Digitalisation of spatial planning and building processes in Norway. Innovative collaboration between public and private sector, and the necessary re-thinking of our geospatial infrastructure

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SUMMARY

Spatial planning is key to the development of a society. In Norway the municipalities are the main planning authorities, they handle both spatial plans and building permissions. But the municipalities often depend on different system vendors to create solutions for the flow of geospatial information in these processes. As a result, private constructors spend unnecessary time and money adapting to a variety of systems. In addition, both competence, capacity and complexity vary between small and large municipalities. The time undertaken to fulfil a spatial plan, and/or a building permission, can therefore be very long and lead to a further increase in housing prices.

This paper presents some tools on the step-by-step path to a fully digitalised spatial planning and building process. The aim is to limit both time and cost but it also demands a rethinking of the data flow in our geospatial infrastructure.

1. NORWEGIAN HOUSING, A SHORT STORY

Norway has one of the most liberal housing markets in Europe. Public bodies hardly build anything other than student homes and homes for elderly people. Almost all housing is built by private companies or cooperations. They also submit nearly all the local planning proposals.

As many as four out of five Norwegians own the houses they live in. In general, the houses are spacious, well maintained and of good quality, and the majority of the population are content[1]. Norway is a relatively scarcely populated country, and in many areas, there is no pressure on the housing market. In the cities however, the pressure is high, and the housing prices follow. Most Norwegians have access to an outdoor space in connection to their house or in the immediate surroundings, and very many live in close proximity to nature.

Over the last period the building rate of new dwellings have decreased significantly, and housing prices have gone up. In addition, social and spatial differences are increasing, there are more old people that need a different type of housing than before, and serious issues concerning climate and energy need to be solved. Population growth, demographical changes,

[1] Meld.St 13 (2023-2024) Report to the Storting (white paper): Bustadmeldinga – ein heilskapleg og aktiv bustadpolitikk for heile landet

and migration patterns creates a need for more dwellings. Cost of living is strongly correlated with house prices as about 70 percent of house owners have a mortgage. Therefore, most people find both house prices and development of new housing projects of great interest.

2. NORWEGIAN PLANNING SYSTEM, AT A GLANCE

The Norwegian Planning and Building Act applies to the whole country, extending one nautical mile beyond the territorial boundaries at sea. Key principles to spatial planning are that the process is open with public participation, it is democratic and decentralised, and those affected can take part. Spatial plans can only be adopted by authority based on elected governance, and the municipal level is the main body of decision making.

All municipalities shall have a land-use plan for the whole municipality (master plan). The processing of building application pursuant to the Act shall ensure that projects are carried out in compliance with statues, regulations and decisions made through land-use planning.

Regional and national interests, such as preservation of nature, public access to the seaside and agriculture land, is set forth in national planning guidelines. In December 2024, new planning guidelines for spatial use and mobility, and for climate and climate adaption was adopted by the King in Council. The planning guidelines constitute grounds for objections under the Planning and Building Act.

Level	**Guidelines – programs**	**Temporary binding**	**Binding area plans**
National	• **National expectations (every 4th year)** • Central government planning guidelines	• Central government planning provisions	• Central government land use plans
County	• **Regional planning strategy (every 4th year)** • Regional plan	• Regional planning provision	
Municipal	• **Municipal planning strategy (every 4th year)** • **The social element of the municipal master plan** • Municipal sub-plans for topics or areas of activity	(part of binding area plans)	• **The land use element of the municipal master plan** • Area zoning plans • Detailed zoning plans

Figure 1: The Norwegian planning system

3. THE CHALLENGE: SLOW PLANNING PROCESSES AND HOUSING NEEDS

Despite these regulations ensuring orderly development, the planning system has faced increasing criticism for inefficiency. Lengthy approval processes often result in significant delays in housing projects, exacerbating the housing shortage in key urban areas. These inefficiencies have driven both public and private stakeholders to seek solutions through digitalisation and process optimisation.

One of the major critiques is the excessive time required for planning and building approvals. The complexity of regulations, the need for broad stakeholder involvement, and manual procedures contribute to delays that can stretch into years. The sluggishness has made it difficult to meet the growing demand for housing, particularly in the bigger cities.

