

Economic Commission for Europe

Committee on Urban Development, Housing and Land Management

Eighty-second session

Geneva, 6-8 October 2021

Item 7 (f) of the provisional agenda

Review of the implementation of the programmes of work 2020 and 2021: Land administration and management

Scenario Study on Future Land Administration in the UNECE region

Note by the Bureau of the Working Party

Summary

Decision makers in the field of land administration need a broad understanding of emerging issues and developments that are expected to shape the future of the sector. To this end, in 2017, the Working Party agreed to elaborate scenarios for future land administration and land management solutions (ECE/HBP/WP.7/2017/6). It renewed this mandate at the eleventh session in 2019 (ECE/HBP/WP.7/2019/2). This activity was included in the Working Party programmes of work 2018-2019 (ECE/HBP/190) and 2020-2021 (ECE/HBP/201).

Accordingly, the Bureau initiated a study to develop future scenarios for the land administration sector, based on the relative importance and anticipated impacts of global megatrends and drivers specifically related to the sector. This document includes the introduction, objectives, scenarios, guiding principles, a self-assessment framework and results from an interactive survey with the scenarios applied; the survey was conducted during the Working Party Twelfth Session.

The Working Party agreed on the draft “Scenario Study on Future Land Administration in the UNECE region” at its Twelfth Session on 1 June 2021.

The Committee will be invited to welcome the “Scenario Study on Future Land Administration in the UNECE region” and approve it as official publications in English and Russian, digital and print.

CONTENTS

1. Introduction.....	3
2. Objective of the Study	4
3. Megatrends.....	5
3.1 Megatrend identification.....	6
3.2 Megatrend analysis	6
3.3 Drivers related to land administration.....	8
3.3.2 <i>Next-generation demands</i>	8
3.3.3 <i>Open data and new data sources</i>	9
3.3.4 <i>Artificial intelligence and robot process automation</i>	10
3.3.5 <i>Confidence in the digital world</i>	10
3.3.6 <i>Collaboration, sharing, ecosystems and distributed solutions</i>	11
3.3.7 <i>Innovation through open source, incubators and hackathons</i>	12
4. The scenarios	14
4.1. Definition of the scenario cross and the scenarios.....	14
4.2. Characteristics of the four scenarios	16
4.2.1 Conventional land administration.....	16
4.2.2 As-a-service land administration	17
4.2.3 Platform land administration.....	17
4.2.4 Distributed land administration.....	18
5. Guiding principles for future-proof land administration systems.....	18
6. Self-assessment framework	20
6.1 Guiding questions to assess the scenarios.....	23
6.2 Results from interactive surveys of the scenarios.....	24
7. Conclusions.....	26
References.....	28

1. Introduction

The lives of people across the world, regardless of location, are increasingly being influenced by global trends and developments. These trends include urbanization, climate change, technology advancements, cybersecurity, new ecosystems of collaboration, and migration. These so-called “megatrends” are universal phenomena that are profoundly shaping the world over time.¹ Although challenging due to their complexity, these megatrends also provide tremendous opportunities, including for land administration. As such, they can have both positive and negative impacts. Technology advancements, for instance, can support access to information and knowledge, and thus help achieve universal literacy. At the same time, they can threaten privacy, erode security and increase the digital divide.

Drivers complement these megatrends. They are certain developments or causes that have an effect on, or shape, the future. As with megatrends, some drivers are particularly relevant to land administration. These include new emerging data sources and data integration options, structural shifts in collaboration opportunities, data privacy ethics and related legal considerations, and the introduction of new technology or analysis tools, to name a few. Megatrends and drivers, however, should not be considered in isolation. On the contrary, it is in combination that they generate faster and greater impact, shaping the ongoing transformation of the land sector.

The challenges and opportunities for land administration authorities to remain relevant and provide trustworthy services well into the future are related to their ability to continuously incorporate new user expectations, perform an often widening role as a key partner in solving emerging intersectoral state priorities (e-government, smart cities, spatial data infrastructure, accelerated digitalization, land development process integration, climate change initiatives, etc.), and manage the evolution of various constraints (financial, technological, human resources, legal, organizational, etc.). A central consideration in this continuously changing situation is how land administration authorities can create, increase, and retain value with respect to relevance, liability, stewardship and trustworthiness. The authorities should provide a foundation of trust, on the basis of which society and individuals can develop.

The United Nations Economic Commission for Europe (UNECE) Working Party on Land Administration (WPLA) is the coordinator of this study and is an intergovernmental body covering 56 countries across the pan-European region. Operating under the auspices of the UNECE Committee on Urban Development, Housing and Land Management, members of the WPLA are the national land administration and other related authorities of UNECE member States. The WPLA provides a forum for dialogue in identifying methods to strengthen and modernize land administration.

Overall, the WPLA aims to support security of tenure, improve and create more effective land registries and promote sustainable land use policies. This is done through capacity-building workshops and land administration reviews at country level, upon request from governments. The WPLA contributes to the formulation, implementation and monitoring of land policy and the promotion of sustainable land management programmes and projects through developing guidelines, carrying out research studies and benchmarking; it also provides policy advice and

¹ Report of the UN Economist Network for the UN 75th Anniversary: Shaping the Trends of Our Time (United Nations publication, 2020). Available at <https://www.un.org/sites/un2.un.org/files/20-124-unen-75report-full-en-revised.pdf>.

expert assistance. It is hoped that this Study will initiate an ongoing dialogue among national land administration authorities, that draws on the scenarios and the self-assessment tool, and guides them in the development of long-term strategies.

2. Objective of the Study

Scenarios, in general, are used to understand potential future directions of development and to assess the readiness of an organization for this possible future environment. Moreover, they can support efforts to define and realize strategies for appropriately responding to the implications these possible futures could bring. The four scenarios set out in this Study are based on the relative importance and anticipated impacts of megatrends in combination with sector-specific drivers.

This Study thus aims to provide a “compass” for use by national land administrative authorities to navigate these megatrends and drivers and benefit from them. By setting out possible future scenarios for the land administration sector, the study can enhance the broad understanding of decision makers of the emerging developments that are expected to shape the future of the sector. It is intended as a dialogue instrument for use in strategic planning, shaping visions and self-assessment as to where land administration authorities need to develop as agencies within their relevant land administration and land management ecosystems, and estimate their readiness as well as efforts required in order for to remain relevant long-term. The Study refers to land registry, cadastre and geospatial information management explicitly, while land use, valuation and development are covered implicitly.

Scenario analyses are neither predictions of the future nor expressions of intent for the future development of the land administration systems. Rather, they are developed as stories to stimulate discussion on the future development of land administration organizations. By engaging in discussion of possible scenarios, the risk of a simplistic approach being taken by land administration decision makers is reduced, and their preparedness to adapt to the future, increase their flexibility and build resilience for disruptive events is enhanced.

The analyses will also include aspects such as the identification of challenges and opportunities in a transformative environment, the sharing of best practices for solutions and risk mitigation measures, the improvement of preparedness for future disruptive changes, and the assessment of impacts from national interventions. The Study explicitly encourages nations to elaborate and regularly reassess country strategies on future land administration.

The scenarios and the self-assessment tool were elaborated during a set of roundtables with senior practitioners, policymakers and academics from Austria, Finland, the Netherlands, Norway, Sweden, and Switzerland. The scenarios were presented for the first time at the Conference of the Permanent Committee on Cadastre in Helsinki (20 and 21 November 2019), with the presentation incorporating real-time interactive feedback from the audience on the expected impact of the megatrends and specific drivers, as well as predictions for the scenarios.

The outbreak of the COVID-19 pandemic is affecting the land administration sector. Immediate impacts that have been observed include an opportunity for accelerated digitalization. This involves an increase in the use of e-services and online applications as well as development of initiatives supporting the establishment of “unified system”

structures where national key registers are based on a single platform, often referred to as “government-as-a-platform”. Efficient measures to prepare for similar disruptive events through scenario analysis could be linked to this Study. The Study could, for example, support decisions to take early action regarding expected impacts on the land market, support measures to promote sufficient responsiveness and resilience within national land administration and land management ecosystems and be used for analyzing the impact of a chosen strategy. At the same time, the pandemic will also impact the elaborated scenarios, trigger implementation schemes, and lead to the revision of priorities.

