

# **Ten years to go: The role of geospatial information when approaching 2030**

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**Key words:** sustainable development goals, spatial planning, geospatial information, geospatial infrastructure

## **SUMMARY**

The Norwegian government has decided that the UN sustainable development goals (SDG) shall be the fundament for the governments national and international work. That implicates that Agenda 2030 with its 17 goals and 169 subgoals, will influence and shape the future development.

The UN underscores that two third of the SDGs can only be reached through local achievements. It is essential that everyone pulls in the same direction if we are to reach the goals, and that public and private sector, academia and civilian life work together. Spatial planning is one of Norway's prime tools for sustainable development. The planning system is set up to handle conflicts across sectors and provides a good fundament for understanding the wicked problems we are facing.

This paper presents some of the ways the Norwegian state, regions and municipalities work to achieve the sustainability goals. It includes learning from the many different local approaches, their challenges, the need to generate knowledge so that more people can make use of it, have accessible and updated relevant data and make new use of geospatial information.

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## 1. CHALLENGES

The Sustainable Development Goals are a call for action by all countries – poor, rich and middle-income – to promote prosperity while protecting the planet. We are now six years into the agenda set in 2015 and have about nine and a half years to go. We have already seen progress in many areas, yet we have no time to sit back and relax.

The Norwegian government has decided that the UN sustainable development goals (SDG) shall be the fundament for the governments national and international work. That implicates that Agenda 2030 with its 17 goals and 169 subgoals, will influence and shape all parts of government and development.

The Nordic countries are in a good position to realize the 2030 Agenda at a national level. We score high on indicators such as healthcare, welfare, education, and governance. Still, it would be a blunt mistake to imagine there is no need for improvement. We are for instance faced with challenges when it comes to drop-out rates in the education system (SDG 4), emissions (SDG 13), preservation of biodiversity (SDG 15), and marine litter threatening the health of our oceans (SDG 14). Therefore, the 2020s must be the decade of action.

In this presentation, I will share some of the learning extracted from local ways of working with the sustainable development goals, and tools developed to support spatial planning as a key to achieving them. Coming from a background in social sciences, I am interested in the potential presented by a more extensive use of geospatial data in spatial planning, and how that can be done without the user having to be an expert on GIS.

## 2. SPATIAL PLANNING IS KEY TO A SUSTAINABLE FUTURE

Agenda 2030 is an action plan for what is often called the 5 P's: *People, Planet, Prosperity, Peace* and *Partnership* (United Nations, General Assembly 2015). The final one being crucial for the success of all goals and subgoals. Without partnerships and participation from the different actors involved, it is hard to see how the implementation of the agenda can possibly be successful.

In Norway, building on our existing system for spatial planning is a key. Spatial planning is an efficient, effective management tool for sustainable social development and land use. The county and municipal authorities have been given increased autonomy and greater responsibility to safeguard national and significant regional interests in planning (The Planning and Building Act, 2008). Regional and municipal planning are important to achieve a more sustainable, user-oriented, efficient, and result-oriented public sector.

## **2.1 The wickedness of sustainable development**

The term ‘sustainable development’ came into widespread use following the 1987 publication of *Our Common Future*, the UN-report also known as the Brundtland-report (World Commission on Environment and Development 1987). Linking the development of today to the need of future generation, provided a framework for the gathering of further knowledge, debates, and efforts that followed. However, the past three decades have demonstrated that implementing what we have learned is a difficult task. The UN Secretary-General, Antoni Guterres, has been very clear: “The pressures of the era are mounting; the trust that binds the world is fraying. Today’s generations and the next need the world to do better” (United Nations 2019).

One of the reasons sustainable development is so difficult to achieve, is that it is a “wicked problem” (Pryshlakivsky and Searcy 2012, Hanssen et al. 2015, Stang and Ujvari 2015, among others). The wickedness lies in the lack of clarity, ambiguity, limited understanding, and high risk. Sustainability, as most wicked problems, has blended into other issues and only became visible when we started to feel its serious effects. The UN agreement on the 17 sustainability goals is outstanding.

The Nordic countries are in a good position to realize the 2030 Agenda at a national level. We score high on indicators such as healthcare, welfare, education, and governance. However, facing demanding societal challenges we may not reach the goals within a decade. Given the wickedness of the problem, the solutions must be applicable across sectors and build on the goals and subgoals where we each have most difficulties achieving the goals.