The need for more housing has been on the political agenda for a long time. Lately the increase of living costs, higher costs for building, higher housing interest, and general economic insecurities, has further reduced the number of new projects. Recognising the urgency of the housing situation the Prime Minister set his ambitious goal of 130 000 new homes by 2030. This initiative is not only a response to population growth and urbanisation but also a strategy to keep housing prices affordable. To achieve this, one of the tracks the government has prioritised to make the planning and building process more efficient is increased digitalisation.

To speed up planning and building approvals, the government has implemented some key initiatives:

- Transitioning from paper-based (or pdf's) and fragmented system to a fully digital workflow
- Engaging municipalities, technology providers, and industry stakeholders to test and refine digital solutions

A central player in these efforts is the Norwegian Directorate for Building Quality (DiBK), which has led the charge in digitalising the building permit process and is now extending this approach to spatial planning. The directorate operates as both an authority, a centre of expertise and a government advisor. Their authority tasks are anchored in the Planning and Building Act, they research and develop digital solutions to simplify and make the construction industry more efficient, and they are professional advisors to the Ministry of Local Government and Regional Development.

4. DIGITALISATION; A STEP-BY-STEP APPROACH

A number of measures have already been implemented to digitise the planning and building application processes, with the Directorate for Building Quality being an important actor and driving force in this work. Digitisation of planning and building application processes results in simpler and faster processes, more accurate applications, reduced resource use, and significant savings for applicants, the industry, and municipalities.

In 2018 the directorate launched a digital regulatory platform that checks the building application against the regulations and sends it to the correct municipality. Later the directorate successfully introduced Digital Building Application (eByggesak), a digital system that allows municipalities to process building applications more efficiently. This has reduced processing times significantly and set the stage for further digital transformation in the planning sector.

So far, approximately 270 municipalities have acquired “eByggesak”. The goal is for all municipalities to adopt it by the end of 2025. The Directorate for Building Quality and the municipalities, in collaboration with the ministry, have developed a National Requirement Specification for planning and building cases that municipalities can use when acquiring a new case processing system.

Many building cases involve other sector authorities. The Norwegian Labour Inspection Authority now processes its part of the building application digitally in 90 percent of the cases. This has reduced the processing time from up to 12 weeks to just a few minutes. The aim is that the Directorate for Building Quality can help establish such digital interaction with more sector authorities in the planning and building application processes.

Digital neighbour notification saves applicants time and money. Over three million neighbours have received such notifications by now. The Directorate for Building Quality continuously develops the solution, and since 2020 it has been possible to notify the board of a co-ownership instead of all co-owners. So far, the solution has saved developers and private individuals more than one billion Norwegian kroner[2]. The directorate continuously develops digital guides that are widely used and relieve municipalities of guidance work. The Directorate will now develop a digital application for exemption with guidance.

Based on this success, the Directorate for Building Quality is now working to digitalise the entire planning process, aiming to create a seamless end-to-end system. This involves:

- Standardising data formats: Ensuring interoperability between different municipal systems and private sector tools
- Automatic routine checks: Using AI and rule-based systems to verify compliance with regulations automatically
- Enhancing transparency: Providing real-time access to planning data for developers, municipalities, and the public

Standardising data formats

The standardisation of data formats is an essential aspect of enabling interoperability across various municipal systems and private sector tools within Norway’s digitalisation of spatial planning and building processes. For effective integration, it’s critical that geospatial data, zoning information, and building applications are all structures in a consistent format that can be seamlessly shared between systems. This ensures that data from different stakeholders, whether public or private, can be accessed, interpreted, and utilized without loss of fidelity or function.

A key technical challenge lies in the adoption of GIS standards for geospatial data exchange[3]. Municipalities are adopting these standards to ensure that when building applications or zoning plans are processed, the data is appropriately formatted for both local and national stakeholders, as well as for private contractors working on urban development projects.

Norway's municipalities historically used diverse systems for managing spatial data, such as local GIS platforms or proprietary building permit tools. Most municipalities use private software providers to facilitate solutions for archive- and service provisions. There are three to four such companies of significance and they have their own systems for a full circle of products. As such, municipalities often feel they are "tied" to a provider for a range of services and may find it difficult to change. Ensuring these systems speak the same language, while maintaining high data accuracy remains one of the biggest hurdles. Not all municipalities possess the same level of technical capacity, resulting in a disparity between those that can handle sophisticated GIS tools and those that struggle with basic digital mapping. There is a continuous need for developing integrated solutions that accommodate both advanced geospatial technologies and legacy systems.

