FIG PUBLICATION
NO 80

DIGITAL TRANSFORMATION AND LAND ADMINISTRATION

Sustainable practices from the UNECE region and beyond

Food and Agriculture
Organization of the
United Nations

UNECE
UNITED NATIONS

FIG
INTERNATIONAL
FEDERATION OF
SURVEYORS (FIG)

FIG PUBLICATION NO. 80

DIGITAL TRANSFORMATION AND LAND ADMINISTRATION

Sustainable practices from the UNECE region and beyond

Cover and back cover photographs: Rohan Bennett (the source of the righmost image on the back cover Shutterstock)

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FOREWORD

It is our pleasure to introduce this new publication. It is a collaborative work between the Food and Agricultural Organisation of the United Nations (FAO), the United Nations Economic Commission for Europe (UNECE), and the International Federation of Surveyors (FIG).

The idea for the publication commenced from the recognition that the COVID-19 pandemic impacted significantly on the land administration sector in many country contexts. There were stories of success and stress in the face of the severe social disruption. One of the key realisations was that land administration systems coped and often thrived during lockdowns, and this was largely thanks to digital transformation. In many countries, the digitalization of land administration services was accelerated. The event saw increased demand to fundamental spatial and other information on tenure rights for governments and citizens. It also demonstrated the importance of ensuring no one is left behind, particularly women and vulnerable groups, when it comes to access to digital land administration services.

Throughout the COVID-19 pandemic, the FAO, UNECE and FIG fostered dialogue between countries using webinars to capture experiences and the key lessons. That knowledge forms the basis for what is presented here. The publication delivers country-level perspectives using case materials drawn mainly from the UNECE region. It also takes a broader view of the contemporary land administration domain. It reveals the digitally disrupted era that all land administration systems must now operate in. It shows the benefits of accelerating digital transformation, but also the challenges. It unpacks the key elements for future land administration systems and reveals the pathways for taking action, sourcing financing including public investment, and achieving implementation.

We hope land administrators can apply the lessons and knowledge within and use the document to advocate for land administration advancement within their home country contexts.

Our special thanks to Rumyana Tonchovska (FAO) who was the main initiator of this publication, Frederick Zetterquist, Chair, UNECE Working Party on Land Administration (WPLA) and Hana Daoudi (UNECE) as well as Hartmut Müller and Louise Friis-Hansen (FIG). The drafting team with the three experts Rohan Bennett (in the lead), Claudia Stöcker and Kwabena Asiama who did a remarkable job. Furthermore, we would like to thank all those country level representatives who delivered content, and the dozens of reviewers and proof readers.

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EXECUTIVE SUMMARY

Starting from the digital disruptions triggered by the COVID-19 pandemic, this publication examines the state-of-play and future directions for digital transformation in land administration in the United Nations Economic Commission for Europe (UNECE) region and beyond.

At the onset of the pandemic, many land administration organizations were already well equipped for the new normal, adapting to working at-distance, handling service spikes, responding swiftly to changing customer needs, and delivering novel data analytics services. Legal arrangements to support digital service delivery were often already in place or adaptable at short notice. The event even produced financial gains for many land administration organizations. Nevertheless, it also placed a spotlight on issues of digital exclusion, data quality, standards, staff capacity, customer awareness, and partner collaboration. These are areas where investment is most urgently needed.

Digital disruption *is* the new normal for land administration organizations. Successful systems already operate with this mindset and can pivot, adapt, and learn on-the-fly – be it through leveraging off information technology (IT) infrastructure investments, fast-tracking e-conveyancing, becoming more data-driven, fostering dynamic capabilities, or supporting innovation incubation hubs. Land administration and National Spatial Data Infrastructure (NSDI) organizations should recognize digital disruption as an opportunity to improve services and data quality, find new customers, and create new services. To be equipped, digital transformation agendas for land administration must align with broader governmental digital agendas, infrastructure developments, and cybersecurity plans. Investment plans should equally direct resources towards partnership building, capacity and skills development, communication, and awareness-raising, to ensure they deliver societal benefits and bridge the digital divide.

The COVID-19 pandemic evidenced the indispensable role that spatial and other information on tenure rights play in supporting the government to deliver on broader policy goals. They can help integrate cross-government business processes, improve data supply lines, and support streamlining of e-services for health management, emergency response, property market stimulus, economic recovery, poverty reduction, protection of women and vulnerable groups, climate change response, food security and agricultural enhancement, disaster and conflict management, infrastructure provision, government interconnectedness, open data initiatives, citizen and business activation, and coordinated cybersecurity responses.

The land sector is accelerating towards fully digital operating environments. They are establishing 'dynamic capabilities' to sense digital opportunities, seize them and continuously transform business processes. Capacity development programs are needed to further enhance these capabilities. Authoritative, available, accurate, accessible, and unambiguous digital datasets of land parcels, buildings, rights, restrictions, responsibilities, and people must also be in place. Land administration organizations are often responsible for the quality of 11 of the 14 datasets identified as critical for effective Sustainable Development Goals (SDGs) response. Land administration and NSDI leaders can adopt an ecosystem mindset, assisting in the creation of inter-agency goodwill, goals, sharing, and custodianship.

Future land administration systems must be ready to respond to a diverse number of post-pandemic policy priorities including severe demographic shifts, increasing

societal disparities, economic volatility, newly emerging business ecosystems, anthropogenic environmental damage, decentralized operating environments, political power shifts, and rapid urbanization. Equally, technological developments in cybersecurity, data privacy and ethics, open data, artificial intelligence, robotics, digital collaboration, innovation incubators, and crowdsourced data demand attention. Platforms for partnerships with the business and education sectors, as part of broader capacity development and community awareness-raising, need consideration, alongside actions that better support vulnerable groups, local communities, and deliver upon their basic data needs.

Future land administration systems will require more intelligence, interoperability, inclusivity, interactivity, incorporation, and investment. They may need to explore 'As-a-Service', 'Platform' and 'Distributed' operational models, especially if these can enhance transparency, accountability, reliability, ease of use, collaboration, cooperation, and leadership. Redesigns must be fit-for-purpose and improve land-related decision making, land tenure security, property valuation/taxation, land use planning, land development, and land dispute minimization.

To implement these visions, a holistic approach towards digital transformation is needed. It should incorporate key land administration stakeholders and link to broader government policy goals. It should include baseline assessments, policy alignment, benefits analysis, impact assessment, an action plan, and an investment plan. These should consider the nine strategic pathways from the United Nations Expert Group on Global Geospatial Information Management (UN-GGIM) Integrated Geospatial Information Framework (IGIF) and the Framework for Effective Land Administration (FELA) and specific gaps and opportunities relating to those. Costing of actions, sourcing of finance, and return on investment checks are needed. Sustainable business models should consider fees and value-added services. Performance monitoring and evaluation, utilizing data analytics and dashboards, linked to the SDGs achievement, is essential.

Lessons from the UNECE region can transcend globally, provided contextual factors are responsibly assessed. Supportive legislative environments, coupled with economic stimulus and earlier investments into digital infrastructure, saw land administration continue uninterrupted in many non-UNECE contexts. In many cases, service delivery reached unprecedented levels during the pandemic. In less digitally transformed contexts, halts in face-to-face service provision resulted in request backlogs. Those in rural contexts and the digitally disenfranchised, often women or vulnerable groups, tended to fare worse. Technology can be a leveller, but also a divider: equality to service access and skills development remains a key priority.

Looking ahead, land administration organizations can build from the momentum of the recent COVID-19 pandemic success stories. They must re-evaluate current action and investment plans for digital transformation and further opportunities for acceleration. Short-term actions should ensure requisite cross-sector committees are in place, sector-wide adoption of the disruption paradigm, and global and regional engagement, potentially with donors. Medium-term actions should seek plan adoption, investment funding and implementation. Monitoring of risks, benefits and performance measures will be necessary. Embedding of dynamic capabilities needs to be supported. Where responsible to do so, full digital transformation is now achievable.

ACKNOWLEDGEMENTS

ACRONYMS

aaS	as a Service
AI	artificial intelligence
API	application programming interface
BIM	Building Information Modelling
BPR	Business Process Re-engineering
CAD	Computer Aided Design
CFS	Committee on World Food Security
CORS	Continuously Operating Reference System
COVID-19	Coronavirus Disease of 2019, caused by SAR-CoV-2
DLT	Digital Ledger Technology
DRM	disaster risk management
EuroSDR	European Spatial Data Research
FAO	Food and Agriculture Organization of the United Nations
FELA	Framework for Effective Land Administration
FFPLA	Fit-for-Purpose Land Administration
FIG	International Federation of Surveyors
GDP	gross domestic product
GDPR	General Data Protection Regulation (of the European Union)
GeoIT	Geo-information technology
GFC	Global Financial Crisis
GIS	Geographic Information Systems
GIZ	German Agency for International Cooperation
GLTN	Global Land Tool Network
GNSS	Global Navigation Satellite System
HRSI	High-Resolution Satellite Imagery
IFAD	International Fund for Agricultural Development
IGIF	Integrated Geospatial Information Framework
IoT	internet of things
IT	information technology
IP	intellectual property
ISO	International Standards Organization
LADM	Land Administration Domain Model (ISO 19152)
LiDAR	Light Detection and Ranging
NSDI	National Spatial Data Infrastructure
OGC	Open Geospatial Consortium
PPP	public private partnership
RRRs	rights, restrictions, and responsibilities
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SDI	Spatial Data Infrastructure
SDGs	Sustainable Development Goals
STDM	Social Tenure Domain Model
UAV	Unmanned Aerial Vehicle
UINL	International Union of Notaries
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNGGIM	United Nations Expert Group on Geospatial Information Management

UNSG	United Nations Secretary General
VGGTs	Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests, first endorsed by CFS in 2012
VHRSI	Very High-Resolution Satellite Imagery
VPN	Virtual Private Network
WHO	World Health Organization
WPLA	Working Party on Land Administration

Note: This list of acronyms does not include those of specific national or state land administration organizations, or project acronyms of specific countries. For these, please see the appropriate chapter where the organization is first mentioned.

1   INTRODUCTION

1.1   *What is this about?*

1.1.1 Immediate lessons

On March 11, 2020, the World Health Organization (WHO) officially declared the coronavirus disease (COVID-19), caused by the SARS-CoV-2 virus, a global pandemic (Cucinotta and Vanelli, 2020). The next two-years were characterized by global social, economic, and environmental disruption of unprecedented size and scale. The domain of land administration was not immune to the impacts (Bennett *et al.*, 2020). Being at the centre of the governed relationship between people and land, land administration systems were challenged by stay-at-home lockdown directives, 'at-distance' ways of operating, a 'new normal' for customer and stakeholder interaction, and many different information requests from governmental organizations seeking to manage COVID-19 pandemic responses (See: Case 1.1). There were stories of success, resourcefulness, resilience, much pragmatism, and many lessons for future land administration systems. This publication documents these stories, mainly from the United Nations Economic Commission for Europe (UNECE)[1] context, as a record of the land administration response to the COVID-19 pandemic. It provides immediate lessons for use within the land administration and Spatial Data Infrastructure (SDI) domains.

> ### Case 1.1 – Pandemic strikes!
>
> It is March 2020 and the COVID-19 pandemic is declared. Despite the immediate disruption, land administration organizations across the UNECE region are apparently well prepared. In the Netherlands, well over 99% of all services already occur online at Kadaster – the Netherlands' Cadastre, Land Registry and Mapping Agency. The thousands of requests for parcel-level spatial and other information on tenure rights, property document lodgement, and certificate dissemination continue uninterrupted (Kadaster, 2022). There are similar experiences right across the UNECE including in Armenia, Croatia, Russian Federation, Spain, and Ukraine. Key stakeholders including notaries, estate agents, buyers, sellers, local government, utility service providers, and other government organizations utilize online services. Back in the Netherlands, within days, Kadaster's seven physical national offices, located across the country, are formally closed, reduced to essential staff. Its 1750 employees are closely consulted with and redirected to work 'at distance', mostly from home, making use of the organization-wide standardized 'Kadaster Laptop' – a virtual, secure, Virtual Private Network (VPN)-enabled, mobile working environment. This enables essential daily meetings, information sharing, collaboration and decision making. The radically new way of working brings its challenges and stresses for employees, however, the overriding response is resilience and resourcefulness, enabled by the earlier sustained investment in digital transformation.

1.1.2 Future inspiration

This publication also provides knowledge and inspiration to future land administration practitioners, faced with the task of responsibly redesigning, renewing and sustainably

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1   See: https://unece.org/member-states-and-member-states-representatives "The United Nations Economic Commission for Europe (UNECE) was set up in 1947 by ECOSOC. It is one of five regional commissions of the United Nations. UNECE's major aim is to promote pan-European economic integration. UNECE includes 56 member States in Europe, North America and Asia."

maintaining land administration systems. Therefore, the publication takes a broader perspective beyond the immediacy of the COVID-19 pandemic. Disruption, in its many forms, impacts upon all land administration systems, both pre- and post- the COVID-19 pandemic. Land administrators that recognize disruption as an ever-present, if not positive force, can leverage it to drive and implement change in their own organizations and society more generally. There is a strong correlation between effective land administration service delivery and successful digital transformation programs. The publication also acknowledges digital transformation comes with significant costs and consequences for implementers and users. It can intensify existing economic, social, and technological divides, especially for women and vulnerable groups. It is important to highlight the challenges and solutions in this regard and to discuss the limits of digital transformation in the context of ensuring no one is left behind.

1.2   Why is it needed?

Whilst there are many international and regional policy guides on good practices, designs, and implementations in land administration, this publication is the first in the post-COVID-19 pandemic period. It covers the unique drivers, responses, and design approaches inspired by the event, and new thinking and approaches emerging since. These are ready for documentation, synthesis, and sharing globally.

1.3   Who is it for?

1.3.1 Primary audience

The publication is intended for decision makers, leaders and practitioners working with land administration and National Spatial Data Infrastructure (NSDI) organizations, including those implementing the Integrated Geospatial Information Framework (IGIF) of the United Nations Expert Group on Geospatial Information Management (UNGGIM) (UN-GGIM, 2019). It provides high level guidance and practical case examples, aimed at both informing and inspiring these practitioners. It focuses more heavily on administrative law and operationalization, while recognizing the complimentary role of other actors, including judicial authorities, with regards to land transactions, dispute resolution, and delivery of preventive justice.

1.3.2 Secondary audience

The publication also provides for advocacy and awareness raising amongst higher-level government and donor organizations working in the assessment and financing of land administration improvement programs, or projects with land related aspects. Whilst the publication is not an academic work, it provides many references and materials to support educators and trainers in sharing and learning about the impacts and responses of the COVID-19 pandemic in the land administration sector.

1.4   How was it compiled?

The publication is a joint initiative of the Food and Agriculture Organization (FAO), UNECE's Working Party of Land Administration (WPLA) and the International Federation of Surveyors (FIG). It synthesizes materials from webinars, workshops, and projects conducted by those organizations within the UNECE region and beyond, during the COVID-19 pandemic period. These included coverage of challenges and developments from country representatives from across the UNECE region. It is these country case materials from which this publication is primarily derived, and this helps to justify and explain the se-

lected countries. The publication itself has been through multiple rounds of internal and external reviews by international experts and is endorsed by those organizations.

1.5   How should it be read?

1.5.1 Standalone

The publication is structured around seven chapters. It is written to enable each chapter to be read on its own, although the chapters work equally well as a whole, building on each other to relay the contemporary story of the COVID-19 pandemic response and digital transformation in land administration in the UNECE region. Each chapter is organized as a series of cascading questions that are responded using evidence from case country materials.

1.5.2 Sequential

Following Chapter 1, Chapter 2 unpacks the need to embrace digital disruption in the land administration and NSDI domains, paying specific attention to the COVID-19 pandemic. Chapter 3 explores the recent acceleration of digital transformation investments, revealing impacts and broader societal benefits. Chapter 4 looks forward, assessing where developments in digital transformation are headed, using emerging policy priorities, trends, and megatrends to reveal essential elements and future scenarios for land administration systems. Chapter 5 explores the challenge of implementation and the how to ensure the realization of benefits from investments. Chapter 6 goes beyond the UNECE region, exploring selected developments in digital transformation globally. Chapter 7 summarizes the key takeaways for land administration organizations moving forward.

1.5.3 Themes

Beyond the core themes of the COVID-19 pandemic and digital transformation in the domains of land administration and NSDIs, the publication also has 13 other cross-cutting themes, identified as of high interest for specific interest groups. These relate closely to the Sustainable Development Goals (SDGs). With only one exception, all themes are addressed in all chapters. Table 1 provides an easy-access reference guide.[2]

Table 1: *Recurring themes guide with reference to SDGs.*

	Theme	SDGs	Chapters 1	2	3	4	5	6	7
1	**Gender Equality and Poverty Reduction**	**1, 5, 10**	x	x	x	x	x	x	x
2	**Food Security and Agriculture**	**2**	x	x	x	x	x	x	x
3	**COVID-19 Disruption and Health**	**3**	x	x	x	x	x	x	x
4	**Capacity Development and Education**	**4**	x	x	x	x	x	x	x
5	**Climate Change, Environment, Energy and Disaster**	**6, 7, 12, 13**	x	x	x	x	x	x	x
6	**Economic and Financial Issues**	**8**	x	x	x	x	x	x	x
7	**Investment, Innovation and Benefits**	**9**	x	x	x	x	x	x	x
8	**Cybersecurity, Data Protection and Maintenance**	**9**	x	x	x	x	x	x	x
9	**Integrated Geospatial Information Framework (IGIF)**	**9**	x	x	x	x	x	x	x
10	**Data Quality, Openness, Standards and Analytics**	**9**	x	x	x	x	x	x	x
11	**Urban and Rural Divide**	**11, 15**	x	x	x	x		x	x
12	**Legal and Ethical Concerns**	**16**	x	x	x	x	x	x	x
13	**Partnerships and Collaboration**	**17**	x	x	x	x	x	x	x

(Source: Authors' own elaboration.)

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2   Appendix 2 provides a more detailed section-by-section coverage of the recurring themes.

1.6   What are the key terms?

1.6.1 Land administration

Land administration is a broad domain, being understood differently across disciplines and countries, however, commonalities are evident, and generalizations are possible. In this publication, the term is taken to include the process of determining, recording, disseminating, and maintaining information about the relationship between people and land (FAO, 2002). This includes the notions of land tenure, land valuation and taxation, land use planning, and land development. It involves a variety of associated professions and practice groups including land law specialists, registrars, notaries, conveyancers, surveyors, geodesists, spatial planners, land valuers, land developers, and IT and GeoIT specialists, amongst others. This publication focuses most specifically on land tenure aspects and administrative law. Land administration is seen as an umbrella term including the related terms of Land Registration and Cadastre (Adlington *et al.*, 2021).

1.6.2 Spatial Data Infrastructures

Spatial Data Infrastructures (SDIs) at the national level (NSDIs) are the guiding policies, networks, and standards that enable the exchange, dissemination, interoperability, and use of essential spatial data by governmental, citizen, private sector, and other actors (Crompvoets *et al.*, 2018; Masser, 2019). Since its first use in the mid-1990s, the term and concept have adapted and expanded as technologies, capabilities, and societal demands changed. The IGIF, endorsed by the UN-GGIM, provides global policy guidance for implementing NSDIs (UN-GGIM, 2019). SDIs can also be conceived at supranational levels, as exemplified by the European Commission's INSPIRE[3] directive, and at local government or enterprise levels. There is a close relationship between NSDIs and land administration. Land administration may directly use NSDIs to support service delivery. NSDIs rely on land administration to provide fundamental NSDI datasets and standards.

1.6.3 Spatial and other information on tenure rights

Land tenure is how societies regulate how people, communities and others gain access to land, fisheries and forests (FAO, 2022). Spatial and other information on tenure rights are any organized data pertaining to the administration of people-to-land relationships, including any entities and attributes on people or parties; land rights, restrictions, responsibilities, and related documents (including land tenure, valuation, land use planning, and land development aspects); spatial information including parcel boundaries, coordinates, and survey measurements; and any metadata supporting the land administration process. In the context of SDIs, land information can be considered a subset of geospatial information. (Spatial information is considered synonymous with geospatial information in this publication.) Lifecycle thinking (Kalogianni *et al.*, 2020) is increasingly used to understand and manage land, spatial, or geospatial information.

1.6.4 Sustainable development

Sustainable development is defined as per the SDGs (UN, 2015). Land administration and NSDIs are recognized as essential in achieving sustainable development, particularly through the Committee on World Food Security (CFS) Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (VGGTs) (FAO, 2022), first endorsed in 2012, and more recently the UN-GGIM IGIF and Framework for Effec-

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3   For a background and overview on the INSPIRE directive, see: https://inspire.ec.europa.eu.

tive Land Administration (FELA) (UN-GGIM, 2020a). Of the 14 fundamental data themes identified by UN-GGIM as essential in achieving the SDGs at country level, at least 11 are regularly under the mandate of land administration organizations.

1.6.5 Digital disruption

Disruption is a disturbance or interference to an event, activity, or process. Digital disruption occurs when the event disturbance emerges due to digital technologies, i.e. those technologies built out of Boolean logic and microchips. For land administration this includes data capture tools and sensors including total stations, Global Navigation Satellite Systems (GNSS), Continuously Operating Reference Systems (CORS), High and Very High-Resolution Satellite Imagery (HRSI/VHRSI), UAVs (Unmanned Aerial Vehicles), LiDAR (Light Detection and Ranging) and conventional digital orthoimages; data processing and storage software tools including GIS (Geographic Information Systems), CAD (Computer Aided Design), BIM (Building Information Modelling), geodatabases, mobile devices and apps, cloud technologies, crowdsourcing, blockchain (or Digital Ledger Technologies, DLTs), smart contracts and artificial intelligence (including automatic feature extraction); data dissemination approaches including online e-services, e-signatures, online services, application programming interfaces (APIs); and data visualization tools including web mapping services, 3D/4D animation, virtual reality and augmented reality. The term is increasingly used in business and government as a means for understanding and responding to changing societal demands driven by emerging digital technologies (Skog, Wimelius and Sandberg, 2018). Digital disruption should be seen as neither positive nor negative, rather it is ubiquitous in modern business and administration.

1.6.6 Digital transformation and acceleration

Digital transformation is considered an umbrella term describing the process of moving an organization or sector from a paper-based and manual service delivery mode, towards one that is fully mediated by digital technologies (Vial, 2019). Alongside increased efficiencies, it provides for the creation of entirely new digital products and services. The process is underpinned by supportive IT infrastructures within and from outside an organization. It demands organizations to be equipped with dynamic capabilities that enable digital opportunity identification, selection, and application (Teece, 2018). Digital transformation is a major focus area for land administration globally, regionally (European Union, 2022), and at the country level, and may form part of a whole-of-government digital agenda. Within the umbrella term of digital transformation, 1) **digitization** refers solely to the conversion of data and information from analogue to digital form; 2) **digitalization** is the adaption or redesign of existing business processes to take advantage of digital data and technologies usually for the purposes of increasing operational efficiencies, and may be considered as part of Business Process Re-engineering (BPR); and 3) **digital acceleration** or accelerated digitalization is the observed increase in instigation and implementation of digital transformation initiatives.

1.6.7 Benefits and impacts

The benefits and impacts of digital transformation investments into land administration are both direct and indirect. Investments directly deliver financial efficiencies, improved service experiences for citizens, and potentially new revenue streams. Additionally, they also deliver indirectly in alignment with other governmental polices and broader societal goals. This includes, via the servicing of spatial and other informa-

tion on tenure rights to broader government, improving inclusion of women and vulnerable groups; poverty reduction through land tenure security; enhancing climate-change adaptation and mitigation, food security, and clean energy policy responses; supporting innovation initiatives and responding to cyberthreats; and creating more sustainable cities and rural environments; amongst others. The 17 SDGs and related indicators offer a framework for governments to measure the benefit and impacts of digital transformation in land administration.

1.6.8 Women and vulnerable groups

Special attention is paid in this document to the challenges and solutions relating to land administration system access, inclusion, and safeguards for women[4] and vulnerable groups.[5] These groups are identified as being routinely denied access to essential services, including land administration services. The broad UN definitions pertaining to these groups are used in this publication.

1.7   Summary

Using the digital disruptions triggered by the COVID-19 pandemic as a starting point, this publication is about to share understandings for harnessing the opportunities of digital transformation in the UNECE land administration sector. The publication is made available to all land administration leaders, practitioners, and educators. It can be used for building new understandings, creating awareness, lobbying, and training purposes. It places a special emphasis on the challenges faced by women and vulnerable groups and seeks to show the direct and indirect benefits that investment into digital transformation of land administration brings to the achievement of national policy goals and the SDGs.

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4   For more information on international agreements related to women see https://www.unwomen.org/en/about-us/guiding-documents.
5   For more information on vulnerable groups see: https://www.un.org/en/fight-racism/vulnerable-groups.

2 EMBRACING DIGITAL DISRUPTION – ENSURING AND IMPROVING LAND ADMINISTRATION IN UNCERTAIN TIMES

2.1 What is disruption in land administration?

2.1.1 Disrupted era

Land administration systems seek to deliver stability (Zevenbergen, de Vries and Bennett, 2015) through the provision of available, accurate, authoritative, assured, and unambiguous (Bennett, Pickering and Sargent, 2019) information about who holds what land, where it is located, its value, how it is used, and how it could or must be used. These are important ingredients towards ensuring social, economic, and environmental steadiness (Williamson *et al.*, 2010) or sustainability. However, increasingly, land administration systems must be equipped to deal with disruption, whether it stems from internal or external sources. The global COVID-19 pandemic is the most recent large-scale disruption impacting land administration: it will not be the last. Responding poorly to disruption can halt service provision, or exacerbate issues of exclusion and digital division, particularly for women and other vulnerable groups. Responding well can mean rapid performance improvement in short amounts of time. Good responses don't just happen though. Coping with disruption demands whole-of-organization cultural change, underpinned by supportive change management policies, incentives, and capacity development programs. This leads to more agile, lean, and innovative decision making and operations. Land administration organizations need to understand the nature and impact of the disruptions they face.