## **2.2 From theory to practice**

County- and municipal authorities are key players to realise sustainable development and attainment of the sustainable development goals in Norway. They are closest to the local population, businesses, and organisations. At the same time, they are responsible for much of the social and physical infrastructure that directly affects people’s living conditions and development opportunities.

The Norwegian planning system is well developed and continuous, with tasks divided between three administrative levels elected by the people, and with tools equipped for each task. The Planning and Building Act (2008) underscores the importance of sustainable development. Every fourth year the government publishes the national expectations regarding regional and municipal planning for a further sustainable development. In the latest version it is stated that the government expects that “the county and municipal authorities base their social and land-use planning on the United Nations’ sustainable development goals” (Kommunal- og moderniseringsdepartementet 2019).

However, studies show that there is a large variety in the implementation of the sustainable development goals (Lundberg et al. 2020, Sánchez Gassen 2018). Some municipalities have just started working, whilst others have used the goals actively in developing new municipal

plans. However, all the municipalities express a need for the government to communicate clearly what challenges and priorities are most urgent, and to provide some guidance on the level of local ambitions.

Making a goal into an appropriate action is never a quick fix. The move from using the sustainability goals as an overall framework to actual decisions on how to develop and maintain our physical surroundings, proves a difficult task. The 17 sustainable development goals consist of 169 subgoals and more than 200 global indicators. Many local planners and decisionmakers find the indicators useful, but not directly applicable to local issues. There is obviously still a need for better guidance, as well as more customised indicators.

### **3. EVERYTHING HAPPENS SOMEWHERE**

In March this year, the Norwegian government launched a white paper on data driven economy and innovation (Kommunal- og moderniseringsdepartementet 2021). Better use of data is important if we are to succeed in the transition towards a more sustainable society and a greener economy. The governments ambition is to increase the sharing of data within and between private and public sector. In the 2020 report on Open Data Maturity, Norway had fallen from the 9<sup>th</sup> place to being number 2 (European Commission 2020). A more effective and secure digital infrastructure for the sharing and use of public data is crucial both to the future economy and the global sustainability goals.

Good access to, and use of, public geographical information is increasingly important. The European Union has defined geospatial data in the category of a high-value datasets. According to the Open Data PSI Directive, such datasets have the potential to generate significant socio-economic or environmental benefits and innovative services, benefit a high number of users, assist in generating revenues, and be combined with other datasets (Cory 2020).

#### **3.1 Digitalisation – technology and culture**

Although the Covid-pandemic threatens to slow the process of reaching the sustainable development goals even further, it has also made us provided us with a digitalisation leap. During the last year, our view on working from home has changed significantly. From sounding more like a bad excuse for taking some time off, the home office has proved both possible and efficient. When all this is over, there are hardly anyone believing we will go back to where we started. The flexibility offered by digitalisation leaves us at a point of no return as it bridges the two worlds of work and home, so strictly separated back in the days of the industrial revolution.

The lesson learnt is that with most inventions, it takes a culture to provide it with any impact. The pandemic has changed our culture in ways no one thought possible. Zooms and Teams was here before 2020, but it took a world-wide crisis to make us all jump on board. When we

did, it was not only made possible because someone had invented the technology, but also because the infrastructure that feeds it existed.

In the report *Digital Government Review of Norway*, OECD urges public agencies to challenge private sector on how to make use of public data, and invite them to a dialogue on which data needs to be available and how to make it happen (OECD 2017). Some public agencies are already active in promoting their data, such as The Norwegian Mapping Authority. Together with academic institutions, they have encouraged more innovative and extended use of geographical data for several years by arranging the hackathon #Hack4no, where the public sector meets with IT-students and start-up companies to explore new ideas based on open accessible data.

### **3.2 An infrastructure for geospatial information**

The government has stated a vision that Norway shall be at the forefront in the use of geospatial information (Kommunal- og moderniseringsdepartementet 2018). Geospatial information is required to meet social challenges, such as climate change, environmental challenges, transport, resource management, emergency planning and urbanisation. Professionals and private individuals use geospatial information to visualise physical phenomena and events and increase the value of other information.

Geographic information is part of very many operations, often as an aspect within another sector. For example is the statistics for road traffic accidents considered transport information. The collection, management, analysis and disclosure of such information will first and foremost be the responsibility of the authorities and actors in the transport sector. However, every single accident 'happens somewhere', and as such localised spatial information is used to support the identification, analysis and understanding of the primary information, and to convey this knowledge further.

