

# Norwegian Support to the Geospatial Sector in the Republic of Moldova: Sixteen Years of Capacity Development

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**Key words:** geospatial; capacity development; international cooperation; development assistance.

## SUMMARY

Moldova is one of the poorest countries in Europe, with its economy relying heavily on agriculture. As a result, the country depends on external funding – loans and grants. The Kingdom of Norway is one of the donors supporting the people of Moldova. This paper provides an overview of Norway’s 16–year capacity development support to the geospatial sector of Moldova, focusing on achieved results, lessons learned, and whether the overall development goal has been reached.

During the past sixteen years, assistance from Norway has contributed, among other things, to establishing the geospatial sector and improving public services in the country. The main development goal was to achieve economic growth supported by a functioning land market and tools for good land management. Together with the Agency for Land Relations and Cadastre of Moldova, the Norwegian Mapping Authority has implemented a capacity development program supporting efficient, secure, and transparent real estate registration and providing access to up–to–date geographical information throughout the country. The program has contributed to sustainable land management in the public and private sectors. As a result, several projects have been successfully implemented, delivering tangible results, bringing new technologies, and establishing professional and technical capacity to ensure sustainability and efficient use of the project deliverables and transferred knowledge.

The most important achievement of this multi–year cooperation is the delivery of primary spatial data – high–resolution aerial imagery, orthophotos, digital terrain model, and nationwide digital large–scale base maps, which are the critical components to the National Spatial Data Infrastructure being established in the country to meet the requirement of the European Union Inspire Directive. In addition, the Norwegian–funded program has significantly improved the Agency’s capacity for data storage and distribution to ensure constant and stable access to geospatial data by various groups of users. Last three years, the program was mainly focused on supporting local public authorities with equipment, training, and geospatial data, in close collaboration with the Congress of Local Authorities from Moldova.

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*'It always seems impossible until it's done.'*  
– Nelson Mandela.

When the program in Moldova started in 2006, it was impossible to foresee the scale of results it would come to after 16 years of cooperation.

## 1. INTRODUCTION

### 1.1. Norway – a nation of development assistance

Development aid is deeply rooted in the Norwegian mindset and has a background in a nascent tradition of international assistance; when in 1947, Norway received funds from the United States to rebuild the country after World War II.

Since 1952, Norway has been one of the world's first nations to provide development assistance. Today, it is one of the most generous donors. Annually, Norway allocates approximately one percent of the Gross Domestic Product to development assistance, which amounts to 4 billion US Dollars (Norad, 2023).

The main goal is to equalize the differences between developed and developing countries. Norway is committed to the Sustainable Development Goals, a universal call to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030. Through the promise of 'Leave No One Behind,' Norway and other countries have committed to supporting the furthest behind first.

According to the World Bank, 70% of the world's population lacks legally recognized proof of rights to the land they live on or use for production (Tuck, 2019). It is established that access to reliable geospatial information and secure property rights radically improve the framework for poor people to invest in and improve their housing conditions.

Since 1990, Kartverket – the Norwegian Mapping Authority, has been involved in development assistance concerning geospatial information, positioning services, property registration, and cadastre in more than 20 countries. Since 2006, Kartverket has contributed to the digital revolution in Moldova, establishing the geospatial sector and improving public services for the benefit of Moldovan society.

## **1.2. Moldova at a glance**

Moldova is a relatively small country in Eastern Europe with an area of approximately 34 thousand sq. km between Romania and Ukraine and a population of 2,6 million (National Bureau of Statistics of the Republic of Moldova, 2022). Moldova gained independence in 1991, officially recognized as a United Nations member in 1992.

Previously, the country was one of the republics in the Soviet Union, firmly integrated into the Union's economy, and suffered substantial losses after the collapse. However, since 2009, the country has been governed by a series of pro-European ruling coalitions.