2.1.2 Internal disrupters

Internal disrupters stem from within land administration organizations (Figure 2.1). These may include new internal leadership; reorganizations or restructures; new policies or legal requirements relating to land rights, restrictions, and responsibilities, including those relating to land data and process management; open data policies; new financing approaches or business models, including outsourcing of surveying or registration tasks and functions; implementation of new IT systems or quality improvement programs for processes and data, including dealing with legacy paper-based systems and cybersecurity issues; the push for the adoption of standards; the existence and promotion of innovation cycles within the organization; fostering or fragmenting of partnerships between business units; and new staff, skills and changing workplace demographics and values.

2.1.3 External disrupters

External disrupters occur outside land administration organizations, eventually impacting internally. These may be political/legal, economic, social, technological, or environmental in nature, although they usually manifest as a combination of forces (Bennett *et al.*, 2010; Turner, 2002) (Figure 2.2).

2.1.4 Political disruptors

Wars, conflicts, international law disputes, and post-conflict scenarios – for example, the Western Balkans across the 1990s, the Middle East migration crisis of 2015/16, and more recently wars between Russian Federation and Ukraine and Armenia and Azerbaijan –
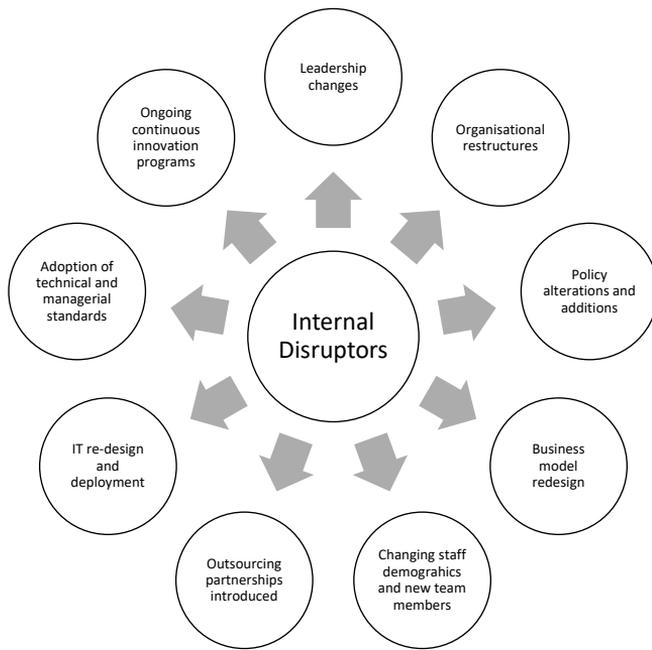
Figure 2.1: *Internal disruptors within land administration organizations.*
(Source: Authors.)
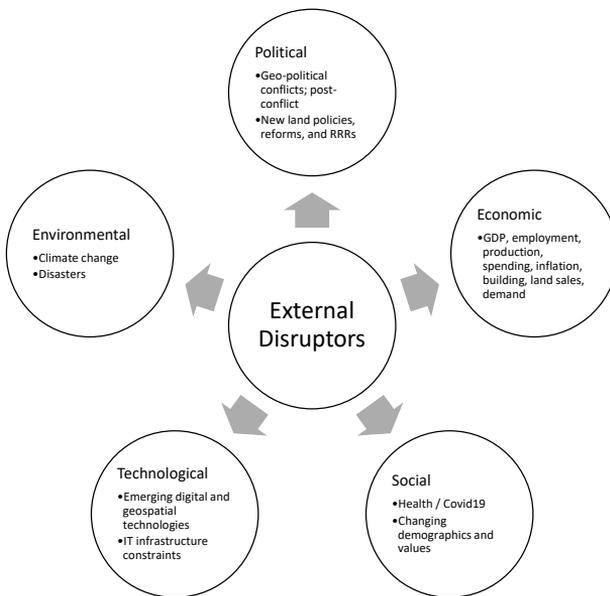
Figure 2.2: *External disruptors impacting land administration organizations.*
(Source: Authors.)

have significant ramifications for land administration systems. They create in-country economic instability that diverts resources away from the day-to-day activities of government. They can result in the cessation of land administration services sometimes by decree (to protect records and the property market), and sometimes by force (often accompanied by destruction of records). In countries with ongoing conflicts, such as Ukraine (Guenette, Kenworthy and Wheeler, 2022), spatial and other information on tenure rights are used to not only monitor the immediate concerns of built and natural environment destruction, but also medium-term concerns, including crop production and food security. In post-conflict contexts, land administration systems are used as a basis for peace building and bringing stability (Todorovski, Zevenbergen and van der Molen, 2016). This occurs through national land policy development, land reform programs, and legally redefining land rights, restrictions, and responsibilities (RRRs).

2.1.5 Economic disruptors

Economic upheavals such as the Global Financial Crises (GFC) starting in 2008, and the subsequent European Debt Crisis in 2011, might have localized causes, but significantly influence global land markets, impacting greatly on property sales and mortgage defaults. They directly impact on land administration organization finances and operations due to reduced transactions. Land administration systems may face financial pressures leading to lay-offs or cessation of digital transformation agendas. Conversely, high-level government stimulus measures may result in increased property market activity, putting strain on systems, processes, and human resources. Land administration systems can be an important tool for monitoring and evaluating economic disruptions (Bennett *et al.*, 2012).

2.1.6 Environmental disruptors

Environmental disruptors to land administration are typically climate-related natural disasters, impacting both urban and rural settings. In the UNECE, these include the recent flooding events experienced in Belgium, Germany, and the Netherlands in 2021; droughts and subsequent wildfires, regularly experienced in Portugal, Greece, or parts of Russian Federation; leading to impacts on food availability, particularly for vulnerable groups, due to price increases or shortages. Earthquakes and volcanic activity are also not uncommon in parts of Italy and Spain (See: Case 2.1). Marine environment degradation and waterway pollution are further examples. In these cases, land administration organizations, along with other government functions, must have rapid responses, be it through easy-to-access foundational datasets, online web services support, or fast-tracked or alternative land administration procedures to assist in re-settlement or rebuilding (Mitchell, Enemark and van der Molen, 2015).

> ### Case 2.1 – Volcanic disruption, digital reaction
>
> Volcanic eruptions along the Cumbre Vieja volcanic ridge on the Island of La Palma, part of Spain's Canary Islands, started on 19 September 2021 and lasted until 13 December 2021. Over 7,000 people were evacuated, and lava flows covered 1,000 hectares. Much surrounding land and property were impacted: 3000 buildings were destroyed, and the damage bill was estimated at almost EUR 850 million. All paper-based property registers were already digitized and secured: there was no loss of records. A special web service was swiftly set up, integrating land parcel, environmental and lava flow information, to support impacted citizens (Figure 2.3). Land Offices helped those whose land was damaged or lost, assisting them in proving

ownership claims, and eventually assisting in delivering adequate compensation. Whilst it was the first eruption since 1971, environmental disruptions like these are on the rise across the UNECE and beyond. The event reveals the importance of having reliable, interoperable digital geoinformation in place before a disaster strikes.
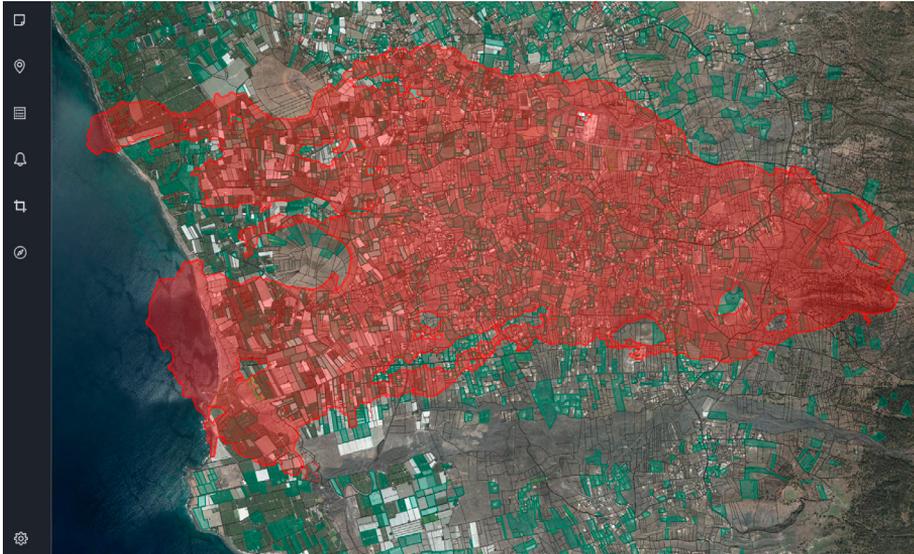
Figure 2.3: *Area affected by the La Palma volcano.*
(Source: Geoportal. 2022. Information Affected Cumbre Vieja Volcano,
https://geoportal.registradores.org/, accessed 20.04.2022.)

2.1.7 Social disruptors

Social disruptions, such as increased awareness and advocacy on civil rights for vulnerable groups and women, impact directly on the laws that govern land administration, including land rights recognition, recording, or the make-up of leadership teams within land administration organizations (Spichiger *et al.*, 2013). They also shed light on what may be perceived as corrupted or outdated land records and practices. As is explored in this publication, social health-related disruptors such as the COVID-19 pandemic can significantly impact on land administration operations and service delivery.

2.1.8 Technological disruptors

Technological disruptors in the current era are those usually associated with digitalization (Williamson and Ting, 2001). These include the continuing spread and uptake of high-speed internet technologies, online services, smart mobile devices, GNSS and CORS networks, UAVs, HRSI/VHRSI, freely available web mapping tools,[6] blockchain or DLTs, smart contracts, and cryptocurrencies. Embodied in the umbrella term '4th Industrial Revolution', land administration organizations must identify, unpack, understand, and form ways of dealing with all these external technological developments. The process is continuous. It may include adoption, diffusion, or even short-term rejection. Land administration systems require built-in technology scanning capabilities, enabling responsiveness, rather than ad-hoc reaction.

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6   Note: Whilst there may be no direct financial payment to use these services, indirectly users often pay by agreeing, knowingly or otherwise, to allow capture and use of the data relating to their use of the service.

2.2   What digital disruptions did COVID-19 trigger?

2.2.1 Working at-distance

By April 2020, most national and state Governments were seeking to 'flatten the curve' of COVID-19 cases by 'locking down' public and even private events and spaces. For most land administration organizations this meant the closure of physical service counters and back offices. Employees were required to work remotely, usually from home. These complete closures remained in place for weeks, months, and in some cases, even the majority of 2020 and 2021. Previous investments in digital transformation including on IT infrastructure and digital upskilling of workforces meant land administration organizations were well equipped to work 'at distance' and embrace a 'new normal' in operations (See Case 2.2). Organizations with several geographically spread physical offices converted them to hundreds or thousands of virtual offices, with individual land organization employees logging into networks via Virtual Private Network (VPN), or other means, to the services and platforms needed to facilitate delivery of services (See: Chapter 1; Case 1.1). In many cases, notaries, private surveyors, local government offices, and citizens had already long been completing dealings online prior to the pandemic. This situation continues with many employees still working only a fraction of the time in physical offices; and clients using available online services, avoiding the need to visit offices.

> ### Case 2.2 – Disruption? Deploy!
>
> It is May 2020, and despite initial concerns, many land administration organizations across Europe are ably dealing with the COVID-19 pandemic disruption – including the Kingdom of Norway and the Republic of Serbia. In Norway, the real estate sector, in dialogue with the health authorities, quickly establishes guidelines for infection control to enable Covid-safe property inspection of private and commercial properties (Figure 2.4). Through government stimulus and relaxation of purchaser capital holding requirements, finance is injected into the property market. Mortgage holders under stress are also supported. The cash interest rate is reduced to a historic 0%. Large amounts of the required property transaction communication and document handling are already digital. Solutions are communicated and embraced by the public. Sales volumes for second-hand homes increase by 7% and 36% for holiday homes. Nominal price values increase up to 12.5% across 2020 – see
>
>
>
> **Figure 2.4:** *Stakeholder dialogue and existing digital platforms enabled property market continuity during the COVID-19 pandemic in Norway.*
>
> (Source: Geving, C. 2021. *The impact of COVID-19 on the property market: Norwegian Association of Real Estate Agents' experience. In: COVID-19 and Property Markets: How is the pandemic affecting property markets in the UNECE region?* UNECE Webinar. UNECE, 15 April 2021. https://unece.org/info/Housing-and-Land-Management/events/354070.)
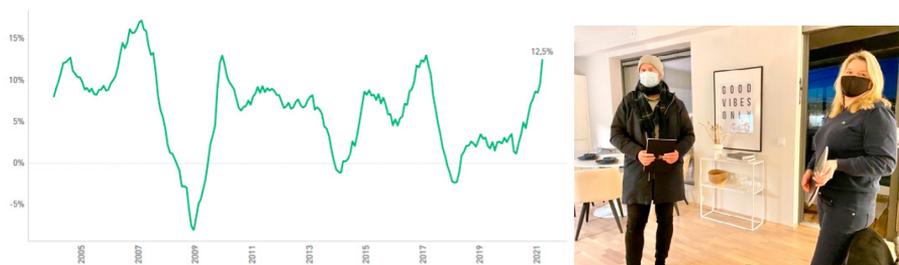
Figure 2.4. Coupled with appropriate government interventions, and an accelerated digitalization of land administration services, the property market thrives amongst disruption. In Serbia, despite initial drops in property market activity and challenges with high numbers of ill and quarantined staff, 2020 ends up being the strongest year in a decade (Adlington et al., 2021). To cope with the high demand, the country uses its online services developed prior to the pandemic, eliminating the need for citizens to visit land administration offices, where before up to 5 visits were needed. Citizens had previously continued to go face-to-face, but the pandemic creates the emphasis for mandatory digital submission of mortgage applications and registration, via notaries, for all new cases. Coupled with motivated citizens, there is spiked demand for online services. Norway and Serbia embrace disruption, deploy digital solutions, and do not falter.

2.2.2 Online service spikes

Initial anticipation was that lockdowns would mean a substantial drop in economic activity, the property market, and land administration operations. Whilst short-term dips were experienced in share markets and property markets, many markets in the UNECE showed resilience, bouncing back to pre-pandemic levels in months (See Case 2.2), and some even experienced unprecedented growth.[7] The challenge for land administration was to cover the increased demand for online services: e-services enabled by web and internet technologies were crucial. In some countries, like Norway, key services were already available online including property information searchers (of databases and scanned archives), lodging, and checking/verifying lodged documents, and disseminating land information, titles, or deeds. In others, land administration organizations were still offering parallel physical and online services. Here, the lockdowns resulted in most services being moved fully online or heavily becoming paper-digital hybridized. In Serbia, the move online is estimated to have saved over 6 million hours in queue time for customers. In Croatia, the number of e-service transactions rose from approximately 25% of cases pre-pandemic, to 85% during the pandemic. In situations where only portions of processes were digitized – for example, the lodgement of an information request, such as at the Cadastre Committee of the Republic of Armenia – a small drop in overall transaction requests was observed in early 2020, before immediate spikes later in 2020 and 2021. This was because physical counter service was still necessary. Transaction backlogs therefore mounted and delayed the workload spikes.

2.2.3 New customers and data analytics

The pandemic also spiked demand for spatial and other information on tenure rights, including geocoded parcel and address information. Health and emergency services became key users for pandemic-related purposes including mapping infections, monitoring and enforcing lockdowns, delivery of aid and food, identifying and combating the tenure insecurity caused by lockdowns, and supporting innovations in the land market (e.g. enabling e-inspections, digital auctions, and proliferation of the use of e-signatures). The land market was also recognized by governments as a key enabler of post-lockdown economic recovery. Earlier investments by the land sector in creating

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7   Note: Several factors were at play here. Economic stimulus measures including reduction of interest rates by central banks and the release of funds into the economy by central governments eased credit access. Funds flowed into property investment. Social lockdowns provided 'mental space' for individuals to reappraise livelihood options and living circumstances, including property arrangements. Across many countries, already high levels of internet uptake and mobile proliferation meant large parts of the community already conducted significant portions of social, business, and government activities fully online.

property data supply chains, data warehouses and data analytics capabilities enabled value-added service providers to offer close to real-time property market analytics services. These services had flow-on benefits to government policy makers and the land sector more broadly, including real-estate agents (See: Case 2.3).

Case 2.3 – Data analytics from disruption

Prior to the pandemic, the land administration organizations of the Federation of Bosnia and Herzegovina[8] and the associated Republic of Srpska, implemented an integrated sales price register. Like other federations, the two entities have different property registration legal frameworks, institutional arrangements, and IT systems. The new database focuses on technology and data interoperability, bypassing the need to tinker with institutional arrangements. It hosts all real estate transactions, and for the first time enables holistic monitoring and analysis of the real estate market, public access to the property market data (Figure 2.5), and reporting to other parts of government. It makes possible interoperable procedures for the registration of transactions and increases confidence in real estate transactions. Notaries lodge documents via a web portal into a central database. Information on property descriptions, sales information, transactional status, and the scope of rights on properties is publicly available. Regular reports include statistics of property buyers and sellers classified by gender: this helps to monitor gender-related SDG indicators. The sales price register was monitored during the COVID-19 pandemic. The country initially experienced a dip in sales in early 2020, but soon recovered with 2020 sales outdoing 2019. The land administration organization of the Republic of Serbia had similar results with its integrated sales price register.

Meanwhile, 'Housing Lab' based out of Oslo in Norway uses freely available and up-to-date property market data to create the 'Bubble Index'. This allows near-real-time
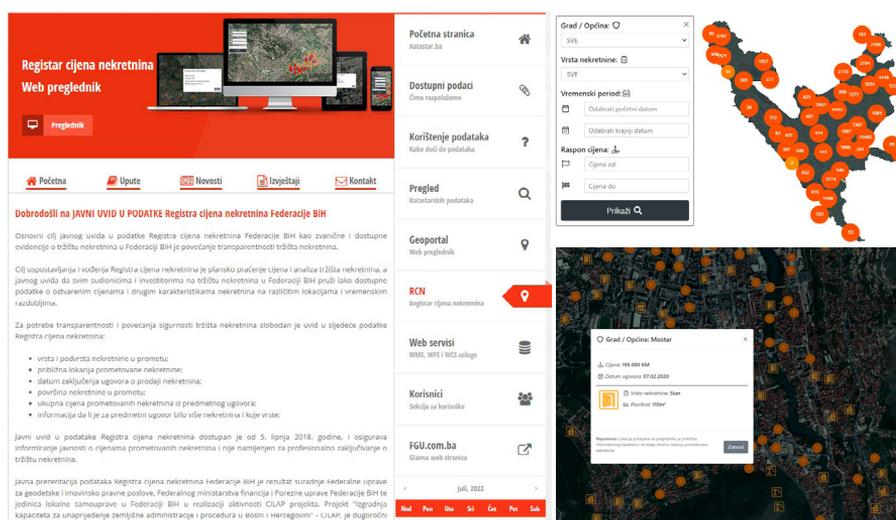
Figure 2.5: *Bosnia and Herzegovina's Sale Price Register delivers property market analytics capabilities to citizens and other government agencies.*

(Source: Zelić, J. 2021. *Sales Price Register and impact of COVID-19 on the property market in the Federation of BiH. In: UNECE Webinar: COVID-19 and Property Markets: How is the pandemic affecting property markets in the UNECE region?* UNECE, 15 April 2021. https://unece.org/info/Housing-and-Land-Management/events/354070.)

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8   Note: Also includes the District of Brcko.

> monitoring for property market decision makers to assess whether prices are over-valued – highly important, given the COVID-19-driven increase in market activity. The Land and Business Registrars of Spain offer open data and statistics from land businesses and mobile property registers. The data is collected and analysed at set periods, helping citizens and decision makers understand the market status in terms of volume, price, and transaction origin (national or international). These statistics were crucial for decision making during the COVID-19 pandemic.

2.2.4 Technology scale-up

The COVID-19 pandemic delivered a swath of managerial and technical challenges for land administration organizations. Demand increase for online services was felt across all sectors and placed increased demand on backbone high-speed internet infrastructure. This could have resulted in the need to rapidly scale-up and scale-out web servers in land administration systems. However, as many transactions were already partially or fully using these platforms prior to the pandemic, and because service demand spikes were not immediate, but rose in the latter half of 2020, there is little documented evidence that IT infrastructure failed to cope. Though in some cases, the backlog of paper-based lodgements caused by lockdowns required extra staff effort in 2021.

2.2.5 Legislative readiness

Prior to the COVID-19 pandemic many UNECE systems had already moved towards recognition of buyer and seller e-signatures for land transactions, thanks to previous efforts to modernize legislation, implement regulations, and related business processes. In 2018, Serbia, working with the World Bank, invested significantly to simplify the legal framework governing land administration processes, resulting in more interoperable IT infrastructure, data, and seamless processes (Figure 2.6). The pandemic motivated

2016 **2019**
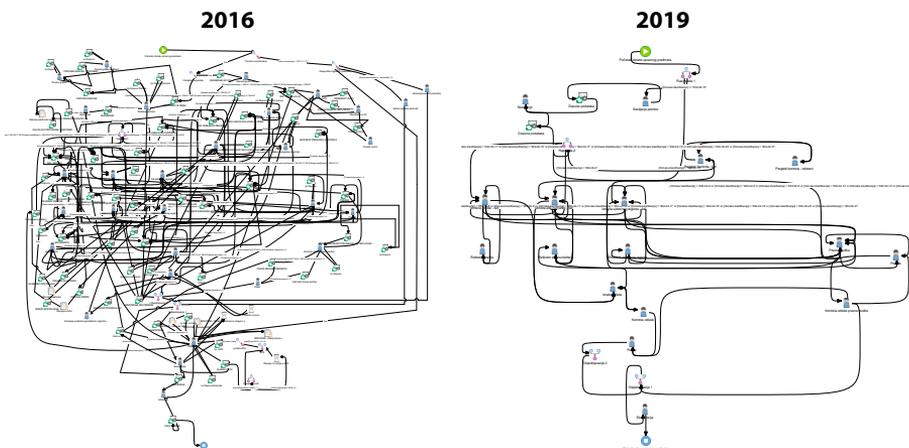
Figure 2.6: *Serbia radically simplified its legislative framework and business processes relating to property transactions prior to the pandemic. Note: Each line represents an interaction and each node represents an actor.*

(Source: Draskovic, B., Vucetic, D. and Tonchovska, R. 2021. *Geospatial Information in Response to Covid-19 Pandemic Serbian Experience. In: FIG e-Working Week: Smart Surveyors for Land and Water Management – Challenges in a New Reality*. FIG, June 2021; Vucetic. 2021. *Geospatial Information in response to COVID-19 pandemic – Serbian Experience. In: NSDI, geospatial data and technology: The role of geospatial and cadastre agencies in the COVID-19 pandemic response*. UNECE Webinar. UNECE, 11 May 2021. https://unece.org/housing/events/nsdi-geospatial-data-andtechnology.)

the full utilization of those laws and saw rapid uptake of digital services, backed by e-signatures.

In other cases, legislation still favoured paper-based wet signatures as the legal point-of-truth. This was a challenge for 'at distance' land administration: people still needed to go to land administration offices. Legislative changes are notoriously lengthy processes, especially with parliaments either being in hiatus or heavily focused on COVID-19 pandemic responses. However, there were examples of swift legislative amendment during the COVID-19 pandemic (see Case 2.4), and in other cases, land administration practitioners collaborated to create temporary workarounds. In Croatia, whilst customers could not enter land offices, security guards practicing Covid-safe measures were enabled to courier documents from citizens to land administration staff. In France, where notaries often facilitated transactions in-person, use was made of online meeting tools and two notaries per transaction, to verify the identities of participants. As many legislative frameworks move towards full legal recognition of digital lodgment and digital signing, there is also recognition amongst UNECE countries of the need to ensure that land interests and rights of vulnerable groups remain protected. This means ensuring digital inclusion, women's access to new technologies, protection of human rights in the digital era, and promoting trust and security in digital environments are part of any legislative reform package. The UN General Assembly (UNGA)[9] and Secretary General (UNGS) have issued specific resolutions and supportive roadmaps on these matters.[10]

Case 2.4 – Legislative responses for disruption

By mid-2020, Finland's land sector, with government support, creates the 'Act on the temporary procedure for holding cadastral survey meetings' under the Real Estate Formation Act. Driving proposal 48/2020 is that implementation of major infrastructure projects requires statutory cadastral survey meetings, often numbering more than ten landowners. People often come from all over the country. Organizing the meetings during lockdowns is problematic due to travel and social-gathering restrictions. Until the end of June 2021, the law allows for electronic meetings as well as in the written procedures for real estate formation. The law also allows for parties unable to attend cadastral meetings to send a proxy representative. Despite the exceptional situation caused by COVID-19, cadastral surveys and work in the terrain continue as before. Meanwhile, in Spain, a Royal Decree and two resolutions impacted on the land administration operations of Land Registries. In general, these involved temporarily reducing requirements on land market participants. Limitation periods on land registration processes were relaxed to avoid expirations and provoke damages. The prescribed time for Land Registries to issue documents was increased by 15 days. Moratoriums on foreclosure were introduced to support financially stressed mortgage holders. The time limit for providing publicity by electronic means was increased. Simple note requests into Land Registries were permitted via email. Employment contacts of Land Registry workers were adapted to enable work from home whilst also ensuring data protection.

2.2.6 Financial windfalls

Government budgets were heavily impacted during the pandemic: government borrowing and spending were dramatically increased, and tax revenues decreased. Many

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9   The specific UNGA resolution is: UNGA Resolution A/RES/70/125 (2016).
10 For more on the UNGS roadmap see: https://www.un.org/en/content/digital-cooperation-roadmap/.

land administration systems weathered initial downturns in the property market and went on to post impressive, if not best-ever, figures across 2020 and 2021. This trend was experienced across most, if not all, UNECE countries. Depending on the business model and financial status of the land organizations, this meant some profits could be driven back into digital transformation initiatives, staff benefits or recruitment. In other cases, land administration revenues provided an important source of income to support other areas of government.