For private sector in Norway it has proven specially demanding to innovate on municipal data, as there is still a lack of standardisation and a variety of different practice in between local authorities. The exception is municipal geographical data, as they are regulated by the Spatial Data Act, with the Norwegian Mapping Agency as the national geospatial coordinator. For a long time, we have had functional models for cooperation between public and private sector on collecting, moderating, and sharing geospatial information. These solutions have provided us with a variety of geospatial data, services and solutions adopted to shared standards that make integration into different sectors possible. However, the increase of data that is being produced, the number of users, new needs, and higher expectations of accessibility, makes it necessary to further develop our geographical infrastructure.

Society needs good, up-to-date data in private and public activities, within all the specialist areas and sectors. Data must be available in ways that meet the needs. The data must have known coverage and a quality adapted to the needs of the various actors, so that it can support their specific applications and be part of the relevant decision-making processes. Up until

now, public sector has been the main driver in the cooperation on common solutions for sharing geospatial data. However, we now expect that private sector will take an increasing part in producing and receiving geographical information and contribute to further innovation.

Detailed topographic maps, cadastre and digital elevation models on land and sea, improves societal and spatial planning, and provides for new businesses to evolve. More available datasets make it easier to develop innovative user-solutions for a more sustainable development. An extension of the number of geospatial datasets and improved access for private sector to take part in the geospatial ecosystem, challenge our existing models for cooperation. The Norwegian Mapping Authority therefore consider implementing a national program for further development of our geographical infrastructure. The goal being that the next sharing platform for geospatial data will make it easier to share and interact with other data ecosystems.

#### **4. LOCAL IMPLEMENTATION OF GLOBAL GOALS**

In line with the Open Government Partnership (OGP), Norway works accordingly with an action plan for open and inclusive management. We find that open and participatory planning processes is one of the best ways to ensure that conflicts of interest are both mediated and dealt with at an early stage. When working with how to translate the global sustainability goals and give them local relevance, we have had several projects and studies to reveal both which subgoals are most important, how to work with them, and to see if there are further subgoals or indicators needed (Lundeberg 2020, Asher et.al. 2019, Sweco 2018). The sustainability goals are cross-sectoral, but they are also sometimes in conflict with one another, and that makes it even more urgent to have proper tools for collecting and sharing the data needed for a knowledge-based spatial planning.

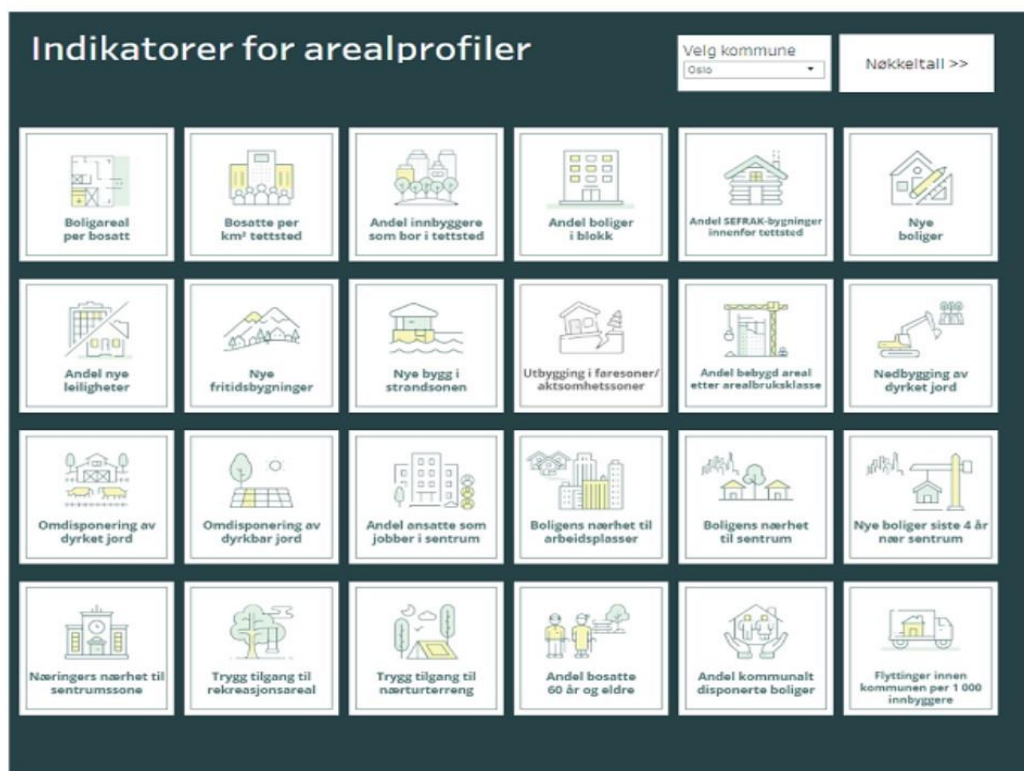
The municipalities are the authorities of spatial planning in Norway. 82 percent of the total population in Norway inhabit approximately one thousand towns, cities, and villages. Despite a clear and continuous tendency of urbanisation shared with the rest of the world, Norway is still the European country where fewest people live in large cities. Density and demography vary across the country, where some parts experience growth, some stability, whilst others experience a population decline. Whatever the situation is, it comes with challenges for the land use planner.

