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Strategies for densification of Longyearbyen

Spatial, morphological, geological, and social analyses of the arctic town Longyearbyen in Norway

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ABSTRACT

The arctic town Longyearbyen on Spitsbergen, Norway, is in a transition phase from a local community based on mining activities towards a community where tourism and research are taking over as the dominant industries. The town needs various sustainable development strategies due to natural hazards, outdated buildings, high private-car usage, and a costly road and technical infrastructure. A densification of Longyearbyen could be a solution to the challenges the town is facing. To uncover the current situation in Longyearbyen several configurative and morphological analyses have been carried out. A survey was also carried out to map the inhabitants' relationship to and thoughts about Longyearbyen.

The results show that Longyearbyen has several strengths and weaknesses. The town has a poorly constructed street network facilitating private car dependency. There is a shortage of outdoor living areas and there is a low degree of functional mix in the town. The seafront in Longyearbyen is poorly utilized. The town's identity is strongly linked to its history in the form of cultural monuments, building style and unique nature, something the inhabitants think is important to preserve. Densification of Longyearbyen should be carried out with a focus on improving the street network, establishing good outdoor living areas, and encouraging a mix of functions. New urban development of the town should consider existing building style and cultural-historical elements in a sustainable urban development.

KEYWORDS

Densification, arctic town, spatial analyses, strategic planning

1 INTRODUCTION

The Arctic Archipelago Spitsbergen is the northernmost part of Norway and is located 1300 km from the north pole. Svalbard is largely covered by glaciers covering about 60% of Svalbard's surface. The landscape is otherwise characterized by fjords and pointed mountain peaks. Spitsbergen has 4 settlements, where Longyearbyen with its 2000 inhabitants is the largest town.

Employment in the mining sector is declining, while simultaneously other business sectors are growing, including construction, tourism, public sector, and service industries. Currently the population is increasing. Therefore, there is a need to find suitable land for expanding and densifying in Longyearbyen. This can be challenging, due to high landslides and flooding risk.

The purpose of this short paper is to form a perspective on how a densification can be carried out in Longyearbyen, as well as how a densification could affect the town and its residents. This is done by investigating the current potential of Longyearbyen, and by involving the inhabitants to shed a light on their thoughts and desires for the town.

Densification is associated with compact dense building structure. By this is meant that both the ground space and floor space must be high (Rådberg 1988, 1996). Jan Gehl (1971) believes that medium-sized buildings are desirable because this creates attractive urban areas. Jane Jacobs (2000) believes that 310 to 500 housing units per hectare is ideal for an attractive urban environment. A compact city contributes to short distances between various urban functions (Rådberg 1996). The ideal is high proximity between home, workplace, public transport, services, leisure activities and parks or green areas (Klima- og miljødepartementet, 2020). Short walking distance to a significant public transport hub that offers a variety of transport options can reduce residents' dependence on the car (Curtis, 2012). The challenge for Longyearbyen is to change it from a sprawled private car dependent town towards a dense town that facilitates walking.

As research has shown, a street network with high local and global integration within short metrical distance enhance dense, multifunctional lively urban areas than enhance walkability (van Nes et.al 2012, Ye and van Nes 2014, van Nes 2021a). Moreover, a network street pattern promotes inter-accessibility, which in turn promotes the use of public transport or cycling and walking. Conversely, a tree-structured street pattern creates long travel distances as the neighbourhoods are often isolated from the main roads. This contributes to car-usage and capacity problems because all local streets are connected to main roads for travelling between neighbourhoods (van Nes 2021). Longyearbyen has a network structure street pattern in its centre, whereas outside the centre most streets have a tree-structured street pattern.

As space syntax research has shown there is a relationship between spatial configuration in an area and the movement pattern and the socio-economic activities that take place there (Penn et.al 1998, van Nes 2021b). According to the theory of the natural movement economic process, the largest flow of

movement and the highest economic activity will take place in the streets that are most integrated (Hillier et al., 1993). The degree to which a street is integrated depends on how many changes of direction the street has to all other streets in a city or place (van Nes and Yamu, 2021). High accessibility and orientability lead to an increased flow of people, and with it an increased degree of vitality and more favourable conditions for economic activity (de Koning & van Nes, 2019).