2.2.7 Spotlight on standards and data quality

The quality of digital products became more apparent as services moved fully online, and more reliance was placed on the data created by customers (via online forms), and on digital archives/repositories (versus historic paper archives), and digital product dissemination. The pandemic helped to shed light on areas where digitalization processes had been less than optimal – revealing issues with accuracy, validity, completeness, duplication (or uniqueness), consistency and temporal quality. This raised the opportunity to advocate for resources to improve textual and spatial data quality – and move towards more standardization. In contexts where standards were in place, challenges of developing applications to support pandemic operations were far more easily implemented (See: Chapter 4; Case 4.2).

2.2.8 Cooperation and awareness

Land administration and NSDI organizations that had previously invested in partnership building arrangements, potentially via IGIF interventions, were better placed. With lines of dialogue and service agreements already established prior to the pandemic, swift development of new pandemic related services, or alternative modes of land administration service delivery, were more easily enabled. In other cases, the lack of partnerships revealed the opportunity and use cases to work on external relationships with other government organizations, businesses, and the community.

2.3 How can land administration better embrace disruption?

2.3.1 New normal, no choice

The COVID-19 pandemic and other disruptions showed the benefits for land administration organizations that embrace disruption. It helped the acceleration towards the 'new normal' service delivery mode. Organizations that do not adapt may find they are increasingly caught out, having neither the plan nor the ability to change service delivery modes at short notice. They may face public backlash and political pressure. The demand for digital land and property services will not decrease post-pandemic. Digital disruption continues to be a major influence on land administration organizations' strategies and operational designs. Organizations must have a plan for recognizing and responding to disruption.

2.3.2 Deal or demise

Once disruption is accepted, it can be dealt with. There are now many guides and approaches applicable to both business and government. The A6 model offers Avoid, Analyse, Attack, Acquire, Ally and Alternative (Huntley, 2019). For land administration organizations, 'avoid' is no longer realistic: denial of the need for online services is not accepted by the land sector, broader customer base, and only exacerbates longer-term fall out. 'Analyse' may involve observing how other land administration organizations

respond. It can be an astute approach, holding out on technology uptake, waiting until they mature to a level that enables responsible deployment. However, it often ultimately means e-service development in land administration lags behind other sectors. The evidence for the benefits of embracing digital disruption is now significant, especially post-pandemic. Land administration organizations are moving beyond this passive approach. 'Attack' involves rebutting the technological opportunity, exposing weaknesses, and downplaying the benefits of it. The initial rebuff of blockchain technologies by parts of the land sector provides a recent example, despite the technology being successfully deployed in the finance and currency sectors. This approach usually only applies short-term. 'Acquire' and 'ally' involve buying-out or buying-into a technological solution or ecosystem. Whilst some land administration organizations continue to develop in-house IT solutions, the 'acquire' and 'ally' approaches – via outsourcing and public-private partnerships – are increasingly used to scale-up IT infrastructure, services, and capacity. However, the approach also comes with the responsibility to ensure service level agreements and other contractual arrangements are in the best interests of citizens and are enforced. 'Alternatives' require investigation of what similar organizations do and strategies to do something radically different. This approach has less relevance for land administration organizations. Globally, land administration organizations tend to seek to share lessons, knowledge, and learn from each other, building consensus on the best way to deal with a specific disruption.

2.3.3 Journey with allies

Of the available approaches, those based on partnership building with other government organizations, private sector bodies, professional peak bodies, community groups, and the tertiary sector, appear most promising for land administration organizations (See Case 2.5). The responsibilities and mandates that land administration organizations carry, mean they are necessarily more risk-averse, and this lends well to partnering with organizations able to operate in the agile, innovative, and lean ways needed for adoption, adaption, and deployment of digital technologies. In many cases, potential partners for land administration organizations are already on the same journey. For example, at the international level, the International Union of Notaries (UINL) already collaborates with FAO to outline the opportunities the digital era brings with regards to technologies and techniques to support preventative justice in the context of land tenure security (FAO and IUNL, 2022). There are many examples of government land organizations using the approach to accelerate digitalization initiatives. These are shown to produce sustainable longer-term results for not only organizations, but the administration of land and public well-being more broadly.

> #### Case 2.5 – Allies out of disruption
>
> Finding allies to deal with disruption suits the land administration sector: the rights, restrictions and responsibilities over land are complex, as are the diversity of stakeholders involved. This includes banks, courts, notaries, registrars, lawyers, surveyors, planners, valuers, and other government organizations. Spain passed a law in2015 to ensure coordination between Land Registries and the Cadastre and the combining of digital legal and spatial information. This led to the development of the GEOBASE platform that enables both registration and presentation of geographic information in Land Registries. It helps to identify encroachment on public lands or breaches of planning laws. During the COVID-19 pandemic, across many UNECE countries collaborating with health authorities and land administration organiza-

tions, many notaries visited clients and made transactions possible, to fulfil their legal duties. Serbia's land administration and NSDI organizations already collaborated prior to the pandemic to improve land administration services and NSDI (Figure 2.7). The pandemic motivated these authorities to expand data sharing services beyond the Ministry of Interior, to those dealing with agriculture, taxation, and local government. They connect directly with the taxation authority's citizen register. New data provision arrangements and online services are established with emergency services, police, fire service, crisis staff, postal service, food delivery, and humanitarian organizations – all to support COVID-19 responses. The 'ally' approach goes beyond borders, with Serbia's land administration and NSDI organizations regularly working with international donors to improve systems. The approach brings international knowledge and finance rapidly into the organization.
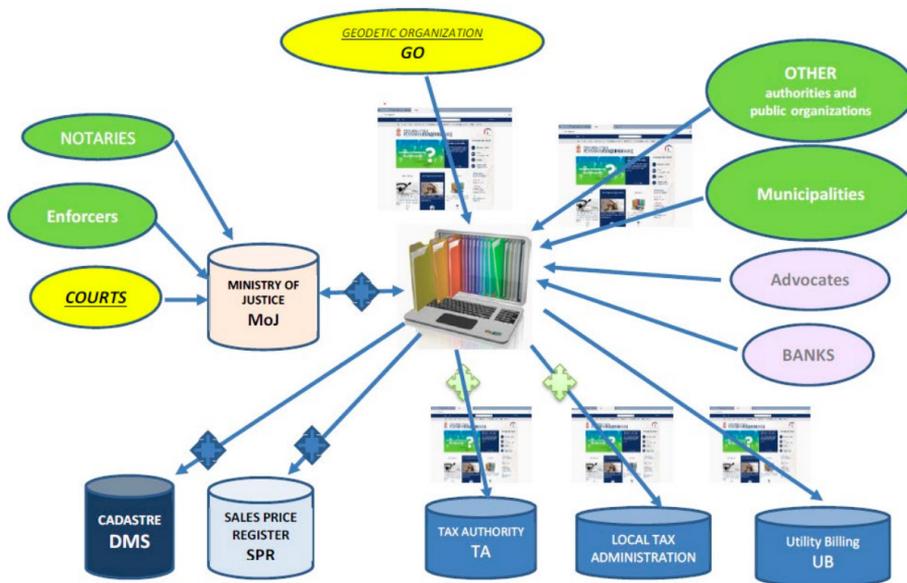
Figure 2.7: *Serbia's land information ecosystem of allies.*

(Source: Zelić, J. 2021. *Sales Price Register and impact of COVID-19 on the property market in the Federation of BiH*. In: *UNECE Webinar: COVID-19 and Property Markets: How is the pandemic affecting property markets in the UNECE region?* UNECE, 15 April 2021. https://unece.org/info/Housing-and-Land-Management/events/354070.)

2.4 Takeaways and recommendations

The COVID-19 pandemic is the most recent disruptor for land administration. Systems must perform under uncertain internal and external conditions. This is expected by governments and demanded by citizens. Those land administration organizations that were digitally prepared for the pandemic quickly pivoted and offered e-services 'at distance' and deployed a remote workforce model. They developed entirely new data products and services for new needs and clients. Others were more limited in their ability to respond. Land administration organizations faced challenges adapting laws, quickly building new partnerships, ensuring short-term financial stability, dealing with data quality issues, and examining the need to scale IT infrastructure. Land administration organizations must build a culture that embraces digital disruption. If capacity in-house does not exist, it may be necessary to find allies and build local knowledge ecosystems and international partnerships to expedite the process.

3 UNDERSTANDING ACCELERATED DIGITIZATION – LEVERAGING LAND INFORMATION FROM LAND ADMINISTRATION

3.1 How is land administration accelerating digitally?

3.1.1 Pivoting under pressure

Land administration systems have tended to evolve over time, via the pull forces of changing societal demand, and the push forces of technological development (Asiama, Bennett and Zevenbergen, 2017; de Vries, Bennett and Zevenbergen, 2015). Land administration organizations have generally tempered demands for high-speed change against the need to ensure service provision remains always-on and accessible-to-all. This approach is increasingly under pressure. During the COVID-19 pandemic, the key requirement at the onset of lockdowns was to keep the property market open. This was despite citizens being unable to leave home and non-essential businesses and government offices being closed. In Spain, an initial reduction of up to 74% of documents presented for registration was experienced in some areas. The pandemic created urgency for accelerating digitalization from front office to back office. Land administration organizations had to pivot. Countries with robust digital infrastructure plans were able to continue service provision (See Chapter 2). In Spain, this meant the market came roaring back after the land administration organizations had pivoted. Some organizations even accelerated plans for further digitalization in the areas of end-to-end e-land conveyancing (Tomasic, 2022), geospatial data management, and extension of value-adding digital services.

3.1.2 Leveraging existing IT investments

The importance of robust IT infrastructure cannot be overstated. The ability to scale-up e-services at the start of the pandemic revealed the differing digitalization rates between countries. In the Republic of Serbia (Vucetic, 2021), its GeoSrbja platform, established prior to the pandemic, surged in use only after the pandemic hit. The same trajectory was seen in Russian Federation (Martynova, 2021) where the drive to scale up infrastructure was fuelled by the heightened residential property markets. Its *digital platform* saw a marked increase in users after the first lockdown. Croatia (Fuckar and Simic Rukavina, 2021) also showed a smooth transition into e-services. The United Kingdom of Great Britain and Northern Ireland (Harlow, 2021) showed a slower take-up rate, with there being less legislative backing. In some cases, rather than merely keeping the market going, land administration organizations went further, leveraging off earlier efforts to modernize legislation to support digital land administration; or simply making use of IT infrastructure and services that were previously underutilized.

3.1.3 Fast tracking e-conveyancing

In the United Kingdom (Case 3.1), fast tracking included refocusing on long-standing efforts to support e-conveyancing, including placing attention on witnessed and *qualified* electronic signatures, and improving security controls within existing digital platforms (Harlow, 2021). In the Russian Federation, it involved the provision and collection of registry data via the newly Unified Register of Real Property (Litvintcev, 2021). Though seemingly smooth, issues were encountered that related mostly to transactional security concerns or legal impediments linked to outdated legislation that could

not be easily solved. In Spain, e-conveyancing sat between these two extremes, where certain processes had already been developed prior to the pandemic, but the lockdown made it necessary to scale up operations. In Germany, already since 2007, notaries had communicated via a secured electronic connection and transmitted authenticated deeds electronically to the commercial register. The arrangement likely prevented a slowdown of the conveyancing rate during the lockdown.

3.1.4 Becoming user, purpose and data driven

The COVID-19 pandemic brought into focus the fundamental value of good quality data for decision making. Tracking the spread of infections, providing emergency supplies, enforcing stay-at-home restrictions, monitoring food insecurity, and tenure security all required good quality land information. Many contexts had in place good quality address, parcel, and tenure information, backed by continuous improvement processes, including improving quality measurements, mandated error reporting, and automated validation. Others were found wanting. E-services, mobile apps, and cloud utilization are irrelevant if data quality is not aligned with the user needs, or the purpose for which it is to be used. Completeness, validity, uniqueness, consistency, timeliness, and accuracy in datasets need to be aligned to the principles of FFPLA – especially with regards to cadastral boundaries, building footprints, land use, land value as well as indicating rights, responsibilities, and restrictions. Without these characteristics, technological innovations lose credibility and users are dissatisfied. It is also important to look at the practical limits of digital transformation, vis-à-vis the user expectations and confidence. Certain processes may be viewed as too sensitive to be undertaken online, especially relating to legal processes (Tomasic, 2022). The extent to which the users feel comfortable with the online processes should be considered with respect to the legal provisions.

3.1.5 Fostering dynamic capabilities

The COVID-19 pandemic revealed many land administration organizations already embracing dynamic capabilities (Teece, 2018) involving the active 'sensing' and 'seizing' of digital opportunities and transforming of sector-wide processes. Whether these were innate to the organization or strategically developed in-house as part of capacity building programs is unclear. The capabilities allowed for re-invention in response to immediate societal needs. Embedded contextual 'sensing', in place prior to the COVID-19 pandemic, enabled swift identification of digitally related threats and opportunities (Schippers and Rus, 2021), while 'seizing' enabled action and financing of immediate digitalization decisions. Lockdowns converted physical back offices to virtual networked working environments, and face-to-face counters to online service portals. 'Transformational' abilities were exhibited in the modification of business processes. In some contexts, entirely new e-conveyancing processes were instigated. Elsewhere, countries with existing parallel e-conveyancing processes saw quick and almost full adoption. That said, some still saw the pandemic as a short-term interruption or emergency response, and not a 'new normal'. It is however worth noting that current indicators point to the continuance of online measures.

3.1.6 Utilizing emerging geospatial technologies

A new wave of experimentation and innovation continues (See: Chapter 2) to be taken up in the land sector, including explorations of blockchain technologies (Bennett, Pickering and Sargent, 2019; Müller and Seifert, 2019), smart contracts (Bennett *et al.*, 2021), crowd-

sourced land information, VHRSI, HRSI, LiDAR, UAV-derived imagery – all backed by FFP-LA (Enemark, McLaren and Lemmen, 2021) thinking. In contexts such as the Netherlands, artificial intelligence is being used to support the whole-of-dataset improvement of the spatial accuracy of cadastral fabric (Bennett *et al.*, 2020). In Kyrgyzstan (Wills, 2022),using an FFPLA approach, the capture and use of orthophotos resulted in a 75 percent reduction in costs (from USD 53 to USD 13.5 per parcel/building). Lessons from this case study show, however, that there is still the need for political backing, and a new legal and regulatory framework that will support the resultant data from FFPLA.

Case 3.1 – Sensing and seizing digital change

The one main concern for Her Majesty's Registry in early 2020 (HM Registry – the Land Registry Service of England and Wales) is to keep the property market open. The first action is to deal with completion services, allowing documents under processing to keep their place in the queue and avoid unnecessary delays (Figure 3.1). A combined legal and technical solution, aimed at taking paper out of the system, is implemented within the Registry. After the first lockdown, as government stimulus is unleashed, including a reduction in transaction taxes, the residential housing market comes roaring back. HM Registry allows for physical distancing and remote participation in the conduct of business. They introduce the Witnessed e-Signature, the Qualified e-Signature, and the Digital Identity Check. Developed at the start of the pandemic, they are envisaged to be the basic building blocks of the paperless conveyancing system. They are a success! However, the development of a secure whole-of-sector digital platform is slower: strict conveyancing processes and semantics impede rollout, although a strong collaborative spirit is maintained between spatial and conveyancing institutions. E-conveyancing is now understood as not just an emergency response, but a foundation for future digitalization efforts. Meanwhile, German and Spanish notaries create a platform called EU-Doc that allows notaries from one European country to transmit electronically authenticated documents to another to verify the authenticated signatures. This system will allow for a completely paperless communication of deeds that can be used for purposes of land registration.

"Sectors such as property that are reliant on physical interaction must adapt at lightening speed to survive." – *Estate Agent Today, 16th March 2021*

"Buyer Beware of bottlenecks to get completions over the line" – *Inside Conveyancing, 17th March 2021*

"PropTech needed for agents to cope with soaring transactions" – *Estate Agent Today, 16th March 2021*

"Having earlier access to property data and a faster view of critical insights is fundamental" – *Today's Conveyancer, 16th March*

"Get Britain Moving: join our campaign to improve home buying and selling" – *The Times, 15th March 2021*

"multiple tales of loss and grief as some buyers take up to five attempts to secure a home" – *The Times, 15th March 2021*

Figure 3.1: *Sensing societal agitation, HM Land Registry seized upon digital opportunities.*

(Source: Harlow, M. 2021. Working Towards a Truly Digital Conveyancing Process. In: *Accelerated Digitalisation: The impact of the COVID-19 Pandemic on the Land Administration sector.* UNECE Webinar. UNECE, 22 March 2021. https://unece.org/info/events/event/354013.)

3.2 How is NSDI development also accelerating?

3.2.1 Responding to the health emergency

First up, the start of the pandemic created an opportunity for NSDI stakeholder organizations to show their abilities to quickly adapt to the changing context. This included making possible links between the health sector, emergency services, and law enforcement, to support tracing the outbreak, monitoring hospital service levels, enforcement of quarantine and lockdowns, and later vaccine rollouts. In the case of the Republic of Srpska (Svitlica, 2021), part of the Federation of Bosnia and Herzegovina, one of the key goals was to provide information for critical services such as medical emergencies, food delivery and COVID-19 case tracking. Later these flowed into the need to monitor the aid, food security and tenure security of vulnerable and minority groups impacted by the pandemic. NSDIs and related organizations showed the dynamic capabilities required to sense, seize, and support the rapid transformation of emergency services.

3.2.2 Improved awareness and recognition

Land administration organizations integrate into broader NSDI initiatives (Wallace *et al.*, 2006). This is anchored on the nine strategic pathways of the IGIF as a mechanism for harnessing spatial and other information on tenure rights, towards integrating various government services, especially during the pandemic. Out of the 14 fundamental spatial data themes identified by UN-GGIM as critical for every nation, 11 regularly fall under the mandate of land administration authorities, including the geodetic reference frame, addresses, buildings and settlements, geographical names, land cover and land use. NSDIs gained in importance and prominence during the COVID-19 pandemic. Interoperable spatial and other information on tenure rights, available via mature web portals and APIs, were essential to the delivery of a variety of pandemic-related government services from health and emergency response, economy management and stimulus, border protection and social security, and societal development. The challenge is funnelling this heightened awareness into more sustainable NSDI capacity building around IGIF's three main areas of influence: Governance, Technology, and People.

3.2.3 Servicing new sectors and demands

Beyond the unified goal and goodwill of the COVID-19 pandemic response between geospatial data custodian organizations, the event sparked the development of new services and products; new customers; new suppliers and data providers; and new modes of service delivery including those linked to social inclusion, agricultural production, the built environment, forestry, environmental stewardship, and government accountability. NSDIs with appropriately set regulations, standards, and networks could provide the necessary underlying infrastructure. Other sectors with actors from both the private and public sectors could build appropriate tools atop these layers, to capture, manage, aggregate, and disseminate required information and services. Developments include new sources of data stemming from artificial intelligence and crowd-based sources.

3.2.4 Standardizing and opening data

The data-driven response to COVID-19 revealed data quality variation between fundamental datasets and the need for improved interoperability. The use and development of country-level data standards development, including those of INSPIRE, OGC, and ISO (including LADM), is now underway in Moldova. In the Republic of Serbia (Vucetic,

2021), a collaborative online platform brought the collection and provision of spatial data under one umbrella, for the creation of spatial registers. They also developed and maintain an e-Cadastre via the creation of these spatial registers, as well as provided critical datasets for the response to the pandemic such as guiding lockdowns, tracking people in isolation and information on food security. The COVID-19 pandemic also drove momentum for increased open geospatial data, either available for viewing on a map, or full download. Novel services relating to the pandemic response including local neighbourhood virus tracking, lockdown perimeter mapping, QR code check-ins, covid-safe mobility apps, and delivery services, all relied on openly available foundational geospatial data layers. In many cases, these arrangements were already in place, including in Poland and the Netherlands, where the central government provides subsidies to ensure key datasets are available and accessible, or for free. Kyrgyzstan's (Wills, 2022) Fit-for-Purpose creation of orthophotos (Enemark, McLaren and Lemmen, 2016) is said to inspire more trust due to the engagement process used with citizens.

3.2.5 Enhancing government partnerships

The new data demands drove home the importance of collaboration and cooperation between organizations collecting geospatial data. Land administration organizations and allied geospatial information data collectors found new common ground and shared goals. The collaborations and partnerships that were formed were mostly emergency responses, however, the foundations were laid before the pandemic (UN-ECE, 2021a). In Russian Federation (Litvintcev, 2021; Martynova, 2021), the basic structure for the GIS Federal Fund for Spatial Data and the GIS Unified Digital Cartographic Framework was developed before the pandemic, and the pandemic served as an accelerator for its development. In the Republic of Serbia (Case 3.2), a similar trend was experienced, with the basic framework for a unified body for the collection and provision of all geospatial data, resulting in the development of Geosrbija, a collaborative platform for geospatial data sharing (Vucetic, 2021).

3.2.6 Activating citizens and business

Apart from government organizations, the COVID-19 pandemic activated private citizens and private businesses to share data for the greater good, even with the government. This was facilitated by faster wireless internet networks, including 5G enabled use of crowdsourcing via online platforms and especially mobile apps (Tonchovska, Kelm and Coote, 2022). This approach relies on people feeling in control of their data and the promise of data-driven decision-making. Generally, citizens and businesses are less willing to share information with the government than with other private citizens and other organizations, for example, via social media platforms. NSDIs and land administration organizations need to further explore tools and learn to provide the best control for users on how their data is shared and used. Lessons can be learnt from capacity development programs in other sectors, such as digital wallets for e-identity, personal online data spaces and emerging intermediary services.

3.2.7 Focusing on cybersecurity and privacy

The three main areas of influence of the IGIF – Governance, Technology, and People – centre around the ever-important issues of cyber security and privacy. Responses to the COVID-19 pandemic drove integration, sharing, and exchange of data, along with issues of digital privacy, digital security, cyber threats, and their accompanying national security aspects (See: Chapter 4 for more). This is further exacerbated by the increased

use of artificial intelligence and machine learning across government and private businesses. It remains a challenge for governments to balance the ethical concerns of prior and informed consent and protection of personal data against the desire for improved, innovative, and more timely service provision. NSDIs and land administration systems have long histories of seeking to secure and protect transactions and data – including identities and related land information. This issue is critical in the process of data integration and migration to a digital delivery platform. Emerging technologies can provide support. They make it easier to access, use, manipulate, visualize, and disseminate large volumes of data, thus increasing its transparency.

Case 3.2 – Government partnerships and citizen activation

The Republic of Serbia's GeoSrbija was initially developed in 2017 and provides a digital and collaborative platform connecting around 200 institutions with 1,500,000 unique users. At the onset of the pandemic, the government of the Republic of Serbia established two groups, one dealing with economic issues (under the President), and the other on health and social issues (under the Prime Minister). The organizational structure of the spatial organizations and their government users was also reorganized around a central committee with spatial agency under its aegis (Figure 3.2). This allows a centralized collection and dissemination of data, whilst avoiding duplication. It also creates the opportunity for citizens to provide spatial information. Important, the purpose and scope-of-use of this crowdsourced data is made clear to citizens. It is used for monitoring food security and environmental changes.

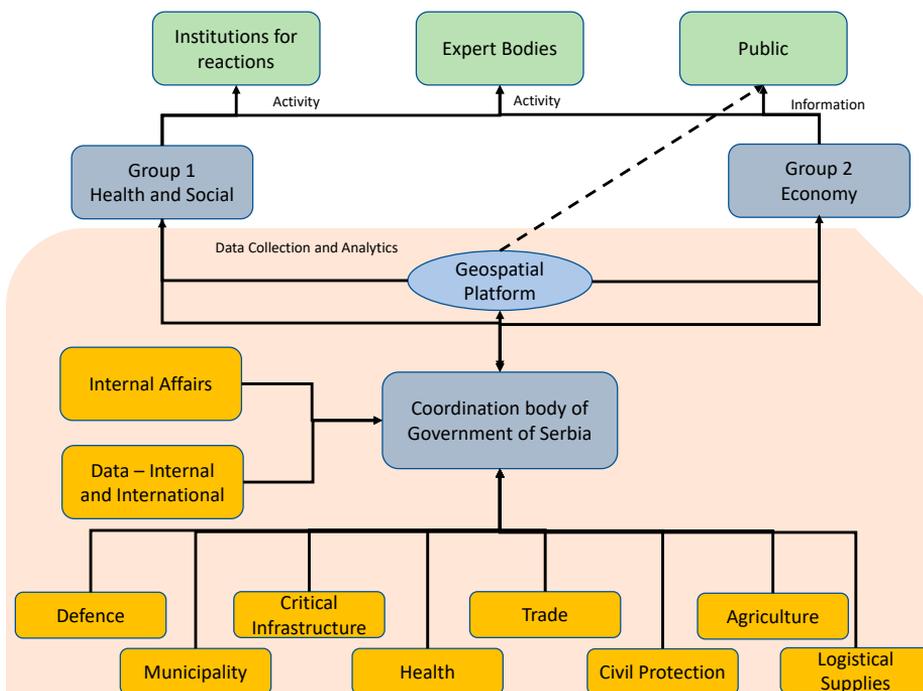**Figure 3.2:** *The Republic of Serbia's COVID-19 driven restructure.*

(Source: Vucetic, D. 2021. *Geospatial Information in response to COVID-19 pandemic – Serbian Experience. In: NSDI, geospatial data and technology: The role of geospatial and cadastre agencies in the COVID-19 pandemic response.* UNECE Webinar. UNECE, 11 May 2021. https://unece.org/housing/events/nsdi-geospatial-data-and-technology.)

