60]**, an agreement reached between LKAB, the Municipality, and the Norrbotten County Administrative Board.

The nodes are also defined by icons that represent the type of the action. This category, unlike the previous ones, is more subjective and presents somewhat vague boundaries, but it remains fundamental in identifying key aspects of each node.

The nodes are divided into three main groups, the first of which encompasses **documents**. There are four types of documents: **design**, **informative**, **prescriptive**, and **technical**.

The first type includes documents with a strong design focus, These documents are united by the fact that they represent a forecast of a future that can only be realized thanks to their existence. An example is the winning project of the competition for the city's design: Kiruna Forever **[29]**. Informative documents, on the other hand, aim to communicate, indirectly affecting the urban space by enabling interaction between stakeholders, such as the Invitation to Architecture Competition, and New City Hall in Kiruna **[34]**. The third

[8] LKAB & Wilhelmson Architects. Mar. 2006. **The New Kiruna - Northwest Alternative.**

[60] Kiruna kommun & LKAB. Nov. 2018. **Management of Cultural Buildings for Relocation due to Level 1365, Version 3.**

[29] White Arkitekter & Ghilardi+Hellsten. Dec. 2012. **Kiruna Forever.**

[34] Kiruna kommun. 2013. **Invitation to architecture competition, new City Hall in Kiruna.**

category, the prescriptive document, is characterized by its authority; these documents grant legal force to design-related documents, as they are issued by a governing body, such as a project approved by the municipality of Kiruna. The last type consists of technical documents, which are the result of objective analyses and mathematical calculations that often form the basis of long chains of documents. The most striking examples of this category are the Deformation Forecasts.

The second macrocategory relates to the interaction or conflict between stakeholders, or within the stakeholders themselves. It includes the categories: **agreement**, **conflict**, and **consultation**. As expected, almost all of these nodes are characterized by two or more colors, reflecting the involvement of multiple actors.

The last macro category consists of a single type: **material effects**. Nodes with this symbol represent the three activities that are shaping the new city: demolition, reconstruction, and relocation.

Additionally, 5 logos are highlighted with a black circle; this symbol indicates the most important nodes for the process, such as the mail to Kiruna kommun **[2]** or the inauguration of the new city center **[90]**.

The nodes are interconnected through various links that give the diagram a network-like structure, making the process more understandable. The highlighted connections are only those that are direct and immediately identifiable, and they are divided into four categories: **direct consequence**, **collateral consequence**, **projection**, and **update**.

Direct consequence is the most common type of connection and appears whenever a document explicitly anticipates the creation of another document or subsequent action. An example is the connection between "A New City Centre for Kiruna: Invite to an Architecture Competition" **[24]** and the First Delivery **[25]**. In contrast, collateral consequence occurs whenever a node has an unforeseen impact that leads to the creation of a document or action. For instance, the Expression of Interest **[19]** that influenced the Municipality's decision on where to relocate the city, which was formalized through the Agreement of the Municipal Board on City Relocation **[21]**.

[2] LKAB. Mar. 2004. **Mail to Kiruna kommun.**

[90] Kiruna kommun & LKAB. Sep. 2022. **Inauguration ceremony of blocks 7, 8, 9.**

[24] Kiruna kommun. Apr. 2012. **A new city centre for Kiruna invite to an architecture competition.**

[25] White Arkitekter & Ghilardi+Hellsten. May 2012. **First delivery.**

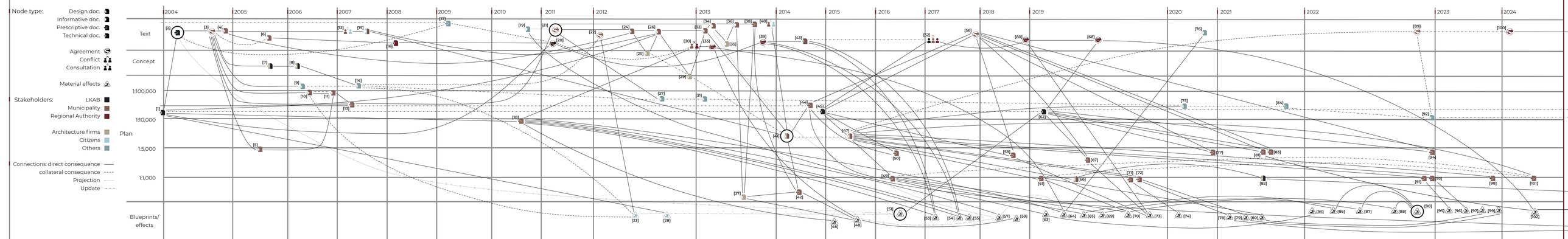
[19] Avalon. 2011. **Expression of interest.**

[21] Kiruna kommun. Sep. 2011. **Agreement of the Municipal Board on city relocation.**

Another type of connection is projection, which is similar to a direct consequence, but the resulting document (or more commonly, the material effect) precedes the generating document. An example of this is the Mail to Kiruna kommun **[2]**, written in anticipation of the full exploitation of Level 1,365, which would only occur 12 years later. The final type is update, which, as the name suggests, simply connects two documents that perform the same function but succeed each other over time like the various deformation forecasts.

This chapter summarizes the rules by which the diagram was created, which, once completed, allowed for further reflections on the complex process taking place in Kiruna.

[2] LKAB. Mar. 2004. **Mail to Kiruna kommun.**


Node type:
Design doc.
Informative doc.
Prescriptive doc.
Technical doc.
Agreement
Conflict
Consultation
Material effects
Stakeholders:
LKAB
Municipality
Regional Authority
Architecture firms
Citizens
Others
Connections: direct consequence
collateral consequence
Projection
Update
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Text
Concept
1:100,000
1:10,000
Plan
1:5,000
1:1,000
Blueprints/
effects

4.3 Ex post considerations

Observing the diagram, one can notice several trends that are difficult to identify based solely on the narratives presented in the previous chapters. Some interesting insights are provided by the distribution of nodes and connections within the diagram.

In particular, it can be observed that **direct consequence** connections, which are by far the most prevalent in the diagram, tend to direct more towards the downward direction on average than towards the upward direction, in a ratio of 4 to 1. This confirms the initial hypothesis that the process tends to move downward as it progresses (when controlled). This is not the case for **collateral consequences**, which are less frequent but much more balanced in terms of direction. They are distributed more evenly in both upward and downward directions, with a ratio approaching 1 to 1.

Connections labeled as **projections**, similarly to direct consequence connections, also exclusively move downward, partly because their endpoints are often located in the lower part of the chart. A noticeable difference from the previous types is the length of the segments; in this case, they are consistently longer, averaging 7 years. This indicates that preparing for future events in this context requires significant lead time, partly due to the limited period during which demolitions and reconstruction can be carried out, which is constrained by the Arctic climate.

The final type of connection, namely the **update**, consists almost exclusively of horizontal lines of intermediate length between projections and the first two categories.

The distribution of connections within the graph appears to be quite random, and the same can be said for the different types of nodes. However, interesting trends can still be identified, such as the predominance of **design documents** before 2014, during which 14 documents were produced compared to 5 after that period. In contrast, **prescriptive documents** are more numerous after 2014, with a ratio of 5 to 1. The same applies to **material effects**, which, reaching the end of the chain, are all positioned in the second half of the graph, starting from 2012, the year when the temporary railway line was built.

The most unexpected and interesting conclusion from the graph is the area it occupies. Nodes and connections, considered as a whole rather than individually, form a distinctive **butterfly shape**. From 2004 to 2014, the graph is positioned in the upper part of the space; during this period, nodes never exceed the 1:5000 scale, except for the two railway-related interventions carried out in 2012. Conversely, starting from 2015, nodes and connections shift rapidly downward, with the vast majority of nodes positioned below the 1:100,000 scale, and only slightly more than one-tenth positioned above this scale.

This butterfly-shaped pattern reflects the transition between two phases: the first phase, characterized by design documents with a very low scale, positioned in the upper part of the diagram, spanning from 2004 to 2014, and a second period where land deformations forced stakeholders to produce prescriptive documents with a smaller scale and to transform the territory with urban interventions. This second phase, which currently has a duration similar to the first, is expected to continue for 11 more years according to forecasts **[26]**.

This analysis, which has identified the two phases of the Kiruna relocation process, highlights the period when these phases overlap, namely the year 2014, a year rich in events such as the drafting of the Development Plan **[41]**, one of the key documents in the process.

As this period is the focal point of the diagram, it is central to this research project. It serves as both the culmination and synthesis of the initial analysis phase and as the starting point for the development of the digital tool for Kiruna. The diagram embodies the fundamental idea behind the tool and one of its main interfaces.

[26] Kiruna kommun. Jul. 2012. **Architecture competition brief.**

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

5 Kiruna eXplorer

On the following pages, the results of the **design** of the **software tool** are described, along with the **methods** used to develop the project and those used to communicate it to the developers.

5.1 A tool for Kiruna

5.1.1 Recognizing a need

The goal of this thesis is the design of a digital tool that integrates into the ongoing process. The act of designing is typical of an architect; the architect translates instances into a narrative that produces material effects only through other actors, and in the vast majority of cases, the design will undergo changes and revisions. This usually doesn't happen in university, where in the case of a thesis, the only other actor who can modify the project is the supervisor. In this case, since it is a project that is being realized, my contribution is not total but joins that of Professor Torchiano and, of course, my advisor Valeria Federighi.

For this reason, I want to be clear about the tasks I have carried out, the first of which was the difficult decision regarding the function to assign to the web app. In the decision-making process that led me to define in which area the tool should intervene, it was crucial for me to identify a need. But whose need? First and foremost, the need of the city, understood as civitas, that is, the set of social instances that make up a human settlement. The processes taking place in Kiruna seem to reveal two major concerns that are also two major challenges:

the need to tell the story of what has happened, along with the need to remember the old city, and the concerns surrounding the new town, with all the problems and difficulties of managing a rapid and tumultuous process that is not always easy to control.

Given these premises, the decision was made to create a tool that narrates the ongoing process, consistent with the work I have done so far, and by telling and tracking the past, it could also push into the future to some extent, attempting to foresee the process's developments. Starting from the 17 stories narrated in Chapter 3, the tool is intended to expand the knowledge of the ongoing process in Kiruna by implementing the scheme with new documents and testimonies of material effects that can more accurately narrate the process than this thesis alone has done, and that can continue to tell the story in the future and facilitate its developments.

The choice of a tool with these characteristics stems from the need to represent the complexity of the relationships between the documents, allowing flexible and non-linear access to the collected material, with the intention of enabling a wide audience to understand and contribute to the ongoing process.

The first step I took in designing the web app was to define the **users**. An architect often has a client, but not always; a significant skill for an architect is the ability to see a project's potential even before its (future) client does. In this case, we find ourselves in between these two scenarios. While I didn't have a specific task assigned by anyone other than the Polytechnic, my collaboration with the municipality of Kiruna opened the door to making my work more than just a master's thesis. For this reason, the first and most important users are the **urban planners** of the municipality of Kiruna. Specifically, the web app is aimed at the offices for the environment and construction, culture and education, and all those who produce documents within the town hall itself.

The tool will enable these figures to reorganize and represent the complexity of the ongoing process in Kiruna. The Kiruna administration has produced an impressive amount of documents over the past 20 years, and it has not always been easy to keep track of them, especially those documents that have seemingly completed their deontic cycle but remain fundamental for understanding the subsequent steps.

Two factors have contributed more than others to the difficulty in tracking these documents, aside from the already mentioned issue of overwhelming numbers. The first is the lack of direct witnesses: often, the staff within the Kiruna municipality consists of people born elsewhere, who have held various positions before this one and rarely stay in the same role for more than 10 years. As a result, some documents from the early phase may be unknown to them. The second factor is related to Kiruna's status as a moving city: the physical archive containing the first batch of documents related to the relocation was housed in the town hall, which was demolished and rebuilt in the new city center. This led to the relocation of the archive itself, which, due to the immense workload on the local administration, has not yet been reorganized, with many documents still stored in the packaging used for their transport.

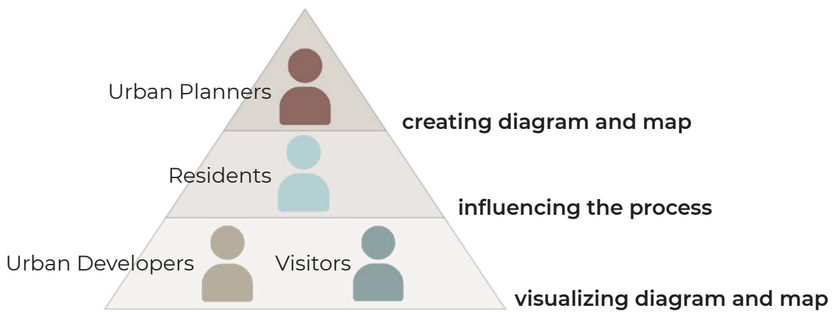
The ease and immediacy of consultation, one of the objectives to be achieved in the development of the tool, aims to allow use by another type of user: those who are experiencing the change firsthand: the **Residents** of Kiruna. With a focus on institutional transparency and public engagement, a crucial theme for authorities in this part of the world, explored in Chapter 3.2.3, the tool will be publicly accessible online, allowing citizens to stay constantly updated on the processes that affect them directly as residents of Kiruna.

The significant media attention analyzed in Chapter 3.4, as well as the academic interest the case has received, has led to an increasing number of individuals needing more or less specific information about the ongoing process. From this need arises the third category of users: **Visitors**. Like the inhabitants, they might monitor the situation in Kiruna and easily retrieve documents drafted even many years ago. Compared to the latter category, these users will have access to a smaller number of tools, given that the process does not directly involve them. Their use of the app would come after the technicians', and they would have the same ability to view documents as the citizens. However, since their goals and research would differ, they have been categorized as a separate user group.

The fourth and final type of user is represented by the **Urban Developers**. Like the last two user categories listed, they could use the tool to enhance their knowledge of the territory and monitor the production of specific documents useful for carrying out their work in coordination with the municipality of Kiruna. They too could have a partially active role in implementing the document schema, in addition to having some of the viewing capabilities of the previous categories.

In general, the four types of users are organized in a pyramidal structure. At the top are the urban planners, followed by the inhabitants, with the visitors and urban developers positioned lower down. Users higher in the hierarchy can access all the features availa-

ble to the lower-ranked categories, but not vice versa.



User pyramid diagram. On the right are listed the features accessible to the user category they are aligned with and to all categories above.

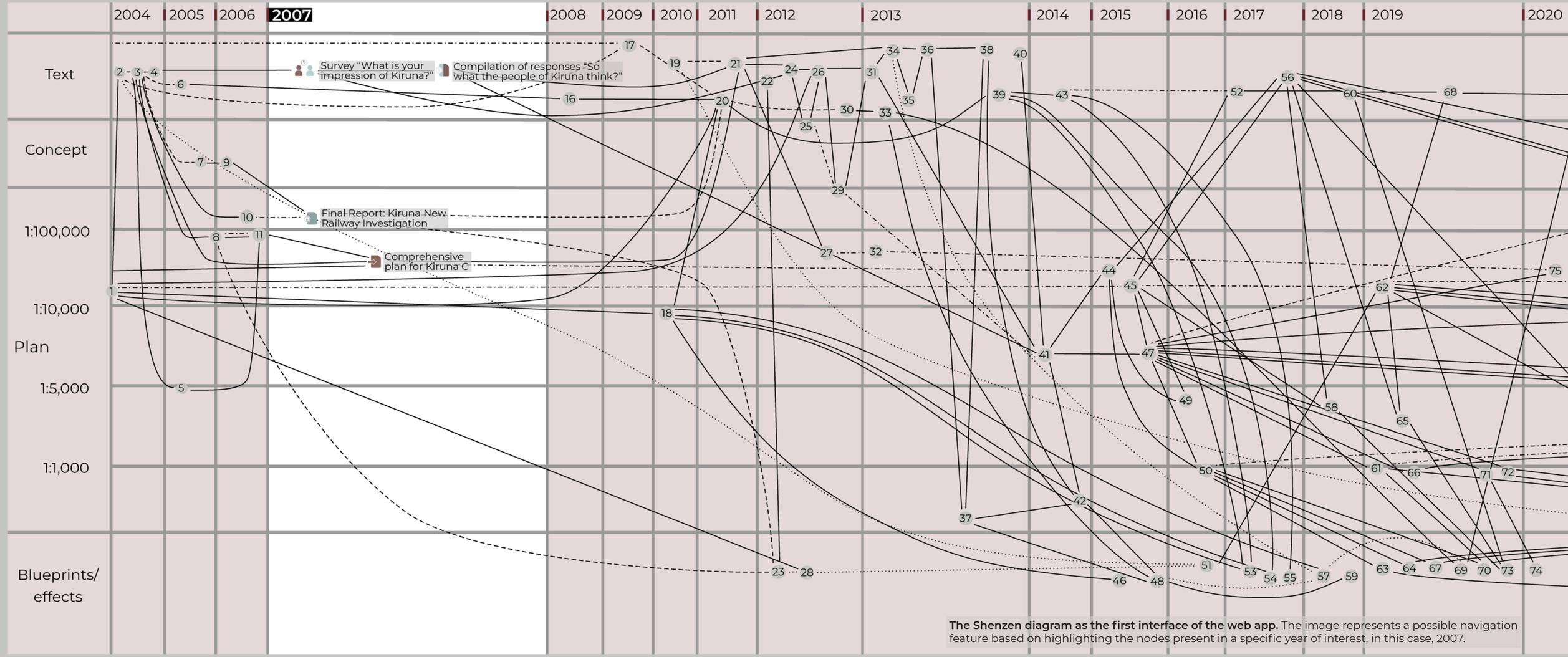
5.1.2 Interfaces

To visualize the actions, that is, the documents, interactions, and material effects on the territory a scheme similar to, if not the same as, the diagram shown in Chapter 4 is used.

The **Shenzen diagram** constitutes one of the two main **user interfaces** visible to users once they access the site; for the 'urban planner' user category, this would be the first visible interface. Starting from a scheme already developed based on the collection, classification, and organization of actions, users have the opportunity to implement this scheme by modifying the attributes of the documents and their placement within the diagram, as well as altering connections if they deem it necessary by changing links and characteristics.

However, the main feature is the ability to add new actions, along with their respective connections, with the dual purpose of enhancing the existing scheme and, above all, continuing to narrate the story of the process until its completion, currently expected in about 10 years.

Inserting nodes, whose main component is the documents, into a Cartesian space and then connecting them to



The Shenzen diagram as the first interface of the web app. The image represents a possible navigation feature based on highlighting the nodes present in a specific year of interest, in this case, 2007.

other nodes is an excellent way to visualize the process and fix it in the mind through visual memory. By leveraging these properties, the tool takes on the appearance of an archive, where finding documents, even when their title is forgotten, becomes much easier than in a conventional physical or virtual archive.

The diagram can also be implemented by the last user type discussed in the previous chapter, namely the Urban Developers. However, their ability to act is much more limited compared to the municipal urban planners, as they can only implement the scheme with elements specific to their expertise, always subject to municipal approval before publication, and without the ability to modify the existing scheme except for the nodes they have added.

All four user types have the ability to access and view the user interface represented by the diagram and navigate freely through it, accessing various contents as they are published. Transforming a static drawing into an interactive tool opens up endless possibilities for making the visualization clear and intuitive, as well as facilitating navigation within the diagram. For example, expanding a timeline by one year or a scale of interest, highlighting all nodes connected to a node of interest, or displaying all actions linked to a story when a particular node is focused on.

The decision on which visualization functionality to add in order to implement the static design will be left to the creativity of computer engineering students, who will develop a first draft of the tool by January 2025. The importance of adding filters to facilitate navigation is directly proportional to the number of elements present in the diagram; if these elements were to grow exponentially, the issue would become crucial for the project's success. The addition of these enhanced visualization schemes will be evaluated with the help of the users, namely the four user types defined in the previous chapter.

However, the diagram constitutes only one of the two main user interfaces of the tool. For all user types except the urban developers, the most important interface displayed will be a **georeferenced urban plan** of the Municipality of Kiruna.

This user interface represents the connection point between the 17 stories and the context. Since every action in the diagram directly affects a specific area, the map represents the place where all these actions converge.

Through this interface, which is also accessible to everyone, users can understand which areas are connected to the nodes by visualizing them on the map.

Through this second visualization

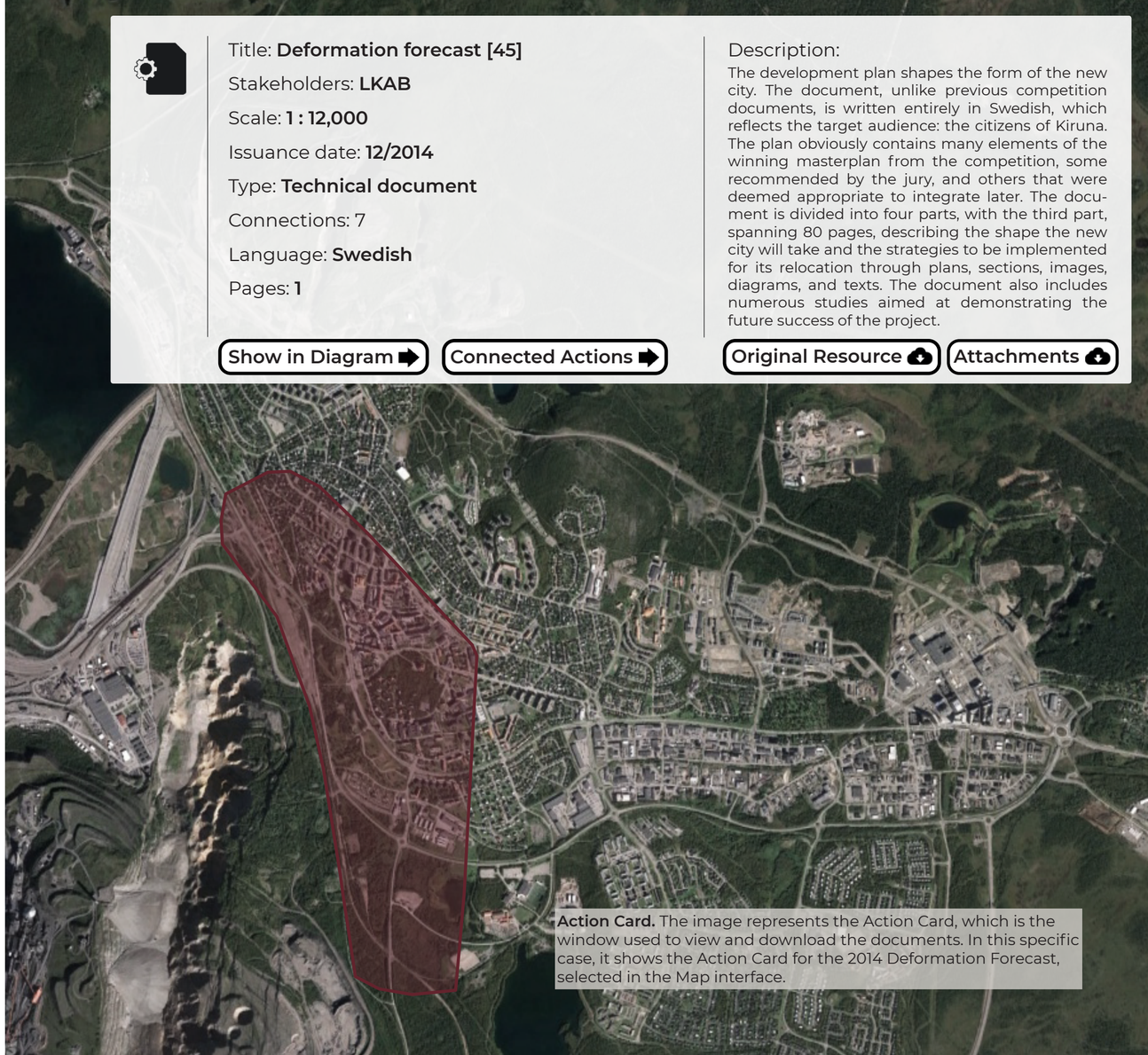
The other user interface: Georeferenced Urban Map. The image represents the area covered by the "Development Plan" document created by the municipality of Kiruna in collaboration with White Arkitekter, as selected in the Map interface.

method, the various user categories could monitor the process in a specific area of the city of their interest, each with a different purpose. Urban developers are generally interested in areas where the land use is not yet defined, seeing opportunities for economic investment. Inhabitants could monitor the area where they live, own property, or the areas in the new city where they plan to relocate. Researchers, on the other hand, might choose areas of interest if they wish to delve deeper into a specific aspect of the process or recreate the timeline of a location.

The georeferenced map opens up endless possibilities for navigation tools similar to those found in other interactive maps, such as Google Maps or Google Earth. As with the other user interface, it will be up to the student's discretion to decide which of these functionalities to implement in the app.

Without this second, essential interface, it would be impossible to grasp one of the most important types of interaction between actions: territorial overlap, a principle on which the Detroit Great Game is based (understood as a board game).

The two graphic interfaces are closely connected to each other, and users can easily switch between them through the actions. Essentially, they represent two different ways of visualizing the same process: the first focuses on the social value attributed to the actions while the second spatializes their effects.



Action Card. The image represents the Action Card, which is the window used to view and download the documents. In this specific case, it shows the Action Card for the 2014 Deformation Forecast, selected in the Map interface.

5.1.3 User stories

An architecture project truly exists only when it is communicated. A project that remains in an architect's mind is merely an idea; it is communicated through countless exchanges with other designers, technical experts, clients, and especially with those who will ultimately bring the project to life.

The methods an architect uses to communicate an architectural project are numerous and well-known. Communication occurs primarily through drawings, which include common floor plans and sections, as well as renderings or diagrams, but also through words, almost always written, though often spoken as well. Typically, communication with the executing company happens through construction drawings; however, in this case, given that the design project was a software tool, a different communication method was necessary.

In this instance, the method used was language, which is an instrument found in any architect's toolkit, though applied quite differently from how it would be used to communicate an architectural project. The input provided to the 128 students in the Software Engineering II course consisted of two types of information. The first form of communication occurred through multiple reviews conducted by my supervisor Valeria Federighi, Luciana Mastrolia, Tommaso Listo, Camilla Forina, and myself, in which we guided the students verbally toward our vision of the web app while remaining open to modifications whenever they proposed ideas that we found interesting. The second form involved written language, consisting of a series of very brief texts, each under 30 words. These texts contained all the required app functionalities and represented the main input provided to the students to begin programming.

The texts are written as requests from the four user types described in Chapter 5.1.1, all following a specific format: the first part identifies the user to clarify who is making the request; the second part, always starting with "I want," describes the action the user wishes to perform; and the third part (not always present), beginning with "So I can," describes the ultimate goal of the action. This communication method was not created for this thesis but is instead adopted from a well-established practice in the Software Engineering II course. I wrote these brief statements, and they were then refined by Professors Marco Torchiano, Antonio Vetrò, and researcher Riccardo Coppola.

The next step was to assign a business value from 1 to 1000 to each statement to order them in a list according to their importance. This allowed students to start developing the app with the most critical features, moving on to additional ones afterward.

These brief texts are called stories, through which the tool is described. They are the output of the diagram discussed in Chapter 4, very different from the stories collected within the diagram itself. In this sense, the diagram serves as the hinge of the thesis: it is the product of the stories narrated in Chapter 3 and generates other stories described in this chapter.

5.1.4 Epic 1

EPIC 1

As an Urban Planner, I want to feed the system with relevant documents.

The text of the first epic envisions the possibility of adding documents into the system. Positioned higher than the others, this epic groups the stories that are linked to the primary function of the application, namely collecting documents related to the process of relocating Kiruna.

Story: Kx2
b. v.: 1000

As an Urban Planner, I want to add a new document description.

The first story, which has the highest business value, opens up the possibility for Urban Planners to fill out a card with information about a specific document included in the web app. At this point in the tool's development, there is neither the possibility of uploading original documents nor implementing the diagram. Once implemented, the diagram will allow access to the cards. Urban Planners will be able to complete certain fields, some mandatory, with information common to all nodes, such as name, node type (as described in Chapter 4.2), stakeholder who created it, scale, number of connections, publication date of the document, and a brief description in text form.

Story: Kx3
b. v.: 980

There are also some optional fields with important information that are not common to all nodes, such as the language in which the document was written and the number of pages.

The document's publication date also has a degree of flexibility. Recognizing that it is not always possible to know the exact date a document was published, it is possible to enter only the month and year or even just the year in the date field.

The cards are designed to provide immediate feedback to all users browsing through the documents, allowing them to quickly determine if a particular document is relevant to their interests without needing to download or open it first. This is particularly useful given that many of the documents are written entirely in Swedish, often exceeding 100 pages, while others may even be missing.

As an Urban Planner I want to add one or more original resources for a document.

The second story involves the ability of Urban Planners to upload the original source of a document. On each node's card screen, a button allows users to download or view the original source, which would be the file or files containing the original document. Almost all documents related to the relocation of Kiruna are open source and freely accessible to everyone. Providing users with the option to download these documents is crucial for sharing the ongoing story of this process, one of the tool's primary objectives. This feature is also essential for ensuring institutional transparency for the municipality of Kiruna, a highly valued aspect in this context.

However, uploading the original resource is not mandatory when creating the document. Many documents, although known to exist, lack an original source. Therefore, the original source can be uploaded at a later stage or not uploaded at all, while still allowing the card to be viewed.