The capacity and the competence of spatial planners is fundamental for effective spatial planning. Municipalities with a vast area to manage, yet a small number of inhabitants are facing some of the main challenges when it comes to recruiting spatial planners and competence in for instance GIS. The number of applicants to study programs have since been increased, but there is also a great need for digital tools and guidance that are easily accessible.

#### 4.1 Land use profiles for municipalities and counties

The Ministry of Local Government and Modernisation have been working together with Statistics Norway, which is the national statistical institute of Norway and the main producer of official statistics, on developing land use statistics. The idea of making knowledge more accessible to spatial planners through land use profiles was launched in a white paper on sustainable cities and rural districts (The Norwegian Ministry of Local Government and Modernisation). The aim is to provide a tool for strategical planning and more efficient planning processes.

The land use profiles provide the municipalities with relevant statistics without demanding high competence or the use of large resources locally. The time wasted on searching for answers is limited as the land use profiles provide 24 indicators that are custom-made for use in spatial planning. The main target-group is Norwegian municipalities and the workforce involved in a planning process. However, the land use profiles also provide insight and knowledge to politicians, business stakeholders, media, and the general public.



*The first version of land-use profiles is now available on the web page of Statistics Norway: [vis-arealprofiler - Statistisk sentralbyrå \(Statistics Norway\) | Tableau Public](#)*

Working with the sustainable development goals has provided an opportunity to extract more use of the good infrastructure for sharing geospatial information. A lot of the geospatial data available, proves very useful as a knowledge base for sustainable development, hereunder

also the development of indicators. Through the land-use profiles, one can access different indicators relevant for spatial planning and sustainable development. The statistics is provided by the municipalities themselves through KOSTRA, a regularly report from municipalities to the state on resources, priorities, and goal achievement. The land use profiles have developed indicators on issues such as number of inhabitants per square kilometre, housing typology, share of new apartments, second homes, development in areas with a risk of flooding or landslide, the reallocation of cultivable earth and proximity to recreational areas, among others.

Based on the first version now published, the ministry has undertaken a user-test that showed a further interest among the municipalities to connect the land-use profiles to achieve the sustainable development goals. This will be taken into consideration as the ministry and Statistics Norway continue our work.

#### **4.2 Land use accounting**

Land use accounting is nothing new. What is new is the opportunities offered by technology and digitalisation. We are currently working on how to make a map-based account that can integrate new content. The aim is to make it easier for the municipalities to understand and communicate the amount of land that is about to be developed, and what this land consists of in terms of for instance cultivable earth and biodiversity. Put together with population forecasts, a land use account can contribute to a critical review of the local land use and support spatial planning processes.

A mapping of different practice in the municipalities shows that a map-based land use account can improve the dialogue between local and regional authorities, public and private sector, and between local management and the inhabitants (Rambøll 2020). Such an account can contribute to an increased mutual understanding of available land and the rules and regulations involved. In connection with the sustainable development goals, a land use account can prove helpful for keeping track of what has been achieved and what's left to reach the goal.

However, to prove a successful tool, it is crucial that the intention behind a land use account is obvious for everyone involved. Such a tool must provide the municipalities with an overview of the potential in development areas, and at the same time set a value to the areas before and after development takes place. Developing tools for better land use accounting, is also linked to work undertaken on calculating the climate gas emissions. The Norwegian Institute of Bioeconomy Research is currently working on a map-based tool for calculating emissions from land-use change.

#### **4.3 Detailed elevation models**

Digital representation of the topography is essential for spatial planning and climate adaption. In 2016, the Norwegian Mapping Authority started a mapping program to generate a new detailed elevation model based on LiDAR and image matching.