3. Megatrends

Prior to creating possible future scenarios in land administration systems, the underlying external factors on which the scenarios are based needed to be defined and analyzed. These factors comprise both global megatrends and specific drivers related to the land administration sector. There was then the need to estimate the possible impact of these factors and the degree of uncertainty likely to occur within the given time frame. For this Study, the scenarios are based on a ten-year vision.

First, the scope of the Study and what land administration means were defined. The coverage is based on the definition of land administration (Enemark 2005), covering the four land administration functions (land tenure, land valuation, land use and land development) in the context of a defined land policy framework, institutional arrangement and information infrastructure.² Land registries and cadastres and their main functions are considered relevant to this Study. Also included in the Study is the discussion of the management of geospatial information and its potential for generating societal benefits. In other words, the Study aims to outline a comprehensive and holistic perspective on land administration.

The Study has been aligned with the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) *Integrated Geospatial Information Framework* (UN-GGIM, 2018) and the *Framework for Effective Land Administration (FELA)* (UN-GGIM, 2020a). The latter was recently endorsed by UN-GGIM³ as a reference for member States when developing, reforming, strengthening and modernizing effective and efficient land administration processes and systems. Reference is also made to a recently finalized UN-GGIM report on *Future trends in geospatial information management: the five to ten year vision – Third edition* (UN-GGIM, 2020b), which reflects on a wide set of emerging and developing trends regarding the collection, management and use of geospatial information in the future.

This Study engaged land practitioners, researchers and policy leaders in dialogues of ideas and visioning. Various stakeholders also took part in a verification process of feedback throughout the process. In this regard, intermediate results of this Study were presented at a joint event of WPLA, the International Federation of Surveyors (FIG) and the Technical Chamber of Greece in Athens (November 2018), the UN World Geospatial Information Congress in Deqing,

² Information infrastructure refers to the communications networks and associated software that support interaction among people and organizations.

³ Tenth session of the United Nations Committee of Experts on Global Geospatial Information Management (New York and online, 26 and 27 August 2020, and 4 September 2020) Available at <http://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/>.

Zhejiang Province, China (19-21 November 2018), the eleventh session of WPLA in Geneva (27-28 February 2019), the Permanent Cadastre Committee (PCC) conference in Helsinki, Finland (19-21 November 2019), the joint PCC and Eurogeographics conference in Lisbon, Portugal (26-27 May 2021, webinar), the twelfth session of WPLA in Geneva (1 May-1 June 2021, hybrid) and the FIG e-working week (20-25 June 2021, webinar).

3.1 Megatrend identification

Most publications discussing scenarios regarding the recent and ongoing megatrends have focused on the development of cadastral systems without analyzing how different megatrends will impact them. For instance, two studies produced in New Zealand and Australia outlined expectations for the future of cadastres (LINZ, 2014 and ICSM, 2014). FIG also published a study entitled *Cadastre 2014 and Beyond*, describing future visions for cadastres. Some research carried out in Finland has similar objectives to this Study; it examined the perceived importance of 21 global megatrends in the context of cadastral systems and the implications of relevant megatrends for the Finnish cadastral system (Krigsholm et al., 2018).

3.2 Megatrend analysis

The concept of megatrends has been explained by various authors (Naisbitt, 1981; Mittelstaedt, 2014). In comparison to regular trends, a combined definition of megatrends is their inevitability, the extent of their impacts and the duration of time within which they evolve. The WPLA Bureau agreed to use 11 out of 12 megatrends, as defined by Z-punkt⁴ in 2018, as the basis for the analysis of this Study. A short description of the characteristics of these megatrends are given in

Table 1. They were complemented by drivers specifically related to land administration (section 3.3). Eight senior international land administration experts⁵ were requested to describe possible impacts of these megatrends on land administration. They were asked to score the relevance and comparative importance of megatrends for land administration on a 10-point scale, from 1 (no or very low relevance) to 10 (very high relevance). Since they were not asked to rank the megatrends, it was possible to use the same score multiple times (Table 2).

Table 1 - Megatrends and their brief characteristics

Megatrend	Indicator
1 Demographic change	Regional development asymmetries Global population ageing
2 Societal disparities	Increased wealth concentration Intensification of social conflicts
3 Differentiated life worlds	Weakening of traditional gender roles New forms of individuality
4 The digital transformation	Digital networking in everyday life New opportunities through “big data”, artificial intelligence, robot process automation, etc.

⁴ A consulting company specializing in trends and futures research. Available at <http://www.z-punkt.de/en/>.

⁵ David Boman, Lantmäteriet (Sweden); Wernher Hoffmann, BEV (Austria); Kirsikka Riekkinen, Aalto University (Finland); Martin Salzmann, Kadaster (Netherlands); Mats Snäll, Lantmäteriet (Sweden); Daniel Steudler, Swisstopo (Switzerland); Rik Wouters, Kadaster (Netherlands); and Fredrik Zetterquist, Ordnance Survey (United Kingdom).

5 Volatile economy	Global debt overload Concentration of productivity and profits
6 Business ecosystems	Expansion of the platform economy Sharing as a business model
7 Anthropogenic environmental damage	Anthropogenic climate change Increased environmental pollution
8 Decentralized environments	Decentralized organization Assisted and automated working arrangements
9 New political world order	Multipolar world Asymmetrical conflict lines
10 Global/regional power shifts	Growth of the global middle class Increased influence of non-State actors
11 Urbanization	Unmanaged urban growth Modernization crisis in municipal infrastructures

Source: (Z-Punkt, 2017)

Table 2 - Megatrends scored by their importance to land administration

Megatrend	R1	R2	R3	R4	R5	R6	R7	R8	Average	Ranking
1. Demographic change	4	3	6	6	3	8	7	2	4.9	7
2. Societal disparities	3	2	6	4	6	5	4	3	4.1	8
3. Differentiated Lifeworlds	2	2	2	2	8	2	7	6	3.9	10
4. The digital transformation	10	10	10	10	10	10	8	10	9.8	1
5. Volatile economy	8	6	3	7	8	4	5	3	5.5	6
6. Business Ecosystems	8	7	8	8	10	4	8	10	7.9	3
7. Anthropogenic Environmental Damage	5	8	7	7	8	2	8	6	6.4	5
8. Decentralised environments	8	6	5	5	10	6	6	8	6.8	4
9. New political world order	3	5	3	3	3	7	6	2	4.0	9
10. Global/regional power shifts	3	5	5	4	2	-	4	3	3.7	11
11. Urbanisation	7	5	9	8	10	-	8	10	8.1	2
Average	5.5	5.4	5.8	5.8	7.1	5.3	6.5	5.7	5.9	

Average scoring by the respondents turned out to be similar, indicating that there is a shared view on the relevance of megatrends for the land administration sector. Similarly, the scoring for each respective megatrend was distributed relatively equally among the respondents (Table 2). Discrepancies in scoring can be partly explained by different interpretations of these megatrends. The “differentiated life worlds” megatrend, for example, was considered by some respondents to also cover “individualization” and therefore was scored higher than by other respondents. This overall high degree of consensus statistically strengthens the precision of the scored relevance of each megatrend relative to the land administration sector.

To facilitate the analysis of the importance of these megatrends for the land sector, they can be divided into five categories using the so-called “PESTE framework”: political, economic, social, technological and environmental megatrends. This framework is often applied in future studies (Krigsholm et al., 2017). In the megatrend scoring by the expert group, political (megatrends 8, 9, and 10 in Table 1) and social megatrends (megatrends 1, 2, and 3) were generally considered to be of lower importance for the land sector compared to technological (megatrend 4), economic (megatrends 5 and 6) and environmental (megatrends 7 and 11) megatrends. This observation confirms earlier studies which also concluded that technological, environmental and economic megatrends are expected to have the most significant impact on future land administration (Krigsholm et al., 2017; Riekkinen & Krigsholm, 2018). Nevertheless, social and political megatrends have a certain importance that should not to be

neglected. The experts attached lowest importance to the megatrends 10: global/regional power shifts and 3: differentiated life worlds. However, overall, these trends still score almost four points on a scale from 1 to 10.