As an Urban Planner I want to add one or more attachments for a document.

From the card entry screen, in addition to uploading the original source, it is also possible to upload additional files, such as photos, videos, or any other type of format, containing supplementary information that may help in understanding the original document. These fields are also optional.

As an Urban Planner I want to read documents So that I can study them.

This request specifies the ability for Urban Planners to view document cards, download original resources and attachments, and view them online if they are too large. This story complements the previous three, which allow for the creation of these items, by providing unrestricted access to the creators.

As an Urban Planner I want to delete a document.

Story: Kx6
b. v.: 920

Just as the option to create a node containing a description, original resource, and attachments have been provided, Urban Planners should also have the option to delete any of these items (individually or together) in case errors were made during their creation.

As an Urban Planner I want to link documents to each other So that I can study their relationships.

Story: Kx7
b. v.: 900

Story: Kx4
b. v.: 960

At this stage of the tool's development, it is not yet possible to view the diagram. However, with future visualization in mind, it is essential to allow Urban Planners to link documents directly from the creation interface. When entering data, Urban Planners will also need to specify the type of connection that will link the new node to existing ones, choosing from the four types described in Chapter 4.2.

Story: Kx5
b. v.: 940

Although every node must have at least one connection to be included in the diagram and become part of the process, this field cannot be mandatory. There may be instances where it is necessary to create a document without any connections, which can then

be linked at a later stage.

Story: Kx8
b. v.: 880

As an Urban Planner I want to georeference a document (possibly at insertion time) So that I can study its relationship to the territory.

This request concludes the cycle of stories related to the information Urban Planners need to input when creating a new node/document. At this stage, there is still no interface available to view the map of Kiruna. However, as with the previous story, even though this option is not yet available, Urban Planners are expected to georeference a document by entering its geographic coordinates or by clicking a button that will automatically select the entire municipal area. This is in preparation for the future implementation of an interface that will provide additional ways to georeference documents, such as directly selecting a point on the map without needing to know its coordinates.

Story: Kx9
b. v.: 860

This field is mandatory, as all documents have a direct impact on the territory and influence the transformation of a specific area within the municipality of Kiruna.

Story: Kx12
b. v.: 800

As an Urban Planner I want to review the added document before releasing it to the public So that I can avoid making mistakes.

Story number 12 has been designed to provide the ability to review documents at the end of the data entry process. At the end of the process, the Urban Planner will see a summary screen, where they can view a summary of the data they have just entered.

Questa funzione è fonadamentale per evitare di rendere pubblico un documento che contenga degli errori, cosa che potrebbe risultare in un danneggiamento, seppur estremamente limitato, dell'immagine del comune.

Potrebbe essere in oltre prevista l'obligatorietà di effettuare un double check da parte di un altro operatore del comune, se lo si riterrà necessario, per diminuire ulteriormente la possibilità di rilasciare documenti inesatti.

As an Urban Planner I want to create new types of documents.

This story introduces the possibility for Urban Planners to further customize the tool by creating new types of documents, in addition to the 8 types already described in Chapter 4.2 of this thesis. These 8 types were selected based on a specific theoretical background, namely the theory of architectural design. However, the users of the application may not understand or share this system of knowledge. Therefore, the goal is to give future users the ability to describe the ongoing process in a form they deem most appropriate, thus modifying the underlying assumptions of the diagram and not just its final structure.

Story: Kx10
b. v.: 840

As an Urban Planner I want to create new types of links between documents.

In a manner similar to the previous story, this instance introduces the possibility of adding new types of connections, beyond the 4 already described in Chapter 4.2, with the aim of increasing the flexibility of the tool.

Action Creation Interface. The image represents the screen where Urban Planners can fill out the card, upload original resources and attachments, and then proceed to the next page. On the following page, it is possible to indicate the connections between the newly created node and others.

5.1.5 Epics 13 and 17

EPIC 13

As an Urban Planner I want to access the relevant document So that I can study them.

Epic 13 builds upon Story 5, expanding its content and opening up various possibilities for searching and organizing the work of data entry and document review for Urban Planners.

Story: Kx14
b. v.: 780

As an Urban Planner I want to list all documents.

Story: Kx16
b. v.: 740

The action of listing the documents is performed automatically by the web app. Every new document added to the system is automatically placed in a list, where all the other documents are also stored. This step is essential for enabling the actions related to the next story.

Story: Kx15
b. v.: 760

As an Urban Planner/Resident/Visitor I want to search documents So that I can find what I am interested in.

This story specifies the possibility of searching for documents using a search bar. The search bar is essential for finding documents when their name or specific attributes are known.

EPIC 17

The addition of this functionality allows the tool to perform like any search engine, with the aim of making the story of Kiruna more accessible to everyone.

Various features can be added to the search bar, such as displaying suggested names once the user starts typing the document name, or a correction feature that selects documents with similar names in case of a typographical error while typing. Another interesting feature would be the ability to search for nodes based on specific characteristics, such as node type, scale, or even the stakeholder who created it. The implementation of all these features, which are not mutually exclusive, will depend on the creativity and capabilities of the tool's developers and the requests of the stakeholders.

As an Urban Planner I want to attach notes to the documents So that I can keep track of nonpublic aspects.

The ability to add notes to documents, visible only to Urban Planners, is an important feature for system management. Using this system, the technicians of the municipality of Kiruna can flag potential errors, suggest modifications to be made to the documents, or raise any concerns about the accuracy of the information contained in the nodes, without necessarily having to communicate these service-related details to the public.

As an Urban Planner I want to maintain the document information up-to-date.

This epic contains several stories related to updating the document network and correcting any errors that will inevitably be made during the document entry process.

As an Urban Planner I want to edit document links.

The connections between nodes in the diagram are not the result of an unbreakable mathematical law; it is up to the designer's judgment to decide which type(s) of connection are most appropriate for linking two documents together. Since this choice is somewhat subjective, the connection should be modifiable at a later stage, allowing for the correction of any human errors in the connections that might otherwise remain in the diagram permanently.

As an Urban Planner I want to mark which documents are relevant to me So that I can find them easily.

Allowing Urban Planners to highlight documents is essential for achieving the objectives of the next story. Documents can be marked only by the Urban Planners, both at the time of entry and at a later stage. The lists of marked documents by each operator do not merge with those of others to form a single list, ensuring that they remain separate.

As an Urban Planner I want to see which documents are marked as relevant So that I can find them easily.

The goal of this story is to allow operators to quickly view the documents of interest once they have marked them, as described in the previous story. To achieve this objective, there are countless graphic techniques that can be applied. As in the case of story KX16, the documents marked by an Urban Planner are not visible to the public, and in this case, they are also not visible to other Urban Planners since they are placed in separate lists.

Story: Kx18
b. v.: 720

As an Urban Planner I want to receive a notification when a document or a document forecast relevant to me is inserted.

Story: Kx23
b. v.: 640

The ability for Urban Planners to receive a notification when an important document for their work has been uploaded by another operator is undoubtedly a very useful feature to keep them updated on the progress of the Kiruna relocation process.

Story: Kx21
b. v.: 680

However, this possibility is dependent on the classification of documents into different categories, so that users can choose one of interest. These categories, however, have not yet been defined, and the 8 types of actions described in Chapter 4.2 do not seem useful for this purpose. One option remains, without a doubt, for Urban Planners to receive a notification whenever a document is uploaded, without the possibility of

Story: Kx22
b. v.: 660

filtering.

This option will only be applicable if the flow of uploaded documents remains manageable. If not, to avoid overwhelming users with notifications that will inevitably go unread due to their excessive number, it will be necessary to proceed with a division into categories. These categories could potentially be created by the Urban Planners themselves and assigned to documents at the time of entry.

5.1.6 Epics 24 and 28

EPIC 24

As an Urban Planner I want to implement the relationship diagram.

In this epic, the user interface, consisting of the diagram described in Chapter 4, is introduced for the first time. The interface is one of the key elements that make the story of Kiruna easily visualizable and understandable to a wider audience. The stories related to Epic 24 describe the actions that Urban Planners can take to implement the system directly from the diagram.

Story: Kx25
b. v.: 620

As an Urban Planner I want to visualize all documents on the diagram So that I can study their relationship with time.

The ability for Urban Planners to view all documents in the diagram is crucial to ensure they have an overview of the ongoing process and, consequently, can keep it under control.

Story: Kx26
b. v.: 600

As an Urban Planner I want to adjust the position of documents on the diagram So that I can improve the readability.

This story envisions the possibility of changing the placement of documents directly in the diagram. Documents could be inserted via a drag-and-drop

system into the correct position in the diagram. Their placement could later be manually adjusted either directly from the interface or through data entry. The ability to perform this action manually, as opposed to entering data by filling out fields, would likely make a stronger impression on the user, giving them a better understanding of the diagram.

EPIC 28

Additionally, the possibility of modifying the placement of documents from the interface by dragging them manually after insertion is planned, should it be necessary. This would apply in cases such as documents with the same date and scale, which would inevitably overlap, or documents where day and/or month fields are missing, causing them to appear centered under a year. After creation, these documents could be manually moved to a more specific time period. Repositioning would occur if additional information becomes available, such as knowing the document was certainly issued before or after the uploaded one, or knowing the season in which the document was released.

Story: Kx29
b. v.: 560

Story: Kx27
b. v.: 580

As an Urban Planner I want to adjust the connections of documents on the diagram So that I can update it.

Story: Kx30
b. v.: 540

The possibility of modifying connections between nodes directly from the "diagram" user interface is also planned. Urban Planners can disconnect one end of a connection from a document and attach it to another simply by clicking on it and dragging the end to the document they wish to connect. They also have the ability to delete or modify the type of connection by double-clicking on it.

As an Urban Planner I want to interact with the relationship diagram.

The diagram, in addition to being a useful interface for documenting the story of Kiruna's relocation, is primarily the visual tool through which this story is conveyed. Epic 28 lists all the interaction and navigation options available to the four types of users within this interface.

As a Resident/Visitor/Urban Planner I want to filter the documents shown on the diagram So that I can focus on what is relevant.

To facilitate navigation within the diagram interface, various filtering systems have been designed, as described in Chapter 5.1.2. These filters can be applied individually or in various combinations. The decision on which filters to use will depend on the screen size of the user's device, as well as other factors outlined in the previous chapter.

As a Resident/Visitor/Urban Planner I want to click on the documents shown on the diagram So that I can access the document.

This story includes one of the core functions of the web app: accessing the cards containing information about the documents, where users can view and download the original source.

This capability, introduced in the earlier stories, connects two interfaces: the single node view and the view where the entire network of nodes can be seen in its full complexity.

As a Resident/Visitor/Urban Planner I want to see on the map the document selected in the diagram.

Seamlessly switching between the two main interfaces is one of the most challenging goals of the project. This story refers to the ability for all users to view selected documents on the map from the diagram.

To implement this story, the creation of the second interface (the interactive map of Kiruna) is essential. To view the area associated with a document of interest, users simply need to open the card from the diagram, where a "view area" button will appear. This button will allow them to access the map interface, with only the area impacted by the document highlighted.

As a Resident/Visitor/Urban Planner I want to highlight all the documents linked to a document selected on the diagram So that I can see the related documents.

An architectural project only takes shape when the documents related to it are so closely interconnected that they form a network from which the project cannot detach. This belief underpins the idea that to fully understand a document, one must look at its direct connections, those linking it to all nodes with a cause-and-effect relationship to it, thereby contributing to its definition.

To highlight a node's connections and facilitate navigation between nodes, a feature has been designed that allows users to view all documents connected to a document of interest directly from its card. From there, users can navigate to connected documents or, alternatively, from the diagram interface itself, where highlighting nodes connected to the one of interest falls under the category of visualization filters described in Chapter 5.1.2.

Story: Kx31
b. v.: 520

Story: Kx32
b. v.: 500

5.1.7 Epics 33, 37, 44 and 57

Story: Kx35
b. v.: 460

EPIC 33

As a Visitor I want to interact with the map So that I can check what happened in the territory.

In Epic 33, various stories are gathered that describe the navigation possibilities within the map. While the previous chapter made an explicit request to access the map through cards, this chapter lists all the actions that can be performed once on this interface.

Story: Kx34
b. v.: 480

As a Resident/Visitor/Urban Planner I want to view the documents on the map So that I can see to which position or area they relate.

Story: Kx36
b. v.: 440

The ability to view the areas linked to various documents on the map is not dependent on selecting them within the diagram. The two interfaces are equivalent, and in this story, it is assumed that users can search for and access documents based on their geographic location. Documents often overlap within the same areas, making it difficult to view all overlapping areas simultaneously. To address this visualization issue, only an icon has been added to the map, displaying limited information such as a name or a unique identification number for each document. By clicking on an icon, the area associated with the document will open, which could represent either a single point or the entire municipality.

EPIC 37

As a Resident/Visitor/Urbam Planner I want to access a document info through the map.

Similarly to the navigation offered by the diagram interface, the map interface also allows direct access to the cards. The connection is made through document icons scattered across the map. After selecting a document and verifying its area, you can select it again to access all the additional information contained in the card, and, if needed, download the original source and attachments.

As a Resident/Visitor/Urban Planner I want to see on the diagram the document selected in the map.

This story completes the loop between the two interfaces. Starting from the card selected on the map, users can navigate to the diagram and view the document's position there. In the card (almost identical to the one accessible through the diagram nodes) the only difference will be a button to view the diagram instead of the area. Once in the diagram, users can return to the map, as described in previous stories, and vice versa.

As a Resident I want to interact with the map So that I can check what happened in the territory.

This epic describes several additional functions available to the residents of Kiruna, some of which are exclusive to them, while others are accessible to all users. Some stories outline important functions related to the map interface, as in the previous epic, while others describe special interaction options within the card interface.

As a Resident I want to certify my status as a resident So that I can access reserved functions.

The first step to allow residents to access features reserved for them is to provide a login option to verify that those accessing the system are indeed residents.

Given that the population of Kiruna is in the tens of thousands, an automated system will need to be developed, based on some document in the residents' possession that confirms their place of residence. Once signed in, residents will receive a username and password via email to access the app and use the features reserved for them.

If it becomes necessary to extend access to these features to non-residents, a "guest" account has been designed, with temporary credentials provided by the Kiruna municipal technicians. These accounts are essential for allowing researchers, artists, and other official guests of Kiruna to have a full experience of the relocation process. The time frame for access to these additional features will be determined at the time the credentials are issued.

Story: Kx39
b. v.: 400

As a Resident I want to trace an area of interest on the territorial interface So that I can receive a notification whenever a document is released in that area.

Story: Kx38
b. v.: 420

The first feature exclusively available to Kiruna residents allows users, once they have accessed the "map" interface, to outline an area of interest, which can later be modified as desired. Once the area is defined, users will receive notifications whenever a document is released for that area; the notification will then provide a direct link to the document's card for review.

This feature is designed to help residents stay updated on the transformation of specific areas within the municipality of Kiruna. Residents might be interested in tracking developments in the area where they currently live, an area they plan to move to, a location where they own property or any other zone that catches their attention.

Story: Kx40
b. v.: 380

As a Resident I want to comment on the various documents when they are published So that I can provide feedback to the planners.

In this story, residents are given the option to leave comments within the cards, providing insights that may be useful to other users for understand-

ing the documents. This social interaction is important for engaging the population in the process; the app also becomes a space for exchanging opinions and advice, as well as a source of ideas for municipal leaders.

Story: Kx42
b. v.: 340

Other users are excluded from this feature because, as non-residents, they do not have the right to influence decisions that will impact the residents of Kiruna. Additionally, keeping the number of comments lower is advantageous for maintaining a focused conversation on the ongoing process. If it is deemed essential to allow someone outside of Kiruna to comment, they could use the “guest” account described in previous stories.

This feature could be extended to other types of users, but only with specific measures in place: it must be clear which comments are made by Kiruna residents and which are not, in addition to certain specific functionalities related to notifications described in story Kx42.

Story: Kx41
b. v.: 360

As a Resident/Urban Planner/Visitor I want to read the comments on the various documents when they are published So that I can understand more about the document.

As mentioned, the goal of the comments is to increase the amount of information available on the nodes, including insights on public sentiment toward each document. To achieve this, the ability to read comments is open to everyone, with urban planners being key beneficiaries, as they would gain valuable feedback from the population.

As a Resident/Urban Planner/Urban Developer I want to be notified when someone responds to one of my comments.

The ability to reply to comments in order to make the conversation smoother is something we associate with the social media universe. This feature is designed to make interactions between platform users more direct. Urban Planners are also given the ability to reply to comments, with their comments distinguished from others to highlight their role as moderators of the discussion. They can also comment directly on the card to respond to multiple comments at once, without repeating the same text under each similar comment. Similarly to social media, users receive a notification whenever a reply is posted to their comment. From the notification banner, they can then directly access the conversation to reply.

In the event that it is deemed essential to give all users the ability to comment, Kiruna municipal technicians will have the ability to disable notifications linked to comments from a specific type of user, based on the reasons described in story Kx40.

As an Urban Planner I want to interact with the map So that I can define document georeferences.

This epic gathers three requests that conclude the cycle of stories related to the georeferencing of documents, which was already described in story KX8 of the first epic.

As an Urban Planner I want to define the geolocated area of a document on the map.

In this story, for the first time, urban planners are given the ability to manually draw the area of influence of a document when it is being uploaded. Until this point, users could only assign a point or the entire area of the municipality. Starting from this story, a third option is added: the ability to manually trace the area using a polyline, to better describe the connection between documents and their material effects.

As an Urban Planner I want to link a document to a georeferenced path So that I can study the movement.

The fourth and final georeferencing option for documents described in this request is related to a unique aspect of the Kiruna relocation process: the relocation of historically significant buildings from one location to another.

Considering the inclusion of documents related to this action, the possibility has been envisioned to insert open paths as georeferencing: polylines that trace the route taken by the buildings from point A to point B, in order to best describe their impact on the territory.

EPIC 44

Story: Kx47
b. v.: 280

As an Urban Planner I want to adjust the georeferencing of a document on the map So that I can study its relationship to the territory.

Story: Kx45
b. v.: 320

The last of the three stories concerns the possibility for urban planners to modify the georeferencing of a document if the point, path, or area inserted is incorrect.

EPIC 57

As an Urban Planner I want to monitor the usage of the site.

The last epic refers to the functionalities available to urban planners that allow them to monitor the usage of the site, receiving feedback on which areas and topics are considered most important by the population.

Story: Kx46
b. v.: 300

Story: Kx58
b. v.: 140

As an Urban Planner I want to visualize the most active areas of interest.

Within the map interface, urban planners have the ability to see which areas are experiencing the most activity. The tool will calculate which zones have been selected the most by users as "areas of interest" and will visually represent them using a gradient, providing an immediate understanding of what

is currently the focus of attention.

Story: Kx59
b. v.: 120

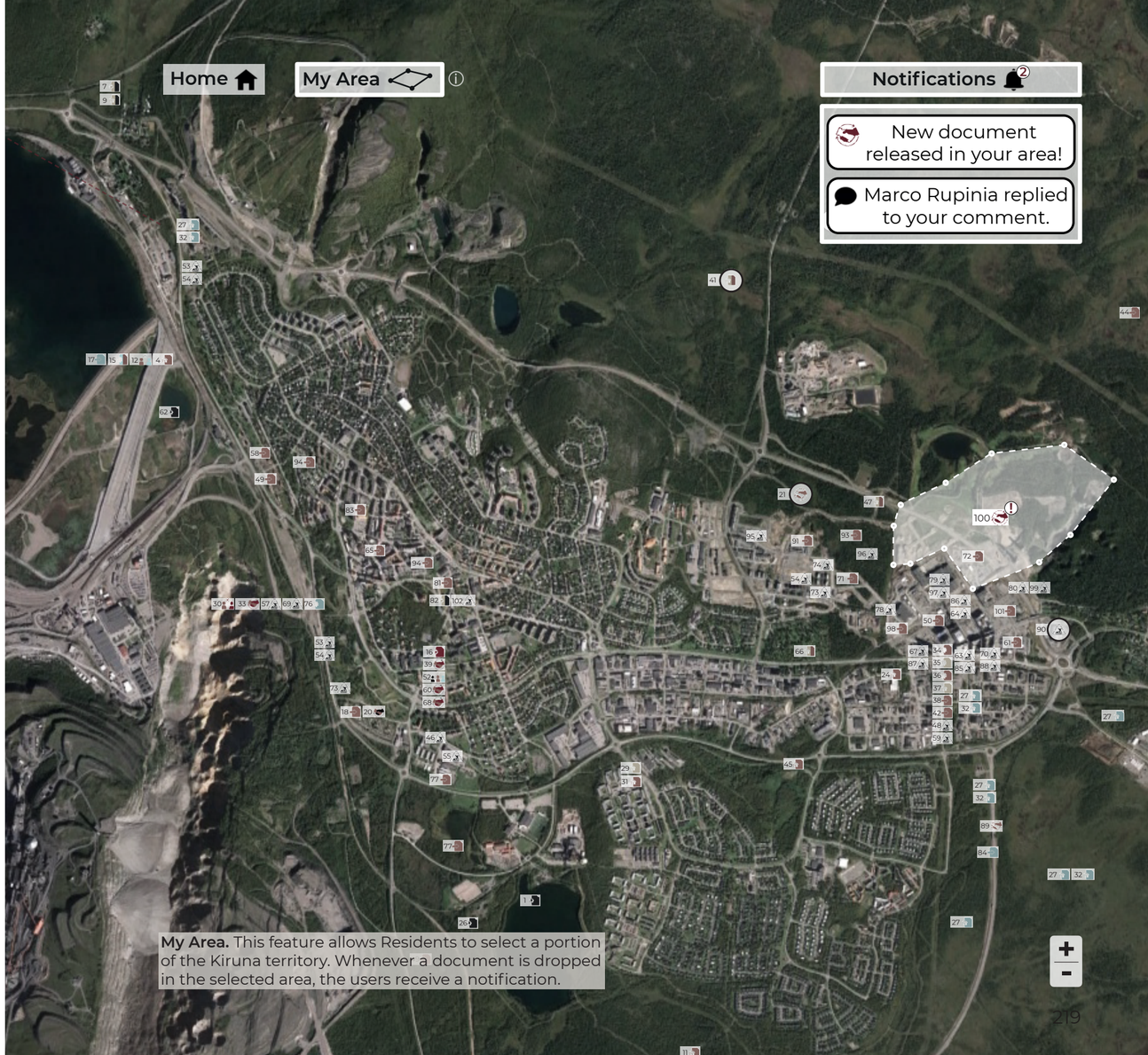
As an Urban Planner I want to visualize the most consulted documents.

Similarly to the areas, urban planners will be able to see which documents are the most clicked, both on the map and in the diagram. When entering "monitoring" mode, halos will appear around the documents, with a gradient that indicates the number of accesses to the document's card.

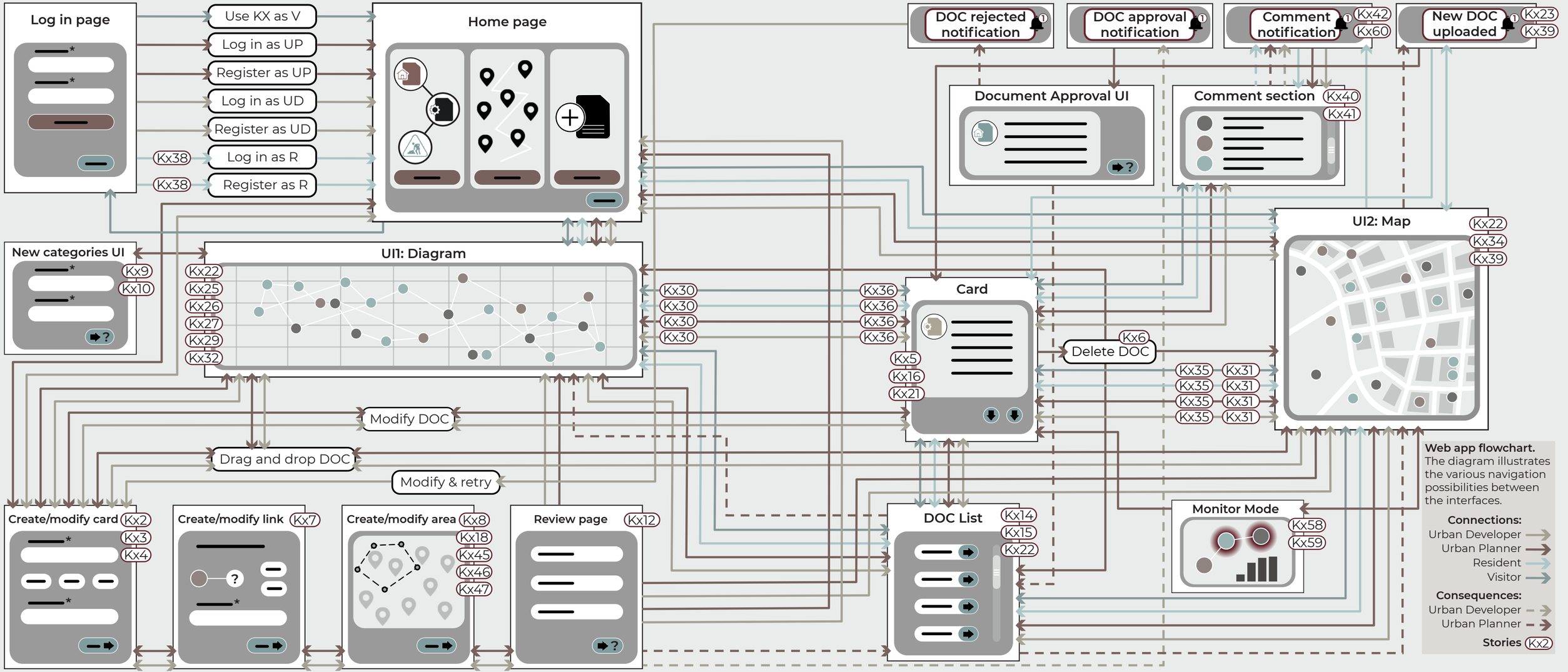
Story: Kx60
b. v.: 100

As an Urban Planner I want to receive a notification as soon as a Resident comments on a document.

A type of notification, similar to the one users receive when someone replies to their comment, is sent by the system to urban planners when someone comments on a document they have uploaded. This monitoring method aims to allow urban planners to respond immediately, clarifying their actions and addressing any questions, thereby alleviating uncertainties within the population.



My Area. This feature allows Residents to select a portion of the Kiruna territory. Whenever a document is dropped in the selected area, the users receive a notification.


Log in page
Use KX as V
Log in as UP
Register as UP
Log in as UD
Register as UD
Kx38
Log in as R
Kx38
Register as R
Home page
DOC rejected notification
DOC approval notification
Comment notification
Kx42
Kx60
New DOC uploaded
Kx23
Kx39
Document Approval UI
Comment section
Kx40
Kx41
New categories UI
Kx9
Kx10
UI1: Diagram
Kx22
Kx25
Kx26
Kx27
Kx29
Kx32
Kx30
Kx30
Kx30
Kx30
Card
Kx36
Kx36
Kx36
Kx36
Kx5
Kx16
Kx21
Kx6
Delete DOC
UI2: Map
Kx22
Kx34
Kx39
Kx35
Kx31
Kx35
Kx31
Kx35
Kx31
Kx35
Kx31
Modify DOC
Drag and drop DOC
Modify & retry
Create/modify card
Kx2
Kx3
Kx4
Create/modify link
Kx7
Create/modify area
Kx8
Kx18
Kx45
Kx46
Kx47
Review page
Kx12
DOC List
Kx14
Kx15
Kx22
Monitor Mode
Kx58
Kx59
Web app flowchart.
The diagram illustrates the various navigation possibilities between the interfaces.
Connections:
Urban Developer
Urban Planner
Resident
Visitor
Consequences:
Urban Developer
Urban Planner
Stories
Kx2

5.2 Scenario 1

5.2.1 A tool for the past

Design is always a prediction of the future, an inexact forecast that anticipates only one of countless possible scenarios, with the goal of making that scenario real. No one can predict the future, least of all the designer. Projects are, in fact, self-fulfilling prophecies; they become reality due to the Rosenthal effect and certainly not because of any divinatory powers of the designer.

Projects are also inexact prophecies; none of them reach completion without being modified multiple times, with their content shaped by various factors encountered along the way. These factors are largely unpredictable for two reasons: their nature is unknown, and their effects on the project cannot be anticipated.

To give a concrete example, we could mention one of the numerous instances of unforeseen intervention in the history of Kiruna, such as the expression of interest by Avalon in exploiting the Viscaria mine **[19]** Or the decision by the municipality to build the new hospital **[89]** on the site where the railway

[19] Avalon. 2011. **Expression of interest.**

[89] Kiruna kommun. Sep. 2022. **Agreement of the Municipal Board on hospital relocation.**

authority had planned to position the station. In this case, the municipality's decision can be seen as the component related to the nature of the factor: until the municipality explicitly decided to rebuild the hospital in that exact location, this factor didn't exist and was, at least in this case, entirely unpredictable. Trafikverket's decision to move the station slightly further east **[92]**, onto the site of Road 870, represents the effect produced by this factor; namely, the solution that the railway authority found to address the issue, which was also unforeseeable until the new plan was drafted.