The spatial configurational conditions in street networks can have an influential effect on building density and degree of multifunctionality in an area (van Nes and Yamu 2020). Regards the theory of natural urban transformation process, which is a preliminary theory derived from theory of natural movement economic process, it is claimed that a high degree of spatial integration can result in higher building density and increased functional mix (Ye and van Nes 2014, 2016).

A neighbourhood must be able to serve more than one function. For example, pure mono-functional residential areas can be unsustainable because the people who live there must constantly travel out of the residential area to be able to do their daily activities (Carmona et al., 2010). Again, Jacobs (1960) claims that a mix of land use, functions and activities is an essential condition for creating attractive and vibrant urban areas. Multifunctional buildings contribute to activities throughout the day by different types of people. This gives a social dimension of sustainability (Montgomery). Moreover, social sustainability requires also to accommodate homes with different sizes and price ranges in a town. It is also important that the existing companies can offer a varied selection of services, activities, price ranges, quality and opening hours. All this helps to create attractiveness and life in a town. In Longyearbyen, the student housings are often located at the edge of the town, and only a few buildings in the town centre contains several functions.

2 SPATIAL AND SOCIAL ANALYSES OF THE CURRENT SITUATION

An online questionary survey was conducted of the residents of Longyearbyen in March 2021. The software SurveyXact was used. The survey was shared on a local Facebook group for Longyearbyen. We also distributed 600 flyers in the inhabitant's mail boxes and hung up a poster with a QR code at the library. The questions were about age, type of job, family situation, long or short-term dweller, transportation mode for getting around in Longyearbyen, dwelling situation, sense of belonging to the place, the quality of living in Longyearbyen, and local perception of architecture, building structure, densification and place identity in general. We asked also what kind of functions is lacking in Longyearbyen. We managed to get response from 10% of the population (240 respondents).

Longyearbyen consist of a high number of short-term dwellers. 18% of the dwellers lives less than one year, and 36% of the dwellers lives between 1-5 years. 28% of the dwellers have children, which put other requirements on services and facilitation than other dwellers. Walking and driving are the main modes for transport for conducting daily activities. The infrastructure facilities are well designed for car and snow mobile. Families with children claims that Longyearbyen is good for children. Most of the respondents have a strong sense of belonging to the place and find Longyearbyen a good place

to settle. Most of the respondents find that the original building structure shape the place identity, and the characteristic colours on buildings is important for the place character. Moreover, most of the respondents claims also that a compact town can contribute to make the daily activities more efficient. There are some disagreements to whether Longyearbyen is a pretty or an ugly place. Obviously, most respondents agree on that the nature, landscape setting and the artic climate contributes to Longyearbyen's identity. Regards suggestions for improvements, most respondents answered that they lack opportunities for social meeting places, access to good dwellings and that the quality of the transport infrastructure is poor. There is a wish to improve the outdoor public spaces and provide more playgrounds for children in the town. Moreover, the inhabitants claim that the variation in shops are poor (only one supermarket). Shops for children and hardware stores are lacking.

Figure 1: Global and local integration of Longyearbyen (top) and an image from the buildings with typical colours used in Longyearbyen (below).

Figure 1 shows the local and global integration of Longyearbyen and an image from a row with dwellings with colours contributing to shaping the place character. The pedestrianized main shopping street has the highest values in both analyses. It is not only important to have a highly integrated street

network to make streets attractive to walk in. The degree of building-street interface affects how attractive it is to walk on a street. The more the buildings are turned away from streets, the lesser attractive the street tend to be (van Nes and López 2010, Rønneberg Nordhov et al 2019).