The Ministry of Local Government and Modernisation together with seven other national government bodies, sponsor the project. The goal is to have a complete new set of national elevation and surface models at various detail levels by 2022 covering the whole country (325 000 km<sup>2</sup>). All elevation datasets, both raw point clouds and derived grid products, collected in the program are open data and are freely available to everyone to use and republish (GeoForum 2019). Data from the national elevation and surface model improves the detailing of analysis for flooding and landslide, as well as overgrowth, cultural heritage sites and biodiversity.



*Detailed elevation data, on land and below sea, can be used to make terrain models.  
Illustration: The Norwegian Mapping Authority*

#### **4.4 3D-models of the shore zone**

Detailed 3D-models help planners managing land use. The ministry of Local Government and Modernisation has therefore published a guide showing how to visualise development on along the coastline (Kommunal- og moderniseringsdepartementet and Asplan Viak, 2020). It shows what data is relevant to include, the various software-solutions available, and how to create a 3D-model. The goal is to make it easier for local planners and authorities to make use of 3D-modelling in their planning processes, and to utilise the potential created in the national detailed elevation model and national datasets.

The shore zone in Norway is an area of severe land use conflicts. It is an important recreational area and it provides access to the sea for both business and leisure. When managing the shore zone, municipal authorities have an important task in weighing development interests against local, regional, and national interests. That job is not always easy, and one reason is that it often proves difficult to get an overview of the situation. Most of the time, the work is based on word-documents and analogue or digital 2D-maps, but these tools don't necessarily show the full picture when it comes to estimating for instance actual accessibility or to what degree the land use is becoming privatised. Digital maps and GIS-tools hold relevant thematic data that can make the job easier for the local planner.

The 3D-model is a web-solution available to everyone. Based on datasets available through the geospatial infrastructure, a 3D-image of an area can be supplied with everything from vegetation, terrain, regulations, roads, fences, traffic, cultural heritage, biodiversity, view to the sea from different angles, shadows from buildings, and more. For planners, investors, inhabitants and others, the totality at view in a 3D-model can provide a better mutual understanding of how much of the shore zone is in fact available to the public, and what consequences different forms of development will have.



Screenshot from the municipality of Askøy shown in the guide to 3D-modelling: [Veileder for strandsonen i 3D - regjeringen.no](https://www.regjeringen.no)