However, not all deviations are unpredictable. There are specific cases where it is possible to forecast the future effectively, but for this to occur, two conditions must be met. First, the nature of the impending event must be known; it cannot be an unforeseen disruption but rather something planned over time. Second, this event must lead to a limited number of direct effects.

A clear example of this case is Kiruna's candidacy for the European Capital of Culture **[h]**. The decision on whether Kiruna will actually be selected will occur on a set date, making it a planned event; and the direct possible outcomes are limited to only two: either Kiruna will be selected as the European Capital of Culture or it will not.

In cases like this, where there is a finite number of possible futures, **scenario planning** becomes both possible and useful. When anticipating major turning-point events, it is crucial to envision different scenarios, each with a corresponding project, that is a kind of inexact prophecy that may or may not self-fulfill, depending on how events unfold.

It is precisely with regard to this significant turning point, which will impact Kiruna in December 2024, that scenario planning has been employed in the project phase of this research.

The first scenario considered is one in which Kiruna is indeed selected as the **European Capital of Culture** for 2029. In this case, the tool will take a direction entirely oriented toward the past. Its primary function would be to recount the history of Kiruna's urban transformation from 2004 to 2029. The user group that would gain the most importance would be Group 3: the visitors. Should Kiruna become the European Capital of Culture, there would likely be a large influx of tourists, art enthusiasts, and researchers eager to learn about Kiruna's history. The web app would address this need, allowing this group of users to explore the extraordinary story of Kiruna's relocation. This understanding would enable them to engage with the cultural and artistic initiatives that typically accompany this event with a more informed and critical perspective.

To effectively respond to these needs, several modifications to the tool have been planned, which will manifest in two main ways: a reordering of story priorities and the addition of new stories (described in the following chapter) to be implemented should this scenario occur.

The reordering of the stories is done by modifying the business value associated with each story. All the stories deemed important for achieving the objectives outlined above are assigned a higher value, allowing them to climb the ranking and be implemented before the others.

[92] Trafikverket. Dec. 2022. **New railway line studies.**

[h] Kiruna kommun. Jan. 2024. **Submission of the application for European Capital of Culture 2029.**

5.2.2 Epic 48

EPIC 48

As a Researcher I want to interact with the documents So that I can check what happened in the territory.

In the epic that introduces this group of stories, a new type of user is given a voice: the Researcher. Already included within the user group known as Visitor, this role has been specified here to highlight its importance, as this type of user will be essential to the success of the project Kiruna European Capital of Culture 2029.

In particular, the following stories analyze various specific interactions that Researchers may have with documents and with the web app in general.

Story: Kx49
b. v.: 260

As a Researcher I want to view all documents related to a document of interest So that I can check them.

This story encompasses various options for simplified navigation tailored for Researchers. In addition to direct navigation between documents, such as the option to access linked nodes directly from the card without going through one of the two main user interfaces, it also provides the ability to filter documents within the diagram interface, as detailed in Chapter 5.1.2.

Story: Kx50
b. v.: 240

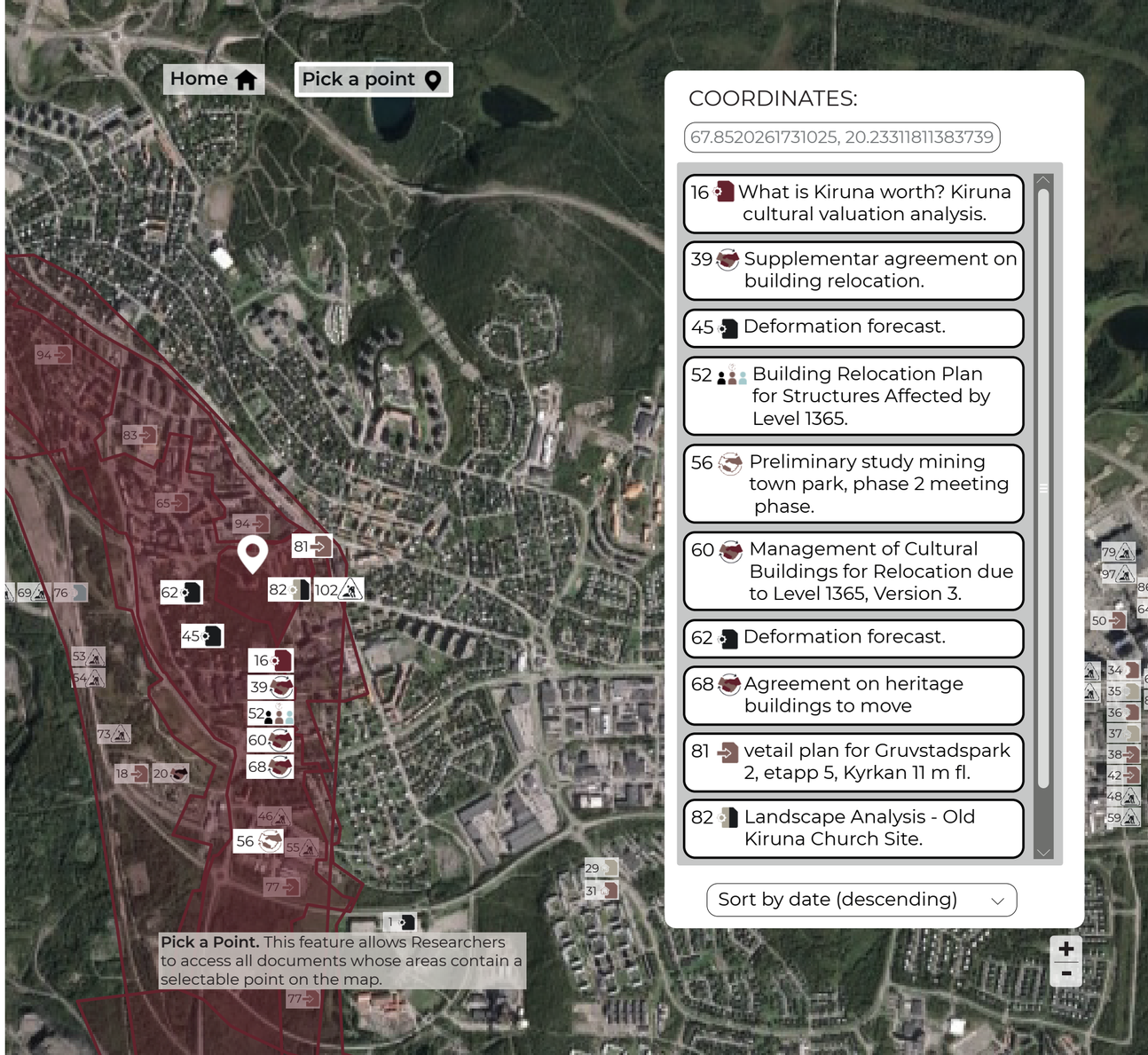
In this specific scenario, the chosen filtering system is story-based. By clicking on a document once, rather than displaying the related card, all documents linked to one of the 17 tales narrated in Chapter 3 are highlighted. This type of filter is essential, as researchers are likely interested in reconstructing the story of a specific topic. This way, they can immediately see the documents forming a narrative thread, without needing to check each node's connections individually.

To enable this functionality, documents must first be grouped into various stories, a task assigned to the Urban Planners. They are also able to add new stories or modify the documents within them as needed.

Another way to study document relationships is by examining the areas they pertain to. In the map interface, users can trace the history of a specific location within the municipality of Kiruna by simply clicking on it. Selecting any point on the map brings up all the documents associated with that area, arranged chronologically from oldest to newest, effectively reconstructing the timeline of a place.

As a Researcher I want to mark which documents are relevant to me So that I can find them easily.

Similar to what Urban Planners can do starting from the Kx21 story, Re-



searchers (if Kiruna is selected as the European Capital of Culture) will also have the ability to mark which documents are important to them. To ensure that their preferences are saved, they will need the option to create a personal account, as previously proposed for the first two user categories.

As a Researcher/Visitor/Urban Planner/Inhabitant I want to download documents So that I can study them.

Story: Kx51
b. v.: 220

In the final story of this epic, all user categories are granted the option to download a document's original resource.

This capability is, in fact, important across all scenarios, although it is particularly essential for this one. Users can download original documents directly from the card for closer study or, if the files are too large, open them in the browser with the same purpose.

5.2.3 Expected outcomes

The first scenario in which the web app is integrated envisions its use and implementation by the Urban Planners at least until the end of 2029, the year in which a significant influx of tourists is expected. The technical staff of the municipality of Kiruna would have exactly four years to input the documents into the diagram and geo-reference them on the map. The first period, in particular, will be important for reconstructing the past history, from 2004 until the end of 2024, which this thesis has traced, with the main objective of the municipality, and, consequently, the tool, becoming to narrate the story of Kiruna's relocation process. This history, however, risks fading into oblivion, for reasons already mentioned in this thesis, such as the lack of direct witnesses to the entire process between the municipality's technicians and the difficulty of retrieving physical documents after the relocation of the municipal archive from the old town hall to the new one.

The primary beneficiaries of this historical reconstruction will be the many people who will come into contact with Kiruna without knowing the complexity of the processes that have enveloped it like a whirlwind over the past 20 years. One of the expected out-

comes is undoubtedly to make visitors more aware of the city they are visiting.

They will be able to use the app to obtain information about the historical buildings they will see in Kiruna, such as those relocated to the new town center. These buildings strongly capture attention due to the contrast they create with the newly constructed ones. Visitors will be able to learn about their history through descriptions and view the path along which they were transported via the map interface. They will also have access to photos and videos of the relocation, helping them better understand the dynamics of this unusual and spectacular event.

The European Capital of Culture receives funds to promote its culture and the forms of art intrinsic to the territory in which it is located. Artworks and events are usually displayed and held within the city throughout the year. Knowing the history of Kiruna would therefore be crucial to understanding the artworks and events, whose foundations are deeply rooted in the territory.

Additionally, the possibility of having a digital tool accessible to everyone around the globe would ensure that even those not in Kiruna could connect with its recent history. This would help more people become passionate about this extraordinary process, with the ultimate goal of attracting a greater influx of visitors during 2029. Visitors, by increasing their knowledge of the place, would presumably also be more respectful and inclined to stay longer in this beautiful city.

One of the objectives behind the decision to nominate Kiruna as the European Capital of Culture is to attract more people to live in the area permanently. As a company town, Kiruna is subject to the fluctuations of the global iron market. If the prices of this raw material drop to the point where mining in the Kiirunavaara mine is no longer profitable, the city would suffer a severe blow from which, according to the residents of Kiruna, it would never recover, eventually leading to complete depopulation.

Starting from these assumptions, it is logical that the municipality is pushing as much as possible for the diversification of the job market, a diversification that is somewhat increasing. The tourism and aerospace research sectors have been alongside the extraction industry for several years and constitute important sources of employment that should be further developed to counterbalance the workforce drain caused by the mining sector. Unfortunately, these sectors are still underdeveloped and, above all, depend on costly infrastructures, such as the railway and the hydroelectric power plant, which are sustained by the mining industry. For this and other reasons, the diversification of the job market in Kiruna is currently insufficient to withstand a crisis that exceeds the length of the one that began in 1975.

To address the region's needs, the event "Kiruna Capital of Culture," and consequently the supporting digital tool, aims to tackle two main fronts. The first is to increase the flow of visitors to the region starting in 2029, with the goal of boosting the tourism sector and creating more employment opportunities tied to it. The second is to provide visitors with a positive and meaningful experience, an objective for which the tool would be essential, ensuring that some of these visitors decide to stay in Kiruna permanently.

5.3 Scenario 2

A tool for the future

The second scenario considered in this research is the one in which Uppsala is selected to become the European Capital of Culture in 2029, meaning that Kiruna will not be able to take advantage of this great opportunity. Analyzing various articles on the subject, it is not clear which of the two cities has the upper hand. The question of which city is more likely to succeed was defined, during a Swedish radio broadcast, as a "*million dollar question*"[101], another indication that it is by no means easy to determine which way the scales will tip.

Without valid information on the subject, it can be assumed that the probabilities of success for the two Swedish cities are equal. Therefore, it is essential to foresee the development of the web app in a way that makes it useful in the event that the scenario outlined in Chapter 5.2 does not occur.

To address this eventuality, the tool has been modified so that it is not only a place to tell the story of Kiruna but also a tool to help design its future while looking to the past. It serves as a support tool for urban planning, aimed at

[101] Radio broadcast from Sverigesradio.

streamlining the city's relocation process, particularly in those components that are more cumbersome.

While an overall positive assessment can be made of the process management by the planners, if for no other reason than the fact that the relocation is taking place, this research has highlighted some critical issues that, in such a tumultuous urban transformation, were inevitable. First and foremost is the lack of flexibility in the reconstruction of buildings. In the design of the new city, the municipality does not account for those residents who sell their homes and might wish to move from a villa to an apartment or vice versa. In New Kiruna, the same exact number of dwellings is being rebuilt for each type of building (apartment/villa), ensuring that in the worst-case scenario, where all residents choose to move rather than sell, there will be an appropriately sized home for each of them.

This makes the reconstruction process quite rigid, as it does not allow for converting a portion of single-family homes into apartments in multi-story buildings, an action that would reduce land wastage, land that is an extremely precious resource in Kiruna.

Another issue is related to the scarcity of buildable land in the new town center. Finding a buildable plot in New Kiruna is becoming increasingly difficult, forcing some business owners and even some residents to pack up and move south.

The tool would address these and other aspects of the practical sphere of relocation, acting as a control center for the technical staff of the municipality of Kiruna, helping them monitor the process and improve its performance where possible. The key stakeholders involved in this scenario are the Urban Planners, who, in addition to implementing the diagram for other users, would directly benefit from it themselves; the residents and business owners of Kiruna who still need to find a place in the new city; and especially the Urban Developers, a category that has so far been almost sidelined but would become essential as promoters of the city's urban development.

In particular, this last category would have access to several functions of the urban planners, such as creating nodes or uploading documents they have prepared, with the aim of making the web app not only the place where stakeholders learn about urban transformations but also the platform where documents are exchanged between them.

To make Kiruna eXplorer not only a web app focused on the past but also a practical tool in the hands of the municipality of Kiruna, contributing to pushing the process toward the future, the business value of certain stories has been reassessed, and new ones have been created, containing requests for features suited to this purpose, similar to what was done for the previous scenario. Additionally, some requests have been modified by adding, at the beginning of the texts, the description of the actor who can perform the action (the Urban Developers) allowing them to carry out certain basic functions for implementing interfaces, on par with the Urban Planners.

5.3.2 Epic 52 and other stories

Story: Kx11
b. v.: 820

As an Urban Planner I want to insert a document forecast into the future space So that I can schedule the insertion of a document.

The first story that exclusively pertains to the second scenario is included within the first epic.

With the aim of making the web app a tool dedicated to design, meaning a specific way of predicting the future, the possibility was provided to insert 'document forecasts,' or cards that are created and placed in the diagram before the actual drafting and publication of the documents themselves.

EPIC 52

These cards will be positioned in the diagram beyond the "red line of today" and will be of fundamental importance for the process planning. Naturally, they will be less detailed than the nodes placed directly in the past; for example, the original resource will be missing in all cases. These types of nodes will be the places where the actual documents will later be uploaded, making them identical to those placed in the past.

Story: Kx53
b. v.: 200

Story: Kx20
b. v.: 700

As an Urban Planner I want to receive a notification when it is time to replace a document forecast with an actual document.

One of the benefits for the Urban Planners brought by the previous story is the ability to receive a notification whenever it's time to upload a new document. This notification leads directly to the pre-filled card of the document forecast, where it's possible to enter the missing attributes, such as the original resource. This functionality can prove to be of fundamental importance in helping the Urban Planners keep up with the process, which, at certain times, can become quite tumultuous.

As an Urban Developer I want to view and modify the elements of the map.

Under Epic 53, there are three stories describing the potential uses of the Urban Developers of the map interface and other functionalities. To adapt to the scenario described in the previous chapter, the position of this type of user becomes undoubtedly more central to the project. For this reason, functions have been designed that are exclusively accessible to them, as described in stories Kx53, Kx54, and Kx55.

As an Urban Developer I want to visualize on the map the stage of the transformation process for the different areas.

The first, and perhaps most important, of the three stories, concerns the ability of the Urban Developers to visualize the progress of the relocation process of Kiruna. To do this, they have access to another map interface view reserved for them. This mode, accessible via a button located in the second interface, instead of showing the documents in their positions, displays the cadastral parcels of the municipality of Kiruna, each in a different color, such as, for example, a color scale ranging from red to green depending on the development phase of the area. An example of the list of phases that can be described with different colors might be:

-Detailed plan not present

-Detailed plan under consultation

-Detailed plan under examination

-Detailed plan adopted

-Building permit requested

-Building permit issued

-Start of construction work

-Inauguration of the building

These are just some steps I have been able to verify as part of the bureaucratic process in this part of Sweden. The actual steps will need to be determined later by the technicians of the municipality of Kiruna, the only ones who can decide which steps are most appropriate to describe the progress of the process within the territory.

The Urban Developers, for their part, can view the area of Kiruna as an incomplete puzzle, monitoring in real-time which areas are most attractive for their activities. They can also access the genealogy of documents from various locations directly on the map, from which they can also submit requests to the municipality, such as a building permit application.

Story: Kx54
b. v.: 180

As an Urban Developer I want to be notified when a document I've posted is commented on So that I can respond.

Along with the ability to upload documents, Urban Developers are also given the opportunity to be notified whenever a comment is made on one of their documents. Similarly to the functionality provided for Urban Planners, they receive a notification that allows them to access the discussion directly, where they can respond. Their responses will be displayed through graphic cues that are immediately recognizable, especially when coming from the creator of the node.

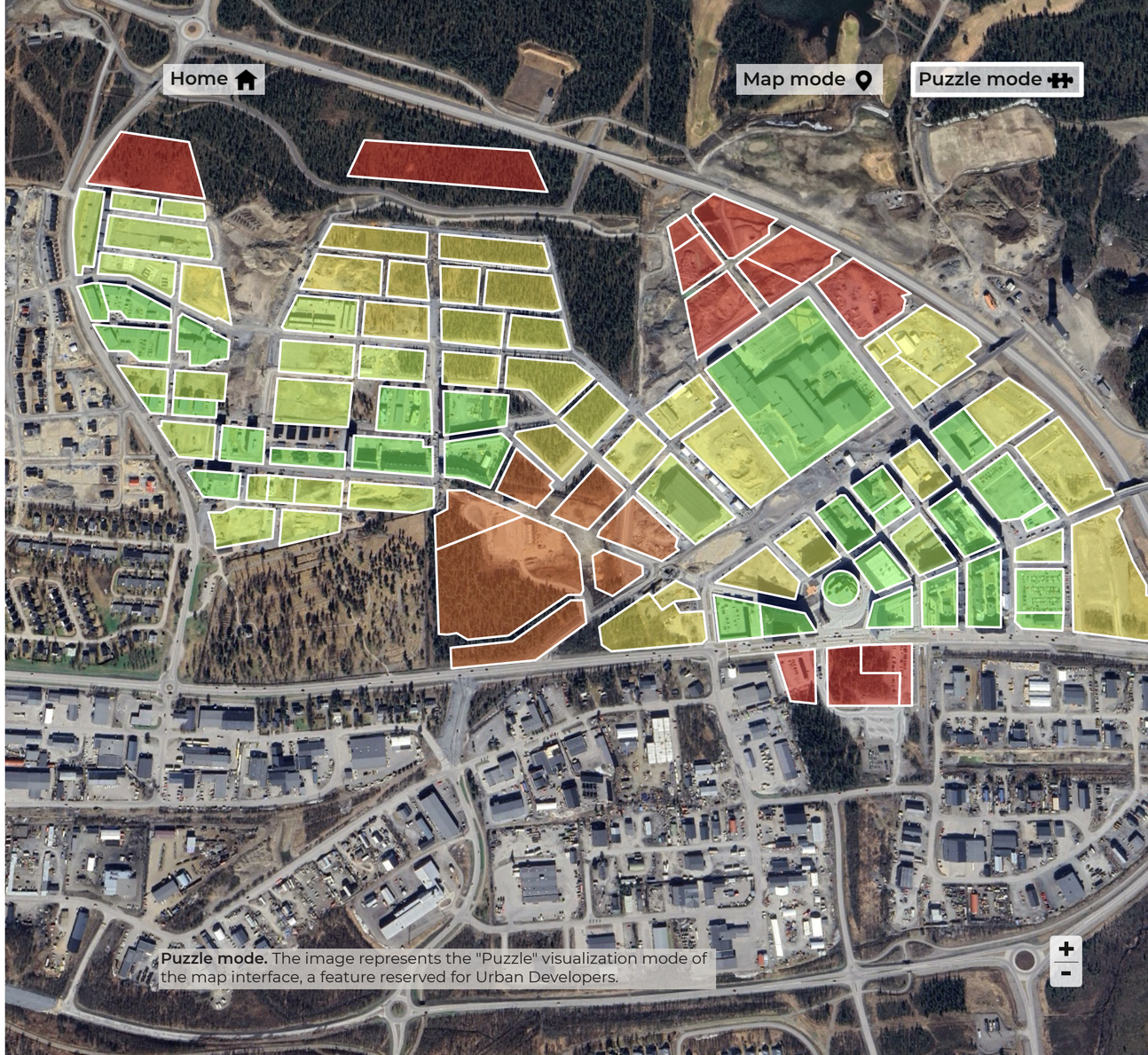
This mode, more than being designed for institutional transparency, serves a practical purpose for professionals. The municipality, LKAB, developers, and buyers will be able to exchange important information directly on the platform.

Story: Kx55
b. v.: 160

As an Urban Developer I want to select different areas So that I can be notified when a document is published that falls within these areas.

In this last story, Urban Planners are also given the ability to select areas of interest, a functionality already described in story Kx39. The selection can be made through both map visualization modes reserved for Urban Developers. In the classic mode, they have the option to draw an area, while in the puzzle mode, they can select the different cadastral parcels with a click. The ultimate goal is to receive a notification whenever a document is released in the selected area, from which they can access the card directly.

This functionality is very important for keeping Urban Developers updated on the process. The areas of interest will be chosen by them as areas where they plan to carry out construction activities. For this reason, this data will be accessible to Urban Planners so they can understand how developers are operating in the territory.



Puzzle mode. The image represents the "Puzzle" visualization mode of the map interface, a feature reserved for Urban Developers.

5.3.3 Expected outcomes

The web app, modified to address the scenario in which Kiruna will not be the European Capital of Culture in 2029, has as its primary goal the streamlining of the city's relocation process. It is true that this represents a unique opportunity for the Lapland city to maintain high media attention and present itself to Europe in a different light from the one for which it is known today. On the other hand, if the opportunity is not seized, this is undoubtedly an undesirable scenario. Moreover, the city will need even more to attract people who will settle in the area or, alternatively, to prevent the inhabitants of Kiruna from migrating elsewhere.

The streamlining of the process, through the tool, would occur in the areas already outlined in section 5.3.1. The first critical context where the web app would operate is the rigidity of reconstruction. By facilitating interactions between planners and citizens, it will be possible to have more control over the process, allowing some housing units, such as "villa s", to be rebuilt in the form of apartments, in case the residents of these units wish to move to a multi-story building. The main expected consequence is the increased availability of buildable land in New Kiruna, land that is a limited resource and, at the same time, absolutely necessary in this context.

With the increase in buildable land, Urban Developers, business owners, and even the ordinary residents of the old town center would have many more opportunities to rebuild independently in New Kiruna, which would relieve the Municipality and LKAB of a significant portion of the costs associated with managing the process.

The figures mentioned at the beginning of the paragraph could benefit, in addition to the increased number of potential buildable areas, from the full range of new services provided by the web app, which are dedicated exclusively to this scenario. These include tools like the puzzle interface, which would make it even easier to find buildable land.

What may seem like a secondary issue is actually a very delicate matter. In fact, if someone who has sold their property in the old town center, in anticipation of its future demolition, is unable to find a buildable area outside the red line within the time frame between the sale and the actual evacuation, the likelihood of them emigrating grows exponentially.

Several property owners of buildings that provided essential services have already decided to sell and not rebuild. One such case is the owner of the old Scandic Ferrum hotel, who, after selling to LKAB, showed no further interest in the developments of the new hotel. The hotel was still rebuilt for its symbolic value and the need for such an important service in the city. In truth, there is no confirmed reason for the former owner's decision, but it is clear that this is not an isolated case.

Even the owners of other hospitality establishments are considering leaving Kiruna for good, with many struggling to find the right buildable plot that is close enough to the new town center to make the property attractive to visitors. A notable example is another well-known hotel, whose owners, facing considerable difficulties in their search, are contemplating the idea of not rebuilding at all[102].

This can logically also be applied to ordinary residents, who, after selling their homes and failing to find a satisfactory new place to live, might be tempted to look elsewhere. This is especially true because, while Kiruna has many qualities, such as the warmth of its people, safety, and the beauty of the surrounding landscape, it also faces significant challenges related to its climate and isolation. These difficulties contribute to the fact that Kiruna's annual migration balance is negative, although not alarmingly so[103].

For the diversification of the job market, which is necessary to protect the city from demographic fluctuations tied to the global iron price, it is essential that the population grows in number. To achieve this, it is not enough to just attract new people; it is equally important to ensure that these individuals do not move elsewhere. The primary goal of the Kiruna eXplorer project, in this specific scenario, is therefore not to attract new residents, as in the previous scenario, but rather, without any doubt, a goal no less important, to ensure that the inhabitants of Kiruna remain in their city, to preserve its vitality for many years to come.

[102] Hotel manager. Personal interview, May 28, 2024.

[103] Net migration from AdminStat.

6 Conclusions

6.1 Evaluation

As stated in Chapter 1.2, Kiruna is an extremely unique case. However, it is highly likely that in the near future, many settlements will face the same fate that has befallen the city in Swedish Lapland.

Over the next 50 years, the world will face environmental catastrophes linked to climate change, one of the most frequently discussed is the rise in ocean levels. This phenomenon occurs for two main reasons: the first is related to water temperature, which, being much higher than in the past, causes water masses to expand, occupying more space. The second, which is fairly obvious, is linked to the melting of alpine glaciers and polar ice caps.

Due to global warming, sea levels have risen by an average of 20 cm since 1880[104], a rise that is expected to double by 2050, according to estimates from the National Oceanic and Atmospheric Administration, currently one of the most authoritative sources on the matter. Several other studies have produced converging estimates on the rise in ocean levels by 2100. These studies suggest that unless there is a drastic shift in greenhouse gas production, the sea level will rise by an average of around 70 cm, a rise that will lead to an increasing frequency of phenomena such as flooding of wetlands, erosion, and contamination of aquifers by saltwater. Furthermore, extreme weather events such as hurricanes and typhoons, whose increased power we can already observe today, will become more frequent.

These phenomena will increasingly affect populations living along the coasts that constitute the most densely populated areas on the planet, with 40% of the world's population living within 100 km of the sea[105]. According to a study conducted by Climate Central in 2019, which estimated a rise in sea levels of between 50 and 100 centimeters by 2100, if no adequate countermeasures are taken, 190 million people will be forced to migrate, along with their homes and infrastructure. Countermeasures that, however, have already been implemented in some contexts, such as the Mose project in Venice, which would still be ineffective if such a rise were to occur[106]. Another example is the allocation of 35 billion euros for the construction of a 25-meter-high dam to prevent the waters of the Sunda Strait from flooding Jakarta.

These countermeasures will inevitably not be adoptable everywhere, with the consequence that the inhabitants of many urban centers, especially smaller ones, will be forced to migrate, as happened to Kiruna. The parallel between this imminent catastrophe and the ongoing process in Kiruna has not gone unnoticed by several media outlets, including World Finance.

The London-based magazine, in 2014, in an article dedicated to the relocation of the Swedish city, under the paragraph titled "The world is watching," states that the process in Kiruna will be closely watched by the administrations of those cities vulnerable to coastal areas, which could use Kiruna as an example, both positively and negatively, of how a city can be relocated.

In this context, Kiruna would become a **fundamental case study** for several countries around the world, and all the materials produced about it would be re-examined in a different light, contributing to supporting the tough decisions that await us in the future.

Unlike the case study, which seems to be a unique example, at least within our geographic context and historical period (excluding, of course, the case of Gällivare), the Kiruna eXplorer experience appears to be, with the necessary adjustments, **easily replicable**.

A web app that tracks and facilitates urban evolution could be applied to any territorial transformation process that generates a considerable amount of documents.

The limitations of the web app's application lie in the need for the studied process to be long enough to make its temporal developments interesting and to influence a sufficiently vast area so that there is a range of scales that can be organized into a diagram similar to the one proposed in Chapter 4. The dimensions of the territory affected by the process are also crucial because they determine whether the implementation of the second interface makes sense.

Another aspect, less obvious but equally important for the applicability of the tool, is the ability to precisely delineate the phenomenon to be analyzed both temporally and spatially. To define the temporal boundaries two events are needed to act as dividing points. In the case of Kiruna, these are the email from LKAB to the Municipality **[2]** and the demolition of the last building in the old town center which, according to forecasts, will take place in 2035.

[104] Nunez C. 2022. Il livello del mare aumenta: che cosa succederà nei prossimi 30 anni? *National Geographic Italia.*

[105] Livi Bacci M. 2021. Le coste del mondo sono le più popolate e più fragili. *Limes.*

[106] Dal Sito M. 2020. *Quando qui sarà tornato il mare.* Roma: Alegre.