In 2014, the country signed an Association Agreement and a Free Trade Agreement (EU-Moldova DCFTA, 2014) with the EU connecting Moldovan products to this market. One outcome of the DCFTA was redrafting the country's customs legislation and procedures in line with EU standards and aligning with the EU's Customs Code.

EU integration prospects have driven the governments' policy reform agenda since 2009. These developing links with the EU have been a significant contributing factor in the progress of the various policies supporting the development of the geospatial landscape in Moldova and have been one of the drivers behind the development of its National Spatial Data Infrastructure (Kartverket, ConsultingWhere, 2022).

Moldova is one of the poorest countries in Europe, with its economy relying heavily on agriculture (BBC, 2023). As a result, the country depends on external funding – loans and grants. The Kingdom of Norway is one of the donors supporting the people of Moldova.

## **1.3. Land reform and lack of up-to-date maps**

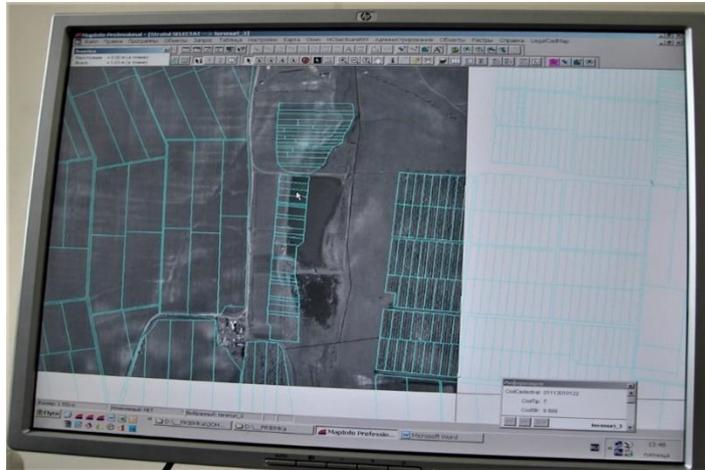
Like many post-Soviet and socialist states, Moldova has undergone a massive land privatization program called land reform. The main goal of the land reform was to transfer state-owned land to private ownership and establish a class of property owners. To organize the land reform in Moldova, a professional public authority – the Agency for Land Relations and Cadastre, was established in 1994. Supported by USAID – the United States Agency for International Development and World Bank, Moldova made good progress with land privatization during 1997 – 2006.

Land reform was high on the political agenda in Moldova. Therefore, implementing reforms quickly to show positive changes with the transition to the new political system was essential. Unfortunately, the political prioritization caused a situation where privatization was carried out without up-to-date maps, particularly in rural areas.

At the time, the existing topographic maps were only on paper, 10–15 years old, and unsuitable for property registration. Moreover, the scale of maps 1:10 000 and 1:25 000 was small for the subdivision of former agricultural collective farms and for planning new property boundaries.

The absence of appropriate regulations for cadastral works and the lack of reliable maps led to 10% of newly established properties being mapped with various errors.

Picture 1 shows an example of systematic error. The subdivided property units were measured with good adjacent accuracy, and the shapes and sizes of the properties seemed correct, but the project location was shifted to the right. If not corrected, these errors could generate a significant proportion of land disputes in the Moldovan legal system.



Picture 1: Aerial images captured in 2007 were used to identify errors in the mass privatization program. Photo: Lars Mardal, Brede Gundersen, Kartverket, 2007.

Due to the lack of a comprehensive approach, privatizing former collective farms resulted in land fragmentation. In most cases, an owner was given two or more parcels – parts of arable lands, pastures, orchards, vegetable gardens, walnut trees, etc. The areas were divided into several narrow but very long individual parcels that resembled "a patchwork quilt."



Picture 2: Land fragmentation in Moldova: Former collective farms were subdivided into many-parcel "patchwork quilt." Lars Mardal, Brede Gundersen, Kartverket, 2007.

Land fragmentation is economically disadvantageous: If the neighbours disagree on using parcels, machinery farming would be impossible. Some owners managed to let or sell their lots to resourceful investors. Many have left their land.