3.3 What are the impacts and benefits of this acceleration?

3.3.1 Benefits realization from investments

Realizing the benefits of investments in land administration and NSDIs requires a long-term perspective. The costs of IT infrastructure establishment and maintenance are significant, often paired with minimal immediate political gains. Governments are often impatient or distracted by societal issues of the day. Through the COVID-19 pandemic response, the underpinning role of digital land information systems and NSDIs in supporting broader societal challenges gained renewed prominence. Land administration and NSDIs were seen as part of the longer-term provision of economic recovery and stimulus, broader land sector and property market integration, and large-scale land development projects. They need to be further seen as part of the critical infrastructure for emergency response, including health (as already covered), poverty reduction, food security, climate change response, and increased protection for women and vulnerable groups.

3.3.2 Economic recovery, entrepreneurship, and innovation

Economic recovery and stimulus were a centrepiece of many COVID-19 response measures. However, as government services go back to normal, it begs the question of whether the digital measures put in place will remain. The European Union passed its temporary NextGenerationEU (NGEU) COVID-19 pandemic recovery instrument seeking immediate economic boosts and repair (Böhme et al., 2022). With this plan, three of the seven headings relate directly to land administration – the single market, innovation and digital; natural resources and environment; and public administration. COVID-19 allowed inroads for permanence in innovation into land administration and NSDIs. Whilst some initiatives are intended purely as emergency response, others such as the use of digital signatures and digital identity checks are likely here to stay. There are indications in several countries that some initiatives will be rolled back. This is due to lack of available financing, skills and expertise needed to sustain them longer term. Meanwhile, whilst land administration functions have mostly remained a public administration activity, technological push and associated costs provide the opportunity for a wider range of private actors to contribute. This is a dynamic setting, differing between countries, with dialogue still ongoing. What is sure is that countries need to take a proactive approach to support further innovation and incubation of land sector businesses.

3.3.3 Poverty reduction for women and vulnerable groups

The COVID-19 pandemic led to an increase in poverty and social exclusion levels. A broadening economic gap occurred between those with adequate housing, income, and digital means, and those without. The disadvantaged groups were most vulnerable to losing work and exposure to the virus. They tended to occupy jobs involving more face-to-face or manual labour, with fewer opportunities to go digital (UNECE, 2022a). This flowed into issues of food insecurity and then tenure insecurity – driven by increases in food prices, lack of availability of food, and landlords moving to evict non-financial tenants. Whilst the proportion of people switching to online services and processes more than doubled during the pandemic, it was generally older people, women, and other vulnerable groups that were excluded. Spatial and other information on tenure rights helped to bring these issues to the fore, however, in many cases, not soon enough. Laws surrounding land tenure and land use could be improved to better protect these groups. Data within the land administration system itself could also be used to monitor and evaluate the concerns, via digital dashboards coupled with

census data. NSDIs could act as an early warning system against emerging cases of dispossession and poverty.

Digitally transformed land administration can play a crucial and positive towards women and vulnerable groups. It decreases or makes free the cost to access essential services. In Serbia and Croatia, simple and free mobile services increase service availability. In Bulgaria, citizens can run limited online checks on the status of their properties free. This helps remove physical travel, paper documents, and long queues at government offices. Travel to a government office might mean sacrificing a day of earnings. In Russian Federation, a country with nine time zones, using the exterritorial service, for any property in the country, citizens can submit applications online 24/7, or alternatively visit the closest local office. Exchange of digital data between government and municipal institutions also helps vulnerable groups. They do not have to repeatedly provide the same documentation to receive social subsidies. Digitally transformed land administration also enables monitoring of vulnerable groups, acting as a poverty or food insecurity early warning system. They also help to demonstrate progress towards equality.

3.3.4 Food security and agricultural planning

Global numbers from the UN SDGs and the FAO show a strong relationship between food security and poverty. Projections show a marked increase in the number of malnourished people in 2020 ranging between 720 million and 811 million people (FAO *et al.*, 2021). Though food security in UNECE is generally sound, the continent is not exempt from the effects of the pandemic. Like elsewhere, the number of food-insecure communities in the UNECE increased during the COVID-19 pandemic. The pandemic revealed gaps in the food systems around the world (United Nations, 2021). A similar trend was seen with poverty, where global numbers increased rapidly. The basic global challenges demand wider use, provision, and dissemination of land and spatial information for monitoring and evaluation of agricultural production, and for enhanced planning around land tenure and land use with regards to food production.

3.3.5 Climate change and disaster response

The COVID-19 pandemic drove changes in the organizational structures of government organizations, such as those in the Republic of Serbia (Vucetic, 2021), resulting in more emphasis on geospatial information coordination. It sparked further interest from private persons and businesses to contribute information and garner widespread interest in the use of interactive maps – including for deployment in agriculture and environmental initiatives. This interest influenced initiatives including a cadastre for natural resources, ecological and climate impacts in Belarus (Case 3.3, (Litreeva, 2021)). The COVID-19 pandemic is rapidly giving way to a renewed focus on climate change response. The increased awareness of the evidence-based decision making that maps and spatial information can support should be further leveraged in this regard.

> #### Case 3.3 – From land administration to emergency response
>
> It's May 2020, and for countries like the United Kingdom, Russian Federation, and Belarus, day-to-day land administration tasks are piling up, alongside the information demands of the pandemic, following the first lockdown. Belarus responds swiftly to the demand by scaling up its remote services. This sparks a surge in view requests on platforms that enable an analysis of real estate, including interactive street maps. A further demand spike emerges as requests to provide relevant datasets, services, and maps for emergency services increase. This relates to logistical

movement and postal services. Information is also provided in the public cadastre including the cadastres of natural resources for climate change monitoring. The Republic of Srpska, Bosnia and Herzegovina, experiences a similar situation (Figure 3.3). The young republic has many new institutions and new laws, and many records were lost or destroyed during the war. The development of the GARS Information System improves links between cadastral information system (eKatastarRS), digital archives, and tax administration. During the COVID-19 pandemic its use expands further, including supporting emergency medical services, police, fire services, crisis staff, post office, food services, and humanitarian organizations.
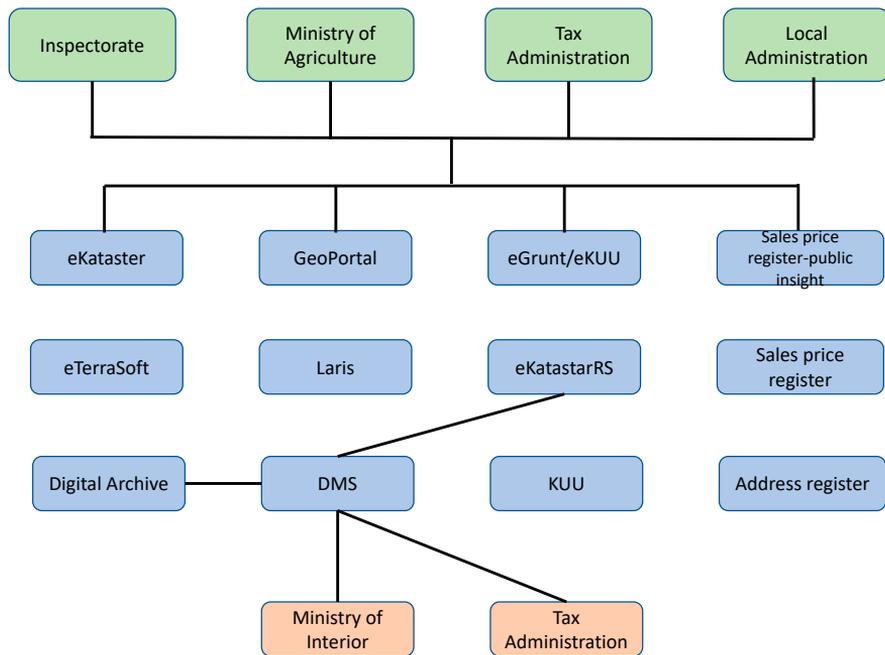
Figure 3.3: *GARS Information System (Republic of Srpska, Bosnia and Herzegovina) responds to both land administration and emergency response needs.*

(Source: Svitlica, D. 2021. *The impact of Covid-19 on the real estate market in Republika Srpska. In: COVID-19 and Property Markets: How is the pandemic affecting property market in the UNECE region? UNECE Webinar.* UNECE, 15 April 2021. https://unece.org/info/Housing-and-Land-Management/events/354070.)

3.4   Takeaways and recommendations

Land administration and NSDI stakeholders' preparedness and response to the pandemic varied. Those prepared pivoted under pressure; leveraged IT infrastructure; advanced e-conveyancing; became more user, purpose and data driven; fostered dynamic capabilities; and continued to explore technology innovation. NSDIs are now more integrated into health service provision and are underpinning the creation of new products and services – as open data, standards, data quality, crowdsourcing, government partnerships, and cybersecurity issues are all explored further. Further applications are emerging in poverty reduction, food security, climate change, and economic recovery, supporting a culture of innovation. These lessons can guide thinking and forecasting on plans for further digital acceleration and the future of land administration, not only within the scope of the COVID-19 pandemic.

4 ADVANCING DIGITAL TRANSFORMATION – STRATEGIES FOR SUSTAINABLE DIGITALIZATION IN LAND ADMINISTRATION

4.1 Which policies will take priority post-pandemic for land administration?

4.1.1 Diversity of drivers

Global developments reshape society, economies, lifestyles, and land administration practices. The reshaping was amplified during the COVID-19 pandemic. Society now seeks on-demand land information, mobile e-services, easier management of complex land tenure issues, and assurance that vulnerable groups are not left behind. Land administration organizations within the UNECE must continue to change. They must explore new revenue models, inter-organizational business processes, skillset diversity, and increasing business intelligence. There is a need to understand the breadth and interconnectedness of all these drivers, and to have sustainable visions that can support them.

4.1.2 Trends and megatrends

A trend is the general direction in which something is developing. It has impact and influence on other things. A megatrend is a global trend that is likely to occur, but over which there is little individual control (Retief *et al.*, 2016). Megatrends encompass social, economic, political, environmental, and technical movements and shape daily lives, business, and geopolitics. They are large in scale, long in duration, intertwined, complex, multi-layered, and not easily reversed. Megatrends impact differently in different places and how they are dealt with determines future conditions. Though challenging, they can be shaped over time through policy (UN-DESA, 2020) and actions that support adaptation. The UNECE region identified megatrends considered most consequential for future land administration scenarios.[11] Trend and megatrend analysis are essential for future scenario planning. A combined contemporary overview is now provided.

4.1.3 Urbanization and rural depopulation

The decades-long mass migration from rural to urban living continues. In 2050 (UN-DESA, 2018), 68% of the people globally will live in cities (Figure 4.1). The percent is higher in the UNECE region (UNECE, 2022a). Especially in emerging countries, rapid urbanization often outpaces adequate housing construction, leading to urban sprawl and informal settlements. In 2020, one in four urban dwellers lived in slums or informal settlements, with 85% of them in Asia and Africa (UN, 2022). Climate-related and geophysical disasters also increase the demand for resilient housing.[12] Provision of affordable housing and renewal of decaying urban infrastructure are key government agenda items globally. Rural populations are also in decline, often leading to gaps in digital infrastructure and information services for those remaining. Women often experience the brunt of the service gap. Land administration systems must reflect these changes and support responses.

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11 The identification of the most relevant megatrends was provided by a panel of eight international land administration experts who were asked to score the relevance and comparative importance of megatrends for land administration on a 10-point scale (UNECE, 2021b).

12 The World Bank and Build Change address this aspect in their Global Program for Resilient Housing aimed at formalizing global development approaches to providing safe, sustainable housing in regions prone to climate stress and natural disasters. https://www.worldbank.org/en/topic/disasterriskmanagement/brief/global-program-for-resilient-housing#result.
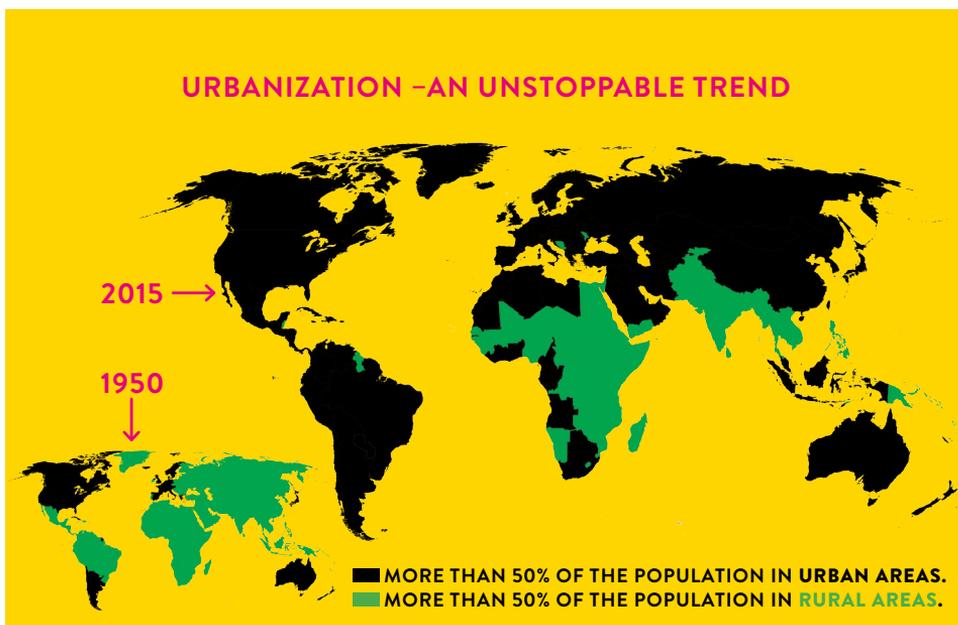
Figure 4.1: *Global urbanization statistics.*

(Source: World Bank. 2022. Global Program for Resilient Housing. In: *Build Better Before, Save Lives After.* Cited 16 August 2022. https://www.worldbank.org/en/topic/disasterriskmanagement/brief/global-program-for-resilient-housing.)

4.1.4 Environmental damage, disaster and food insecurity

Anthropogenic environmental damage impacts ecosystems, biodiversity, and natural resources, and leads to deforestation, soil degradation, desertification, marine and waterway pollution, reduced air quality, large-scale wildlife extinction, extreme weather events, sea-level rise, temperature increases, noise and light pollution, and decreased biodiversity in flora and fauna. These issues may be acerbated by agricultural production techniques, and ultimately impact on food security. The United Nations Framework Convention on Climate Change (UNFCCC) provides the basic legal framework and principles for international climate change response. The Kyoto Protocol and the Paris Agreement provide guidance for country-level responses. In 2021 in Glasgow (United Kingdom), the phase-down of unabated coal power generation and the phase-out of inefficient fossil fuel subsidies was referenced.[13] Land administration systems must deal with an increasing number of climate-related rights, restrictions, and responsibilities.

4.1.5 Social inclusion and gender equality

The needs of vulnerable and minority groups including women, children, youth, persons with disabilities, older persons, Indigenous Peoples, refugees, internally displaced persons, and migrants demand special focus (See: Chapter 2). Whilst the COVID-19 pandemic accelerated digital transformation in land administration, it also widened the income equality gap between marginalized groups and other populations in the UNECE region (Gray, 2021). Digital inequality also increased in terms of digital infrastructure access, digital skills development, and the ability to benefit from technology (Robinson

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13 For more on the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow see https://ukcop26.org.

et al., 2020). Tackling inequality is embedded in the SDGs, particularly in Goals 5 on gender equality and empowerment of all women and girls, and 10 on the reduction of inequalities in income as well as those based on sex, age, disability, race, class, ethnicity, religion, and opportunity (UN, 2022). Land administration systems must take the needs of women, vulnerable groups and minorities into consideration. The challenge is not new, however, the urgency increases as land administration systems accelerate towards digital-only service modes to support land governance (FAO, 2022), gender equality (FAO, 2013), informal settlements (UNECE, 2022b), as well as land and conflict issues (World Bank, 2016). The empowerment of women and vulnerable groups pays off through enhanced societal resilience.

4.1.6 Regulatory tensions and sandboxing

Through lockdowns and vaccination programs, the COVID-19 pandemic laid bare tensions between requirements for regulatory controls on the one hand and demands for individual freedoms on the other. In land administration, prevailing legal and institutional arrangements are often suggested to impede the digital transformation of the sector. Emerging technologies often face the problem of pace, that is, the tendency for regulatory frameworks to lag technological development (Hagemann, Huddleston and Thierer, 2018). Meanwhile, regulation can create the conditions that drive innovation. It is ultimately a balancing act to reconcile regulation, institutions, and innovation. Regulatory 'sandboxes'[14] can be used to undertake temporary and spatially limited tests of innovative technologies and business models in real conditions and under the supervision of regulators (BMWi, 2019). Looking at the innovation potential of digital technologies and digitally transformed futures of land administration systems, this intermediate step offers the opportunity to test before full implementation.

4.1.7 Business ecosystems, liquid enterprises, and partnerships

Operating boundaries between organizations are challenged by interoperability in all its forms – semantic, legal, and technological. In the face of such challenges, networks gain in importance, while collaboration, sharing, ecosystems and distributed solutions are promoted. Organizational forms are more dynamic, fluid, or liquid (Dale, 2022). The conventional role of LAS as data creator increasingly morphs to data collator. Tasks are distributed amongst a complex array of interdependent public, private and non-governmental organizations. The approach is considered crucial for SDGs response. Public-private partnerships (PPPs) (Case 4.1) are used to fill capacity and resourcing limitations within land administration organizations. They are also among the focus of the World Bank (World Bank, 2020a) and UNECE (UNECE, 2021a). If managed well, they can deliver expert knowledge, technology upgrades and improved service levels. If poorly implemented via inadequate management of service level agreements, they may cause harm. A clear institutional framework for PPPs is needed.

> ### Case 4.1 – Productivity via PPPs
>
> Out of 21 countries surveyed within UNECE region, 75% utilize some type of PPP in land administration tasks (study presented by Riekkinen). The main reason for not applying PPPs is legislative: law mandates the execution of land administration tasks by public entities. Nearly two-thirds of the land administration systems ap-

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14 'Regulatory sandboxes' are intended as safe places for testing new regulatory approaches. For more see: https://link.springer.com/article/10.1007/s40258-021-00665-1.

plying PPPs use specific legislation, whereas the remaining countries apply general legislation. PPPs are suggested to be most influential in data production, IT support, service delivery, and the execution of cadastral procedures and land registration. Intended benefits are faster processes, more accurate registration services, and decreasing land administration fees and public costs savings.

4.1.8 Flexible workers and start-up culture

The COVID-19 pandemic accelerated already ongoing changes for workers. They were required to be more agile, mobile, and flexible. Organizations are adopting more open structures with increasing spatial and temporal flexibility. This emphasizes personal responsibility and self-organization, whilst still demanding accountability. Technological change via artificial intelligence and robotics is leading to automation, but also boosting the importance of quality human interaction. Bottom-up innovation in organizations through incubators, social events and hackathons is happening. The exploitation of promising research activities is key to digital transformation and addressing societal challenges. Startup programs can attract young talent and entrepreneurs, facilitating the transfer of research into practice. That said, legal frameworks, governance arrangements and policy stances can create barriers to the scaled uptake of innovative technologies (Stöcker *et al.*, 2022).

4.1.9 Next generation and skills development

Creating the next generation of land administration practitioners is a key challenge. Land administration organizations, the private sector, and universities in the UNECE region are increasingly experiencing bottlenecks in recruiting talent, as recently reported from Serbia and various universities (UNECE, 2022c). Emerging demographics bring entirely new sets of demands and attitudes. Constant connectivity, digital dependence, individuality, empowerment, and a sense of societal purpose are demanded. Satisfying these needs brings new challenges to educational programs. Beyond ensuring up-to-date competencies in data science, analytics and geospatial technologies, managerial and socio-legal skills gain in importance. Knowledge and skills can be acquired through conventional academic programs or vocational training. However, these more traditional educational programs are not necessary in all cases, especially when it comes to broadening competencies. Alternatives include widely available online courses (such as Massive Open Online Courses, or MOOCs), distance-learning, or fast-track training programs at (online) conferences or workshops.

4.1.10 Open data, crowd data, and valued data

Organizational collaboration leads to the delivery of new data-driven products and services. Value-creation emerges at the interfaces, supported by edge computing, and demands adaptation of business models. Cross-sectoral value chains and structures are exemplified in the platform economy concept. Open data supports this value creation, and spatial and other information on tenure rights are considered essential open data sources (European Parliament, 2019; UNECE, 2021b). Whilst the requirement for land administration organizations to generate revenue from data may appear to contradict the liberal aims of open data, results from European Spatial Data Research (EuroSDR) show open data supplies have no significant effect on funding (Welle Donker, Crompvoets and van Loenen, 2017). Public provision of official data leads to higher level of innovation and return on investment, as experienced in Poland (Grudzień, 2021). Via crowdsourcing, citizens can be collectors, improve or verify data, helping to

reach unprecedented levels of scale, coverage, and up-to-dateness (Cetl *et al.*, 2019). In Sweden, crowdsourcing was used to verify cadastral property boundaries via an online application. That said, in many contexts, quality assurance, authenticity, accountability, and liability continue to hinder the wider use of crowdsourced information by public institutions.

4.1.11 Artificial intelligence and robotics

Disruptive technologies (Govender, 2020) including cloud computing, big data analytics, internet-of-things (IoT), and blockchain offer radically new possibilities for data collection, processing, management, visualization, and dissemination. This is not limited to mere automation of existing processes by replacing manual or semi-manual procedures, it is leading to a results-oriented radical redesign and re-engineering of business procedures (Kedar, 2021). The automation of data capture, validation, integration, and quality improvements – via robotic processes and artificial intelligence – changes operational aspects of land administration systems. These enable real-time analysis and pattern recognition on vast amounts of data, support optimized solutions to complex problems, and require minimized human interventions. In land administration, automation enables direct machine-to-machine communications and more interconnected NSDIs that make interoperable data from various ecosystems, as showcased in Finland's recent work on digital twins (Suomisto, 2021). Other examples include change detection and feature extraction services – for example, building footprint (Overland, 2021) or land use (Dorosh *et al.*, 2021) data feeds derived from high-resolution aerial remote sensing. The automated generalization of the map production further reduces the time and costs for creating and updating base maps, as experienced in the Netherlands (Land, 2021).[15]

4.1.12 Blockchain and smart contracts

The shift toward a more machine-centric world (UN-GGIM, 2020b) is not a mere technical exercise, it requires holistic consideration of legal issues, business models, value creation, and partnership models. In this vein, the government is seen as an enabler and needs to provide instrumental support in the development of different tech-driven initiatives, as exemplified by blockchain (OECD, 2019). In the UNECE region, various initiatives already tested the use of blockchain and smart contracts for the land registry either as part of the business process or for data dissemination, including Russian Federation,[16] Sweden,[17] Georgia,[18] and the Province of British-Colombia in Canada (Bennett, Pickering and Sargent, 2019). The Federal Chamber of Notaries in Germany[19] in cooperation with the ministry of justice of Bavaria currently tests blockchain for notarial powers of attorney and certificates of inheritance.

4.1.13 Cyber security, data stewardship and digital trust

Maintaining ethical and efficient control over spatial and other information on tenure rights is an ever-greater challenge. Cyber-attacks lead to privacy breaches, disruption

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15 Dutch Kadaster – Map production took 25 person years of effort to produce topographic base maps without automation. 75% of the costs could be reduced by fully automating the map production process, lessening the time needed to 3 weeks.
16 For more on the Russian blockchain project for real property see: https://вэб.рф/en/press-center/35544/.
17 For more on the Swedish blockchain demonstration and pilot see: http://ica-it.org/pdf/Blockchain_Landregistry_Report.pdf.
18 For the Georgian land-related blockchain example see: https://www.oecd.org/corruption/integrity-forum/academic-papers/Georg%20Eder-%20Blockchain%20-%20Ghana_verified.pdf.
19 For more on the German Chamber of Notaries example see: https://www.bmwk.de/Redaktion/DE/Wettbewerb/Fragmente/innovationspreis-reallabore-blockchain.html.

of services, risks to national security and delays in technological advancement. Understanding and anticipating cyber threats is increasingly a primary focus in land administration organizations and broader government. There is an increased focus on digital data security, privacy, ownership, liability, data ethics and data stewardship programs. It is becoming increasingly important to establish and implement national and international standards that create trust in digital infrastructures and identities. The Organisation for Economic Co-operation and Development (OECD) Guidelines on the protection of privacy and transborder flows of personal data continue to represent an international consensus on general guidance concerning the collection and management of personal information (OECD, 2013). Inside the European Union, the need for enhanced data protection is addressed through the General Data Protection Regulation (GDPR).[20] The Locus Charter[21] outlines ten principles that seek to help practitioners understand and mitigate risks specific to geospatial technologies. System security and trust are not only technical concerns. Land sector corruption remains challenging and must be combatted via comprehensive legal and institutional frameworks. Digital systems can support these efforts with much simpler procedures that eliminate the possibility of human discretion and technologies that are used responsibly and support accountability (Zúñiga, 2018).

4.2 What are the essential elements of future land administration systems?

4.2.1 Synthesis and six elements

Building atop previous visions (Wallace *et al.*, 2006), and synthesizing the above trends and megatrends, land administration drivers, and the UNECE's 24-guiding principles (UNECE, 2021b), six essential elements for future land administration systems are revealed (Figure 4.2). These elements are hardly new, but the analysis affirms the cross-organizational importance of them.

4.2.2 Intelligent

Future land administration systems are fully digitalized containing information about rights, restrictions and responsibilities relevant to all properties. A large degree of automation allows real-time registration of transactions, combined data-driven and people-driven decision making, as well as responsive yet efficient services and processes which are digital by design. Transparency and authenticity with regards to reliable data and service quality are key to ensuring trust and confidence in the intelligent system. Processes for the fulfilment of effective land administration functions are based on emerging technologies and supported by embedded innovation developments in land and NSDI organizations.