[2] LKAB. Mar. 2004. **Mail to Kiruna kommun.**

The urban processes that can be analyzed are vast in range. For example, one could think of reconstructions following a traumatic event such as an earthquake, a case that presents a clear dividing moment, represented by the earthquake, much more distinct than the one analyzed in this thesis, which is certainly more debatable. Other cases could be found in contexts where sudden regime changes have given a significant impulse to urban development; not to mention that even newly founded cities lend themselves well to being subject to a narrative similar to the one explored in these pages.

As for defining the spatial region impacted by the phenomenon, replicability is easier. The urban organism to which the analysis is most logically applied is the city, but this does not mean that it cannot be used in a specific portion of it or in larger territorial areas.

Without a precise definition of spatial and temporal boundaries, the studied process could expand without limits, both geographically and temporally, progressing backward in time to the creation of the first documents, and forward into the future until this way of envisioning the territory is abandoned.

6.2 Related Works

"How to move a city, mapping the process of Kiruna relocation" is not just a thesis, but a broader project that incorporates various other components and activities that contributed to the final research outcome while helping me grow as a person more than the first three semesters of my master's program and perhaps more than my entire course of study.

Among the most formative experiences I had while working on my thesis was undoubtedly my role as a "Product Owner" in the course "**Software Engineering II**", for which I owe thanks to my supervisor and Professor Torchiano. This experience allowed me to engage with computer engineering students, individuals with a completely different background and knowledge base than my own, and to tackle an extremely practical and entirely new challenge for me: the development of a web app.

In this context, I also had the opportunity to deliver a lecture, an experience that significantly contributed to my growth in several ways. I learned the essential steps for preparing a lesson, practiced my presentation skills in English, and enhanced my confidence in public speaking.

The course "Software Engineering II" was not the only opportunity I had to share my knowledge about the ongoing process in Kiruna with Politecnico students. Prior to this experience, I had the chance, once again thanks to my supervisor Valeria Federighi, to deliver the introductory **lecture** on the "gameboard" for the "Architectural Design Theory" course, in which Kiruna once again served as the framework for the game this year.

Another project I had the pleasure of contributing to involved the BUB, a group of former students from the Politecnico di Torino, who showcased their work during the **Graphic Days.** This project applied their design tool, based on artificial intelligence and generative algorithms[107], to Kiruna. For this event, my role was to identify an area within the new city center suitable for applying the tool. Additionally, I took on the challenging task of condensing Kiruna's history into just a few sentences, which were then used to create a postcard distributed to the exhibition's attendees. The event took place in May 2024.

The knowledge I gained during this journey has been shared not only through spoken words but also in written form. Thanks to my supervisor, I had the opportunity to write an **article** about the ongoing process in Kiruna, with a contemporary perspective. This piece was published in the Giornale dell'Architettura in June 2024 under the title "*Ritratti di città. Kiruna a metà del guado.*" This experience was highly formative, as publishing an article for the first time enhanced my ability to communicate in a tone suitable for both professional and non-expert readers.

I also participated with Professor Federighi in the **Call for Papers** for an issue of the Journal of Architectural Education titled "Worlding. Energy. Transitions, Architecture Beyond Extraction," set to be released in Spring 2025. On this occasion, our submission was not a text but an image. Although the work was not selected, the illustration (Appendix D) proved invaluable for the development of the digital design tool.

As a project that goes beyond the scope of my master's thesis, "How to Move a City" does not conclude with the defense of the thesis but continues in multiple directions. The municipality of Kiruna has expressed interest in showcasing the diagram presented in Chapter 4 during the **exhibition** celebrating the **city's 125th anniversary** in Summer 2025. Our counterproposal was to showcase an interactive installation that incorporates, or is at least based on, one of the beta versions developed by the students of the Software Engineering II course.

The future of the project will largely depend on the outcome of the selection process for the European Capital of Culture 2029. If Kiruna is selected, it could lay the groundwork for a collaboration between the Politecnico di Torino and the Municipality of Kiruna to refine the tool for its official launch in conjunction with the events planned for 2029.

If this scenario does not materialize, the likelihood of perfecting the web app decreases significantly. However, the methodology employed in this project could still be tested and applied to other contexts, using the same tool to narrate different stories, stories that undoubtedly deserve to be told.

[107] Kuş B., Özgen B., Şimşek U. Y. 2023. *Evolutionary Algorithms: Their Creative Applications in the Early Design Phase of Urban Design & Architecture.* Thesis: Politecnico di Torino.

May 7, 2024:

The question that Max asks me in the kitchen of the Spis Hostel, which will be closed by the time of my graduation in view of its upcoming demolition, is: "What is the question of your thesis?" I reply that I actually don’t know. Probably it is: "How does a city move?" But this thesis has never set such high expectations; I do not intend to create a manual on how to move cities. I am not capable of that, and probably no one is, not even those who are successfully relocating the city of Kiruna. Every city is different, every case is unique. Therefore, the ultimate aim of this thesis is to present a snapshot of an extremely complex reality like the relocation of Kiruna. In doing so, I have utilized various tools that architects typically have at their disposal, such as storytelling, place description, design, and guiding processes that others will handle afterward.

REFERENCES

Ahlström G. 1969. *De mörka bergen: en krönika om de lappländska malmfälten.* Stockholm: Norstedt.

Ahnlund M., Brunnström L. 1992. *The company town in Scandinavia.* Oxford: Oxford University Press.

Ajok S. 1908. *Samernas historia.* Gällivare.

Armando A., Bonino M., Frassoldati F., Federighi V. 2015. *Watersheds. A Narrative of urban recycle.* Guangzhou: Sandu Publishing.

Armando A., Durbiano G. 2017. *Teoria del progetto architettonico. Dai disegni agli effetti.* Roma: Carocci.

Backman F. 2015. *Making place for space, a history of "Space Town" Kiruna 1943-2000.* Umeå: Print & Media, Umeå University.

Borges M. J., Torres S. B. 2012. *Company Towns Labor, Space, and Power Relations across Time and Continents.* New York: Palgrave Macmillan.

Borgogno F., Pozza A. 2016. *Build out Kiruna, from a mining city to a city with a mine.* Thesis: Politecnico di Torino.

Boyd E. 2023. *To Resettle a Settler Mining Town: experiences, spectres, and recursive discourse in the deformation zone, Kiruna, Sweden.* Thesis: Durham University.

Brunnström L., Myhr J. K., Sjöholm J., Viklund R. 2015. *The book of KLAB: The national treasure of Sweden.* Stockholm: Förlaget Näringslivshistoria.

Cho L., Jull M. 2024. *Design and the Built Environment of the Arctic.* New York: Routledge.

Cobârzan B. 2014. *Resilience of former mining communities.* PhD Thesis: Babeș-Bolyai University.

Crawford M. 1995. *Building the workingman's paradise.* London: Verso.

Dal Sito M. 2020. *Quando qui sarà tornato il mare.* Roma: Alegre.

Diamond J. 1997. *Guns, Germs and Steel: The Fates of Human Societies.* New York: Norton.

DiNapoli B. 2021. *Platforms: Re-Framing Urban Relocation through an Ownership Model for Resident-Led Transformations of the Built Environment.* Thesis: Harvard University.

Ebrahimbady S. 2012. *Improvements in Addressing Cold Climate Factors in Urban Planning and Design.* Licentiate Thesis: Luleå University of Technology.

Federighi V., Bruno E. 2022. *The Detroit Great Game. Explorations around architectural design and its agency.* Baunach: AADR.

Forss L. 2013. *Flyttprocessens påverkan på identiten – utveckling eller avveckling? En fallstudie kring flytten av Hjalmar Lundbohmsgården i Kiruna.* Thesis: Umeå University.

Garner J. S. 1945. *The model company town: urban design through private enterprise in nineteenth-century New England.* Boston: University of Massachusetts Press.

Gebremedhin F. 2018. *Urban planning from scratch: collaboration and participation of stakeholders in the urban transformation of Kiruna.* Thesis: Örebro University.

Gimberger C., Norberg K. 2006. *Uppdrag att flytta en stad – en studie av planeringsprocessen i samband med Kiruna stadsomvandling.* Thesis: Uppsala University.

Golling D., Carrasco C. M. 2020. *Kiruna Forever.* Stockholm: Arkitektur Förlag.

Hågg K. 1993. *Kvinnor och män i Kiruna: om kön och vardag i förändring i ett modernt gruvsamhälle 1900-1990.* Thesis: Umeå University.

Hannevik A, Hastrup K. 1996. *Komparativ Kulturforskning: En evaluering af HSFR's satsningsprogram.* Stockholm: Forskningsrådsnämden

Hansson S. 2001. *Norrbottens Teknologiska Megasystem.* Överklinten: Hugin & Munin Kulturinformation.

Herman D., Phelan J., Rabinowitz P. J., Richardson B., Warhol R. 2012. *Narrative Theory: Core Concepts and Critical Debates.* Columbus: Ohio State University Press.

Huisman C. J. 2021. *Transforming the City of Kiruna: Stabilizing Change and Changing Stability.* PhD Thesis: Uppsala University.

Hygerth J. 2014. *”Vart ska jag ta vägen?” En kvalitativ studie om kirunabornas, LKABs och Kiruna kommuns olika åsikter om den pågående stadsflytten.* Thesis: Uppsala University.

Johansson B. O. H. 1997. *Den stora stadsomvandlingen: erfarenheter från ett kulturmord.* Stockholm: Fritze.

Karlsson R. 2018. *Mining the City: Urban Transformation and the Loss of City Space in Kiruna, Sweden.* Thesis: Stockholm University.

Kirthan S. 2024. *Back to the Future, Forward to the Past Rethinking Arctic Extraction from a Post-Extraction Perspective.* Thesis: Delft University of Technology.

Kiruna. Municipality. 2000. *Kiruna – 100-årsboken.* Kiruna: Hs copy e mediaservice.

Kiruna Municipality. 2007. *Kiruna - A city in transformation.* Kiruna.

Kuş B., Özgen B., Şimşek U. Y. 2023. *Evolutionary Algorithms: Their Creative Applications in the Early Design Phase of Urban Design & Architecture.* Thesis: Politecnico di Torino.

Leoni S. 2022. *The Chinese Box. Unfolding Chinese Architectural Practice in Transitional Communities.* Thesis: Politecnico di Torino.

Lindén M. 2006. *Glaciodynamics, Deglacial Landforms and Isostatic Uplift during the last Deglaciation of Norrbotten, Sweden.* Thesis: Lund University.

LKAB. 2017. *This is LKAB.* Luleå: Lule Grafiska.

LKAB. 2024. *Year-end report Q4 2023.* Luleå: Lule Grafiska.

López E. M. 2021. *Transforming Kiruna : Producing Space, Society, and Legacies of Inequality in the Swedish Ore Fields.* PhD Thesis: Uppsala University.

Malmberg J., Buckland J. 2015. *The Norrbotten Technological Megasystem: Impact on Society and Environment.* Thesis: KTH Stockholm.

Morata B. 2021. *The Northbothnian Technological Megasystem: Urbanization, territorial metabolism and political ecologies.* PhD Thesis: UPC-BarcelonaTECH.

Nilsson K. L. 2009. *Place reinvention by real change image: the case of Kiruna’s spectacular make-over.* In Place Reinvention. Northern Perspectives. Farnham: Ashgate Publishing.

Nilsson K. L. 2010. *Complexity in Spatial Planning Practice and Theory: The Case of Kiruna Mining Town.* In A Planner’s Encounter with Complexity. Farnham Ashgate Publishing.

Nobile M. L. 2023. *Kiruna, lost and found: identity and memory in the streetspace of an Arctic town.* In Everyday Streets. London: UCL Press.

Nordin Å. 2002. *Relationer i ett samiskt samhälle: En studie av skötesrensystemet i Gällivare socken under första hälften av 1900-talet.* PhD Thesis: Umeå University.

Nyseth T., Granås B. 2007. *Place Reinvention in the North. Dynamics and Governance Perspectives.* Stockholm: Nordregio.

Persson C. 2009. *Tuolluvaara - ett gruvsamhälle i skuggan av Kiruna: en jämförande studie av tre samtida gruvorter i Malmfälten.* Thesis: Luleå University of Technology.

Persson C. 2015. *Hjalmar Lundbohm. En Studie om ledarskap inom LKAB 1898-1921.* PhD Thesis: Luleå University of Technology.

Rosén J. 2012. *Stadsförflyttningen av Kiruna. En undersökning av hur byggnadsminnena Hjalmar Lundbohmsgården, Kiruna stationshus samt Kiruna stadshus påverkas.* Thesis: Högskolan på Gotland.

Sartin S. 1988. *Framtidslandet: debatten om Norrland och naturresurserna under det industriella genombrottet.* Stockholm: Carlsson.

Schönbeck B. 1994. *Stad i förvandling: uppbyggnadsepoker och rivningar i svenska städer från industrialismens början till idag.* Stockholm: Statens råd för byggnadsforskning.

Sjöholm J. 2013. *Heritagisation of built environments: a study of the urban transformation in Kiruna, Sweden.* Licentiate Thesis: Luleå University of Technology.

Sjöholm J. 2016. *Heritagisation, Re-Heritagisation and De-Heritagisation of Built Environments: The Urban Transformation of Kiruna, Sweden.* PhD Thesis: Luleå University of Technology.

Solly A. 2013. *The Europeanization of spatial planning: the case of Sweden.* Thesis: Politecnico di Torino.

Storm A. 2014. *Post-Industrial Landscape Scars.* New York: Palgrave Macmillan.

Suzuki T. 2015. *Cultural Gaze? - Understanding Japanese and German Perceptions of Kiruna as a Tourist Destination (Applying Volunteer Employed Photography).* Thesis: Umeå University.

Tidholm P. 2012. *Norrland: Essäer & Reportage.* Luleå: Teg Publishing.

Viklander M. 2011. *Sustainable living conditions in subarctic regions of Sweden.* Luleå: Luleå University of Technology.

Zachrisson I. 1997. *Möten i gränsland · samer och germaner i Mellanskandinavien.* Stockholm: Statens historiska museum.

Zeff S. 2007. *Visions for a Sustainable Future Before Relocation of an Arctic Town.* Thesis: Stockholm University.

Abrahamsson L., Johansson J., Johansson B. 2009. Future metal mining: sixteen predictions. *International Journal of Mining and Mineral Engineering*. Vol. 1, no. 3.

Adolphson M., Olsson K. 2009. Urban design and social life - the relocation of Kiruna. Conference paper: *AESOP*.

Bodbacka-Rak I. 2017. Samernas historia i fokus. *Österbottens tidning*.

Boyd E. 2023. Memorialisation and its denial: slow resistance through derealisation in Kiruna, Sweden. *Journal of Political Power*. Vol. 16, no. 2.

Bromwich J. 2016. How Do You Move a City? Ask Kiruna, Sweden. *New York Times*.

Brorsen L. 2005. Kiruna - Cultural heritage in motion. *Conference paper*.

Campa G. 2023. Come si sposta una città. *Radar magazine*.

Cumming G. S., Cumming D. H. M., Redman C. S. 2006. Scale mismatches in social-ecological systems: Causes, consequences, and solutions. *Ecology and Society*. Vol. 11, no. 1.

Davidson J., Braithwaite J. A. 2006. Tools for Sustainable Community Development Around Mining Operations. *Academia*

Didino G. 2016. Viaggio a Kiruna, la città lappone che aspetta di essere spostata. *Internazionale*.

Drago N. 2022. Kiruna, la città che trasloca per far spazio alla miniera. *Osservatorio artico*.

Ekholm E. 2016. Mesolithic settlement in northernmost Sweden: economy, technology, chronology. *Fennoscandia archaeologica*. Vol. 33.

Fawcett K. 2016. Here's How Architects Plan to Move an Entire Swedish City. *Mental Floss*.

Forsell H. 2015. Modernizing the Economic Landscapes of the North. Resource Extraction, Town Building and Educational Reform in the Process of Internal Colonization in Swedish Norrbotten. *International Journal for History, Culture and Modernity*. Vol. 3, no. 2.

Frietsch R. 1978. On the magmatic origin of the iron ores of the Kiruna type. *Economic Geology*. Vol. 73, no. 4.

Frietsch R., Perdahl J. 1995. Rare earth elements in apatite and magnetite in Kiruna-type iron ores and some other iron ore types. *Ore Geology Reviews*. Vol. 9, no. 6.

Granås B. 2012. Ambiguous place meanings living with the industrially marked town in Kiruna, Sweden. *Geografiska Annaler. Series B, Human Geography*. Vol. 94, no. 2.

Houston G., Glindmeier V., Hermann C. 2020. Adapting historic places to climate change: Proceedings of the international virtual conference of the project Adapt Northern Heritage. Conference paper: *Adapt, Northern Heritage Conference*.

Jakobsson M. 2009. Preferences about the future among youth during the economic boom in Northern Sweden. *Forthcoming*.

Jensen T., Sandström J. 2020. Organizing rocks: Actor–network theory and space. *Organization*. Vol. 27, no. 5.

Kinder T. 2014. Kiruna: How to move a town two miles east. *BBC*.

King A., Barry J., Berg E. 2008. Changing Equal Opportunities in Sweden? Gender and work in transition in Kiruna. Conference paper: *12th International Research Conference Changing Contexts and Dilemmas for the Human Services*.

Kløcker Larsen M., Österlin C., Guia L. 2018. Do voluntary corporate actions improve cumulative effects assessment? Mining companies' performance on Sami lands. *The Extractive Industries and Society*. Vol. 5, no. 3.

Landholm K. 2000. "Det är jag som är chefen": Kungen av Kiruna. *Populär Historia*. Vol. 8.

Lantto P. 2010. Borders, citizenship and change: the case of the Sami people, 1751–2008. *Citizenship studies*. Vol. 14, no. 5.

Leonhardt G. 2015. Relocating a city, challenges and opportunities for the transition of water infrastructure in Kiruna. Conference paper: *10th International Urban Drainage Modelling Conference, Mont-Sainte-Anne (Canada).*

Lindahl T., Crépin A. S., Schill C. 2016. Potential Disasters can Turn the Tag into Success. *Environ Resource Econ.* Vol. 65.

Liu D., Deters R., Zhang W. J. 2009. Architectural design for resilience. *Enterprise Information Systems.* Vol. 4, no. 2.

Livi Bacci M. 2021. Le coste del mondo sono le più popolate e più fragili. *Limes*.

Maguire E. 2015. A Swedish town's dilemma: Move brick by brick or be swallowed by a mine. *CNN*.

Mäkitaavola K. 2016. Application of InSAR for Monitoring Deformations at the Kiirunavaara Mine. Conference paper: *3rd International symposium on mine safety, science and engineering, Montreal Canada*.

Mäntysalo R., Jarenko K., Nilsson K. L., Saglie I. L. 2014. Legitimacy of Informal Strategic Urban Planning—Observations from Finland, Sweden and Norway. *European Planning Studies.* Vol. 23, no. 2.

Marques da Silva I. 2023. Kiruna La città che cammina *Euronews.*

Meerow S., Newell J. P., Stults M. 2016. Defining urban resilience: A review. *Landscape and Urban Planning.* Vol. 147.

Miller C. 2016. An entire city center in Sweden is moving. *Business Insider*.

Newton J. 2024. Sweden to upgrade Ore Line from Luleå to Narvik. I*nternational Railway Journal*.

Nilsson B. 2010. Ideology, environment and forced relocation: Kiruna - a town on the move. *European Urban and Regional Studies.* Vol. 17, no. 4.

Nilsson B., Lundgren A. S. 2015. Logics of rurality: political rhetoric about the Swedish North. *Journal of Rural Studies.* Vol. 37, no. 100402.

Nilsson J., Lindberg P. O., Gallner C., Asplund D. 2023. Railway timetabling for the future? A pilot study on a single track line. *Journal of Rail Transport Planning & Management*. Vol. 27.

Nilsson K. L. 2007. The global iron prize causes the relocation of a town : Uncertainties and risks in planning policy and practice. Conference paper: *AESOP, XXI Congress, Planning for the risk society.*

Nunez C. 2022. Il livello del mare aumenta: che cosa succederà nei prossimi 30 anni? *National Geographic Italia.*

O'Sullivan F. 2015. The Plan to Move an Entire Swedish Town. *The Atlantic.*

Overud J. 2019. Memory-Making in Kiruna - Representations of Colonial Pioneerism in the Transformation of a Scandinavian Mining Town. *Culture Unbound.* Vol. 11, no. 1.

Parak T. 1975. Kiruna iron ores are not "intrusive-magmatic ores of the Kiruna type". *Society of Economic Geologists.* Vol. 70, no. 7.

Perry F. 2015. Kiruna: the arctic town city being knocked down and relocated two miles away. *The Guardian.*

Perry K. 2024. Netflix's The Abyss: The true story of the Swedish town that's sinking into a crater. *The Independent.*

Poon L. 2016. Sweden Is Moving an Entire City. *The Atlantic.*

Prino M. 2014. Svezia, si sposta un'intera città per fare posto a una miniera. *La Stampa.*

Rhys T. 2014. Moving Kiruna: what does it take to relocate a city? *World Finance.*

Riccio G. 2021. Kiruna, come si sposta (edificio per edificio) una città svedese. *Futuro Prossimo.*

Rizzo A., Sjöholm J., Luciani A. 2023. Smart(en)ing the Arctic city? The cases of Kiruna and Malmberget in Sweden. *European Planning Studies*. Vol. 32, no. 1.

Sandahl I., Wikström A. 2005. Space education in Kiruna, Northern Sweden. *Advances in Geosciences*. Vol. 3.

Sandberg L., Ronnblom M. 2016. Planning the new city-emotional reaction and positions. *Emotion, Space and Society*. Vol. 21.

Shapiro G. F. 2020. Kiruna, Forever Changing. *Places Journal*.

Simms D. 1997. The Early Period of Sámi History, from the Beginnings to the 16th Century. *Sámi Culture*.

Sjöholm J. 2015. Att flytta en mönsterstad. *Fabrik & Bolig*.

Sjöholm J. 2017. Authenticity and relocation of built heritage: the urban transformation of Kiruna, Sweden. *Journal of Cultural Heritage Management and Sustainable Development*. Vol. 7, no. 2.

Stihl L. 2022. Challenging the set mining path: Agency and diversification in the case of Kiruna. *The Extractive Industries and Society*. Vol. 11, no. 101064.

Storey K. 2001. Fly-in/Fly-out and Fly-over: Mining and regional development in Western Australia. *Australian Geographer*. Vol. 32, no. 2.

Szpak A. 2019. Relocation of Kiruna and construction of the Markbygden wind farm and the Saami rights. *Polar Science*. Vol. 22, no. 100479.

Tepecik D. A., Karimnia E. 2021. Reframing Kiruna's Relocation—Spatial Production or a Sustainable Transformation? *MDPI Sustainability*. Vol. 13, no. 3811.

Veiga M. M., Scoble M., McAllister M. L. 2001. Mining with communities. *Natural Resources Forum*. Vol. 25.

Vulliamy E. 2016. Kiruna: How Sweden is moving a city 3km to stop it sinking into the ground. *Independent*.

Wainwright O. 2014. Kiruna: the town being moved 3 km east so it doesn't fall into a mine. *The Guardian*.

Whittington G. 2015. A Swedish City's Plan to Pick Up and Move to Avoid Disaster. *Triple Pundit*.

Winsa P. 2016. How to move an entire Swedish town. *Toronto Star*.

AdminStat. *Maps, analysis and statistics about the resident population* ugeo.urbistat.com/AdminStat/it/se/demografia/dati-sintesi/kiruna/20412903/4/home?-Export=1 Last accessed: 16/11/2024.

Boverket. *Municipal physical planning* www.boverket.se/sv/samhallsplanering/sa-planeras-sverige/kommunal-planering/ Last accessed: 16/11/2024.

calcolopercorso. *Altitude Aili Kangas gata, Kiruna, 981 85, Svezia* calcolopercorso.it/it/altitudine Last accessed: 18/05/2024

Climate data. *Kiruna Climate (Sweden)* it.climate-data.org/europa/svezia/norrbot-tens-laen/kiruna-10715/ Last accessed: 16/11/2024.

Copperstone resources. *Time plan Viscaria.* copperstone.se/en/viscaria/tid-plan-viscaria/ Last accessed: 11/05/2024

Facebook. *"Kiruna" Public Group.* www.facebook.com/groups/2363430126/?ref=group_browse_new Last accessed: 16/11/2024.

Fores. *Migrations Info.* www.migrationsinfo.se/ Last accessed: 25/03/2024.

fxtop. *Historical Converter.* fxtop.com/en/historical-currency-converter.php?A=527&C1=SEK&C2=EUR&DD=01&MM=06&YYYY=2024&B=1&P=&I=1&btnOK=-Go%21 Last accessed: 16/11/2024.

Gällivare kommun. www.gallivare.se/ Last accessed: 16/11/2024.

Ghilardi+Hellsten. www.ghilardihellsten.com Last accessed: 16/11/2024.

Henning Larsen Architects. www.henninglarsen.com Last accessed: 16/11/2024.

Khazaleh L. 2015. *Forced displacement in Sweden: When a mine company de-molishes and rebuilds an entire city.* www.sv.uio.no/sai/english/research/projects/overheating/news/lopez.html Last accessed: 12/04/2024.

Kinder T. 2014. BBC News. *Kiruna: How to move a town two miles east.* www.bbc.com/news/magazine-26447507 Last accessed: 16/11/2024.

Kiruna Bilder. *Kiruna pictures - photos from a mining town in Lapland.* www.kirunabilderlapplandfoton.se/ Last accessed: 25/03/2024.

WEBSITES

Kiruna kommun. www.kiruna.se/English/ Last accessed: 18/06/2024.

Kiruna in Swedish Lappland. *Kiruna.* kirunalapland.se/en/destinations/kiruna/ Last accessed: 16/11/2024

Kiruna in Swedish Lappland. *Startsidan.* www.kirunalapland.se/en/ Last accessed: 16/11/2024.

Kirunatopia. blog.goethe.de/kirunatopia/ Last accessed: 25/03/2024.

Klaus Thymann. *Kiruna.* www.klausthymann.com/projects/kiruna/ Last accessed: 16/11/2024.

Kotsoni E. 2014. Vice. *The Swedish Town Being Swallowed by the Earth.* www.vice.com/read/the-swedish-town-collapsing-into-a-crack-kiruna Last accessed: 25/03/2024.

KTH Royal Institute of Technology. www.kth.se/en Last accessed: 16/11/2024.

LKAB. www.lkab.com/en/ Last accessed: 16/11/2024.

LKAB. *For people who own a house.* amhallsomvandling.lkab.com/en/for-those-who-are-affected/for-people-who-own-a-house/#segment-d2233a8a-36ff-4d14-908a-0d0482572edd Last accessed: 17/05/2024

LKAB. *Kiruna Church.* samhallsomvandling.lkab.com/en/project/kiru-na-church/ Last accessed: 16/11/2024.

LKAB. *Luleå: a hub for iron ore exports and thriving industrial growth.* lkab.com/en/lkab-in-lulea/ Last accessed: 16/11/2024.

LKAB. *Questions and answers concerning the situation.* lkab.com/en/news/questions-and-answers-concerning-the-new-situation/ Last accessed: 16/11/2024.

LKAB. *Timetable for selling and moving.* samhallsomvandling.lkab.com/en/for-those-who-are-affected/timetable-for-selling-and-moving/ Last accessed: 16/11/2024.

LKAB. *To Those concerned*. samhallsomvandling.lkab.com/till-dig-som-berors/ Last accessed: 25/03/2024.

LKAB. *Urban Transformation*. www.lkab.com/en/Future/Urban-Transformations/ Last accessed: 25/03/2024

Luleå Hamn. portlulea.com/ Last accessed: 16/11/2024

Luleå University of Technology. www.ltu.se Last accessed: 16/11/2024.

Mining Technolgy. *Kiruna Iron Ore Mine*. Sweden www.mining-technology.com/projects/kiruna/?cf-view Last accessed: 16/11/2024.

Norrbottens Museum & LKAB. *Old City Hall Virtual Tour* norrbottensmuseum.se/panorama/kiruna_stadshus/stadshus.html Last accessed: 16/11/2024.

Persson B., Sten R. *Sverige & Norge Järnväg, Swedish and Norwegian Railway Co Ltd*. historiskt.nu/normalsp/staten/malmbanan/s%26nj/malmb_snj.html Last accessed: 16/11/2024.

SkyNews. *Kiruna: Sweden suffers one of its strongest earthquakes at an Arctic iron ore mine*. news.sky.com/story/kiruna-sweden-suffers-one-of-its-strongest-earthquakes-at-an-arctic-iron-ore-mine-11990483 Last accessed: 16/11/2024.

Spaces In-Between in Kiruna City Transformation. walkonwildsideanna.wordpress.com/category/okategoriserade/page/2/ Last accessed: 16/11/2024.

Statistikmyndigheten. www.scb.se Last accessed: 16/11/2024.

Statistikmyndigheten. *Sweden's GDP*. www.scb.se/en/finding-statistics/thematic-areas/economic-statistics/business-cycle-indicators/gdp/ Last accessed: 16/11/2024.

Stockholm University. *Stockholm Resilience Centre*. www.stockholmresilience.org/ Last accessed: 16/11/2024.