For the purpose of this Study the megatrends identified as the most important will be considered. In this context, it is important to note that megatrends reflect the time of their appearance, and might change over time (Mittelstaedt et al., 2014).

Not surprisingly, the “digital transformation” megatrend scored the highest. This megatrend is already affecting many, if not all, sectors. Many countries have in this regard, in recent years established new public bodies (ministries, agencies) which have mandates to ensure a holistic nationwide approach to digitalization. Major initiatives are being taken by the land administration sector to leverage digitalization. This megatrend is already transforming the land sector, from technical, organizational, legal and financial perspectives. As this megatrend will have a significant impact on all possible future scenarios, it is considered as a cross-cutting or “background” megatrend in the Study.

3.3 Drivers related to land administration

In addition to global megatrends, land administration-related drivers will also impact on future land administration systems. They include:

3.3.1 Cybersecurity, privacy aspects and digital ethics

Cybersecurity and integrity aspects of data ownership, access and use are at the top of the agendas of many leaderships. The importance of these aspects is expected to rise as collaborations become more complex, data integration business models are extended, and new concepts and technologies, such as cloud services, artificial intelligence (AI) and distributed network systems are introduced. Machine-to-machine processing will have the potential to produce new sets of data that might pose a risk to the security of individuals and raise ethical concerns. Another challenge is to secure privacy aspects without postponing or impeding the innovations necessary for further development. Accelerated digitalization and technological advancements often develop faster than the implementation of legal measures, which can further jeopardize cybersecurity and the protection of data privacy.

An important debate to recognize is that of what makes data “personal data”. It can, in some circumstances, be difficult to identify any land-related data that is not also related to personal data. Since there is a risk that data might be transferred and used by some countries with less stringent or non-existent security and protection for personal data of individuals, the use of cloud services for land administration arrangements may be excluded in some countries. This would consequently affect other nations engaging with those countries. In general, integrity and cyber security are a global challenge in the context of open and data-driven societies.

3.3.2 Next-generation demands

Many users/customers grew up in a digital society with little or no memory, reference or usage experience of analogue procedures. They are used to, and expect, digital workflows, and

automated case handling and decisions, including work conducted through machine learning, artificial intelligence and robots.⁶

Public agencies and their services thus need to respond to the new demands and attitudes of their customers in order to stay relevant in the future. A priority in this regard will be the ability to operate entirely digitally. The most important aspect is that this shift should not just be a transfer of analogue and computerized workflows to new models and technical systems; rather, it should realize the full value of other possibilities. The importance of the difference between “just converting and transferring” versus “inventing and implementing” digital workflows, information models and processing into new business models adapted to the digital transformation should not be underestimated.

Many of today’s customers are shaping future demands on land administration information and services. Land administration executives need to adopt a future perspective approach, include change management in their strategic leadership, and use applicable tools and analysis to look ahead and identify what the next generation of property owners and service users will expect and request.

3.3.3 *Open data and new data sources*

Geospatial and land information is one of the most important data sources when it comes to open data. Free, anytime access to public data is becoming the norm. Evidence suggests that providing official data publicly can lead to increased levels of innovation and new developments. The value created through open data can far exceed the initial value of the data. This, consequently, can increase tax revenues available to fund services and products.

Some countries have taken a more liberal approach, allowing for open data. This has stimulated innovation, and increased the diversity of applications, business models and collaboration arrangements. Other countries have restricted open data due to risks of free data flows. These risks include the potential use of cloud solutions located outside national boundaries, and the potential reorganization of existing financial models. In many public systems, the data-processing cycle - collection, storage, maintenance and dissemination - is linked to an authoritative data-quality assurance. This must be financed, either through fees and charges for users or through state grants. When switching to an open data system, the country must find alternative ways to finance those businesses and services that are based on privileged access to data. A big challenge during the transition to open data often occurs in cases where access to data involves fees that finance its collection and management. Open data also conflicts with some important security and integrity aspects, as described in section 3.3.1.

The general consensus in the regulated data sector is that open data is the preferred way to go. However, concerns around security and financial aspects hold back development in many countries. Those countries that do transition to open data will be in a better position to use the data to support innovation and development as well as to increase transparency. However, evaluation of the risks and consequences with regards to security and integrity must not be overlooked. If the concept of open data is adopted, it is important that countries develop new digital data models. If data is managed in the same way as before the transition to open data, problems regarding dissemination and restrictions in data availability may be inevitable. A

⁶ These are either physical robots or “software” robots, often referred to as robot process automation (RPA).

likely consequence to consider when introducing open data is that, in order to strengthen confidence in the data processes, a solution will be required that encodes the origin and source of the data, and verifies the sender and receiver as “true”. Further discussion of this can be found in section 3.3.5.

New data sources and data collection applications involving drones, high-resolution satellites, crowdsourcing using smartphones and social media are expected to have a significant impact and to drive the development of solutions and arrangements that are both more user and data centric. However, using a variety of data sources makes establishing proper interoperability solutions, as well as harmonizing standards and licensing, more complex.

3.3.4 Artificial intelligence and robot process automation

Even if data is not openly accessible, the management of “big” data requires new methods of processing to achieve desired outcomes and extended values. Artificial intelligence (AI) is rapidly being developed. With proper adjustment and configurations of information, innovation and development, along with a realistic budget, the implementation of AI-based services - including machine learning - may be a solution to both private and public businesses.

One benefit of AI is that it can facilitate the automation of processes that are normally handled manually or semi-manually and which are easy to replace with automated procedures. This, in turn, enables organizations to reallocate staff to areas where human resources are more essential. The next step is for AI-based services to predict and foresee customer behaviour and meet customer demands in a proactive way.

With proper technical configuration, skills development and collaboration with AI-savvy private sector partners, AI may well be used to improve business cases related to land administration. Robot process automation (RPA) is a common development, closely related to AI. One example of RPA is customer relations departments using chat-bots to provide adapted services and generating predictions concerning customer behaviour through analytics.

It is important to consider relevant ethical questions when adopting AI, especially if it is used for automated procedures involved with decision-making. New data is likely to be generated with an increased usage of AI and machine-to-machine processing. This data might be of a sensitive nature and necessitate changes in legal considerations.

3.3.5 Confidence in the digital world

Trust in the land administration system stems from several built-in mechanisms that are used, practiced and upheld in courts. Examples of these include diaries and logs of applications and cases, public and transparent registers, contracts, decisions that can be appealed to courts, rationales for decisions, and salary levels that motivate civil servants to resist corruption.

The era of digital transformation is leading to changes to this established system of trust. Not only are there changes in how things are being done, but there are also changes in who is making the decisions and who is realizing them. With digital transformation, the system is automated, and executes decision-making through a complex network of technical components, including machine-to-machine communications. Important actions for users and customers are made by logically programmed software, robots and AI. Future automated

systems will be used more frequently in all kinds of areas, and become more autonomous. Systems and components will also communicate with each other in wider aspects than just reporting the status of things or situations; this process is described by the concept of the “internet of things” (IoT). An application for land registration, for example, might be handled by AI on behalf of a person, and land registration might also be executed by AI, rather than a registrar as before.

Transactions often depend on the authority, competency and authenticity of the parties involved. While it is currently important to verify the identities of those involved in a transaction, along with their capacity to conduct the transaction, systems must, in the future, be able to verify the capacity and identity of digital objects. Here, the relevance to land administration is obvious. Most land administration authorities are responsible for property IDs, addresses, coordinates, boundaries, buildings, apartments, etc. These will all need a proper, secure and valid identification, along with a description of their capacities and any other information relevant to the transaction.⁷

Another relevant concept in this context is the idea of creating a “digital twin”. A digital twin is a digital representation of a real physical object. The twin can be used as part of almost any action or transaction that the physical object is part of. So far, digital twins are mainly used in manufacturing and machine maintenance. It is possible to monitor machines and predict problems in the machinery using sensors and data from the IoT. This practice is adaptable to property, and is becoming part of smart city and urban development concepts. “Building information modelling” is one way in which these practices are used in urban development. A digital model of a building may require both digital coordinates and marks relating to the real world as well as other characteristics. Developers may be able to create a digital twin of the building and then, using sensors in the real building, gradually add further information to the model. For cities, the digital twin facilitates the studying of the city performance and development from different perspectives and time dimensions, including how (i) to understand how the existing city operates, (ii) the digital twin can mirror and visualize what is happening in the city in real-time and from this manage the functions in the city (e.g., traffic arrangements) and (iii) to foresee and plan a simulated future function or development of the city.