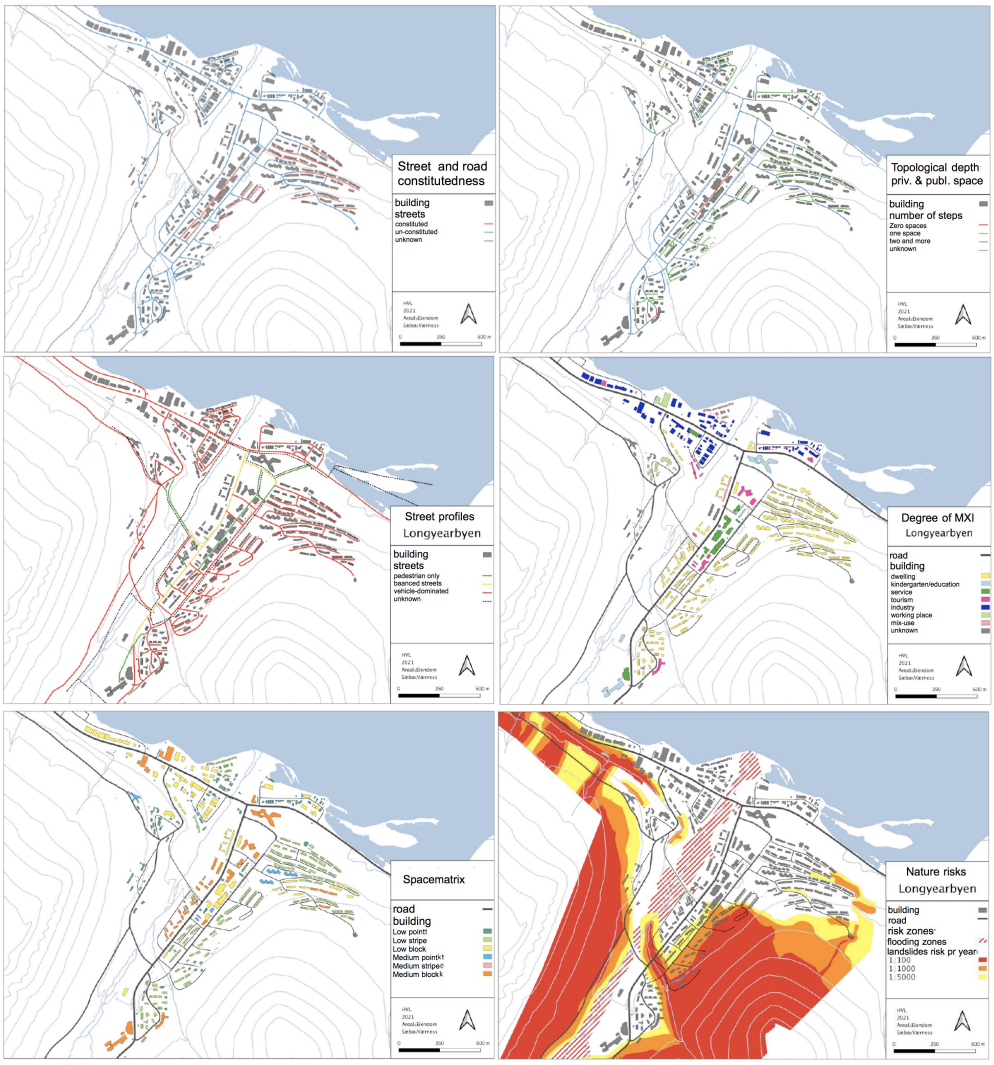

Figure 2: Spatial and nature risk analyses of Longyearbyen

Figure 2 (top) shows the degree of constitutedness of streets and the topological depth between private and public space. Only a few streets are constituted and only the main shopping street has building entrances with windows directly connected towards the street.

The analyses of the street functions, developed by Eldijk et al (2014), shows that most of the roads in Longyearbyen are vehicle dominated (figure 2 middle left). The MXI analyses, developed by van der Hoek (2009), shows that the dispersal of functions in Longyearbyen is very mono-functional. Amenities, services, working places and dwellings are separated from each other (figure 2 middle right). The spacematrix analyses, developed by Rådberg (1988, 1996), shows that most of the

buildings in Longyearbyen consist of low and medium rise row houses (figure 2 below left). It can be concluded that the building density is rather low in Longyearbyen.

Longyearbyen is located in a valley with high risk of flooding and landslides. The map in figure 2 lower right shows the location of the areas with the highest flooding and land slide risk. These aspects need to be taken into consideration when choosing areas for densification to facilitate population growth and growth in the tourism industry.