Sverigesradio *First historic building shifted as Kiruna moves entire city* sverigesradio.se/artikel/6703200 Last accessed: 16/11/2024.

Sverigesradio. *Premiere for Kiruna's new town hall*. sverigesradio.se/artikel/7095488 Last accessed: 16/11/2024.

WEBSITES

Sverigesradio. *Uppsala and Kiruna competing for the European Capital of Culture title*. https://sverigesradio.se/artikel/uppsala-and-kiruna-competing-for-the-european-capital-of-culture-title Last accessed: 14/11/2024.

Vattenfall. *Porjus*. powerplants.vattenfall.com/porjus/ Last accessed: 16/11/2024.

Veidekke. *Veidekke begins the move of Kiruna church*. www.veidekke.se/aktuellt/pressmeddelanden/veidekke-paborjar-flytten-av-kiruna-kyrka/ Last accessed: 16/11/2024.

White Arkitekter. www.white.se/ Last accessed: 16/11/2024.

Youtube. Luleå tekniska universitet. *The Graduate School of Space Technology in Kiruna, Sweden*. www.youtube.com/watch?v=m8uauZoS-_o Last accessed: 16/11/2024.

Youtube. VICE News. *An Entire Swedish Town Is Moving Because the Ground Is Caving In*. www.youtube.com/watch?v=jK-npw0vBv8 Last accessed: 16/11/2024.

[l] Kiruna kommun. 1984. **Kiruna's conservation plan.**

Kiruna kommun. 1992. **Piano ambientale.**

Länsstyrelsen Norrbottens Län. 2001. **Norrbottens Teknologiska Megasystem.**

[1] LKAB. 2004. **Deformation Forecast.**

[2] LKAB. Mar. 2004. **Mail to Kiruna kommun.**

[3] Kiruna kommun. Dec. 2004. **Agreement on city relocation.**

[4] Kiruna kommun. 2004. **Vision 2099.**

[5] Kiruna kommun. Jun. 2005. **Sketch proposal - Alternatives for expansion and densification.**

[6] Kiruna kommun. 2005. **Cultural heritage in motion.**

[7] LKAB ÅF & Infraplan. ~2005. **Report New Kiruna - The Northwestern Alternative: Preliminary Analysis and Conceptual Sketches.**

[8] LKAB & Wilhelmson Architects. Mar. 2006. **The New Kiruna - Northwest Alternative.**

[9] Banverket. Apr. 2006. **Railway investigation, Kiruna new railway.**

[10] Kiruna kommun. Aug. 2006. **Comprehensive Development Plan for the Central Area of Kiruna.**

[11] Kiruna kommun. Dec. 2006. **Environmental Impact Assessment for Comprehensive Development Plan for the Central Area of Kiruna.**

[12] Kiruna kommun. 2007. **Survey “What is your impression of Kiruna?"**

[13] Kiruna kommun. Jan. 2007. **Comprehensive plan for Kiruna C.**

[14] Banverket. Mar. 2007. **Final Report: Kiruna New Railway Investigation.**

[15] Kiruna kommun. 2007. "**So what did the people of Kiruna think?” - Compilation of responses from the survey “What is your impression of Kiruna?"**

[16] Norrbotten museum. Feb. 2008. **What is Kiruna Worth? Kiruna - a Cultural Valuation Analysis.**

[17] Directorate General for Ancient Monuments. 2009. **Renewal of national interest.**

[c] Jul. 2010. Ministry of Rural Affairs and Infrastructure SPN BB. **Planning and Building Act (2010:900).**

[18] Kiruna kommun. Oct. 2010. **Detailed plan for Bolagsomradet Gruvstadspark.**

[19] Avalon. 2011. **Expression of interest.**

[20] Kiruna kommun & LKAB. Feb. 2011. **Agreement: “Gp1-atvalet".**

[21] Kiruna kommun. Sep. 2011. **Agreement of the Municipal Board on city relocation.**

[22] Kiruna kommun. Jan. 2012. **Agreement on temporary railway relocation.**

[24] Kiruna kommun. Apr. 2012. **A new city centre for Kiruna invite to an architecture competition.**

[25] White Arkitekter & Ghilardi+Hellsten. May 2012. **First delivery.**

[26] Kiruna kommun & Swedish association of Architects. Jul. 2012. **Architecture competition brief.**

[27] Trafikverket. 2012. **Preliminary study on railway relocation.**

[29] White Arkitekter & Ghilardi+Hellsten. Dec. 2012. **Kiruna Forever.**

[30] County Administrative Board. 2012. **Rejection of declassification of Kiruna Town Hall.**

[31] Trafikverket. Feb. 2013. **Preliminary Study Kiruna Railway Station.**

[32] Kiruna Kommun. Mar. 2013. **A new city center for Kiruna. Jury Pronouncement.**

[34] Kiruna kommun. 2013. **Invitation to architecture competition, new City Hall in Kiruna.**

[36] Kiruna kommun. 2013. **Architectural competition New City Hall Kiruna.**

[38] Kiruna kommun. 2013. **Architectural competition New City Hall. Jury Pronouncement.**

[39] Kiruna kommun & LKAB. Nov. 2013. **Supplementary agreement on building relocation.**

[40] Kiruna kommun. 2013. **Kiruna 2.0 Vision report.**

[41] Kiruna kommun, White Arkitekter & Ghilardi+Hellsten. Mar. 2014. **Development plan.**

[42] Kiruna kommun. Mar. 2014. **Detailed plan for LINBANAN 1.**

Kiruna kommun. 2014. **Exhibition Action Detailed comprehensive plan for Kiruna seat.**

[43] Kiruna kommun. Sep. 2014. **Analysis of Kiruna's Cultural Heritage Phase 2.**

[44] Kiruna kommun. Oct. 2014. **Detailed Overview Plan for the Central Area of Kiruna 2014.**

[45] LKAB. Dec. 2014. **Deformation forecast.**

LKAB. 2014. **Annual and Sustainability Report 2014**

LKAB. 2015. **Future, LKAB's urban transformation in Kiruna and Malmberget.**

[47] Kiruna kommun & White Arkitekter. 2015. **Adjusted Development Plan.**

[49] Kiruna kommun. Jul. 2016. **Detailed plan for square and commercial street.**

[g] Kiruna kommun & Skanska. Nov. 2016. **Land acquisition agreement.**

[50] Kiruna kommun. Dec. 2016. **Detailed plan Gruvstadspark 2 etapp 1 KIRUNA 1:1 m.fl.**

[52] Kiruna kommun, County Administrative Board & LKAB. Feb. 2017. **Building Relocation Plan for Structures Affected by Level 1365.**

[54] LKAB. May 2017. **Now we are moving Kiruna-Press invitation.**

Kiruna kommun & LKAB. Jun. 2017. **The assignment description for managing cultural buildings for relocation within the 1365.**

Kiruna kommun. Sep. 2017**. Clara Nyström's assessment on the demolition of the Kiruna station.**

[m] LKAB. Oct. 2017. **Länsmansbostaden will now be moved-Press release.**

[56] Kiruna kommun. Dec. 2017 **Preliminary Study Mining Town Park, Phase 2 (Decision) Meeting Phase 1.**

[58] Kiruna kommun. Oct. 2018. **Detailed plan for Gruvstaspark 2, etapp 3, del av SJ-området m m.**

[60] Kiruna kommun & LKAB. Nov. 2018. **Management of Cultural Buildings for Relocation due to Level 1365, Version 3.**

[f] Kiruna kommun & Skanska. Nov. 2018. **Building permit for hotel and parking garage.**

Kiruna kommun. Dec. 2018. **Comprehensive Development Plan.**

[61] Kiruna kommun. Mar. 2019. **Detailed plan for retail park and center, part of property Tuolluvaara 1:1 and others.**

[62] LKAB. Apr. 2019. **Deformation Forecast.**

[66] Kiruna kommun & White Arkitekter. Apr. 2019. **Study on the relocation of the church of Kiruna.**

Kiruna kommun. May 2019. **Agreement of the Municipal Board on building relocation.**

[67] Kiruna kommun. Jun. 2019. **Detailed plan for Gruvstadspark 2 etapp 2 del av centrum.**

[68] Kiruna kommun & LKAB. Jun. 2019. **Agreement on heritage buildings to move.**

[71] Kiruna kommun. Nov. 2019. **Detailed plan for part of Tuolluvaara 1:1 m. fl.**

[72] Kiruna kommun. Nov. 2019. **Detailed plan for the KNOWLEDGE HUB.**

[75] Trafikverket. 2020. **Railway plan.**

[76] Norrbotten Museum. Nov. 2020. **Demolition documentation, Kiruna City Hall.**

[77] Kiruna kommun. Dec. 2020. **Detailed plan for GRUVSTADSPARK 2 ETAPP 4, BOLAGSOMRÅDET m fl.**

[81] Kiruna kommun. Aug. 2021. **Detailed plan for Gruvstadspark 2, etapp 5, Kyrkan 11 m fl.**

[82] LKAB & AFRY. Aug. 2021. **Landscape Analysis - Old Kiruna Church Site.**

[83] Kiruna kommun. Aug. 2021. **Detailed plan for Gruvstadspark 3, etapp 1, Hovmästaren 1, centrum 4:2 m fl.**

[84] Trafikverket. Oct. 2021 **Comprehensive Assessment of Line Studies.**

[89] Kiruna kommun. Sep. 2022. **Agreement of the Municipal Board on hospital relocation.**

[90] Kiruna kommun & LKAB. Sep. 2022. **Inauguration ceremony of blocks 7, 8, 9.**

[91] Kiruna kommun. Nov. 2022. **Detailed plan Tuolluvaara 1:1 and others, part of Western green finger, housing etc.**

[92] Trafikverket. Dec. 2022. **New railway line studies.**

[93] Kiruna kommun. Dec. 2022. **Detailed plan Tuolluvaara 1:1, part of northeast of Vinterleden, housing etc.**

[94] Kiruna kommun. Dec. 2022. **Detailed plan for Gruvstadspark 3, etapp 2, del av centrum, nedre Norrmalm m fl.**

Trafikverket. Mar. 2023. **Basis for consultation Kiruna new railway station and reconstruction of road 870.**

Trafikverket. Mar. 2023. **JP Kiruna Consultation Report Kiruna, New Railway Station.**

[98] Kiruna kommun. Oct. 2023. **Detailed plan proposal for the City Park.**

[h] Kiruna kommun. Jan. 2024. **Submission of the application for European Capital of Culture 2029.**

[101] Kiruna kommun. May. 2024. **Detailed plan for volume trade and the center, part of Tuolluvaara 1:1 etc., change.**

Course glossary

Architectural Scale: It is the relationship between the dimensions drawn on a plan or architectural drawing and the actual dimensions of the building. Architectural projects are usually represented on a reduced scale to allow for an overview while maintaining accuracy in details. The scale is indicated within the drawing by a division (e.g., 1:100; each unit on the drawing represents 100 actual units). **Large Architectural Scale**: A large architectural scale refers to projects or representations where the dimensions of a building or structure are depicted with a high level of detail, with a ratio closer to the actual scale (e.g., 1:20). **Small Architectural Scale**: A small architectural scale refers to the representation of a project or building in which the ratio between the drawing size and the real size is very small (e.g., 1:10,000). This scale is commonly used in urban planning and territorial planning.

Attachment: Any additional documentation provided to better understand the original documents may include photos, videos, or any other type of file. However, they cannot, of course, be **original resources** downloadable from another node or within the node itself.

Blueprint: The term refers to detailed technical drawings used as the definitive guide for the realization of a project, such as a building.

Card: The cards are the initial panels that appear when you click on a document. They contain various pieces of information, including the document description.

Collateral Consequence: This type of connection between nodes occurs when a node has an unforeseen impact that leads to the creation of a document or action. For instance, the Expression of Interest by Avalon and the Municipality's decision on where to relocate the city are linked by this kind of connection.

Concept: A type of drawing that can take forms such as a plan or section that are not necessarily drawn to scale. This type of representation, used in the early stages of a project, is useful for communicating design ideas visually and intuitively, without the constraints of actual dimensions.

Detail Plan: Of the three planning tools available to Swedish municipalities, this one has the largest scale. It determines land use and is the only one of the three types of plans in the Swedish system to be mandatory. It always consists of two objects: a plan that defines land use and a written text that explains what led to the drafting of the plan with these characteristics.

Diagram (User interface): The Diagram is essentially the visualization of all the documents, negotiations, and material effects that have had or will have an impact on the form of the emerging city, namely the new Kiruna, and the city that is dying: the old town center. The diagram aims to depict the phenomenon of Kiruna's relocation. The diagram organizes the nodes on a Cartesian plane where the horizontal axis represents time, and the vertical axis represents scale, understood both as architectural scale and as proximity to achieving the goal, namely the construction of the architectural artifact.

Direct Consequence: Direct consequence is the most common type of connection between nodes and appears whenever a document explicitly anticipates the creation of another document or subsequent action. An example is the connection between "A New City Centre for Kiruna: Invite to an Architecture Competition" and "First Delivery".

Document (Action)(Node): The Documents are the nodes of the diagram. They represent the agreements, conflicts, consultations, material effects, and papers that directly influence the relocation of Kiruna. Each of them is connected to a specific area within the municipality of Kiruna.

Document description: Brief text regarding the information contained in a document, it helps site visitors quickly understand if the document they are looking for is actually the one they have selected, without necessarily downloading the original resources.

Informative document: This type of document aims to communicate, affecting the urban space by enabling interaction between stakeholders, such as the "Invitation to Architecture Competition, New City Hall in Kiruna".

LKAB (Luossavaara-Kiirunavaara AB): It is the Swedish mining company operating in Kiruna, state-owned and founded in 1890. It is one of the largest global producers of iron ore, with operations mainly concentrated in northern Sweden.

Material Effect: It is a type of node present in the diagram representing the three activities that are shaping the new city: demolition, reconstruction, and relocation.

Nodes: Nodes are elements of the diagram, each of which represents a document. The various nodes are connected to each other by one or more connections.

Original Resources: Original resources are the original items or documents, which could consist of multiple files, for example, a map and a text document of a ruling. For example, the original resources of the detailed plans for Kiruna from 2004 onwards always consist of two PDF files: one contains a plan that defines land use, and the other consists of a written text that explains the reasoning behind the drafting of the plan with these characteristics.

Projection: This is a type of connection between nodes that is similar to a direct consequence, but the generating document (or more commonly, the material effect) precedes the resulting document. An example of this is the Mail to Kiruna kommun, written in anticipation of the full exploitation of Level 1,365, which would only occur 12 years later.

Prescriptive document: The prescriptive document is characterized by its authority; these documents grant legal force to design-related documents, as they are issued by a governing body, such as the detailed plans of the Municipality of Kiruna.

Resident (User2): The Residents of the municipality of Kiruna.

Urban Developer (User4): A figure involved in the construction process of the new city. Urban Developers are part of companies that invest in real estate in Kiruna, purchasing land to construct buildings on it, which they will then sell or, more rarely, economically exploit to achieve a financial return. These figures are essential for the development of New Kiruna.

Urban Planner (User1): The Urban Planner is an employee of the municipality of Kiruna, often a professional architect or urban planner, who is responsible for municipal land-use planning. His main task is the preparation of detailed plans.

Update: This type of node connection, which, as the name suggests, simply connects two documents that perform the same function but succeed each other over time, like the various deformation forecasts.

Visitor (User3): An umbrella term that includes everyone from casual tourists and curious onlookers to researchers studying the relocation process of Kiruna.

B

Interview plan

1 How long have you been in Kiruna? How long have you been working for your organization?

2 What roles does your organization have in Kiruna's urban transformation process?

3 What is your role in Kiruna's urban transformation process?

4 Tell me about a specific urban transformation intervention you have been involved in.

5 What unforeseen events have altered the final outcome of the intervention?

6 Which features of the intervention were influenced by the 2014 masterplan?

7 Which other act or document do you think was fundamental for the realization of the intervention or somehow influenced it?

8 What documents did your organization produce to carry out the intervention?

9 Tell me about an urban transformation intervention in which you could not participate, and it somehow personally affected you.

10 Name a person who had significant influence in the process.

11 How could you have intervened in the process?

12 What is your collaboration relationship with other actors influencing the process?

13 What are the main points of agreement and divergence between your organization and the (stakeholder's name)?

14 A situation in which your organization must defer to the wishes of another actor in Kiruna.

15 A situation in which another actor must defer to your organization.

16 Which expectations have been met from 2014 to the present?

17 Which ones have not been met?

18 What are the major challenges that have arisen during the transformation that were not foreseen 10 years ago?

19 Name a person whom you think would be interesting to interview for the research.

1st week: Meeting with officials from **Kiruna's technical offices** to gain a comprehensive understanding of the relocation process.

Tue 30 Apr: Arrival in Kiruna
Wed 1 May:
Thu 2 May: Meeting one with C. & S.
Fri 3 May: Meeting two with S.
Sat 4 May: Meeting three with M.
Sun 5 May:

2nd week: Meetings with **architecture firms** involved in the relocation practices to gain a more specific understanding of the necessary actions to implement the process.

Mon 6 May:
Tue 7 May:
Wed 8 May:
Thu 9 May:
Fri 10 May:
Sat 11 May:
Sun 12 May:

3rd week: Interacting with the **LKAB offices**, particularly those involved in the construction sector, to understand their specific roles within the process.

Mon 13 May:
Tue 14 May:
Wed 15 May:
Thu 16 May:
Fri 17 May:
Sat 18 May:
Sun 19 May:

4th week: Interviews with **residents** of the areas soon **to be relocated** to understand the process from the perspective of those affected and to identify their concerns and expectations.

Mon 20 May:
Tue 21 May:
Wed 22 May:
Thu 23 May:
Fri 24 May:
Sat 25 May:
Sun 26 May:

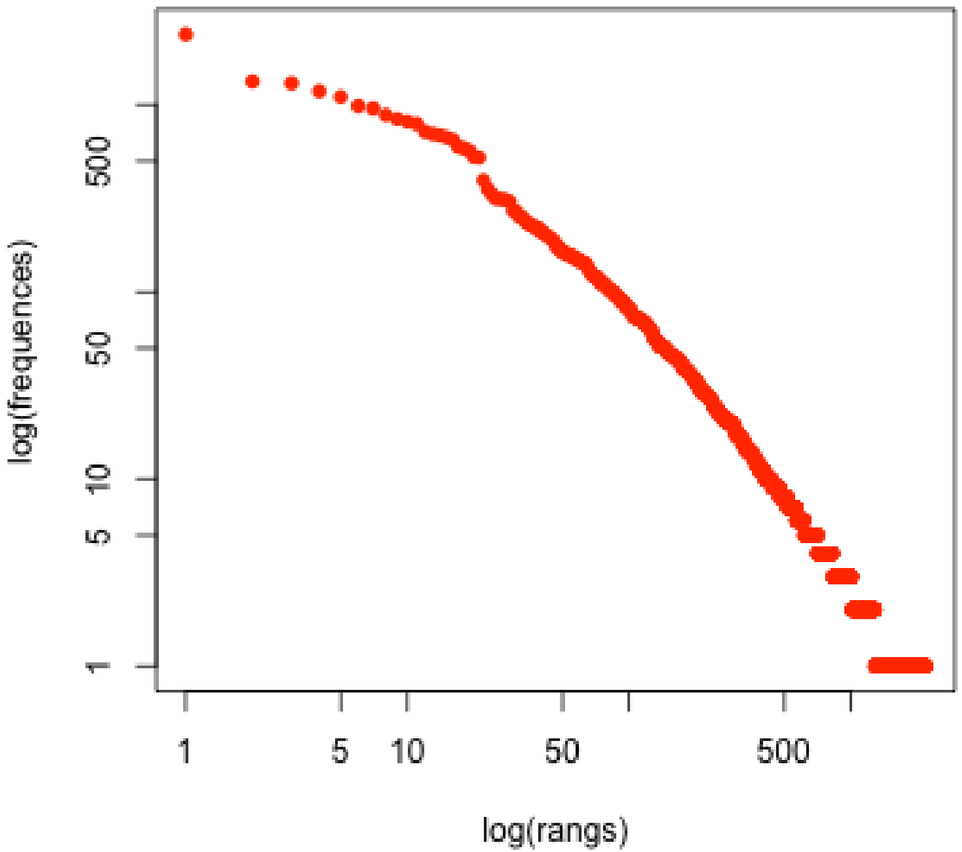
5th week: Interviews with **residents** who have **recently moved** to the new area to understand the effectiveness of the relocation process from the perspective of those affected.

Mon 27 May:
Tue 28 May:
Wed 29 May:
Thu 30 May:
Fri 31 May:
Sat 1 June
Sun 2 June:

Analysis of word frequency

build	309	nom
move	238	ver
city	155	nom
plan	151	ver
person	142	nom
big	121	adj
year	120	nom
work	112	nom
building	112	nom
lkab	110	nr
municipalit	109	nom
lot	106	nom
land	103	nom
hotel	102	nom
need	101	ver
thing	98	nom
kiruna	96	nr
start	94	nom
old	92	adj
house	88	nom
buy	82	ver
bite	82	ver
time	80	nom
part	72	nom
agreement	71	nom
mine	65	nom
line	64	nom
centre	64	nom
space	57	nom
live	56	adj
put	55	ver
park	55	ver
close	52	ver
sell	51	ver
project	51	nom
inside	51	nom
change	48	ver
tenant	47	nom
problem	47	nom
own	47	ver
good	47	adj
company	47	nom
tell	46	ver
call	46	nom
school	44	nom
interest	44	nom
design	44	nom
architect	44	nom
place	43	nom
snow	42	ver
high	42	adj
road	41	nom
money	41	nom
competitio	41	nom
church	39	nom
skanska	38	nr
nice	38	adj
find	38	ver
talk	36	ver
library	36	nom
detail	36	ver
town	35	nom
sort	34	nom
important	34	nr
decide	34	ver
pay	33	nom
happen	33	ver
understanc	31	ver
sweden	31	nr
easy	30	adj
side	29	nom
point	29	ver
long	29	adj
kind	29	adj
cost	29	ver
property	28	nom
guess	28	nom
flat	28	nom
document	28	nom
day	28	nom
show	27	ver
send	27	ver
italy	27	nr
hospital	27	nom
affect	27	nom
fence	26	nom
floor	25	nom
area	25	nom
apartment	25	nom
winter	24	nom
roof	24	nom
open	24	adj
car	24	nom
begin	24	ver
ago	24	nr
scandic	23	nr
room	23	nom
leave	23	ver
give	23	nom
stuff	22	nom
process	22	nom
office	22	nom
garage	22	nom
develop	22	ver
write	21	ver
villa	21	nom
rome	21	nr
plot	21	nom
manage	21	ver
hear	21	ver
hard	21	adj
hall	21	nom
forecast	21	ver
back	21	nom
window	20	nom
water	20	nom
suppose	20	ver
public	20	nom
permit	20	nom
normal	20	nom
material	20	nom
level	20	nom
gonna	20	nr
constructic	20	nom
bad	20	adj
small	19	adj
developer	19	nom
anymore	19	nr
sign	18	nom
wait	17	nom
pretty	17	adj
meet	17	ver
contract	17	nom
basically	17	nr
ask	17	ver
acquisition	17	nom
shape	16	nom
reasonable	16	nr
feel	16	ver
view	15	nom
middle	15	nom
contractor	15	nom
win	14	ver
wall	14	nom
price	14	nom
mountain	14	nom
month	14	nom
million	14	nom
metre	14	nom
mandatory	14	nom
life	14	nom
let	14	ver
less	14	adj
iron	14	nom
investor	14	nom
expensive	14	nr
allow	14	ver
job	13	nom
invest	13	ver
finish	13	ver
early	13	adj
drink	13	nom
value	12	nom
stop	12	nom
speak	12	ver
skywalk	12	nr
reason	12	ver
question	12	nom
owner	12	nom
master	12	nom
hot	12	adj
grind	12	ver
facade	12	nom
difficult	12	nr
deal	12	nom
cold	12	adj
wood	11	nom
traffic	11	nom
tower	11	nom
today	11	nom
summer	11	nom
study	11	nom
soon	11	adj
relocate	11	ver
read	11	ver
moment	11	nom
list	11	nom
kid	11	nom
huge	11	adj
dig	11	nom
culture	11	nom
crack	11	nom
concrete	11	nom
thomas	10	nr
story	10	nom
store	10	nom
stay	10	ver
stand	10	nom
sky	10	nom
rend	10	ver

Distribution of word frequency



Most used words diagram - words used more than 28 times

Most used words diagram - all words

Analysis of words frequency - interviewees(P2) and interviewer(P1)

X.P_1	X.P_2	word
8	19	affect
10	34	school
23	73	kiruna
9	2	study
3	17	permit
0	21	plot
9	18	hospital
10	36	call
31	15	tell
4	19	room
35	77	work
6	18	roof
10	13	give
7	5	hot
0	22	office
13	3	reasonable
4	25	side
0	12	facade
6	6	master
14	30	architect
16	35	project
2	15	acquisition
22	43	mine
1	10	concrete
9	33	snow
15	5	bad
6	8	mandatory
2	10	speak
17	27	interest
4	10	life
2	18	suppose
1	27	property
0	11	kid
18	3	rome
18	12	easy
22	70	old
16	4	normal
6	6	deal
9	12	hear
23	28	inside
0	10	drive
7	3	picture
29	51	time
9	8	basically
1	26	show
3	17	level
8	3	dig
8	15	leave
7	14	villa
6	12	sign
11	18	cost
6	14	water
20	28	change
4	13	wait
1	9	market
17	39	live
1	10	today
16	8	car
11	13	winter
4	17	write
19	17	talk
6	6	cold
4	16	window
4	17	hall
35	85	year
13	20	happen
14	43	space
4	10	million
6	4	possibility
38	60	thing
14	29	place
21	88	municipality
9	20	long
8	16	open
58	97	city
10	72	bite
0	10	rend
0	24	begin
7	7	price
46	64	lkab
8	15	scandic
3	8	wood
17	4	forecast
3	14	contract
4	11	middle
4	9	finish
6	5	summer
14	27	money
9	2	read
14	6	gonna
2	9	traffic
3	8	tower
9	32	competition
2	8	stand
12	29	road
4	21	area
42	64	lot
18	16	important
1	12	invest
4	10	month
5	20	apartment
16	18	decide
5	6	list
2	17	small
7	19	fence
4	40	design
7	13	public
10	45	put
15	13	flat
2	45	company
10	25	town
0	11	huge
6	19	floor
4	18	develop
4	8	skywalk
9	24	pay
6	5	soon
3	16	developer
16	31	good
17	11	document
15	73	house
7	14	hard
1	11	reason
4	13	ask
3	13	feel
6	22	guess
3	7	store
9	93	hotel
18	37	park
25	47	part
12	17	kind
11	40	sell
3	11	mountain
47	104	plan
2	8	thomas
22	16	find
10	7	pretty
1	10	culture
25	27	close
6	8	iron
18	11	point
22	17	church
6	8	expensive
0	10	meeting
27	4	understand
19	8	italy
13	6	anymore
4	7	moment
4	9	early
3	9	grind
59	83	person
5	11	shape
2	13	contractor
95	214	build
48	73	big
7	14	back
20	51	agreement
2	8	story
2	10	question
6	4	fast
22	42	line
26	12	nice
12	12	ago
24	79	land
8	19	send
4	7	relocate
3	11	let
6	8	metre
6	8	win
8	13	manage
0	10	private
2	32	sort
3	7	challenge
5	12	meet
7	15	process
8	34	high
5	7	stop
4	6	light
6	8	allow
89	149	move
4	34	skanska
11	9	material
0	14	investor
16	12	day
2	45	tenant
2	8	keep
4	8	owner
24	70	start
6	25	sweden
27	74	need
26	38	centre
8	14	stuff
8	7	view
5	8	job
4	10	wall
2	10	value
4	8	difficult
9	4	drink
0	10	load

Analysis of relative frequency - interviewees(P2) and interviewer(P1)