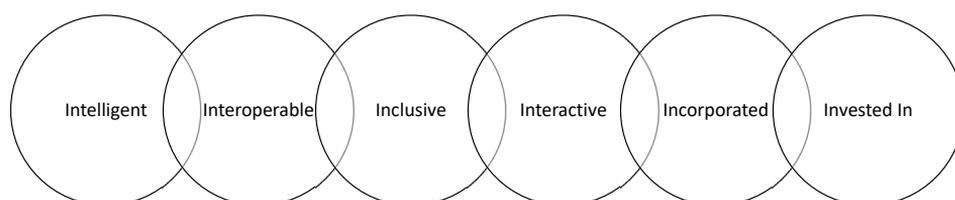**Figure 4.2:** *Essential elements of future land administration systems.*

(Source: Authors' own elaboration.)

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20 For more on the EU GDPR see: https://gdpr-info.eu.
21 For more on the Locus Charter see: https://ethicalgeo.org/locus-charter/.

4.2.3 Interoperable

Future land administration systems, whilst supportive of the wide diversity of tenure types, are interoperable throughout the country with regards to data production, dissemination, and visualization. This allows for the connection of data relating to native or customary title, underground situations, water and marine environments,[22] natural resources, land use planning, built environment (BIM), valuation, and taxation, as well as the broader NSDI. Interfaces enable the integration of the digital processes of private agents such as real estate agents, notaries, or surveyors. A system of key registers is applied to ensure interoperability with other government data. Policies, laws, organizational structures, as well as international and national standards such as ISO 19152 (LADM), provide starting points for interoperability.

4.2.4 Inclusive

Future land administration systems are inclusive ensuring women, minorities and vulnerable groups have access to land administration services. Participation is guaranteed and needs are acknowledged in the design of the system and interactions with it. Most essentially, all types of tenure – be they customary, freehold, leasehold, occupancy, or common properties – can be documented and secured in the system allowing the recognition of collective traditions and customs. The digital divide between and within countries, and between men and women, needs to be addressed through an enabling policy environment by ensuring that all, especially the poor and vulnerable groups, have access to digital land management services. In this context, it is important to promote the development of digital infrastructure and bridge the digital literacy gap (UN, 2016). An inclusive land administration system is equitable and promotes peace, safety, and security among all parts of society.

4.2.5 Interactive

Future land administration systems are accessible, easy to operate, and increasingly online. It is cautioned that it may not be appropriate for them to be only or permanently online in all contexts. Electronic communication for both registration of transactions and dissemination of registered information provides the basis for enjoyable public experiences. Backed by an online environment, data is open, is always accessed via mobile devices (or in physical offices where appropriate), and includes responsible security controls. User interfaces are engaging, visually attractive, and simple, ensuring broad access by the public, including vulnerable and minority groups. The system is legitimized through legal frameworks and connected with digital identities, e-signatures, and privacy features.

4.2.6 Incorporated

Future land administration systems encourage cooperation, partnerships, and multi-disciplinary as well as multi-sectoral participation. With land administration being a cross-sectoral discipline contributing to several state priorities, ecosystems can be built, fostering greater coherence and commitment between stakeholders and decision-makers. Partnerships can be facilitated through PPPs and other arrangements, bringing and building together knowledge, skills, and experiences. But the ecosystem is not limited to the public and the private sector, rather it seeks engagement with donors, non-governmental organizations, and civil society as well, with inclusivity and transparency further advocated.

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22 The 'Joint Roadmap to accelerate Maritime/Marine Spatial Planning processes worldwide (2017)' is available at: https://www.mspglobal2030.org/wp-content/uploads/2019/04/Joint_Roadmap_MSP.pdf

4.2.7 Invested in

Future land management systems are based on sustainable business models that balance the costs of implementation and maintenance with the affordable provision of land administration services (Case 4.2). However, investment plans should not be limited to land administration processes alone but should also ensure that land authorities remain relevant by providing funding for capacity-building programs, education, and awareness-raising campaigns. In addition, land administration systems create value for broader society, which can be assessed by comparing socio-economic costs and benefits.

> **Case 4.2 – Investment = Incorporation = Interoperability = Intelligence**
>
> Various UNECE countries invested key register systems in recent years including Denmark, the Netherlands, and Azerbaijan (Figure 4.3). In Denmark, a positive business case is witnessed with huge cost savings for the development, maintenance, and use of the simplified system (Danish Ministry of Energy Utilities and Climate, 2015). Increased efficiency in communication and operations between private surveyors, the cadastral agency and municipalities is observed. There are similar experiences in Azerbaijan where the introduction of key registers provides the incentive to go fully digital (Niftiyev, 2015). In the Netherlands, work began in the early 2000s and it currently includes 11 key registers, 7 of which are geolocation related (Ertink, 2022; van der Vegt, 2021). Underpinned by service-oriented architecture, cloud infrastructure, IT outsourcing and a cooperative cost-sharing model, every public body is mandated to use the key register. Information nodes act as an intermediary between information holders and users, supporting efficient sharing of data. The key register data is authentic and trusted. For example, address data is only registered once, after undergoing predefined quality checks. Key registers can be linked. Keeping the relations between key registers is crucial and demands inter-organizational processes and standards.
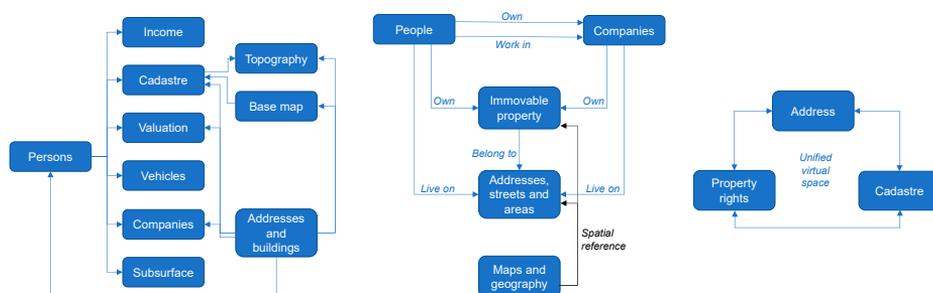
Figure 4.3: *Overview of key registers in the Netherlands (left), Denmark (centre), Azerbaijan (right).*

(Source: Ertink, D. 2022. *NSDI in The Netherlands. Presentation for the BiH High-Level NSDI Commitee*. Kadaster International; van der Vegt, H. 2021. *Key Registers in the Netherlands*. In: Geospatial Information for Digital Transformation. Online Conference. Kartverket. Norway, 27–29 October 2021; Danish Ministry of Energy Utilities and Climate. 2015. *Key registers and keys between registers – the key to effectiveness in the basic data programme in Denmark*. In: *WPLA Seminar*. Baku, Azerbaijan, 2015. https://www.oicrf.org/documents/40950/43224/Key+Registers+and+Keys+between+Registers+the+key+to+effectiveness+in+the+Basic+Data+Programme+in+Denmark.pdf/d57251d0-0664-7f94-69a0-f04d7ddd11ad?t=1510190786715; Niftiyev, Y. 2015. *Interoperability between key registers in e-government: Azerbaijani experience*. In: *WPLA seminar*. Baku, Azerbaijan, 2015. https://www.oicrf.org/documents/40950/43224/Interoperability+among+key+registers+in+e+Government+Azerbaijani+expericence.pdf/2bde9e26-a8cc-ecc9-2f2c-14bb95dd38d0?t=1510190723573.)
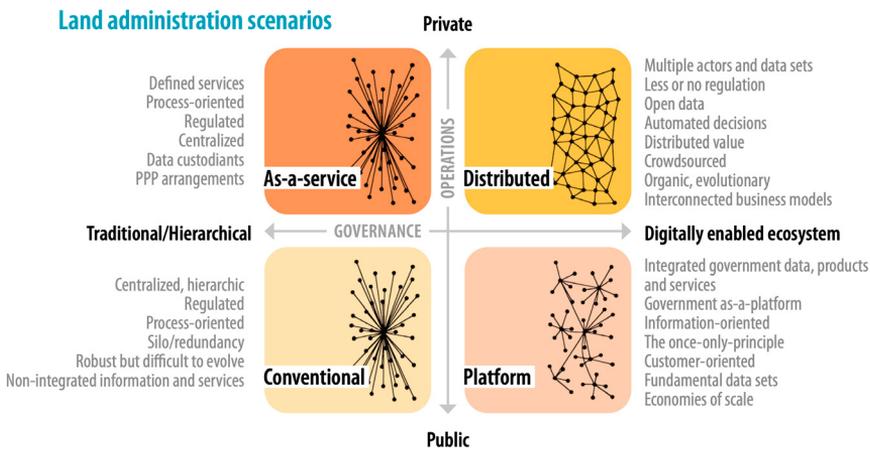
Figure 4.4: *Land administration scenarios as defined by UNECE WPLA.*

(Source: UNECE. 2021. *Scenario Study on Future Land Administration in the UNECE Region.* https://unece.org/info/Housing-and-Land-Management/pub/363124.)

4.3 What land administration design scenarios are available?

4.3.1 Scenario development

Translation of the essential design elements into a land administration system vision involves a unique journey for each country's context. Clusters of common approaches are identifiable via scenario development. Scenarios are a policy development and strategic planning method enabling the exploration of potential future directions, assumptions, and the courses of action. Through multiple rounds of consultations, the UNECE defined four key scenarios (Figure 4.4) integrating the specific drivers of land governance and the most influential megatrends (UNECE, 2021b). The scenarios use a 10-year timespan and are focused specifically on land registration, cadastral and spatial data management functions. They intend to improve decision-makers' understandings of trends and impacts and stimulate discussions on responses and benefits (Case 4.3). The scenarios are not to be seen as predictions or intended future developments. Additionally, the transformation of land administration in any direction of the scenario matrix should be context-specific and purpose-driven.[23]

4.3.2 Scenario 1: conventional land administration

Representative of most countries in the UNECE, this scenario illustrates a classic centralized land administration heavily managed by the state. Rigid hierarchies and top-down management characterize this scenario, as do regulated protocols for processes and services. Data is collected and updated in a controlled manner, resulting in high data authenticity. In many situations, there is a lack of integrated information products and data infrastructures, which creates the risk of data being stored in silos, sometimes leading to redundancy and overlap. The robustness of the system pays tribute to its

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23 The scenarios are organized in a 2x2 matrix format, based on two characteristics along with two parameters. The first parameter (vertical axis) distinguishes the main actors for land administration operations on a continuum between private actors and public actors. The second (horizontal axis) distinguishes between two qualities of land administration governance – traditional/hierarchical systems and digitally enabled ecosystems. The combination of two values for two parameters allows for the differentiation of four scenarios: conventional land administration (public actors in a traditional/hierarchical ecosystem), as-a-service land administration (private actors in a traditional/hierarchical ecosystem), platform land administration (public actors in a digitally enabled ecosystem), and distributed land administration (private actors in a digitally enabled ecosystem).

ability to evolve, respond to changing expectations, and adapt to new situations such as the increasing digitalization of services and processes.

4.3.3 Scenario 2: as-a-Service (aaS) land administration

Scenario 2 involves both the public and private sectors while still embedded in a hierarchical and centralized governance structure. While land administration authorities function as a contracting authority setting the rules for land administration, the private sector is engaged as a service provider, often in short- or long-term PPP arrangements. Outsourcing typically comprises some or all land administration services, such as setting up or maintaining a land administration information system. In emerging economies, PPPs are increasingly investigated in relation to the first level registration, the inception and operation of a Continuously Operating Reference System (CORS) or the land registry. The advantages of this scenario are seen in the increased flexibility and performance of the public sector by leveraging innovation potential, competencies, and technology from the private sector.

4.3.4 Scenario 3: platform land administration

In Scenario 3, land administration is organized in a unified platform including multiple public entities, each having clearly defined functions and responsibilities. Typically, a national architecture of key registers is implemented, in some cases embedded in a government cloud system. Key registers refer to integrated systems entailing national datasets such as the land registry, the cadastre, or the mortgage register. Once a public body files an update in its key register, all registers are updated as well following the once-only principle avoiding work redundancy or overlaps. This fully digital architecture facilitates the effective sharing of national datasets, the provision of data-driven customer-oriented applications and extended state services with integrated governmental data.

4.3.5 Scenario 4: distributed land administration

This scenario embodies the most forward-looking of all scenarios and includes both government and private sector actors working together in a digitally enabled ecosystem. Multiple actors from both sectors are highly interwoven and work on equal footing, sharing responsibilities and risks. The low level, or even lack of clear, regulation requires a high level of trust among all entities, as well as the distribution of liabilities. Land administration operates fully digitally, leveraging technological drivers such as blockchain, artificial intelligence or IoT. Processes and decisions are optimized through automation. Data may be sourced from different providers, including public and private entities as well as crowdsourced, and is typically published following open data policies. This in turn requires high standards for data protection, ethical use, and data privacy. Compared to the other scenarios, distributed land administration is considered the most responsive and adaptive to new developments and customer expectations.

> **Case 4.3 – Land administration system futures for UNECE**
>
> Initiated by UNECE WPLA, 22 countries took part in an interactive survey assessing the current, expected, and desired situation of the respective land administration systems concerning the four scenarios (Figure 4.5). The results point to a trend toward digitally enabled ecosystems in the years to come, but also a gap between the expected and desired situation in 2030. The desire appears to be for more involve-

ment of the private sector and more emphasis on the fully digital ecosystem. The study enhanced the ability of land administration authorities to point out efforts required to stay relevant in 2030, touching on competencies, leadership, technology, networking, and legal issues. The respondents further saw a large benefit of the scenarios as an instrument for continuous dialogue to shape visions and develop long-term strategies among UNECE members but also at a regional scale.
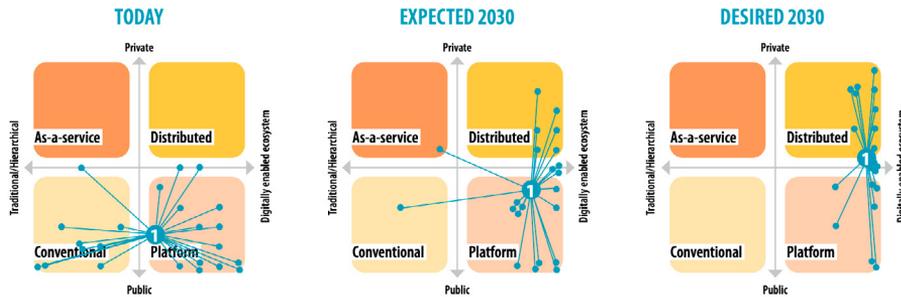
Figure 4.5: *Self-assessment of 22 countries concerning the four future scenarios. Note: The mean value of all voting is indicated as a circle including the number 1.*
(Source: UNECE. 2021. *Scenario Study on Future Land Administration in the UNECE Region.* https://unece.org/info/Housing-and-Land-Management/pub/363124.)

4.4   Takeaways and recommendations

Beyond digital transformation, trends and megatrends drive future land administration development: urbanization, rural depletion, environmental damage, social inclusion and equality, business ecosystem development, flexible workforces, next generation demographic demands, value creation, open data, data quality, cybercrime and digital trust all demand attention. Holistic appreciation of these forces is needed to ensure sustainable digital transformation of land administration. Six essential elements and four design scenarios for future land administration encourage land administration stakeholders to think beyond the now and to assess the potential for transformation of land administration systems. Fundamentally, any selected scenario must ensure improvement of land administration services, better land-related decision making, enhanced land tenure security, land dispute minimization, fairer property taxation, and improved land-use planning and monitoring in both urban and rural areas.

5 IMPLEMENTING AND BENEFITING – ACTION AND INVESTMENT PLANS FOR LAND ADMINISTRATION

5.1 What makes a good implementation plan?

5.1.1 National policy driver alignment

Envisioning future visions and scenarios for digitally transformed land administration is only the first step in a process (See: Chapter 4). Implementation demands its own planning and resourcing. Increasingly, implementation plans must be fully aligned with country-level policy drivers from the outset. Despite the economic, social, and environmental benefits that LAS deliver (Deininger and Feder, 2009), there is less direct financing available for the funding of land administration improvement for its own sake, from both national governments and international donors. This means implementation plans must demonstrate the benefits of land administration to other economic, social, or environmental policy goals. Often, these are directly aligned with the SDGs.

5.1.2 Systematic, unified, and durable

Implementation is not a simple technical matter of ad-hoc procurement of hardware, software, and cloud storage. It must be driven by systematic action and investment planning, connected to continuous strategic planning procedures. It requires ambitious leadership, a collaborative mindset and openness to consensus. A unified or holistic approach is needed, incorporating leaders, decision makers and regular staff across all stakeholder organisations. This often takes the form of an empowered intergovernmental committee or taskforce. Top-level championing should be coupled with bottom-up empowerment enabling for pivoting when contextual drivers inevitably change. A durable, long-term perspective and stores of organisational resilience are required – both within land administration organizations and across the entire land sector ecosystem. Therefore, low-hanging fruit and short-term goals should be identified. It should be recognised that hybrid digital-paper modes or parallel states may be needed for a lengthy period, to ensure no vulnerable groups are excluded.

5.1.3 Globally guided

Land administration organizations embarking on, or already embedded into, the digital transformation journey, can utilise the wealth of international policy guidance and technical support compiled, updated and available. High-level policy direction is provided through the SDGs.[24] More specific to land issues, the VGGTs (FAO, 2022)[25] deal directly with technical and administrative aspects of land tenure, value, planning and development. The FAO's Land Tenure Series[26] and Knowledge for Investment series,[27] the pro-poor land tools suite of UN-Habitat and the Global Land Tool Network (GLTN),[28] including the Social Tenure Domain Model (STDM), and the GeoTech4Tenure program of the International Fund for Agricultural Development (IFAD), provide more innova-

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24 For more on the SDGs see: https://www.un.org/sustainabledevelopment/sustainable-development-goals/.
25 Note: The VGGTs were endorsed in 2012 and updated in 2022, although the update was merely to align the document with newer FAO editorial guidelines.
26 For more on the FAO tenure series see: https://www.fao.org/3/a1179e/a1179e00.htm.
27 For more on the FAO Knowledge for Investment series see: https://www.fao.org/support-to-investment/our-work/by-area-of-work/k4i/en/.
28 For more on GLTN tools and activities see: https://gltn.net/.

tions relating to the administration and management of land (See: Chapter 1). More specifically on issues relating to digital technologies, United Nations General Assembly (UNGA) resolutions provide guidance on supporting digital literacy, protecting digital identity, and ensuring women's access to digital technologies (See: Chapter 2). The International Federation of Surveyors (FIG),[29] specifically Commission 7 on Land Management and Cadastre and Commission 3 on Spatial Information Management, provides further advocacy support and specific statements on technical approaches. This has included support for the development of Fit-for-Purpose Land Administration (FFPLA, (Enemark, McLaren and Lemmen, 2021)) concept and guidelines, and the development of the Land Administration Domain Model (LADM), endorsed since 2012 as ISO 19152 (International Standards Organisation). These international policy frameworks, tools, and knowledge repositories are supported at the implementation level by regional bodies such as UNECE Working Party on Land Administration (WPLA),[30] by international financing bodies such as the World Bank[31] and IFAD,[32] and country-level donors.

5.1.4 Strategic pathways focused

The UN-GGIM's IGIF (UN-GGIM, 2019) and its FELA (UN-GGIM, 2020a) specialization illustrate the direct relationship between the achievement of the SDGs and integrated geospatial information governance (Case 5.1). IGIF and FELA provide a framework of nine essential strategic pathways, demonstrating that governance, people, and technology must work together (Figure 5.1). They collate the supportive tools needed to ensure the holistic implementation and sustainability of NSDIs and land administration systems. The frameworks provide the basis for baseline assessment, gap analyses, action
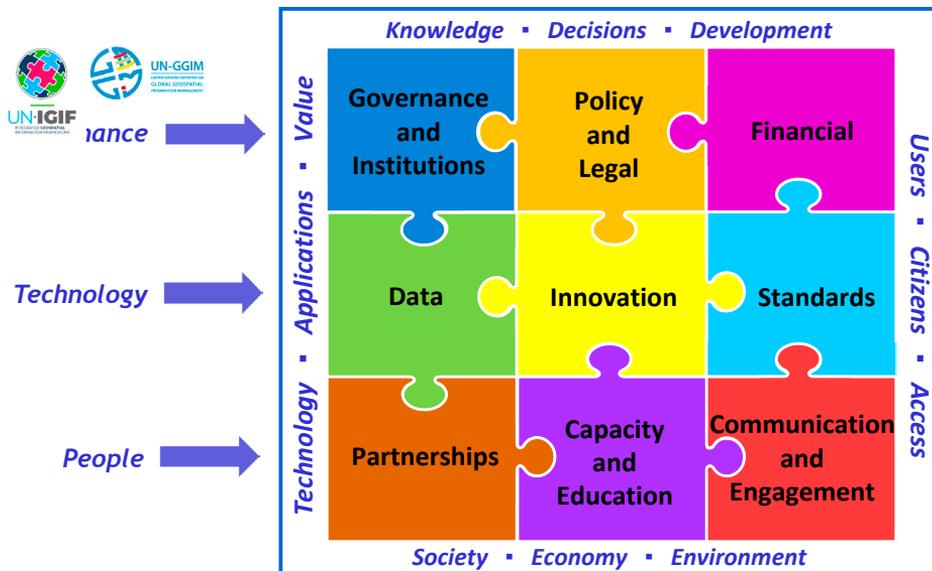
Figure 5.1: *UN-GGIM IGIF's 9 interlinked strategic pathways.*

(Source: UN-GGIM. 2019. *Integrated Geospatial Information Framework*. https://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part 1-IGIF-Overarching-Strategic-Framework-24July2018.pdf.)

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29 For more information and access to FIG publications see: https://www.fig.net/resources/publications/figpub/.
30 For more on the activities and outputs from UNECE WPLA see: https://unece.org/housing/working-party.
31 For access to World Bank reports and outputs on land see: https://www.worldbank.org/en/topic/land.
32 For more information on IFAD see: https://www.ifad.org/en/land.

planning, road mapping, and implementation. Regardless of whether the digital transformation vision is aimed at developing, reforming, renewing, strengthening, modernizing, or monitoring land administration systems and NSDIs, the nine strategic pathways of IGIF and FELA act to ensure all essential aspects are covered. It is recognized that the IGIF pathways overlap. Changing one element impacts others. Therefore, an integrated change management perspective is needed when seeking to upgrade governance and legal frameworks, modify business models and financing streams, improve data maintenance, embed innovation and standards, create partnerships amongst a digital ecosystem, build human resource capacity, or raise community awareness.

Case 5.1 – Moving from global policy to national implementation

Global policy transfer (Unger *et al.*, 2020) enables realisation of consensus-created international guidance at the national level. UN-GGIM's IGIF and FELA provide starting points for land administration organizations and NSDIs to link their digital transformation plans to a country's national-level policy agendas and the SDGs (Figure 5.2): land administration and geospatial data improvements are rarely a justification on their own. There are currently at least 37 countries using or implementing IGIF (Scott, 2021), and FELA is already translated into Spanish, French, Mandarin, Arabic and Dutch (Zeeuw, 2022). In collaboration with the UN, the World Bank (Kelm, 2021) uses its IGIF toolkits and templates (Kelm, 2022) and Open Learning Campus to support country-level technical support, capacity strengthening and financing. Georgia uses the World Bank's IGIF tools to develop over 70 use cases (Bakhia, 2021), demonstrating the socio-economic benefits of investments into geospatial and land information, and a subsequent country-level action plan containing 52 specific actions, with emphasis on communications and awareness, and with a cost-benefit ratio of between 2.6 and 3.8 (Kedar, 2022). The process of creating the action plan leads to engagement with key stakeholders across the government and the private sector. Moldova undertakes a baseline assessment of its current NSDI status

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Addresses				*		*	*		*		*						
Bldgs and Settlements	*		*	*		*	*		*		*	*	*				
Elevation and depth	*	*	*			*	*				*		*	*	*		
Functional Areas	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Geographical Names	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Geology and Soils		*	*			*	*	*	*		*	*	*	*	*		
Land Cover/Land Use	*	*	*		*	*	*	*	*		*	*	*	*	*		
Land Parcels	*	*		*				*			*						
Orthoimagery		*				*			*		*			*	*		
Physical infrastructure		*	*			*	*		*		*						
Population distribution	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Transport Networks		*	*					*	*		*						
Water		*	*			*	*		*		*	*	*	*	*		
Global Geodetic Reference Framework	*					*	*	*	*	*	*	*	*	*	*	*	

Figure 5.2: *Foundational geospatial data layers are essential for monitoring and achievement of national policy goals linked to the 17 SDGs.*

(Source: Hadley, C. 2018. *Fundamental Global Geospatial Data Themes.* In: *World Geospatial Information Congress 2018*. https://ggim.un.org/unwgic/presentations/SS2_20Nov_Clare-Hadley.pdf.)

using IGIF tools (Coote, 2022). Whilst the strategic pathway on data shows promising results, other areas demand attention. The process illustrates the opportunity to better link land administration and NSDI advancement – namely geocoded address register creation and sector-wide upskilling – to policy drivers including disaster risk management, agricultural management, local governance, and emergency service provision. Ukraine (Makarenko, 2021) undertakes IGIF baseline assessments in both 2019 and 2021 that are used to drive NSDI improvements in communication, awareness, and leadership. The need for simple, clear and cross-cutting use cases is evident and is relevant to organizations beyond those dealing with geospatial information management.