Blockchain is an example of a technology that has the potential to add to the trust of systems. This is because it has the ability to keep digital values in original form, making them impossible to tamper with or corrupt. The high energy consumption for running blockchain arrangements is, however, a concern.

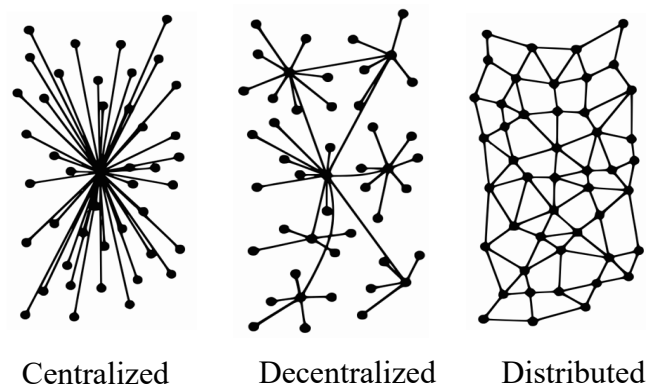
It is of utmost importance that the system of trust is understood, and work is done to develop successful mechanisms to retain this trust in the transition to digital. It is recommended to further explore and test blockchain and AI, as well as to combine these technologies.

3.3.6 *Collaboration, sharing, ecosystems and distributed solutions*

⁷ A relevant example is a Swedish consortium inventing a language to exchange information between buildings/properties and IoT and even to communicate among each another. The language is called RealEstateCore (<https://www.realestatecore.io>).

Co-operation, collaboration, co-working and networking are strategic prerequisites for success. Networking, or being a part of an ecosystem (referring to “business ecosystems”⁸), is often a task given by governments to state agencies. There is still much to learn about how these kinds of networks work and what the giving, sharing and earning look like for the different nodes in the network. It is important to understand that there is a big difference between (i) a traditional network for public entities where the network is built around one central body, i.e. a centralized network, (ii) a decentralized network where there might be several central entities and (iii) a fully distributed network where all nodes may depend or contribute to one another more organically, see (Figure 1).

Figure 1. Types of networks



One example of public administration networking is networks for specified areas of interest. In several countries, you find networks for public sector agencies on AI and blockchain. Land administration authorities have an important role as the custodians of location data, which is of importance in many technology systems and applications today. Cross-border networks on similar subjects are also emerging.

The practice of networking and forming a part of an ecosystem is crucial and needs to be analyzed by high-level management as a strategic area in itself. A “network strategy” could be created in some cases.

3.3.7 *Innovation through open source, incubators and hackathons*

⁸ The concept first appeared in Moore's May/June 1993 Harvard Business Review article, entitled "Predators and Prey: A New Ecology of Competition". Moore defined a "business ecosystem" as "an economic community supported by a foundation of interacting organizations and individuals — the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles."

Innovation is more important than ever. The rapid pace of development driven by technology is well-documented. There are, however, still many challenges associated with innovation. Some existing policies, legal frameworks and governance might be a burden and a restriction, preventing innovation and development instead of enabling it. In some countries, there is a long tradition of law-making in an open and democratic environment, using a legal framework and governance, which has often helped to support development. However, the procedures for making decisions and writing acts into law are often complicated and take time.

It is important for both developed and emerging economies to find ways to use innovation and meet demands for legal development. Short and quick processes for introducing new regulations must be adequately balanced with the aspect of confidence in the (legal) system.

There are several methods practiced in innovation that may accelerate policy development and/or innovation. “Open source” programming, where code is open/available for use and developed in open communities, may assist considerably in reaching implementation faster, with development supported by experience and input from outside the organization. Although they are “open”, open source applications and similar should still be regulated in ways that can be known and considered by the user.

A “society hack” is a crowdsourced workshop on a subject of interest for a certain group or category of people/organizations. It may be carried out in real time in one or several locations or entirely virtually. It is often organized to focus on a very specific task that needs a solution, while at the same time acting as an opportunity to inform and communicate on the chosen subject matter. A “policy hack” is a workshop set up with the purpose of solving a regulatory issue that needs to be handled quickly in order to move forward with a certain task or innovation. Incubation centres/hubs are becoming popular, allowing public bodies to play a major role in supporting entrepreneurs through mentorship, funding and making public data available; this stimulates the development of new applications to address different societal challenges.

3.3.8 Crowdsourcing

In land administration, the term “crowdsourcing” may be applied when the general public, citizens or groups of people (e.g. real-estate owners), collect, add, improve or verify information and data. One example from Sweden is a process of using an online application to collect verifications or opinions on the correctness of property boundaries, names of places etc. given in the cadastre. With the crowdsourced data, it would be possible to have a quality assurance declaration attached to the public data in registers.

For public agencies, crowdsourcing activities may be used to collect information and improve data quality and coverage. The key to achieving this is, firstly, finding a proper channel through which the agency can have a wider reach regarding contact with people than just having a portal or a webpage and, secondly, finding incentives for people to participate. Many of the various processes used for data capture are quite similar to the concept of crowdsourcing. The tools, however, may differ.

3.3.9 Skills requirements and education programmes

In order to properly respond to new challenges, megatrends and drivers need to be carefully considered when revising education and training programmes, particularly in regard to legal, technical, managerial and data development aspects. Traditional land administration competencies need to be complemented by new areas of expertise, including data science and analytics, and geospatial technologies.

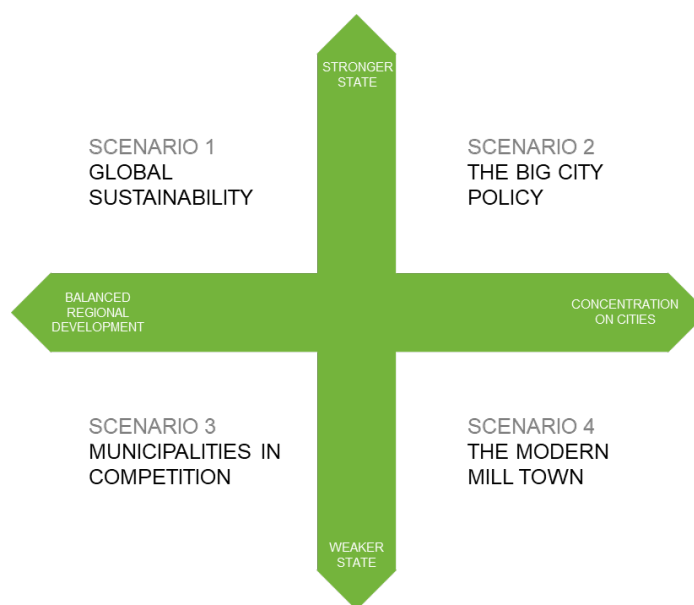
4. The scenarios

The global megatrends and specific domain drivers described in the previous section constitute the basis for forming the scenarios. As mentioned, the scenarios describe possible futures and development directions in order to help an organization estimate its readiness for these potential new environments. Moreover, they can support efforts to define and realize strategies for appropriately responding to the implications these futures may bring.

4.1. Definition of the scenario cross and the scenarios

There are different approaches to describing scenarios. This Study applies the “scenario cross” approach. This approach can be best described by giving the example of Lantmäteriet, the Swedish mapping, cadastral and land registration authority. Lantmäteriet used the scenario cross to better understand how future spatial and land use planning would be conducted, based on the influence of external trends and, consequently, the expected role of Lantmäteriet in that context. The aim was to understand what the major processes would be, who would be the most important actors, and what the most prominent and determining questions for spatial change would be. Analyses of trends determined the two axes in the scenario cross. The vertical axis defined the influence of the State, that is, whether the State would influence spatial planning or would other actors, such as municipalities and the private sector, take the lead. The horizontal axis defined regional development, whether there would be continued concentration on larger cities, or if regional development would be more balanced. For each quadrant, a possible scenario was elaborated (Figure 2).