Data sourced from varied platforms, such as satellite imagery, cadastral databases, and environmental impact assessments, requires careful harmonisation to avoid discrepancies in mapping and spatial analysis.

Automating routine checks

The application of AI and rule-based systems to automate regulatory compliance checks involves a shift towards more sophisticated, data-driven methods of evaluating building applications and spatial plans. Machine learning and rule engines can be leveraged to automatically cross-reference applications against zoning regulations, building codes, and environmental standards – all of which are intricately mapped and encoded in digital form.

In practice, this could involve deploying a spatial rule engine that uses semantic reasoning to evaluate whether a proposed building's footprint adheres to predefined spatial zoning constraints. For instance, a system might flag a construction proposal that is situated within a flood-prone zone or doesn't meet setback requirements from designated heritage sites. Additionally, by using natural language processing, it is possible to allow for automatic parsing and interpretation of regulatory documents, transforming complex legal jargon into machine-readable rules that can be directly applied to specific projects. However, there are some challenges. Local regulations can vary across the country, adding an additional layer of complexity to automating compliance. The intricate layering of municipal, regional and national regulations, combined with exceptions, makes full automatization a challenging task.

The accuracy of AI-driven systems is heavily reliant on the quality and granularity of input data. Incomplete or outdated cadastral data, inconsistent zoning information, or gaps in environmental data can lead to errors in compliance checks. In addition, the scalability of AI models may be challenging. While AI and rule-based systems are highly effective in certain contexts, scaling these models to handle the vast diversity of building and planning scenarios – each with unique constraints – remains an ongoing challenge. Machine learning models must continually be trained with new datasets and edge cases to remain accurate across all types of applications.

[3] Such as ISO 19115 series for metadata and OGC (Open Geospatial Consortium) standards for geospatial data exchange.

Enhancing transparency: Providing real-time access to planning data for developers, municipalities, and the public

Transparency is a cornerstone of the digital transformation of Norway's spatial planning and building processes. Enabling real-time access to planning data for all stakeholders – developers, local authorities, and he general public – requires robust data-sharing infrastructures. These infrastructures must integrate dynamic GIS layers, planning documents, stakeholder comments, and approval statuses into an open, user-friendly platform.

A public-facing platform that provides a real-time map interface allows developers to visualise proposed zoning changes and building permits in their area of interest. This map layer would automatically update with any new application, comments from local residents, or objections submitted during the public consultation phase. Public access to data on urban planning and environmental conditions would also allow developers to access geo-referenced data in formats compatible with their own design tools, improving efficiency and reduce delays.

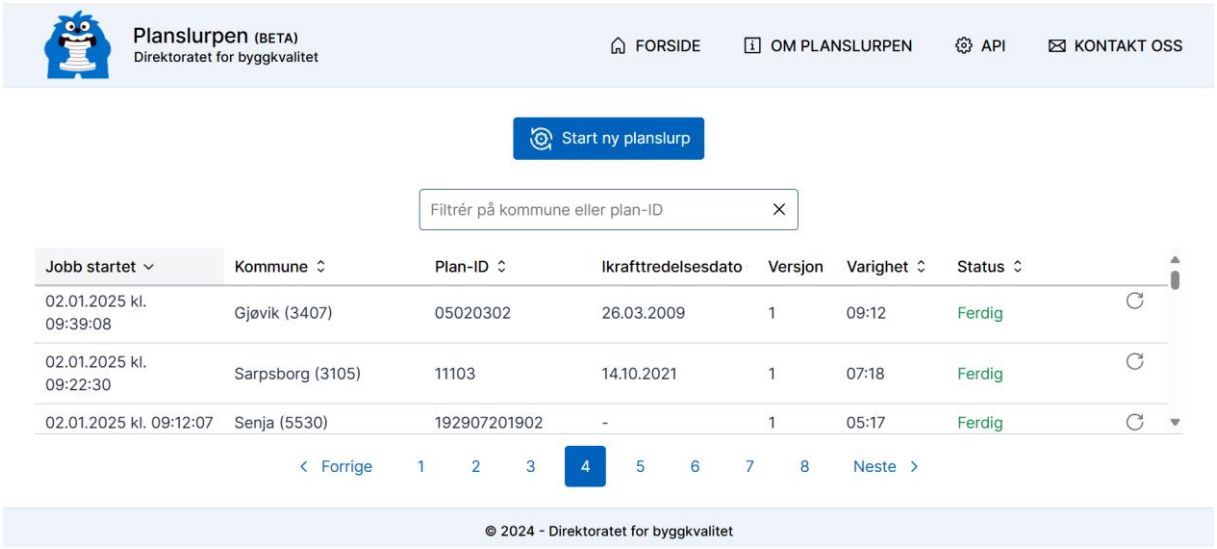
While the push for greater transparency is important, the balancing act of ensuring that sensitive data is protected, particularly with respect to personal data, or commercially sensitive information, remains a critical issue. In addition, transparency is only valuable if the data being shared is accurate and reliable. Integrating diverse datasets, often collected through different agencies or at different times, requires thorough validation and reconciliation to ensure that the information being shared is up to date and valid across all stakeholders. The success of such transparency initiatives depends on ensuring that the platforms used for data sharing are intuitive and easy to navigate for both technical and non-technical users. GIS professionals often have advanced spatial analysis capabilities, but residents and developers may lack this expertise, requiring significant focus on usability and accessibility in platform design. The same goes for many of the Norwegian municipalities. Some of which cover a vast land but is scarcely populated. The local administration may consist of very few, if any, with technical competence in the field. The difference between municipalities in terms of capacity and competence in the field, is a major force for the initiatives towards more digital planning- and building processes.