To improve the situation, measures called ‘land consolidation’ are required. Land consolidation leads to parcel reallocation. The authorities negotiate a fair parcel exchange with property owners to suit better machinery agriculture.

The process is complex and time-consuming due to its sensitive nature. It requires presence and close dialogue with the local population. In addition, legislation, and strategy for the fair distribution of different types of lands between members of former agricultural collectives must be in place. Not least, the process must be supported by updated geospatial information – aerial imagery and base maps.

## **2. NORWEGIAN SUPPORT TO THE GEOSPATIAL SECTOR IN MOLDOVA**

During the past sixteen years, assistance from Norway has contributed to establishing the geospatial industry and improving public services in Moldova. The main development goal of the program was to achieve economic growth supported by a functioning land market and tools for good land management. Kartverket, jointly with the ALRC, implemented projects supporting efficient, secure, and transparent land registration by providing access to up-to-date geographical information throughout the country.

The Government of Norway annually provided 5 million NOK (ca. 0,5 million USD, as of March 2023) to the program, which totaled almost 84 million NOK (ca. 8,5 million USD, as of 2023). Ninety percent of the funds were used for direct investments to create geographical data, deliver technical solutions and modern IT systems, and build the local human and technical capacity.

Between 2006 – 2023, eight projects were implemented, and the people of Moldova received

- Two generations of nationwide aerial imagery, digital elevation model, and orthophotos
- First national geoportal with free and open access to orthophotos
- First nationwide geographical positioning system MOLDPOS
- IT system for property registration and cadastre MOLDLIS
- First digital large-scale base map
- First national Geographical Names Register and regulations
- Action and investment plans for National Spatial Data Infrastructure.

The Norwegian-funded program has significantly improved the Agency’s data storage and distribution capacity to ensure constant and stable access to geospatial data by various groups of users.

Last three years, the program was also focused on supporting local public authorities with equipment, training, and geospatial data, in close collaboration with the Congress of Local Authorities from Moldova (CALM):

- 150 local municipalities have received workstations and training on using maps, digital elevation models, and orthophotos for territory planning and evidence-based decision-making.
- 200 local municipalities with no cadastre engineers have received master copies of territory plans and maps, which they can use daily.

CALM assists its members with matters, among others, related to territory planning, land disputes, and land use. CALM has established a Centre of Excellence to conduct training and hold workshops and collect, scan, and systematize documented evidence on utilities within the local authorities' competence – pipelines, underground cables, etc. The project provided CALM with the required equipment – scanner and workstations.

### **2.1 First updated orthophotos in 25 years**

The delivery of primary spatial data – high-resolution aerial imagery, orthophotos, digital terrain model, and nationwide digital large-scale base maps is considered the most important achievement of the cooperation. These datasets are the critical components of the National Spatial Data Infrastructure, which is being established in Moldova to meet the requirements of the European Union Inspire Directive.

The most recent analog aerial photographs of Moldova's territory date back to the 1980s, when Moldova was part of the Soviet Union. From its independence until 2006, ALRC could scan and digitize the topographic maps series 1982 edition. It was apparent that the country urgently needed updated maps. The quickest and most efficient method was to photograph the country's area and produce orthophotos – photo maps that are as accurate as regular maps.

In the spring of 2007, aerial photography was carried out in the frame of the first Norwegian-funded project. That was when digital cameras started to be widely used for aerial photography. Kartverket's experts developed product specifications and quality control procedures.

The Agency received a nationwide orthophoto-map with a 35 cm resolution. The resolution was even better for 45 settlements, including the capital, Chisinau, at 20 cm. In addition, a digital elevation model – DEM, was also generated and delivered to the Agency.