5.2   How do we move towards implementation?

5.2.1 Overarching methodology

Consensus-created global policy frameworks are necessarily high-level and generalised. For national-level implementation, dialogue is needed between actors, leading to localised assessment, planning and implementation. The resulting digital transformation action plan is therefore tailored to a specific country context or agency. The IGIF provides this channel through its detailed Implementation Guide,[33] but importantly calls for country-level action plans.[34] If needed, these can be developed with international donor support. The FAO, collaborating with the World Bank and ConsultingWhere Ltd., provide a suggested methodology (Figure 5.3). World Bank also provides specific tools and templates for each step.[35] FELA encourages the use of IGIF tools and methodologies, adapted specifically to the land administration domain.
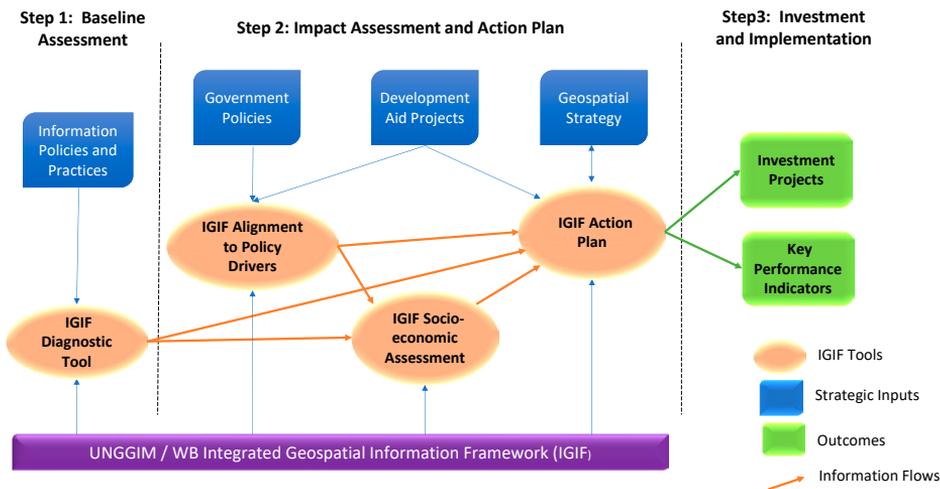
Figure 5.3: *IGIF country-level implementation methodology developed by FAO, World Bank and WhereConsulting Ltd.*

(Source: Coote, A. 2022. *Socio-Economic Impact Assessment for Moldova*. In: S*ocio-economic benefits of geospatial information*. UNECE Webinar. UNECE. 19 May 2022.)

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33 To learn more about the IGIF Implementation Guide see: https://ggim.un.org/IGIF/part2.cshtml.
34 To learn more about IGIF Country-Level Action Plans see: https://ggim.un.org/IGIF/part3.cshtml.
35 To learn more about the World Bank IGIF tools, templates and techniques see: https://d3gzc8yfvw5zzm.cloudfront.net/Geospatial/Template/index.html.

5.2.2 Baseline assessment, impact assessment, and action plans

A baseline assessment uses diagnostic tools to identify specific NSDI gaps and oppor-
tunities. It uses existing information policies and practices as inputs. For IGIF-specific
work, this involves an assessment of the nine (9) strategic pathways. Impact assessment
is undertaken through an assessment of alignment of NSDI activities to government
policy drivers. At the national level, these are increasingly linked back to the global
drivers embedded in the 17 SDGs. A broader socio-economic assessment and broader
socio-economic benefits analysis then ensure investments can deliver desired goals.
From these, a detailed action plan is created. This identifies and prioritises specific ac-
tions, directly linked to policy goals, articulating milestones, deliverables, timelines,
and resource requirements. The broad approach of IGIF means that beyond techni-
cally oriented actions, a focus is also placed on requisite actions relating to institutional
development, legislative change, business model development, partnership building,
awareness-raising, and training and capacity development.

5.2.3 Investment plans

Investment plans should provide detailed accounts of the costing of actions, sourc-
ing of finance (including donor support), return on investment checks and balances,
and plans for monitoring and evaluation of implementation. They articulate specific
investment projects and key performance indicators (KPIs). Investment may be locally
sourced or backed by international donors (Case 5.2). Investment plans must also in-
clude monitoring and evaluation measures and cycles – and these must ensure invest-
ments lead to fair, accessible, responsible, and most importantly, sustainable systems.
Investment plans must be financially sustainable for the longer-term, and able to be
maintained beyond a typical 3–5 year project or governmental election cycle. They
must be backed by supportable business model(s). Where appropriate, they should
seek to exploit the full range of available funding approaches including cost-sharing
between organizations (Lillethun, 2021), public-private partnerships (PPPs), and non-
financial benefits to contributors (e.g. giving and receiving of data). Not-for-profit en-
gagement should also be considered. Land administration systems, and particularly
land registration services, are seen as revenue generators via fees, levies and charges
applied during land transactions and for land information. These revenues are reliant
on citizens trusting and using the system, and internal processes being efficient and
effective to ensure revenues outweigh costs. As part of the investment plan, the fund-
ing model underpinning the land administration agency demands review for appro-
priateness, whether this includes the agency receiving a regular annual subsidy from
the government, operating as a government business enterprise, generating profits via
pay-per-use, cost recovery, or making use of land-based financing tools.[36] The invest-
ment plan must align with the selected model.

> #### Case 5.2 – Collaborate for action
>
> International donor collaboration is a fast way to bring high-level capacity and skills
> to a county-level land administration agency. It can be done sustainably. Moldova
> (Ovdii and Zekušić, 2021), through the Agency for Land Relations and Cadastre of
> Moldova, builds long-standing and successful relationships over almost two dec-
> ades with the World Bank, Kartverket (Norway), USAID (United States of America),

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36 For more on land-based financing see: https://gltn.net/land-based-financing/.

JICA (Japan) and the European Union. This includes the creation of essential geo-spatial products including national level orthoimagery, digital terrain models, digital base maps, and most recently an IGIF Country Level Action Plan. The EU project includes advice and support from the national mapping and land administration organizations from the Netherlands, Poland, and Croatia. It includes training of over 100 staff, sustainable business model identification and development and pilot programs. Likewise, Kyrgyzstan's State Agency for Land Resources collaborates with Norway to fast-track high-quality (10–20cm) orthoimagery capture to support base mapping for disaster risk management and fit-for-purpose land registration activities (Figure 5.4, (Wills, 2022)). Recipients eventually also become providers. Lithuania, Latvia and Estonia undertook initial donor supported digitalization efforts in the 1990s and 2000s and later acted as country-level showcases for others embarking on similar journeys.

Land Registration & Cadastre
(Source: Google Maps.)

Disaster and risk management – earthquake hazards
(Source: AFP.)
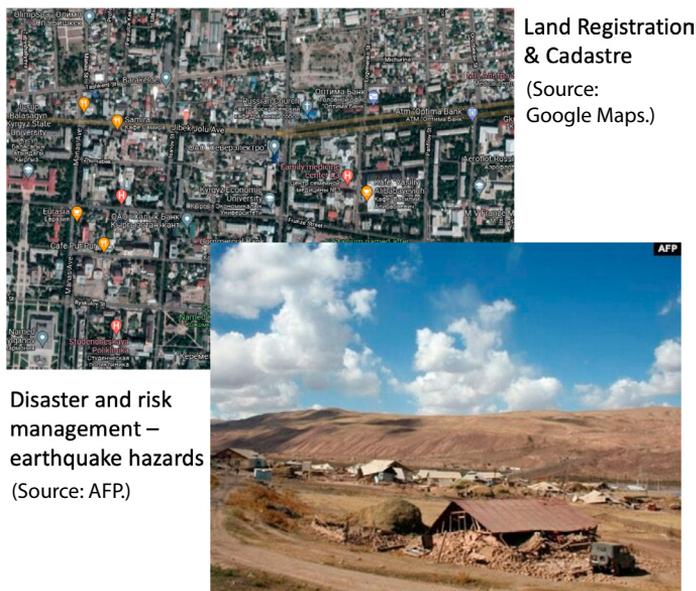
Figure 5.4: *Cooperation allows a fast-tracked infusion of financing, advocacy support and technical know-how into Kyrgyzstan.*

(Source: Wills, S. 2022. *Kyrgyzstan: A model for sustainable base mapping* . In: *Socio-economic benefits of geospatial information*. UNECE Webinar. UNECE, 19 May 2022. https://unece.org/housing-and-land-management/events/socio-economic-benefits-geospatial-information.)

5.2.4 Business models

Underpinning investment plans, a sustainable business model ensures the establishment, renewal, or maintenance of a system continues beyond the initial donor or project investment. Fundamental is that a system becomes self-sustaining, through revenue generation or some alternative – if not initially, then in the medium to longer term. This may mean providing options that enable incomes from land transactions to be distributed amongst all entities that generate up-to-date information and services.

Common issues include an agency not having a clearly defined business model; the model being entirely reliant on regular budget allocations or donor hand-outs; inappropriate costing and estimates of business model inputs and outputs; or an un-

dermined business model due to rent-seeking behaviours or failure to recognise important externalities. These can be countered by seeking to change the overarching financing model for the agency; moving towards open access data models with alternative funding arrangements (Case 5.3); seeking models where government or donor funding is guaranteed for longer periods; engaging in public relations campaigns to improve awareness of the system and promote increased use, and therefore lower fees; localisation of service offerings through digital one-stop-shops; or moving towards 'as a service' or subscription models.

Business model problems are often linked to broader governance problems within the land sector (Bennett *et al.*, 2021). This includes land administration organizations having only project-focus, rather than a focus on continuous improvements; organizations only having a mandate for initial data collection or registration; internal land administration employees and other stakeholders resisting changes due to perceived threats on job security; and organisational inertia underpinned by a lack of a culture of innovation and fit-for-purpose pragmatism within the organisation. These can alternatively be resolved through awareness raising, capacity development, or sector reorganisation.

Case 5.3 – Open for business

Contemporary implementation plans must consider the option of using 'open' and 'free' data. Open data is data that is publicly viewable, downloadable, streamable and reusable to the public, with some restrictions. This may come with a fee. Free data is open data with no fee or payment involved. It is 2014 and Poland is already moving towards the open data model for two key reasons: 1) value-added product creation by the private sector (Figure 5.5), which generates employment, more users, and more tax revenue for the government; and 2) the previous business model of selling data was not meeting cost recovery requirements. Jumping forward to 2020, going beyond addresses, geographic names, administrative boundaries and low-res DTM, the Head Office of the Geodesy and Cartography (GUGiK) opens most data sets, including partially opening cadastral parcels and building footprints. Opening data needs a holistic approach, alongside the policy decisions: online portals, services, partnerships, and awareness-raising needs funding. The agency also now helps 80% of the 380 local municipalities publish open cadastral data.
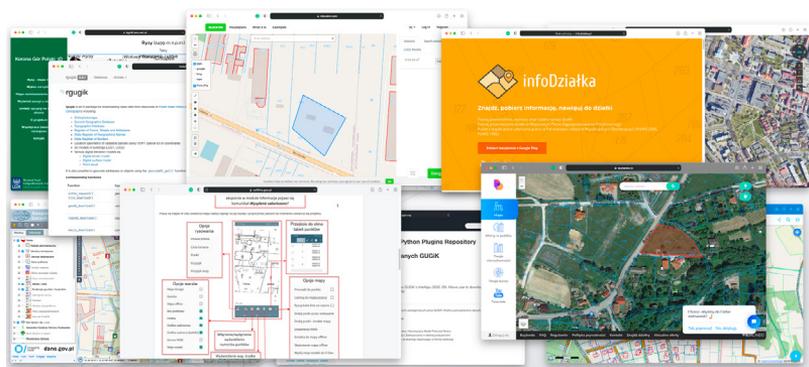

Figure 5.5: *Poland's open data policy activates value-added service creation.*
(Source: Grudzień, M. 2021. *Experiences from Poland on Open Data Policy*. In: *Geospatial Information for Digital Transformation*. Online Conference. Kartverket. Norway 27–29 October 2021.)

5.3 How do we ensure benefits are realised, measured, and sustained?

5.3.1 Goals, indicators and measurement

Performance management is the non-negotiable mainstreaming of assessment of organisations and individuals. It is enabled by goal establishment, indicator identification and measurement. The land administration and NSDI sectors have embraced the performance management approach. Increasingly, driven by corporate social responsibility objectives (CSR), performance measurement is aligned to SDGs achievement, including in land administration organizations. The aim is to ensure an agency and its people deliver broader societal benefits, be they towards environmental sustainability, social inclusion of vulnerable groups, equality or fairness. For land administration these include the following SDGs and targets: 1) No Poverty (Target 1.4); 2) Zero Hunger (Target 2.3 and 2.4); 5 Gender Equality (Target 5.a); 11) Sustainable Cities and Communities (Target 11.1, 11.3, and 11.7); and 15) Life on Land (Target 15.1, 15.2, and 15.3).[37,38] This emerging emphasis on the SDGs means moving from an immediate focus on outputs of organisational tasks and processes to a broader and longer-term focus on outcomes, where the broader societal impacts of the work of the agency are measured. Digital transformation agendas, driven by action and investment plans, must align with this new approach to performance management.

5.3.2 Data-driven and dashboards

Digital transformation of land administration organizations creates increased internal capabilities for tracking performance, measurement of indicators, and ongoing goal assessment. Data-driven, people-oriented land administration organizations have increased analytical capabilities meaning KPIs are measurable in close-to real-time, be they related to numbers of land transactions processed, amounts of spatial and other information on tenure rights streamed, positive customer interactions, or data quality or maintenance measures. Via online dashboards, performance is made available to decision makers and the public in simple, visualised, and accessible fashions, supported via online and social media publications. Land administration outputs and outcomes can be aggregated, cleaned, and used to report on broader societal goals, such as those SDGs linked to carbon emissions reductions, or property rights in the name of women. As an example, since 2013, Western Balkans countries including North Macedonia have worked with FAO and the German Agency for International Cooperation (GIZ) to create gender-disaggregated property ownership information directly from property registration and cadastral systems. This now helps to measure, record, track and visualize SDG target 5a that seeks "to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws" (Figure 5.6).

5.3.3 Indicators for cybersecurity and risk management

Digital transformation is double-edged when it comes to performance. Moving towards fully digital operating environments exposes land administration organizations to the threat of cyberattack. The digital acceleration of online service provision occurring during the COVID-19 pandemic was also accompanied by increases in cybercrime.[39] As more

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37 For more on LAS-related SDGs see: https://landportal.org/book/sdgs.
38 For coverage of FAO-related SDGs see: https://www.fao.org/sustainable-development-goals/indicators/en/.
39 For more on increases in cybercrime during the COVID-19 pandemic see https://www.cyber.gov.au/acsc/view-all-
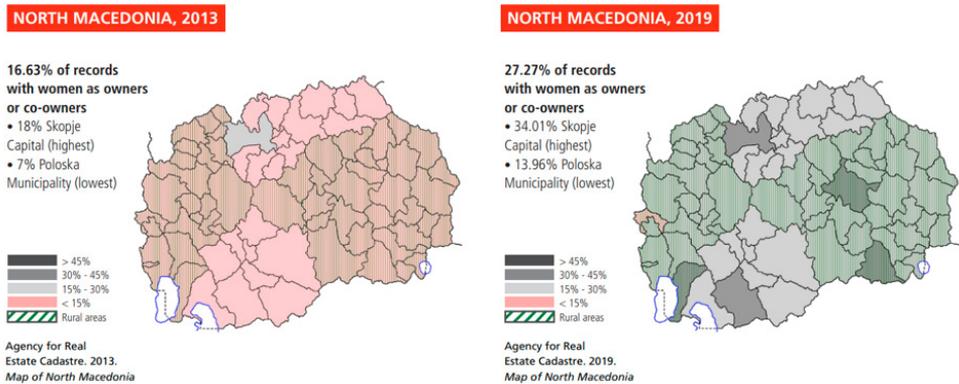
Figure 5.6: *Gender disaggregated property ownership information supports monitoring of SDG 5 in North Macedonia.*

(Source: FAO. 2022. Achieving Indicator 5.a.2 in the Western Balkans and Beyond, Partnership for Gender Equality and Land Ownership and Control. https://www.fao.org/3/cb9475en/cb9475en.pdf.)

organizations, businesses and enterprises go digital, the size and scale of cyber threats and attacks will increase. Former paper-based processes and manual procedures were carefully developed to minimize the risks of fraud, corruption, and document damage. Whilst digital systems are also designed with these risks in mind, digital transformation potentially reopens and expands these threats, especially if technological solutions are not implemented appropriately. For example, the lauded immutability of blockchain does not mean it cannot be undermined by social engineering attacks, insider threats, or smart contract coding errors (Zamani, He and Phillips, 2020). Digitally transformed systems must deal with new risks and threats specific to the digital environment.

Specific threats to land administration organizations may come from internal or external sources: customers, disgruntled employees, consultants, or malicious international crime syndicates. Common attacks include digital fraud, identity theft, extortion,[40] malware attacks, and enablement of stalking. Exposure sites and activities include employee workstations and laptops, other external devices, outsourcing or offshoring arrangements, crowd applications and use of cloud services. These issues go beyond ethical concerns around data ownership and intellectual property (IP) protection, data re-use, digital profiling, aggregators, personal data privacy, and data sovereignty. These emerging cyber threats require the establishment of a digital transformation risk management framework, linked to the overarching performance management system of the land administration system. Digital transformation risk identification, assessment, and management – either avoidance, mitigation, transfer, or acceptance – must be undertaken in collaboration with IT and legal functions within the land administration organization and broader government. This is an area for urgent international attention. Much guidance already exists on how land administration can support broader disaster risk management at societal and individual levels, however, less is available on how to digitally secure land administration organizations. Implementation, action, and investment plans need to include these elements.

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content/reports-and-statistics/acsc-annual-cyber-threat-report-2020-21.

40 Note: Unfortunately, in some country contexts, public access to land information systems and other open databases is used for identifying wealthy people and extortion attacks.

5.3.4 Review service levels, maintenance and sustainability

The benefits of digital transformation also raise expectations of the community, citizens, and customers. Moving to the 24/7 online service paradigm sees an increase in demand for an always-on helpdesk and online query resolution. The expectation is that there is no downtime, or at least a clear and advance warning if systems are taken offline for periods of maintenance. These expectations require assessment and potential adjustment of resource allocations. A broader perspective on sustaining performance and maintenance must be taken. Conventional financial (i.e. revenue generation) and service-oriented (e.g. transaction quantities, timeliness, customer feedback) metrics for land administration organizations remain relevant, however, digital capabilities also create demand for a new set of indicators. These might include system maintainability, upgradability, resilience, accessibility (e.g. social exclusion and inclusion), community awareness and trust (Case 5.4), human resource pipelines, cyber-attacks and responses (including measures for confidentiality, integrity and availability). Monitoring and evaluation of these aspects will ensure the longevity of both hard and soft aspects of any digital transformation investment.

> ### Case 5.4 – Ethics and land data
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> Land tenure, land value, land planning and land development are sensitive issues. Decisions on land use and ownership can have significant political, economic, and social fallout. Land administrators know this. It is why professional codes, policies, laws, and regulations are developed to guide practitioner and organisational conduct. It is also why land is implicit in so many of the SDGs. Data about land is no different. Land administration practitioners and organizations must be aware of both the opportunities inherent in digital land data use, and the ethical threats. Locus Charter[41] principles are developed to support professionals and organizations in the ethical collection, use, dissemination and sharing of spatial and other information on tenure rights. These aim to protect not only personal privacy but ensure minimisation of financial, social, or political exploitation or disadvantage by government, private sector or not-for-profits. The aim is to empower professionals, rather than create barriers to sharing. Aggregated land data can also shed light on disadvantages or improvements for women and other vulnerable groups if collected, protected, and disseminated in responsible ways. It can help to identify good practices and demonstrate the achievement of the SDGs.

5.3.5 Track capacity, education and training

Longer-term sustainability of land administration systems demands increasing the focus on education, training, and capacity development. This aspect is often mentioned and constitutes one of the nine strategic pathways of both IGIF and FELA. However, capacity, education and training are often poorly implemented in practice through limited coordination, inadequate resourcing, and failure to undertake sector-wide capability mapping and monitoring. In the digital era, this capacity gap for land administration becomes an even greater issue. Not only must land administration systems ensure a pipeline of new talent and upskilling of traditional surveying, legal and administrative professionals, but the IT function also brings a new resource and training requirement and associated expenses. All new land administrators require digital acumen and an IT

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41 For more see: McKenzie, D., (2021), Location Privacy and More In: Geospatial Information for Digital Transformation – Current Initiatives and Future Opportunities, Online Conference, 27–29 October, Kartverket, Oslo, Norway.

skillset, yet many educational institutes fail to embed basic concepts and IT into programs. This is whilst practitioners and land administration organizations regularly cite IT skills as the most important, most scarce, and hardest to place future skillsets within their organisations.[42] An additional burden for land administration organizations is that once local staff are upskilled with IT skillsets, they receive strong offers from the private sector. Solving the capacity issue requires long-term thinking. It requires a baseline assessment of the gaps within a country. It needs sector-wide coordination in developing strategies and actions to fill gaps, including close collaboration with professional bodies, land administration organizations, and tertiary providers. A sustainable means for delivering on the strategies is also needed. This could include legislative changes (e.g. recognise professions, increase ease of entry), new funding models (e.g. industry scholarships), partnerships with industry (e.g. internships, outsourcing), standards creation, continuous and lifelong training, and awareness-raising amongst high-school leavers.

5.4 Takeaways and recommendations

Moving from a vision of digital transformation towards implementation demands significant attention and resources. Any initiative must directly align with and demonstrate benefits for broader governmental priorities. The approach must be systematic, unified, and durable. Global guidance and support on implementation, via the IGIF and FELA strategic pathways, are encouraged. Digital transformation baseline assessments are needed, followed by impact assessment and action plan development. These must be tailored to the specific country context and detail costing of actions, sourcing of finance, return on investment, and plans for monitoring and evaluation. A sustainable business model is essential to ensure initial and ongoing investment into the system. This includes funding for coordination, regulatory development, technology, capacity development and communication aspects. Fundamental is that a system becomes self-sustaining, through revenue generation, that could be shared between agencies. A broader perspective on performance must be taken, preferably ensuring alignment with the SDGs, supported by data-driven tracking and measurement of indicators. Emerging cyber threats require the establishment of a digital transformation risk management framework.

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42 UNECE (2022) Webinar – Geospatial information – advanced education and competence needs, March 22 2022, https://unece.org/info/events/event/364956.

6   IMPACTING GLOBALLY – LESSONS AND OUTREACH FOR THE INTERNATIONAL LAND ADMINISTRATION SECTOR

6.1   Are digital transformation lessons globally transferable?

6.1.1 Common ground

Ideally, land administration systems reflect local conditions and beliefs about land (Masser, Williams and Williams, 2005). Each system should have unique features. Efforts to directly transplant the system of one country to another have often failed (Asiama, Bennett and Zevenbergen, 2017). However, geographical, and historical similarities do exist and provide for common ground. The global land administration community recognizes this, seeking to support the development, sharing, and responsible transfer of land administration knowledge and approaches. It results in policy guidance, techniques, tools, and donor support.

6.1.2 Digital dialogue

As already seen, the land administration systems of UNECE countries are at different phases of digital development. Many are well advanced, but many still have parts of processes using paper, manual and face-to-face procedures. The digital transformation of land administration offers a new space for knowledge creation and sharing between countries in the UNECE and beyond. The next sections cover COVID-19 pandemic digital disruption experiences from the Asian, African and Latin American regions. The intention is to give a broad selection of diverse cases, based on case materials made available from selected countries and project work.

6.1.3 To pause or proceed?

Like the UNECE, other regions and countries had mixed COVID-19 digital disruption experiences. In some contexts, digital services were already in place, expanded, and further development was pursued. In other contexts, where digital ecosystems were still immature and lacking basic digitization, land administration services continued face-to-face, meaning service pauses, backlog build-up, or informal transactions. Additionally, in contexts that relied heavily on donor support, a slowdown in development was experienced, due to lockdowns and travel restrictions on international expertise.

6.2   How do developments compare in Asia?

6.2.1 Rapid advances with digital diversity

Asia is large, diverse, and home to more than 50% of the world's population. At the onset of the pandemic, many Asian countries stood out for their early response to the COVID-19 pandemic. Technological capabilities and innovations, especially in mobile and digital technologies, provided the basis for rapid and effective action to protect the health of people in the region (as shown in e.g. China, the Republic of Korea and Singapore). Digitization of products and services was critical, led by the development of test kits and apps to track and trace infections, but also the rapid establishment of digital communication platforms and virtual networks that enable home-based work to sustain economic activity.[43] In these contexts, digital land administration services continued as

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per the UNECE region. In contexts where digital ecosystems were less developed, land administration services had to continue face-to-face, and in some cases cease. With many islands and coastal areas, Asia has the highest proportion of weather-related disaster displacements worldwide. Interlinked challenges between land tenure, food security, and climate change are experienced in China (Jansen, 2022), Cambodia (de Andrade Correa and Jansen, 2022d), Lao People's Democratic Republic (de Andrade Correa and Jansen, 2022c), Myanmar (de Andrade Correa and Jansen, 2022a), and Viet Nam (de Andrade Correa and Jansen, 2022b). Major challenges facing land governance and SDIs include resettlement, climate-induced migration and disaster risk management (DRM). Vulnerable groups are most at risk. Different trends and drivers are shaping current digital initiatives. Like in selected UNECE countries, IGIF is being used by World Bank and other donors for baseline assessment, action and investment planning.

6.2.2 Digital and direct access in India

The Indian State of Karnataka's Bhoomi project continued to deliver impressive results during the COVID-19 pandemic. Implemented under the framework of the computerization of land records, it is a collaboration between the State government and the Federal Rural Development Ministry. Paper-based records were first digitized, and further sourced into a digital land record system. This delivered vast improvements over the manual system it replaced. Aided by accelerated digitalization of entire processes, Bhoomi significantly reduced inefficiency and corruption and improved service delivery (Munshi, Kumar and Malik, 2019). Transparency was increased through an implemented mandatory change log including biometrical identification of all system operators. Enabled through a centralized digital infrastructure, land records can be accessed at subdistrict offices, allowing instant printing and the (partly digital) interaction with digital land records. End-user devices with internet access can also access records on rights, tenancy, and crops. As of July 2021, more than 30 million applications had been received, and almost 20 million applications were approved.[44] An important contrast to many UNECE countries is the upkeep of subdistrict land offices that actively counteracts the digital divide by ensuring local service access for those without internet. The Bhoomi project in Karnataka potentially sets an example for digital transformation across other parts of the country.[45]

6.2.3 Driver variety in Viet Nam

Like countries in the UNECE region, an array of drivers pushes Viet Nam's land administration system towards full digitalization. This includes the e-government reforms[46] and the National Digital Transformation Programme.[47] These intend to accelerate a digital transformation in Viet Nam by 2025, specifically in response to climate change (de Andrade Correa and Jansen, 2022b). Six key land agency datasets, including geospatial data, were identified as critical to Viet Nam's economic development, emphasizing the importance of national-level dataset availability, interoperability, and integration at the national level. Through donor collaboration, several key registers are being integrated on a nationwide platform (Figure 6.1). Meanwhile, efficiency and transparency play a

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44 For more on Bhoomi see https://landrecords.karnataka.gov.in/service127.