X.P_1	X.P_2	word
3,37	3,84	affect
4,21	6,87	school
9,68	14,74	kiruna
3,79	0,4	study
1,26	3,43	permit
0	4,24	plot
3,79	3,63	hospital
4,21	7,27	call
13,05	3,03	tell
1,68	3,84	room
14,73	15,55	work
2,53	3,63	roof
4,21	2,63	give
2,95	1,01	hot
0	4,44	office
5,47	0,61	reasonable
1,68	5,05	side
0	2,42	facade
2,53	1,21	master
5,89	6,06	architect
6,73	7,07	project
0,84	3,03	acquisition
9,26	8,68	mine
0,42	2,02	concrete
3,79	6,66	snow
6,31	1,01	bad
2,53	1,62	mandatory
0,84	2,02	speak
7,15	5,45	interest
1,68	2,02	life
0,84	3,63	suppose
0,42	5,45	property
0	2,22	kid
7,58	0,61	rome
7,58	2,42	easy
9,26	14,14	old
6,73	0,81	normal
2,53	1,21	deal
3,79	2,42	hear
9,68	5,65	inside
0	2,02	drive
2,95	0,61	picture
12,21	10,3	time
3,79	1,62	basically
0,42	5,25	show
1,26	3,43	level
3,37	0,61	dig
3,37	3,03	leave
2,95	2,83	villa
2,53	2,42	sign
4,63	3,63	cost
2,53	2,83	water
8,42	5,65	change
1,68	2,63	wait
0,42	1,82	market
7,15	7,88	live
0,42	2,02	today
6,73	1,62	car
4,63	2,63	winter
1,68	3,43	write
8	3,43	talk
2,53	1,21	cold
1,68	3,23	window
1,68	3,43	hall
14,73	17,16	year
5,47	4,04	happen
5,89	8,68	space
1,68	2,02	million
2,53	0,81	possibility
15,99	12,12	thing
5,89	5,86	place
8,84	17,77	municipality
3,79	4,04	long
3,37	3,23	open
24,41	19,59	city
4,21	14,54	bite
0	2,02	rend
0	4,85	begin
2,95	1,41	price
19,36	12,92	lkab
3,37	3,03	scandic
1,26	1,62	wood
7,15	0,81	forecast
1,26	2,83	contract
1,68	2,22	middle
1,68	1,82	finish
2,53	1,01	summer
5,89	5,45	money
3,79	0,4	read
5,89	1,21	gonna
0,84	1,82	traffic
1,26	1,62	tower
3,79	6,46	competition
0,84	1,62	stand
5,05	5,86	road
1,68	4,24	area
17,68	12,92	lot
7,58	3,23	important
0,42	2,42	invest
1,68	2,02	month
2,1	4,04	apartment
6,73	3,63	decide
2,1	1,21	list
0,84	3,43	small
2,95	3,84	fence
1,68	8,08	design
2,95	2,63	public
4,21	9,09	put
6,31	2,63	flat
0,84	9,09	company
4,21	5,05	town
0	2,22	huge
2,53	3,84	floor
1,68	3,63	develop
1,68	1,62	skywalk
3,79	4,85	pay
2,53	1,01	soon
1,26	3,23	developer
6,73	6,26	good
7,15	2,22	document
6,31	14,74	house
2,95	2,83	hard
0,42	2,22	reason
1,68	2,63	ask
1,26	2,63	feel
2,53	4,44	guess
1,26	1,41	store
3,79	18,78	hotel
7,58	7,47	park
10,52	9,49	part
5,05	3,43	kind
4,63	8,08	sell
1,26	2,22	mountain
19,78	21	plan
0,84	1,62	thomas
9,26	3,23	find
4,21	1,41	pretty
0,42	2,02	culture
10,52	5,45	close
2,53	1,62	iron
7,58	2,22	point
9,26	3,43	church
2,53	1,62	expensive
0	2,02	meeting
11,36	0,81	understand
8	1,62	italy
5,47	1,21	anymore
1,68	1,41	moment
1,68	1,82	early
1,26	1,82	grind
24,83	16,76	person
2,1	2,22	shape
0,84	2,63	contractor
39,98	43,21	build
20,2	14,74	big
2,95	2,83	back
8,42	10,3	agreement
0,84	1,62	story
0,84	2,02	question
2,53	0,81	fast
9,26	8,48	line
10,94	2,42	nice
5,05	2,42	ago
10,1	15,95	land
3,37	3,84	send
1,68	1,41	relocate
1,26	2,22	let
2,53	1,62	metre
2,53	1,62	win
3,37	2,63	manage
0	2,02	private
0,84	6,46	sort
1,26	1,41	challenge
2,1	2,42	meet
2,95	3,03	process
3,37	6,87	high
2,1	1,41	stop
1,68	1,21	light
2,53	1,62	allow
37,46	30,09	move
1,68	6,87	skanska
4,63	1,82	material
0	2,83	investor
6,73	2,42	day
0,84	9,09	tenant
0,84	1,62	keep
1,68	1,62	owner
10,1	14,14	start
2,53	5,05	sweden
11,36	14,94	need
10,94	7,67	centre
3,37	2,83	stuff
3,37	1,41	view
2,1	1,62	job
1,68	2,02	wall
0,84	2,02	value
1,68	1,62	difficult
3,79	0,81	drink
0	2,02	load

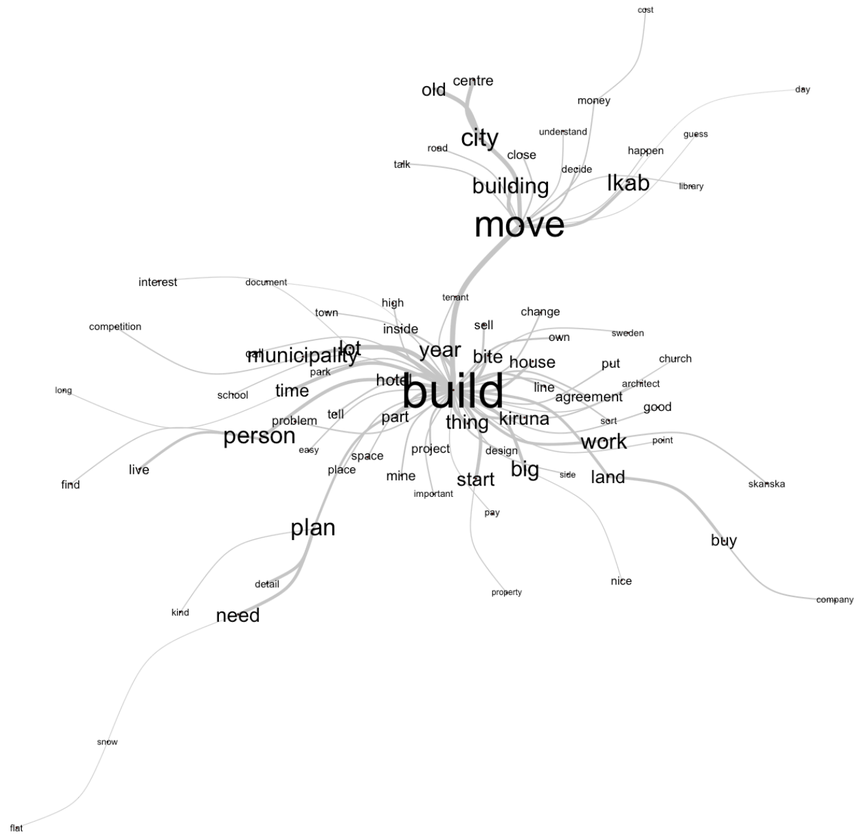
Analysis of word frequency - between interviews

interwiew_	interwiew_	interwiew_	interwiew_	interwiew_	interwiew_	word						
18	7	2	0	0	0	affect	15	6	0	1	0	7 cost
9	10	2	19	3	1	school	0	12	1	6	0	1 water
2	11	16	14	21	32	kiruna	6	7	0	3	5	27 change
0	0	3	8	0	0	study	4	4	0	0	3	6 wait
0	0	0	0	1	19	permit	0	0	0	0	1	9 market
0	6	0	0	0	15	plot	3	10	10	20	12	1 live
6	18	0	0	1	2	hospital	0	4	1	1	0	5 today
6	3	2	15	6	14	call	1	1	10	11	1	0 car
2	7	15	14	4	4	tell	0	12	2	5	0	5 winter
1	1	1	1	2	17	room	5	1	0	3	0	12 write
19	13	11	16	13	40	work	16	0	5	5	7	3 talk
0	1	2	6	0	15	roof	0	1	2	6	3	0 cold
5	0	1	5	1	11	give	0	0	1	2	0	17 window
0	0	0	12	0	0	hot	0	4	5	0	1	11 hall
0	0	0	1	5	16	office	17	19	13	36	3	32 year
7	4	2	2	1	0	reasonable	8	8	3	2	0	12 happen
2	2	3	3	8	11	side	2	10	5	2	1	37 space
0	0	1	0	2	9	facade	4	0	0	4	0	6 million
2	3	0	1	0	6	master	2	2	0	0	4	2 possibility
2	0	0	14	4	24	architect	18	9	12	8	10	41 thing
8	0	1	7	10	25	project	2	9	12	10	2	8 place
0	0	0	0	0	17	acquisition	11	6	3	6	8	75 municipality
14	16	0	17	5	13	mine	2	1	9	5	5	7 long
2	0	2	0	1	6	concrete	2	10	3	6	0	3 open
0	9	0	6	0	27	snow	19	5	36	29	36	30 city
1	1	4	9	2	3	bad	19	4	3	3	7	46 bite
0	14	0	0	0	0	mandatory	0	0	0	1	2	7 rend
0	0	1	0	2	9	speak	4	0	2	0	7	11 begin
10	11	3	2	2	16	interest	2	0	0	4	0	8 price
3	6	2	1	0	2	life	33	11	9	8	9	40 lkab
9	3	1	1	3	3	suppose	0	1	5	0	9	8 scandic
0	0	1	0	0	27	property	1	0	2	0	1	7 wood
2	3	0	5	1	0	kid	14	4	1	1	0	1 forecast
0	0	2	17	1	1	rome	4	0	0	0	5	8 contract
11	8	1	2	0	8	easy	3	4	3	1	0	4 middle
14	4	28	21	8	17	old	1	3	1	0	1	7 finish
4	4	2	7	0	3	normal	3	1	0	5	2	0 summer
0	0	0	2	1	9	deal	9	7	3	8	1	13 money
0	3	1	13	0	4	hear	4	1	1	5	0	0 read
9	10	0	18	3	11	inside	7	5	2	2	0	4 gonna
3	3	3	1	0	0	drive	0	0	9	1	0	1 traffic
1	0	1	1	1	6	picture	0	9	0	0	0	2 tower
20	10	12	13	8	17	time	0	0	0	0	8	33 competition
0	2	3	3	2	7	basically	1	4	0	0	1	4 stand
5	6	0	1	4	11	show	8	11	17	5	0	0 road
2	4	0	0	0	14	level	8	13	0	0	0	4 area
1	2	2	6	0	0	dig	35	19	11	10	5	26 lot
6	5	3	4	1	4	leave	12	7	0	3	1	11 important
1	19	0	1	0	0	villa	0	1	0	0	1	11 invest

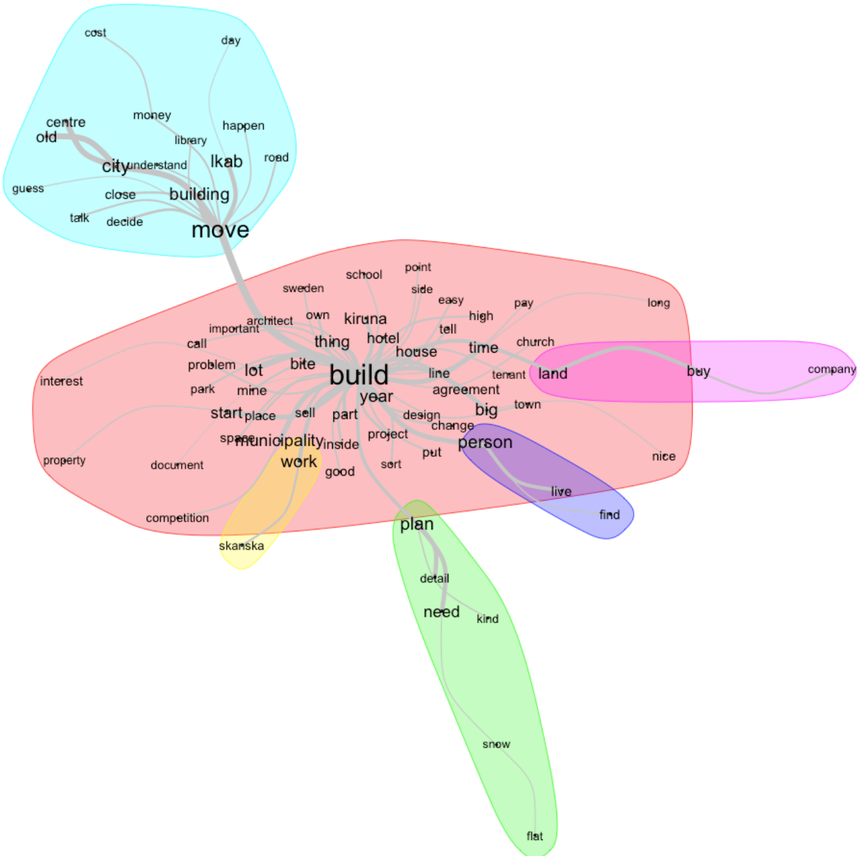
Analysis of relative frequency - between interviews

interwiew_	interwiew_	interwiew_	interwiew_	interwiew_	interwiew_	word						
14,43	6,54	2,61	0	0	0	affect	12,03	5,6	0	0,89	0	2,82 cost
7,22	9,34	2,61	16,99	4,68	0,4	school	0	11,2	1,3	5,37	0	0,4 water
1,6	10,27	20,86	12,52	32,76	12,88	kiruna	4,81	6,54	0	2,68	7,8	10,87 change
0	0	3,91	7,16	0	0	study	3,21	3,73	0	0	4,68	2,42 wait
0	0	0	0	1,56	7,65	permit	0	0	0	0	1,56	3,62 market
0	5,6	0	0	0	6,04	plot	2,41	9,34	13,04	17,89	18,72	0,4 live
4,81	16,81	0	0	1,56	0,81	hospital	0	3,73	1,3	0,89	0	2,01 today
4,81	2,8	2,61	13,42	9,36	5,64	call	0,8	0,93	13,04	9,84	1,56	0 car
1,6	6,54	19,56	12,52	6,24	1,61	tell	0	11,2	2,61	4,47	0	2,01 winter
0,8	0,93	1,3	0,89	3,12	6,84	room	4,01	0,93	0	2,68	0	4,83 write
15,24	12,14	14,34	14,31	20,28	16,1	work	12,83	0	6,52	4,47	10,92	1,21 talk
0	0,93	2,61	5,37	0	6,04	roof	0	0,93	2,61	5,37	4,68	0 cold
4,01	0	1,3	4,47	1,56	4,43	give	0	0	1,3	1,79	0	6,84 window
0	0	0	10,73	0	0	hot	0	3,73	6,52	0	1,56	4,43 hall
0	0	0	0,89	7,8	6,44	office	13,63	17,74	16,95	32,2	4,68	12,88 year
5,61	3,73	2,61	1,79	1,56	0	reasonable	6,42	7,47	3,91	1,79	0	4,83 happen
1,6	1,87	3,91	2,68	12,48	4,43	side	1,6	9,34	6,52	1,79	1,56	14,9 space
0	0	1,3	0	3,12	3,62	facade	3,21	0	0	3,58	0	2,42 million
1,6	2,8	0	0,89	0	2,42	master	1,6	1,87	0	0	6,24	0,81 possibility
1,6	0	0	12,52	6,24	9,66	architect	14,43	8,4	15,65	7,16	15,6	16,51 thing
6,42	0	1,3	6,26	15,6	10,06	project	1,6	8,4	15,65	8,94	3,12	3,22 place
0	0	0	0	0	6,84	acquisition	8,82	5,6	3,91	5,37	12,48	30,19 municipality
11,23	14,94	0	15,21	7,8	5,23	mine	1,6	0,93	11,73	4,47	7,8	2,82 long
1,6	0	2,61	0	1,56	2,42	concrete	1,6	9,34	3,91	5,37	0	1,21 open
0	8,4	0	5,37	0	10,87	snow	15,24	4,67	46,94	25,94	56,16	12,08 city
0,8	0,93	5,22	8,05	3,12	1,21	bad	15,24	3,73	3,91	2,68	10,92	18,52 bite
0	13,07	0	0	0	0	mandatory	0	0	0	0,89	3,12	2,82 rend
0	0	1,3	0	3,12	3,62	speak	3,21	0	2,61	0	10,92	4,43 begin
8,02	10,27	3,91	1,79	3,12	6,44	interest	1,6	0	0	3,58	0	3,22 price
2,41	5,6	2,61	0,89	0	0,81	life	26,46	10,27	11,73	7,16	14,04	16,1 lkab
7,22	2,8	1,3	0,89	4,68	1,21	suppose	0	0,93	6,52	0	14,04	3,22 scandic
0	0	1,3	0	0	10,87	property	0,8	0	2,61	0	1,56	2,82 wood
1,6	2,8	0	4,47	1,56	0	kid	11,23	3,73	1,3	0,89	0	0,4 forecast
0	0	2,61	15,21	1,56	0,4	rome	3,21	0	0	0	7,8	3,22 contract
8,82	7,47	1,3	1,79	0	3,22	easy	2,41	3,73	3,91	0,89	0	1,61 middle
11,23	3,73	36,51	18,78	12,48	6,84	old	0,8	2,8	1,3	0	1,56	2,82 finish
3,21	3,73	2,61	6,26	0	1,21	normal	2,41	0,93	0	4,47	3,12	0 summer
0	0	0	1,79	1,56	3,62	deal	7,22	6,54	3,91	7,16	1,56	5,23 money
0	2,8	1,3	11,63	0	1,61	hear	3,21	0,93	1,3	4,47	0	0 read
7,22	9,34	0	16,1	4,68	4,43	inside	5,61	4,67	2,61	1,79	0	1,61 gonna
2,41	2,8	3,91	0,89	0	0	drive	0	0	11,73	0,89	0	0,4 traffic
0,8	0	1,3	0,89	1,56	2,42	picture	0	8,4	0	0	0	0,81 tower
16,04	9,34	15,65	11,63	12,48	6,84	time	0	0	0	0	12,48	13,29 competition
0	1,87	3,91	2,68	3,12	2,82	basically	0,8	3,73	0	0	1,56	1,61 stand
4,01	5,6	0	0,89	6,24	4,43	show	6,42	10,27	22,16	4,47	0	0 road
1,6	3,73	0	0	0	5,64	level	6,42	12,14	0	0	0	1,61 area
0,8	1,87	2,61	5,37	0	0	dig	28,07	17,74	14,34	8,94	7,8	10,47 lot
4,81	4,67	3,91	3,58	1,56	1,61	leave	9,62	6,54	0	2,68	1,56	4,43 important
0,8	17,74	0	0,89	0	0	villa	0	0,93	0	0	1,56	4,43 invest

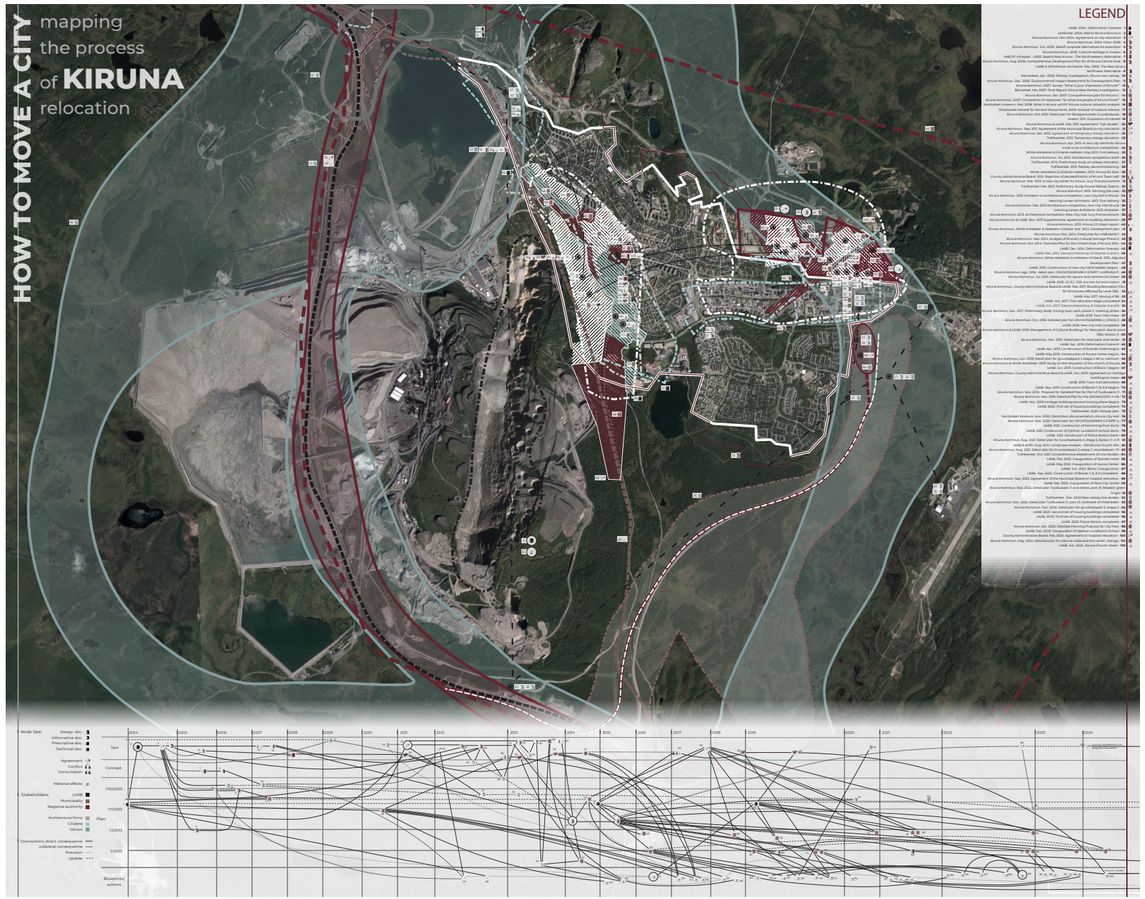
Analysis of word relationships - words used more than 28 times

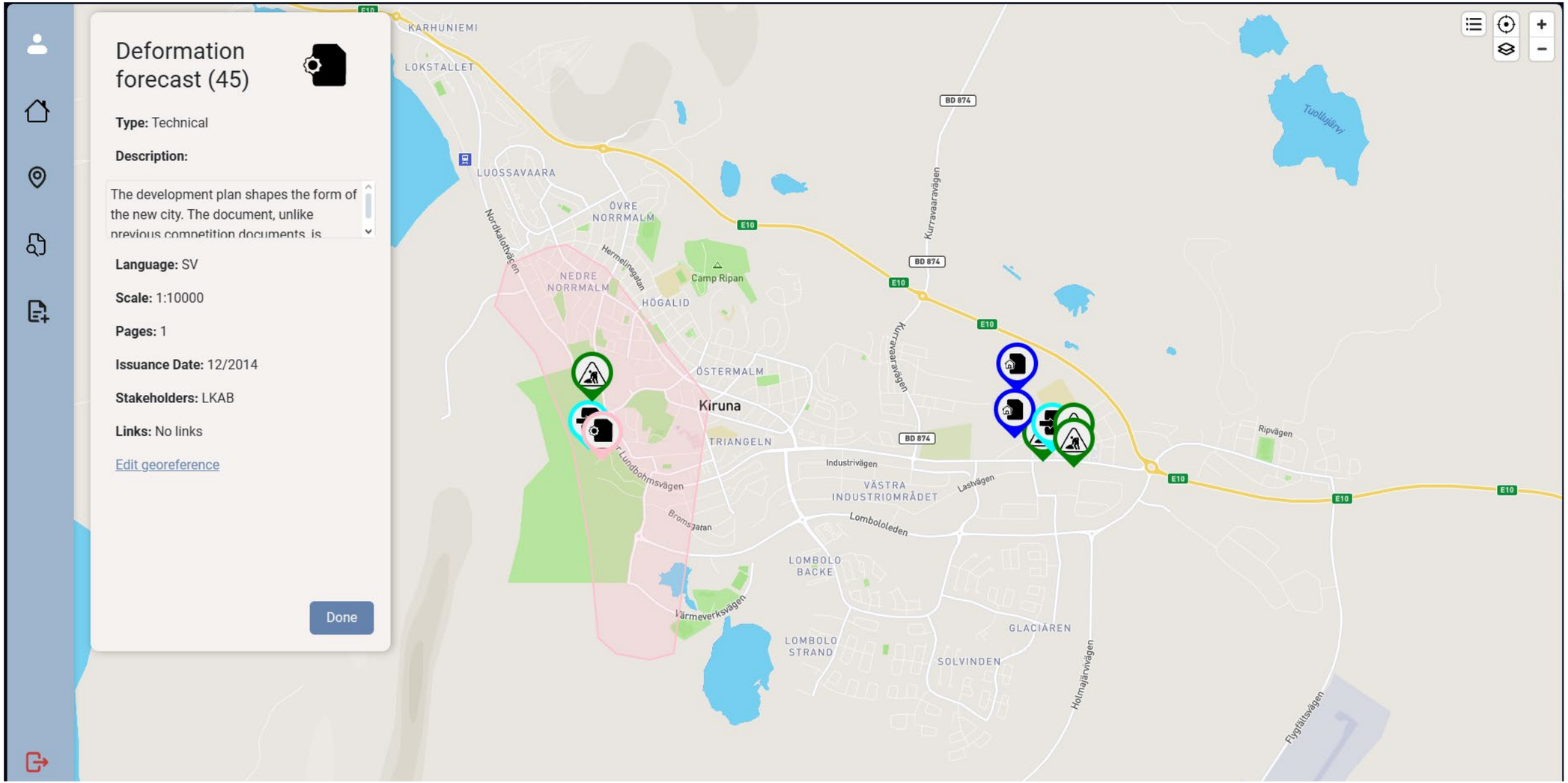


Analysis of word relationships and clusters - words used more than 28 times



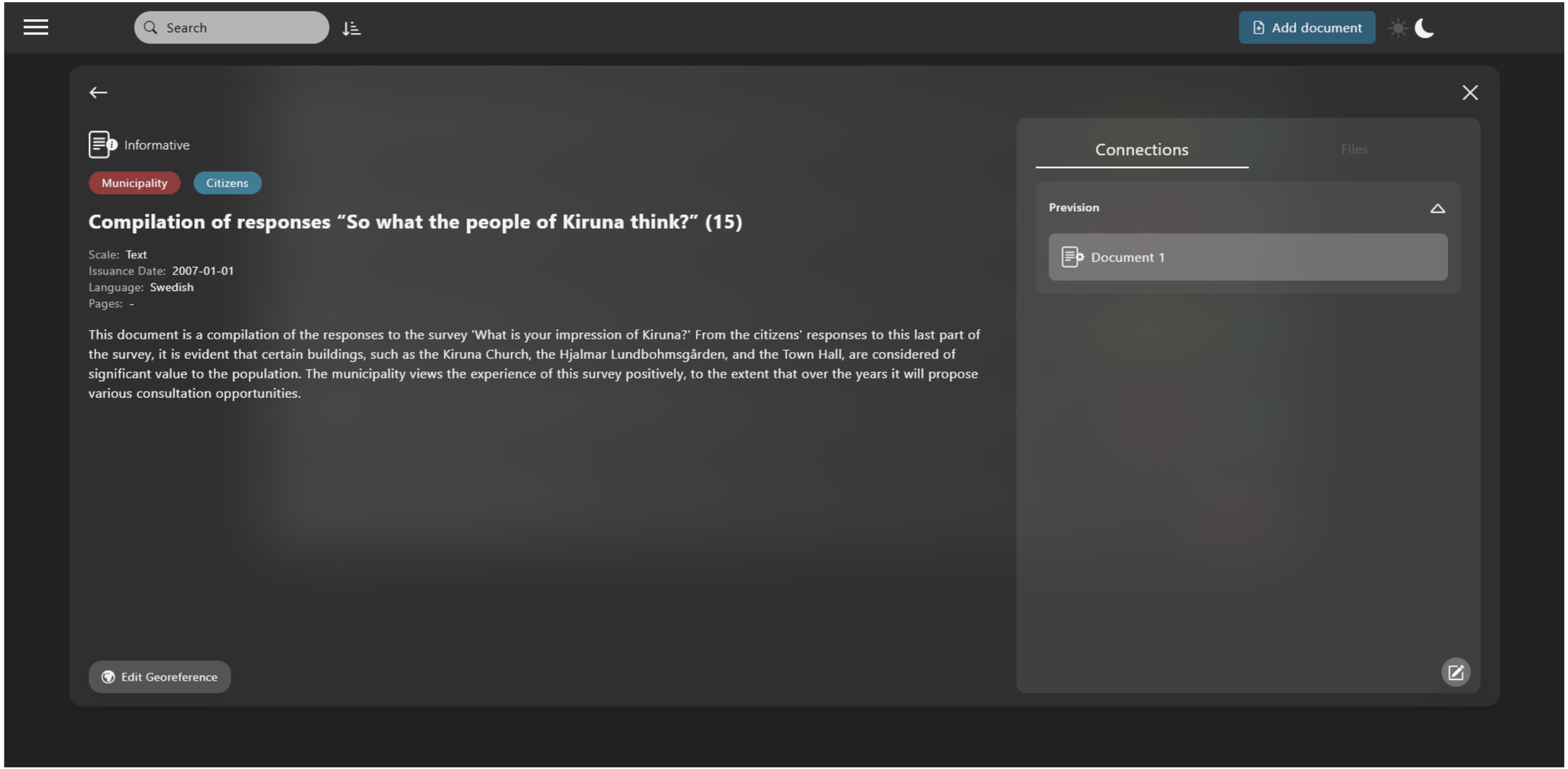
D Entry for the "Architecture Beyond Extraction" call for papers by JAE





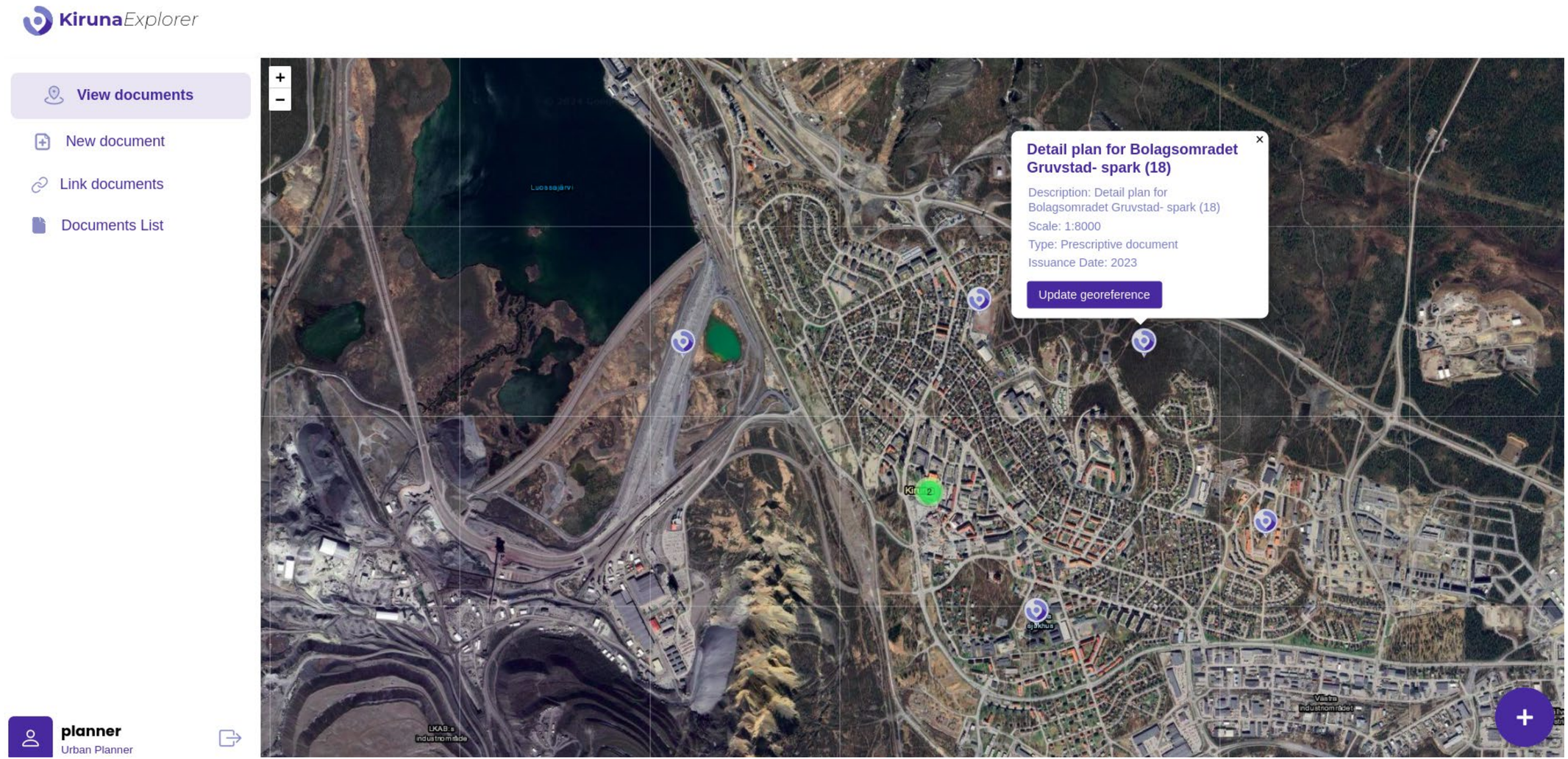
Map interface with a card opened by an Urban Planner.