5. THE "PLANNING SNEAK", AN EXAMPLE OF THE USE OF AI

The "Planning sneak"[4] is a digital tool developed by the Directorate of Building Quality together with private software suppliers and IT-architects, to assist municipalities in their spatial planning processes. The tool serves as an automated advisory and compliance-checking system that helps municipalities identify potential errors and inconsistencies in submitted planning proposals. In Norway a very large part of the planning proposals, and nearly all when it comes to housing, is proposed by actors in the private sector. Some companies are small newcomers, others are large and experienced. When submitting a planning proposal in two different municipalities, a standardised system is of great benefit.

By analysing planning applications against existing zoning plans, regulatory requirements, and other spatial data, the tool provides recommendations and flags issues that need to be addressed before a proposal can proceed further in the planning process. The "Planning

sneak" uses advanced algorithms to automatically verify if planning applications comply with local zoning laws, building codes, and environmental regulations. It provides real-time feedback to planning authorities, helping the case manager to spot discrepancies or conflicts early in the process, reducing the need for manual oversight and extensive revisions later. The "Planning sneak" also facilitates greater transparency by providing planners, developers, and the public with an accessible platform for tracking the status and details of planning applications.



The way it works is that developers or planners submit their proposed plans electronically through the municipality's digital platform. The "Planning Sneak" system analyse the submitted plans against relevant regulatory data, zoning maps, and predefined planning criteria. It then generates feedback on whether the proposal adheres to applicable planning laws, highlights potential conflicts, for instance environmental protection zones or infrastructure requirements, and suggests necessary amendments. The municipal planning authorities receive this analysis as part of their decision-making process, streamlining the review and approval steps.

By automating routing compliance checks, the "Planning Sneak" tool reduces the administrative burden on municipalities and speeds up the planning review process. It ensures that planning applications are consistently checked against the most current and accurate regulatory data. By preventing errors early in the process, the "Planning Sneak", reduces costly revisions and delays in the planning and approval stages. As with all other AI-driven tools, the effectiveness of the "Planning Sneak" depends on the quality and integration of the data used. Inaccurate or outdated data can lead to misleading feedback. Norway's municipalities have diverse planning needs and regulatory frameworks. Ensuring that the tool can adapt to local variations without compromising its functionality can be a challenge.

The "Planning Sneak" is an example of how the directorate works with engaging both private and public sector, building small success stories along the way. The tool is built on a similar "sneak" for the building process alone and is still being tested out on the more complex planning process. It is a crucial component of Norway's ongoing digitalisation efforts, designed to simplify and enhance the planning process while ensuring compliance and transparency.

6. THE PATH FORWARD AND LESSONS LEARNED

The digitalisation of spatial planning and building processes in Norway is not a one-off project, but a continuous evolution toward a more integrated data-driven urban management model. The Directorate for Building Quality emphasis on a collaboration with private-sector innovators, from GIS technology firms to urban planning software providers, has proven essential for developing scalable solutions that can be adapted to different municipalities. Trough an incremental approach, he directorate is working to overcome the challenges of data standardisation, AI integration, and public engagement in digital spatial planning. Key lessons include the need for adaptive methodologies and iterative testing to ensure that both technical infrastructure and regulatory compliance mechanisms evolve in tandem.