The orthophoto and the DEM were published online on a web portal, [www.moldova-map.md](http://www.moldova-map.md), with the motto "find your house on the map." The data was provided free of charge to all government agencies, academia, schools, and universities. It was quickly adopted by the geospatial data users in the private sector: In the construction and tourism industry, telecom, agriculture, and surveying companies. They started using the orthophoto as a background for creating value-added products – various thematic data, like tourist maps, mobile applications,

etc. For the first time in the young republic's history, the government provided everyone with geospatial data free of charge. That was also the first updated geodata in 25 years.

## **2.2 Satellite-based services save time and money**

Land privatization is a program that requires significant resources. Like many post-Soviet states, Moldova has done the first systematic land privatization with loans from the World Bank. Over three million property units were established, and property boundaries were surveyed in the field. There were dozens of local surveying companies engaged. They used conventional surveying methods and equipment and managed to cover 10–15 properties daily.

When orthophoto maps were ready and compared with the property maps, a rough estimate showed that ten percent of the property boundaries were surveyed with errors. Three hundred thousand properties were affected.

Today, satellite-based positioning services are used to determine geographical locations accurately. A network of ground reference stations receives signals from satellites and passes them on to surveyors in the field, which use modern equipment to obtain positioning correction signals. As a result, surveying property boundaries takes significantly less time. A surveyor can measure from 30 to 70 properties a day.

In 2010, with support from Norway, Moldova received its first permanent network of ten continuously operating reference stations and a control facility MOLDPOS – Moldova Positioning System. It provides services to over 200 users. The largest customer is the Public Services Agency, responsible for the cadastre and land registry. As a result, geodetic surveying has become cheaper for professional institutions and customers.

Nowadays, positioning services are also used in Moldova for 'precision farming' in agriculture and food production, project design and planning, and control of large machinery in construction.

## **2.3 Large-scale base maps**

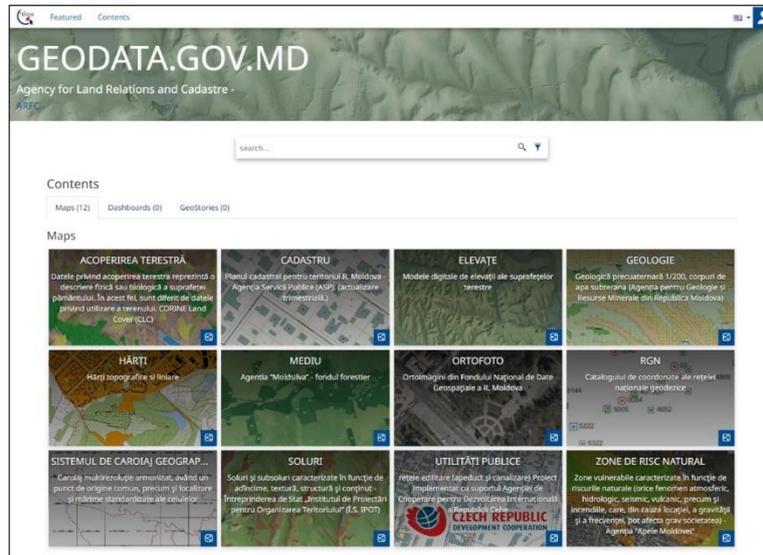
The program's final phase focused on producing the nationwide digital large-scale base map. Map production was completed in March 2021, and in addition to the orthophoto and elevation model, a new base map formed a basis for the National Spatial Data Infrastructure.

The production process used aerial imagery, digital terrain model, and orthophotos to register visible objects for five feature themes categories: buildings and contractions, transportation, utilities, nature, and hydrography. The product specifications for the large-scale base map were developed, including feature tables, code lists, and representation rules.

The map production was done "in the house" by the photogrammetric department of the geodetic institute Ingeocad, which is the Agency's professional geodetic institution with

qualified employees. The base maps data was quality checked by Norwegian experts and is of high quality – both in accuracy and level of detail.

The data is available to users online via the web portal [www.geodata.gov.md](http://www.geodata.gov.md). In addition, ALRC disseminates its data via the M–Cloud platform [www.date.gov.md](http://www.date.gov.md).