Group 1: Giuseppe Maria Barone, Emanuele Coricciati, Mitra Heidari, Marco Piasso, Riccardo Scanu, Amirhoseein Torabiardekani, & Francesca Villanova.



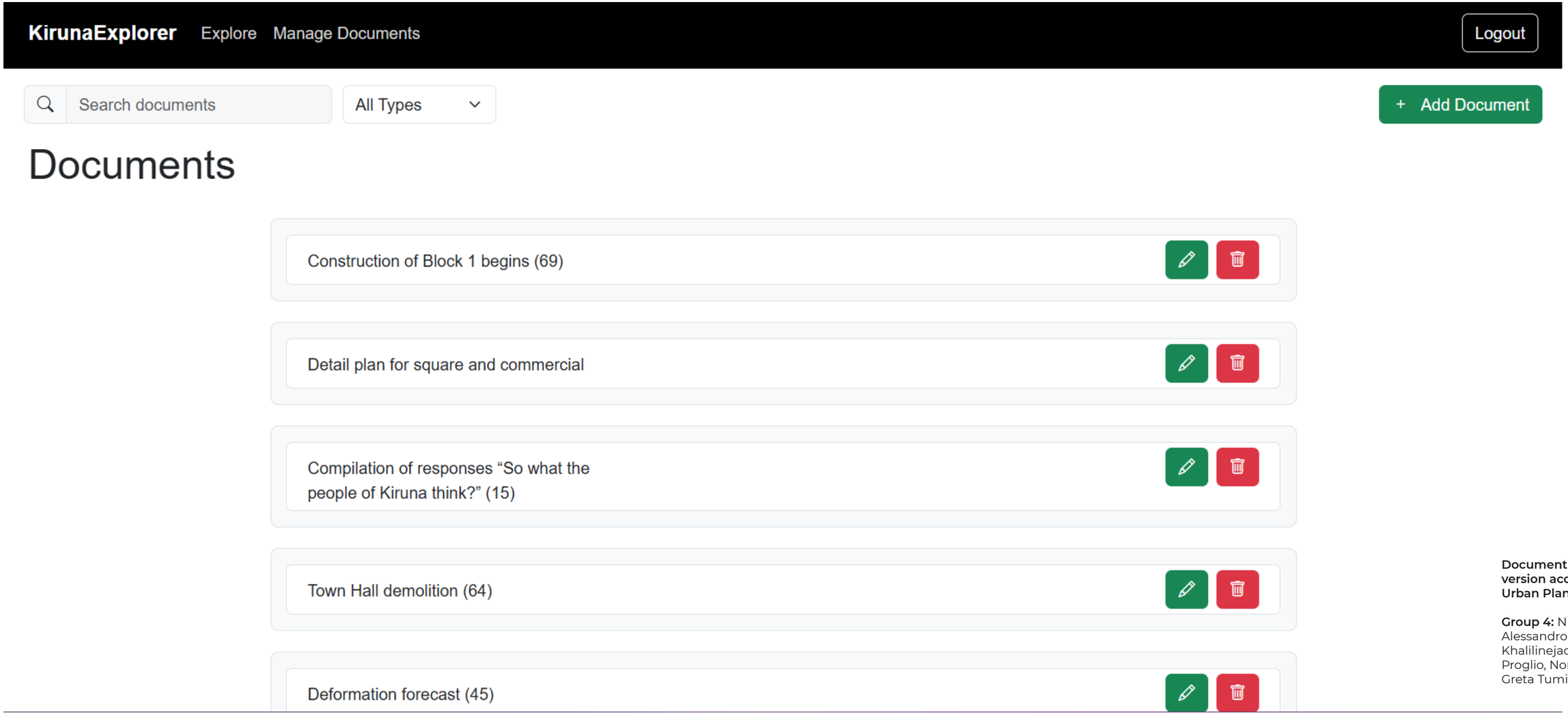
Card opened by an Urban Planner.

Group 2: Oğuzhan Akgün, Francesco Chiaia, Lorenzo Cuccu, Elisa della Valle di Pompei, Cosimo Emanuele Desantis, Michele Perseo, & AmirHossein ZandVakili.



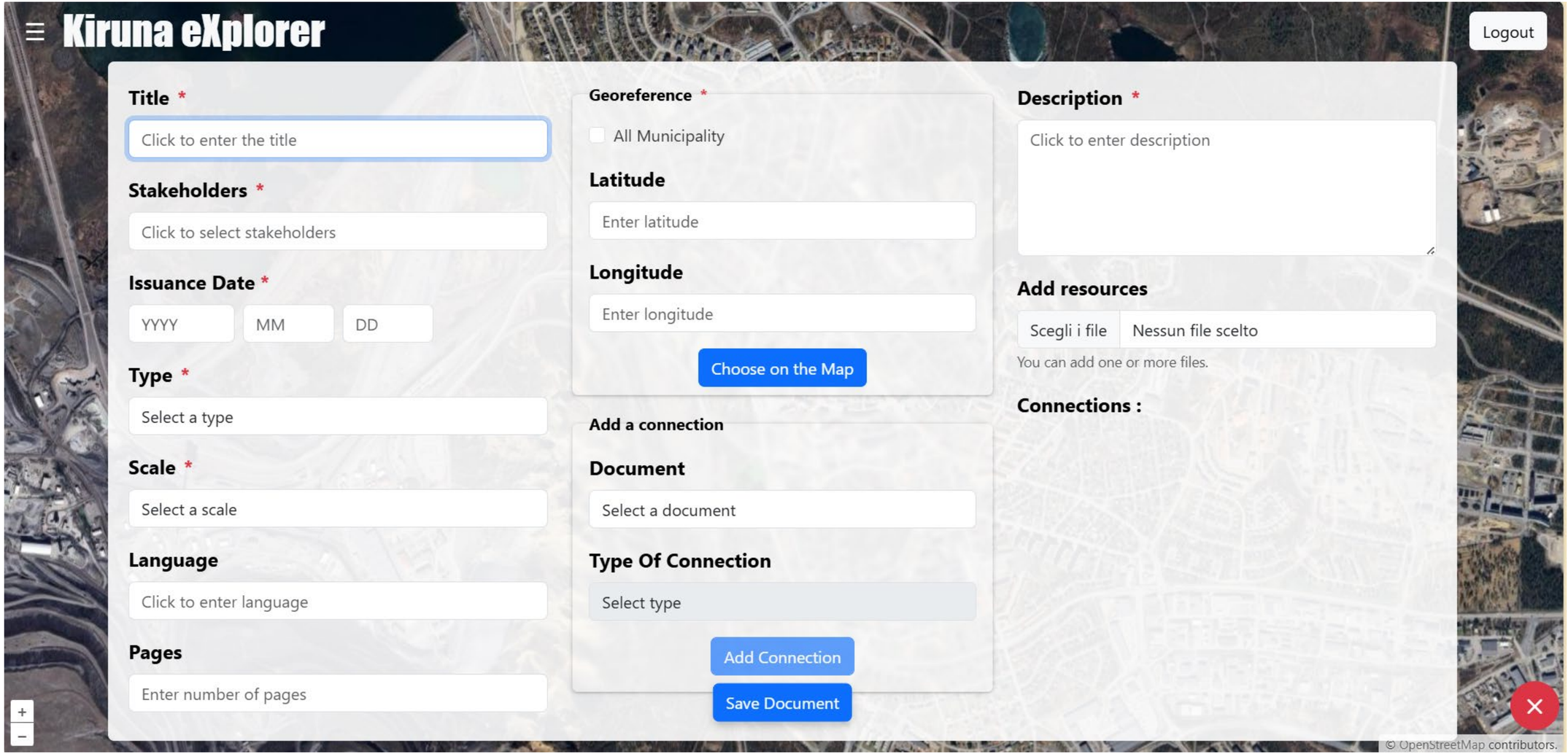
Map interface with a card opened by an Urban Planner.

Group 3:
Salar Farahmand, Setareh Neshatdoust, Matteo Vincenzo Petrera, Sara Poiatti, Alessandro Poletti, Simone Marcos Sagaria, & Wajahat Saleem.



Document list in the version accessible only to Urban Planners.

Group 4: Niloofar Bani, Alessandro Genco, Alieeza Khalilinejad, Davide Proglio, Noman Rafiq, & Greta Tumiatti.



Document creation form.

Group 5: Marco Ammirati, Giulio Como, Antoine Cremona, Luca Ferraris, Luciana Galliani, Lorenzo Mannino, & Danish Ali Qureshi.

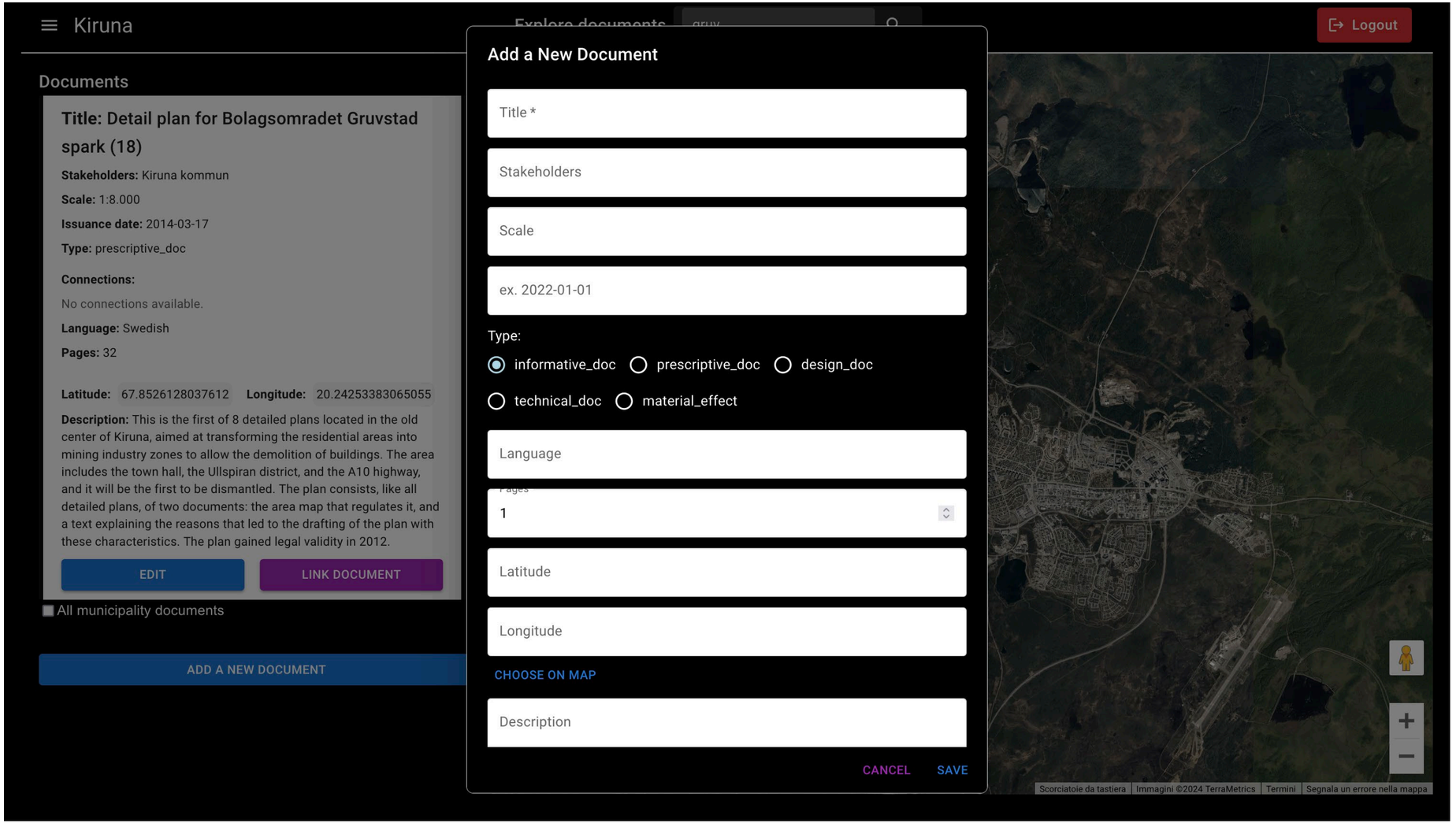
Welcome to Kiruna Explorer

Discover the journey of Kiruna! Our platform allows visitors to explore the city's history, learn about its transformation, and access key documents related to various landmarks. For urban planners, Kiruna Explorer provides tools to add, manage, and link documents, helping build the evolving story of the city.

Discover Kiruna

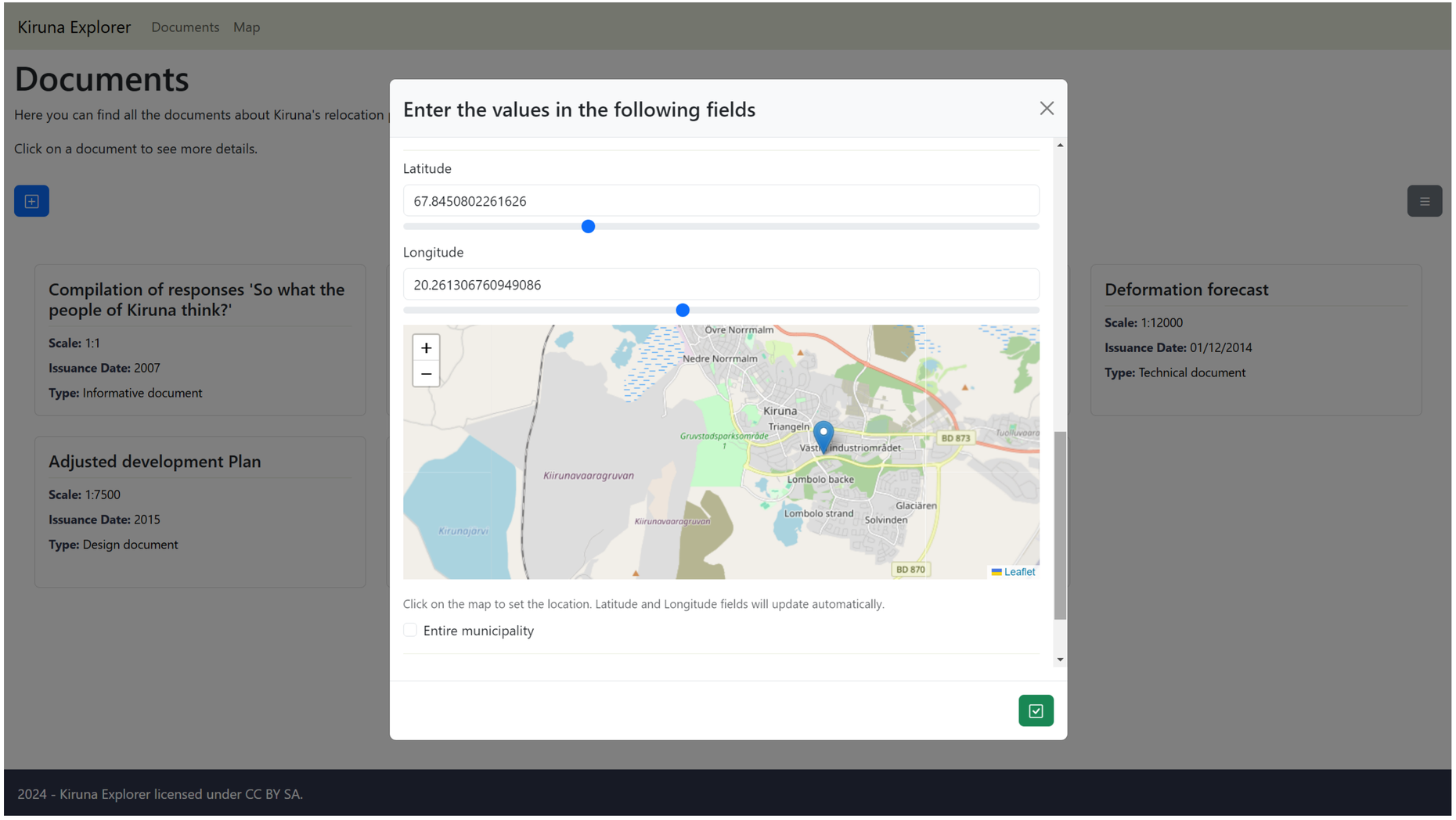
Landing page.

Group 6: Giacomo Belluardo, Luca Dadone, Muhammad Haris, Bahar Makvand Hosseini, Giada Socorro, & Giancarlo Virga.



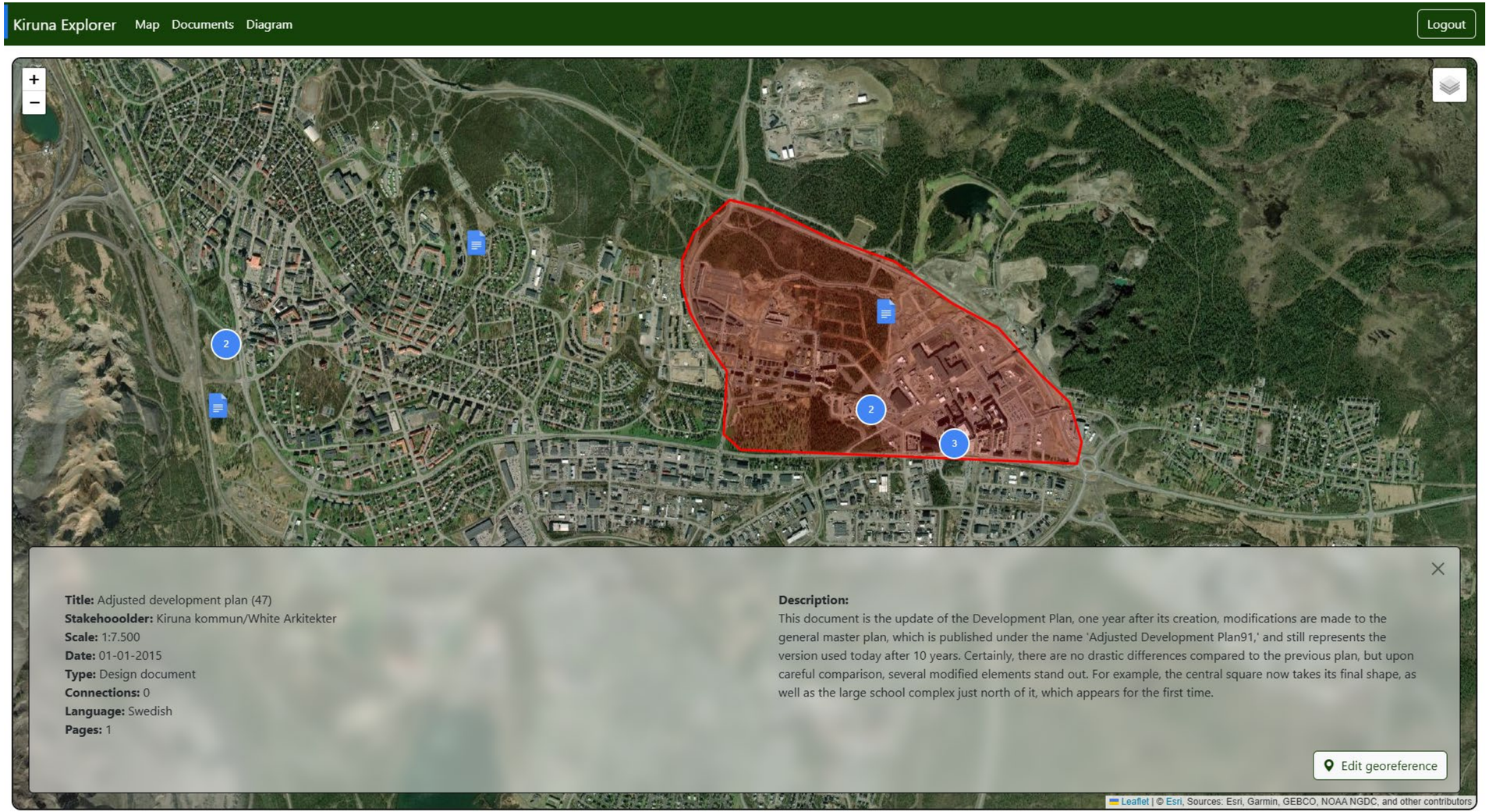
Document creation interface.

Group 7: Angelo Bongiorno, Alessandro Boscolo Zemelo, Dragos Constantin Buhnila, Lorenzo Gaetani, Neshatdoust Setareh, Noohi Sayedali, & Rjimati Zineb.



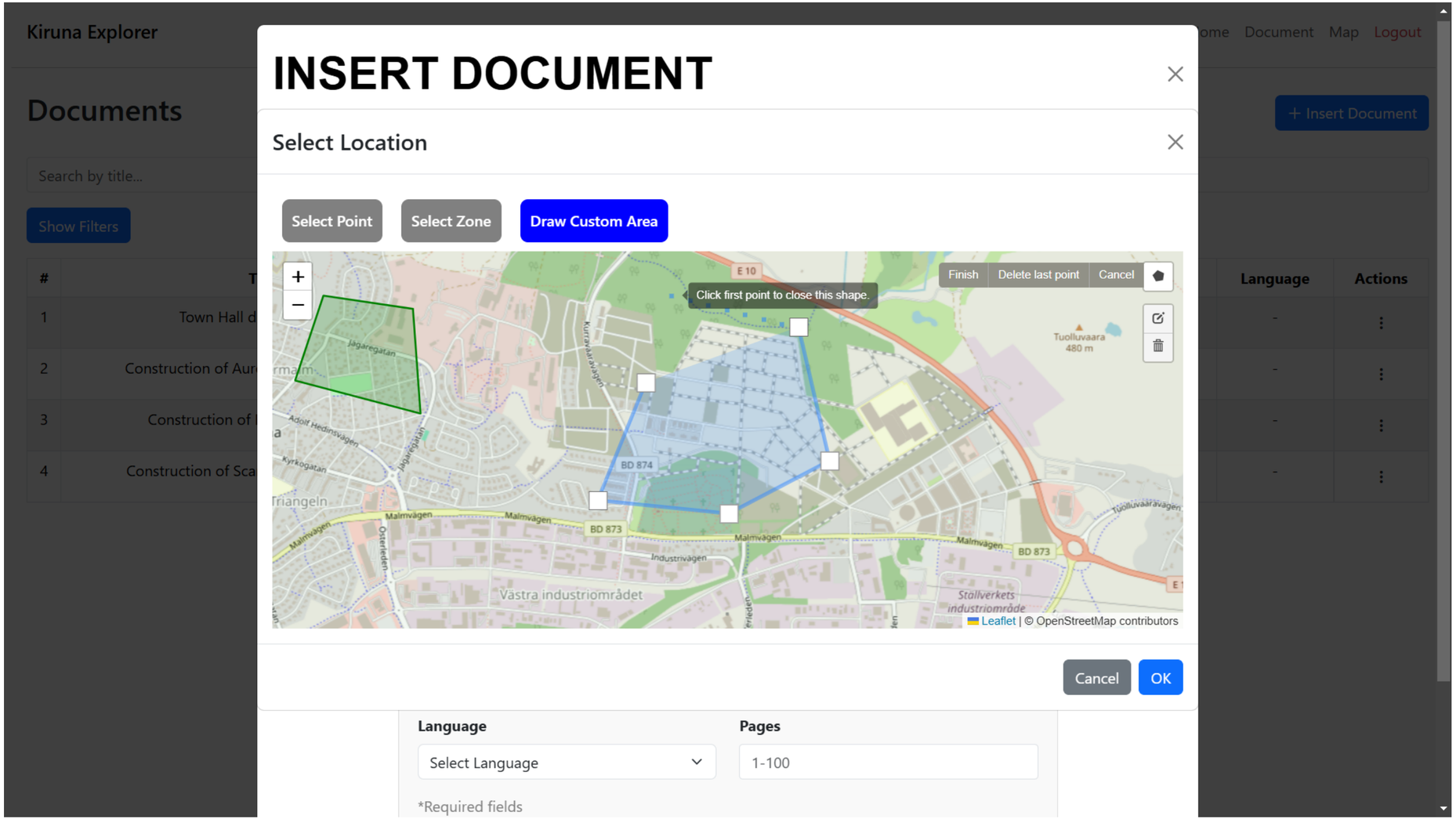
Document georeferencing editing interface.

Group 8: Maria Pia Abbondandolo, Luigi Bavaro, Alessandro Fedriga, Konstantin Krylov, Nassim Mansour, Giorgio Rondinone, & Ruggero Rossino.



Map interface with a card opened by an Urban Planner.

Group 9: Enrico Gioseffi, Alberto Margaglia, Seyedeh Fatemeh Moravej Hariri Paskiabi, Michelepio Mucci, Ehsan Safari, Antonella Sarcuni, & Francesco Servente.



Tracing the influence area of a document from the input interface with the "draw custom area" feature.

Group 10: Alexandru Valentin Barascu, Sara Franceschini, Shayan Khalighi, Sogand Mardani, Marco Russo, Simone Scalora, & Alessio Vantaggi.