3 STRATEGIES FOR DENSIFICATION

When making strategies for densification, it must be planned for where and how the densification can be realized in Longyearbyen. First one must be aware of the natural boundaries. These will be physical boundaries such as topography, where some plots will be more suitable than others, and restrictions that are set due to natural hazards such as landslides and floods. These various constraints are not man-made and can therefore be difficult to control.

Based on the discussed shortcomings that have been discovered in Longyearbyen, and the possible areas for densification, a proposal has been prepared for densification of Longyearbyen. The strategic plan shows the relevant areas for transformation and redevelopment, and which green areas should be prioritized to develop well-functioning outdoor living areas.

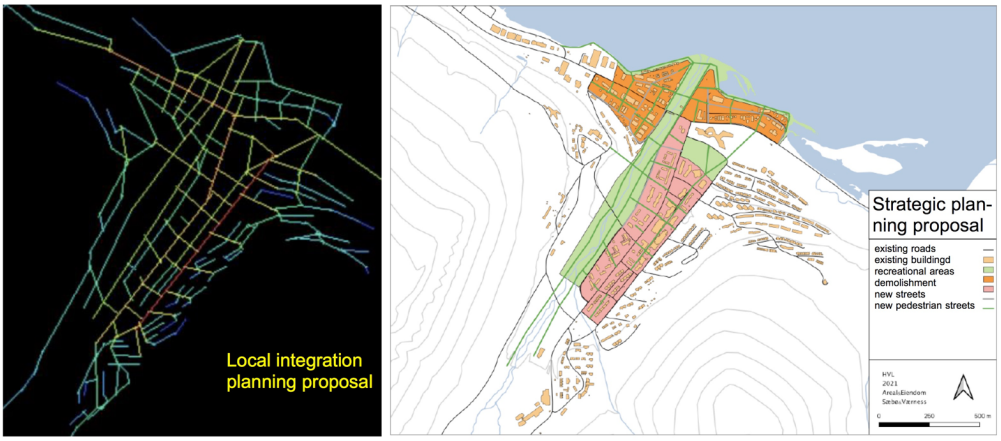

Figure 3: Strategic planning proposal for densification in Longyearbyen

The proposal also shows a new and improved street network. Here are some streets prepared for car traffic, but a large majority are only for pedestrians and cyclists. The analysis of the new street network is shown in figure 3. The streets at the seafront area are all much more integrated in the new proposal than with the existing (shown in figure 1). This has been done by creating more connections between the different areas, especially by adding more bridges, and cross-connections within the densification areas.

This street network has been incorporated into the strategic plan and represents together

with the potential areas for transformation and redevelopment a proposal for how a densification of Longyearbyen can be performed (Figure 3 right).

A multiple-choice survey was made for the residents of Longyearbyen on their thoughts and desires for the city. As the analyses of the survey show, it is the nature, landscape, and climate that the respondents most associate with Longyearbyen's identity. Densification is about creating better land use in already developed areas and will have little direct impact on the landscape and nature associated with the city. Instead, a change in the city's image can have an impact on how the landscape is perceived and presented in the cityscape. The city's characteristic building style and use of colour, especially in the residential areas, interact well with the landscape and are, according to the respondents to the survey, important for the city's place identity.

Densification often involves compact building structures. We recommend that new buildings should be adapted to the various locations and medium size block development. This style has a higher area utilization than the traditional buildings and is in line with what has been built in recent years. One respondent in the survey expressed his concern that the view through the city will deteriorate if it is built higher than 2 storeys. In Longyearbyen, 2 storeys buildings are often higher than what is usual on the mainland in Norway, as the ground conditions requires that the buildings are built on poles due to permafrost.

A densification of Longyearbyen could contribute to Longyearbyen becoming a more sustainable town than what it is now, with particular emphasis on the fact that densification will hopefully stimulate more sustainable transport methods such as cycling and walking. Densification should be carried out with a view to social and economic sustainability, so that Longyearbyen will be maintained as a community for families. Through a densification and development of Longyearbyen, sustainable and energy-efficient buildings must also be an overriding goal to ensure the development of Longyearbyen as a sustainable town.

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