Picture 3: Front page of the web portal [geodata.gov.md](http://geodata.gov.md) where geospatial data – orthophotos, elevation model, and base maps are available for free viewing. Source: [geodata.gov.md](http://geodata.gov.md), 2023.

## 2.4 Geodata for the development of local municipalities

Everything happens somewhere. Good governance and evidence–based decision–making depend on reliable and updated geographical information. States, counties, communes, and settlements have specific geographical boundaries and, thus, a responsibility to deal with everything that happens within these boundaries. Therefore, geographical information and systems for geographical data use and analysis are indispensable for good and effective management, especially at the local level. The local level is where people live, work, and receive public services. Geographical information and systems for its use and analysis (GIS) help local governments provide citizens with high–quality, map–based services cost–effectively.

GIS applications provide efficient tools for territory development, such as planning new roads, schools, public health, electrical, water supply, and sewage, to name a few. In addition, information on property value, traffic density, crime statistics, flood–endangered areas, etc., is in high demand by potential investors.

Since 2020, Kartverket’s assistance in Moldova has focused on supporting local public authorities and enhancing their technical and professional capacity for using Geospatial

Information Systems and geographical data. In addition to ALRC – the Agency for Land Relations and Cadastre, Kartverket collaborated with CALM – the Congress of Local Authorities from Moldova.

In support of LPAs, Kartverket cooperated with several other actors that had their activities toward local authorities in Moldova. The goal was to coordinate actions and avoid duplications. One of the partners was the USAID–funded ‘My Community’ program aimed to establish local geographical information systems in nineteen LPAs, including a pilot project at the Municipality of Chisinau.

ALRC and CALM were instrumental in selecting municipalities eligible for technical support. A thorough survey was conducted, and one hundred fifty LPAs – local public authorities, were selected. The main decisive factor in the selection process was the wiliness and readiness of a municipality to use geospatial data. This was confirmed by formal requests signed by mayors, which also appointed cadastral engineers for training.

The selected municipalities have received powerful workstations, large–format monitor screens, and multifunctional A3–format units. In addition, cadastral engineers have received introductory and advanced training courses on QGIS. This free and open–source desktop Geographical Information System application supports viewing, editing, printing, and analysis of geospatial data. In addition, two hundred LPAs received printed wall maps and sets of mapping data for their territories as digital and hard copies.

To ensure the continuity and sustainability of the assistance provided by Norway, CALM has established a training and technical support centre to assist LPAs with GIS applications and geospatial data.

In 2022, CALM visited and interviewed over twenty municipalities collecting examples of how LPAs use geospatial data. The feedback was positive and often emotional. Reportedly, it was the first time that LPAs were donated high–performance equipment and obtained access to up–to–date maps.

Providing geospatial tools and knowledge helps local governments achieve sustainable development and economic growth. The interviews showed that local public authorities use GIS and geodata to support local economic activities and employment, such as to name a few:

- Manage public property, including common areas, public buildings, cultural and protected objects, street and road installations, water, drainage, street lighting, recycling, garbage disposal, etc.
- Develop territory plans and regulations
- Handle building permits and execute public control
- Collect and provide evidence for land disputes
- Collect various kinds of household data for national statistics.

In the future, local governments will use GIS and geodata to deal with environmental and climate issues and for nature protection management.

## 2.5 Use of GIS applications in Orhei

Orhei is a city, municipality, and administrative centre of the Orhei district. It is located ca. 40 km North of Chisinau. Orhei was selected as a pilot LPA for streamlining of use of geospatial data at the local level.

The municipality has received substantial technical support – servers, powerful workstations, a wide-format plotter, and a scanner. Furthermore, access to geodata at the Agency via web services was established. In addition, training and knowledge transfer were provided.

It is highly satisfactory to observe that with a modest financial contribution, Orhei has become one good example of how geographical data should be used in a local municipality. Using GIS applications, they can overview the municipality's area, properties, buildings, addresses, common areas, roads, etc.