Document List

Show On Map

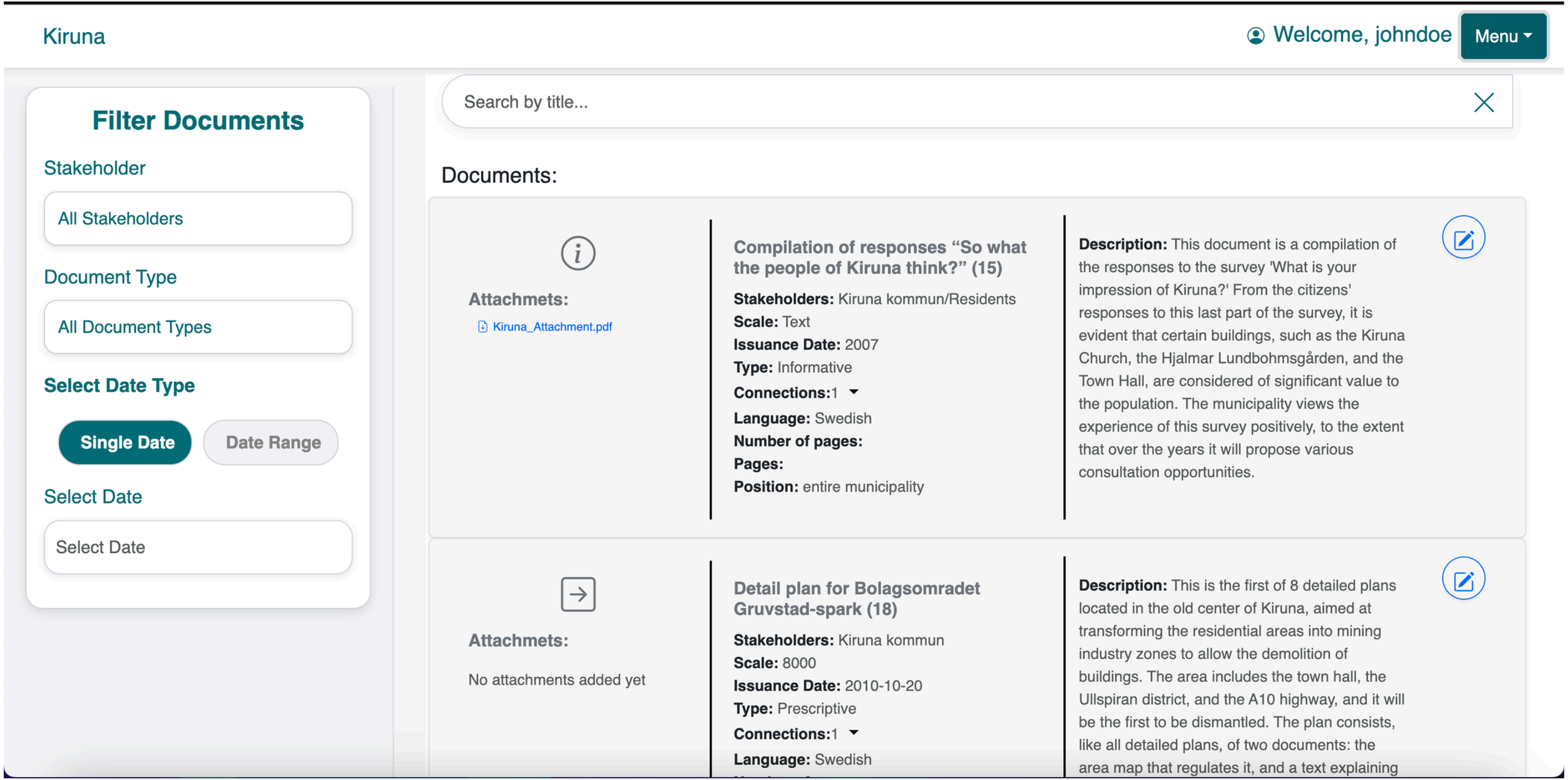
Title	Stakeholders	Type	Connections	Issuance Date	
City Transformation Plan 2024	LKAB, Municipality	Prescriptive Document	2	15-01-2024	Preview
LKAB Mining Impact Assessment	LKAB, Regional Authority	Technical Document	2	01-02-2024	Preview
New Kiruna Center Development	Architecture Firms, Municipality	Design Document	2	15-02-2024	Preview
Community Consultation Results	Citizens, Municipality	Consultation	1	20-02-2024	Preview
Environmental Impact Study	Others, Regional Authority	Technical Document	1	01-03-2024	Preview

Document list.

Group 11: Simone Anedda, Edoardo Esposito, Bilol Ibrohimzoda, Mohammadreza Mirhajianmoghadam, Tomiris Narimanova, & Alice Santoro.

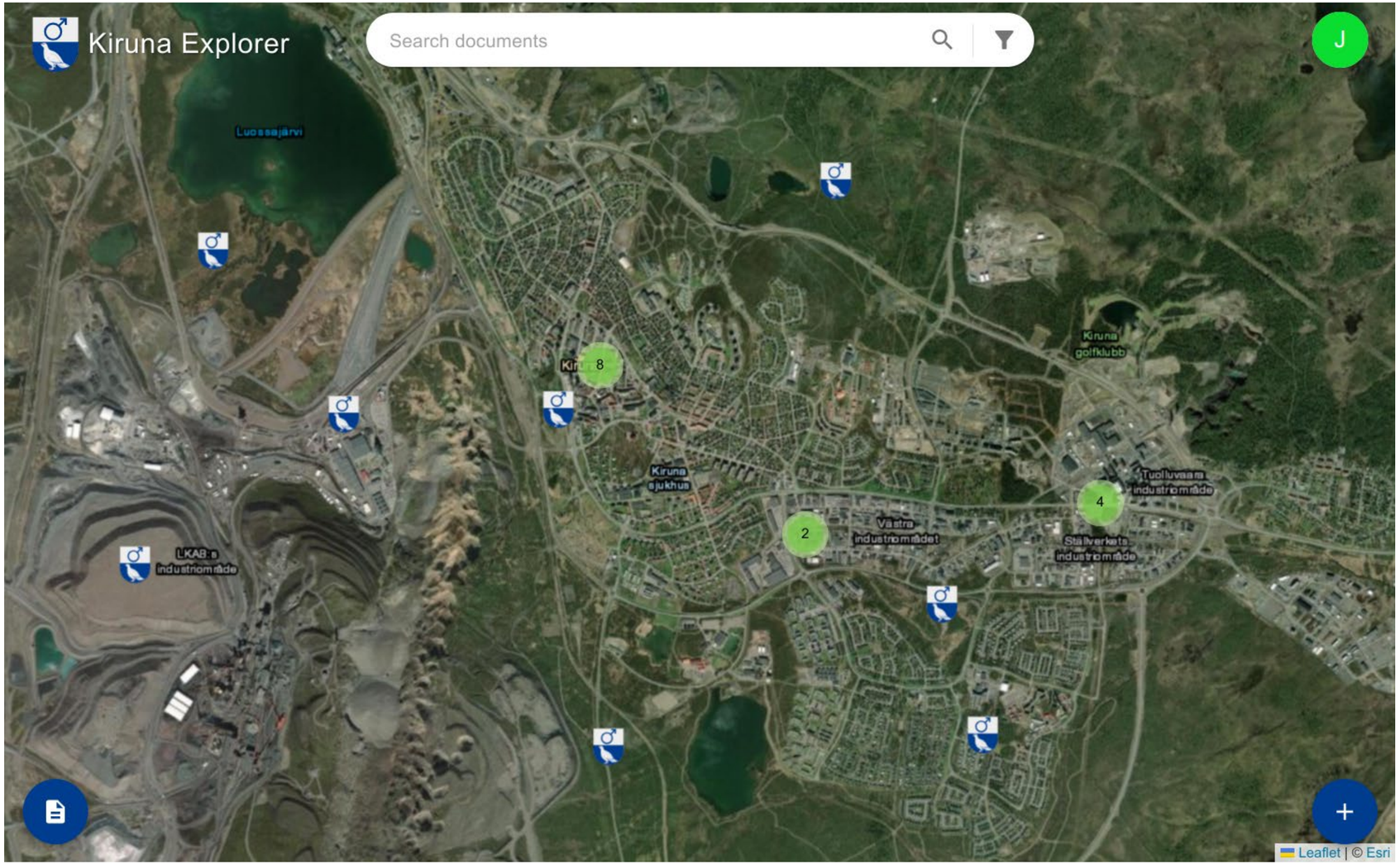
Map interface.

Group 12: Matteo Bollo, Stefan Marc Diaconu, Milica Dimitrievska, Roberto Montesanto, Souna Neisi, Giacomo Ponzuoli, & Furkan Yilmaz.



Document list.

Group 13: Stefano Fumero, Murad Galayev, Gianluca Maida, Luca Pes, Zurehma Ayesha Rameez, & Sindi Shima.



Map interface.

Group 14:
Fabio Gigante, Ghadi Haj, Fatemeh Nouri, Federico Palazzi, Rutuja Sujitkumar Patil, Giorgio Silvestre, & Angelo Squillino.

Kiruna eXplorer.

Welcome to the Kiruna eXplorer,
Where tales of the Arctic come alive.
Embark on a journey through Kiruna's history,
A place where Sweden's heart and heritage thrive.
Enjoy your adventure!

Welcome Back!

Email

example@gmail.com

Password

Enter your password

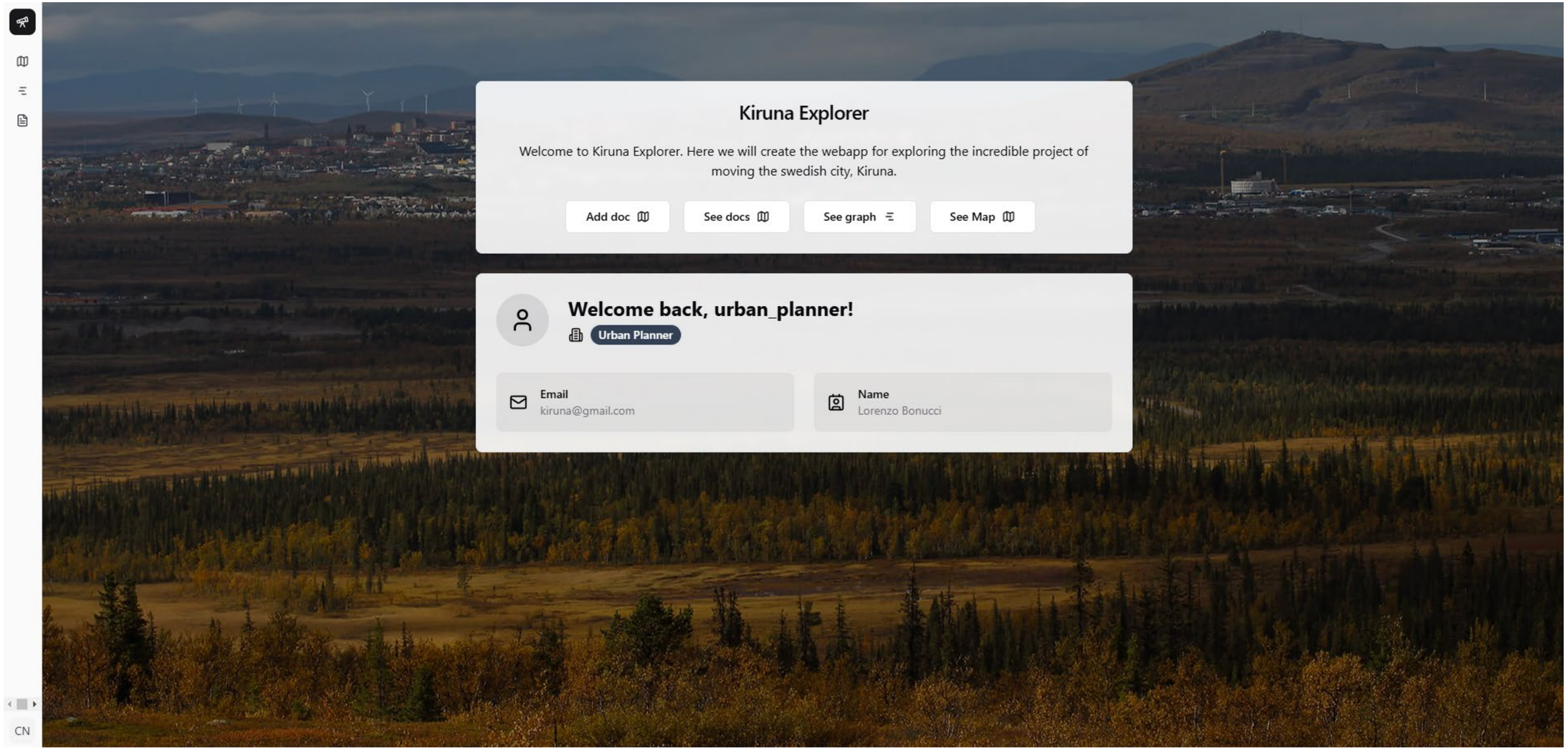
Forgot password?

Login

Doesn't have an account? Sign up for free

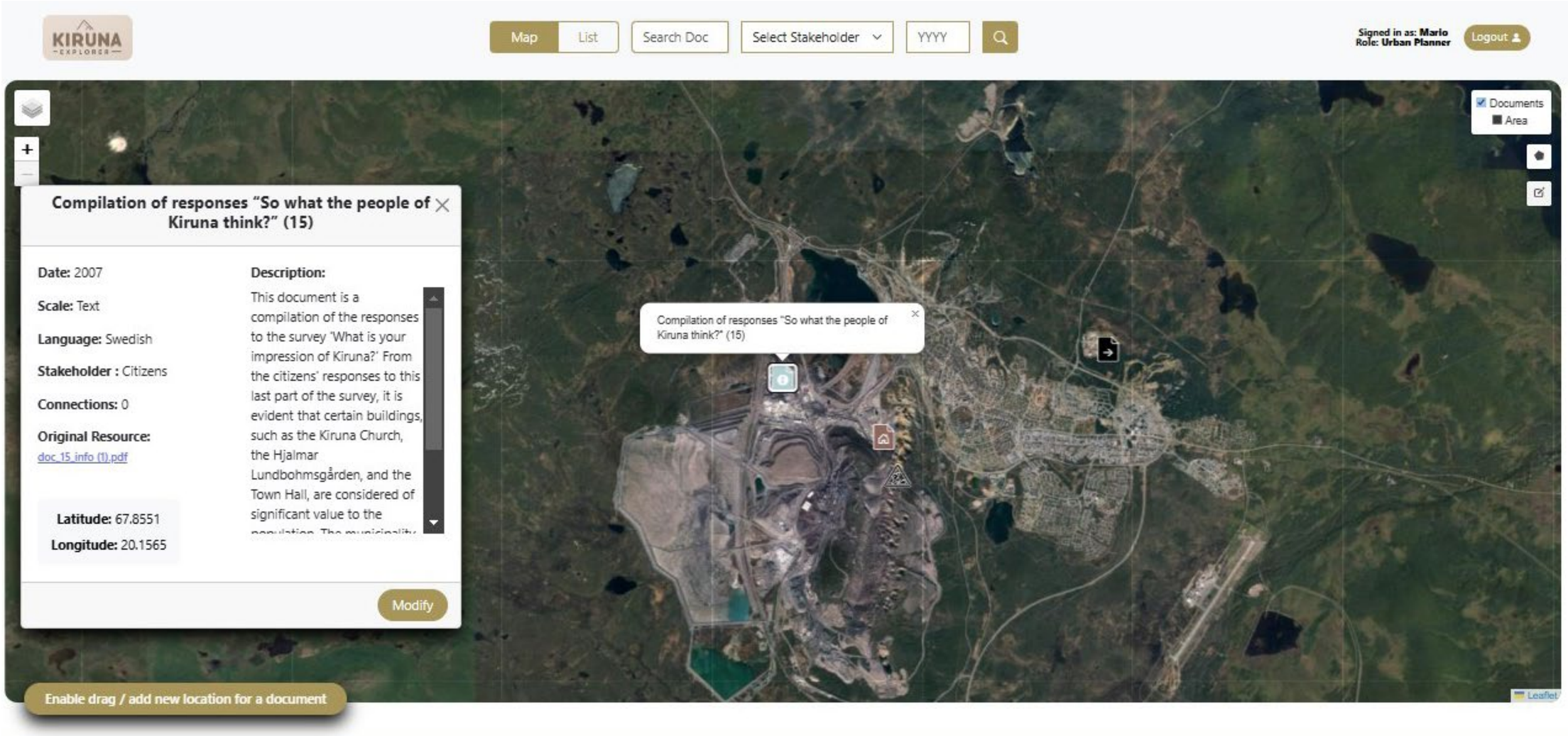
Login page.

Group 15: Setayesh Farzin, Umberto Fontanazza, Emanuele Frisi, Sofía García Arcila, Paolo Michelotti, Lorenzo Ricci, & Junaid Shah.



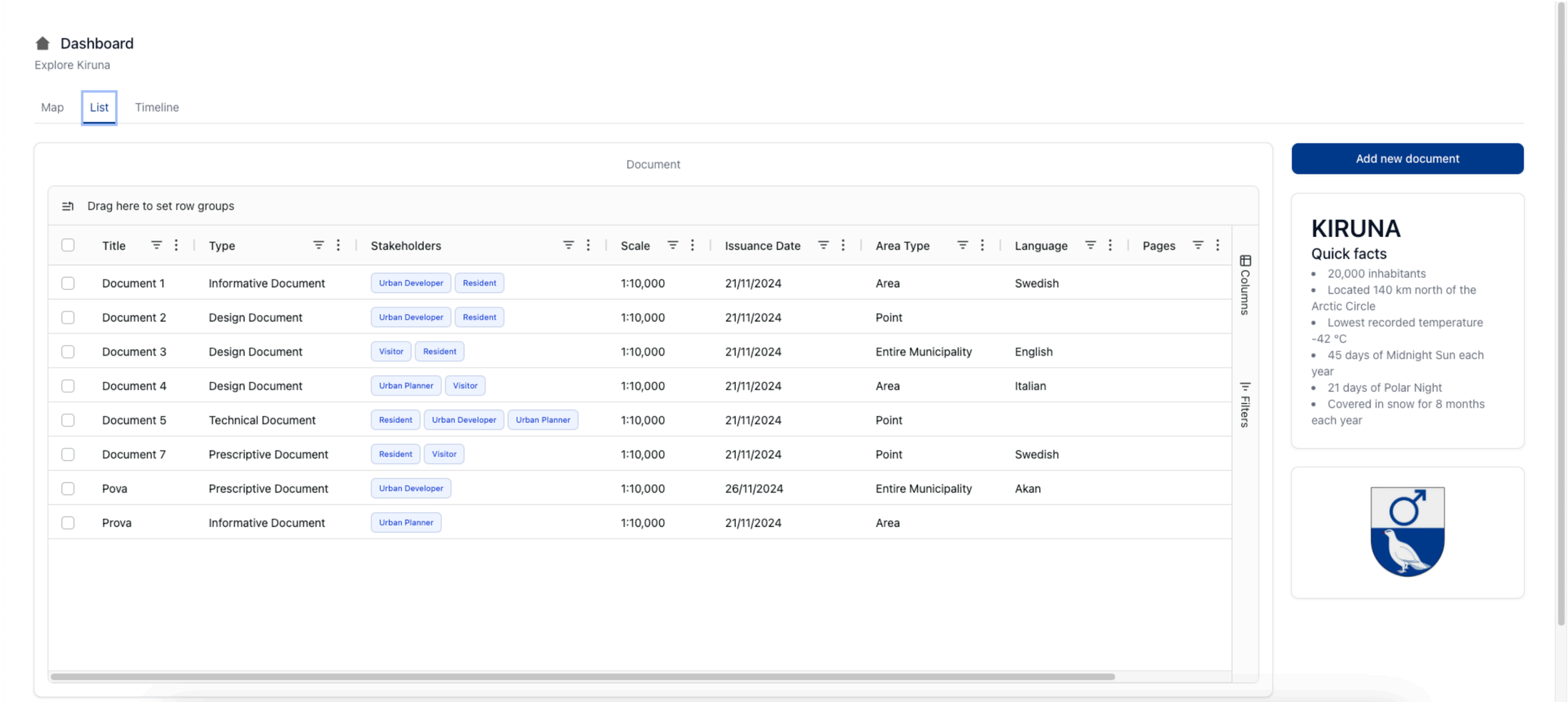
Home page.

Group 16: Mahsa Arsalani, Marta Chiarenza, Nicolai Faye, Simone Fenech, Davide Licitra, & Galanti Stefano.



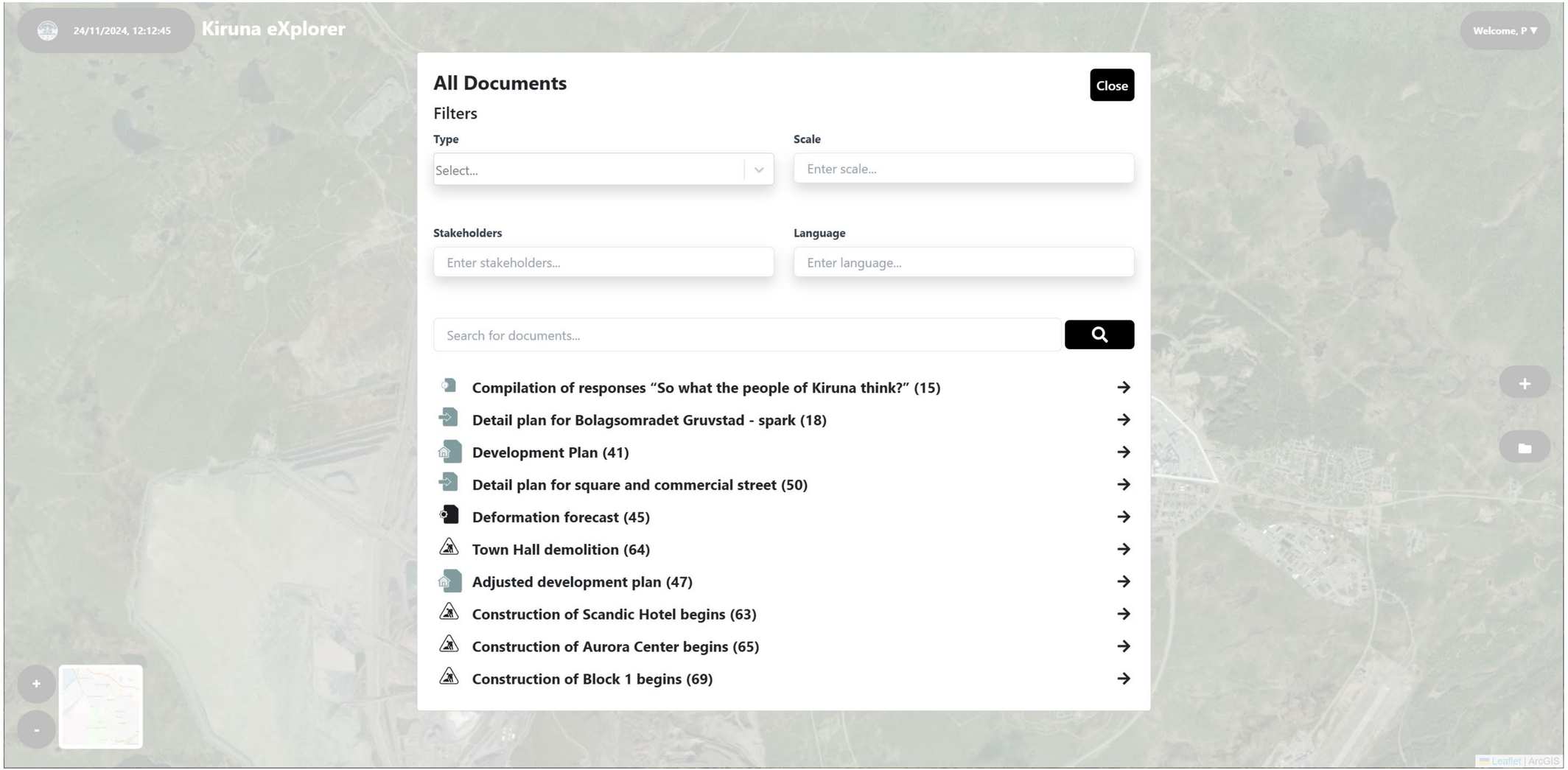
Map interface with a card opened by an Urban Planner.

Group 17: Arefeh Ataeinazari, Sefa Kurtoglu, Mina Pavlinova Nikolova, Davide Pellegrino, & Giuseppe Pisanu.



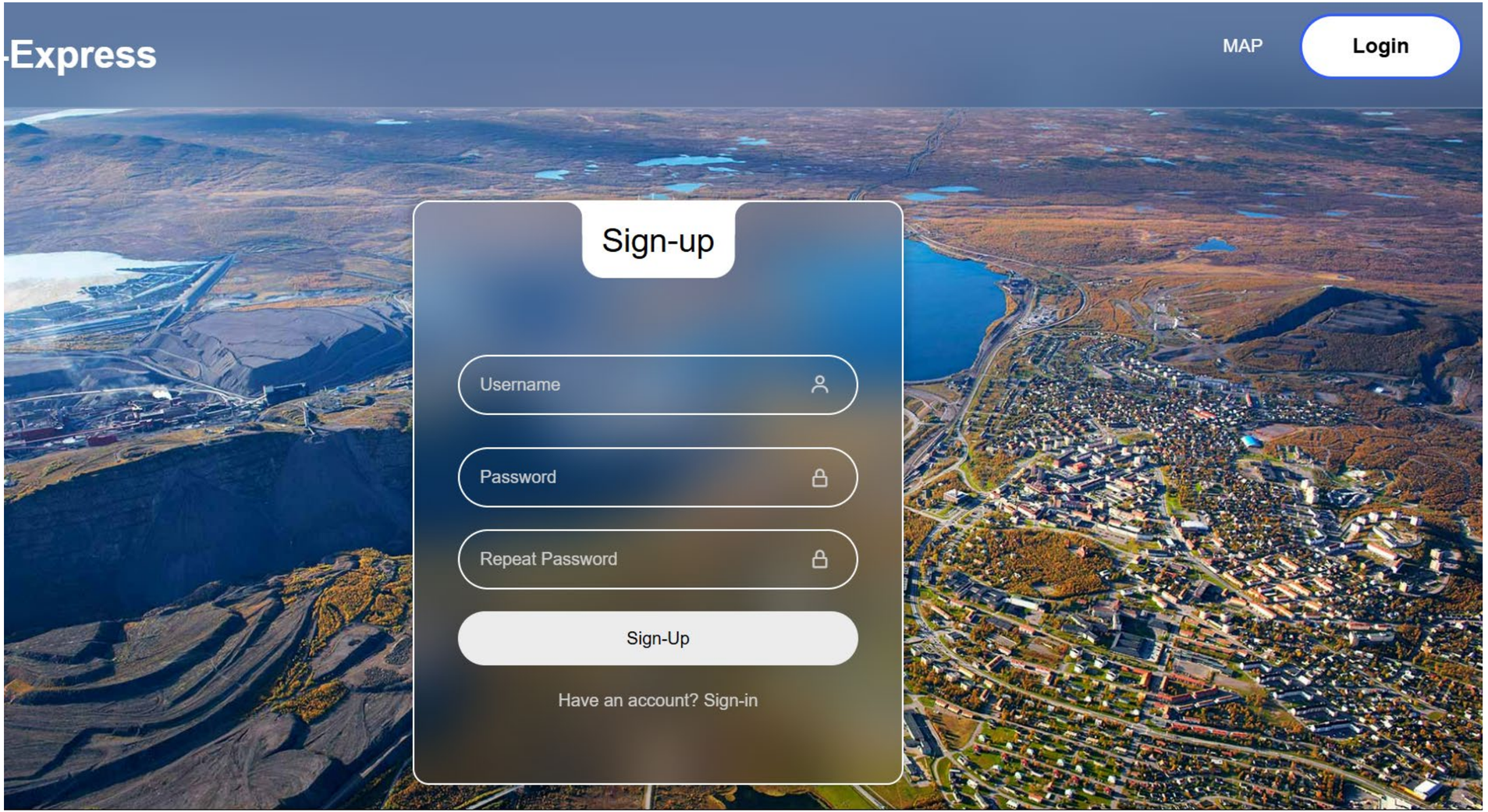
Document list in the version accessible only to Urban Planners.

Group 18:
Giuseppe Arbore, Luca Bordino, Stefano Di Leo, Patricia Khalil, Mohammad Mawassy, Alberto Pedalino, & Golnaz Saraji.



Document list.

Group 19: Francesco Albano, Paolo Cagliero, Sergio Cicero, Diego Porto, Mina Samadi, & Mariam Telly.



Sign up page.

Group 20: Matteo D'Alicarnasso, Christian Galipò, Roya Hosseinpour, Roshanak Jabbari, Ludwig Lenzini, & Villellas Yann.

I would like to sincerely thank all the people who made this research work possible, especially:

My supervisor, **Professor Valeria Federighi**, for giving me the opportunity to undertake this incredible journey and for supporting me in every aspect of it.

Clara Nyström, Sofia Lagerlöf Määttä, and **Monika Paleckaityte**, for welcoming me into their city and for sharing their knowledge regarding the ongoing process in Kiruna.

Professor Alvise Mattozzi, for helping me develop the questions for the interviews conducted in Sweden

Professor Pedro Henrique de Carvalho Rodrigues, for his advice on the analyses to be performed on the interviews.

Professor Giovanni Durbiano and **Professor Alessandro Armando**, for their theoretical teachings, which this thesis is based on, and for their valuable insights on the project component of the research.

Camilla Forina, **Federica Joe Gardella**, **Tommaso Listo**, and **Luciana Mastrolia**, for their guidance and advice during the writing of the thesis.

Professor Marco Torchiano, for giving me the opportunity to carry out the Kiruna eXplorer project.

Professor Antonio Vetrò and **Riccardo Coppola**, for their support in the project phase of the thesis.

Professor Jing Ma and **Professor Agatino Rizzo**, for allowing me to present my research work at their university and for the valuable advice I received there.

Professor Andrea Luciani, for his support in Luleå and for the interesting references he directed me to.

All the people who made themselves available for the interviews conducted in Kiruna and Luleå, for the important information shared and the wonderful moments spent together.