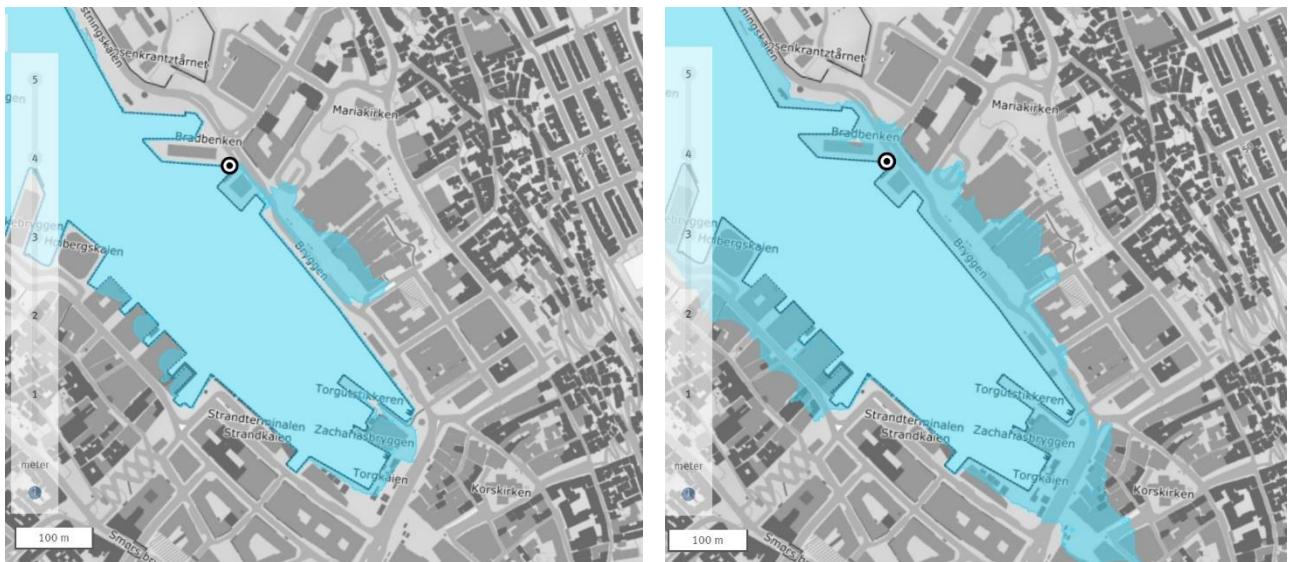
#### 4.5 Coastal flood mapping

Norway is located relatively near the Kvarken-region which has a land uplift of approximately 8,5 mm. per year, and as such Norway is not at a very high risk from sea level rise. Still many parts of the local coast are potentially vulnerable to flooding. The long and complex coastline is home to people, communities, businesses, and a considerable amount of infrastructure. Nationwide, an area of 400 km<sup>2</sup> 105 000 buildings, and 510 km of roads that are at risk of flooding from a 200-year storm, and the numbers will increase to 610 km<sup>2</sup>, 137 000, and 1340 km with projected sea level rise to 2090 (Breili et al. 2020).

The Norwegian Mapping Authority has provided a digital tool for coastal flood mapping, where one can easily see a visualisation of the consequences of sea level rise from different locations. Freely accessible to everyone, the service also provides datasets of risk, statistics of buildings, roads and infrastructure threatened by flooding, downloadable for use. The tool supports planners to communicate the risk that sea level rise and extremely heavy rain provide.

75 percent of the Norwegian population lives along the coast, and approximately 280 Norwegian municipalities have a coastline. For everyone working on sustainable spatial development along the coast, this tool is useful to identify areas of risk where there may be a

need for further analysis before a decision is made. It makes it easier for both municipal planners and private businesses to be better prepared on the consequences of climate change.



*The image to the left shows that if a 200-year storm hits the centre of Bergen today, it will affect an area of 1,12 km<sup>2</sup>, 4,6 km of roads and 2273 buildings. The image to the right shows the effects of the same storm hitting the same spot in 2090. It will then affect an area of 2,16 km<sup>2</sup>, 10,2 km of roads and 2849 buildings. [Se havnivå i kart | Kartverket.no](#)*

#### **4.6 More precise digital data in harbours**

A budget allocation designed to secure working places during the Covid-pandemic, has given a boost to a laser-scanning and detailed measuring of the depths of the harbour basins in Norwegian harbours. The Norwegian Mapping Authority is in charge, and the aim is to get more updated geospatial information using new technology.

For the management in the harbours, the new data also makes it easier to communicate with ships coming to dock. Fewer misunderstandings and less things go wrong when updated and reliable data is shared on mutual platforms rather than through e-mails.

As it turns out small differences discovered in this work make a significant impact on sustainability. For instance, the depth of Kristiansand harbour turned out to be 60 cm. deeper than earlier assumed. For one of the shipping companies, that meant their boats transporting raw materials to and from Canada and South-Africa, could carry approximately 3000 tons extra and thereby reducing the number of trips. That is both good for the climate, the local workplaces, and the economy.





*Extended mapping of the Oslo harbour. Photo: Terratec*

## **5. KNOWLEDGE IS THE BASIS OF SUSTAINABLE DEVELOPMENT**

With the words of Antoni Guterres in mind, that we need to do better, it is tempting to quote one of the great minds of our time; Stephen Hawking, saying: “The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge”. As being just that; 'our times', I will not even go into the various web pages questioning if this is truly a quote of Hawkins or one from the librarian of the U.S. Congress, Daniel J. Boorstin. Whomever was the first mover, the quote underscores the point that we need to know what we are dealing with, to deal with it. And as such, the knowledge we can provide today from geospatial information, must be shared, and used for the common good of a sustainable future. We may disagree on what path to take, but we should not need to disagree on the basic facts from which our different meanings derive from.

During spring this year, possibly before this presentation is held, the Norwegian government will launch a white paper as an action-plan to these last ten years. It carves out a path, that can only be walked together. Academics, business, public authorities, inhabitants, and NGOs need to join forces, and luckily it seems that digitalisation provides us with some useful tools. In the national geospatial strategy towards 2025, the government underscores the need to work for a national knowledge base, shared solutions and technology, well-functional interaction with respect to management, sharing, development and innovation between both public and private sector, and a predictable framework well suited to the challenges of a digital society (Kommunal- og moderniseringsdepartementet 2018).

That will be equally important for a continuous sustainable development.

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## **BIOGRAPHICAL NOTES**

Educated in Human Geography, with a specialisation in urban development from the University of Oslo. Philosophiae 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 Modernisation.

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