Picture 4 demonstrates an example of how Orhei municipality receives geodata directly from the sources: Base maps, orthophotos, property information, administrative boundaries, and other geographical data are available online and via various web services. In addition, they connect to the data distribution platforms provided by data owners. As a result, they have access to the latest, updated, and reliable information.



Picture 4: Connection to the distribution solution WMScadastru.md at the Public Services Agency to get cadastral data - property boundaries, addresses, buildings, and property value). They connect to WMS moldova-map.md at ALRC to receive base maps and orthophotos. Source: Igor Cernei.

They have developed a GIS application to plan and control garbage collection routes using the locations of garbage bins. In addition, the municipality uses a GIS application for street lighting management. They created a map with the geolocation of all lamp poles, numbered and geo-referenced. Further, they collected data on the types of light bulbs at each light pole. This allows the municipality to plan its resources saving public funds and protecting the environment.



Picture 5: GIS application for streetlight management in Orhei. It shows the location of all streetlamp poles. There were 2250 LED light bulbs, 1543 economy bulbs in use, and 512 illuminated streets. Source: Igor Cernei.

## 2.6 Geographical Names

Geographical names are an integral part of geospatial data, which, in addition, to high economic value, has historical, cultural, and political significance. Moreover, growing demand from the public and authorities for more reliable real-time location data requires adequate geospatial data services. Those are crucial for fast and correct decision-making for saving human lives, emergency response, security, and defense. Geographical names as intangible historical and cultural heritage objects are essential to common national identity and self-determination, particularly for indigenous and minority people.

A map without place names is a collection of points, lines, and polygons. Therefore, one of the project components concerned the development of the Geographical Names Register so that geographical names would be shown on the maps. To achieve this goal, it was necessary to study the existing legislation, the “as is” situation, and the Agency’s vision for place names governance in Moldova.

The institutional responsibilities related to the place names governance in the country are divided between several authorities. Thus, the Agency for Land Relations and Cadastre is responsible for geographical names' management. At the same time, the Public Services Agency runs the national Address Register, which includes the geographical names of all settlements, streets, and transport arteries. The Road Authority is responsible for place names related to the national road network. The Forest Authority – is for place names related to forests, and the Water Authority – is for place names of all water objects in Moldova. In addition, local administrations hold a decisive mandate for appointing new place names.

Considering this spread responsibility between many involved parties, a working group on geographical names was established to ensure stakeholders' efficient communications and engagement.

The project team, consisting of experts from Kartverket and the University of Bergen, worked with the working group, experts, and academia from Moldova on developing a legal framework for the Geographical Names infrastructure, including a Glossary of Terms for Standardization of Geographical Names in the Romanian language, Procedures for Geographical Names Standardization, Methodological Guide for Geographical Names Standardization, and Draft Law on Geographical Names. Congress of Local Authorities had a leading role in drafting the law.

Despite the COVID pandemic in 2020-2021, which did not allow field missions for data collection in Moldova, the project team met regularly online. Finally, the first project meeting in person took place in Norway in October 2022. The 5-day workshop was held at the University of Bergen, where the results of a two-year work were summed up.

By the end of 2022, the Geographical Names Register was developed, including an application for data collection. The development was done in the house as part of the institutional cooperation agreement between Kartverket and ALRC. It included database design, development, and testing. The Register consists of two integrated databases – spatial and scientific.

The Agency's National Geospatial Data Collection runs the Register and serves as a connection hub for the involved place names' data producers and the Register. The Register provides the data to users, while any updates delivered by data producers are inserted in the Register by ALRC after verification using automated procedures.

## **2.7 Implementation of the Integrated Geospatial Information Framework**

The Integrated Geospatial Information Framework – IGIF, jointly developed by the United Nations and the World Bank, supports the development of national infrastructures for geospatial information management in lower and middle-income countries.