Figure 2
An example of a scenario cross application

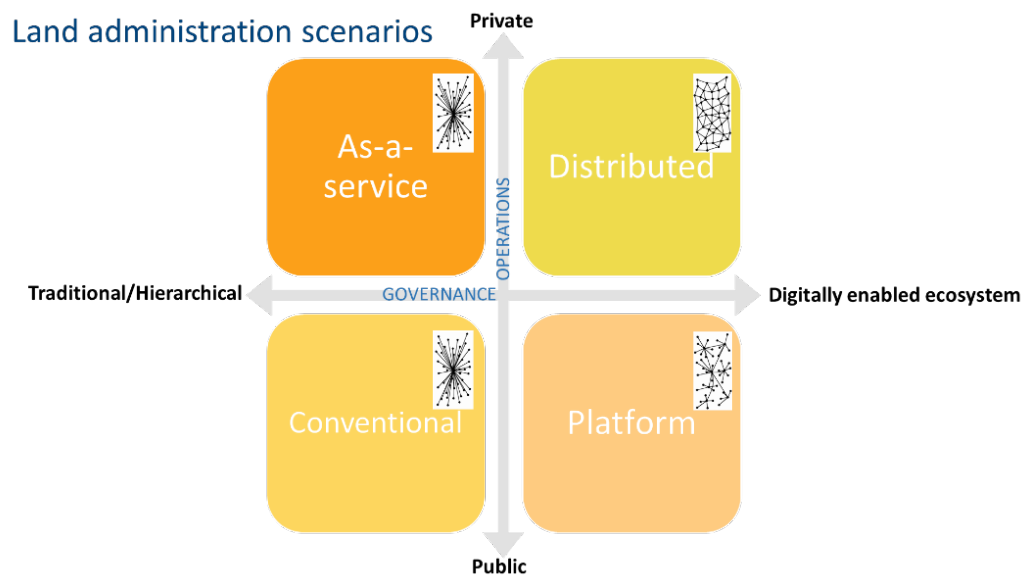


During the development of possible scenarios of future land administration, the conclusions by the expert group on the importance of certain megatrends and drivers for land administration were used as input for two roundtable sessions on scenario development, organized in Stockholm in June 2018 and in Amsterdam in December 2018. The roundtables first identified a shared point of departure: how land administration authorities stay relevant, liable and trustworthy, and/or increase their relevance, independently of where they currently position themselves in the scenario cross and/or if they intend to move in a certain direction within the cross.

The scenario cross was outlined from clustering the 11 megatrends combined with the land administration-related drivers and the collective experience of experts. The “business ecosystem” megatrend was selected to explicitly be part of one of the axes. “Urbanization” and “digital transformation” were two megatrends considered to greatly affect all scenarios. Therefore, they could not be used for defining the axes as such. Rather, they were used as “influencers” when interpolating the trends to define the scenarios.

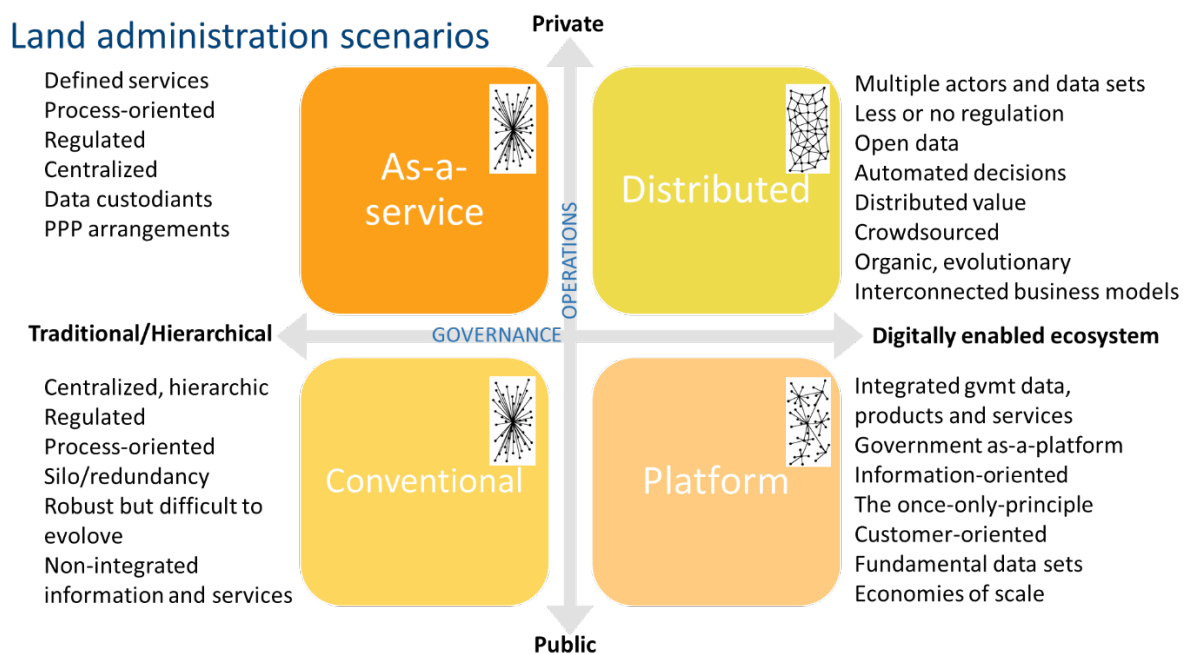
The elaborated scenario cross was defined by the horizontal axis representing land administration *governance*, with a traditional/hierarchical ecosystem on the outer left side and a digitally enabled ecosystem to the outer right side. The vertical axis defines the responsible actors for land administration *operations*, with the upper end representing private actors and the lower end public actors (Figure 3).

Figure 3 - Defined axes of the scenario cross



The scenario cross is completed by adding the four land administration scenarios (Figure 4).

Figure 4 - Characteristics of the scenarios



4.2. Characteristics of the four scenarios

4.2.1 Conventional land administration

This scenario characterizes the most common situation in the UNECE region and globally today. It represents a centralized land administration, where functions, operations, services and data are typically managed and governed by the State. It is characterized by a hierarchical organization, top-down management, limited delegation downwards, and often limited

transparency of the financing of services. Data is captured and updated in a controlled way, resulting in authoritative data. Services and processes are regulated in detail. The conditions and performance of professionals, representing both the private and public sectors, are also strictly regulated. Often, the various data sets are stored in several silos, such as building, property, parcel, title, address, and land use. There is a risk of work redundancy and overlap of information at attribute level. Much of the information products and services are non-integrated. While land administration in this scenario often can be considered as robust, the scenario tends to have system solutions, characterized by constraints on their ability to evolve, develop new capabilities and meet new expectations. This is particularly true when geospatial data is included, as this attracts many producers and users. It also drives applications that require an open and more integrated environment. Expected increased complexities in people-to-land relations (rights, restrictions and responsibilities) and e-services challenge land administration systems positioned within this scenario. The fact that land administration authorities are, to an increasing extent, involved in state priorities in the vicinity of their core responsibilities, for example, e-government, integration of building and land development processes, spatial data infrastructures, smart cities and climate change initiatives, puts additional pressure on land administration authorities represented in this scenario.

4.2.2 As-a-service land administration

This represents a scenario where one or a few private sector actors execute all or some land administration services, often through a long-term as-a-service model, with the State still governing the data and setting the rules for land administration. The private actor(s) might also be responsible for the technical system and its maintenance. The idea that capital, technology and skills can be leveraged from the private sector to enhance land administration is increasingly gaining traction. Often a public-private partnership (PPP) model is applied, with revenue-sharing, using, for example, transaction fees, data/service fees and property tax. Existing use cases are typically from developed countries, where the land registry is operated by private companies (e.g. Australia (western), and Canada (Ontario)). Several emerging economies are now investigating PPP/as-a-service solutions for parts of their services, such as the operation of continuously operating reference stations (CORS) for satellite positioning, first registration processes, land registry, and valuations for taxation and mortgaging. The World Bank as well as the WPLA have recently conducted PPP consultations to further explore these opportunities and develop guidelines.