The work in the directorate has powered a strong collaboration with the Norwegian Mapping Authority (Kartverket). A digitalisation of the planning- and building process heavily rely on accurate, authoritative and updated spatial data that are seamlessly integrated in the system. Over the years, the Mapping Authority have been working to modernise its own systems and was recently rewarded with a prestigious award for their central role in a public-private partnership on digital interaction in property transactions[5]. As society becomes more digitalised, the need for easily accessible data also increases. The Mapping Authority does a crucial job of standardising and disseminating all the data that is collected, a job that supports many areas of society, including housing construction. They also work to develop pathways to extract and standardise new data, an interesting case being a nationwide wetlands dataset (LAVDAS). Together with research institutes and environmental agencies, LAVDAS aims to improve the mapping of wetlands by utilising AI and satellite imagery, providing municipalities and planning authorities with precise and up-to-date data for sustainable land-use planning. Wetlands are critical ecosystems in Norway, serving as carbon sinks, biodiversity hotspots, and natural flood regulators. However, accurate data on their distribution is lacking, especially in high-altitude areas. There is an ongoing debate of whether all wetlands should be preserved. If such a regulation goes through, the need for accurate data on this specific landscape will be even more crucial. New datasets generated through this project is just one of many examples of the constant change and expansion of data collected and used in spatial planning.

When digitalising complex administrative processes, like spatial planning and building permit systems, the choice of development methodology is crucial. Traditionally, large-scale government IT projects have followed the classic waterfall model, a structured approach where all requirements are defined upfront, and development proceeds in sequential phases (analysis – design – implementation – testing – deployment). However, this method has proven problematic for digital transformation efforts in dynamic regulatory environments like urban planning and construction.

As noted in the beginning of this paper, the planning- and building approval process in Norway is governed by multiple layers of regulations. These frameworks are constantly evolving due to political decisions, technological advancements, and changing societal needs. In a waterfall approach, the assumption is that all legal, technical, and operational requirements can be fully defined at the start. However, regulations change during

[5] Vedrø, stor pris for 2024 til Kartverket | DFØ

development, rendering parts of the system obsolete before launch. User needs evolve, especially when municipalities and developers begin testing new digital tools, and error or inefficiencies often surface only during implementation, requiring costly redesigns. Instead of attempting to build a fully operational system all at once, the step-by-step (or agile) approach focuses on iterative development. Both the Directorate for Building Quality and the Norwegian Mapping Authority seek to start with small, functional components, such as digital submission of site plans, before expanding to more complex processes. They run test panels with different stakeholders and users, refining features based on feedback, and they allow for adjustments as regulations and technical possibilities evolve.

When the Directorate for Building Quality set out to digitalise the planning- and building processes, they deliberately chose a step-by-step approach. As the public sector is sometimes a slow-moving ship, the waterfall model is often preferred because it fits with a classical system for financing public projects. The need to control all aspects are, logically, high when using the taxpayer's money to realise a project. However, if the directorate had chosen to launch a single, monolithic e-permitting system, they would probably never had the success they have had so far. By digitalising the building permit application first, then integrating automation tools for rule-based compliance checks, and now moving toward spatial planning digitalisation, they have reduced risk, ensured practical usability, and allowed the municipalities to adapt to regulatory changes without major system overhauls.

To automate compliance effectively, digital tools must integrate various data sources, account for local variation, and apply rule-based logic, that can adapt to exceptions. This is why full automation remains a challenge, and why Norway is taking an incremental, step-by-step approach to digitalising the planning- and building processes. While challenges remain, particularly around data integration and regulatory harmonisation, the long-term outlook for a fully digital planning- and building process, is promising.

BIOGRAPHICAL NOTES

Educated in Human Geography, with a specialisation in urban development from the University of Oslo. Philosphiae doctor in urbanism from Oslo school of Architecture and Design, with a PhD on spatial planning and area-based strategies. Leading positions in projects on sustainable urban development, both nationally and in a Nordic context. Now deputy director general at the Norwegian Ministry of Local Government and Regional Development.

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