The IGIF offers an excellent framework for future development. National mapping and cadastre authorities need to adapt to remain relevant. Enhancing human capacity is essential to meeting

future challenges. Data sharing, so data is created once and used many times, is a key principle. Significant investment is needed to build long-term sustainable solutions, but the benefits are substantial and impact many sectors of national economies. As aid budgets are increasingly squeezed, developing countries must seek other funding sources.

Since the endorsement of IGIF, the Norwegian Mapping Authority has taken an active role in promoting the implementation of IGIF in Moldova. An international consultancy was engaged to support the Agency through the process, which started with the baseline assessment of the geospatial sector in the country.

The Baseline Assessment aimed to present the status of the National SDI in Moldova as a basis for the Action Plan. The diagnostic method assessed the “as is” position of geospatial information management in the country, structured around the nine IGIF pathways, including governance, policy, financial, human capacity, and technical perspectives. Furthermore, the Baseline Assessment provided suggestions for immediate action. Those were intended to help with the rapid progress of the current implementation of the National SDI. In addition, actions from individual pathways would be used as references in preparing the Action Plan.

Further, an analysis of how the geospatial industry aligned with the national policy drivers and priorities was done. The result showed that Moldova had a solid basis for implementing the National Spatial Data Infrastructure. There is a good legal framework, a clear objective - EU integration, and a consistent approach across the various policy areas, supported by a stakeholder community whose geospatial activities are closely aligned with the multiple policy goals and objectives.

The final output from this study was the list of stakeholders. The list identified many stakeholders whose responsibilities include activities likely to provide input to the socio-economic impact assessment.



Picture 6: The IGIF reports for the Republic of Moldova are available at ALRC, 2022.

### 3. LESSONS LEARNED

Project implementation is a challenging task associated with many risks and substantial responsibilities. Carrying out a development assistance project brings even more challenges, risks, and significant duties. Grant funding is tax-payers money that must be used correctly and efficiently. In addition, cultural differences, accustomed ways of working, and not least multi-language environments come into play and affect the work.

The past 16 years of work in Moldova were both challenging and instructive. Observing how assistance from Norway contributed to ALRC's growth and maturity was satisfying and inspiring.

A holistic approach to planning and implementation was essential when working in multicultural environments. Following the Theory of Change and Goal Hierarchy while managing complex projects with several components was crucial. For ICT-related parts, a product-oriented management model with elements of agile methodology was effectively used.

Delivery of tangible results was the main driver. The Norwegian support for establishing primary geospatial data – orthophotos, digital elevation model, and base maps has been a significant game changer for the geospatial industry in Moldova. Data maintenance shall continue using the tools and methodologies delivered by the project.

The Agency has strengthened its role as a national geodata coordinator. We observe positive shifts at the Agency toward sharing data with stakeholders in the public and private sectors. For example, 10 – 12 years ago, only a few public authorities were willing to cooperate and share their data with other data producers and the public. Data sharing is a common practice that must continue with consistent stakeholder communication and engagement policy.

Mutual understanding, respect, and trust were the three fundamental values that paved the way to success and contributed to the projects in Moldova delivering on their goals.

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## **BIOGRAPHICAL NOTES**

Elena Busch is a Project Leader of the Norwegian Mapping Authority. Since 2006, she has led capacity development projects in many post-socialist countries, including Moldova. In 2017 - 2023, Ms. Busch was appointed bureau member of the UN-ECE Working Party on Land Administration. By background, Elena is a mining engineer-surveyor. In addition, she holds a Master's degree in Land Administration from the Royal Institute of Technology in Stockholm.

Maria Ovdii is the Head of Geodesy, Cartography, and Geospatial Information at the Agency for Land Relations and Cadastre of the Republic of Moldova. In addition, she serves as a Secretary to the NSDI committee of Moldova. Ms. Ovdii has been instrumental in gaining and coordinating support from various donors over many years, including Kartverket, the World Bank, USAID, JICA, and, most recently, the EU Twinning project.

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