4.2.3 Platform land administration

In this scenario, land administration is executed within a national/sectoral framework which includes several state bodies. Each state body has its own designated functions, responsibilities and defined data sets under a “unified system” architecture. Typically, a range of key registers with national data sets (for example cadastre, land registry, business register, mortgage register, statistics, utility register and address register) are included, sometimes within a government cloud. The updating process considers all registers, and the once-only principle is applied for data capture in order to avoid work redundancy, data duplication and inconsistency. Key identifiers, and not the data content, are exchanged. National architecture of key registers thus overarches agencies and institutions. The updating process therefore embraces all relevant registers, and each attribute is linked to a specific custodian, that is, the authority responsible for the defined data set. This approach, sometimes referred to as “Government-as-a-platform”, facilitates the provision of data-centric applications, extended state services with integrated

governmental data, and automated processing. E-government initiatives are often a driver towards this concept and have the potential to provide economies of scale for the Government while, at the same time, improving the sharing of national data sets and capabilities across organizations and sector boundaries for extended integrated public products and services.

4.2.4 *Distributed land administration*

This is considered the most visionary scenario. It represents an environment with a highly automated and multi-stakeholder land administration, where the private sector has a large stake and where governance is moving to an ecosystem of technologies, platforms and diverse sets of stakeholders. Thus, there is a high level of trust “within the system”. Trust is distributed among the stakeholders, private as well as public. Governance is aligned with distributed liabilities. The services and information products are fully digital. Distributed value chains, for example blockchain, are implemented. A set of configurable building blocks (technology and services) are implemented to meet various user requirements and societal needs. This requires extensive cooperation and the clear distribution of responsibilities and risks. The widened opportunities for the integration of data from multiple providers, including crowdsourced data combined with an open data policy, require a high degree of standardization and stringent policies on compliance with data privacy and data security regulations. The concept facilitates process automation and transparency, and enables a wide spectra of user applications. It also provides for a built-in evolutionary environment that, in a complex context, could transform and adapt to new expectations and requirements over time (e.g. from 2-dimensional to 3-dimensional, introduction of digital twins, blockchain, artificial intelligence, and big data analysis). It has the potential to trigger digital engagements and efficiently leverage digital trust.

5. **Guiding principles for future-proof land administration systems**

When developing strategic planning based on the scenarios, this planning should be checked against a set of global principles which were developed based on previous experiences and existing good practices. Such guiding principles are the recently endorsed UN-GGIM *Framework for Effective Land Administration*.⁹ They are deemed valid for all jurisdictions in the world today. They should be applied irrespective of the predicted scenario.

In addition, a more specific set of guiding principles was developed by the group of senior land administration experts. These guiding principles are designed for countries of the UNECE region, focusing on their mid- and long-term future. They are provided in this section.

The following guiding principles should be ensured:

- (a) The land administration system provides security of tenure, and guarantees the integrity and transparency of both information and transactions regarding property. This is for the benefit of the people and the State, in order to support social stability and economic growth;
- (b) The land administration system is resilient to cyber-attacks, natural disasters and other events that could destroy or damage the register and its information;
- (c) The land administration system is fully digitalized, including maps of property and geospatial information;

⁹ For more information, see UN-GGIM, 2020a. Framework for Effective Land Administration (FELA). Available from: http://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/E-C.20-2020-29-Add_2-Framework-for-Effective-Land-Administration.pdf

- (d) The land administration system is uniform throughout the country, and contains information about all properties, regardless of type, use and ownership;
- (e) The land administration system contains information about rights, restrictions and responsibilities relevant to all properties;
- (f) The land administration system is robust, and capable of reflecting the dynamic nature of information stored in it over time, including information on rights, responsibilities and restrictions, thereby containing historical data on properties, such as information about changes in ownership and parcel boundaries;
- (g) All professional and private users can access all information about the location of properties, as well as information related to land and property rights, restrictions and responsibilities;
- (h) Information contained in the land administration system is open for remote inspection by all professional and private users, to ensure transparency and accountability;
- (i) Users of the land administration system should be able to trust that the information provided in the system is correct, and that they will be compensated should they suffer a loss due to erroneous information;
- (j) The land administration system provides information about the origin and quality of information, including that of the details in the cadastral maps, such as boundaries;
- (k) The land administration system takes into account the dynamic nature of geodetic reference systems, reflecting that the surface of the Earth is moving horizontally and vertically;
- (l) The land administration system is interoperable with other key registers and integrated with the overall national spatial data infrastructure, and is able to provide the most accurate information about the location of a property and the wider territory;
- (m) The land administration system provides 3D information about the vertical and horizontal limitation of properties, with their related rights, restrictions and responsibilities. Hence, the system contains information about properties under or above the surface of earth, such as apartments, tunnels and underground storage facilities;
- (n) The land administration system facilitates linkages with building information models (including geometrical as well as semantical characteristics) , for both data production and data dissemination;
- (o) The land administration system facilitates the registration of different tenure types, such as freehold, leasehold, occupancy right, and common property. It incorporates the fact that the tenure could be dynamic over time, and that related limitations could be fixed or ambiguous;
- (p) The land administration system provides access to information supporting the registration of transactions, such as contracts, deeds and survey reports. If relevant, this is organized in a digital archive integrated with the land administration system;
- (q) The land administration system information is available on a variety of fixed and mobile platforms and electronic devices;
- (r) When relevant, crowdsourcing is used for data preparation and for the verification of data contained in the land administration system;

(s) The preparation of data for registration in the land administration system is well integrated with the digital processes of private agents, such as notaries, real estate agents, lending banks and land surveyors;

(t) The land administration system offers real-time registration of transactions, largely subject to automatic digital checks only. Transaction documents are standardized for machine reading. Only complex cases are checked manually by the land administration authority;

(u) Fees and taxes for property transactions are transparent to users, and digital payment is facilitated;

(v) The land administration system contains legally valid information. It can disseminate information to users, which replicates the content of the system with full integrity;

(w) International standards are applied for the design and operation of the land administration system; and

(x) Licensing and monitoring of private agents is adapted to facilitate electronic communication with the land administration system, for both the registration of transactions and the dissemination of registered information to clients.

6. Self-assessment framework

The Scenario Study is intended as a dialogue instrument for use in strategic planning, shaping visions and self-assessment as to where land administration authorities need to develop as agencies within their relevant land administration ecosystem. To help estimate the preparedness of an organization and define what strategy is appropriate for the respective scenario, a set of questions to facilitate self-assessment is provided. The questions are preliminary. It is anticipated that they will be reviewed and refined during the twelfth session of the WPLA.

Which of the scenarios is preferred depends on the local context of each jurisdiction, the maturity of its land administration, and the degree of pressing societal needs in relation to land present in the country. Other central considerations are how land administration systems can create, increase and retain value with respect to the relevance, liability and trustworthiness of the land market and with respect to policy and societal issues related to land.

When assessing the scenarios, it should be ensured that the outcomes are aligned with the goals of the recently endorsed UN-GGIM *Framework for Effective Land Administration (FELA)*. Hence, effective land administration caters to all people, and must:

1. Accelerate the proportion of the population with tenure security;
2. Develop confidence and trust, and promote security, safety, peace and peacebuilding;
3. Promote an efficient and vibrant land market, taking into consideration the aspects of land value and land development;
4. Allow economic development through revenue systems that are equitable and fair;
5. Contribute to smart and resilient societies;
6. Cater to all circumstances, situations and people – in times of peace and prosperity, and in times of stress and hardship (disaster and conflicts, migration and human displacement, poverty, and food and water scarcity);

7. Promote preparedness, resilience (with increasing climate vulnerabilities), sustainable consumption and strong institutions (UN-GGIM, 2020a).

These objectives are deemed valid for all jurisdictions. In contrast, the guiding principles formulated in section 4 are more specific, and are designed for countries of the UNECE region, focusing on their mid- and long-term future.