45 Note: Although the modernization of the land administration was initiated three decades earlier, progress in the 27 states of India continues to vary greatly.

46 For more on e-government developments in Viet Nam see: https://www.afd.fr/en/carte-des-projets/support-development-e-government-vietnam.

47 For more on the National Digital Transformation plan see: https://www.vietnam-briefing.com/news/vietnams-digital-transformation-plan-through-2025.html/.
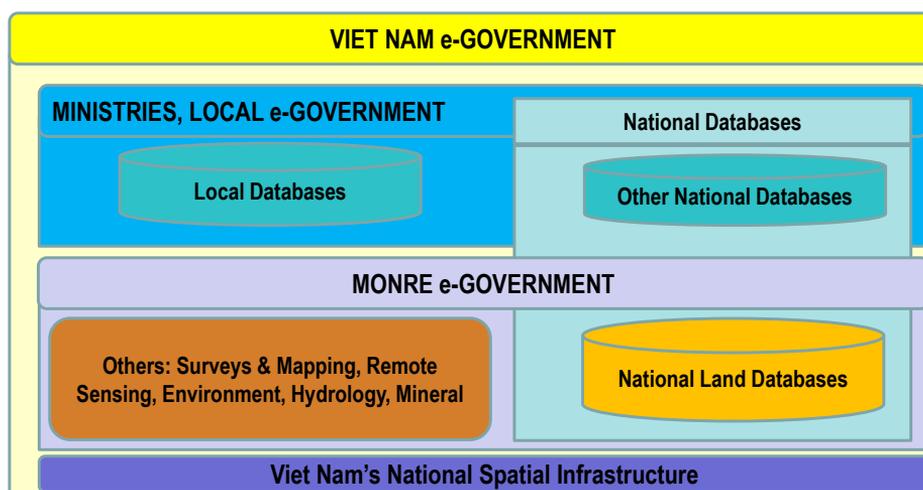
Figure 6.1: *Viet Nam National Land Information System in e-Government Architecture.*

(Source: Phong, D.H. 2019. *Vietnam National Land Information System in e-Government Architecture*. In: *FIG Working Week: Geospatial information for a smarter life and environmental resilience*. Hanoi. 22–26 April 2019.)

major role in the World Bank-funded Land Administration and Database Improvement Project (2016–2023).[48] The project focuses on improving access to land information and land services, paying particular attention to vulnerable groups, especially ethnic minorities, through the implementation of development plans and land rights registration. A national multi-purpose land information system (MPLIS) is being developed to provide broader government and public access to authentic information.

6.2.4 Acceleration with accountability in Indonesia

By population, Indonesia is the 4th largest country in the world. It has over 10,000 islands. In 2018, the country invested USD 200 million to establish clarity on actual land rights and land use at the village level in selected areas (World Bank, 2018). The aim is to map all remaining Indonesian land parcels by 2025. It is expected that there exist 126 million parcels. Indonesia's President has set the Indonesian Ministry of Agrarian and Spatial Planning/National Land Agency (ATR/BPN) a huge challenge and the organization is responding heavily through the use of digital technologies (Sancoko *et al*, 2022). It has used IGIF and FELA to support its work in this regard. For the parcel-level data capture, it has embraced digital FFPLA approaches, such as PaLaR (Aditya *et al.*, 2020). It is capturing millions of parcels per year out of its 400+ local land offices. Whilst paper-based records and certificates remain the legal point of truth and are housed at the local level, all data is digitized daily and submitted electronically to the national data centre outside Jakarta.[49] It acts as the master repository and is accessed by the local land offices for information requests via web services. The scale is impressive; however, the high-speed process creates many challenges. The quality of both historic digital and paper records is not considered high: many records are disputed or lack accurate spatial or legal information. Beneath many of the information issues sit more fundamental

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48 For more on the World Bank project see: https://www.worldbank.org/en/news/press-release/2016/07/05/vietnam-improving-efficiency-and-transparency-in-land-administration-services.

49 For more on the Indonesia One Map policy see: https://www.opengovpartnership.org/wp-content/uploads/2001/01/case-study_Indonesia_One-Map-Policy.pdf.

Figure 6.2: *Digital documents and services supporting ATR-BPN digital transformation.*
(Source: Sancoko, A.Y.D., Ramadhani, S.A., Brilianto, D.E. and Swantika, S.P. 2022.
COVID-19 Pandemic and Land Administration Modernization in Indonesia.
In: FIG Congress 2022, Poland, 11–15 September 2022.)

and unresolved land tenure issues. Citizens are also unaware or unwilling to use the services of ATR/BPN due to service fees or lack of trust. During the COVID-19 pandemic (Sancoko et al, 2022), efforts were made to reduce paper-based processes (Figure 6.2). However, ATR/BPN is careful not to impose full digital solutions on the hugely diverse and disparate population. It recognizes the need to implement e-policies responsibly and therefore continues to maintain and enhance its local land offices.

6.2.5 Faster and free in the Philippines

Traditional surveying and land administration methods would take far too long and are simply not feasible to fulfil the Presidential mandate to distribute all state lands and collective lands to beneficiary farmers by 2024.[50] Instead, simple, fast and innovative procedures are needed to advance data collection on parcels and land rights. In the COVID-19 pandemic year of 2020, the World Bank-funded SPLIT (Support to Parcellation of Lands for Individual Titling) project[51] was launched and is being implemented by the Philippine land agencies (Department of Agrarian Reform, Department of Environment and Natural Resources and Land Registration Authority). The aim of the project is to improve parcelling procedures with the help of digital technologies. A data management system is being introduced by the Ministry of Agrarian Reform to support parcelling and the issuing of land titles. Additionally, the KoBo Toolbox forms another part of the toolkit to achieve the ambitious goals. The Kobo Collect platform is a free and open-source Android software that significantly speeds up the process and

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50 For more on process improvements in the Philippines see: https://www.dar.gov.ph/index.php/articles/news/103021.

51 For more on the World Bank SPLIT project see: https://projects.worldbank.org/en/projects-operations/project-detail/P172399.

reduces physical contact between team members and farmers, allowing for more efficient and socially distanced data collection during COVID-19. However, in addition to the supporting technology, capacity is also needed to implement the project on a large scale. Recently, 6,000 people were recruited for the project. In the event of a future pandemic, the Philippines is well prepared with digital infrastructure and data collection methods that also allow for social distancing.

6.3 Are there similar developments evident in Africa?

6.3.1 Youth, capacity, and investment opportunities

Africa is the fastest-growing continent with a young and increasingly well-educated population. This should present huge opportunities for country-level land administration digitalization; however, initiatives tend to lag. Even though 80% of the continent's population has a mobile subscription, the continent is still the least connected (34% coverage). Key challenges are low internet network coverage and quality, high operating costs, barriers to market entry, lack of competition, cybersecurity (cybercrime) and high operating and investment risks (Diagana, 2021). Compared to the UNECE COVID-19 experiences, with most of the workers on-site and with fewer lockdowns, there was less immediate impetus for digital acceleration in the land sector. Many initiatives were even delayed or stalled. However, many mobile-enabled platforms across the region from other sectors are experiencing exponential growth. They are disrupting traditional value chains (Songwe, 2020). Sound investments, incentives, and business models will deliver digital transformation.

6.3.2 Seeking system sustainability in Rwanda

Like various UNECE post-conflict countries, Rwanda used the development of its land laws and administrative systems to support national reconciliation and consolidate political stability in the early 2000s (Takeuchi and Marara, 2022). Its initial FFPLA land regularization program used a hybrid of paper-based and digital processes and registered approximately 12 million land parcels over three years. Despite many logistical and social challenges, the intervention was a benchmark for FFPLA. In the decade since the initial registration, Rwanda has faced the challenge of keeping its national land information system up-to-date, and the underpinning IT infrastructure maintained. In-house government capacity for this work is scarce. It is difficult to hold highly trained staff. There are also the challenges of getting citizens to register transactions, maintaining software licenses, and ensuring the initial investment produces longer-term benefits. These challenges remain ongoing. Meanwhile, further afield, support for broader digitalization in government is provided by the World Bank. It is assisting in creating digital literacy among the citizens, especially among women and girls (World Bank, 2021). In contrast to UNECE counties, digital literacy is being tackled before embarking on wider digitalization efforts. Meanwhile, a PPP with Medici Land Governance led to the piloting of the Ubutaka app, a land transaction application that is being integrated across essential Rwandan services for improved efficiency in land transactions (Figure 6.3). The app is built on a blockchain and integrated with existing infrastructure and existing e-services. It is designed to make land transfers by voluntary sale paperless and more secure. Again, if successful, it will be important to ensure vulnerable groups can also access the system.

Figure 6.3: *Rwanda's paperless land registration application dubbed 'Ubutaka App' has received high recommendations at the African Union level with a promise to disseminate it to other countries on the continent.*

(Source: Mediciland. 2021. Rwanda's Ubutaka app. https://mediciland.com/ubutaka-app-rwandas-paperless-land-registration-system-ready-to-go/. Photo: Kwabena Asiama.)

6.3.3 Donors, disasters, and digitalization in Ghana

Ghana's digital initiatives have been mainly donor led. Prior to 2017, effort centred on digitizing land title deeds. This was driven by DRM and aimed to provide a backup to protect against disasters like flooding (Figure 6.4). The initiatives were oriented towards the backend with no catalogue or public online portal (EAP, 2022). Post-2017, digitalization efforts were oriented towards multiple sectors and spearheaded by the President. Despite the initiative, the country still lacked spatial information to support land

Figure 6.4: *Perennial floods in Accra, Ghana, results in damaged records and drives digitization of land records.*

(Source: Graphic Online. 2022. Floodwater destroys documents at Lands Commission. https://www.graphic.com.gh/news/general-news/floodwater-destroys-documents-at-lands-commission.html.)

administration (Asiama, Bennett and Zevenbergen, 2017). In 2020, like the experiences in UNECE countries, the COVID-19 pandemic brought impetus to fast-track e-conveyancing in Ghana. The national-level government's online portal, *ghana.gov*, was linked to the lands commission to allow for the tracking of land registration processes. Where previously document verification processes were paper-based, online land transactions were now enabled, and processing times decreased.[52] However, in terms of equality and inclusion, the situation was less positive in rural customary lands: customary land secretariats fell outside the COVID-19 digitalization process (Asiama and Arko-Adjei, 2022). The passage of Ghana's Land Act 2020 aimed to streamline the operations of the customary land secretariats in both urban and rural areas. However, with the National Geospatial Policy still under debate, there remains a gap between agencies that use spatial data, especially on rural customary lands. Ghana's situation shows the need for a responsible and holistic approach to digitalization, especially where legal pluralism exists. It shows the importance of building an ecosystem of stakeholders in land administration development.

6.3.4 Pilots, pandemic and profits in Uganda

Unlike most UNECE countries, Uganda still seeks complete country-wide land administration coverage. It has undertaken various FFPLA pilots over the previous 10 years (Musinguzi, Enemark and Mwesigye, 2021). The SLAAC project (Oput, 2022) provides a recent scaled example (Case 6.1). To support these data capture developments, with World Bank support, Uganda has taken steps to scale its National Land Information System (NLIS) roll-out through the National Land Information System Infrastructure (DeSINLISI) Project, part of the 2015–2020 Land Sector Strategic Plan II. This program involved the digital integration of land administration data and processes. Most paper titles were digitized and verified in the system. The system has already returned more than 300% profit on the initial World Bank support. Additionally, the COVID-19 pandemic drove the introduction of two laws in the Ugandan parliament: 1) Electronics Transactions Act, and 2) the Electronic Signature Act, showing that, like UNECE countries, Uganda is also on the pathway towards e-conveyancing.

> ### Case 6.1 – Piloting FFPLA in Uganda via SLAAC
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> The goal of SLAAC is to secure the land tenure rights of customary land rights holders and users through systematic adjudication, demarcation, mapping of the land parcels, recording and issuance of Certificates of Title (Oput, 2022). Focusing on several districts, the objectives of the Project under Phase II are to: 1) adjudicate, demarcate, map, process and issue 830 000 Certificates of Title to customary land rights holders in rural areas of Uganda; and 2) adjudicate, demarcate, map, process and issue 100 000 Certificates of Title to land rights holders in peri-urban areas of Uganda. The use of the SLAAC Data Capture and Processing Application supports the issuance of Certificates of Customary Ownership, Communal Land Associations and Freehold Titles. It is a collection of tools, procedures and infrastructure that assist in the data collection, mapping, and processing of spatial and other land-related data in digital format. The data capture and processing application is based on mobile tablets installed with Windows Operating System (OS) and is now being upgraded to Android OS and is based on open-source software running on a Postgres/PostGIS database, Alfresco, and using QGIS software for mapping.

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52 For more on the online verification process in Ghana see: https://www.graphic.com.gh/news/general-news/lands-commission-to-commence-one-stop-verification-system.html.

6.3.5 Learning from local innovation in Kenya

System digitalization demands a holistic approach (Amankwah-Amoah *et al.*, 2021) underpinned by infrastructures such as electricity, internet, and social capacity. Some African countries have been creative in this regard with innovative solutions being found where essential or formal infrastructure was missing.[53] Mobile Money is one such solution with Mpesa in Kenya providing a prime example. Built to be a medium of money transfer, it soon became a medium for saving, as there were no charges for saving money. The urban poor and rural dwellers saw the value in the secured digital platform, considering that most could not demonstrate the baseline requirements needed to open a bank account. In Kenya and Zimbabwe, the rise of mobile money was first accelerated by the shock of civil conflict and runaway inflation (Ntara, 2015). It accelerated again during the COVID-19 pandemic as money transfers to relatives and donations for humanitarian aid became paramount (Gitobu, 2021). Land administration organizations in Africa can take advantage of such solutions. These homegrown digital innovations were implemented rapidly and occurred without donor support. Policy support is on the way too. The African Union Convention on Cyber Security and Personal Data Protection was adopted in 2014, and finally signed off in 2020 (African Union, 2020). The Convention addresses: 1) electronic transactions; 2) personal data protection; and 3) cyber security and cybercrime. As per the UNECE region, cybersecurity is prevalent and on the rise in Africa too.[54]

6.4   What are the comparable lessons from Latin America?

6.4.1 Digital transformation on the agenda

Latin America and the Caribbean account for less than 10% of the world's population, yet the region accounted for nearly one-third of all COVID-19-related deaths. Despite government efforts, the region became a global hotspot with Brazil as the country with the second-highest number of deaths at the country level and Peru with the world's highest rate of deaths per capita.[55] Similar to the UNECE region, the COVID-19 pandemic was seen as an opportunity to accelerate digitalization across sectors,[56] including land administration where, with donor support, previous efforts to integrate systems, digitize data and digitalize processes have delivered mixed results (Figure 6.5, (Munoz, 2022)). That said, many countries have in place supportive digital transformation policies that can be used as a basis to enhance land administration services. In Argentina, the *Agenda Digital Argentina*, is in line with the United Nations 2030 Agenda for Sustainable Development and is the basis for governing the digital transformation of the country (OECD *et al.*, 2020). Likewise, COVID-19 made a strong impact in the implementation phase of the Brazilian Digital Transformation strategy that started in 2018 (OECD, 2020). Similar drivers and envisaged developments as in the UNECE region are expediting the process (Figure 6.6).

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53 For more background on mobile money see; https://www.gsma.com/mobilefordevelopment/wp-content/up-loads/2020/10/State-of-the-mobile-money-industry-in-Africa-SOTIR19-cut.pdf.

54 For more on the African Union Convention and the rise in cybercrime in Africa see https://ccdcoe.org/organisations/au/ and https://ccdcoe.org/incyder-articles/african-union-adopts-convention-on-cyber-security/#footnote_0_2659.

55 For more on the WHO COVID-19 Dashboard see: https://COVID-19.who.int.

56 For an overview of the World Bank's Latin America and the Caribbean regional coverage: https://www.worldbank.org/en/region/lac/overview#1.

Figure 6.5: *Cadastre/Registry Integration in Latin America.*

(Source: Munoz, J. 2022. *Land Tenure Reforms in Latin America: The experience over past 20 years and future perspectives.* In: *World Bank Land Lightening Conference.* World Bank, May 2022.)
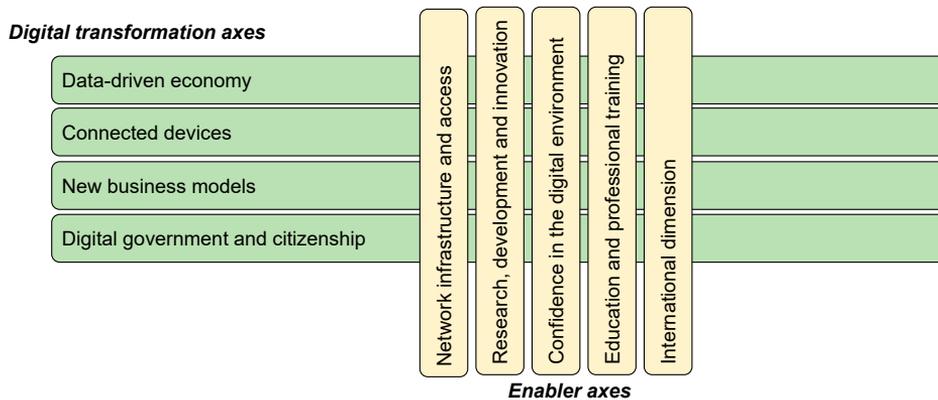
Figure 6.6: *Brazil's Digital Transformation Strategy.*

(Source: Government of Brazil. 2018. Brazilian Digital Transformation Strategy. https://www.gov.br/mcti/pt-br/centrais-de-conteudo/comunicados-mcti/estrategia-digital-brasileira/digitalstrategy.pdf.)

6.4.2 Interoperability and inclusion in Colombia

Like Rwanda and several UNECE countries, Colombia is an example of a post-conflict country driving the peace process via land policy and administration interventions. The development of a multi-purpose cadastre is key in this process. The government plans

to deliver improved services, data authenticity and 100% territorial coverage by 2025 (IGAC, 2019). Standards are playing a crucial role, with the national LADM-COL model developed to ensure data interoperability (Olaya Alvarez, Guarin and Cassalprim, 2020). However, the lack of up-to-date data and the existence of individual cadastres at the municipal level create large challenges for scaling up. In rural areas, an innovative, transparent, and participatory FFPLA methodology is central to the approach for land regularization,[57] whilst in Bogota, there has been much urban cadastre modernization (Moreno, 2022). Under the endeavour of fostering rural economic development, USAID is currently joining forces with the government of Columbia to implement the Land for Prosperity project.[58] Besides the facilitation of land titling, restitution, as well as capacity development, PPPs are also heavily promoted with the aim to strengthen local value chains, create new job opportunities, and spur rural economic development. Overall, heavily supported by donor financing, Colombia is accelerating digitally, and leveraging digital technologies to modernize its land administration system.

6.4.3 Durable and decentralized in Honduras

Aspects of digital transformation are visible in emerging countries like Honduras. Efforts started as early as 2004 through the PATH program (Proyecto de Administración de Tierras de Honduras) aiming to integrate the registry and cadastre into a single institution. These efforts were further accelerated in 2013 to bring the land administration system in line with the new institutional context, service delivery trends, and technology adoption (Handal, 2019). Modernization aims primarily at reducing the time and costs of land transactions (Ortega and Alvarez, 2019). PPPs are key in this process and already backed by supportive laws. The National Property Administration System architecture, SINAP, seeks to deliver a framework for an NSDI and, like in UNECE countries, is based on durable OGC and ISO standards. It hosts three interrelated subsystems: 1) SURE: Unified System of Registries integrating information relating to the property rights, 2) SINIT: National Territory system which records norms and territorial planning laws, and 3) RENOT: Territorial Norms Registry which registers and discloses national mapping information. The system maintains outlets for both public and private stakeholders and thus enables efficient workflows across sectors. SURE is managed by notaries and commercial banks, which has led to increased efficiency of land transactions with a significant reduction in processing time. However, the management of such a system, which should be fed by different institutions, was difficult to develop. In addition to the technical infrastructure, the decentralization of land administration services and the qualification of municipal offices to manage the cadastre in the national system, are also crucial to the modernization process.

6.4.4 COVID-19 collaboration in Nicaragua

The development of a new national cadastre and registry information system is also on Nicaragua's agenda. For 20 years the World Bank and other international donors financed PRODEP, a land administration project touching on legal, social and technical aspects. Aligned with holistic approaches seen in the UNECE, significant progress has been made in strengthening the legal framework, promoting gender equity in land rights, improving regularization, and the modernization of the land administration sys-

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57 For more on the Land in Peace Project in Colombia see: https://www.kadaster.com/-/land-in-peace-project-in-colombia; https://www.esri.com/about/newsroom/blog/colombia-remaps-land-for-peace/.
58 For more on the USAID project: Land for Prosperity, see: https://www.usaid.gov/sites/default/files/documents/Land_for_Propsperity_FactSheet_7.13.21.pdf.

tem. Tangible outcomes include the reduction of the days to complete a property transaction – from 50 to 18 – and a reduction in time to issue a cadastral certificate – from 12 to 6 days (World Bank, 2020b). PRODEP also contributed significantly to improved beneficiary perceptions of both land tenure security and land value (de la O Campos, Edouard and Ruiz Salvago, 2021). During the implementation of PRODEP, SIICAR, the national cadastral information system, was developed to unify cadastral and register information in one system to simplify processes and increase productivity. Examples include 1) the digitalization of cadastral documents and registry entries; 2) the structured management of registration and cadastral updating templates; 3) the exchange of information in real-time; 4) the establishment of performance and compliance alerts; 5) the modernization of registry and cadastral techniques; and 6) the implementation of the electronic folio. The implementation of SIICAR throughout the country is still a work in progress. However, at the onset of the COVID-19 pandemic the demand from notaries and banks to have access to online services increased, providing impetus for the cadastre and register to work more closely together and to accelerate the open access to SIICAR.

6.5   Takeaways and recommendations

The similarities and differences between country experiences with regards to digital transformation and COVID-19 responses show the importance of comprehensive politico-legal (Home, 2021), socio-economic and technological (Ameyaw and de Vries, 2020) aspects before generalizing (Asiama *et al.*, 2019). Like in the UNECE region, countries faced unique COVID-19 service delivery challenges, but also opportunities to utilize digital solutions. In Asia, digital transformation is high on the agenda in many countries and driven by rapid technological innovation, as a tool to lower levels of corruption and increase transparency. Elsewhere, climate change impacts drive donor support. In the African Region, whilst progress is steady and heavy reliance on donors remains, digital innovation is emerging from the informal or non-government sectors. This may drive conventional systems to move faster. The potential of digitalization to improve the lives of rural poor is recognized, however, harnessing the opportunity remains challenging for the government. Latin America shows the opportunity to use digitalization for post-conflict nation-building and that digital transformation agendas must and can link directly to SDGs achievement.

7 CONCLUSIONS AND WAY FORWARD

7.1 What are the major takeaways?

Starting from the digital disruptions triggered by the COVID-19 pandemic, this publication examined contemporary and future developments on digital transformation in the land administration domain, both in the UNECE region and beyond. There are many lessons and new knowledge is embodied in the following final takeaways.

7.1.1 COVID-19 response a cautionary success story

Exploration of land administration responses to the COVID-19 pandemic revealed many challenges, successes, and lessons (Chapters 2 and 3). Many land administration organizations were already equipped to work at a distance, deal with online service demand spikes, scale up IT infrastructure, respond swiftly to changing customer needs, and deliver novel data analytics services. Legal arrangements to support digital service delivery were often already in place or were adapted at short notice. Whilst the COVID-19 pandemic produced financial windfalls for many land administration organizations, it firmly put the spotlight on issues of digital exclusion, data quality, standards, staff capacity, customer awareness, and the need for cooperation with allies. These are areas where investment is most urgently needed.

7.1.2 Digital disruption is the new normal

Digital disruption is the new normal for land administration organizations (Chapters 2 and 3). Already, new armed conflict and energy crisis disruptions supersede the COVID-19 pandemic. Many systems are already operating with this mindset and can pivot, adapt, and learn on-the-fly – be it through leveraging off IT infrastructure investments, fast-tracking e-conveyancing, becoming more data-driven, fostering dynamic capabilities, or supporting innovation incubation hubs. Land administration and NSDI organizations should recognize digital disruption as an opportunity to improve services and data quality, find new customers, and create new services. To be equipped, digital transformation agendas for land administration must align with broader governmental policies, digital agendas, IT infrastructure development, and cybersecurity plans. Investment plans should equally direct resources towards partnership building, capacity and skills development, communication, and awareness-raising, to ensure they deliver societal benefits and assist in bridging the digital divide.

7.1.3 Investing in digital delivers for broader policy goals

Beyond the immediate lessons for the land administration and NSDI domains, the work brings a timely reminder that these systems do not function in isolation (Chapters 3 and 4). The COVID-19 pandemic evidenced the indispensable role that spatial and other information on tenure rights play in supporting the government to deliver on broader policy goals. They can simplify and help integrate cross-government business processes, improve data supply lines, and support streamlining e-services. The platforms can support health management, emergency response, property market stimulus, economic recovery, poverty reduction, protection of women and vulnerable groups, climate change response, food security and agricultural enhancement, disaster and conflict management, infrastructure provision, government interconnectedness, open data initiatives, citizen and business activation via crowdsourcing, and improved cybersecurity arrangements.