To assess the extent to which these objectives and guidelines are achieved in the scenarios, it is proposed that countries assess the scenarios based on the underpinning principles that were initially formulated as part of the UN-GGIM *Integrated Geospatial Information Framework (IGIF)*. These seven principles (Box 1) are generic, and relate to key characteristics and values that should underpin the land administration system in every country.

Box 1 – Seven principles of UN-GGIM Integrated Geospatial Information Framework**PRINCIPLE 1: Strategic Enablement**

The implementation of the Framework requires political and financial support, and should therefore align with, and support, government's strategic direction on issues such as economic growth, social well-being, job creation, natural resource monitoring, and environmental management and preservation.

PRINCIPLE 2: Transparent and Accountable

Government geospatial information is developed and shared according to key accountability and transparency guidelines so that all citizens, government agencies, academia and the private sector have access to this valuable and underpinning national resource.

PRINCIPLE 3: Reliable, Accessible and Easily

Geospatial information is reliable and made accessible and usable so that it can be leveraged for research and development, used to stimulate innovation, and support the creation of sustainable services and products to advance social, economic and environmental development.

PRINCIPLE 4: Collaboration and Cooperation

Collaboration and cooperation (between government, business, academia, civil society and donors) are factored into the implementation of the Framework to strengthen information-sharing between providers and users, reduce duplication of effort across the government sector, make for a robust system, as well as providing clarity on roles and responsibilities.

PRINCIPLE 5: Integrated Solution

The implementation of the Framework is to be integrative in nature – and consider how people, organizations, systems, and legal and policy structures work together to form an effective system for managing geospatial information and its use.

PRINCIPLE 6: Sustainable and Valued

The implementation of the Framework will be conducted in such a way that it enhances national efficiency and productivity; is sustainable in the long term; and is deployed in a way that provides improved government services to citizens.

PRINCIPLE 7: Leadership and Commitment

Importantly, the implementation of the Framework will require strong leadership and commitment, often at the highest level, to enhance the long-term value of investments in geospatial information. This will be achieved through careful analysis, prioritization and sequencing to develop an action plan that carefully applies interventions in the short, medium and long term, and that can receive high level endorsement and support by government.

6.1 Guiding questions to assess the scenarios

To assess the value of each of the four scenarios for a country and its land administration system, the following guiding questions were prepared by the group of land administration experts. The questions are based on the seven principles of the UN-GGIM *Integrated Geospatial Information Framework*.¹⁰

(a) *Strategic enablement*

- Is land administration considered an essential strategic resource in the (national) political, administrative and societal context?
- Is there a robust legal basis underpinning the land administration system?

(b) *Transparent and accountable*

- Do all stakeholders have access to the land administration system, based on shared and transparent guidelines?
- Is the accountability of all stakeholders involved in land administration established and maintained?
- Is the accountability established for all elements in the value chain?
- Are the costs for users fair and transparent?
- Are the roles and responsibilities of all parties in the system clear, transparent and adhered to?

(c) *Reliable, accessible and easily used*

- Is the information on land available, easily accessible and usable to all stakeholders?
- Is land information authoritative and/or subject to state guarantees?
- Is all information on land (rights, restrictions, and responsibilities) available, over multiple dimensions (3D) and over time (4D)?
- Is coverage of land information national and complete?

(d) *Collaboration and cooperation*

- Are all parties in the public sector, private sector, academia, and civil society involved in the operation and development of the land administration system?
- Are duplications within the system avoided?
- Is the system open to new entrants or information sources?

¹⁰ UN-GGIM, “Part 1: Overarching Strategic Framework”, in *Integrated Geospatial Information Framework. A Strategic Guide to Develop and Strengthen Geospatial Information Management* (July 2018). Available at <https://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf>

(e) Integrative solution

- Is the proposed system integrated in, or at least connected with, the information society (both public and private)?
- Is the system effectively managed by the stakeholders?

(f) Sustainable and valued

- Is there a sustainable business model in place for the whole system and for each party in the land administration value chain?
- Are appropriate mechanisms and incentives in place to further develop the system?
- Is the system responsive and able to absorb new needs related to land from society?

(g) Leadership and commitment

- Is strong political leadership and commitment in place to warrant continuity and long-term investment in the system?

6.2. Results from interactive surveys of the scenarios

During the two occasions where the draft Scenario Study has been presented at international conferences, i.e. at the PCC conference in Helsinki (19-21 November 2021, notably prior to the pandemic) and at the 12th Session of the WPLA (Geneva, 31 May-1 June 2021), two independent and anonymous interactive surveys were conducted with the participants answering questions related to the scenarios. The overall purpose was to evaluate the interest in using the scenarios as a dialogue instrument for exploring the future and develop strategies in a consultative process. Another objective was to allow the respondents estimate where they *believe* land administration systems are positioned today as well as in year 2030, with respect to the four scenarios. At the Twelfth Session of the WPLA the survey was further developed to let the respondents also indicate a *desired* future state (year 2030) of the land administration systems in their country as well as to estimate their country's readiness and efforts required to stay relevant in 2030 with respect to five aspects (required competences, leadership adapted to new environment, technology catch-up, collaboration with other actors and legal adaptations). There were 31 respondents at the PCC conference and 22 respondents at the Twelfth Session of the WPLA.

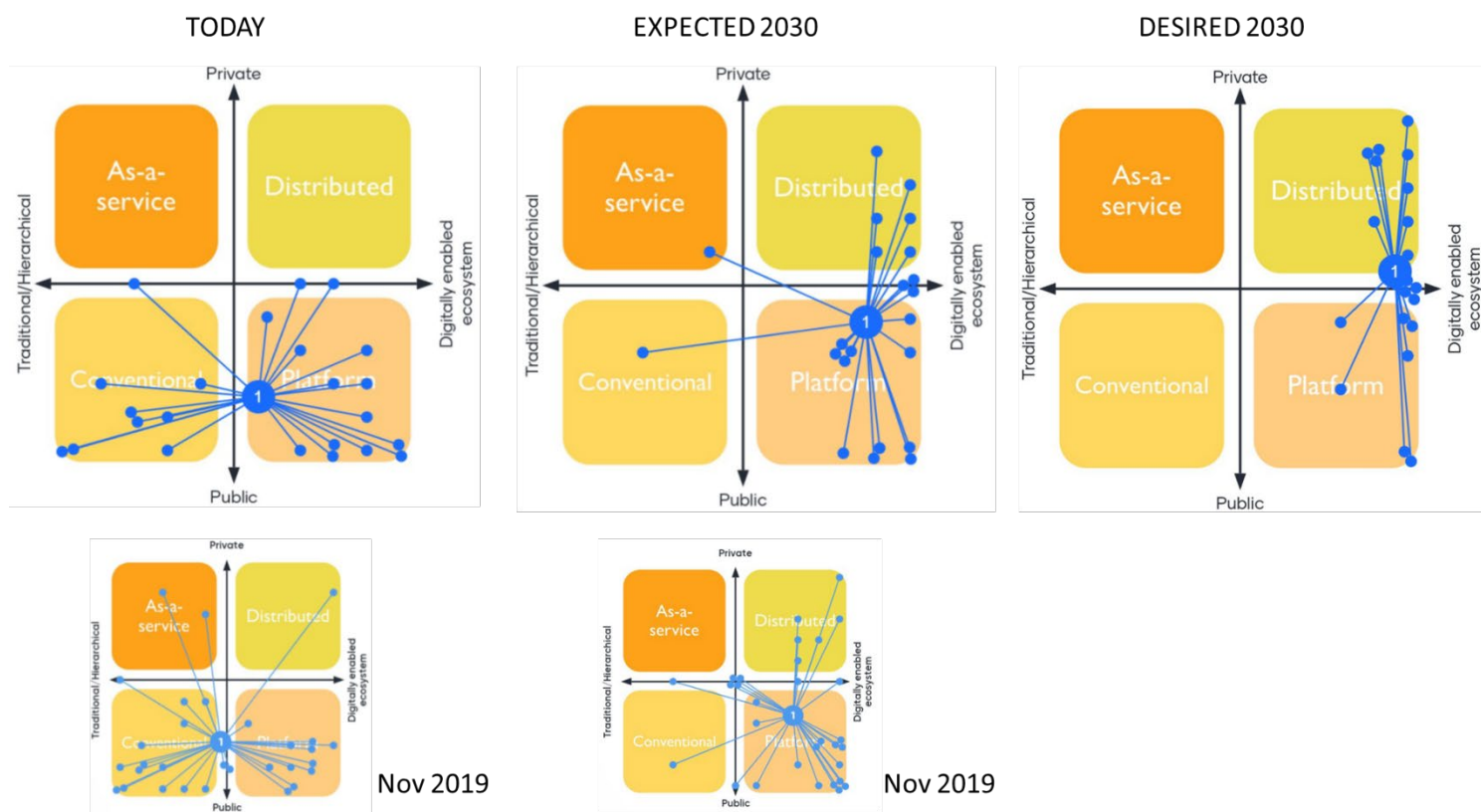


Figure 5 – Results from the interactive survey on estimated current, future and desired state of land administration arrangements