7.1.4 Capacity development of dynamic capabilities is urgent

The land sector is accelerating towards fully digitally transformed operating environments. They are establishing 'dynamic capabilities' to sense digital opportunities, seize them and continuously transform business processes (Chapters 3, 4 and 5). Capacity development programs at all levels of land administration organizations are needed to enhance these capabilities. Authoritative, available, accurate, accessible, and unambiguous digital datasets of parcels/buildings, rights, and people are an essential starting point. Beyond core datasets, land administration organizations likely have responsibility for 11 other datasets identified by UN-GGIM as critical for effective SDGs response. This includes responsibility for data quality. Land administrators must also have a data ecosystem mindset, assisting in the creation of inter-agency goodwill, goals, sharing, and custodianship.

7.1.5 Drivers and trends are diverse

Future land administration systems must be ready to respond to a diverse number of post-pandemic policy priorities (Chapters 4 and 5) including severe demographic shifts, increasing societal disparities, economic volatility, newly emerging business ecosystems, anthropogenic environmental damage, decentralized operating environments, political power shifts, and rapid urbanization. Equally, technological developments in cybersecurity, data privacy and ethics, open data, artificial intelligence, robotics, digital collaboration, innovation incubators, and crowdsourced data demand attention. Platforms for partnerships with the business and education sectors, as part of broader capacity development and community awareness-raising, need consideration alongside consideration of how to better support vulnerable groups, local communities, and basic data needs.

7.1.6 Selected design options must be fit-for-purpose

Future land administration systems will require more intelligence, interoperability, inclusivity, interactivity, incorporation, and investment (Chapter 4). They may need to explore 'As-a-Service', 'Platform' and 'Distributed' operational models, especially if these can enhance transparency, accountability, reliability, ease of use, collaboration, cooperation, and leadership. The selection must be fit-for-purpose and lead to improved land-related decision making, land tenure security, property taxation, land use planning, development, and land dispute minimization.

7.1.7 Action and investment needed now

A holistic approach is needed to implement digital transformation. It should incorporate key land administration stakeholders and link to broader government digital transformation agendas. The World Bank (Chapter 5) recommends the process including a) baseline assessment; b) alignment to policy drivers; c) socio-economic benefits analyses; and the subsequent d) detailed action plan and investment plan. The baseline assessment and action plan should consider the nine strategic pathways from UN-GGIM IGIF and FELA frameworks. The country-level digital transformation action plans should align with national policy agendas and target specific IGIF gaps and opportunities. The investment plan should cost actions, identify sources of finance, and include Return on Investment checks (RoI). Sustainable business models should consider fees and value-added services. Performance monitoring and evaluation, utilizing data analytics and dashboards, linked to the SDG's achievement is also essential.

1. Embrace Digital Disruption

2. Continue to Accelerate

3. Identify New Services for New Clients

4. Do the 6 i's, especially Inclusivity

5. Assess the 4 Models

6. Develop Action and Investment Plans

7. Manage Risks, Benefits and Performance

8. Share Globally
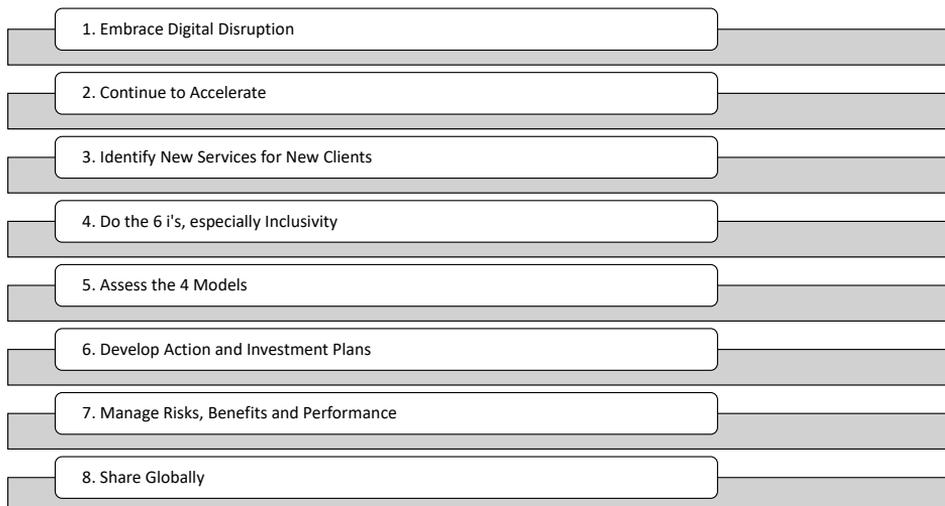
Figure 7.1: *Key takeaways and recommendations.*
(Source: Authors' own elaboration.)

7.1.8 Local lessons transcend globally, beware the digital divide

Lessons from the UNECE region transcend globally (Chapter 6). Supportive legislative environments, coupled with economic stimulus and earlier investment into digital infrastructure, saw land administration continue uninterrupted, and in many cases, service delivery reached unprecedented levels. In other less digitally transformed contexts, halts in face-to-face service provision were experienced resulting in a build-up of backlog requests. Here, those in rural contexts and the digitally disenfranchised tended to fare worse. Technology can be a leveller, but also a divider: equality to service access and skills development remains key (Chapters 1 to 6).

7.2 What are the key recommendations?

The major recommendations from across all chapters are provided in Figure 7.1. Like this work, they can be taken as stand-alone lessons, but also work together as a coherent and sequential whole.

7.2.1 Embrace digital disruption

Land administration must embrace digital disruption and adopt a robust digital transformation agenda.

7.2.2 Continue to accelerate

Land administration systems and NSDIs should accelerate both strategic and operational digitalization agendas.

7.2.3 Identify new services for new clients

Land administration can deliver or support the delivery of a range of new data products and services (including data analytics capabilities) to other sectors, government organizations, and citizens.

7.2.4 Do 6 I's: Intelligent, Integrated, Inclusive, Interactive, Incorporated, and Invested In

Land administration systems of the future will be more intelligent, integrated, inclusive, interactive, incorporated and invested in. However, perhaps of most importance is ensuring the digital inclusivity of women and vulnerable groups.

7.2.5 Explore the four models

There exists no 'one-size-fits-all' approach for the digital transformation of land administration: conventional, as-a-service, platform, and distributed models can be used to start the country-level discussion

7.2.6 Develop an action plan and business model

Successful and sustainable digital transformation of land administration is grounded in a sound action plan, investment planning, and a robust business model. These should be aligned to county-level drivers, be fit-for-purpose, include short- and long-term priorities, and be predicated on a reliable benefits analysis.

7.2.7 Measure risks, benefits, and performance

Risk assessment, benefits analysis and performance measurement are essential components of successful digital transformation in land administration.

7.2.8 Share globally, include locally

There is much to be gained by sharing transferrable regional and country-level lessons of land administration digital transformation, noting that no two systems are alike.

7.3 What comes next?

Looking ahead, building from the momentum of the recent COVID-19 pandemic success stories, land administration organizations can re-evaluate current plans for digital transformation and further opportunities for acceleration. Figure 7.2 provides baseline high-level guidance for short-, medium- and longer-term actions, noting that all land administration systems are at differing levels of development and operating in differ-
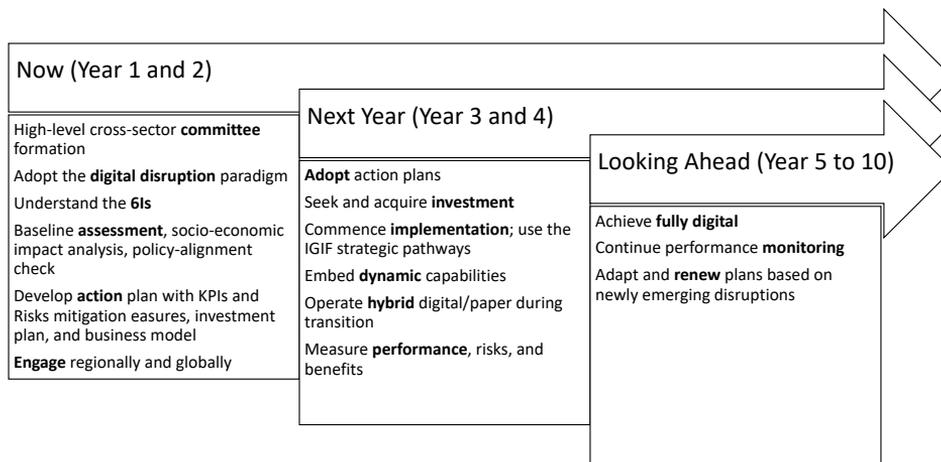
Figure 7.2: *Baseline next steps plan for the digital transformation of land administration.*
(Source: Authors' own elaboration.)

ent country contexts: some actions may already be complete, others at varying stages of implementation. Therefore, the baseline actions are to be treated as checks, rather than a hard sequential list of activities.

Short-term actions should ensure requisite cross-sector committees are in place, sector-wide adoption of the disruption paradigm, global and regional engagement, baseline assessments of the state of play, assessment of the contents of this publication, and creation of action and investment plans. Medium-term actions should seek adoption of the plans at a higher level, investigate investment funding acquisition, and commence implementation, noting the need for transition planning. Monitoring of risks, benefits and performance measures is also necessary. Embedding of dynamic capabilities at individual, organizational, and sector levels is important during this period. Longer-term actions seek to achieve full digital transformation, continuous monitoring and responding to emerging disruptions.

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GLOSSARY

It is considered necessary that a publication of this kind, dealing with constructs linked to land tenure, land administration, and land information, makes clear the definitions of terminology used within. In this regard, this section points readers to previous FAO and FIG glossaries, abstractions of key terms from within those, and specifically the Land Portal's LandVoc (https://landportal.org/es/node/100227). Note: included in this glossary are only those terms considered central and cross-cutting to all chapters in this publication.

Cadastre
A spatial register recording interests in land, usually parcel-based.

COVID-19 pandemic
The World Health Organization declared a global pandemic linked to the coronavirus disease, caused by the SARS-CoV-2 virus, from 11 March 2020. At the date of publication, the pandemic was on-going.

Digital acceleration
The observed increase in instigation and implementation of digital transformation initiatives and may also be referred to as 'accelerated digitalization'.

Digital disruption
A disturbance or interference to an event, activity, or process triggered by digital technologies.

Digital transformation
An umbrella term describing the process of moving an organization or sector from paper-based and manual service delivery, towards modes that are fully mediated by digital technologies, and providing for the creation of entirely new digital products and services.

Digitization
The conversion of data and information from analogue to digital form.

Digitalization
The adaption or redesign of existing business processes that seek to take advantage of digital data and technologies and may be considered part of business process re-engineering.

Integrated Geospatial Information Framework (IGIF)
A policy framework and associated set of resources to support the implementation of NSDIs, endorsed by the UNGGIM.

Framework for Effective Land Administration (FELA)
A complementary specialization of the IGIF for the domain of land administration.

Geospatial information
Data that is organised and directly or indirectly references a specific location or geographical area. Considered synonymous with 'spatial information' in this publication.

Land administration
The process of determining, recording, disseminating, and maintaining information about the relationship between people and land, including tenure, value, use, and development.

Land Administration Organization
An entity mandated to deliver land administration services, usually at national or state level. It is usually a governmental or public entity, but can also be a private or non-governmental institution.

Land information
Any organised data that results directly or indirectly from the processes of land administration.

Land registration
The process of recording interests over land, of which the land register is the primary artefact.

Land tenure
Land tenure is how societies regulate how people, communities and others gain access to land, fisheries and forests. These tenure systems determine who can use which resources, for how long, and under what conditions. There is no international definition of land within the context of tenure. The meaning of the word may be defined within the national context (FAO, 2022).

Spatial Data Infrastructures (SDIs)
The policies, networks, and standards that enable the exchange, dissemination, interoperability, and use of essential spatial data by governments, citizens, the private sector, and other stakeholder users. At the country-wide level, these are known as National Spatial Data Infrastructures or NSDIs.

Sustainable development
The development that meets the needs of the present without compromising the ability of future generations to meet their own needs. As part of the 2030 Agenda for Sustainable Development, a framework of 17 Sustainable Development Goals (SDGs) was defined and adopted by all UN Member States in 2015.

Spatial and other information on tenure rights
Refers to any organized data on the administration of people-to-land relationships, including any entities and attributes on people or parties; land rights, restrictions, responsibilities, and related documents (including land tenure, land valuation, land use planning, and land development aspects); spatial information (including parcel boundaries, coordinates, and survey measurements); and any metadata supporting land administration. The information can be statutory or non-statutory in nature. The terms spatial is considered synonymous with geospatial in this work.

APPENDIX 1 – UNECE COUNTRY CASES AND REFERENCES

	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7
Andorra							
Armenia	X	X					
Austria							
Azerbaijan		X		X			
Belarus			X				
Belgium		X	X				
Bosnia and Herzegovina		X	X				
Bulgaria			X				
Canada				X			
Croatia	X	X	X		X		
Cyprus							
Czech Republic							
Denmark				X			
Estonia					X		
Finland		X					
France		X					
Georgia				X	X		
Germany		X	X	X	X		
Greece		X					
Hungary							
Iceland							
Ireland							
Israel							
Italy		X					
Kazakhstan							
Kyrgyzstan			X		X		
Latvia					X		
Liechtenstein							
Lithuania					X		
Luxembourg							
Malta							
Republic of Moldova			X		X		
Monaco							
Montenegro							
Netherlands	X	X	X	X	X		
North Macedonia					X		
Norway		X			X		
Poland			X	X	X		
Portugal		X					
Romania							
Russian Federation	X	X	X	X			
San Marino							
Serbia		X	X	X			
Slovakia							
Slovenia							
Spain	X	X	X				
Sweden				X			
Switzerland							
Tajikistan							
Turkey							
Turkmenistan							
Ukraine	X	X			X		
United Kingdom			X				
United States of America							
Uzbekistan							

Note: Chapter 6 is dedicated to country cases from outside the UNECE, from Asia, Africa, and Latin America. Chapter 7 is a summary chapter.

APPENDIX 2 – THEMES

		Relevant SDGs	Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6	Chapter 7
1	Gender Equality and Poverty Reduction	1, 5, 10	1.1.2; 1.6.7; 1.6.8	2.1.1; 2.1.6; 2.1.7; 2.2.5; Case 2.3	3.2.1, 3.2.3; 3.3.1; 3.3.3	4.1.1; 4.1.3; 4.1.5; 4.2.4	5.1.2; 5.1.3; 5.3.1; 5.3.2; Case 5.4	6.2.1; 6.2.2; 6.2.3; 6.3.2; 6.4.4;	7.1.3; 7.1.5; 7.2.4
2	Food Security and Agriculture	2	1.6.7	2.1.4; 2.2.3; Case 2.5	3.1.4; 3.2.1; 3.2.4; 3.3.1; 3.3.3; 3.3.4; 3.3.5; Case 3.2; Case 3.3	4.1.4	5.3.1	6.2.1	7.1.3
3	COVID-19 Disruption and Health	3	1.1.1; 1.1.2; 1.5.1; 1.5.2; 1.5.3; 1.6.5; Case 1.1	2.1.1; 2.1.7; 2.2 (all); 2.3 (all); Case 2.1; Case 2.2; Case 2.3; Case 2.4; Case 2.5	3.1.1, 3.1.4; 3.1.5; 3.2 (all); 3.3 (all); Case 3.1; Case 3.2; Case 3.3	4.1.1; 4.1.5; 4.1.6; 4.1.8	5.3.3	6.1.2; 6.1.3; 6.2.1; 6.2.3; 6.2.4; 6.3.1; 6.3.3; 6.3.4; 6.3.5; 6.4.1; 6.4.4	7.1.1; 7.1.3; 7.3
4	Capacity Development and Education	4	1.6.7	2.1.1; 2.3.2	3.1.5; 3.2.2, 3.2.6	4.1.7; 4.1.9; 4.2.7	5.1.4; 5.2.2; 5.2.4; 5.3.5; 5.2.3; 5.3.5; Case 5.1; Case 5.2	6.2.4; 6.2.5; 6.3.2; 6.3.5; 6.4.1; 6.4.2	7.1.1; 7.1.2; 7.1.4; 7.1.5
5	Climate Change, Environment, Energy and Disaster	6, 7, 12, 13, 14	1.6.7	2.1.4; 2.1.6; Case 2.1	3.2.3, 3.3.1; 3.3.2; 3.3.4, 3.3.5; 3.4; Case 3.2; Case 3.3	4.1.2; 4.1.3; 4.1.4; 4.2.3	5.1.1; 5.3.1; 5.3.3; Case 5.1; Case 5.2	6.2.1; 6.2.3; 6.2.4; 6.3.3; 6.4.1	7.1.2; 7.1.3; 7.1.5
6	Economic and Financial Issues	8	1.1.1; 1.3.2; 1.6.7	2.1.1; 2.1.2; 2.1.5; 2.2.2; 2.2.3; 2.3.2; 2.2.6; Case 2.2; Case 2.4; Case 2.5	3.1.5, 3.3.1; 3.3.2; 3.3.3; Case 3.2	4.1.1; 4.1.2; 4.1.10; 4.2.7; 4.3.3	5.1.1; 5.1.3; 5.1.4; 5.2.2; 5.2.3; 5.2.4; 5.3.1; 5.3.2; 5.3.4; Case 5.1; Case 5.2; Case 5.3; Case 5.4	6.2 (all); 6.3 (all); 6.4 (all)	7.1.1; 7.1.3; 7.1.5; 7.1.7; 7.1.8; 7.3
7	Investment, Innovation and Benefits	9	1.5.2; 1.6.7; Case 1.1	2.1.1; 2.1.2; 2.2.1; 2.2.3; 2.2.5; 2.2.6; 2.2.8; 2.3.1; 2.3.2; 2.3.3	3.1.2, 3.1.4; 3.1.5, 3.1.6; 3.2.7; 3.3 (all)	4.1.6; 4.1.8; 4.1.10; 4.2.2; 4.2.6, 4.2.7; 4.3.3; Case 4.1; Case 4.2	5.1 (all); 5.2 (all); 5.3 (all); Case 5.1; Case 5.2; Case 5.3	6.2 (all), 6.3 (all); 6.4 (all); Case 6.1	7.1 (all); 7.2.4; 7.2.6; 7.3
8	Cybersecurity, Data Protection and Maintenance	9	1.6.7	2.1.2	3.1.3; 3.1.4; 3.2.1; 3.2.2; 3.2.7; 3.3.1	4.1.8; 4.1.13; 4.2.4; 4.2.5; 4.2.7; 4.3.5; Case 4.2	5.1.2; 5.1.4; 5.2.4; 5.3.2; 5.3.3; 5.3.4; Case 5.4	6.3.1; 6.3.5	7.1.2; 7.1.3; 7.1.5; 7.3
9	Integrated Geospatial Information Framework (IGIF)	9	1.3.1; 1.6.2; 1.6.4	2.2.8	3.2.2; 3.2.7	~4.2	5.1.4; 5.1 (all); 5.3.5; Case 5.1; Case 5.2	6.2.1; 6.2.4	7.1.7; 7.3
10	Data: Quality, Openness, Standards and Analytics	9	1.6.2; 1.6.3; 1.6.8	2.1.2; 2.2.7; 2.2.3; Case 2.3	3.1.4, 3.2.3; 3.2.4, 3.2.5; Case 3.2	4.1.6; 4.1.8; 4.1.9; 4.1.10; 4.1.11; 4.1.13; 4.2.2, 4.2.3; 4.2.5; 4.3.5; Case 4.2	5.1.3; 5.1.4; 5.2.4; 5.2.5; 5.3.2; Case 5.1; Case 5.2; Case 5.3	6.2.4; 6.2.5; 6.3.1; 6.3.2; 6.4.2; 6.4.3; 6.3.5; 6.4.4; Case 6.1	7.1.1; 7.1.3; 7.1.5; 7.1.7; 7.2.3; 7.2.6; 7.2.8
11	Urban and Rural Divide	11, 15	1.6.7	2.1.2; 2.1.6; 2.2.1; 2.2.2	3.1 (all); 3.2 (all); 3.3.3; 3.3.4; 3.3.5	4.1.3	5.3.1	6.2 (all); 6.3 (all); 6.4 (all)	7.1.3; 7.1.5; 7.1.6; 7.1.8; 7.2.4
12	Legal and Ethical Concerns	16	1.6.1	2.1.2; 2.1.4; 2.2.5; Case 2.3; Case 2.4	3.1.3, 3.1.4; 3.1.6, 3.2.3; 3.2.7, Case 3.1	4.1.4; 4.1.6; 4.1.7; 4.1.8; 4.1.9; 4.1.12; 4.1.13; 4.2.5; 4.3.5; Case 4.3	5.1.4; 5.2.5; 5.3.2; 5.3.3; 5.3.5; Case 5.4	6.2.4; 6.3.3; 6.4.4	7.1.1; 7.1.5; 7.1.8
13	Partnerships and Collaboration	17	Case 1.1	2.1.2; 2.2.3; 2.2.5; 2.2.8; 2.3.3; Case 2.5; Case 2.5	3.1.4; 3.2.1; 3.2.2; 3.2.3; 3.2.5; 3.2.6; Case 3.1; Case 3.2; Case 3.3	4.1.7; 4.1.10; 4.1.12; 4.2.3; 4.2.6, 4.2.6; 4.1 (all); Case 4.1; Case 4.2	5.1.2; 5.1.4; 5.2.4; 5.2.5; 5.3.4; Case 5.2; Case 5.3	6.1 (all); 6.2 (all); 6.3 (all); 6.4 (all)	7.1.1; 7.1.2; 7.1.3; 7.1.5; 7.1.6; 7.1.7; 7.1.8; 7.2.3; 7.2.4; 7.2.8; 7.3

ABOUT DRAFTING TEAM

@FIG

Rohan Bennett is Incoming Chair of FIG Commission 7 on Cadastre and Land Management 2023–26. He holds a PhD in Land Administration from the University of Melbourne, Australia, and degrees in Geomatic Engineering and Information Systems.

@FIG

Claudia Stöcker is part of the FIG Young Surveyors Network and Commission 7 on Cadastre and Land Management. She holds a PhD in Land Administration from the University of Twente, Netherlands, and a degree in Geography.

@FIG

Kwabena Asiama is Incoming Chair of FIG Commission 8 on Spatial Planning and Development. He holds a PhD in Land Administration from the University of Twente, Netherlands, and degrees in Land Economy from KNUST, Kumasi, Ghana.

ABOUT FAO

The Food and Agriculture Organization (FAO) is a specialized agency of the United Nations, established in 1945, that leads international efforts to defeat hunger and improve nutrition and food security.

Its goal is to achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives. With 195 members – 194 countries and the European Union, FAO works in over 130 countries worldwide. FAO's Investment Centre provides investment an finance support to member countries to access public and private investment over the long term to improve the lives and livelihoods of their citizens. FAO's Inclusive Rural Transformation and Gender Equality Division coordinates FAO's work on various social dimensions including on rural institutions, services, social protection, gender equality, decent rural employment, tenure rights and the right to food.

ABOUT UNECE

The United Nations Economic Commission for Europe (UNECE) is one of five regional commissions of the United Nations. It was established by ECOSOC in 1947 to promote pan-European economic integration. UNECE comprises 56 member States in Europe, North America and Asia and is open to all interested United Nations member States who may participate in its work. Over 70 international professional organizations and other non-governmental organizations take part in UNECE activities, which focus on housing, land management and urban development; forests; economic cooperation and integration; environmental policy; sustainable energy; population; trade; transport and statistics.

ABOUT FIG

International Federation of Surveyors is the premier international organization representing the interests of surveyors worldwide. It is a federation of the national member associations and covers the whole range of professional fields within the global surveying community. It provides an international forum for discussion and development aiming to promote professional practice and standards.

FIG was founded in 1878 in Paris and was first known as the Fédération Internationale des Géomètres (FIG). This has become anglicized to the International Federation of Surveyors (FIG). It is a United Nations and World Bank Group recognized non-government organization (NGO), representing a membership from 120 plus countries throughout the world, and its aim is to ensure that the disciplines of surveying and all who practise them meet the needs of the markets and communities that they serve.

FIG PUBLICATIONS

The FIG publications are divided into four categories. This should assist members and other users to identify the profile and purpose of the various publications.

FIG Policy Statements

FIG Policy Statements include political declarations and recommendations endorsed by the FIG General Assembly. They are prepared to explain FIG policies on important topics to politicians, government agencies and other decision makers, as well as surveyors and other professionals.

FIG Guides

FIG Guides are technical or managerial guidelines endorsed by the Council and recorded by the General Assembly. They are prepared to deal with topical professional issues and provide guidance for the surveying profession and relevant partners.

FIG Reports

FIG Reports are technical reports representing the outcomes from scientific meetings and Commission working groups. The reports are approved by the Council and include valuable information on specific topics of relevance to the profession, members and individual surveyors.

FIG Regulations

FIG Regulations include statutes, internal rules and work plans adopted by the FIG organisation.

List of FIG Publications

For an up-to-date list of publications, please visit
www.fig.net/pub/figpub

The COVID-19 pandemic accelerated the digital transformation of land administration. Online services were embraced. Working at distance became the new normal. Spatial and other information on tenure rights found new users and increased demand. This publication shares how land administration organizations responded to the challenges of the COVID-19 pandemic.

Most cases are drawn from the UNECE region, however, a broader perspective is also provided. The disrupted era that land administration systems must now operate within is revealed. The pressing demand for digital transformation is shown. Digital transformation ensures ongoing system sustainability and responsiveness to changing societal demands. The publication also exposes the challenges of undertaking digital transformation. Ensuring inclusion of women and vulnerable groups is critical. No one can be left behind.

Pathways for digital transformation implementation and benefits realisation are offered. Cross-cutting themes including institutional development, legislative redesign, financing, quality management, open data, cybersecurity, standards creation and uptake, partnership building, communications, and capacity development are all unpacked.