The figure above illustrates the results from the survey with the upper three scenarios corresponding to the survey conducted during the Twelfth Session of the WPLA in June 2021 and the two lower represent the survey results from the PCC conference in November 2019. Although the surveys statistically cannot be considered fully verified, the mean values (represented by number one in each scenario cross) indicate a clear trend towards a more platform-based land administration and with increased participation of the private sector. It also indicate a shift in the same direction when comparing the results from the pre-pandemic survey and the recent survey in June 2021. Furthermore, the desired scenario coincides with the expected scenario, with slightly more active involvement of the private sector.

As mentioned, the questions on the scenarios at the Twelfth WPLA session were complemented by a question regarding readiness and efforts needed in order for land administration authorities to stay relevant in 2030. The mean values of the five aspects are illustrated below. It should be noted that the variance among the respondents' answers regarding each aspect is significant which means that for a deeper understanding, each answer should be analyzed separately.

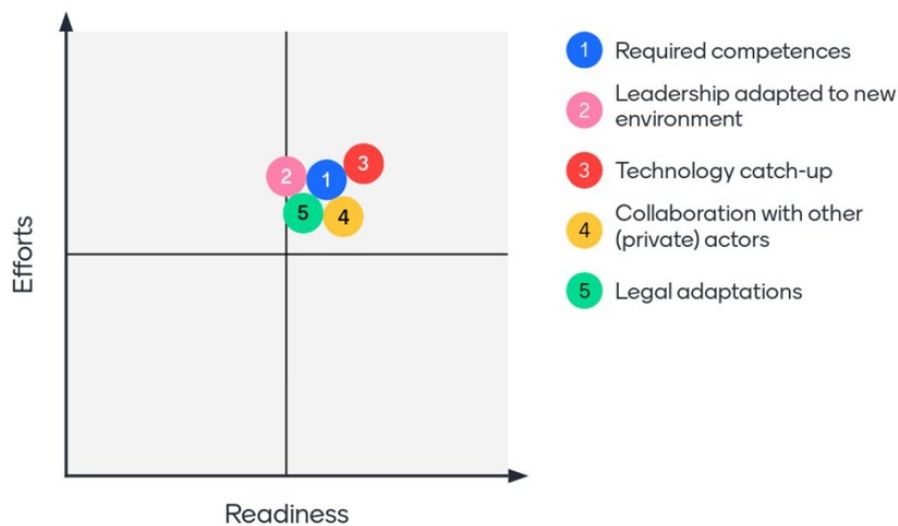


Figure 6 – Expected readiness and efforts required for land administration authorities to stay relevant in 2030

The respondents were asked to what extent they would be interested to use scenarios as an instrument for ongoing dialogue to shape visions and develop long-term strategies, in-country as well as regionally through exchanges with other UNECE member States. As the survey results indicate below, there is a strong interest to use the scenarios for planning future land administration systems, especially through a regional dialogue with other UNECE member States.

Would there be an interest to use scenarios as an instrument for continuous dialogue to shape visions and develop long-term strategies...

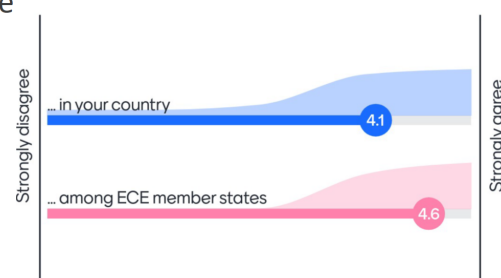


Figure 7 – Results (on a scale 0-5) on the interest to use scenarios as a dialogue instrument

7. Conclusions

Results from the interactive surveys prove that scenario planning is a very appropriate instrument for planning, consultations and stakeholder engagement. This instrument helps to develop better understanding of emerging trends in land administration. The scenario instrument therefore provides land administration authorities with needed information for planning its future work. The information obtained can be used to facilitate development of long-term national strategies which will be based on evidence-based approach. The scenario dialogues, whether among stakeholder in-country or at regional or global levels also support

the identification of common challenges and opportunities, sharing of best practices of risk mitigation measures and approaches to improve preparedness for future disruptive changes. It is suggested that scenario planning be deployed as an instrument also when it comes to developing relevant thought leadership to the long-term strategic work of the authorities for them to stay relevant, liable and provide trustworthy and future-proof services.

In addition, to the continuous studies to develop the scenarios, the WPLA also plans to define certain thematic focus areas to explore outcomes of the scenarios in further depth. These thematic focus areas will be defined in close consultation with the member States to ensure their alignment with the needs of future land administration systems.

Land administration authorities are encouraged to use the scenarios to enter into a continuous strategic dialogue and regularly adjust the scenario and self-assessment tool to better assess expectations and changes in needs over time.

References

- Enemark, S., 2005. *The Land Management Paradigm for Institutional Development*. ICSM, 2014. Intergovernmental Committee of Surveying and Mapping, Canberra, Australia.
- International Federation of Surveyors (FIG), 2014. *Cadastrre 2014 and Beyond*.
- Intergovernmental Committee of Surveying and Mapping, 2015, Canberra, Australia. *Cadastrre 2034 – Powering Land & Real Property. Cadastral Reform and Innovation for Australia – A National Strategy*.
- Krigsholm, P., Zavialova, S., Riekkinen, K., Ståhle, P., Viitanen, K., 2017. *Understanding the future of the Finnish cadastral system – A Delphi study*. Land Use Policy Vol. 68 (2017), 133-140.
- Land Information New Zealand, 2014. *Cadastrre 2034 – A 10–20 Year Strategy for Developing the Cadastral System: Knowing the ‘Where’ of Land-related Rights*.
- Mittelstaedt, J. D., Shultz, C. J., Kilbourne, W. E., Peterson, M., 2014. *Sustainability as Megatrend – Two Schools of Macromarketing Thought*. Journal of Macromarketing, 34 (3), 253–264.
- Naisbitt, J., 1982. *Megatrends: Ten New Directions Transforming Our Lives*. Warner Books, New York, NY.
- Riekkinen, K., Krigsholm, P., 2018. *Megatrends shaping the future cadastral systems*. Annual World Bank Conference on Land and Poverty, Washington, DC, USA, 19-23 March 2018.
- United Nations, 2020: *Report of the UN Economist Network for the UN 75th Anniversary. Shaping the Trends of Our Time. Executive Summary*. Available from: <https://www.un.org/development/desa/publications/wp-content/uploads/sites/10/2020/09/20-124-UNEN-75Report-ExecSumm.pdf> [Accessed on 21 September 2020].
- UN-GGIM, 2018. *Integrated Geospatial Information Framework. A Strategic Guide to Develop and Strengthen National Geospatial Information Management Part 1: Overarching Strategic Framework*. Available from: <https://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf> [Accessed on 25 September 2020].
- UN-GGIM, 2020a. *Framework for Effective Land Administration (FELA)*. Available from: http://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/E-C.20-2020-29-Add_2-Framework-for-Effective-Land-Administration.pdf [Accessed on 22 September 2020].
- UN-GGIM, 2020b. *Future trends in geospatial information management: the five to ten year vision – Third Edition, August 2020*.
- Z-punkt, 2017. *Megatrends Update – Understanding the Dynamics of Global Change*.